

# Mayan Mycology in the Land of the Jaguars

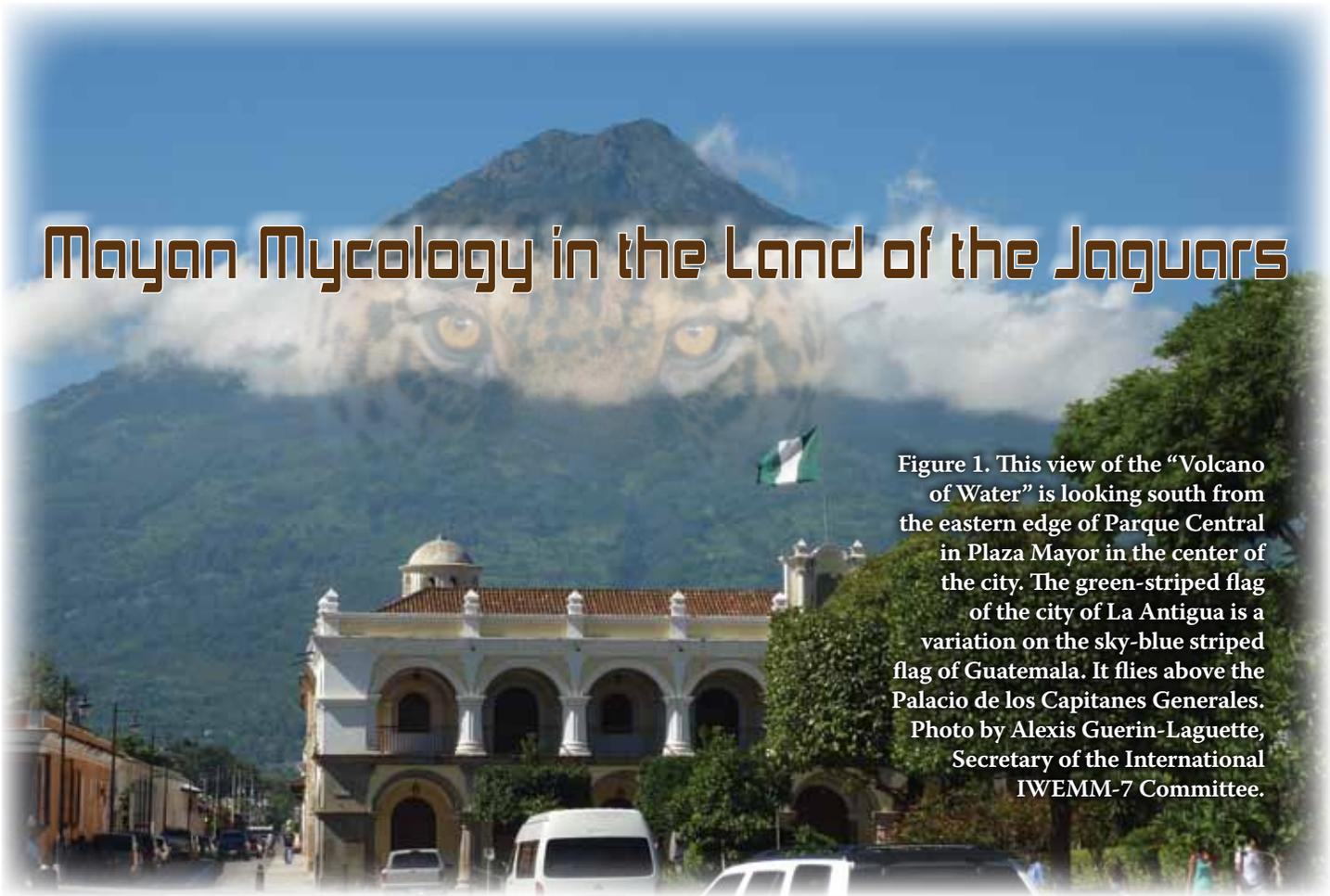


Figure 1. This view of the “Volcano of Water” is looking south from the eastern edge of Parque Central in Plaza Mayor in the center of the city. The green-striped flag of the city of La Antigua is a variation on the sky-blue striped flag of Guatemala. It flies above the Palacio de los Capitanes Generales. Photo by Alexis Guerin-Laguette, Secretary of the International IWEMM-7 Committee.

