



昆明學院
KUNMING UNIVERSITY



雲南大學



University
of Windsor

2024 Horizon Scan Workshop for Global Freshwater Harmful Algal Blooms and Integration of Research, Education and Industry

Prospectus and Agenda

Kunming, Yunnan, China

July 6-11, 2024

1. Workshop Introduction

Harmful Algae Blooms (HABs) cause severe damage to aquatic ecosystems and human health globally. Climate change and other anthropogenic stressors will exacerbate HABs in the future. Research on HABs has made impressive progress, however some important issues have still been overlooked and not fully understood (e.g. mining and synthesis of mechanisms of new algal toxins, succession of dominant algal bloom taxa, and risk prediction under conditions of global change). Horizon Scanning is a collaborative effort to better identify, understand, manage and mitigate emerging threats through multidisciplinary teams of scientists to identify current and future challenges and opportunities. It has been successfully applied in many fields of ecology, including conservation, urban ecosystem management, illegal wildlife trade, marine and coastal biodiversity conservation, and invasive species. However, thus far, no horizon scan specifically targeted HABs, providing our opportunity to convene the world's top scientists in this field to jointly identify key scientific problems in the field of freshwater HABs.

The workshop is co-organized by Kunming University, Yunnan University and the University of Windsor. In addition to the horizon scan, we invited four scientists from the United States, Denmark, New Zealand and China to precede the workshop with keynote speeches, allowing both in-person and online discussions following each presentation. The presentations will identify different opportunities and challenges in the field of freshwater HABs from a global perspective, and significantly enhance the internationalization of scientific research and talent training in this field.

2. General Information

Organizers: Kunming University, Yunnan University, and the University of Windsor

Co-organizer: Kunming Dianchi & Plateau Lakes Institute

Cooperate conference support: Yunnan Chenhai Business Co., LTD

Venue: Green Lake Hotel, Kunming, Yunnan, China. Green Lake is a popular site for both locals and tourists in downtown Kunming. The Green Lake Hotel is located on the lake's shore. It takes about 1 hour to walk around the lake, which is populated with many cafés and restaurants.

Zoom Access: ID: 835 5484 6917, Code: 084441

Organizing Committee:

Prof. Dr. Hugh J. MacIsaac, University of Windsor & Yunnan University
Prof. Dr. Xuexiu Chang, Kunming University & University of Windsor
Prof. Dr. Lirong Song, Institute of Hydrobiology, CAS
Prof. Dr. R. Michael McKay, University of Windsor, Director of GLIER
Prof. Dr. Tiyan Xia, Kunming University, Dean of School of Agronomy and Life Sciences
Prof. Dr. Zhiming Zhang, Yunnan University, Executive Associate Dean of SEES
Prof. Dr. Haijun Wang, Yunnan University, Associate Dean of SEES
Prof. Min Pan, Kunming Dianchi & Plateau Lakes Institute, Associate Director
Prof. Weili Li, Kunming University, Director of Office of Science and Technology
Prof. Ling Chen, Kunming University, Director of Office of International Cooperation & Exchange
Prof. Dr. Zhen Ren, Kunming University, Associate Dean of School of Agronomy and Life Sciences
Dr. Runbing Xu, Yunnan University

Affairs Committee and emergency contact information (Chinese/English = C/E)

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3. Agenda for 2024 Workshop for Horizon scan on cHABs

