

# Land Cover Change in the Natural Reserve of the Yellow River Delta, China, 1999-2008

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# Outline

- 1、 Introduction
- 2、 Data and Methodology
- 3、 Results
- 4、 Conclusions and Discussions



# 1、Introduction

## □ Land Cover Change

**Land cover** is an expression of human activities and, as such, changes with changes in land use and management. (Louisa, J.M.J., et al, 2001)

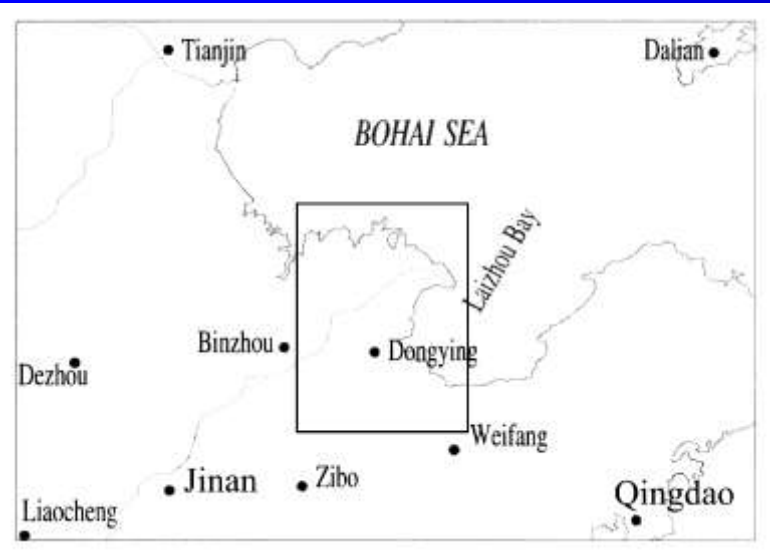
**Land cover change** could be regarded as change in biotic diversity, actual and potential productivity, soil quality, run-off, and sedimentation rates. Land cover change has caused and will continue to cause dramatic changes in the structure and function of ecosystems. (Steffen, W.L., et al, 1992)

## □ The Yellow River Delta

**The Yellow River Delta (YRD)**, one of the most rapidly changing regions in the world, lies among multi-ecotones of dynamic interactions of Bohai Sea, land, atmosphere and the Yellow River.



# 1、Introduction



# 1、 Introduction

## □ Researches on Land Cover Change in the YRD

Concerns about land cover changes in the YRD have increased during the past decade. These researches used transition matrix method, and generally focused on calculation of transition probability matrix at given time period, and hereby analyzed land use change trends and driving forces, but few detailed analysis on land use succession processes were made.

## □ The Main Objective of This Paper

To monitor the land cover change in the natural reserve of the YRD using transition matrix method, especially changes of natural vegetation communities in the recent ten years.



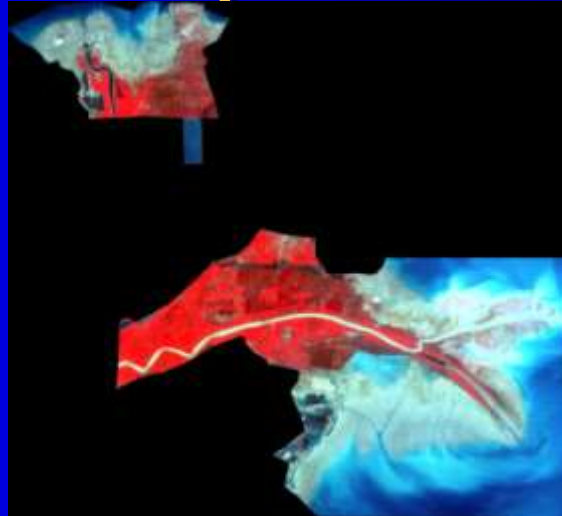
## **2、 Data and Methodology**



## 2、 Data and Methodology

### □ Data

Four images of Landsat acquired on 25th June, 1999 and 9th August, 2001 and 28th October, 2004 and 2nd October, 2006, and one image of HJ-1B satellite acquired on 2nd October, 2008 were geo-registered. The overall accuracy of the registration was less than 0.50 Pixel. Then these five images were classified using visual interpretation method, and the average accuracy of classification results was 91%.



