

## ORIGINAL RESEARCH ARTICLE

# Current situation and protection countermeasures of wetland resources in Shaanxi

Bo Yang, Xiaolian Wei, Ruixin Sun, Liaodui Li, Zhengping Liao, Junbao Li\*, Liang Yu, Yani Gao, Zhe Wu, Zhilin Ma, Zhiguo Xie

Shaanxi Academy of Forestry Sciences, Xi'an 710082, China. E-mail: 870538286@qq.com

### ABSTRACT

In order to guide the management, protection and utilization of wetlands in Shaanxi Province, this paper analyzes and summarizes the current situation and existing problems of the protection and utilization of wetland resources in Shaanxi Province, and puts forward suggestions accordingly. There are 4 wetlands and 12 wetland types in Shaanxi Province, 308,500 hectares. The area and proportion of various wetlands are 257,600 hectares of river wetlands, 83.50%; 32,300 hectares of artificial wetlands, 10.46%; 7,600 hectares of lake wetlands, 2.46%; and 11,000 hectares of swamp wetlands, 3.58%. There are 77 families, 207 genera, 341 species and 3 varieties of wild vascular plants in the wetland, including 2 species of key wild protected species at the national level and 4 species at the provincial level. In view of the problems in the protection and utilization, such as the collaborative mechanism has not been established, the resource background has not been completely clear, and the investment is insufficient, we should build a scientific and appropriate wetland evaluation index system in Shaanxi Province, carry out the investigation and evaluation of wetland resources in the province, continue to carry out wetland ecological restoration and reconstruction projects, establish and improve wetland protection management and technical system, and formulate the protection and utilization direction of different types of wetlands.

**Keywords:** Shaanxi Province; Wetland Resources; Present Situation; Protection; Utilization

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## 1. Introduction

Wetland refers to natural or artificial, permanent or intermittent marshes, peatlands and water areas, including static or flowing, fresh or brackish water and salt water, as well as sea areas with a water depth of no more than 6 m at low tide<sup>[1]</sup>. As one of the three major ecosystems of the earth, it is known as the kidney of the earth, the cradle of life, and the paradise of birds<sup>[2]</sup>, and has many functions such as water storage, flood regulation, climate regulation, water purification, and providing habitat for many species. Protecting wetland ecosystem is of great significance to promote the construction of ecological civilization, ensure national ecological security, and achieve carbon peak and carbon neutralization.

Shaanxi Province is located in the northwest of China. It is the only province across the Yellow River and the Yangtze River. Its ecological location is important. The Yellow River is the mother river of the Chinese nation, and the Qinling Mountains are the source of the Chinese nation and the central water tower. Protecting wetland resources is the need of Shaanxi's ecological environment protection and ecological civilization construction. It is not only related to its own development quality and sustainable development, but also related to the overall situ

ation of the national ecological environment.

## 2. Overview of wetlands in Shaanxi Province

Shaanxi Province is located in the hinterland of China, 105°29"–111°15" east longitude and 31°42"–39°5" north latitude, with a total area of 205,600 square kilometers. From north to south, the terrain is in turn loess plateau in Northern Shaanxi, Guanzhong Plain in the middle, and Qinba Mountain in the south<sup>[3]</sup>. Different climate, terrain, vegetation and other environmental conditions from south to north breed different wetlands with great differences in resources.

### 2.1 Wetland types and distribution

According to the second wetland resources survey in Shaanxi Province in 2010, the total area of lake wetlands, swamp wetlands, artificial wetlands with a distribution area of  $\geq 8$  hm<sup>2</sup> and river wetlands with a width of  $\geq 10$  m and a length of  $\geq 5$  km in Shaanxi Province is 308,500 hectares, accounting for 1.50% of the total area of the province. There are 4 wetlands and 12 wetland types, including 257,600 hectares of river wetlands, accounting for 83.50% of the total wetland area; 7,600 hectares of lake wetlands, accounting for 2.46% of the total wetland area; swamp wetland is 11,000 hectares, accounting for 3.58% of the total wetland area; the constructed wetland covers 32,300 hectares, accounting for 10.46% of the total wetland area<sup>[4]</sup> (Table 1).