July 5-6th	Arrival
Whole day	Attendees will be picked up from Kunming Changshui International Airport (KMG) and taken to the hosting hotel (Green Lake Hotel).
July 6th	City Tour
8:50	Bus departure from Green Lake Hotel.
09:00 - 9:50	Historical Donglu campus of Yunnan University (downtown).
9:50 - 11:00	Travel to and tour of Qianwang Old Street.
11:00 - 12:00	Group lunch: Crossing Bridge Rice Noodles at Yunxianlou Restaurant.
12:00 - 13:30	Return to Green Lake Hotel to rest.
13:30 - 14:10	Travel to Kunming University.
14:10 - 15:10	Tour of Kunming University , Dr. Jinmei Zi (Lab visiting; Dianchi Basin Ecology and Culture Museum).
15:10 - 15:40	Travel to Chenggong (new) campus of Yunnan University.
15:40 - 16:40	Tour of Yunnan University , Dr. Runbing Xu (Lab visiting; campus tour; YNU Museum).
16:40 - 19:00	Travel to and enjoy Ice-breaking dinner : Yunnan Lamb BBQ.
19:00 - 20:00	Return to Green Lake Hotel.
July 7th	Field tour
09:00	Bus departure from Green Lake Hotel.
09:30 - 10:30	Visit Kunming Dianchi & Plateau Lakes Institute, Lake Dianchi. Vice Director Min Pan will give a talk about cHABs in Dianchi in English; Q&A.
10:30 - 11:30	Travel to and visit algae removal and harvesting system, Lake Dianchi.
11:30 - 12:00	Travel to and visit Dabokou eco-restoration system, Lake Dianchi.
12:00 - 13:30	Travel to lunch at Yuyuan Restaurant near Dianchi Lake (traditional group lunch).
13:30 - 15:00	Travel to and visit Baofeng Wetland Park, biodiversity and constructed restoration wetland exhibition for COP15, Lake Dianchi.
15:00 - 16:30	Travel to and visit the world's largest cut flower market, Kunming.

16:30 - 18:30	Return to hotel for rest.
18:30 - 19:00	Opening ceremony and greetings from hosting universities in Green Lake Hotel (Dr. Xuexiu Chang): President Dr. Wenli Ding, Kunming University; introduced by Dr. Xuexiu Chang Vice President Dr. Xingwu Duan, Yunnan University; introduced by Dr. Runbing Xu President Dr. Rob Gordon (recorded video), University of Windsor; introduced by Dr. Hugh Maclsaac. Official thank you for local support (Dr. Hugh Maclsaac)
19:00 - 21:00	Welcome dinner.
July 8th	Keynote talks & Workshop discussions
Morning	Keynote talks
08:00 - 08:10	Formally opening of the workshop (Dr. Hugh Maclsaac)
08:10 - 09:10	<i>Hans Paerl</i> (virtual), Institute of Marine Sciences, University of North Carolina, USA. (Introduced by Dr. Runbing Xu) Topic: Mitigating harmful cyanobacterial blooms in a hotter, hydrologically more extreme world: Evolving Issues
09:10 - 10:10	<i>Lirong Song</i> , Institute of Hydrobiology, Chinese Academy of Sciences, China. (Introduced by Dr. Runbing Xu) Topic: Proliferation of filamentous cyanobacterial bloom: recent understanding on its eco-physiology and challenges for control
10:10 - 10:40	Coffee Break
10:40 - 11:40	<i>Susie Wood</i> , Coastal and Freshwater group, Cawthorn Institute, New Zealand. (Introduced by Dr. Xuexiu Chang) Topic: Insights into the ecology and toxin production of toxic benthic cyanobacteria proliferations
11:40 - 12:40	<i>Erik Jeppesen</i> , Aarhus University (Denmark), Middle East Technical University (Turkey), Yunnan University (China). (Introduced by Dr. Xuexiu Chang) Topic: Can macrophytes, zooplankton and nitrogen reduction help control cyanobacteria in (shallow) lakes
12:40 - 14:00	Buffet lunch in Green Lake Hotel
14:00 - 15:00	Rest in Green Lake Hotel
15:00 - 18:00	Workshop discussions the topics/themes selection
18:00 - 19:30	Travel to dinner in local restaurant (Yunnan Dai cuisine)
July 9th	Workshop discussions
9:00-12:00	Workshop discussions of final topic choices, journal selection, establish writing teams for each topic, establish the global writing team (5-6 persons), paper writing instructions, timelines for initial team submission of drafts section, global review team, return first complete draft to authors for review.

