

# **WEAVING THE WETLAND AND THE SEA**

Liao River Estuary Conservation Area Ecological Planning

**Project Name:** Liao River Estuary Protected Area Ecological Planning

**Project Address:** Liao River Estuary National Nature Reserve, Liaoning Province, China

**Area:** 128,000,000.0m<sup>2</sup>

**Planning time (year):** 2024

**Category:** Analysis and Planning(UNBUILT)

## PROJECT STATEMENT

The project site is located at the southern end of the temperate zone in northeastern Asia, in the coastal area where the Liao river Plain meets the Bo Sea. As a key area in the East Asia-Australasia migratory zone, it is habitat of the largest populations of endangered species of Saunders's gulls(*Larus Saundersis*) and hundreds of other migratory birds`species. It has the most intact ecological plots of temperate estuarine wetland vegetation types in the world as well as the world's largest area of seep weeds flats.Decades of human activities such as farmland expansion, aquaculture development and oil exploitation have posed serious threats to the estuarine wetlands and mudflats, leading to increase of habitats fragmentation, seawater pollution, and inefficient use of natural resource, which have not only threatened the local ecological environment and wildlife, but also continued to deteriorate the habitat.

This project is dedicated to the ecological restoration in the Liaohe Estuary Protected Area. By analyzing factors such as land cover, species distribution and hydrological conditions in the site, the project proposes strategies such as restoring the habitats of key species, improving the habitat network, promoting the transformation from a traditional production-mode to a more eco-friendly one, integrating eco-tourism resources, establishing infrastructure facilities shared by tourists and residents, and regulating the residents of the Protected Area in the way they utilize the resources.

The project will establish a protected area governance system that balances ecology and industry.This project provides a new perspective for the planning of the temperate coastal wetland areas, which promotes ecological environmental protection and restoration, improves the efficiency of human utilization of natural resources, and creates a highly efficient, green, and sustainable natural reserve governance system.



# PROJECT NARRATIVES

## 1. Background Analysis

### 1.1 Project Status

The Liao River Estuary National Nature Reserve is located on the coastline of Panjin, Liaoning Province, China. The Liao River, which originates from the Yan Mountain Range in northern China, flows into the Bo Sea, and where a large amount of sediment from the Mongolian Plateau and the Liao River Plain has created a unique estuarine mudflat landscape, which has given the land a rich biodiversity.

As a key node in the East Asia-Australia migratory bird migration zone, the wetlands of the Liao River Estuary Nature Reserve are the breeding grounds and migratory stopover points for more than 300 species of migratory birds, and are the northernmost wintering grounds for endangered birds such as red-crowned cranes and black-faced spoonbills; the colourful seep weed mudflats along the seashore are not only beautiful in the eyes of mankind, but also one of the main breeding sites for the saunders's gull, of which there are only 10,000 left in the world. In addition, the Liao river estuary is one of the main breeding sites for the western Pacific spotted seal in China.

### 1.2 Major challenges

After investigating the current situation of the site, we found and concluded several major problems in the reserve. The challenges are categorized into four levels: ecological, production, tourism and protection.

Problems at the ecological level mainly focus on habitat fragmentation and habitat loss; problems in the production industry are mainly inefficient resource utilization and environmental pollution caused by a simplex mode of production; problems in the tourism industry are mainly manifested in the lack of management and publicity; and problems at the protection level concerns on how to propose a scientific protection method and how to improve the living standards of local residents to achieve a win-win situation of harmony between humanity and nature.

## 2.Objectives and Strategies

### 2.1 Overall Objectives

We propose a four-pronged strategy corresponding to the existing problems in the region, which cover the four areas of ecological restoration, ecological production, ecotourism, and ecological monitoring. Based on these strategies, we have constructed several scenarios corresponding to our expectation. Firstly,First, restoration of key habitats in protected areas and establishment of ecological networks in accordance with the bill introduced by the Government. Secondly, we explored the possibility of developing the ragworm farming industry in the local area, and taking into account the ecological factors, a sustainable ecological agricultural model of rice-crab symbiosis is identified, so as to transform and upgrade the local agriculture, and to bring considerable income to the local residents.Transformation and upgrading of existing industries and introduction of new agricultural industries. Then, the integration of agriculture and tourism breaks through the boundaries of two different industries, creating unique integrated products and positioning diversified consumer groups. Through combining the industrial advantages of agriculture and tourism, it creates a new model of rural economy. Finally, by monitoring the regional ecosystem, including species diversity, the atmospheric environment, the water environment and so on,real-time control of the regional status and timely warning of potential risks are realized through monitoring of the regional ecological environment, including species diversity, atmospheric environment and water environment.

According to our vision of the future development of the Liaohekou Protected Area and the proposed planning strategy, we drew four blueprints of the planning system corresponding to the ecological restoration of the protected area, the development of the green production industry, the development of the tourism and the construction of the security system:

(1) Ecological restoration. Restoration of habitats in 2 core areas, establish 3 main corridors, and rebuild the habitats at 5 key nodes.

(2) Development of green production industry. From piont to area, 9 surrounding ecological protection zones are served, and 3 green production bases are established.

(3) Landscape tourism development. 5 landscape tourism service areas, 4 major landscape perspective nodes, 2 major landscape tourism routes.

(4) Eco-protection system construction. 4 major monitoring elements, 7 eco-monitoring stations, and employment in 4 communities will be driven.

## **2.2 Strategy I : Habitat Restoration & Habitat Network Construction**

To deal with the challenges faced by *Larus Saunders`* gulls and other migratory birds at the Liaohe Estuary, we proposed corresponding strategies to the conflict between birds and humans. Firstly, we planned three functional zones according to three different protection levels based on the land cover status and ecological carrying capacity, and formulated corresponding strategies for each functional zone. Secondly,, we have formulated three strategies deliberately in different functional zones: Restoration and protection of bird breeding sites; Construction of bird habitat network; Renovation of ecological industry, in order to meet the interests and needs of all groups under different protection levels. Lastly, our protection strategy covers the entire Liaohekou ecosystem, and allows for the balanced development of ecology and economy.

In the buffer zone of cite exists a large area of reed swamp. For human beings, there are almost no other valuable resources here except oil, but the wetland birds in the cite regard it as an important habitat. Here we propose strategies of shaping an important component of the ecological network of the cite: migration corridor. At the same time, we will also propose anti-disturbance strategies to cope with the impacts of human activities.

## **2.3 Strategy II : Green Production**

In this section, in order to enhance the regional ecological benefits effectively, we carry out an ecological transformation of the regional pillar industries, construct an ecological industrial model of recycling& symbiosis, and introduce an agricultural industry that combines economic benefits with ecological value, so as to realize the growth of agricultural output while protecting the regional ecology.

The model integrates eco-agriculture and circular economy, with Ragworms and crabs providing fertilizers for rice growth, and rice paddies providing habitats for ragworms and crabs. Such transformation not only enhances economic benefits, but also realizes an ecological win-win situation. Constructing an ecological planting space for crab and rice, enriching the source of income for local residents. The breeding of ragworms as a new source of income for local residents will provide extra food for migratory birds, thus contributing to a regional ecological harmony.

## **2.4 Strategy III: Ecotourism system around wetlands and coasts**

The vast wetlands and long coastline are gifts from nature to the Liaohekou. Although viewing the red beaches has become a local tourism card, the potential of tourism resources in the Liaohekou goes far beyond that. Based on the ecological resources of the Liaohekou, we have proposed a three-in-one strategy of wildlife observation, natural landscape sightseeing, science education and tourism services.

## **2.5 Strategy IV: Conservation monitoring system combined with local communities**

The sustainable development of the reserve not only relies on ecological and industrial planning, but also requires appropriate conservation strategies and the participation of local residents. We have established targeted conservation and monitoring systems for wildlife and natural vegetation in the protected areas. At the same time, local communities are actively involved in the conservation work.

# **3. Performance Evaluation**

We evaluated the performance of the overall planning strategies after its implementation. High-value performance and the positive impact on local communities is expected for all four strategies including ecological restoration, green agriculture and aquaculture transformation, ecotourism renovation and the new conservation system based on local communities.

## **3.1 To restore Ecological Value**

Conservation of 150 bird species and one mammal, restoration of 91% of native wetlands, and an increase of 236,000 square kilometers of beach vegetation.

## **3.2 To promote Green Production**

Annual production of 3,097.5 tons of sandworms and shellfish, reduction of fertilizer and pesticide emissions by 12,457 tons, and saving of fertilizer and pesticide costs of 26,839,584 RMB.

## **3.3 To improve Landscape Tourism**

Integration of 8 national nature parks, connecting 5 other natural landscape sites, and economic value-added of wildlife observation of 1,007,200 RMB.

## **3.4 To conserve Developmental potential**

Around 90% of the area is covered by protection zone, adding 12 scientific research bases, and increasing the income of community residents by 820,831 RMB.