Table 1. Statistics of wetland area in Shaanxi Province

Wetland type	Northern Shaanxi		Guanzhong		Southern Shaanxi		Total		
	Area/hm <sup>2</sup>	Proportion/%	Area/hm <sup>2</sup>	Proportion/%	Area/hm <sup>2</sup>	Proportion/%	Area/hm <sup>2</sup>	Proportion/%	
Rivers	Subtotal	49,570.33	16.07	120,979.58	39.22	87,041.44	28.21	257,591.35	83.50
	Permanent river	38,742.27	12.56	49,923.94	16.18	82,850.20	26.86	171,516.41	55.60
	Seasonal river	6,959.18	2.26	11,591.36	3.76	0	0	18,550.54	6.01
	Flood plain	3,868.88	1.25	59,464.28	19.28	4,191.24	1.36	67,524.40	21.89
Lake	Subtotal	7,556.74	2.45	41.18	0.01	0	0	7,597.92	2.46
	Permanent freshwater lake	3,020.21	0.98	41.18	0.01	0	0	3,061.39	0.99
	Permanent saline lake	2,665.50	0.86	0	0	0	0	2,665.50	0.86
	Seasonal saline lake	1,871.03	0.61	0	0	0	0	1,871.03	0.61
Swamp	Subtotal	356.95	0.12	5,484.38	1.78	5,192.83	1.68	11,034.16	3.58
	Herb marsh	73.84	0.02	3,325.86	1.08	4,411.38	1.43	7,811.08	2.53
	Inland salt marsh	0	0	2,158.52	0.7	781.45	0.25	2,939.97	0.95
	Swamp meadow	283.11	0.09	0	0	0	0	283.11	0.09
Artificial wetland	Subtotal	4,943.17	1.60	16,423.00	5.32	10,905.01	3.53	32,271.18	10.46
	Pond	4,943.17	1.60	9,439.78	3.06	10,148.41	3.29	24,531.36	7.95
	Canal/water conveyance river	0.00	0.00	2,957.76	0.96	397.25	0.13	3,355.01	1.09
	Aquaculture farm	0.00	0.00	4,025.46	1.30	359.35	0.12	4,384.81	1.42
Total	62,427.19	20.24	142,928.14	46.33	103,139.28	33.43	308,494.61	100.00	100.00

### 2.2 Wetland plant resources

Shaanxi has 77 families, 207 genera, 341 species and 3 varieties of wild wetland vascular plants (Table 2), including 3 families, 4 genera and 5 spe-

cies of ferns, 1 family, 1 genus and 1 species of gymnosperms, and 73 families, 202 genera, 335 species and 3 varieties of angiosperms. Among angiosperms, there are 216 species of dicotyledons in

56 families, 142 genera, and 119 species and 3 varieties of monocotyledons in 17 families, 60 genera. There are 2 species of wild plants under national

secondary key protection and 4 species of wild plants under provincial key protection<sup>[5]</sup> (**Table 3**).

**Table 2.** Categories of wild plants in Shaanxi wetlands

Category	Section	Genus	Species	Variety	National class II protected plants	Provincial key protected plants
<i>Fern</i>	3	4	5	0	0	0
<i>Gymnosperms</i>	1	1	1	0	0	0
<i>Angiosperm</i>	73	202	335	3	2	4
Total	77	207	341	3	2	4

**Table 3.** Wild protected plants in Shaanxi wetlands

No.	Species name	Family	Genus	Protection level	Distribution location
1	<i>Glycine soja</i>	Leguminous	<i>Soybeans</i>	National class II	Wetlands in the province
2	<i>Camptotheca acuminata</i>	Blueberry family	<i>Camptotheca</i>	National class II	Ningqiang Swallow Bianjin long ditch
3	<i>Alnus cremastogyne</i>	Betulaceae	<i>Alder</i>	Provincial key	Jialing River Wetland
4	<i>Myriophyllum spicatum</i>	Small erxiancao family	<i>Sargassum</i>	Provincial key	Wetlands in the province
5	<i>Tamarix ramosissima</i>	Tamaricaceae	<i>Tamarix</i>	Provincial key	Wetlands in Northern Shaanxi
6	<i>Ehretia macrophylla</i>	Shikoniaceae	<i>Pachyderm</i>	Provincial key	Wetlands in Qinba Mountain Area