12:00 - 13:30	Buffet lunch in Green Lake Hotel
13:30 - 15:00	Rest in Green Lake Hotel
15:00 - 17:00	Final Workshop discussions
17:00 - 19:00	Travel to dinner in local restaurant (Laodian Shanzhai)
July 10th	Field tour
08:30 - 09:30	Bus trip from hotel to Stone Forest National Park.
09:30 – 12:00	Tour Stone Forest World Natural Heritage.
12:00 - 13:30	Lunch near Stone Forest National Park.
13:30 - 17:30	Travel to and tour Jiuxiang Karst Cave National Park.
17:30 - 19:30	Travel back and farewell dinner, Yiliang Roast Duck restaurant.
July 11th	Departure
Whole day	Attendees will be delivered to KMG airport from hotel. Individuals with late-departing flights can have activities created for day-time hours before departure. Possible activities include group research meetings, lab tours of university aquatic labs, Green Lake walking tour, local shopping etc. English/Chinese hosts will accompany travelers through the airport check-in process.

4. Introduction of Keynote Talks

Title: Mitigating harmful cyanobacterial blooms in a hotter, hydrologically more extreme world: Evolving Issues

Hans W. Paerl, PhD - Professor, University of North Carolina at Chapel Hill, Institute of Marine Sciences, USA

Abstract: Cyanobacterial harmful algal blooms (CyanoHABs) are a major threat to environmental and human health along the freshwater to marine continuum. As global proliferation of CyanoHABs continues to increase in prevalence, intensity, and toxicity, it is important to identify and integrate the underlying causes and controls of blooms in order to develop effective, long-term mitigation strategies. Nutrient input reductions should receive high priority. However, climate changes are driving CyanoHAB proliferation through increasing global temperatures, changing wind patterns and intensities, and altered precipitation patterns, including more extreme rainfall events, protracted droughts. Resultant hydrologic extremes have led to the “perfect storm scenario;” due to increases in pulsed nutrient loading events, followed by persistent low-flow, lengthened water residence times, favoring blooms. To meet the CyanoHAB mitigation challenge, watershed and airshed N and P input reductions must be formulated under extreme hydrologic conditions in order to maintain CyanoHABs below bloom thresholds. Specifically, long-term CyanoHAB management strategies must incorporate anticipated climatic changes and extremes, and nutrient management strategies should be compatible with other physical-chemical-biological mitigation approaches, such as altering freshwater flow and flushing, artificial mixing, dredging, chemical applications, and top-down biological controls. Lastly, based on evolving knowledge of environmental controls on cyanotoxin production, these management strategies should find ways to reduce CyanoHAB toxin production, in order to minimize adverse ecosystem and human health impacts.



Dr. Hans W. Paerl is a famous international aquatic ecologist, W.R. Kenan Distinguished Professor with UNC's Institute of Marine Sciences, Appointed Research Fellow at Nanjing Institute of Geography and Limnology, Chinese Academy of Sciences. His research addresses aquatic nutrient cycling and primary production dynamics, environmental controls, and management of harmful algal blooms. The Paerl lab also focuses on assessing effects of human and climatic alterations of water quality and sustainability to coastal and inland waters around the globe. He has published more than 600 SCI papers, including journal papers such as Science, Nature and PNAS, being cited more than 76,000 times with h-index of 130 on Google Scholar. He is the top one thousand cited author in the field of ecology and environmental science. He got the G. Evelyn Hutchinson Award from American Society of Limnology and Oceanography in 2003, Odum Lifetime

Achievement Award from the Coastal and Estuarine Research Federation in 2011.

