



Independent Credit Research Topics / Science related Cross Cultural Experiences

Please note that the following project ideas are being provided only as a guide to the possible research topics which could be conducted at Frontier. If you're interested in any of the following ideas, please contact the Research and Development Department for more information (research@frontier.ac.uk). Note that any of the research projects proposed below will need to be discussed in details with our scientists in the field in order to establish their feasibility which depends on a variety of factors, including the area of expertise of the current field staff, the conditions in the field and possible logistics limitations. We are also happy to discuss any other project ideas generated by interested students.

Tanzania Savannah Project

[http://www.frontier.ac.uk/gap_year_projects/Tanzania/Tanzania African Wildlife Conservation Adventure/](http://www.frontier.ac.uk/gap_year_projects/Tanzania/Tanzania_African_Wildlife_Conservation_Adventure/)

- **The importance of miombo woodland in the Kilombero Valley as a habitat for European migratory birds.**

The Kilombero Valley is a RAMSAR designated wetland stretching across Southern Tanzania. While the wetlands themselves are relatively well studied, the surrounding miombo woodlands have been severely overlooked and are currently highly threatened by increasing human encroachment into the area. As well as being home to two endemic bird species, the Kilombero weaver (*Ploceus burnieri*) and Kilombero cisticola (*Cisticola sp. nov.*), the valley hosts a great diversity of migratory birds. This project will complement existing research on resident bird species by identifying areas of specific importance to migratory birds within the lower reaches of the Kilombero Valley, and provide management recommendations to safeguard this important wildlife corridor between the Kilombero River and the Selous Game Reserve.

- **Mapping the southern Ruipa Corridor, a project using GIS**

The Ruipa Corridor stretches between the Selous Game Reserve in Southern Tanzania across the internationally important wetlands of the Kilombero Valley to the Udzungwa Mountains National Park. It is one of two remaining corridors in the area that allow large mammals such as elephant, buffalo, lion and wild dog to move seasonally between foraging grounds and water sources. High levels of human immigration into the Kilombero valley threatens to degrade the Ruipa Corridor to the extent that it could be permanently closed to large mammal movements. This project would be part of an ongoing project to safeguard the Ruipa Corridor. By mapping habitats, land use and instances of habitat degradation, it would provide project staff with an up-to-the-minute overview of current changes within the area.

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- **Testing the intermediate disturbance hypothesis – how do anthropogenic disturbances affect lepidopteran communities in the Kilombero Valley?**

The woodlands of the Kilombero Valley hold a diverse lepidopteran community. Previous research has shown that disturbance caused by elephants can increase the availability of ephemeral habitats used by some lepidopteran species, thereby increasing local species diversity. With an increasing human population in the Valley comes increasing levels of anthropogenic disturbance. The impacts of disturbance on lepidopteran diversity and abundance in the Valley are unknown, but could provide a useful indicator of ecosystem health. This project aims to quantify the diversity and abundance of butterflies or macro-moths in areas of increasing disturbance to identify the overall effects and any potential indicators of currently degrading habitats.

- **Medicinal plant use in the Kilombero Valley**

Medicinal plants are a valuable resource for many rural communities around the world both as a source of medicines and income through trade. The Kilombero Valley is experiencing high levels of immigration from other areas of Tanzania which differ in their floral diversity. These new communities are unlikely to have knowledge of local medicinal plants, and therefore there is the potential for them to become more reliant on costly manufactured drugs to treat minor ailments and also missing the opportunity to develop income generating schemes. This project will explore current levels of local knowledge amongst indigenous communities and more recent immigrants and analyse the potential for communities to increase local income by farming medicinal plants.

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Tanzania Marine Project

http://www.frontier.ac.uk/gap_year_projects/Tanzania/Tanzania_Marine_Conservation_Diving/

- **After fifteen years of protection, how has the Mafia Island Marine Park set up affected fish biodiversity?**

The Mafia Island Marine Park is Africa's largest multi user marine protected area. It was established in 1995 based on data collected by Frontier-Tanzania between 1989 and 1994. The chance to draw comparisons between current surveys and the historical data provides an almost unique opportunity to study the effects of long term marine protection on fish biodiversity and abundance. This comparison will allow assessing the long term effectiveness of marine protected areas in tropical waters not only for protecting – or even enhancing – fish biodiversity but also

- **A comparison of the benthic cover and invertebrate biodiversity between when the Marine Park was set up 15 years ago and today**

Mafia Island Marine Park was established in 1995 based on data collected by Frontier between 1989 and 1994. It is Africa's first and largest multi-user marine protected area. The team now relocating inside the marine park, this will allow drawing comparisons between current surveys and the historical data. This is a rare opportunity to study the effects of long-term marine protection on the benthos and the associated invertebrate communities. A special focus will be on assessing which coral genera have benefited the most from the protection (if any). This comparison will allow assessing the long term effectiveness of marine protected areas with regards to the benthos - especially corals - and the invertebrate communities.

