



Short Communication

Fungal conservation through a private initiative: the Mushroom Research Centre (MRC) in Thailand

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Abstract

The conservation of fungi is an integral part of ecosystem conservation. The Mushroom Research Centre's strategic approach to fungal conservation offers valuable insights. Located in northern Thailand, this institution has emerged as a research and training hub for mycologists across Asia, providing them with practical knowledge and skills. Its influence has not been limited to the region, making it a compelling case study for the potential impact of private conservation initiatives.

Keywords: biodiversity, climate change, fungi, southeast Asia, team effort

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From a biological perspective, the conservation of nature has two facets. One is represented by the multiple initiatives intended to provide a space to protect ecosystems and forests in general. The other is represented by projects that focus on conserving specific resources, whether they are biotic or abiotic.

General conservation initiatives are much more popular than specific ones because it is easier to communicate the idea to the public and build social engagement (Sanderson et al. 2022). However, specific conservation plans are much more relevant in generating thematic scientific information simply because all the effort is directed towards the actual resource being protected (e.g., Wraith et al. 2020). Both facets have in common that they rely on assessing and monitoring, two extremely difficult tasks to carry out, even by modern day methods (Casetta et al. 2019).

In the modern conservation movement, surrogate terms such as flagship, keystone, and umbrella species are commonly applied to organisms that are identified as relevant for conservation efforts (Lindenmayer and Westgate 2020). However, because of a historical bias in the Western Hemisphere, governments, NGOs, and societies have thought, for the most part, only in terms of the flora and fauna. Accordingly, the majority of the species in the center of conservation purposes are either animals or plants. Consequently, most efforts tend to disregard the ecosystem relevance (keystone idea), the biophilic nature (flagship focus), and the multi-phyla interaction (umbrella concept) of the third *f* of nature, the funga (*sensu* Kuhar et al. 2018). Since fungi are one of the most biodiverse and important groups of organisms on the planet (Mueller and Schmit 2007), this is a historical debt that needs to be remediated.

Fungi have been gaining more and more public recognition as modulators and mediators of natural processes (Wurzburger et al. 2017) and are increasing their popularity for sustainable development (Lange 2010). However, neither assessing nor monitoring, the two main conservation tasks, can be achieved without studying fungi at their basic level. This is because understanding the fundamental aspects of fungi, such as their distribution, diversity, and ecological roles, is crucial for effective conservation. In this manner, the task of documenting assemblages of fungi at a given locality can represent one element of research in a general conservation initiative or be the center of attention for one specific conservation project. Reasonably, to gain time and maximize the effort, the second option seems to be the most appropriate one in the present moment of history.

Motivated by those ideas, two decades ago, a group of fungal experts and enthusiasts led by Dr. Kevin Hyde of Mae Feh Luang University in Chiang Rai, Thailand, established the Mushroom Research Centre (MRC) in a forested area north of the city of Chiang Mai in northern

Thailand. Located at an elevation of 770 msl at 19.11785 S and 98.73323 W, this non-government and non-profit organization has had the goal of promoting studies of fungal diversity and taxonomy throughout Asia and the rest of the world. The facilities available at MRC (Fig. 1), which include housing, a dining hall, and a well-equipped laboratory, provide opportunities for students to receive practical and hands-on training to develop their expertise in fungal biology.

Beginning in June 2003, MRC has been the site of several workshops and training programs on topics such as fungal diversity and taxonomy, plant quarantine taxonomy, aquatic fungi, and the identification of macrofungi (Figs. 1 and 2). Numerous mycologists have used MRC as the base of operations for their research. These include Dennis Desjardin, Eric McKenzie, Steve Stephenson, Steve Miller, Else Vellinga, Pedro Crous, Philippe Callac, Silvie Rapier, Philippe Silar, Olivier Raspe, Mieke Verbeken, Larissa Vasilyeva and Gastón Guzmán from such countries as the United States, Netherlands, New Zealand, France, Belgium, Russia, and Mexico.

Located at the heart of the Indo-Burma biodiversity hotspot, Thailand has a highly biodiverse biota (Baimai 2010), and the presence of several universities and research centers has allowed local research to be carried out effectively. Ironically, the province of Chiang Mai, where MRC is located, has been the subject of aggressive land use changes that have impacted the environment in recent decades. Within this context, MRC has not only allowed the continuous documentation of fungal taxa in that part of the world, but it also plays a crucial role in the modulation of both habitat and biodiversity reductions. MRC achieves this through its research, education, and outreach programs that promote sustainable land use practices and raise awareness about the importance of biodiversity conservation. It has been documented that such local conservation efforts in the form of public and private initiatives have dramatically reduced biodiversity losses in Chiang Mai (Lee et al. 2022). Since the lands on which MRC is located were once a shrubby pasture that was allowed to naturally regenerate, this center is a nucleus of both habitat and organismal conservation at once.