Title: Proliferation of filamentous cyanobacterial bloom: recent insights into its eco-physiology and control challenges

Lirong Song, PhD - Professor, Institute of Hydrobiology, CAS, China

Abstract: Cyanobacterial blooms (CyanoHABs) have markedly increased over the past decades and are projected to continue increasing due to the combined impacts of eutrophication, elevated CO₂ levels, and global warming. While excess nitrogen and phosphorus are often cited as primary contributors to CyanoHABs, the specific dominant species responsible can vary widely between different lakes and seasons, even under similar nutrient conditions. The proliferation and persistence of bloom-forming filamentous cyanobacteria (FC) are on the rise across various geographical regions. Numerous studies have elucidated the ecological dominance of FC; however, there has been less focus on their nutrient utilization strategies. Recent research indicates that certain filamentous cyanobacteria may utilize phosphonates (phosphonic acids) in aquatic ecosystems to support their growth. In N-deficient seasons, *Cylindrospermum. raciborskii* sustained a relatively high biomass by utilizing cyanophycin-released nitrogen instead of fixed nitrogen. Additionally, iron bioavailability plays a crucial role in influencing the dynamics *C. raciborskii* and promoting the species' blooms. In a case study of the shallow lake Honghu, both nutrient strategy and non-algal turbidity contributed to the sustained dominance of FC over the past years. However, the effects to combat FC blooms on a large-scale are limited. compared to those targeting *Microcystis* blooms. Therefore, it is imperative and urgent to address the increasing issue concerning the mechanism and control of filamentous cyanobacteria.



Dr. Lirong Song, a professor at the Institute of Hydrobiology, Chinese Academy of Sciences, currently serves as the Deputy Director of the National Aquatic Biological Resource Center and Director of the Freshwater Algae Culture Collection. Dr. Song has conducted extensive foundational research and technological applications in areas such as the physiological and ecological mechanisms of algal blooms, the ecological fate and prevention of cyanobacterial toxins and odors, and the utilization of economic microalgae.

With over 200 publications in reputable journals such as *Water Research*, *The ISME Journal*, *Environmental Science & Technology*, and *Algal Research*, Dr. Song's research has been cited over 8,000 times according to Web of Science, with an h-index of 45. He has previously served as the Chief Scientist on national research projects, including the National Basic Research Program (973), the National High-Tech Development Program (863) and Scientist in the Algal Industry System designated by the Ministry of Agriculture. Previously, Dr. Song served as the President of the Phycology Society of China and an Executive Committee Member of the International Society for Applied Phycology (ISAP). He has been recognized as a National Advanced Individual in Field Scientific Work and has received three first-place awards at the provincial and ministerial level. Dr. Song has mentored over sixty doctoral, master's, and postdoctoral students.

Title: Insights into the ecology and toxin production of toxic benthic cyanobacteria proliferations

Susie Wood, PhD - Senior Scientist, Cawthron Institute, Nelson, New Zealand

Abstract: Proliferations of benthic cyanobacteria are increasing in streams, rivers, lakes, and reservoirs worldwide. The benthic mats responsible for the proliferations smother the bottom of water bodies and may cover many square kilometers. Despite increasing reports of these proliferation and associated animal poisonings, research on many aspects of benthic cyanobacteria ecology and toxin production is well behind the field of planktonic cyanobacteria. Currently there is a limited understanding of the: (1) environmental conditions promoting toxic benthic cyanobacteria proliferations; (2) life cycle of a toxic benthic proliferation (from the initiation of the biofilm to its detachment and fate); and (3) the dynamics of toxin production. In this presentation I will showcase the range of issues globally. Using research examples from our team, I will highlight the suite of methods that we have used to explore what makes streams susceptible to benthic proliferations at a national scale in Aotearoa-New Zealand, and factors that promote proliferations at a regional, river and mat scale. I also demonstrate how genomic techniques are advancing our understanding of mat formation and toxin production.



Dr Wood is a Senior Scientist at Cawthron Institute in New Zealand. Her research is multidisciplinary and integrative, with the overarching goal of improving knowledge on freshwater ecosystems. It spans three broad areas: (i) toxic cyanobacteria dynamics in freshwater systems (both planktonic in lakes and benthic in rivers), (ii) the development and application of molecular techniques to monitor and understand aquatic systems, and (iii) integrating cutting edge techniques with more traditional paleolimnological approaches to guide future lake management and restoration. She is considered a world expert on toxic cyanobacteria and has been involved with developing both recreational and drinking water guidelines for cyanobacteria in Aotearoa New Zealand. She received the Kilham Lecture Award from the International Limnology Society in 2022 for her contribution to freshwater research

internationally, and the New Zealand Freshwater Sciences Society medal in 2019 for her outstanding contributions to freshwater science in Aotearoa New Zealand. She has published more than 230 SCI papers, being cited more than 11,000 times with h-index of 58 on Google Scholar. She serves as Associated Editor of Inland Waters (Journal of the International Society of Limnology).

