

Ways of Integrating Scientific and Technological Strength into Ecological Environment Management by Grassroots Ecological Environment Monitoring Stations: A Case Study of Yanshan County, Wenshan Prefecture, Yunnan Province

Sumei LI, Guofang ZENG, Lei YIN*, Zhangyue WANG

Ecological Environment Monitoring Station of Yanshan Branch, Wenshan Prefecture Ecological Environment Bureau, Yunnan Province, Yanshan 663100, China

Abstract How ecological environmental monitoring provides scientific and technological strength for ecological environmental management was studied. In recent years, the Ecological Environment Monitoring Station of Yanshan Branch, Wenshan Prefecture Ecological Environment Bureau, Yunnan Province has developed into a provincial environmental education base, a provincial science education base, and a national environmental protection facility open to the public by relying on monitoring equipment and facilities, personnel training, monitoring and law enforcement interaction, analysis of abnormal data, and countermeasures and suggestions were put forward for the problems in the development.

Key words Ecological environment monitoring; Ecological environment management; Scientific and technological strength

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When science and technology flourish, the nation prospers, and when science and technology are strong, the country is strong. Ecological environment science and technology is an important part of the national science and technology innovation system, and is a sharp tool to promote the solution of ecological environment problems. The General Secretary Xi Jinping stressed that it is necessary to adhere to accurate, scientific and law-based pollution control, maintain efforts, extend the depth and broaden the scope, continue to fight the battle of blue sky, clear water and clean land, and win the battle of pollution prevention and control, which cannot be separated from ecological environmental monitoring^[1]. The accuracy and speed of ecological environment monitoring are directly related to the effect of ecological protection and restoration. In the "14th Five-Year Plan" for Ecological Environment Monitoring issued by the Ministry of Ecology and Environment, it is emphasized to improve the organization and management of ecological environment monitoring work, strengthen scientific and technological research, and promote the application of new technologies and new equipment in the monitoring field, so as to better support the continuous improvement of ecological environment quality and promote the synergies of pollution reduction and carbon reduction^[2]. Based on the multi-field development of ecological environment monitoring, Yanshan County, Wenshan Prefecture, Yunnan Province, makes the effort to the construction of green Yanshan.

1 Ecological environment monitoring serves as scientific and technological force and technical support for ecological environment management

Ecological environmental monitoring is the foundation of ecological environmental protection and an important support for ecological civilization construction. It is necessary to establish and improve a modern ecological environmental monitoring system, strengthen the "earlier, sensitive and accurate monitoring", make monitoring data "true, accurate, complete, fast and new" with higher standards, and strongly support the continuous improvement of ecological environment quality and the synergistic effect of pollution reduction and carbon reduction^[3]. Environmental monitoring is not only a scientific activity process, but also one of the important means of ecological environmental management. Environmental monitoring is the "ruler" for implementing regulations and standards, as well as the "eyes and ears" and "sentinel" of environmental protection^[4]. A scientific, intuitive and powerful description of "blue sky, green earth and clean water" can be made based on a group of accurate and reliable environmental monitoring data.

2 Yanshan County's ecological environment monitoring strength has gradually developed and expanded, providing scientific and technological support for ecological environment management

Yanshan Environmental Monitoring Station is located in the

"Township of *Panax notoginseng* in China", and passed the metrological certification of Yunnan Province in 2004. In 2020, it was renamed the Ecological Environment Monitoring Station of Yanshan Branch of Ecological Environment Bureau of Wenshan Zhuang and Miao Autonomous Prefecture (hereinafter referred to as the Ecological Environment Monitoring Station of Yanshan Branch). In the past two years, supported by superiors, the value of instruments and equipment has gradually increased from hundreds of thousands of yuan to 8.09 million yuan, and can now meet the ecological environment monitoring work at the county level. In 2012, it became the first batch of national environmental monitoring stations with standardization construction reaching the standard in Yunnan Province, as well as the first environmental monitoring station in Wenshan Prefecture to win this title. In 2021, it won 7.08 million yuan of environmental protection special fund of Yunnan Province to improve the ecological environment monitoring capacity, and solve the problems of old laboratory countertops, poor laboratory ventilation, and old water and electricity. Besides, it has supplemented large equipment, precision equipment, protective equipment such as ICP-MS, GC-MS, continuous flow analyzer, ion chromatograph, *etc.*, installed flue gas purification facilities, and improved the laboratory conditions of the monitoring station to greatly enhance the ecological environment monitoring capacity and provide strong scientific and technological support for ecological environment management.