# LIAO RIVER ESTAURY CONSERVATION AREA ECOLOGICAL PLANNING

01

SITE LOCATION: A KEY NODE ON THE EAST ASIA-AUSTRALISIA MIGRATION

88% OF THE WORLD'S SAUNDERS'S GULLS BREED HERE.

72% OF THE MIGRATORY BIRDS IN NORTHEAST CHINA STOP OVER



- LEGEND**
- REED FIELDS
  - REED WETLANDS
  - PUDDY FIELDS
  - SEEPWEEDS
  - MUDFLATS
  - WATER
  - SETTLEMENTS
  - CULTURE PONDS



**SAUNDERS'S GULL** **VU**  
(*Saundersilarus saundersi*)

SEEPWEEDS MUDFLATS ARE A MAJOR BREED-  
ING GROUND FOR ENDANGERED BIRDS



**SIBERIAN CRANE** **EN**  
(*Leucogeranus leucogeranus*)

FRAGMENTED WETLAND PATCHES PROVIDE HABITAT FOR  
80% OF THE REGION'S BIRD SPECIES



**SPOTTED SEAL** **LC**  
(*Phoca largha*)

ESTUARINE WATERS ARE KEY NODES OF BIO-  
LOGICAL EXCHANGE BETWEEN LAND AND SEA



# PROBLEM JUDGMENT

AFTER INVESTIGATING THE CURRENT SITUATION OF THE LIAOHEKOU NATIONAL NATURE RESERVE, WE FOUND AND CONCLUDED SEVERAL MAJOR PROBLEMS IN THE RESERVE. THE CHALLENGES ARE CATEGORIZED INTO FOUR LEVELS: ECOLOGICAL LEVEL, PRODUCTION LEVEL, TOURISM LEVEL AND PROTECTION LEVEL.

PROBLEMS AT THE ECOLOGICAL LEVEL MAINLY FOCUS ON HABITAT FRAGMENTATION AND HABITAT LOSS; PROBLEMS IN THE PRODUCTION INDUSTRY ARE MAINLY INEFFICIENT RESOURCE UTILIZATION AND ENVIRONMENTAL POLLUTION CAUSED BY A SIMPLEX MODE OF PRODUCTION; PROBLEMS IN THE TOURISM INDUSTRY ARE MAINLY MANIFESTED IN THE LACK OF MANAGEMENT AND PUBLICITY; AND PROBLEMS AT THE PROTECTION LEVEL CONCERNS ON HOW TO PROPOSE A SCIENTIFIC PROTECTION METHOD AND HOW TO IMPROVE THE LIVING STANDARDS OF LOCAL RESIDENTS TO ACHIEVE A WIN-WIN SITUATION OF HARMONY BETWEEN MAN AND LAND

## HABITATS THREATENED



HABITAT LOSS



HABITAT FRAGMENTATION

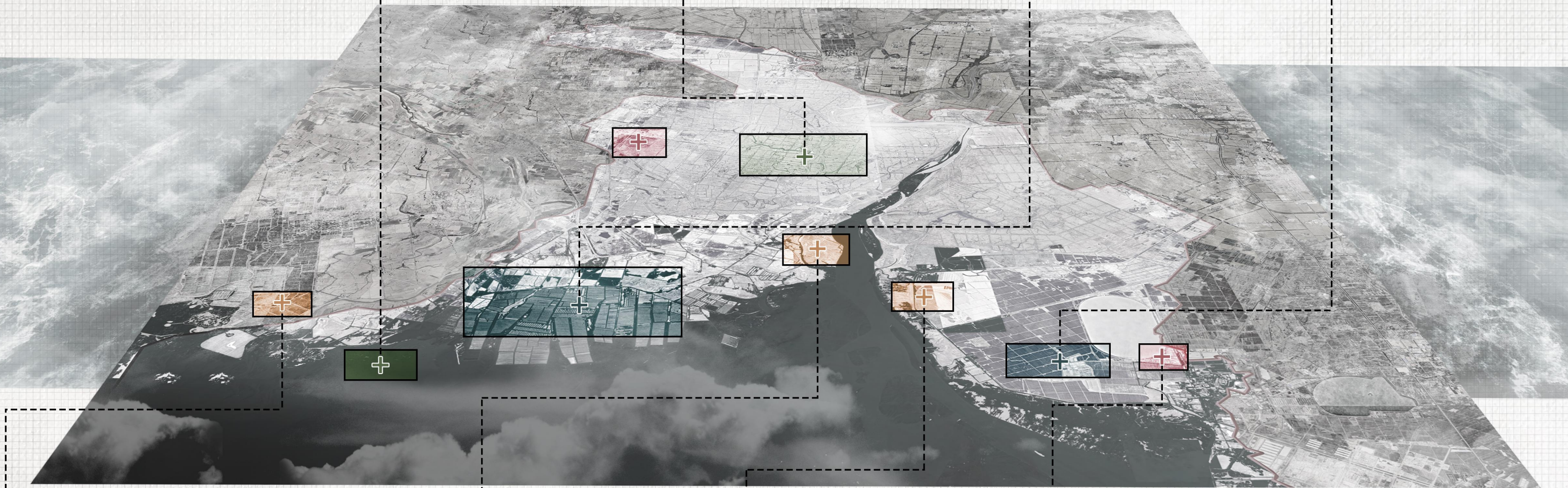


MONO-MARINE AQUACULTURE



MONO-RICE CULTIVATION

## PRODUCTION POLLUTES THE ENVIRONMENT



## UNDERUTILISATION OF LANDSCAPE RESOURCES

DISARRAYED MANAGEMENT

UNREASONABLE CONSTRUCTION

INADEQUATE FACILITIES

RELOCATION ISSUES

INSUFFICIENT POSTS

LOW INCOME

## CHALLENGES TO PEOPLE'S LIVELIHOOD





# ANALYSIS OF THE ECOLOGICAL PATTERN OF THE PROTECTED AREA

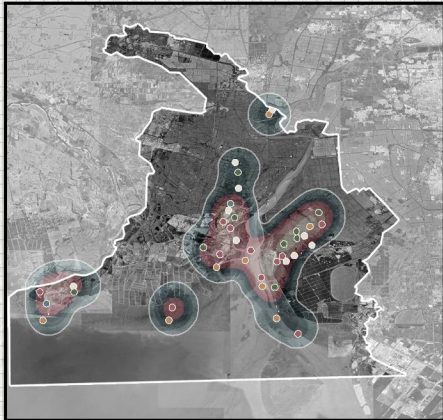
TO DEAL WITH THE CHALLENGES FACED BY LARUS SAUNDERS' GULLS AND OTHER MIGRATORY BIRDS AT THE LIAOHE ESTUARY, WE PROPOSED CORRESPONDING STRATEGIES TO THE CONFLICT BETWEEN BIRDS AND HUMANS. FIRSTLY, WE PLANNED THREE FUNCTIONAL ZONES ACCORDING TO THREE DIFFERENT PROTECTION LEVELS BASED ON THE LAND COVER STATUS AND ECOLOGICAL CARRYING CAPACITY, AND FORMULATED CORRESPONDING STRATEGIES FOR EACH FUNCTIONAL ZONE. SECONDLY,, WE HAVE FORMULATED THREE STRATEGIES DELIBERATELY IN DIFFERENT FUNCTIONAL ZONES: RESTORATION AND PROTECTION OF BIRD BREEDING SITES; CONSTRUCTION OF BIRD HABITAT NETWORK; RENOVATION OF ECOLOGICAL INDUSTRY, IN ORDER TO MEET THE INTERESTS AND NEEDS OF ALL GROUPS UNDER DIFFERENT PROTECTION LEVELS.LASTLY, OUR PROTECTION STRATEGY COVERS THE ENTIRE LIAOHEKOU ECOSYSTEM, AND ALLOWS FOR THE BALANCED DEVELOPMENT OF ECOLOGY AND ECONOMY.