Title: Can macrophytes, zooplankton and nitrogen reduction help controlling cyanobacteria in (shallow) lakes?

Erik Jeppesen and many collaborators

Abstract: Based particularly our own studies from shallow lakes, we show that macrophyte by various mechanisms (e.g. allelopathy, competition and shading) can help reducing the biomass of cyanobacteria. We further show that cyanobacteria is the most negatively affected phytoplankton class when lakes are restored by biomanipulation (fish removal) that leads to dominance of large-bodied zooplankton - despite their low food quality for zooplankton. This may in part reflect that zooplankton can overcome the low quality food of cyanobacteria by up-regulation of fatty acid desaturase genes for essential/semi-essential biochemical synthesis, as shown experimentally. Moreover, high grazer abundance means higher turnover of phytoplankton, which is not to the favor of S-strategists, such as cyanobacteria. Further, using mass balance data from 10 lakes covering 30 years of recovery from eutrophication as well as data from a long-term mesocosm experiment (20 years) run at 3 different temperature scenarios, to which N-loading (but not P-loading) was reduced for 1 year (with data also from 2 years before and after for comparison), we further show that N-fixation cannot compensate for a selective reduction in nitrogen and that N-legacy is low. This suggest that that not only external loading reduction of P, but also of N would be a useful strategy for reducing cyanobacteria biomass in shallow lakes, not least in the period where these lakes are suffering a high internal P-loading.



Dr. Erik Jeppesen is a world-leading international lake scientist, professor of Aarhus University in Denmark and visiting professor of Yunnan University, the main research fields are aquatic ecology, climate change, lake restoration and, eutrophication control. He has published more than 700 SCI papers, including journal papers such as Science, PNAS, Nature Climate Change, Nature Geoscience, The Innovation and Trends in Ecology & Evolution, and cited more than 94,000 times on Google Scholar. He is the top one thousand cited author in the field of ecology and environmental science. He was awarded the Nobel Peace Prize as a member of the Intergovernmental Panel on Climate Change (IPCC) in 2007. In 2010, he was awarded the Naumann-Thienemann Medal by the International Society of Limnology (SIL) and in 2020 the TUBA Distinguished Scientist International Award.