3 Main effect of ecological environment monitoring becoming the scientific and technological support for ecological environmental protection in Yanshan County

3.1 The monitoring station develops in multiple fields, popularizes green communication, and advocates the concept of ecological civilization The Ecological Environment Monitoring Station of Yanshan Branch is an "environmental protection and science popularization station" integrating multimedia teaching, exhibition board publicity, green library, environmental protection classroom, interesting experiment and practice base visit teaching. In December 2016, it was named "Yunnan Environmental Protection · Green Library" and "Environmental Education Base of Yunnan Science" in 2017, and it is the only unit in Yunnan Province to be named with the ecological environment monitoring station as the carrier. In 2019, it was named the "Popularization Education Base of Yunnan Science", and it is the only unit in Yunnan Province to be named with the ecological environment monitoring station as the carrier. In the same year, it was listed as the "unit with national environmental protection facilities and urban sewage and waste treatment facilities open to the public". In 2022, it was listed as the "Off-campus Practice Education Base for Teenagers in Yanshan County". Since the establishment of the base, through the means of entering schools, enterprises, commu-

nities and rural areas, and cloud opening, *etc.*, environmental protection facilities have been opened to the public more than 70 times for teenagers, community representatives, and the masses, with an audience of nearly 50 000 people. Meanwhile, it is needed to use the location advantage to mobilize the enthusiasm of the county sewage treatment plant, waste incineration power plant, cement kiln and other enterprises to cooperate with the disposal of solid waste, create a precedent of "four types of facilities" joint activities in the province, actively popularize environmental protection knowledge, and advocate the concept of ecological civilization^[5].

The Ecological Environment Monitoring Station of Yanshan Branch explores the "cloud opening" work of environmental protection facilities based on existing resources, makes environment-related videos and publishes them on "Environmental Protection & Science Popularization" Tiktok and Yanshan Environmental Science Popularization Base of Science Popularization in China. Some videos have been adopted by Yanshan Financial Media, Department of Ecology and Environment of Yunnan Province, and China Environmental Monitoring Station. In 2021, the Science and Technology Department of Yunnan Province granted a subsidy of 100 000 yuan to it. In 2022, the first-floor garage was transformed into a "earth 24-hour" multifunctional science popularization exhibition hall. Yanshan Branch of Wenshan Ecological Environment Bureau was selected as the "demonstration unit of establishment of model organs in Yanshan County" in May 2022, and was named the "Off-campus Practice Education Base for Teenagers in Yanshan County" in September 2022. Due to the outstanding environmental monitoring and environmental education highlights of the Ecological Environment Monitoring Station of Yanshan Branch, leaders of China Environmental Monitoring Station and Yunnan Environmental Monitoring Center visited the Ecological Environment Monitoring Station of Yanshan Branch to investigate environmental monitoring propaganda and education work in September 2020, and leaders of Yunnan Ecological Environment Department also arrived at the station in July 2022. In 2023, Wenshan Ecological Environment Bureau organized webmasters and business backbone to form a special "public" and "Xichou Spirit Exhibition Hall" ecological demonstration team, so as to promote business improvement by monitoring technology, create environmental education bases and open environmental facilities to the public, and achieve the purpose of promoting exchange by visiting, promoting promotion by exchange, and promoting steps by upgrading.

3.2 Yanshan automatic air monitoring station provides scientific air quality early warning and forecast for environmental management In February 2018, Yanshan automatic air monitoring station was built and operated on the roof of a teaching building of Yanshan Minzu Middle School, and the monitoring data was transmitted to the provincial environmental air quality forecasting and early warning business platform of Yunnan Province. Technicians of the Ecological Environment Monitoring Station pay

timely attention to the platform to observe abnormal data, and conduct on-site investigation and emergency response measures for abnormal conditions. Relevant meteorological monitoring data and the meteorological data of the automatic air monitoring station are analyzed. According to the *Work Plan of Pollution Weather Control Line in Yanshan County*, the emergency response of grade-I control line of pollution weather in Yanshan County is timely initiated, and the supervision of enterprises around the county is strengthened to provide decision-making basis for the environmental management of Yanshan County^[6].

3.3 Building a team of ecological environment science and technology talents to integrate scientific and technological forces into ecological environmental management Ecological environment monitoring should be standardized, and professional teams should be cultivated. It is needed to establish and improve environmental monitoring quality management system to ensure that monitoring work and quality system operation can meet the development requirements of quality system changes. Quality control plans should be developed every year, and daily quality management should be strengthened. Self-inspection and self-inspection should be carried out actively. Comprehensive self-inspection and self-reform should be conscientiously carried out in accordance with relevant requirements, and risks and hidden dangers should be investigated. Targeted measures to effectively prevent, avoid and reduce risks should be taken, and it is ensured that the inspection data and results are true, accurate, fair and complete.