**Table 4.** Categories of wetland wildlife in Shaanxi

Group	Order	Family	Species	National protection level I	National protection class II
Birds	9	24	121	10	26
Fish	6	15	136	0	2
Amphibians	2	7	28	0	1
Reptile	2	5	22	0	1
Mammals	3	4	5	0	1
Total	22	55	312	10	31

### 2.3 Wetland animal resources

There are 312 species of wetland wildlife in Shaanxi Province (**Table 4**), including fish, amphibians, reptiles, birds, mammals, shellfish and shrimp. Among them, there are 9 orders, 24 families, 121 species of birds; fish 6 orders, 15 families, 78 genera, 136 species (including subspecies); amphibians 2 orders, 7 families, 14 genera, 28 species; reptiles 2 orders, 5 families, 17 genera, 22 species; mammals 3 orders, 4 families, 5 species<sup>[4]</sup>. According to the newly revised list of national key protected wildlife<sup>[6]</sup>, there are 10 national level I protected animals and 31 national level II protected animals in the wetland wildlife of Shaanxi Province, including 36 species of birds, 2 species of fish, 1 species of amphibians, 1 species of reptiles and 1 species of mammals<sup>[7-9]</sup> (**Table 5**).

### 2.4 Wetland tourism resources

Shaanxi has numerous river systems and complex landforms, forming a variety of wetland landscapes with unique charm, and rich tourism resources. These include the river beach landscape represented by the Yellow River, Weihe River and Han River; alpine swamp landscapes represented by Zibai Mountain in Liuba, Hanzhong, and congtan in Mian County<sup>[9]</sup>; wetland and lake landscape represented by Yulin Hongjiannao Lake; wetland pond landscape represented by Ankang Yinghu Lake; and the wetland cultural landscape represented by Hukou waterfall, Longmen, and the clear-cut of Jinghe River and Weihe River.

## 3. Achievements of wetland protection in Shaanxi

### 3.1 Wetland protection is gradually legalized and institutionalized

Shaanxi province attaches great importance to

wetland protection. In 2004, the general office of the people's government of Shaanxi Province issued the *Notice on Strengthening Wetland Protection and Management*, which puts forward specific requirements for wetland protection and management and planning in the province; in 2006, the Standing Committee of Shaanxi Provincial People's Congress issued the *Regulations of Shaanxi Province on Wetland Protection*, which is the first wetland protection regulation in Shaanxi Province; in 2008, the Shaanxi Provincial People's government issued a notice, announcing the *List of Important Wetlands in Shaanxi Province*, clarifying the four boundaries and subordinate relationships of 55 important wetlands, and requiring the relevant municipal (county and district) people's governments and relevant departments to thoroughly handle the work of wetland protection and management; in 2017, the general office of Shaanxi Provincial People's Government issued the *Provincial Wetland Protection and Res-*

*toration System Plan*, which pushed the wetland protection work in Shaanxi Province to a new height. As the competent department of wetlands, the Provincial Forestry Bureau has formulated *The 13th Five Year Plan for the Protection of Wetlands and Biodiversity in Shaanxi Province*, *The Protection and Planning of Wetlands in Qinling Mountains in Shaanxi Province*, and *The Planning of Wetland Protection Projects in Shaanxi Province (2009–2030)* since 2008, and issued the ten innovative actions for the management of ecological space in Shaanxi Province, the ten actions for the management of ecological space in the Yellow River Basin in Shaanxi Province, and the ten actions for the management of ecological space in Qinling Mountains in Shaanxi Province. The above laws and policy documents provide an important basis for wetland protection, restoration and reconstruction, popularization of science education, scientific research monitoring and rational utilization.