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## ABSTRACT

*Mayans are one of the oldest and most resilient mycophilic cultures in the Americas. Their homelands in southern México and Guatemala are biologically very diverse. In montane regions, numerous edible ectomycorrhizal mushroom species can be found growing symbiotically with pines, firs, and oaks. Within this rich natural context the Mayans spent millennia developing complex cosmologies and civilizations that incorporated the use of mushrooms for food, medicine, and rituals. Guatemala is emerging from civil war, developing economically and encouraging tourism. Promotion of mycological research and mycotourism could become important components of this development. In this context, the Universidad de San Carlos de Guatemala hosted the 7th International Edible Mycorrhizal Mushroom Workshop (IWEMM-7) in 2013. Written from the lead author's personal perspective, this article describes the workshop and a post-meeting tour around the country visiting many sites of mycological interest.*

## AN INTERNATIONAL WORKSHOP ON EDIBLE MYCORRHIZAL MUSHROOMS

**V**olcán de Agua looms over nearly every view in the old capital city of La Antigua, Guatemala (Figure 1). Everything is on shaky ground. After a series of especially big earthquakes in 1773, the country's capital was moved downhill about 50 miles [~80 km] to current day Guatemala City. Thus somewhat bypassed by development, this old historic city features narrow cobble streets, classic colonial architecture, lively tourist markets, and restaurants established centuries ago. As a location for a workshop on wild edible mushrooms, the city had charm in abundance and hinted at adventures to come. The workshop venue, the La Merced Church and Monastery, is one of the most beautiful colonial buildings in Latin America. Even it was rebuilt with solid arches after massive earthquakes in 1565 and 1717. Its central atrium and large fountain provided a colorful setting for posters, mushroom displays, social events and vendors of mushroom related products.

But first, what exactly is an “IWEMM,” and why did the organizers choose to convene the 7th one here?

The International Workshops on Edible Mycorrhizal Mushrooms revolve around a seemingly narrow scientific focus

Workshop #	MEETINGS	LOCATION	DATE
1	ICOM-1 workshop	Berkeley, California	August, 1996
2	IWEMM-1	Uppsala, Sweden	July, 1998
3	IWEMM-2	Christchurch, New Zealand	July, 2001
4	IWEMM-3	Victoria, BC, Canada	August, 2003
5	IWEMM-4	Murcia, Spain	November, 2005
6	IWEMM-5	Chuxiong, China	August, 2007
7	IWEMM-6	Rabat, Morocco	April, 2011
8	IWEMM-7	La Antigua, Guatemala	July, 2013
9	IWEMM-8	Cahors, France	February, 2016

Table 1. Location and dates of International Workshops on Edible Mycorrhizal Mushrooms.

that in fact encompasses a broad range of multi-disciplinary research conducted by investigators around the world.

Most of the widely-harvested edible mushrooms found in forests of the world fruit abundantly because they are mycorrhizal with trees that provide them with copious quantities of carbohydrates. When the role of humans is considered, the ramifications of this symbiosis between trees and edible forest mushrooms branches into a multitude of topics ripe for study: biology, taxonomy, genetics, ecology, forestry, cultivation, ethnomycology, social anthropology, land tenure, harvesting access, commerce, economic development, regulation, conservation, and mycotourism. Presentations and posters at the IWEMMs have covered all these topics and more.



Figure 2. *Wynnea americana* Thaxt. has previously only been documented in Central America from Costa Rica. Photo by David Pilz.

The first such meeting (Table 1) was indeed a “workshop” organized as a part of the first International Conference On Mycorrhizae (ICOM-1) in Berkeley, California in 1996. The first independently organized “IWEMM-1” was held in conjunction with the ICOM-2 in Uppsala, Sweden in 1998. Thereafter, the IWEMMs were convened separately from ICOM meetings.

The Guatemalan IWEMM-7: “Toward a New World” (July 29-August 2, 2013) continued a fine tradition of mixing science (presentations and posters) with social gatherings, cultural activities and tours of local mushroom sites; all events that build international friendships and promote research collaborations.

Social events included a welcoming reception, local cuisine with some mushroom dishes, a middle-school singing and dance troupe, marimba bands, vendors of native arts and crafts featuring mushroom themes, Ballet Folklórico of the National Institute of Tourism-INGUAT, local food

appreciation at Finca San Rafael Urías (coffee plantation), mushroom hunting and lunch at the Paseo Xejasmín resort, and a guided visit with cultural activities at the Mayan Iximché Ruins in Tecpán, Chimaltenango.



