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The Yellow River Delta National Nature Reserve in Dongying, Shandong province, boasts rich wetland systems.  
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In October 2021, Xi inspected the Yellow River estuary, including the reserve in Dongying. He checked the waterway's tributaries, the wetlands' environment and learned about ecological protection and high-quality development in the Yellow River Basin.

"The Yellow River is our mother river, and conservation is the precondition. We must make unremitting efforts to protect it," Xi said during an inspection visit to the estuary.

The estuary wetlands, typical of those found elsewhere in the world, include lakes, swamps and tidal flats.

In following Xi's concept of ecological civilization, Wang said the work carried out in Dongying has focused mainly on protecting and restoring the wetlands, and acts as a model for the harmonious coexistence of humans and nature.

In recent years, the city has invested 1.36 billion yuan (\$196.7 million) to support 17 wetland protection and restoration projects in the delta, including water supplements, cordgrass treatment, and offshore biodiversity conservation, which has helped strengthen the city's wetland ecosystem.

## Wetlands conservation

At the reserve, a large expanse of water stretches out into the distance. Reeds wave in the wind along both sides of a wooden walkway. Aerial views show a series of connected waterways, which resemble extremely slender veins.

Back in the 1980s and '90s, coastal erosion, seawater encroachment and drought caused the wetlands to shrink. Wang said the delta's rich wetland ecosystems are also seriously threatened by oil production, industrial waste pollution and land reclamation.

The reserve, established in October 1992 to protect the wetlands, covers

about 1,530 square kilometers, with the wetlands comprising most of this area.

"As water is crucial to maintaining the healthy ecological system in the wetlands, we have been replenishing water at the site," Wang said. He added that the abundance of water in the wetlands will significantly prevent destruction of the ecological system from the encroachment of seawater.

In the past three years, more than 480 million cubic meters of water from the Yellow River have been replenished at the reserve. Data from the reserve's management committee show that this work has effectively alleviated soil salinization in the wetlands.

"We have built channels and sluices to ensure that water is replenished when needed at the wetlands," Wang said.

The reserve management committee divided the wetlands into 49 areas based on the growth conditions for animals and plants, ensuring that each area receives the correct amount of water from the Yellow River.

Nurtured by the waterway, the animals and plants are thriving, Wang said.

The Yellow River Law, which took effect last month, regulates water use along the river, to which more water resources will be added to supplement the wetlands, he added.

Work is being carried out in Dongying to restore seagrass beds and

## Delta: National park to aid preservation work

The environment in the (Yellow River) delta provides good living conditions for the birds."

Shan Kai, senior engineer at Yellow River Delta National Nature Reserve in Dongying, Shandong province

native plants growing along waterways in the wetlands, such as *Suaeda salsa*, a type of herb.

Teaming up with the Chinese Academy of Sciences' Yantai Institute of Coastal Zone Research, the local government has created an effective way to eradicate *Spartina alterniflora*, a type of marsh cordgrass found on the estuary coastline that is seriously threatening the habitats of numerous species.

"We cut the grass down before plowing and flooding the area to prevent it returning," Wang said.

*Spartina alterniflora* found on more than 8,730 hectares of land has been eradicated in past years, resulting in 76 kilometers of blocked tidal channels being cleared, the management committee's data show.

Wang said, "Cleaning the *Spartina alterniflora* has provided natural growth conditions for native biological species."

## Home to birds

Late last month, groups of birds were seen resting on ponds on both sides of a road leading to the reserve. Some birds skimmed across the water surface.

Shan Kai, a senior engineer at the reserve, said, "The environment in the delta provides good living conditions for the birds."

Statistics show that the number of avian species in the delta has risen from 187 in the years after the reserve was established to 373.

Last year, 470 chicks were born to Oriental storks at the reserve, while 315 red-crowned cranes were observed wintering at the wetlands.

"To create a good environment for the birds, we built some small islands on waterways where the Yellow River flows through the wetlands," Shan said, adding that thanks to these efforts, the delta has become a well-known home to Oriental storks and Saunders's gulls.

The city is now working to build a Yellow River Estuary National Park to better preserve wetlands and biodiversity in the Yellow River Delta.

In November, Xi addressed the 14th Meeting of the Conference of the Contracting Parties to the Ramsar Convention, or COP14, in Wuhan, Hubei province, via video link.