**Table 5.** Wild protected animals and their distribution and habitat in Shaanxi wetlands

No.	Species name	Protection level	Resident	Distributive type	Distribution location	Habitat
1	<i>Ciconia boyciana</i>	I	P	U	Ningqiang, Pingli	Water area and farmland
2	<i>Ciconia nigra</i>	I	S	U	Zhouzhi, Xi'an, Huayin, Ningshan, Zhashui, Chang'an, Yulin, Shenmu, Yan'an, Huangling, Tongchuan, Luonan, Danfeng	Waters
3	<i>Nipponia nippon</i>	I	R	E	Yang County, Chenggu, Foping, Xixiang, Ningshan, Zhouzhi, Hantai	Water area, forest land, farmland
4	<i>Aquila chrysaetos</i>	I	R	C	Foping, Zhouzhi, Yangxian, Meixian, Liuba, Ningshan, Ankang, Hantai, Xi'an, Taibai, Zhashui, Shiquan, Chang'an, Ningqiang, Xixiang, Pingli, Wugong, Fufeng, Zhenping, Yan'an, Shenmu	Grassland
5	<i>Aquila heliaca</i>	I	W	O	Xi'an, Taibai, Tongchuan, Weinan	Forest land and water area
6	<i>Otis tarda</i>	I	P	O	Zhouzhi, Dingbian, Yulin, Shenmu, Dazheng, Yan'an, Tongguan, Huayin, Xi'an, Heyang, Weinan	Water area, farmland and grassland
7	<i>Larus relictus</i>	I	S	D	Yulin, Shenmu	Waters
8	<i>Grus japonensis</i>	I	W	M	Dali, Tongguan, Heyang	Farmland, grassland, reed
9	<i>Falco cherrug</i>	I	W	C	Martial arts, Yulin, Weinan	Woodland and grassland
10	<i>Mergus squamatus</i>	I	W	U	Yang County, Foping	Waters
11	<i>Pelecanus crispus</i>	II	P	O	Weinan	Waters
12	<i>Platalea leucorodia</i>	II	P	O	Shenmu, Zhouzhi, Shiquan, Heyang, Hantai	Waters

**Table 5. (Continued)**

No.	Species name	Protection level	Resident	Distributive type	Distribution location	Habitat
13	<i>Anser albifrons</i>	II	W	C	Weinan	Water area, farmland and grassland
14	<i>Cygnus columbianus</i>	II	P	C	Yulin, Shenmu, Xi'an	Water area, reed
15	<i>Cygnus cygnus</i>	II	W	C	Heyang, Hengshan, Shenmu, Dali, Yulin, Foping, Xi'an	Water area and farmland
16	<i>Cygnus olor</i>	II	P	C	Weinan	Water area and farmland
17	<i>Aix galericulata</i>	II	P	E	Foping, Dali, Tongguan, Hanyin, Huayin, Shiquan, Huaxian	Waters
18	<i>Buteo buteo</i>	II	P	U	Shanyang, Shiquan, Liuba, Yang County, Zhouzhi, Foping, Xixiang, Feng County, Dingbian, Yulin, Shenmu	Farmland
19	<i>Circus melanoleucos</i>	II	P	M	Ningqiang, Weinan	Water area, farmland and grassland
20	<i>C. cyaneus</i>	II	P	C	Zhouzhi, Xi'an, Hantai, Ankang, Ningqiang, Weinan	Water area, farmland and grassland
21	<i>Falco peregrinus</i>	II	P	C	Xi'an, Taibai, Weinan	Woodland and grassland
22	<i>F. naumanni</i>	II	P	U	Hantai, Shenmu, Weinan	Water area and grassland
23	<i>F. amurensis</i>	II	S	U	Mei County, Xi'an, Huayin, Yang County, Taibai, Foping, Zhouzhi, Zhashui, Xixiang, Chang'an, Dingbian, Yulin, Shenmu, Tongguan	Grassland
24	<i>F. columbarius</i>	II	P	C	Yulin, Yan'an, Foping, Taibai	Woodland and grassland
25	<i>F. tinnunculus</i>	II	R	O	Zhouzhi, Xi'an, Huayin, Yang County, Foping, Shanyang, Taibai, Hantai, Ankang, Liuba, Zhashui, Xixiang, Chenggu, Chang'an, Pingli, Dingbian, Yulin, Shenmu, Ningshan, Weinan, Liquan, Tongguan, Shiquan, Baoji, Binxian	Grassland
26	<i>F. subbuteo</i>	II	S	U	Meixian, Zhouzhi, Xi'an, Huayin, Yang County, Nanzheng, Liuba, Foping, Taibai	Woodland and grassland
27	<i>Pandion haliaetus</i>	II	S	C	Xi'an, Ankang, Hantai	Woodland
28	<i>Grus grus</i>	II	P	U	Xi'an, Huayin, Hantai, Chang'an, Dingbian, Yulin, Shenmu, Weinan, Dali, Qianyang	Water area and farmland
29	<i>G. vipio</i>	II	P	U	Weinan	Water area and farmland
30	<i>Anthropoides virgo</i>	II	S	D	Zhouzhi, Chenggu	Water area and farmland
31	<i>Asio flammeus</i>	II	W	C	Foping, Xixiang, Weinan	Forest land and farmland
32	<i>Athene noctua</i>	II	R	U	Zhouzhi, Huayin, Ningqiang, Nanzheng, Ankang, Yang County, Foping, Ningshan, Taibai, Pingli	Forest land and farmland
33	<i>Glaucidium brodiei</i>	II	R	W	Zhouzhi, Liuba, Yang County, Foping, Taibai, Weinan	Forest land and farmland
34	<i>Otus bakkamoena</i>	II	R	W	Yang County, Foping, Zhouzhi, Taibai, Liuba, Ningshan, Weinan	Forest land and farmland