- **Can low levels of fishing promote species diversity on coral reefs?**

When fishing levels are low, larger fish are often preferentially extracted. This study will compare species diversity and abundance on reefs which experience different levels of fishing to examine whether low levels of fishing can promote the diversity of fish and/or coral species via the mechanism of predator release.

- **Sedimentation of fringing coral reef habitats: an assessment of causes and effects on biodiversity.**

Tanzania's coral reefs are under increasing threat from terrestrial sediment inputs, mainly caused by extensive deforestation. Alongside water and surface sediment sampling, sediment traps to analyse sub-surface sediment could be placed in locations close to Frontier's regular underwater survey sites. Investigating the input history and spatial extent of terrestrial sediment would allow establishing a historical baseline record of sedimentation. This data would help understanding the impacts of sedimentation on the health of nearby coral reefs, by correlating the sedimentation results with the ones of the underwater surveys such as the benthic cover. Ultimately, this study will help to determine the level of threat from increased sedimentation for the island's coral reefs.

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- **An investigation of what motivates the choice of the ‘cleaning stations’ set up by the cleaning wrasse *Labroides dimidiatus* and which trophic groups are preferential users.**

This species is the best known of cleaner fish found on coral reefs in the Indian Ocean. Cleaner fish get their food by removing dead skin and parasites from the scales of other fish in a mutualistic relationship. They maintain what has been called ‘cleaning stations’ where other fish congregate and try to attract the attention of the cleaner fish. While some research has been done on the relationship between cleaning wrasses and their clients, little is known about what makes a cleaning station a desirable site. It might be linked to the topography of the reef, benthic communities or reef fish assemblages. This knowledge is important as destructive fishing practices might change the shape and features of the reefs and thereby threaten the cleaning wrasse populations. In addition, it will be interesting to study if specific trophic groups are preferentially cleaned by the wrasse and the reasons behind this preference.

- **Monitoring coral reef recruitment through an investigation of the number of surviving recruits with a specific focus on damaged reefs**

Coral recruitment is an essential component of reef resilience, which can be defined as the ability of coral reefs to survive and recover from disturbances, such as dynamite fishing. This destructive fishing practice is still common on Mafia Island and threatens several coral reefs. Not only does it kill target fish and other non-target organisms such as corals, but it also physically damages the reef structure. The process and temporal scale of recovery from this damage is still largely unknown but it is likely to be influenced by the habitat structure and community type. It is therefore crucial to understand the characteristics of this process to be able to assess the likely future coral reef composition. This project aims at looking at different habitats, comparing the different substrate types with the survival rates of new coral recruits. The survivorship, growth rate and the causes of coral mortality will be investigated with a specific focus on reefs which have been damaged by dynamite fishing.

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Cambodia Forest Project

[http://www.frontier.ac.uk/gap_year_projects/Cambodia/Cambodia Tropical Wildlife Conservation Adventure Project/](http://www.frontier.ac.uk/gap_year_projects/Cambodia/Cambodia_Tropical_Wildlife_Conservation_Adventure_Project/)

- **Testing the intermediate disturbance hypothesis: Do low levels of logging increase the avifaunal diversity of Botum Sakor National Park?**

Botum Sakor National Park in South-West Cambodia is home to over 200 species of bird, many of which are of national or international conservation concern. It also experiences relatively low levels of logging, mainly for *Raffia* palm. The Intermediate Disturbance Hypothesis suggests that low levels of disturbance can promote diversity. This project will investigate whether this is true for avian species in Botum Sakor and whether low levels of anthropogenic disturbance can benefit species of conservation concern such as great hornbills (*Buceros bicornis*), vernal hanging parrots (*Loriculus vernalis*) and hill mynas (*Gracula religiosa*).