He said it is important to build global consensus on valuing wetlands, respecting nature, minimizing disruption and damage to wetlands caused by human activity, and protecting the ecological security of wetlands for future generations.

It was announced at the convention that the Yellow River Estuary National Park would be designated as a national park. An area of 3,518 square kilometers in three Dongying counties has been allocated for the venue.

Thousands of hectares of farmland at the reserve have been returned to wetlands and beaches to prepare for the park, Wang said.

After it is established, the park is expected to become the first in China to integrate sea and land resources.

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The number of avian species in the Yellow River Delta has risen to 373. WANG JING / CHINA DAILY, HU YOUWEN, YANG BIN, AND LIU YUELIANG / FOR CHINA DAILY

## Reserve's AI system takes the strain out of monitoring avian species

By LI JING and ZHAO RUIXUE in Dongying, Shandong province

An artificial intelligence monitoring system in the heart of the Yellow River Delta National Nature Reserve in Dongying, Shandong province, is helping conservationists keep a close eye on the breeding patterns of the Oriental stork.

Conservationists at the reserve used cameras to observe the birds laying eggs and hatching chicks. On Feb 2, World Wetlands Day, they witnessed an Oriental stork lay its first egg on an artificial nest. A month later, the egg hatched successfully, producing a healthy chick.

Lu Xiuming, an AI monitoring officer at the reserve, said: "We stood in front of a big screen and watched every move the birds made. We felt that the AI monitoring technology was very good."

The Yellow River Delta is one of the world's most important sites for migratory birds, but monitoring and protecting them has been a challenging task that

relies heavily on human labor.

"Initially, bird surveys were conducted purely by humans. Members of the monitoring team needed to walk to every area of the reserve to count the birds individually and record the data," Lu said.

The AI system, which is undergoing a trial operation in the reserve's core area, has significantly improved conservation efforts.

Optical cameras and edge AI processors are used to photograph and identify birds in real time, record their sightings, and store data for further analysis. Such processors provide computing power at the edge of a network.

The system recognizes dozens of avian species and tracks their population changes based on their features, such as tail, feet and beak. It can also detect abnormal behavior or signs of distress among the birds.

Lu said: "The system automatically recognizes the red skin around the eyes of the Oriental stork and its black beak. If a stork

walks or flies in an unusual way or lies on the ground motionless for a long time, the system detects this and alerts us, so that we can take quick protective measures."

Furthermore, the system monitors bird behavior and habitat changes day and night, allowing conservationists to analyze continuous data and uncover new behavioral patterns that were previously difficult to detect.

Shan Kai, the reserve's senior engineer, said the system has already proven its worth by tracking the Oriental stork's complete breeding cycle.

"Previously, we could only observe the birds intermittently. Thanks to the AI system, we can now monitor the complete life cycle of the Oriental stork in real time and detect changes as they happen, providing a more holistic view of the entire process," Shan said.

Oriental storks began breeding at the reserve in 2003. Although the first attempt was unsuccessful, natural reproduction of the species was observed in

the wild in 2005, and the numbers have grown steadily since then.

More than 2,700 Oriental white stork chicks have been born at the reserve since 2005, making it the largest breeding ground for the species in the world.

However, the AI system is not perfect. It sometimes confuses one bird with another, or even mistakes a stone or reed for a bird.

"It was like a wayward child at first, causing many problems, but with continuous learning, it has become much more intelligent and accurate," Shan said.

To improve AI recognition, for example, frames from video footage of the storks need to be captured and extracted. The frames are then manually categorized into eight different behavioral patterns, and the system then uses this foundational data to perform intelligent recognition.

Shan said the accuracy level of the bird identification system rose to more than 90 percent as the sample size and data volume gradually increased.

In addition to its main function of bird monitoring, the system alerts conservationists to any unauthorized human activity in areas off-limits to the public, where the birds congregate, while also serving as an educational platform for the public.

"Visitors can access real-time monitoring resources," Shan said, adding the reserve even experimented with slow livestreaming, which attracted 100 million visits during March and May last year.

Human patrols are still used to gain an overall understanding of avian populations in particular locations at specific times. "The two methods complement each other and are not interchangeable," Shan added.

To further develop the AI system, the reserve is working with research institutes and high-tech enterprises such as Huawei.

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