Ecological environment monitoring should be technicalized to improve the effectiveness of law enforcement. Due to the uneven professional quality of law enforcement personnel in remote areas, weak law enforcement technology, scientific and technological innovation ability, many grassroots ecological environment management departments are not equipped with advanced law enforcement equipment, emergency monitoring equipment (such as convenient spectrophotometer, portable COD meter, and portable pH meter), leading to difficulties in the actual promotion and application. Law enforcement only relies on monitoring personnel to cooperate with monitoring, and it is difficult to improve the effectiveness of law enforcement. In order to solve this shortcoming, Yanshan County innovates environmental management, explores the new concept of "bureau, station and team integration" at the grassroots level, and let the monitoring personnel integrate the professional technology and science of ecological environmental monitoring into environmental law enforcement, participate in daily supervision and law enforcement, and hone the monitoring technology level in actual combat, so as to achieve the double improvement of monitoring and law enforcement capabilities, and increase the holding rate of monitoring and law enforcement certificate to 100%, and effectively alleviate the shortage of personnel, weak technical force and other problems.

The small monitoring station emits a lot of positive energy. Station staff were invited to share the experience of environmental

education and science popularization training courses in the province for 3 times, and more than 50 staff were awarded national, provincial and state commendations. More than 30 papers were published in journals at all levels, and more than 60 pieces of information were adopted by provincial and above media. The county TV station repeatedly reported special news.

4 Main problems

4.1 The mismatch between personnel and equipment has become a bottleneck restricting the development of monitoring Although the Ecological Environment Monitoring Station of Yanshan Branch has made certain achievements, the personnel structure does not match the number of instruments and equipment. The equipment reaches the level of national second-level stations, but the number of personnel only reaches the scale of third-level stations. In the critical period, due to the outflow of talent, there are only 18 personnel, of which 6 personnel are seconded to other departments, and only 11 personnel work on monitoring. Advanced scientific monitoring equipment relies on professional and technical personnel to operate, but also requires monitoring personnel to invest a lot of energy in research. The technical level can not keep up with the newly configured high-precision equipment, resulting in slow monitoring method verification, which becomes a bottleneck restricting the development of monitoring.

4.2 The modernization and automation level of monitoring is not high According to a survey, the Ecological Environment Monitoring Station of Anning Branch in Kunming City has realized the construction of "intelligent laboratories". For remote areas, the Ecological Environment Monitoring Station of Yanshan Branch has a strong overall equipment strength in Wenshan Prefecture, but it is still far from the "intelligent laboratory". The "intelligent laboratory" replaces the busy scene of "people + equipment", and automatic location sampling on site is realized. After a sample is manually put into the placing area, the process of sample separation, reagent addition, monitoring and analysis is automatically completed, which reduces human operation error, and enhances accuracy and work efficiency. Some remote sensing monitoring equipment such as advanced drones, remote control automatic sampling ships, portable and intuitive emergency monitoring equipment need to be supplemented, and the construction of "intelligent laboratories" will become the goal.

5 Countermeasures and suggestions

5.1 Enriching the professional and technical personnel of environmental monitoring, attaching importance to personnel training, building a strong professional team, and ensuring the relative stability of personnel in monitoring posts Ecological environmental monitoring is a professional and highly technical

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search, practical training, innovation, and entrepreneurship. It should truly build the functional Party group of the science and technology academy into an effective carrier for serving and rooting in "agriculture, rural areas, and farmers", cultivating students' integration of knowledge and action, strengthening students' experience of farming and reading culture, and enhancing students' patriotism and love for the people. Teaching and research, internship and practical training, innovation and entrepreneurship, cultivation and education should integrate with the actual agricultural production, effectively enhancing the professional knowledge level and on-site analysis and problem-solving ability of college students, and forming a collaborative effort of "one integration and

two highs".

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science and technology industry, and staff need to explore for a long time to become proficient in the operation of highly sophisticated, high-tech monitoring equipment. It is ensured that the relevant technical strength is abundant, and long-term secondment and other situations should be prevented. Besides, collective learning, work summary and experience sharing are carried out every month to cultivate all-round monitoring talents. Regular business training is carried out, and young cadres are regularly selected and sent to the Yunnan Research Academy of Eco-environmental Sciences and other departments to study, and strengthen the training of backbone forces. Technical backbone are sent to the monitoring stations with strong monitoring strength to study. At the same time, it is needed to create conditions for systematic learning in instrument sales units. Online and offline business training are organized 9 times from 2022 to 2023, and the number of trainees reaches 76, so as to improve the level of monitoring business and better serve the ecological environment management.

5.2 Learning advanced benchmarks and innovating the development model of "station + school + enterprise" Grassroots ecological environment monitoring stations abandon the "old methods and experience", rely on the traditional development model, and carry forward the learning model of "going out of the house".

Meanwhile, they should cooperate with schools and enterprises to build teaching practice demonstration bases or research practice bases, and jointly carry out technical exchanges, subject research, etc. with the advantages of universities and enterprises, improve the level of scientific and technological research and development, innovate and develop new models, and better provide technical support for environmental management.

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