- **Specialisation in space and time as a mechanism for coexistence in the avifauna of South East Asia.**

Botum Sakor National Park in South-West Cambodia is home to over 200 species of bird, each vying for limited resources. Some species, such as the park's nine species of kingfishers, occupy similar niches within the environment and compete for feeding and breeding grounds. This project will use observational data to investigate how competing bird species coexist within a tropical riparian environment by utilising resources at different spatial and temporal scales.

- **Assessing the performance of inexperienced observers when conducting rapid assessment surveys.**

Organisations such as Frontier rely on utilising the collective manpower of volunteer research assistants to collect data on the diversity, distribution and abundance of different taxa in habitats around the globe. It is imperative that these volunteers are capable of collecting the data in a consistent and thorough fashion. This project would assess the efficacy of current training methods for avian, lepidopteran and herpetological surveys. It will also determine the levels of training required for each taxa and provide recommendations for changes to training protocols both pre-expedition and in the field.

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- **Testing the intermediate disturbance hypothesis: Do low levels of logging increase the lepidopteran diversity of Botum Sakor National Park?**

The intermediate disturbance hypothesis states that intermediate levels of disturbance maximize species diversity. If the disturbance level is too low, competitive exclusion by the dominant species is likely to arise. By contrast, with high disturbance levels there is a selection for the species tolerant of the stress, eventually leading to extinctions. This hypothesis has been proposed to explain the patterns of local and regional biodiversity, particularly for sessile organism. It would be interesting to test this hypothesis with respect to the distribution of insects. In Botum Sakor National Park there is an important variety of lepidopteran species and various levels of disturbances, mainly due to logging. It would therefore be of great interest to test this hypothesis by investigating the presence of a correlation between lepidopteran diversity and logging intensity.

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Madagascar Forest Project

http://www.frontier.ac.uk/gap_year_projects/Madagascar/Madagascar_Wildlife_Conservation_Adventure/

- **A rapid assessment of the herpetological fauna of important forest fragments in Northern Madagascar.**

The northern dry forests of Madagascar are exceedingly important for herpetiles, including a number of endangered chameleon species. Outside of protected areas, many of these species are restricted to ever-dwindling fragments of forest. Frontier is currently working within a network of forest fragments situated between Ankarana NP and Montagne d'Ambre NP, an area of experienced continued high deforestation rates. It is imperative that these fragments are surveyed while conservation measures can still be implemented to identify which require the most urgent attention. Results will be used to help develop locally-agreed management and community forestry plans.

- **Habitat effects on the distribution and diversity of small mammal fauna in Northern Madagascar.**

Forest fragments in Northern Madagascar suffer differing levels of anthropogenic impacts including resource extraction (e.g. logging) and the introduction of non-native tree species. It is currently unknown which types, and what levels, of habitat degradation have the greatest effect on native small mammal distributions and abundances. Focusing on one particular disturbance type, this project would study how populations of small terrestrial mammals or bats are impacted by differing degrees of degradation.

- **Creation of a detailed map of potentially important forest fragments between two protected areas in Northern Madagascar, using GIS technology**

Frontier Madagascar Forest camp lies between Montagne d'Ambre National Park to the North and Ankarana Special Reserve to the south. It is located in a secondary dry deciduous forest fragment which is exposed to important anthropological disturbances. The area around the camp is highly degraded and mainly consists of farm lands, deforested grasslands and several small fragments of forest. However, this place is possibly of great ecological importance as the remaining forest fragments might be acting as a habitat corridor or refuge for wildlife between the two protected areas. By mapping wildlife habitats, land use and levels of habitat degradation, this project would contribute to our understanding of the importance of the remaining forest fragments for wildlife and provide essential geographic information to work towards their protection.

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Madagascar Marine Project

http://www.frontier.ac.uk/gap_year_projects/Madagascar/Madagascar_Marine_Conservation_Diving/

- **Holothurian abundance and harvesting in the Bay of Antsiranana**

An increasing human population around the shores of the Bay of Antsiranana is leading to ever greater dependence on marine resources for subsistence and trade purposes. The bay provides an excellent opportunity to implement proactive conservation and sustainable development measures before natural resources become too severely depleted. One such possibility is to instigate holothurian (sea cucumber) farming programs, an approach which has previously been successful in other areas of Madagascar and SE Asia. This project will lay down the groundwork for the development of holothurian farming by assessing current population and utilisation levels within the bay.