HJ-1B satellite acquired on 2nd October, 2008 of the natural reserve in the YRD



$$P_{ij} = n_{ij} / \sum_{j=1}^m n_{ij} \times 100\%$$

## 2、 Data and Methodology

### □ Methodology

Transition matrix method has been used extensively for analysis and stochastic modeling of land use and land cover change since the 1960s.

$P_{ij}$  is transition probabilities and  $n_{ij}$  is transition area or number where land is changed from state  $i$  to state  $j$  at given time period.

$$P_{ij} = n_{ij} / \sum_{j=1}^m n_{ij} \times 100\%$$

### □ Completed in ArcGIS Software

Use the Intersect Function of ArcGIS to acquire land cover change from 1999 to 2008. The results were shown in the following table.



# 3、 Results



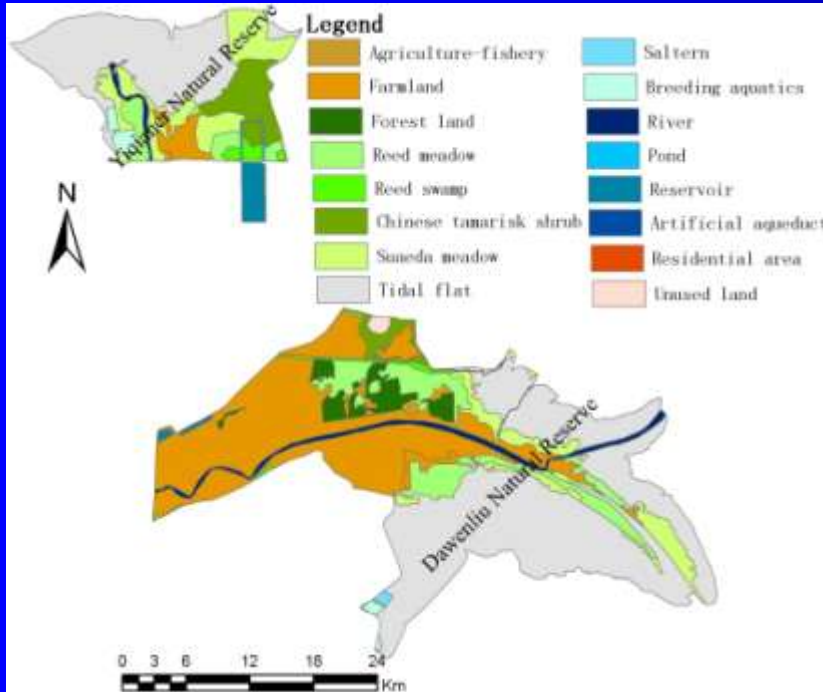
# 3、 Results and Discussions

Table 1 Land use/ land cover structure from 1999 to 2008

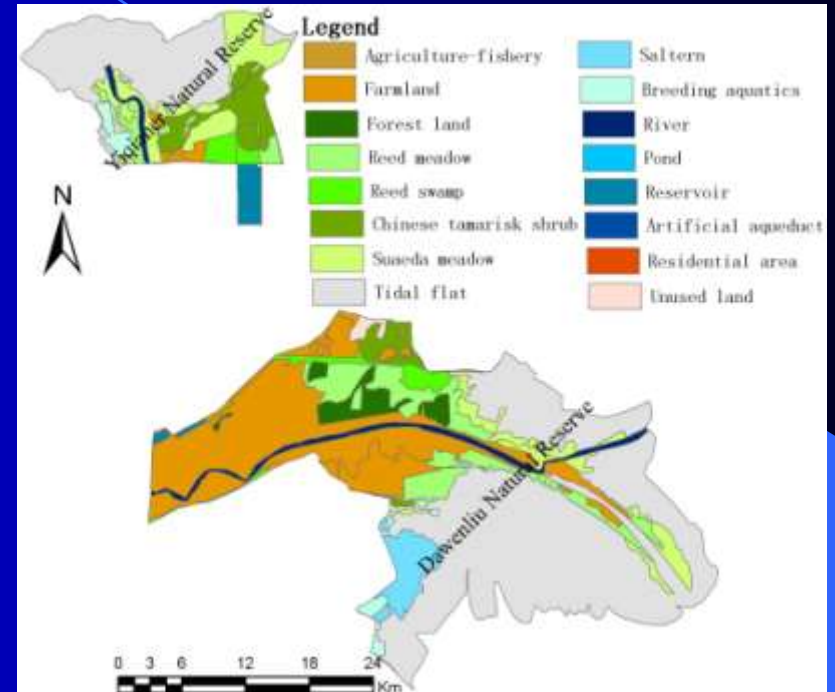
Class	Forest	CTS	RS	RM	SM	AF	Farm	Resident	River	AA	Reservoir	Pond	Saltern	BA	Tidal flat	Unused	
2008	area	39.2	<b>55.4</b>	<b>115.7</b>	<b>28.4</b>	<b>62.2</b>	4.3	<b>218.3</b>	4.8	36.6	2.5	14.7	40.9	34.7	14.8	<b>349.6</b>	6.6