Figure 3. A group photo of IWEMM-7 participants gathered on the central fountain in the atrium of the La Merced Church and Monastery. Photo by José Maria González.

Students from Universidad de San Carlos de Guatemala conducted a foray at the Paseo Xejasmín resort and showed their collections at the workshop the next day, including a rare *Wynnea* specimen (Figure 2). All workshop participants (Figure 3) came away with many colorful impressions, fond memories and ideas for subsequent mycological research projects.

**Readers who are interested** in the scientific program, abstracts of the talks and posters, the organizing committee, workshop sponsors, and details of the events are encouraged to download the IWEMM-7 Workshop Proceedings at <http://www.pilzwald.com/iwemm7/>. World-renowned truffle expert Pierre Sourzat, Manager of the Station d'expérimentation sur la



Figure 4. Guatemala: Land of Diversity. Courtesy of WorldAtlas.com.

truffe in Le Montat, France will be hosting the **next IWEMM-8 in nearby Cahors, France, February 7-13, 2016** (with a field trip afterwards). The website is under construction, so readers can search the web this spring or summer. The URL will likely include the term “iwemm8-cahors.” You may also contact author David Pilz (in English) or workshop organizer Pierre Sourzat (in French, pierre-sourzat@orange.fr) regarding updated workshop information. The web site for the Le Montat Truffle Culture Experiment Station is: <http://station-truffe.pagesperso-orange.fr/index.htm>.

### GUATEMALA AND THE MAYANS

Guatemala (Figure 4) is a land of immense biological, topographic, climatic, edaphic and cultural diversity. Southwestern lowland coastal areas along the Pacific Ocean are hot and tropical, with large swaths of sugar cane plantations. Unlike México, tequila is not a national drink in Guatemala. Rum is! Inland to the north, the land rises quickly into the volcanic Sierra Madre de Guatemala, also referred to as the “Mayan Highlands.” These mountains range in elevation from approximately 5,000 feet [~1500 meters] to more than 13,000 feet [~4000 meters]. Coffee plantations thrive near 5,000 feet; corn and other crops are grown up to 9,000 feet [~2750 meters]. Above 6,000 feet [~1800 meters], pine, fir, oak and other

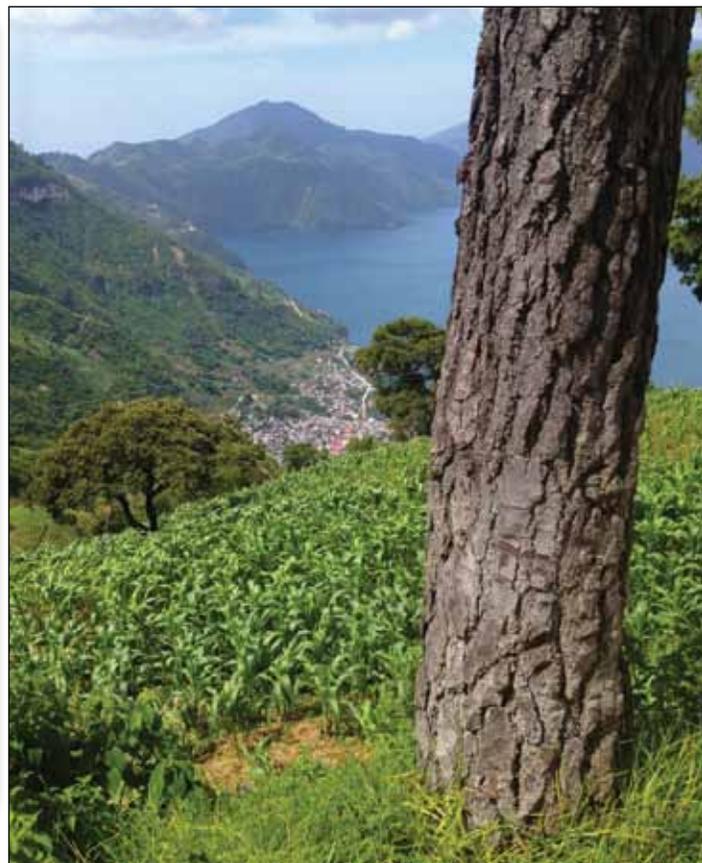


Figure 5. The Highland Mayan landscape with cultivated fields interspersed among conifer/oak forest. Photo by David Pilz.

hardwood species cover the peaks in cloud forests where mycorrhizal mushrooms thrive. The highlands are called “the land of eternal spring,” where year-around temperatures vary little beyond 75° F ± 5° [24° C ± 3°] at the elevations where most people live and cultivate the land (Figure 5). Summer is typically the rainy season and winter the dry season. Further north still, the land drops into the lowland jungles of Petén, a Guatemalan state in the southern Yucatán Peninsula. Southeast of the Sierra Madre is the driest area of Guatemala and northeast the country borders a short stretch of the Gulf of Honduras in the Caribbean Sea.