5. Participants of Horizon Scan on Freshwater Harmful Algal Blooms

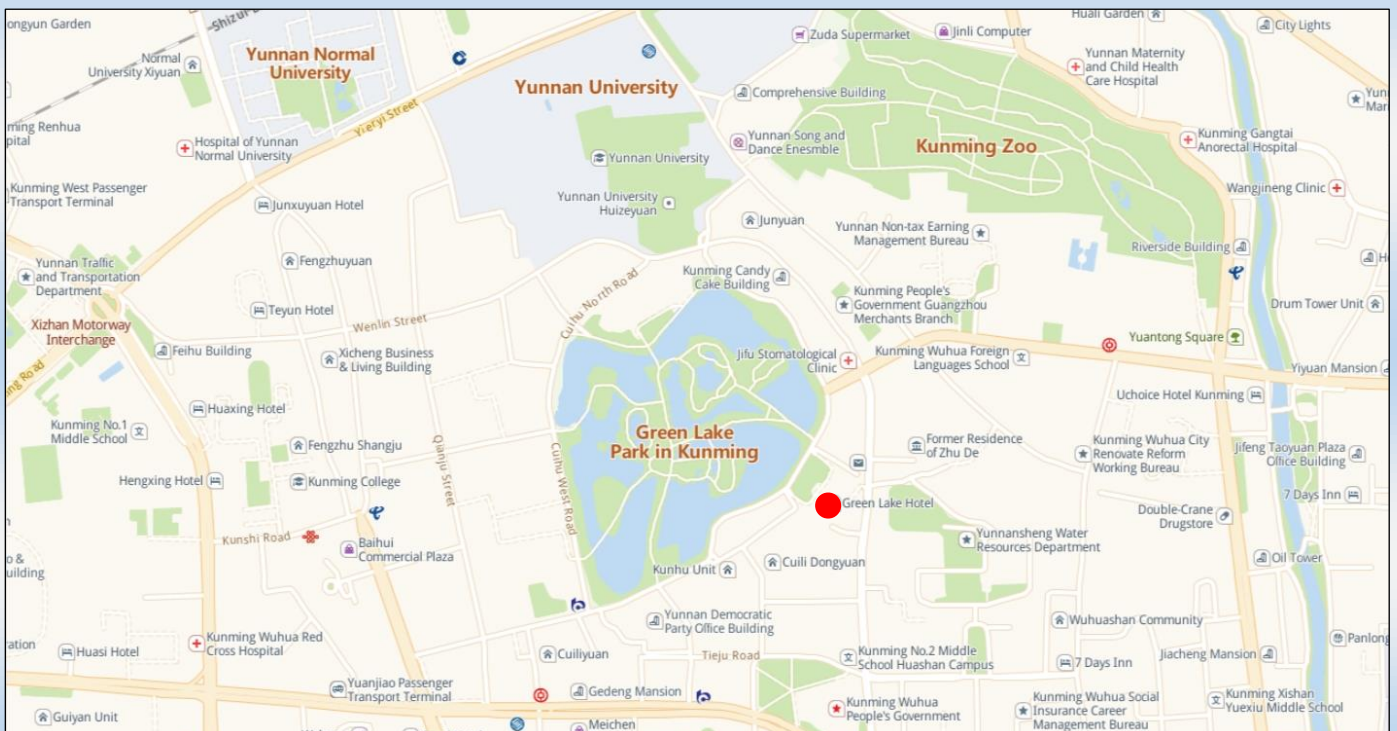
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6. Tips for attendees

For a smooth journey, please pay attention to the following when you arrive in China:

- If you have any **food restrictions**, please contact Xuexiu Chang. She will arrange appropriate foods for your meals.
- **Cash** (currency exchange in the airport) and E-payment (AliPay, ApplePay) are commonly used in China. Credit cards are typically not accepted.
- **Mobile Phone** usage: If you desire to make phone calls while in China, you light wish to obtain a Chinese SIM upon arrival. We recommend you to use the China Mobile SIM card. Prepaid SIM cards can be purchased online or at the airport (PVG, PEK, CAN, only in day time).
- **Language**: You can install a translation APP (Apple Translate, Baidu Translate, offline Google translate) and download the language pack you need before you arrive.
- **Transportation**: Please download the offline map of Kunming before you will arrive in China (Apple map, Baidu map). Transportation during the conference period will be handled by us. If you or your family want to go on a city tour, we can provide you with volunteer services.
- **Weather**: Kunming will be in the monsoon season during July, with average temperature ~ 22°C (range of 18-27°C). Expect brief, intense early evening storms daily.
- **Clothing**: Kunming is located at 2000m and experiences intense solar radiation. We will prepare a hat for everybody, but you can bring your own, and please use sun protection. We will have three days of tours during the conference so we recommend you use easy walking shoes (ordinary sports shoes are OK).
- **Mosquitoes**: Since we will have field tours, we will provide mosquito repellent if required. If you have a preferred mosquito repellent, you can also bring your own. Note that mosquitoes in the Kunming area do not transmit malaria.
- **Google, Facebook** and other common tools do not work in China. Microsoft products do work. If desired, create an Outlook account and temporarily forward your gmail to this account.

7. Map of the Green Lake and Green Lake hotel



The red dot denotes the Green Lake hotel.