	Per.	3.8	5.4	11.3	2.8	6.1	0.4	21.2	0.5	3.6	0.2	1.4	3.9	3.4	1.4	34.0	0.6
	Num.	29	12	24	13	13	1	41	5	5	4	6	9	2	6	8	5
2006	area	39.1	<b>61.2</b>	<b>117.8</b>	<b>28.7</b>	<b>53.8</b>	4.3	<b>207.4</b>	4.8	43.2	2.5	14.7	33.4	32.6	12.2	<b>438.8</b>	8.2
	Per.	3.5	5.6	10.7	2.6	4.9	0.4	18.8	0.4	3.9	0.2	1.3	3.0	3.0	1.1	39.8	0.8
	Num.	29	16	29	17	19	1	46	8	14	4	6	14	4	6	11	5
2004	area	22.2	<b>42.4</b>	<b>101.3</b>	<b>45.2</b>	<b>40.2</b>	0	<b>258.1</b>	0.3	32.8	0	14.5	10.8	11.0	9.1	<b>390.1</b>	1.9
	Per.	2.3	4.3	10.4	4.6	4.1	0	26.3	0.0	3.4	0	1.5	1.1	1.1	0.9	39.8	0.2
	Num.	9	9	26	14	3	0	15	1	10	0	3	8	6	5	12	7
2001	area	26.5	<b>52.2</b>	<b>27.8</b>	<b>84.7</b>	<b>90.4</b>	0	<b>233.4</b>	0.1	28.1	0	14.9	0.4	29.0	14.8	<b>546.5</b>	4.6
	Per.	2.3	4.5	2.4	7.4	7.9	0	20.2	0.0	2.4	0	1.3	0.0	2.5	1.3	47.4	0.4
	Num.	6	6	7	13	14	0	29	4	3	0	3	3	4	9	6	1
1999	area	30.0	<b>44.2</b>	<b>11.5</b>	<b>84.4</b>	<b>97.0</b>	0	<b>261.8</b>	0.00	26.7	0	14.3	1.5	1.5	8.3	<b>459.0</b>	2.9
	Per.	2.9	4.2	1.1	8.1	9.3	0	25.1	0.0	2.6	0	1.4	0.1	0.1	0.8	44.0	0.3
	Num.	4	6	7	13	15	0	19	2	5	0	3	2	1	5	10	1