Along with researchers from the western hemisphere, MRC has allowed several students and regional investigators to conduct their work on fungi. These have included such mycologists as Pheng Phengsintham, Ruilin Zhao, Ohnmar Myo Aung, Thida Win Ko Ko, Samantha Chandranath Karunarathna, Le Than Huyen, Aung Swe, Hanh T.M. Tran, Jian-Kui Liu, Nopparat

Wannathes, Rampai Kodsueb, Ratchadawan Cheewangkoon, Sitthisack Phoulivong, Nilam Fadmaulidha Wulandari, Chen Jie, Putarak Chomnunti, Komsit Wisitrassameewong, Sajeewa Maharachchikumbura, Asanka Ranjana Bandara, Duong Minh Lam, Iman Hidayat, Sutheera Thongkantha, and Phongeun Sysouphanthong, all of whom have worked in MRC at some point. Their work has greatly contributed to our knowledge of numerous groups of fungi on the property of MRC as well as the general area around Chiang Mai and northern Thailand. It has also allowed the “assessing” aspect of conservation to take place in this center and the region.



Figure 1. Some of the facilities at MRC during 2008, including several chalets (top) and a dining hall (bottom) by a lake.

Since its establishment, MRC has been aligned with the idea of conservation from an experiential point of view. The contribution of all the researchers and students that have carried out their work over there has invariably allowed them to construct both personal and collective knowledge on the natural world and the associated fungi. At a deeper level, this type of approach can facilitate developing intimate relationships with the environment that can have long-lasting effects (Hung 2017). Such an ecocentric style is very well aligned with

adequate practices of modern education (Kopnina 2020) as a strategy to counterbalance the current problems in the natural world. In this sense, MRC has supported the conservation of nature through the promotion and understanding of both fungal diversity and ecosystem functions where fungi are essential. Such an effort is very important to increase the popular perception of fungi through deductive thinking.



Figure 2. In 2008, a group of students from countries in Southeast Asia had the opportunity to attend training sessions at MRC.

For conservation purposes, research and education are the primary drivers of goal attainment (Ardoin et al. 2020), and MRC has carried out both activities in a good manner during the time it has operated. This achievement has inspired the creation of a “Fungus-Team” or “F-Team,” a derived idea conceived to work as an international authority for fungi that deals with the generation of regional fungal checklists. This team is comprised of very competent and talented mycologists from different parts of the world who guide, monitor, and identify fungi with the purpose of promoting the use of information for fungal regulatory processes. Since most countries do not have formal regulation of fungal forms in their legal frameworks, the job carried out by the F-Team is extremely relevant in terms of promoting

awareness of fungi as key players in the modern lifestyle.

Most decision-makers and other stakeholders in the conservation world are not trained in the natural sciences and require external input, normally from experts, to understand the dynamics of the natural world. However, those experts require data for informed decisions. Given the current acceptance of monitoring fungi for conservation purposes (Stephenson et al. 2022), MRC is very well-positioned to address a few of those inquiries. This accomplishment is the result of the early idea of creating a research center specializing in the study, documentation, and conservation of fungi, which by modern standards is pioneering in the sense of envisioning the integration of such organisms with the socio-economic world. Today, several solutions to global environmental problems are being addressed with the help of fungi (Falandysz and Treu 2017) and the economic valuation of this group of organisms is increasing (Niego et al. 2023).



Figure 3. American professors Steve Miller (third from left to right), Dennis Desjardin (fourth) and Steve Stephenson (sixth) were in charge of teaching students about fungi in 2010 at MRC.

The Mushroom Research Center in Chiang Mai, Thailand, was created with the idea of studying fungal resources in that part of the world, but most certainly, its impact has reached global boundaries. That is exactly the effect of specific conservation initiatives on private lands, which by means of reduced paperwork, easy access, and strong links with local research institutions, can boost long-term protection of lands (e.g., Dayer et al. 2017) and focal conservation as a result. MRC represents a successful story of fungal documentation and modern research with a strong protection impact, and it demonstrates that team-based work and private initiatives can be key stakeholders in the conservation movement.

Declaration of Competing Interest

The authors have carried out work at MRC and have observed the educational, research and conservation processes taking place there, but are not formally affiliated with MRC or any related institution.