## BASICAL ENVIRONMENT INFORMATIONS

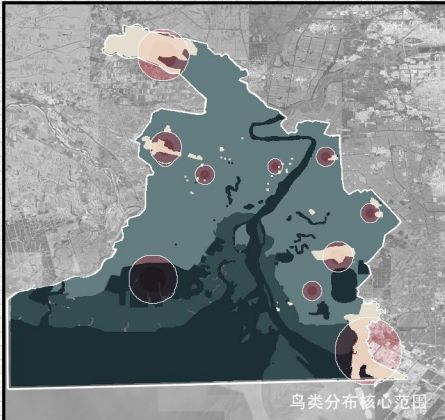
LAND UES & COVER CLASSIFICATION



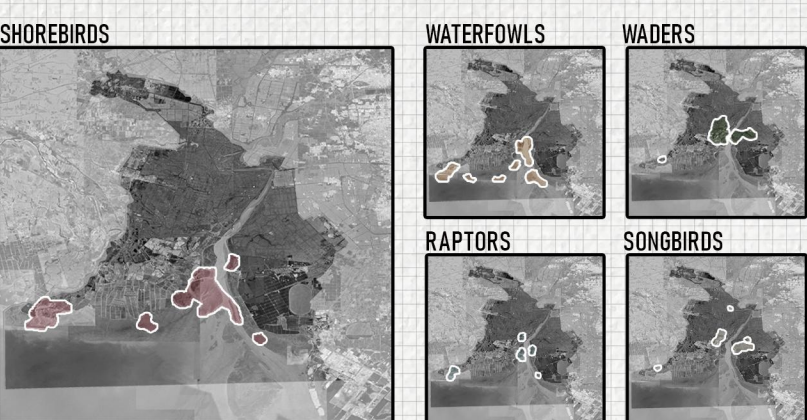
ANALYSIS OF TARGET SPECIES DISTRIBUTION



OVERLAY OF ENVIRONMENTAL ELEMENTS

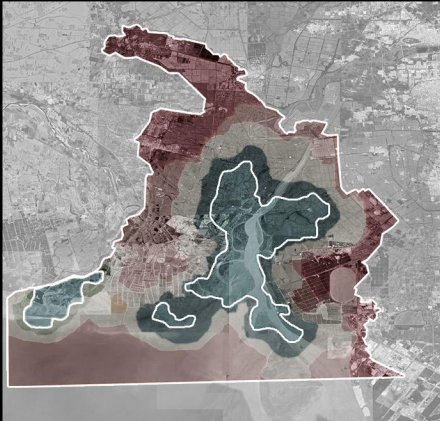


SUITABLE HABITAT AREA (EACH BIRDS CLUSTERS)

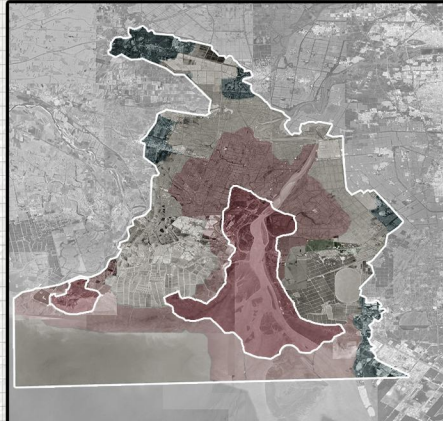


## HABITAT SUITABILITY EVALUATION AND ECOLOGICAL SOURCE IDENTIFICATION

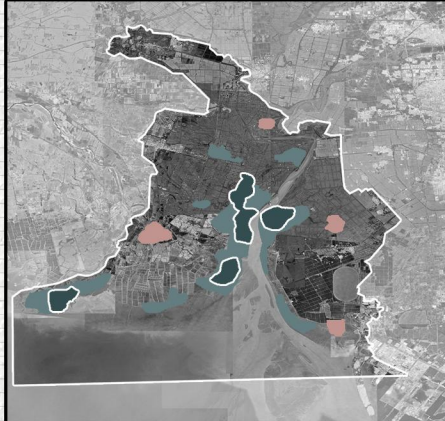
SUITABLE HABITAT AREA (ALL BIRDS CLUSTERS)



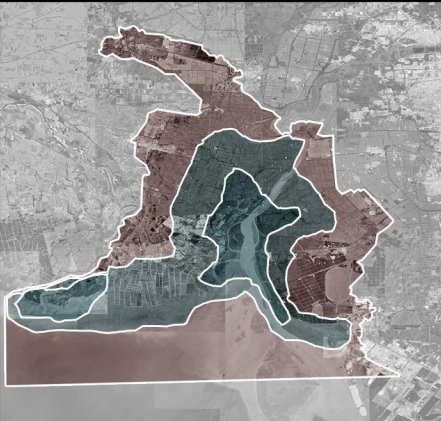
ECOLOGICAL SENSITIVITY



ECOLOGICAL SOURCE IDENTIFICATION

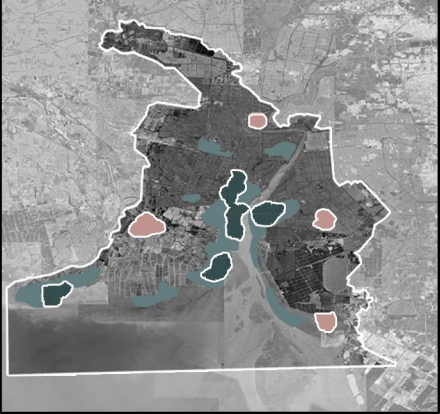


REGIONAL PROTECTION LEVEL DIVISION

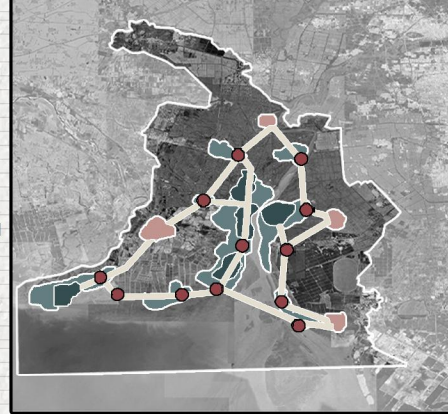


## HABITAT NETWORK IDENTIFICATION

STEP 1



STEP 2



STEP 3



## FUNCTIONAL ZONES OF THE CONSERVATION AREA

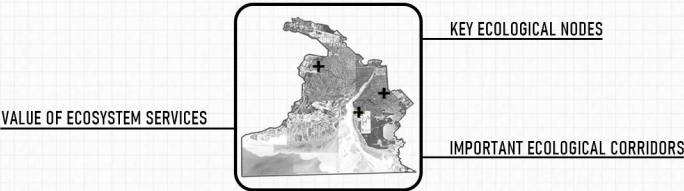




# STRATEGIES AND EXPECTATIONS

IN THIS SECTION, WE PROPOSE A FOUR-PRONGED STRATEGY CORRESPONDING TO THE EXISTING PROBLEMS IN THE REGION, WHICH COVER THE FOUR AREAS OF ECOLOGICAL RESTORATION, ECOLOGICAL PRODUCTION, ECOTOURISM, AND ECOLOGICAL MONITORING. BASED ON THESE STRATEGIES, WE HAVE CONSTRUCTED SEVERAL SCENARIOS CORRESPONDING TO OUR EXPECTATION.

## ECOLOGICAL RESTORATION



The Chinese government has launched the 'National Plan for Wetland Conservation', which combines the construction of regional ecological network to jointly promote the restoration and protection of national wetlands.



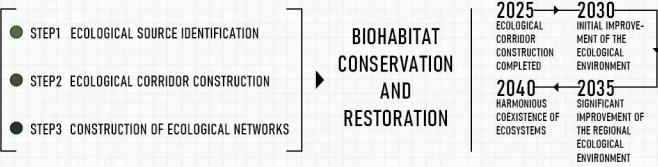
ECOLOGICAL NETWORK CONSTRUCTION



BIOLOGICAL HABITAT RESTORATION

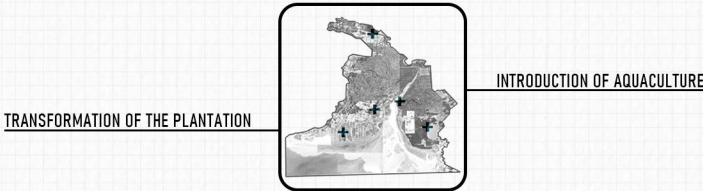


BIRD OBSERVATION AND CONSERVATION



**WETLAND SYMBIOSIS SCENE**  
THE LIAOHEKOU WETLAND, A MODEL OF ECOLOGICAL SYMBIOSIS, DISPLAYS RICH BIODIVERSITY. THE RED BEACHES INTERTWINED WITH THE REEDS PROVIDE AN IDEAL HABITAT FOR BIRDS, ANIMALS, PLANTS AND THE WETLAND ENVIRONMENT FORM A HARMONIOUS SYMBIOTIC RELATIONSHIP, WORKING TOGETHER TO MAINTAIN THE BALANCE AND PROSPERITY OF THIS ECOSYSTEM.

## ECOLOGICAL PRODUCTION



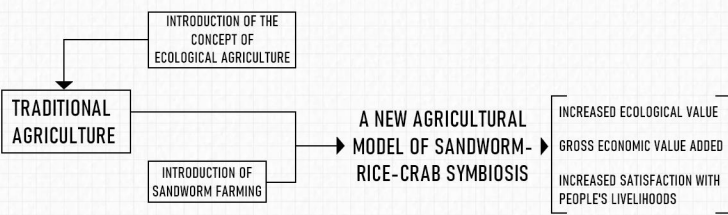
Exploring the possibility of developing the Ragworm farming industry in the local area, and taking into account the ecological factors, a sustainable ecological agricultural model of rice-crab symbiosis is identified, so as to transform and upgrade the local agriculture, and to bring considerable income to the local residents.



