E³ PhD studentship proposal

Cryptic Asian savannas: Where were they? Where are they now?

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Summary
Savannas contribute significant environmental, economic and cultural value to the world. A novel approach will be taken to identifying the SE Asia extent of savanna, where there has been virtually no research.

Background
Asia is an epicentre of biodiversity and of human transformation of landscapes [1]. Tropical savannas are globally extensive across the wet – dry tropics, provide critical ecosystem services and influence the earth-atmosphere system [1]. Tropical savannas store about 15% of the Earth's carbon, account for an estimated 30% of global terrestrial net primary productivity, and play a key role in global carbon and energy cycles [2,3,4]. Tropical savannas are home to most of the world's extant mammalian megafauna, and are the source of origin for important grain crops (e.g., millet, sorghum) [1]. Today an estimated one-fifth of the global human population depends directly on savannas for their livelihoods, including the use of uncleared lands for grazing, fuel wood, food and medicinal plants [5]. Despite the importance of tropical savannas, they have attracted little of the public interest and conservation attention given to tropical forests [1]. Yet tropical savannas face considerable conservation threats and land transformation is set to continue due to increasing food demands [1,5]. A key problem with regards to the conservation status of the savanna biome is that we simply do not know the location of SE Asia savannas. Both the current distribution and land cover before human modification are unknown, although it is highly likely that this was a biome found extensively across Burma, Thailand, Laos, Cambodia and Eastern Indonesia. This project will aim to remedy this problem and in so doing work with a dynamic group of researchers in a thoroughly diverse and enthralling part of the world.



The islands of Eastern Indonesia, in particular Flores, Timor and Papua are undoubtedly home to important remnants of the Asian savanna biome. These areas are home to endangered megafauna such as the Komodo dragon.

Project description
Key Questions: Where are South East Asian savannas? Which plant species dominate this biome in South East Asia? How have South East Asian savannas been transformed by people? Where are key regional remnants of Asian savannas?

Globally applied definitions for biomes generally ignore vegetation characteristics critical to the functioning and evolutionary history of savanna. Hence, regional identification of savannas is often inconsistent and misinterprets the ecological processes governing vegetation structure and

biodiversity. This is particularly the case in South East Asia where biomes that are likely to be functionally savanna (in terms of the importance of fire and mega-herbivory in structuring the vegetation and the dominance of a grassy ground layer) are termed anything from shrublands, closed woodland, to dry deciduous forest. Using our understanding of the limits of savanna from Africa, Australia and South America, the student will use niche modelling to identify a potential climate niche of savanna across South East Asia. Working with the Kew Gardens Herbarium the student will identify key savanna grass and tree species, based on the collections assembled by explorers and collectors (such as Wallace and Schimper) over the last 160 years, to build a geo-located database of key grass and tree species, that can be supplemented by data from the Global Biodiversity Information Portal. Species will be modelled as an ensemble to determine to determine the most likely distribution of South East Asian savannas. Field work combined with remote sensing will be used to validate the proposed distribution of these savannas. This information can then be combined with data on the extent of protected areas and hotspots of land use change and clearing to identify potential priority regions for conservation. Timeline: **Year 1:** Literature review; working with the Kew Herbarium to identify key collectors and regions; training in niche modelling; field trip to SE Asia. **Year 2**: Field trip to SE Asia; analysis and writing. **Year 3:** Focus on analyses and write up. **Year 4:** Completion and further papers.

Research Training

A comprehensive training programme will be provided comprising both specialist scientific training and generic transferable and professional skills. There will be specialist training in taxonomy, niche modelling, and remote sensing via NERC and MSc course and 1:1 engagement with supervisors, and other staff in the tropical land use team. The student will also be trained in presenting their science orally, in written form for scientific journals, and for a wider audience if they are interested in contributing to our successful outreach and teaching programmes. There will also be formal teaching opportunities. The breadth of the supervisorial team will ensure that the individual will also develop the ability to communicate complex ideas within and between disciplines. The studentship will therefore develop an individual with a highly sought after and widely applicable set of hard and soft skills and the project offers an exciting opportunity to work in an interdisciplinary field. The PhD student would be well placed to go and work in academic research, environmental policy and conservation.

Requirements. A student with an MSc (&/or outstanding BSc) in natural, environmental, chemical, physical or biological sciences; experience of, or demonstrated ability to undertake (sometimes challenging) tropical field work. The student will be expected to demonstrate or potential for creativity in thought, for hypothesis development and experimental design; strong quantitative and organizational skills; excellent oral and written communication skills. An aptitude and appetite for writing and publishing their research. The student will need to able to work independently and as part of a larger team. An ability to work in different cultures and an interest in speaking relevant foreign languages are both desirable.

Further reading

[1] Parr, C., et al. (2014) Tropical grassy biomes: misunderstood, neglected, and under threat. *Trends in ecology & evolution* 29: 205-213. **[2]** Scholes, R.J. and Archer, S.R. (1997) Tree-grass interactions in savannas. Annu. Rev. Ecol. Syst. 28, 517–544. **[3]** Van der Werf, G.R. et al. (2010) Global fire emissions and contributions of deforestation, savanna, forest, agriculture, and peat fires (1997–2000). Atmos. Chem. Phys. 10, 11707–11735. **[4]** Grace, J. et al. (2006) Productivity and carbon fluxes of tropical savannas. J. Biogeogr. 33, 387–400. **[5]** Olsson, E.G. and Ouattara, S. (2013) Opportunities and challenges to capturing the multiple potential benefits of REDD+ in a traditional transnational savannah-woodland region in West Africa. Ambio 42, 309–319.