**Table 5. (Continued)**

No.	Species name	Protection level	Resident	Distributive type	Distribution location	Habitat
35	<i>Glaucidium cuculoides</i>	II	R	W	Zhouzhi, Huayin, Chenggu, Yang County, Foping, Shanyang, Danfeng, Taibai, Ningqiang, Nanzheng, Shiquan, Hanyin, Ankang, Liuba, Ningshan, Zhashui, Chang'an, Xixiang, Pingli, Zhenba, Hantai	Farmland
36	<i>Ketupa flavipes</i>	II	R	U	Zhouzhi, Liuba, Foping, Taibai, Pingli, Zhenping	Woodland
37	<i>Hucho bleekeri</i>	II			Ningqiang, Zhenba, Nanzheng, Taibai, Longxian, Lueyang	Mountain streams and rivers
38	<i>Brachymystax tsinlingensis</i>	II			Taibai, Meixian, Zhouzhi, Foping, Longxian	Mountain streams and rivers
39	<i>Andrias davidianus</i>	II			Shangnan, Ningshan, Foping, Taibai, Zuoshui, Danfeng, Yang County, Ningqiang, suigao, Liuba, Luonan, Lueyang	River deep pool
40	<i>Lutra lutra</i>	II			Longxian County, Taibai, Foping, Yang County, Nanzheng, Liuba, Zhashui, Zhen'an, Ningshan, Shiquan, Pingli, Shangnan	Stream and river
41	<i>Palea steindachneri</i>	II			Pingli	Mountain streams and rivers

Note: residence type: R—resident bird, S—summer migratory birds, W—winter migratory birds, P—migratory bird, V—straggler. Distribution type: C—all north type, U—palaeartic type, W—oriental type, M—northeast type, D—central Asia type, P—Highland type, H—himalaya-hengduan mountain type, S—south China type, X—Northeast-North China type, B—North China type, E—monsoon type, O—hard to be classified type. Protection level: I is national level I, and II is national level II.

### 3.2 Continuous improvement of wetland protection management and scientific research institutions

After the institutional reform, the provincial forestry bureau established the wetland, grassland and desertification management office, the wetland and grassland institute of Shaanxi Academy of Forestry Sciences, and the wetland and grassland monitoring center of Shaanxi Forestry Investigation and Design Institute. The municipal and county forestry departments also clarified the wetland management department when adjusting and optimizing the institutional functions, providing the organizational guarantee for promoting wetland protection.