TRANSFORMATION OF EXISTING INDUSTRIES

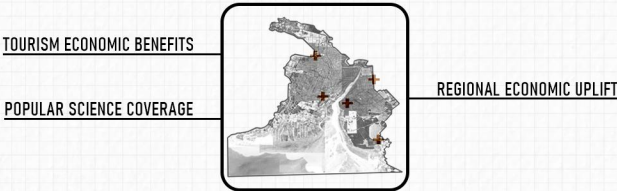


INTRODUCTION OF NEW AGRICULTURAL INDUSTRIES



**AGRICULTURAL PLANT PROTECTION SCENE**  
THROUGH SCIENTIFIC FARMING, REASONABLE CROP ROTATION, USE OF ORGANIC FERTILISERS AND OTHER GREEN AGRICULTURAL TECHNIQUES, THE INTERDEPENDENCE OF FARMLAND AND WETLAND HAS BEEN REALISED, FORMING A UNIQUE AGRO-ECOLOGICAL CYCLE AND DEMONSTRATING THE ECOLOGICAL WISDOM OF HARMONIOUS COEXISTENCE BETWEEN MAN AND NATURE.

## ECOLOGICAL TOURISM



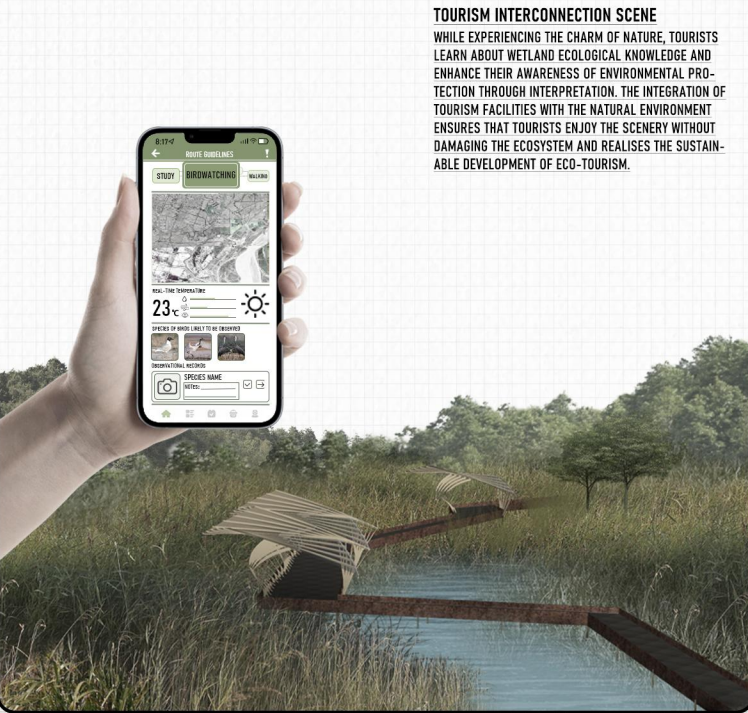
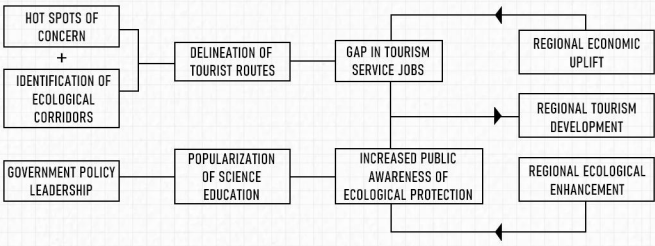
The integration of agriculture and tourism breaks through the boundaries of two different industries, creating unique integrated products and positioning diversified consumer groups. Through combining the industrial advantages of agriculture and tourism, it creates a new model of rural economy.



DELINEATION OF REGIONAL TOURISM ROUTES

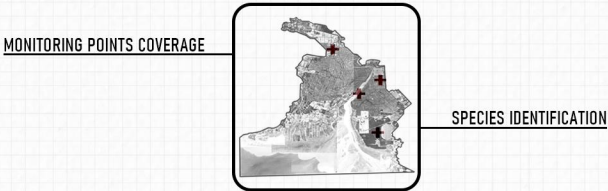


WETLAND ECOLOGICAL SCIENCE EDUCATION



**TOURISM INTERCONNECTION SCENE**  
WHILE EXPERIENCING THE CHARM OF NATURE, TOURISTS LEARN ABOUT WETLAND ECOLOGICAL KNOWLEDGE AND ENHANCE THEIR AWARENESS OF ENVIRONMENTAL PROTECTION THROUGH INTERPRETATION. THE INTEGRATION OF TOURISM FACILITIES WITH THE NATURAL ENVIRONMENT ENSURES THAT TOURISTS ENJOY THE SCENERY WITHOUT DAMAGING THE ECOSYSTEM AND REALISES THE SUSTAINABLE DEVELOPMENT OF ECO-TOURISM.

## ECOLOGICAL MONITORING



Real-time control of the regional status and timely warning of potential risks are realized through monitoring of the regional ecological environment, including species diversity, atmospheric environment and water environment.



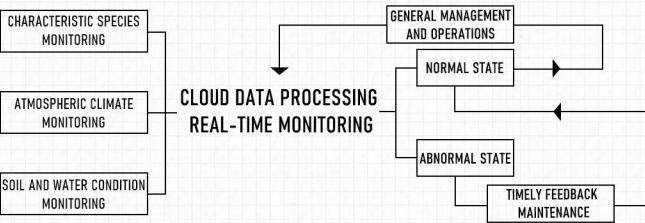
CHARACTERISTIC SPECIES MONITORING



ATMOSPHERIC CLIMATE MONITORING



SOIL AND WATER CONDITION MONITORING



**ENVIRONMENT MONITORING SCENE**  
THE MONITORS USE REMOTE SENSING TECHNOLOGY, WATER QUALITY TESTING INSTRUMENTS AND OTHER EQUIPMENT TO COMPREHENSIVELY MONITOR THE WETLAND'S WATER QUALITY, SOIL AND VEGETATION. THROUGH DATA COLLECTION AND ANALYSIS, THE HEALTH OF THE ECOSYSTEM OF THE LIAOHE ESTUARY IS ASSESSED TO ENSURE THAT THE ECOSYSTEM OF THIS WETLAND IS SCIENTIFICALLY AND EFFECTIVELY PROTECTED.

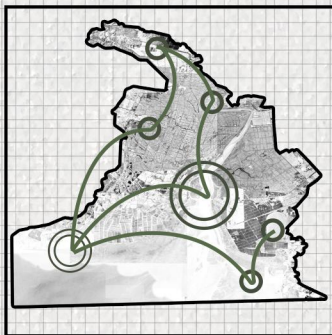


# GENERAL PLAN

ACCORDING TO OUR VISION OF THE FUTURE DEVELOPMENT OF THE LIAOHEKOU PROTECTED AREA AND THE PROPOSED PLANNING STRATEGY, WE DREW FOUR BLUEPRINTS OF THE PLANNING SYSTEM CORRESPONDING TO THE ECOLOGICAL RESTORATION OF THE PROTECTED AREA, THE DEVELOPMENT OF THE GREEN PRODUCTION INDUSTRY, THE DEVELOPMENT OF THE TOURISM AND THE CONSTRUCTION OF THE SECURITY SYSTEM.

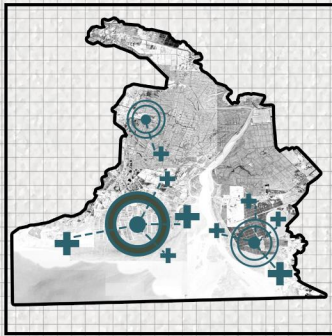
## BLUEPRINT

### ECOLOGICAL RESTORATION



RESTORATION OF HABITATS IN 2 CORE AREAS  
ESTABLISH 3 MAIN CORRIDORS  
REBUILD THE HABITATS AT 5 KEY NODES.