References

Ardoin NM, Bowers AW, Gaillard E (2020) Environmental education outcomes for conservation: A systematic review. *Biological Conservation* 241:108224. DOI: 10.1016/j.biocon.2019.108224

Baimai V (2010) Biodiversity in Thailand. *The Journal of the Royal Institute of Thailand* 2:107–114. Retrieved from: <https://royalsociety.go.th/biodiversity-in-thailand>

Casetta E, da Silva JM, Vecchi D (2019) Biodiversity healing. In: Casetta E, da Silva JM, Vecchi D (editors) *From assessing to conserving biodiversity*. Springer Open. Pp. 1–17.

Dayer AA, Lutter SH, Sesser KA, Hickey CM, Gardalli T (2017) Private landowner conservation behavior following participation in voluntary incentive programs: recommendations to facilitate behavioral persistence. *Conservation Letters* 11(2):e12394. DOI: 10.1111/conl.12394

Falandysz J, Treu R (2017) Fungi and environmental pollution. *Journal of Environmental Science and Health Part B* 52(3):147. DOI: 10.1080/03601234.2017.1261535

Hung R (2017) Towards ecopedagogy: an education embracing ecophilia. *Educational Studies in Japan* 11:43–56. Retrieved from: https://www.jstage.jst.go.jp/article/esjkyoiku/11/0/11_43/_pdf/-char/en

Kopnina H (2020) Education for the future? Critical evaluation of education for sustainable development goals. *The Journal of Environmental Education* 51(4):280–291. DOI: 10.1080/00958964.2019.1710444

Kuhar F, Furci G, Dreschler-Santos ER, Pfister DE (2018) Delimitation of Funga as a valid term for the diversity of fungal communities: the Fauna, Flora & Funga proposal (FF&F). *IMA Fungus* 9:A71–A74. DOI: 10.1007/BF03449441

Lange L (2010) The importance of fungi for a more sustainable future on our planet. *Fungal Biology Reviews* 24(3-4):90–92. DOI: 10.1016/j.fbr.2010.12.002

Lee K, Wangpakattana Wong P, Khokthong W (2022) Evaluating forest-cover changes in protected areas using geospatial analysis in Chiang Mai, Thailand. *CMU Journal of Natural Sciences* 21(2):e2022030. DOI: 10.12982/CMUJNS.2022.030

Lindenmayer DB, Westgate MJ (2020) Are flagship, umbrella and keystone species useful surrogates to understand the consequences of landscape change? *Current Landscape Ecology Reports* 5:76–84. DOI: 10.1007/s40823-020-00052-x

Niego AGT, Lambert C, Mortimer P, Thongklang N, Rapior S, Grosse M, Schrey H, Charria-Girón E, Walker A, Hyde KD, Stadler M (2023) The contribution of fungi to the global economy. *Fungal Diversity* 121:95–137. DOI: 10.1007/s13225-023-00520-9

Mueller GM, Schmit JP (2007) Fungal biodiversity: what do we know? What can we predict? *Biodiversity Conservation* 16:1–5. DOI: 10.1007/s10531-006-9117-7

Sanderson J, Alper R, Barrack J, Byrd C, Glenn E, Jespersen K, Kimple A, Knight H, Konrad P, Kowalski T, Nezzie D, Ortez K, Robles C, Ruth T, Smith D, Steele N, Stevens T, Wagner G, Archibald J (2022) Best practices for collaborative conservation philanthropy. *Conservation Science and Practice* 4(10):e12811. DOI: 10.1111/csp2.12811

Stephenson PJ, Londoño-Murcia MC, Borges PAV, Claassens L, Frisch-Nwakanma H, Ling N, McMullan-Fisher S, Meeuwig JJ, Machado Unter KM, Walls JL, Burfield IA, Vieira Correa DC, Geller GN, Montenegro Paredes I, Mubalama LK, Ntiamoa-Baidu Y, Roesler I, Rovero F, Sharma YP, Wisesa Wiwardhana N, Yang Y, Fumagalli L (2022) Measuring the impact of conservation: The growing importance of monitoring fauna, flora and funga. *Diversity* 14(10):824. DOI: 10.3390/d14100824

Wraith J, Norman P, Pickering C (2020) Orchid conservation and research: An analysis of gaps and priorities for globally Red Listed species. *Ambio* 49:1601–1611. DOI: 10.1007/s13280-019-01306-7

Wurzburger N, Brookshire ENJ, McCormack ML, Lankau RA (2017) Mycorrhizal fungi as drivers and modulators of terrestrial ecosystem processes. *The New Phytologist* 213(3):996–999. DOI: 10.1111/nph.14409