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Figure 6. Mycology student Mariflor Gomez with a mushroom species that will be named *Lactarius neo-deliciosus* Flores & Honrubia. Photo by Roberto Flores Arzú.

The Mayan people, with their myriad languages and local ethnic groups, flourished in the Guatemalan highlands and Petén jungles for close to a thousand years prior to the Spanish conquest. The book “The Maya, 8th ed.” by Michael Coe provides a definitive history. They remain impressively resilient in protecting their cultural heritage. A part of that heritage is a love of mushrooms. Mayans know, collect, eat, and sell a wide variety of forest mushrooms. Many of these types of edible forest mushrooms occur throughout northern temperate forests, but many of the local species have not yet been described and given correct scientific names (Figure 6). The following list includes some European Latin names for convenience in describing close affinity. Mushrooms that can be found in markets include several species of *Cantherellus*; a group of *Boletus edulis* related species; four species of an *Amanita caesarea* group; *Ramaria* species; a *Lactarius* complex with species similar to *L. deliciosus*, *L. salmonicolor* and *L. indigo*; *Laccaria laccata* and *L. amethystina*; *Hydnum repandum*; *Helvella crispa* and *H. lacunosa*; *Tricholoma flavovirens*; *Lepista nuda*; and many others. Less well known is whether the Maya used *Psilocybe* species for ritual purposes, as did the natives of Central Mexico, but they certainly made many “mushroom stones” (Figure 7).

### THE MYCO-TOUR

Mycotourism is beginning to take hold in several parts of the world. After the workshop, eleven of us participated in the first such tour that we know about in Guatemala. We were a mixed



Figure 7. Workshop organizer and author, Natalia Gurriarán Quiróz, holding a Highland Maya mushroom stone made of granite. Photo by Roberto Flores Arzú.

group of workshop participants and spouses from Guatemala, México, Morocco, China, New Zealand, Switzerland, and the United States (Figure 8). Co-author José María González, the official workshop photographer, organized much of the tour and drove us safely around the country.

We spent six days in the highlands and three in the lowland jungles. Many tourist highlights were on our agenda; including the world-famous Lake Atitlán, Fuentes Georginas, San Andrés Xequil, and Xetulul. Just googling these places will likely have you planning your next vacation in Guatemala. One highlight was a visit to the ethereal “Laguna Chicabal” within the caldera of Volcán Chicabal. The lake is sacred to the Mam Mayan people and is preserved as a National Park. While visiting the park headquarters we encountered a couple of young Mayan women. A casual conversation revealed that they were conducting a scientific survey of mushroom diversity in the park! They whipped out their cell phones and for the next hour several members of our group gleefully examined their photographs and discussed identifications.

Although we were visiting in August, which is typically the wet (read “mushroom”) season, we happened to be there during a dry spell. So although we visited many Mayan markets in search of mushrooms being sold, we found only a few



Figure 8. Participants in the post-workshop field trip: (left to right) David Pilz, Jesús Pérez Moreno, Simon and Barbara Egli, Lahsen Kahbar, Roberto Flores Arzú, Yun and Jing Wang, Cristiana Arteaga (Jesús's spouse), and Alexis Guerin-Laguette. Tour leader, José Maria González, was not able to take a “selfie” to include himself in the picture. Background wall art in the town of San Pedro de Laguna on the southwestern shore of Lake Atitlán. Photo by José Maria González.

examples (Figure 9). In one instance, where we had hoped to hunt for mushrooms in cloud forests owned by Mayan villagers, we were denied permission due to local tensions from disputes with mining companies. We did, however, find many examples of mushroom stones in Mayan markets such as the famous market in Chichicastenango. Whether they were authentically ancient was more difficult to determine because mushroom stones in the highlands are made from granite and easily replicated. Occasionally traces of old paint or certain stylistic elements suggested that they were genuine. We bought none of them because, as Roberto politely put it, “We like to keep our National Heritage in the country.” It was difficult to imagine hauling back a large granite stone in our suitcases anyway. Suffice it to say we took as many photographs as possible.