- **The holistic importance of seagrass beds in the Bay of Antsiranana in terms of resource use and conservation.**

Seagrass beds are extremely valuable habitats, both ecologically and economically. Not only do they constitute important habitats for a diversity of organisms, they also play an essential role in stabilizing bottom sediments, act as natural barriers which reduce wave energy and filter coastal waters of nutrients, contaminants and sediments. Seagrass beds are also very important to the local community as they provide the basis of the productivity of many subsistence fisheries. However, because they are located at the interface of land and sea, they are under increasing anthropogenic threat, including sedimentation, eutrophication, human development, beach seine trawling and global climate change. Establishing systematic baseline seagrass surveys would allow assessing the current status of the seagrass resources in the Bay of Antsiranana and monitor changes in their health over time. This would form the first important step in understanding and preserving these valuable habitats.

- **An assessment of the evolution of the biodiversity level in the Bay of Antsiranana through a review of past datasets over the last 5 years**

The coral reefs of the Bay of Antsiranana, although still in relatively good condition, are under increasing anthropogenic pressure, including overfishing, pollution, increased sedimentation and tourism. Previous socio-economic surveys have shown that local fishermen are aware of a decline in fish abundance and size over the last decade. Frontier-Madagascar Marine program started carrying out regular underwater biodiversity monitoring surveys in 2005. Reviewing the existing datasets for the last five years would allow a comprehensive assessment of alterations in coral reef species on different parts of the reef. In addition, comparing fishery surveys - which have also been carried out since 2005 - would make it possible to estimate to which extent the biomass and biodiversity of catches in the bay has decreased. This combined study will be crucial to determine which areas of the reef are the most threatened and will help design effective management strategies such as the set up of new marine reserves in the area.

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- **An evaluation of the composition and distribution of Nudibranch species in the Bay of Antsiranana**

Nudibranchs are marine molluscs which belong to the Gastropod class. They have always been very popular with recreational divers due to their colourful appearances. However, knowledge about their biology and ecology is currently limited, and almost inexistent as far as the Bay of Antsiranana is concerned. They have, however, been previously recorded at Order level by the Frontier-Madagascar team. This project aims at establishing quantitative data on the distribution and substratum preferences of the species present and investigating possible seasonal variations. This study would also allow for a comparison in nudibranchs diversity with the South West of the country (Anakao) where a similar survey has already been carried out by Frontier.

- **Quantifying the extent of coral bleaching in the Bay of Antsiranana and assessing the likely resilience capacity of different coral genera in the face of global warming**

In the context of global climate change, there is a growing need to assess and monitor the effects of higher sea temperatures on coral reefs. Corals are indeed extremely sensitive to environmental changes and coral bleaching is the most widespread and significant threat to the world's coral reefs. It is therefore important to assess the extent of coral bleaching in the Bay of Antsiranana. Frontier already discovered a high level of coral bleaching within the bay using the Coral Watch method. It would be interesting to study in more details and identify potentially resistant reefs which may become biodiversity hotspots in the future. Indeed, different species and morphologies of coral exhibit varying degrees of bleaching tolerance. Faster growing, branching species of coral such as Acropora tend to suffer higher bleaching mortalities than slower growing species with massive morphologies. In the long term this study aims at assisting the development of effective management strategies for coral reefs in the face of global climate change.

- **Assessing the ecological importance of mangrove stands around the northern area of the Bay of Antsiranana.**

Mangroves are trees and shrubs that grow in saline coastal habitats in tropical and subtropical regions. In Madagascar they cover vast areas along the coasts and support a very diverse fauna. Many species of animals use this habitat as nesting, roosting and feeding areas, including several species of threatened and endemic Madagascar waterbirds. They also constitute the habitat of many invertebrates such as crabs and shrimps. In addition, they are also an important source of income for the local population. A socio-economic study carried out by Frontier in 2008 showed that mangrove wood is used in building and occasionally as firewood. However, like in most of Madagascar, mangroves are being cut at an alarming rate in the Bay of Antsiranana. It is therefore important to improve our understanding of their ecological importance. This project aims at complementing the socio-economic study carried out in 2008 with biodiversity surveys of the mangroves in order to create a comprehensive management plan together with the local communities.