### GREEN PRODUCTION INDUSTRY DEVELOPMENT



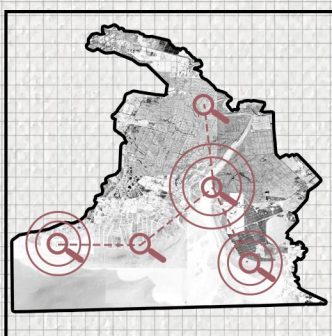
9 SURROUNDING ECOLOGICAL PROTECTION ZONES ARE SERVED  
3 GREEN PRODUCTION BASES ARE ESTABLISHED

### LANDSCAPE TOURISM DEVELOPMENT

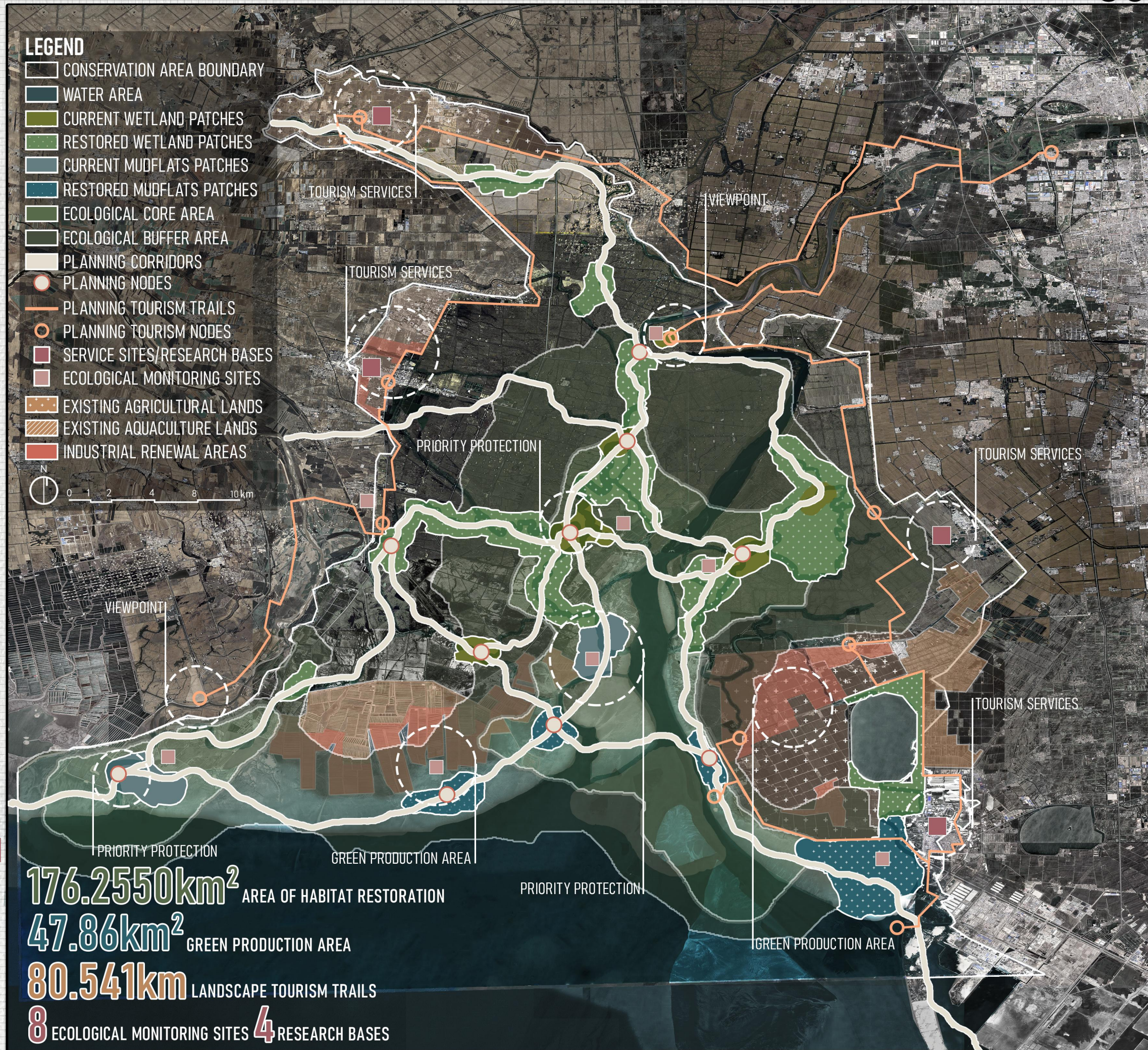


5 LANDSCAPE TOURISM SERVICE AREAS  
4 MAJOR LANDSCAPE PERSPECTIVE NODES  
2 MAJOR LANDSCAPE TOURISM ROUTES.

### ECOLOGICAL PROTECTION SYSTEM CONSTRUCTION



4 MAJOR MONITORING ELEMENTS,  
7 ECO-MONITORING STATIONS,  
EMPLOYMENT IN 4 COMMUNITIES WILL BE





# ECOLOGICAL STRATEGY: HABITAT RESTORATION AND HABITAT NETWORK CONSTRUCTION

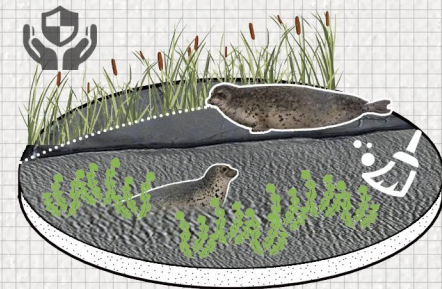
IN THE BUFFER ZONE OF LIAOHEKOU PROTECTED AREA EXISTS A LARGE AREA OF REED SWAMP. FOR HUMAN BEINGS, THERE ARE ALMOST NO OTHER VALUABLE RESOURCES HERE EXCEPT OIL, BUT THE WETLAND BIRDS IN THE LIAOHEKOU REGARD IT AS AN IMPORTANT HABITAT.

HERE WE PROPOSE STRATEGIES OF SHAPING AN IMPORTANT COMPONENT(PART) OF THE ECOLOGICAL NETWORK OF THE LIAOHEKOU RESERVE: MIGRATION CORRIDOR. AT THE SAME TIME, WE WILL ALSO PROPOSE ANTI-DISTURBANCE STRATEGIES TO COPE WITH THE IMPACTS OF HUMAN ACTIVITIES.

## HABITAT RESTORATION

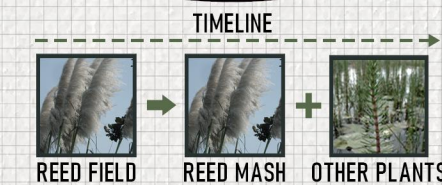
### SHOALS

CLEANING UP RUBBISH ON THE COAST TO AVOID ACCIDENTAL EATING BY SEALS AND SETTING UP PROTECTIVE TRENCHES TO PREVENT STRAY DOGS FROM HARMING SEALS.



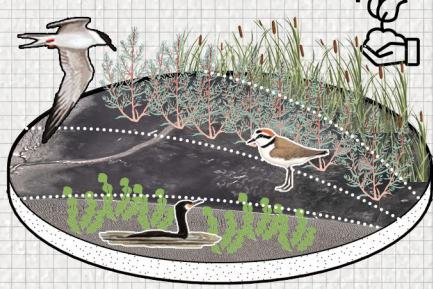
### REED WETLANDS

RESTORATION OF ARTIFICIAL REED FIELDS INTO NATURAL REED MARSHES, LINKING UP EXISTING WATER BODIES AND CREATING DIVERSE BIRD HABITATS.



### SEEPWEED MUDFLATS

REEDS AND SEEPWEEDS PROVIDE REPRODUCTION AND SHELTER, AND SEAGRASS PROVIDES FOOD. AT THE SAME TIME, IT CAN TREAT POLLUTION.



### CULTIVATED LANDS EDGE

ENRICHING THE VEGETATION TYPES AROUND FARMLAND CAN PROVIDE MIGRATORY STEPPING STONES AND NOCTURNAL ROOSTS FOR DIFFERENT GROUPS OF BIRDS.



## AN AXIS FROM THE SEA TO THE WETLAND





ECOLOGICAL PRODUCTION STRATEGIES:INDUSTRIAL TRANSFORMATION AND INTRODUCTION

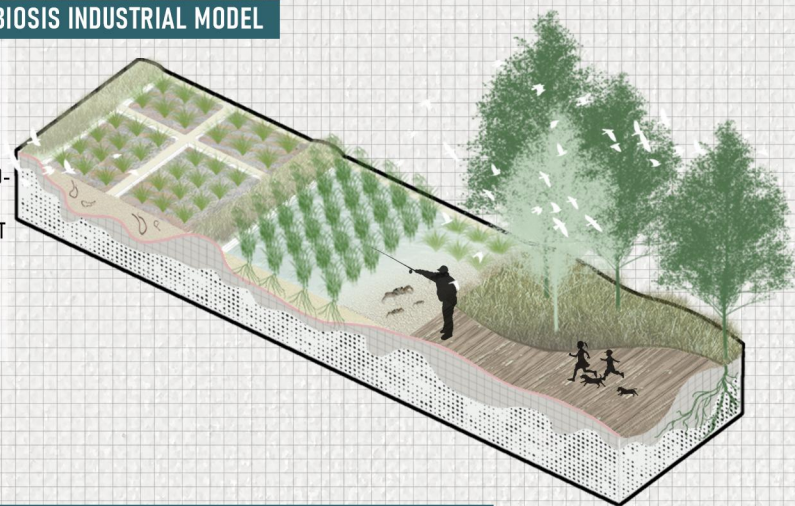
07

IN THIS SECTION, IN ORDER TO ENHANCE THE REGIONAL ECOLOGICAL BENEFITS EFFECTIVELY, WE CARRY OUT AN ECOLOGICAL TRANSFORMATION OF THE REGIONAL PILLAR INDUSTRIES, CONSTRUCT AN ECOLOGICAL INDUSTRIAL MODEL OF RECYCLING&SYMBIOSIS, AND INTRODUCE AN AGRICULTURAL INDUSTRY THAT COMBINES ECONOMIC BENEFITS WITH ECOLOGICAL VALUE, SO AS TO REALIZE THE GROWTH OF AGRICULTURAL OUTPUT WHILE PROTECTING THE REGIONAL ECOLOGY.