The last leg of our trip, in the lowland jungles of Petén, started with a visit to the world-famous ruins of the ancient Mayan city-state of Tikal. I found the place indescribably wondrous and haunting, so I won't try to elaborate further. See



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Figure 9. Mayan women sell “*Lactarius indigo*” mushrooms in the Comalapa market. This beautiful species is one of the most commonly sold mushrooms in Guatemalan markets. Photo by Roberto Flores Arzú.



Figure 10. Luis Colmenares, with ceramic Lowland Mayan mushroom stones in his private Museo Arqueológico Maya, Isla Santa Bárbara, Lago Petén Itzá. [<http://radiopeten.com.gt/radiopeten/santa-barbara-hotel-museo/>]. Photo by David Pilz.

the author notes for José Maria González regarding a beautiful picture book about Tikal. I recommend putting a visit on your bucket list.

The closest airport to Tikal is in Santa Elena, a town with a bridge out to an island in Lake Petén Itzá called Isla de Flores. This island was the last holdout of Maya civilization against the Spanish Conquest. Cortés gave up trying to conquer the island’s Mayan city which was then known as Tayasal or Nojpetén. Only in 1697 did the Spanish manage to take possession and by then the Mayans had fled the city, taking their culture and possessions with them, fading into the jungle. While visiting Flores before going to Tikal we had noticed a smaller nearby island (Isla Santa Bárbara) with a big sign on it saying “Museo.” Subsequent conversations with locals convinced us to change our plans and visit the museum so we rented a boat and arrived in a late-afternoon tropical downpour.

To me, the private museum felt like a scene straight out of an

Indiana Jones movie. The proprietor, Luis Colmenares, had an incredible collection of lowland Mayan artifacts that his father had started collecting in the 1950s. They were displayed in a crowded jumble of glass cases and tabletops crammed into two small rooms. When Luis learned we were mycologists, he brought out two genuine mushroom stones that were made of ceramic in the lowland style because granite would have only been available through trade with the highlands (Figure 10). He generously let us handle and photograph these authentic artifacts. Among his father’s relics were an old Victrola phonograph on which he played an old LP of “La Vie en rose” by Louis Armstrong (dancing ensued) and a vacuum tube radio station that he turned on. We were incredulous when he told us he was still broadcasting! That is, until he took us into his house to show us his modern radio station studio where he broadcasts “Radio Petén.” Check it out: [radiopeten.com.gt](http://radiopeten.com.gt). Tourist lodging is also available on the island.

En route back to Guatemala City by car, we enjoyed further adventures at a resort ranch called Finca Ixobel-Hotel Ecológico and a boat cruise on the Rio Dulce y El Golfete on the Gulf Coast south of Belize. We ended our tour with a visit to the Museo Nacional de Arqueología y Etnología in Guatemala City where there are excellent examples of the various styles of mushroom stones on display, among numerous other amazing Mayan artifacts.

### MYCOLOGICAL RESEARCH IN GUATEMALA

One of our primary purposes in writing this article is to encourage further mycological research in Guatemala. Opportunities abound. Many new mushroom species (edible or not) remain to be described, named, and vouchered. Some of these may be endemic to Guatemala. No native truffles have yet been documented, but they undoubtedly exist. For researchers interested in ethnomycology, Guatemala offers one of the most complex examples of every historic, social, cultural, economic, and land ownership issue pertaining to mushroom harvesting. As the Maya work to sustain their languages and ways of life, cooperating with them to document their traditional mushroom knowledge would enrich modern appreciation of the value of their ancient culture.

Another possible avenue for advancing appreciation, study, and sustainable use of fungi in Guatemala is the idea of “Mycoparks.” This concept was developed at a World Fungi Conference in Córdoba, Spain in 2007 and is modeled after UNESCO GeoParks. These areas of special mycological interest would be designed to simultaneously advance the goals of scientific research, education, conservation, sustainable use, local economic development, and tourism.