8. Stone Forest World Natural Heritage

The Stone Forest lies about 120km southeast of Kunming. A geological phenomenon, the Stone Forest was a vast expanse of sea during the Paleozoic era, 270 million years ago. Later, the movement of tectonic plates altered the earth's crust, causing the limestone bottom to appear, thereby forming land. Constant seepage of rain through the cracks in the limestone produced great stone sculptures of different shapes, all molded by nature.



In the midst of the forest exists is a huge rock screen on which two words - Stone Forest - are engraved in official script (in a calligraphic style typical of the Han Dynasty, 206 B.C.-220 A.D.). Among the scenic sights is the "Sword Peak Pond" with jadeite-colored water so clear that one can see the bottom of the pond. Other astonishing sights include "figure of Ashima," "Shi Ba Xiang Song" (its name originating in the Chinese love story, "Liang Shanbo and Zhu Yingtai"), and "Lotus Peak. The splendor of the Stone Forest is enhanced by local customs of the Sani people (who are part of the Yi minority). Sani people are industrious and hospitable and unconstrained. Sani women are expert at spinning, weaving, and embroidering. They like to wear rainbow-colored headgear and bright-colored dresses. The young people are very good singers and dancers. Every evening, under the moonlight, boys and girls gather at the village platform. Boys play the three-stringed plucked instruments, while girls clap their hands and dance the strong-rhythmed traditional "Dance in the Moon" with great enthusiasm.



Every lunar year, on June 24th, the Sani people celebrate their national festival - the Torch Festival. On that day, the entire Stone Forest is permeated with a celebratory atmosphere. Traditional performances of wrestling and bull-fighting occur. Finally, when the land is enveloped in the curtain of night, the young men (holding torches in their hands) run after the young women to propose marriage in the light of colored lanterns.

9. Jiu Xiang Karst Cave National Park

There is a saying in Yunnan: "Look at the stone forest on the ground, look at the nine villages underground." The nine villages are also a karst landscape, with their beauty in karst caves. The area has hundreds of caves of various sizes, and is known as the "Cave Museum". It is one of the recommended tourist attractions around Kunming.



The Jiuxiang Scenic Area is located in Jiuxiang Yi and Hui Autonomous Township, Yiliang County. The scenic area is densely forested and rich in flora and fauna resources, with magnificent mountain valleys and underground karst caves, making it a typical karst landscape. The main attractions include Yincui Gorge, Jinghun Gorge, Xiongshi Hall, Male and Female Flying Waterfall, Kanda, etc.

To enter the scenic area, take a sightseeing elevator with a drop of 53 meters to the bottom of the Yincui Gorge, and take a cruise through the canyon. Stone stalactites on both sides are diverse and dazzling. Passing through the canyon leads to an underground karst cave. The Lion Hall is an elliptical underground hall with a sloping dome, named after the stalactite mound at the southern entrance resembling a lion. The Lion Hall is tall and spacious, with a total area of over 15000 m². The top of the cave is a huge rock without any support, making it a miracle. In the middle is a huge exhibition hall, showcasing rare stones and ethnic handicrafts.



Passing through the Lion Hall is the Goddess Palace. The densely packed stalactites inside the cave are in various forms, and under the backdrop of colorful lights, they are ethereal and mysterious. Walk over the Diehong Bridge over the hidden river and enter Wolong Cave. On the walls of the Dongzhong Mountain, there are two huge waterfalls flowing straight down, reaching a height of 30 m. From a distance, it looks like a "person" and is called a "male and female dual waterfall". It is one of the iconic landscapes of the Jiuxiang Scenic Area. The splashing waterfall makes the mountain road slippery and difficult to walk on, so it is important to pay attention to safety. On the side of the mountain road, stalactites are stacked layer by layer, converging into terraced fields. Under light, they are magnificent, which is the legendary "Kanda". There is a huge conical stalactite between the Kanda, which is said to be a granary and looks quite similar. Continuing forward, pass through the Linyin Village (where young men and women perform folk dances). Follow the winding mountain road to reach the next stop on the cableway, and take the cableway for 10 minutes to return to the entrance of the scenic area.