ECOLOGICAL TRANSFORMATION OF REGIONAL PILLAR INDUSTRIES

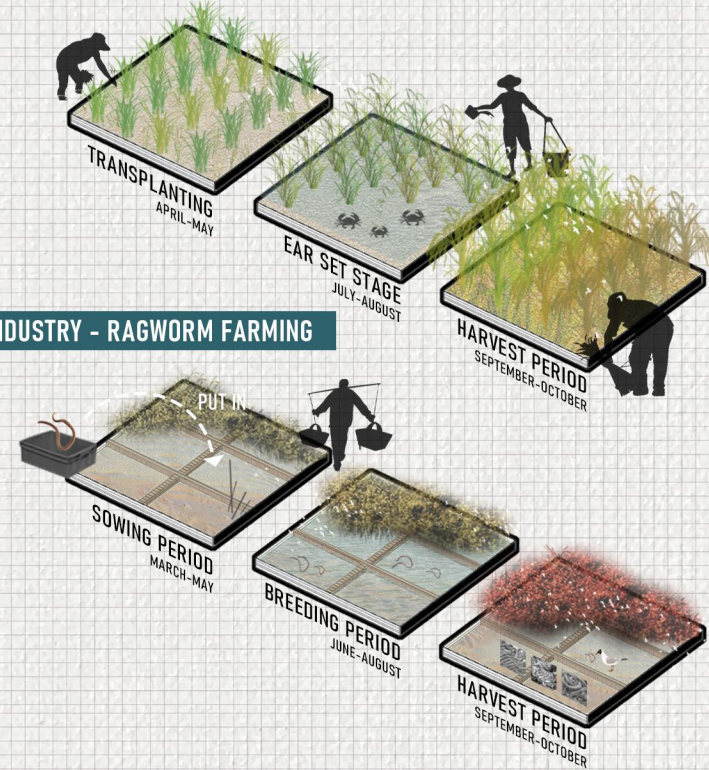
RAGWORM-CRAB-RICE SYMBIOSIS INDUSTRIAL MODEL

THE MODEL INTEGRATES ECO-AGRI-CULTURE AND CIRCULAR ECONOMY, WITH RAGWORMS AND CRABS PROVIDING FERTILIZERS FOR RICE GROWTH, AND RICE PADDIES PROVIDING HABITATS FOR RAGWORMS AND CRABS. SUCH TRANSFORMATION NOT ONLY ENHANCES ECONOMIC BENEFITS, BUT ALSO REALIZES AN ECO-LOGICAL WIN-WIN SITUATION.



TRANSFORMATION OF TRADITIONAL INDUSTRIES-RICE AND CRAB SYMBIOSIS

CONSTRUCTING AN ECOLOGICAL PLANTING SPACE FOR CRAB AND RICE, ENRICHING THE SOURCE OF INCOME FOR LOCAL RESIDENTS.



INTRODUCTION OF ECONOMIC INDUSTRY - RAGWORM FARMING

THE BREEDING OF RAGWORMS AS A NEW SOURCE OF INCOME FOR LOCAL RESIDENTS WILL PROVIDE EXTRA FOOD FOR MIGRATORY BIRDS, THUS CONTRIBUTING TO A REGIONAL ECO-LOGICAL HARMONY.

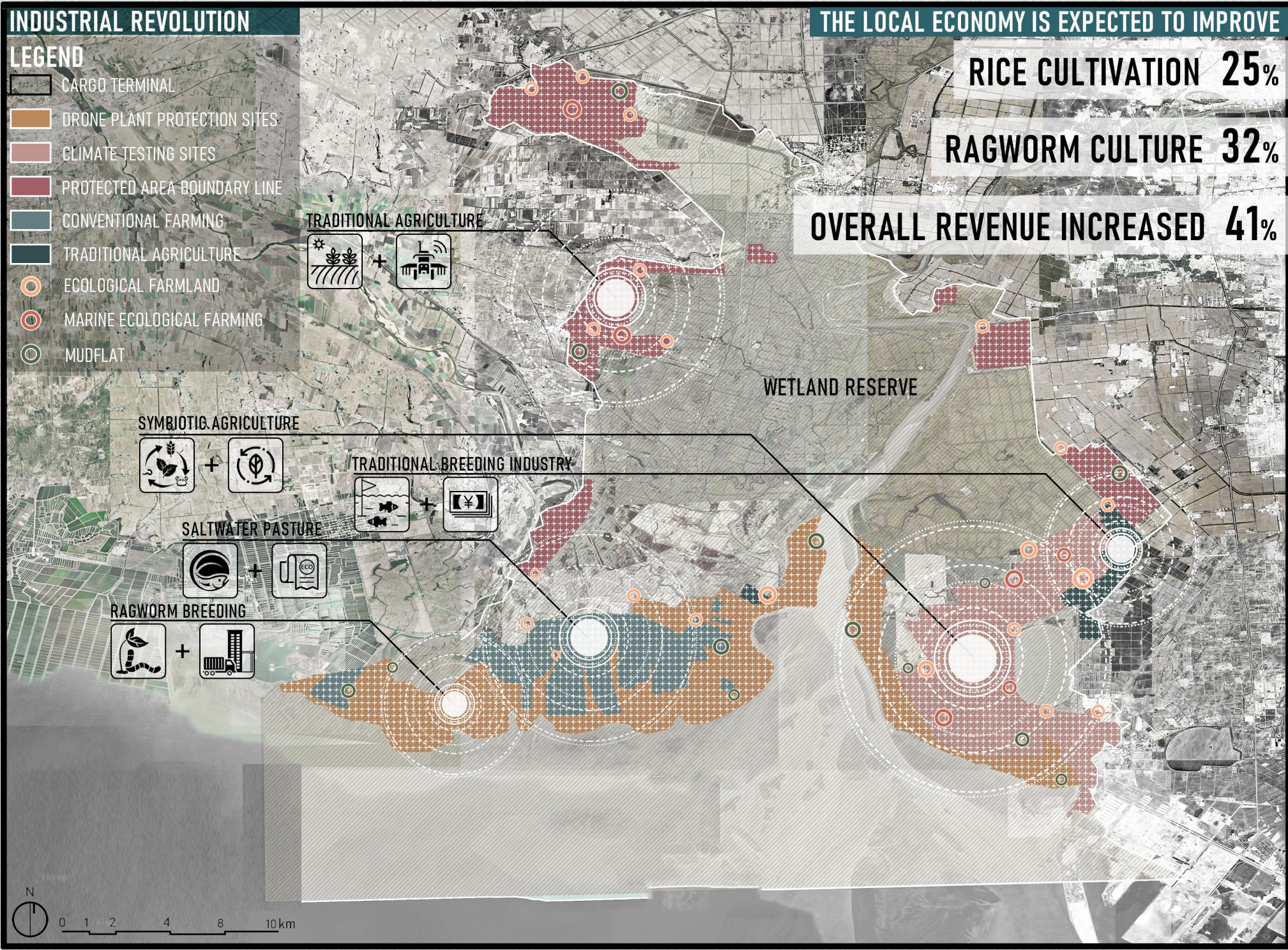
THE EVOLUTION OF THE INDUSTRY FROM BEACH TO INLAND

PHYLLOSTACHYS EDULIS COMMUNITY



INDUSTRIAL REVOLUTION

- LEGEND
- CARGO TERMINAL
  - DRONE PLANT PROTECTION SITES
  - CLIMATE TESTING SITES
  - PROTECTED AREA BOUNDARY LINE
  - CONVENTIONAL FARMING
  - TRADITIONAL AGRICULTURE
  - ECOLOGICAL FARMLAND
  - MARINE ECOLOGICAL FARMING
  - MUDFLAT



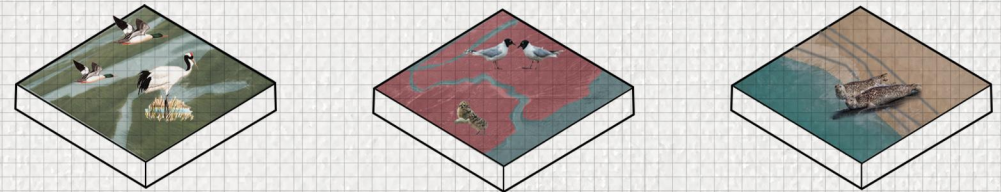


LANDSCAPE TOURISM STRATEGY: ECO-TOURISM SYSTEM AROUND WETLANDS AND COASTS08

THE VAST WETLANDS AND LONG COASTLINE ARE GIFTS FROM NATURE TO THE LIAOHEKOU. ALTHOUGH VIEWING THE RED BEACHES HAS BECOME A LOCAL TOURISM CARD, THE POTENTIAL OF TOURISM RESOURCES IN THE LIAOHEKOU GOES FAR BEYOND THAT. BASED ON THE ECOLOGICAL RESOURCES OF THE LIAOHEKOU, WE HAVE PROPOSED A THREE-IN-ONE STRATEGY OF WILDLIFE OBSERVATION, NATURAL LANDSCAPE SIGHTSEEING, SCIENCE EDUCATION AND TOURISM SERVICES.