Anyone interested in collaborative mycological research on any of these topics should contact author Roberto Flores Arzú. As he noted in the Introduction to the IWEMM-7 Workshop Proceedings, the “University of San Carlos de Guatemala, the second university erected in the Americas (1676), is a pioneer in mycology in Central America and opens its doors to all scientists who want to collaborate to know better the local diversity of ectomycorrhizal mushrooms for a wide range of purposes: phylogenetics, taxonomy, evolution, pharmaceutical applications, forest health, and cultivation of valuable edible species. The more we know, the more we can give to future

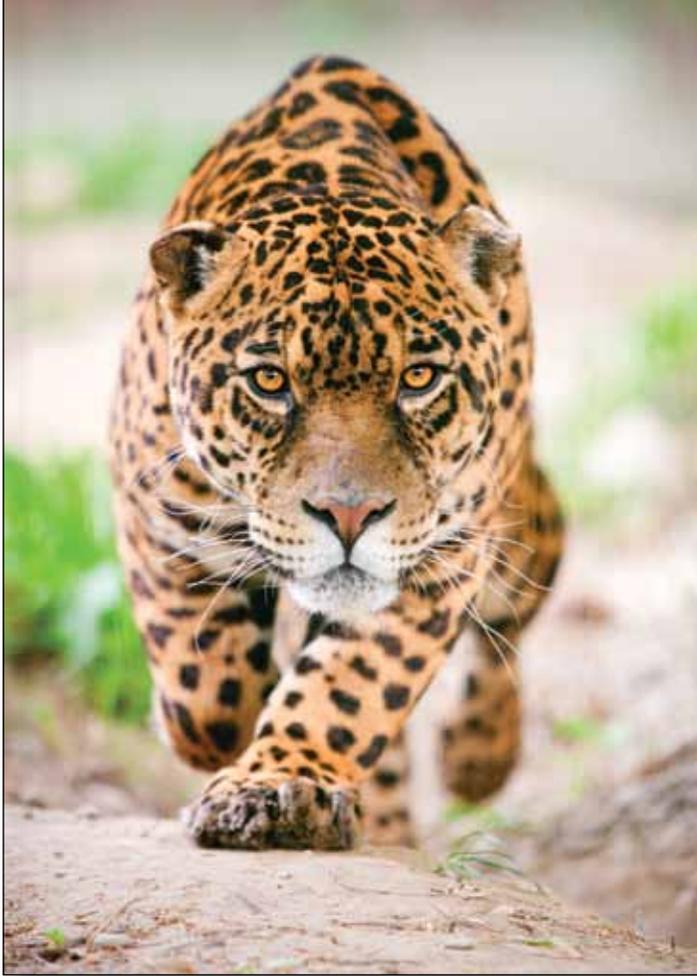


Figure 11. If you visit Guatemala, the authors *do not* recommend staring contests with jaguars. Photo by Ammit Jack, Shutterstock.com.

generations in a New World.”

## JAGUARS

Oh yes, and Jaguars! Although now few in number, these amazing cats still live in the wild in Guatemala and are protected in the Cockscomb Basin Wildlife Sanctuary in neighboring Belize (Figure 11). The Maya revered the Jaguar God of the Underworld. As top predators, ensuring adequate habitat for their survival entails preserving large swaths of connected and undeveloped forests. Large charismatic megafauna such as jaguars and Siberian tigers (*FUNGI* Volume 5(3): 13-17) have been useful for convincing the public and elected representatives of the need to preserve large undeveloped areas with habitat connectivity. These same attributes also serve to ensure robust preservation of natural biodiversity, including mycodiversity, over large scales. So let’s hear it for the Jaguars! May they continue to roam freely. Just check your surroundings when you lean down to pick that mushroom! They can walk through the jungle silently, and you don’t want to look like dinner.

## ACKNOWLEDGEMENTS

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on the post-conference field trip. The second reviewer was Shannon Berch, Soil Ecologist, British Columbia Ministry of Environment, Conservation Science Section, Canada. Shannon hosted the IWEMM-3 in Victoria B.C., Canada in 2003 and has served on the International Committee.

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<sup>2</sup>Dr. Roberto Flores Arzú was the Chairman of the Organizing Committee of the IWEMM-7. He is a Mycology Professor with the Facultad de Ciencias Químicas y Farmacia, Universidad de San Carlos de Guatemala. Roberto may be contacted at: floresarzu.roberto@gmail.com

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José Maria González was the workshop photographer, as well as a co-organizer and driver for the post-workshop field trip. Through Mayagrafic Publicaciones, Guatemala, he has published two beautiful picture books: “Coactemalan: Tierra de Muchos Arboles” (Guatemala: Land of Many trees) and “Guatemala: National Park Tikal.” José Maria may be contacted at: josgonzalez3@yahoo.es. 📧



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