Project meeting: the impact of climate change on the fungal biogeography of the Greater Mekong Subregion

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Fungal diversity is especially high in the Greater Mekong Subregion (GMS), and wild fungi form a staple source of food, medicine, and income for many rural communities here. A better understanding of the fungi in this region is therefore crucial not only for environmental scientists, but also for strengthening the food and financial security of rural communities. Given the importance of fungi in the GMS, researchers from the Kunming Institute of Botany (KIB), Chinese Academy of Sciences, in China and the Center for Excellence in Fungal Research at Mae Fah Luang University (MFU), in Thailand, have been working together to develop a more complete understanding of fungal ecology and biogeography of the GMS as a whole. In pursuit and support of this goal, Prof Peter Mortimer from KIB and Prof Kevin Hyde, from MFU, applied for and received funding for a joint project exploring and mapping the fungal biogeography of the GMS, and how climate change will impact the fungi of this region.

The scope of the project includes both China and Thailand, requiring frequent student exchanges, extensive field work, and communications between two institutions. As such, an annual meeting for the project was arranged and hosted at the Mushroom Research Centre (MRC), outside of Chiang Mai, Thailand. The purpose of this meeting was to provide an opportunity for
researchers involved in the joint project to collectively discuss the progress and challenges they have faced, and to prepare for the analyses of data generated, as a cohesive team. Given the context of the meeting, it would be difficult to find a better suited location.

MRC is situated in a subtropical forest and surrounded by mountains and monasteries, and as such, the participants of the meeting spent much of their free time collecting fungal specimens, and the abundant edible mushrooms also provided more than a few meals for them. The collecting of specimens from the surrounding area allowed the researchers to interact outside of the meetings and discussions, and provided a learning platform for some of the more experienced mycologists to provide training to the more junior participants, taking advantage of the labs and facilities provided by the MRC.

Figure 1 Maps showing the locations of the sampling sites in Thailand (left) and Yunnan Province, China (right).

In order to assess the fungal communities (macrofungi, microfungi, and freshwater fungi) of the GMS, the teams from Thailand and China have already surveyed more than 300 plots across the region. Sites were initially selected to capture as much variance as possible along environmental gradients in the region. Environmental factors used to select sites included a range of climatic variables, slope, elevation, soil type, and land use type. Several additional biogeographical factors are measured during sample collection, including dominant tree type, and organic layer thickness. Later, all soil samples will be analyzed for chemical data including elemental concentrations, as well as total organic carbon, and pH. Each plot is extensively sampled in order to capture as much of the fungi present as possible: 10 independent soil samples are taken per plot to be used for fine scale mapping of the soil fungi (using next generation sequencing
methods), as well as collecting woody litter, leaf litter, roots, and above ground plant samples. The data being generated from this project is mind boggling and should prove very valuable for the broader scientific community.

This data will have several practical uses, in addition to the value of having a fine scale species distribution and soil chemistry data, across the region, the data will be used to make ecological inferences and predictions about the fungal communities of the GMS. Furthermore, one of the originally proposed uses for the data was to predict the effects of climate change on fungal communities. By regressing the fungal community composition against factors such as vegetation cover, temperature and rainfall, future compositions at each site can be extrapolated based on well-established predictions for these factors under future climate scenarios.

Figure 1 Dr. Hui Li samples soil in a pine forest in Qujing, Yunnan Provence, China.

Fungal samples were collected from the following 3 locations:
1. The Mushroom Research Center: the dense forest around the Mushroom Research Center is ideal for collecting both micro- and macrofungi associated with a wide variety of hosts and substrates.
2. The Mok Fa Waterfall Park: Located just a few minutes from the Mushroom Research Center, the Mok Fa Waterfall Park has a wide range of fungi. Collecting fungi on national land is illegal, so mushrooms found at this location were only photographed.
3. Wat Pah Pa Deng: This Buddhist monastery is located just across the road from the Mushroom Research Center. Behind the monastery grounds, there are many trails and wooded areas. Many macrofungi were found here.

The team members from China and Thailand would like to thank the MRC for hosting this project meeting and providing such an enriching environment in which they could discuss their work. Furthermore, they would like to thank both the National Science Foundation of China and the Thailand Research Foundation for funding this work under the following project codes: RDG6120001 and 4176114055.
Amanita hemibapha

Leucocoprinus delicatissimus

Helvella macropus

Amanita hemibapha

Cyptotrama asprata
Marasmius pellucidus

Tremella fusiformis
Phlebopus portentosus

Oudmansiella canarii