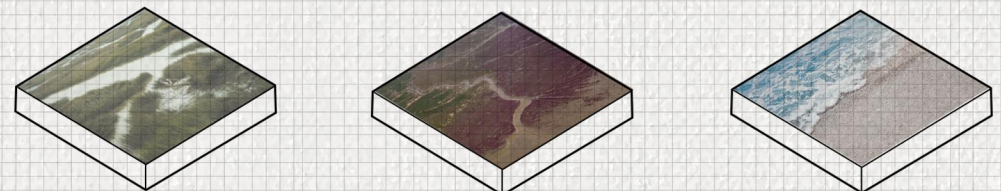
ECOLOGICAL TOURISM MODELS

WILDLIFE OBSERVATION



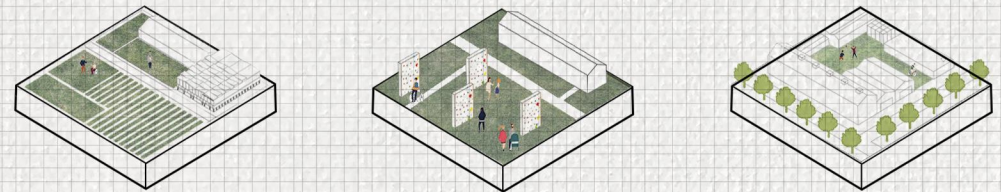
BIRDWATCHING IN WETLANDS BIRDWATCHING IN MUDFLATS SPOTTED SEAL WATCHING

ECOLOGICAL LANDSCAPE



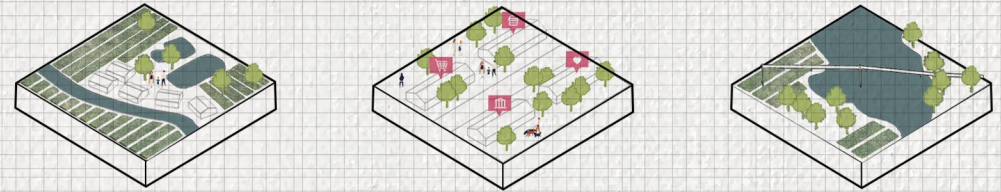
REED MASH WETLANDS SEEP WEEDS MUDFLATS SHAOLS

SCIENCE POPULARISATION AND EXPERIENCE

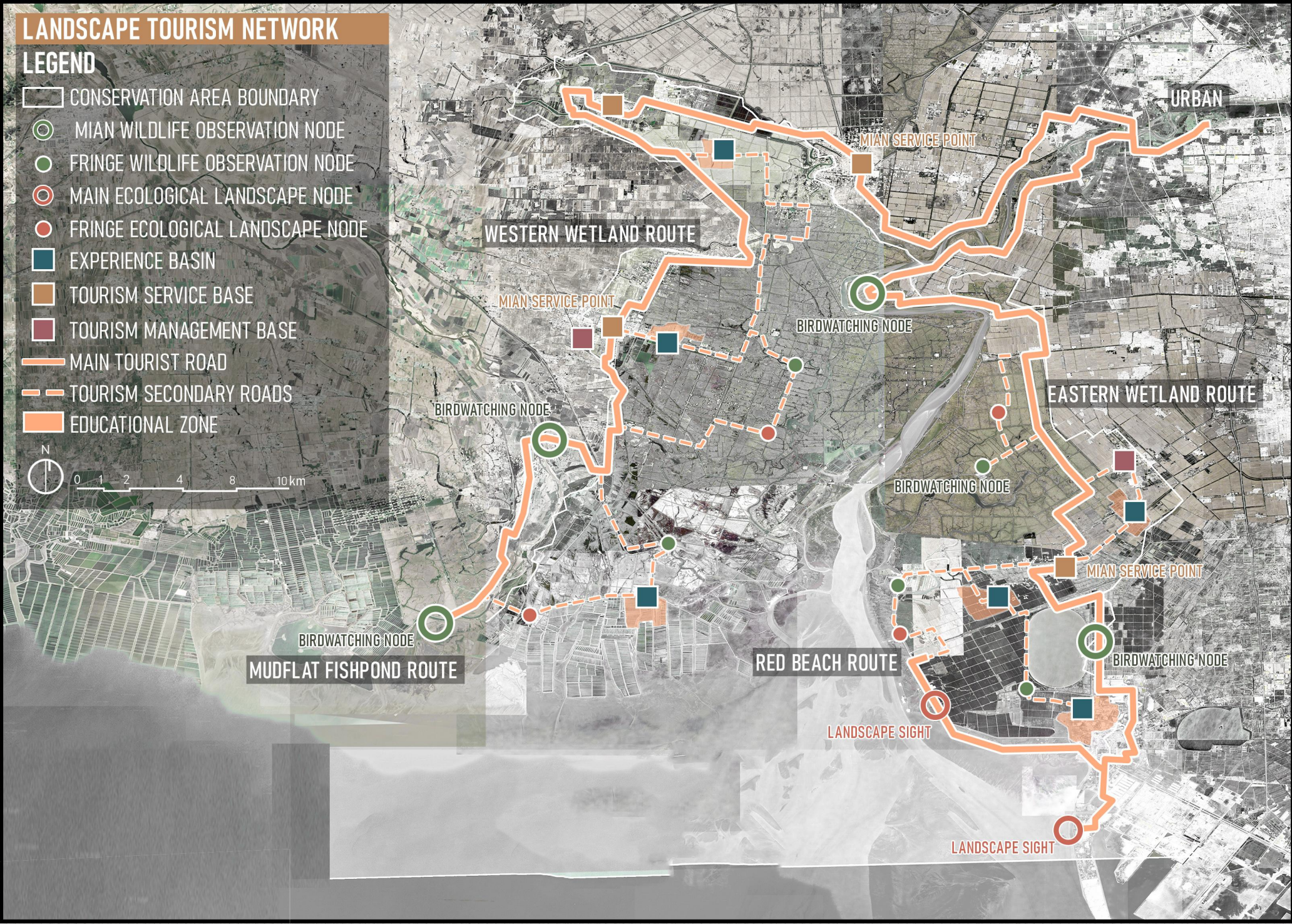


PRODUCTION EXPERIENCE CONSERVATION EDUCATION SUMMER CAMPS

TOURISM SERVICES



ACCOMMODATION SERVICE CATERING SERVICE INFRASTRUCTURE SERVICE



ECOLOGICAL LANDSCAPE+

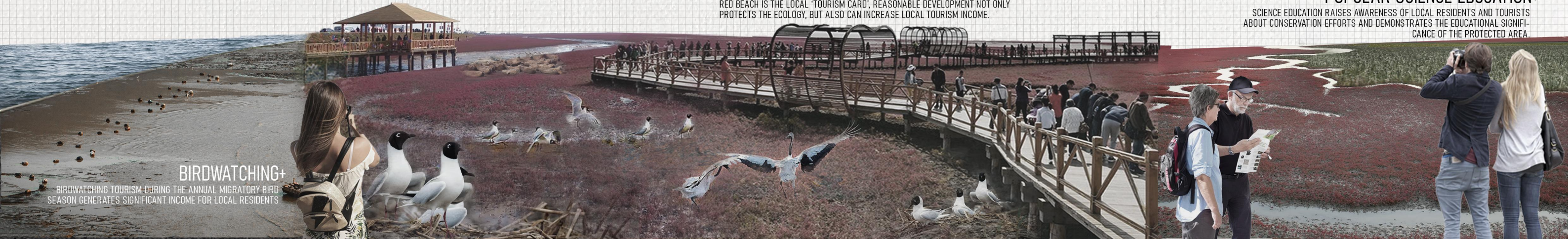
RED BEACH IS THE LOCAL 'TOURISM CARD'. REASONABLE DEVELOPMENT NOT ONLY PROTECTS THE ECOLOGY, BUT ALSO CAN INCREASE LOCAL TOURISM INCOME.