### 3.3 Preliminary formation of wetland protection system

Through years of efforts, a wetland protection system based on nature reserves and national wetland parks has been initially established. So far, the province has established 9 nature re-

serves of various wetland types at all levels; establish 43 national wetland parks (including pilot projects)<sup>[10]</sup>. The protection system has played a great role in maintaining the health and function of the wetland ecosystem in the province. The protection of Crested Ibis, a national first-class protected animal, has become a model for the protection of endangered species in the world. The number of Crested Ibis in the province has increased from 7 at the time of discovery to more than 4,000 now<sup>[11]</sup>.

### 3.4 Strengthen publicity and create a good atmosphere for wetland development

Wetland authorities at all levels, based on major activities such as “World Wetland Day”, “Wildlife Publicity Month” and “Bird Preservation Week”, make full use of various media to widely publicize the great and irreplaceable role of wetland protection in improving environmental quality, maintaining biodiversity, regulating climate, promoting education and scientific research, which improves the public’s awareness of wetland knowledge and im-

portance.

## **4. Problems in wetland protection in Shaanxi**

### **4.1 The contradiction between wetland protection and social development is becoming increasingly intense**

With the continuous development of society, illegal occupation and reclamation of wetlands often occur in industrial and agricultural production and life; chemical fertilizers, pesticides and domestic sewage used in agricultural production not only cause water pollution and eutrophication, but also pose a serious threat to biodiversity; the engineering measures taken in the construction of water conservancy projects, such as cutting bends and straightening, damming and blocking water, and cement hardening, not only directly reduce the wetland area, but also destroy the original shape of the river, hinder the connection of water systems, and have a great impact on the wetland ecosystem.

### **4.2 The collaborative cooperation mechanism for wetland protection has not been established**

As the wetland administrative department, the forestry department has the main responsibility of organizing and coordinating the wetland protection and management and giving overall considerations. However, since the wetland law at the national level has not yet been issued, the Forestry Department of Shaanxi Province mainly carries out wetland protection and management according to the *Regulations on Wetland Protection and Management*, the *Scheme of Wetland Protection and Restoration System* and the *Regulations of Shaanxi Province on Wetland Protection*, which are department regulations of the State Council, official documents of the central government and local regulations respectively. Their legal effect is low, and they do not have the nature of universal national law<sup>[12]</sup>. There is no applicable binding force for the relevant departments of wetland protection such as agriculture, water conservancy, land and so on, and they still need to obey the provisions of national laws and regulations when applicable<sup>[13]</sup>, which makes it dif-

ficult for the forestry department to effectively coordinate the law enforcement and management work of relevant departments, which is not conducive to the smooth development of wetland protection work.

### **4.3 Insufficient scientific and technological support, and the background of wetland resources is not completely clear**

The institutions engaged in wetland research in the province have been established for a short time, the scientific research force is weak, and there is a lack of professional teams engaged in wetland research in colleges and universities. The scientific research on Wetlands in the province is scattered and unsystematic, only partial research on wetland animals and wetland plants has been carried out, and the scientific research achievements supporting wetland protection and management are scarce. The data of the second wetland resources survey in the province completed in 2010 cannot accurately reflect the current situation of wetland resources in the province, and cannot meet the needs of ecological environment protection.

### **4.4 Insufficient investment in wetland protection and management**

Shaanxi Province has only provincial wetland protection special funds. Compared with other provinces, there is a lack of stable investment mechanism for wetland protection funds at the city and county levels. For example, the *Regulations of Qinghai Province on Wetland Protection* and the *Regulations of Henan Province on Wetland Protection* clearly stipulate that people's governments at or above the county level should incorporate wetland protection into national economic and social development planning, increase wetland protection investment, and include wetland protection and management funds into the financial budget at the same level. The insufficient investment in wetland protection and management in Shaanxi Province has seriously restricted the development of wetland restoration construction and protection.