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- **Testing and evaluating the success of various of coral propagation methods in the aim of restoring the damaged reefs of the Antsiranana Bay**

Coral propagation refers to the reproduction of coral and can be artificially achieved through a process called fragmentation. This method was initially designed by aquarium keepers as a cost effective way to have more corals, but is now used more widely, notably to restore damaged coral reefs. Last summer Frontier started carrying out trials of the different coral propagation methods which could be used in the bay to stimulate the propagation of both soft and hard corals (Acropora genus). It is now essential to drive this research project forward by carrying out a more systematic assessment of the efficiency of the different methods and subsequently initiate a coral propagation programme, which will then be constantly monitored.

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Fiji Marine Project

http://www.frontier.ac.uk/gap_year_projects/Fiji/Fiji_Marine_Conservation_Diving/

- **The distribution and mapping of mangroves around Gau Island and an assessment of their importance for coastal protection in the face of climate change**

Rising sea levels due to global warming will have a disproportionately large effect on island nations such as Fiji. Mangroves represent natural defences which could do much to mitigate the effects of rising tide lines. However, in many developing countries, mangroves are an important resource *per se* and have been extensively logged. This project will map the extent of mangrove stands around the coasts of Gau providing information about their current status and recommendations for their continued management.

- **Morphological variations of the coral genus *Acropora* in relation to the physical characteristics of the reefs around Gau island**

Morphological variability is a widespread but poorly understood characteristic of many colonial animals. Corals of the genus *Acropora* are typically found in shallow reef environments with a high level of light and in relatively turbulent water. They also constitute the habitats of a great variety of reef fishes. Interestingly, depending on the species and location, corals of this genus can grow in different morphological shapes and colours. It can for instance be defined as branching, tabular, plating or encrusting and can vary in colour from blue/green to red/brown. Using transect surveys, this study aims at investigating the hypothesis that these variations are related to the physical characteristics of the reef such as its depth, light level, and water turbulence.

- **A study of the abundance and distribution of sea urchins around the island of Gau and an assessment of their potential ecological impact**

Sea urchins are shallow-water echinoderms with soft bodies enclosed in a spherical spiny shell. They are important members of coral reef herbivorous populations and can heavily influence the reef composition. They can have a positive influence by grazing on algae therefore preventing the overgrowth of macroalgae. But if the populations are too large, their aggressive feeding behaviour can damage the coral and lead to the bioerosion of the reef. It is therefore important to collect data on sea urchin densities and species composition. This information will help assess their impact on the health of coral reef system. This study could also include a socioeconomic survey of the sea urchin fishery on the island.

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- **A study of the abundance, size and gender of Grey Reef sharks observed in the Nigali passage (Gau Island)**

Grey reef sharks are large predators that hunt either individually or more rarely in group. They feed primarily on reef fishes but also cephalopods such as squids and octopus. During the day, they usually aggregate in groups of 5 to 20 individuals near coral reef drops, and then separate in the evening as they start hunting. Despite being perfectly adapted to their environment, grey reef shark populations have declined in many places throughout the world and are classified as Near Threatened on the IUCN Red List, partly because of the continuous degradation of coral reefs from human development. In the Nigali passage, which is a natural break in the outer barrier reef of Gau, grey reef sharks are regularly observed. However, they are increasingly sighted with fish hooks, lines and training ropes, which suggest that they might be under threat in this area. The aim of the project is therefore to start a systematic monitoring programme of the populations observed in the Nigali passage in order to assess their current status and possibly make management recommendations.

- **An investigation of the competition between macroalgae and coral in shallow reef areas and an assessment of the risk of coral - algal phase shifts (Gau Island)**

A phase shift occurs on a coral reef when the coral cover of a substrate is reduced in favour of macroalgal dominance and the reef resilience capacity decreases because of ecological processes and/or environmental factors. The phase shift is usually associated with a perturbation such as coral bleaching, storm damage or outbreaks of a coral-eating species. The new state is generally characterised by a combination of reduced herbivory and nutrient enrichment. The coral reefs of Gau island, although still in relatively good condition, are currently threatened by a range of anthropological disturbances and coral bleaching has also been observed. This research project aims at investigating the current level of competition between macroalgae and coral in shallow reefs by means of underwater transects. This study will include an assessment of the benthic cover and of the importance of herbivorous species.

Dissertation topics will be offered from the Frontier-Costa Rica research program from Spring 2010. Please contact the Research and Development Department for more details (research@frontier.ac.uk).

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