POPULAR SCIENCE EDUCATION+

SCIENCE EDUCATION RAISES AWARENESS OF LOCAL RESIDENTS AND TOURISTS ABOUT CONSERVATION EFFORTS AND DEMONSTRATES THE EDUCATIONAL SIGNIFICANCE OF THE PROTECTED AREA.

BIRDWATCHING+

BIRDWATCHING TOURISM DURING THE ANNUAL MIGRATORY BIRD SEASON GENERATES SIGNIFICANT INCOME FOR LOCAL RESIDENTS





THE SUSTAINABLE DEVELOPMENT OF THE RESERVE NOT ONLY RELIES ON ECOLOGICAL AND INDUSTRIAL PLANNING, BUT ALSO REQUIRES APPROPRIATE CONSERVATION STRATEGIES AND THE PARTICIPATION OF LOCAL RESIDENTS. WE HAVE ESTABLISHED TARGETED CONSERVATION AND MONITORING SYSTEMS FOR WILDLIFE AND NATURAL VEGETATION IN THE PROTECTED AREAS. AT THE SAME TIME, LOCAL COMMUNITIES ARE ACTIVELY INVOLVED IN THE CONSERVATION WORK.

CONSERVATION MONITORING MODELS

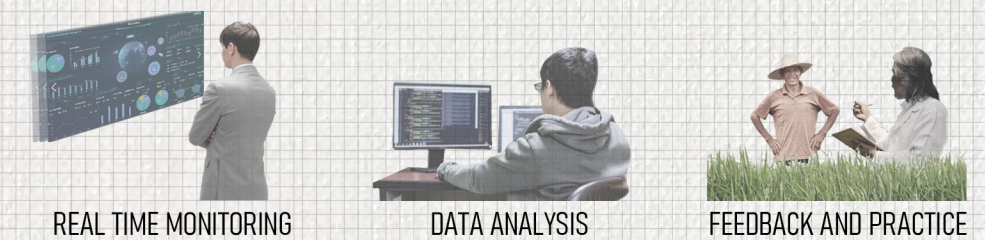
WILDLIVES MONITORING AND PROTECTION



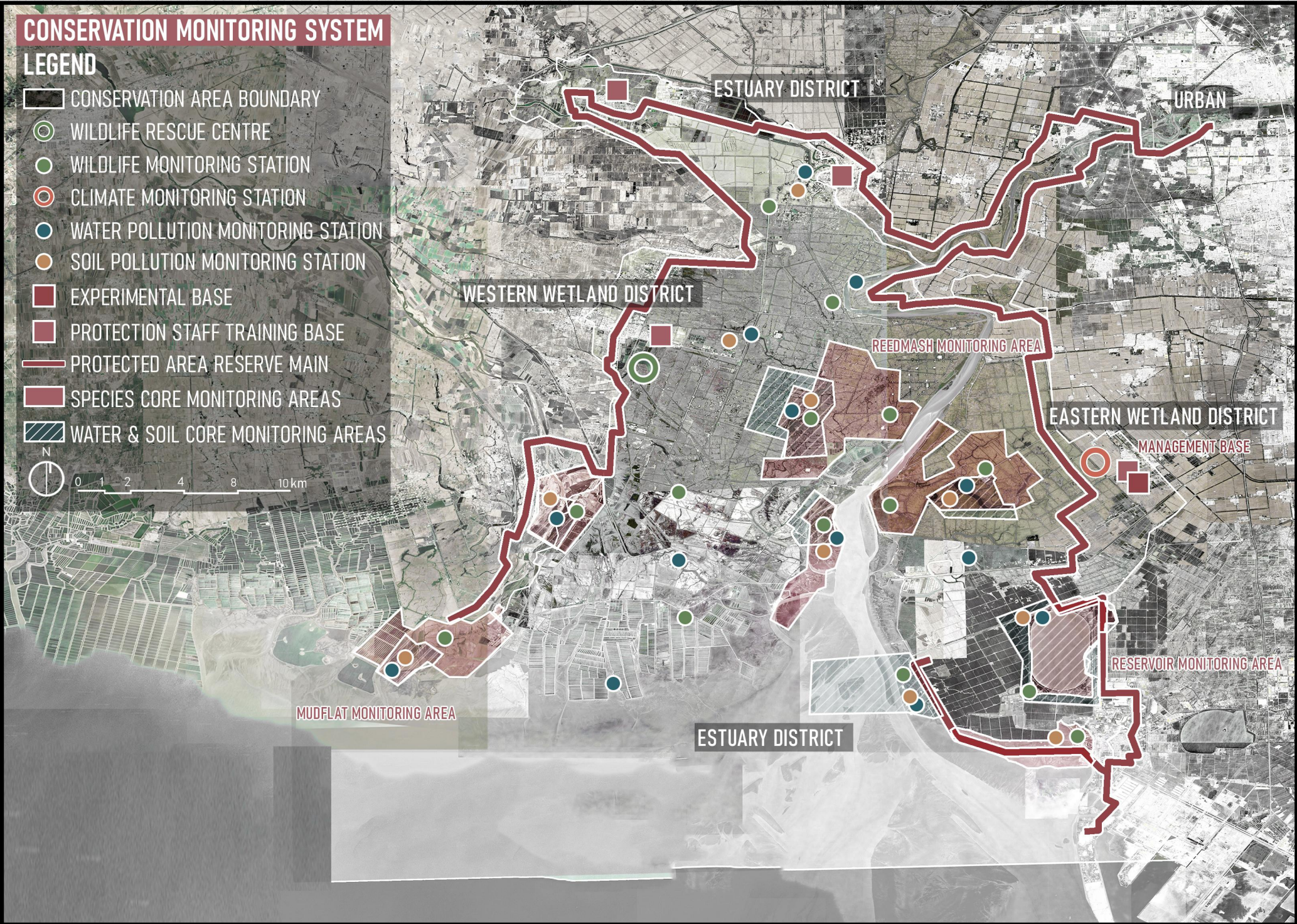
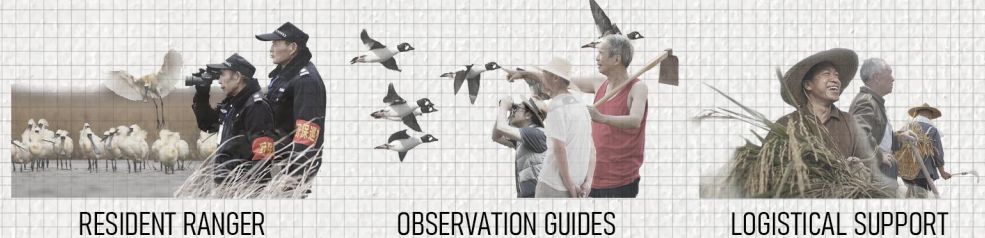
ATMOSPHERIC,SOIL AND WATERCLIMATE MONITORING



INTELLIGENT MONITORING TECHNOLOGY




COMMUNITY-BASED COLLABORATIVE PROTECTION





# EVALUATION OF ECOLOGICAL BENEFITS ESTIMATES

WE EVALUATED THE PERFORMANCE OF THE OVERALL PLANNING STRATEGIES AFTER IT'S IMPLEMENTATION. HIGH-VALUE PERFORMANCE AND THE POSITIVE IMPACT ON LOCAL COMMUNITIES IS EXPECTED FOR ALL FOUR STRATEGIES INCLUDING ECOLOGICAL RESTORATION, GREEN AGRICULTURE & AQUACULTURE TRANSFORMATION, ECOTOURISM RENOVATION AND THE NEW CONSERVATION SYSTEM BASED ON LOCAL COMMUNITIES.




### ECOLOGICAL RESTORATION VALUE

CONSERVATION OF **150** BIRD SPECIES AND ONE MAMMAL

RESTORATION OF **91%** OF NATIVE WETLANDS

AN INCREASE OF **236,000 m<sup>2</sup>** OF VEGETATION



### GREEN PRODUCTION VALUE

ANNUAL PRODUCTION OF **3,097.5t** OF SANDWORMS AND SHELLFISH,

REDUCTION OF FERTILIZER AND PESTICIDE EMISSIONS BY **12,457t**

SAVING OF FERTILIZER AND PESTICIDE COSTS OF **26,839,584 ¥**




### LANDSCAPE TOURISM VALUE

INTEGRATION OF **8** NATIONAL NATURE PARKS

CONNECTING **5** OTHER NATURAL LANDSCAPE SITES

ECONOMIC VALUE-ADDED OF WILDLIFE OBSERVATION OF **1,007,200 ¥**



### PROTECTING DEVELOPMENTAL VALUE

AROUND **90%** OF THE AREA IS COVERED BY PROTECTION ZONE

ADDING **12** SCIENTIFIC RESEARCH BASES

INCREASING THE INCOME OF COMMUNITY RESIDENTS BY **820,831 ¥**