## **5. Suggestions on wetland protection and utilization in Shaanxi**

## 5.1 Carry out wetland ecological restoration and reconstruction projects

Deeply implement the concept of “lucid waters and lush mountains are invaluable assets”, adhere to the “put ecology and conservation first”, focus on ecological restoration, and gradually repair and rebuild damaged wetlands; continue to strengthen the work of returning farmland to wetlands and returning fishpond to wetlands in wetland nature reserves and wetland parks, and constantly improve the wetland protection rate; carry out comprehensive treatment of water pollution, strictly supervise and severely crack down on illegal acts such as pollution, destruction and occupation of wetlands according to law, so as to effectively protect wetlands.

## 5.2 Establish and improve wetland protection and management system

Carry out the revision of the *Regulations of Shaanxi Province on Wetland Protection*, and further clarify and refine the specific responsibilities of relevant departments. As the administrative department in charge of wetland protection, the forestry department should effectively communicate and coordinate with other departments, establish a wetland protection coordination mechanism, strengthen the overall planning of work, form a joint force of work, and constantly promote the development of wetland protection in the province. Implement the territorial management responsibilities of wetland protection, establish a working mechanism for wetland protection assessment, and incorporate the effectiveness of wetland protection into the assessment of governments at all levels.

## 5.3 Carry out the investigation and evaluation of wetland resources in the whole province

Carry out the investigation of wetland resources in Shaanxi Province, and comprehensively grasp the types, area, spatial distribution and current situation of wetlands in Shaanxi Province. Carry out research on applied technologies such as wetland protection, restoration, monitoring and sustainable utilization, formulate the *Measures for the Management of Provincial Important Wetlands*, the *Measures for the Evaluation and Identification of*

*Provincial Important Wetlands*, the *Technical Regulations for Wetland Monitoring in Shaanxi Province*, and the *Technical Regulations for the Evaluation of Wetland Ecological Status in Shaanxi Province*, and build a wetland evaluation index system suitable for the ecological environment, wetland resources, socio-economic status and future development direction of Shaanxi Province, carrying out wetland evaluation in the whole province. On this basis, we should reasonably divide the wetland protection level, implement graded protection management, and establish a provincial wetland classification management system and technical framework.

## 5.4 Increase wetland protection capital investment

Actively strive for more investment of central financial funds in wetland protection and management. Increase the support of local financial funds for wetland protection and management, include wetland protection and management funds into the financial budget, and establish a stable capital investment mechanism. At the same time, in accordance with the principle of “who uses, who benefits, who compensates”<sup>[14]</sup>, social capital is encouraged to join wetland protection and establish diversified investment channels.

## 5.5 Protection and utilization of different types of wetlands

### 5.5.1 Effectively protect and improve the ecological benefits of provincial-level important wetlands and wetland nature reserves

Provincial important wetlands and wetland nature reserves have important ecological location and rich biodiversity, which are of great significance in maintaining ecological security. We should adhere to the “put the ecology and protection first”, protect in strict accordance with the *Regulations of Shaanxi Province on Wetland Protection*, put an end to the development of industries that have adverse effects on resources and environment, such as fisheries, leisure and entertainment, tourism and cater-



ing, and constantly improve and optimize the functions of wetland ecology, culture and education.

### 5.5.2 Give full play to the demonstration role and social benefits of wetland parks

Wetland parks should adhere to the principle of “protection first, supplemented by utilization”, and give full play to their exemplary role in expanding the protected area of wetlands, restoring degraded wetlands, carrying out scientific research, science popularization and education. At the same time, we should thoroughly implement the concept of “a good ecological environment is the most inclusive benefit for people’s well-being”, constantly meet the people’s demand for good ecological products, and make the wetland park a good place for the people to share green scenery, giving full play to its social benefits.

### 5.5.3 Coordinate the relationship between development, utilization and protection, and improve the economic benefits of artificial reservoir wetland

The artificial reservoir wetland should adhere to the principle of “combination and mutual promotion of protection and utilization, keep a balance between exploitation and protection”, organically integrate with rural revitalization and village appearance, adjust measures to local conditions, develop industries with local characteristic and advantageous species and ecological leisure tourism, constantly explore development paths, promote the advantages of ecological environment and landscape resources into economic advantages and benefits, and form a win-win situation of protection and exploitation.

## Conflict of interest

The authors declared no conflict of interest.

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