# 3、 Results and Discussions

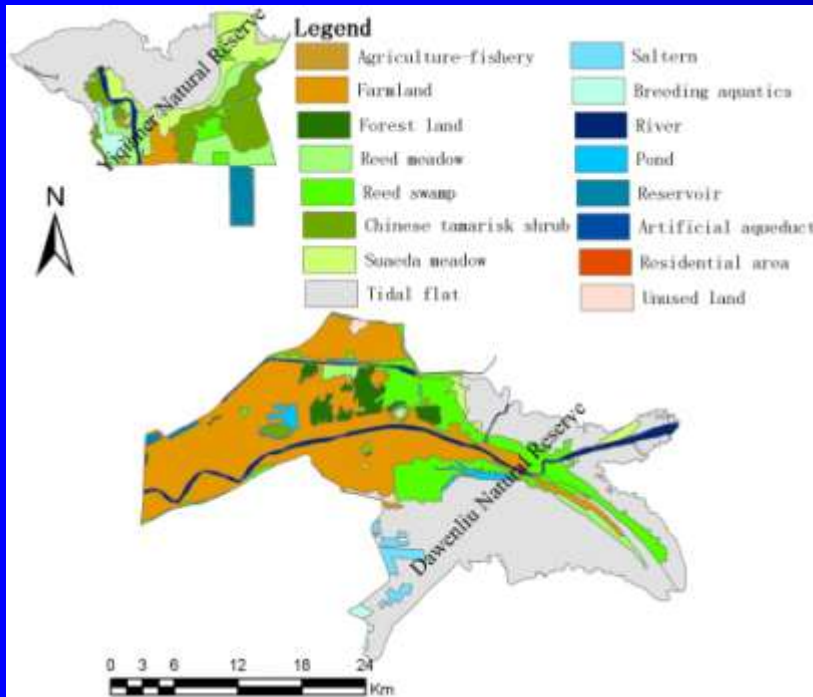


A, on 28th Aug., 1999

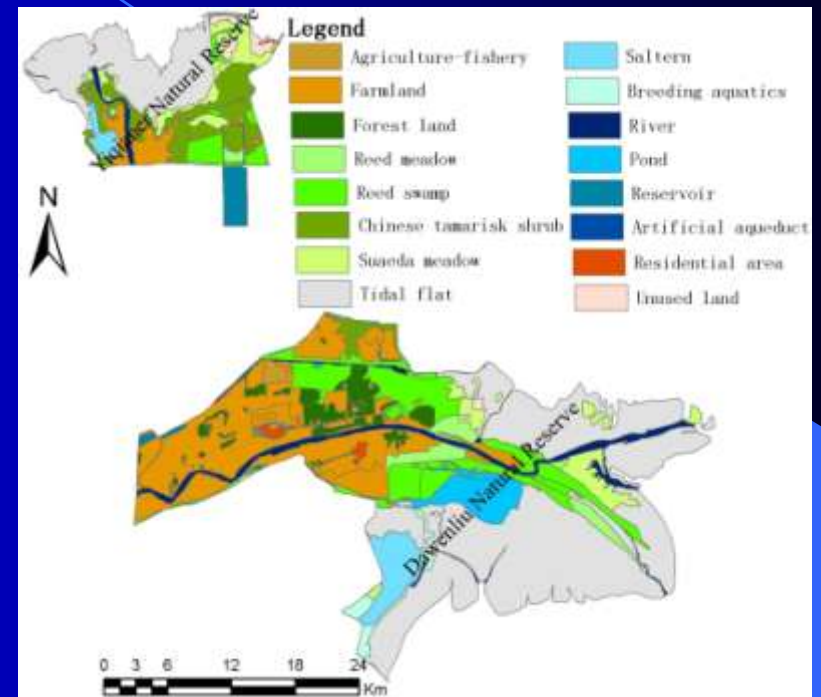


B, on 9th Aug., 2001

# 3、 Results and Discussions

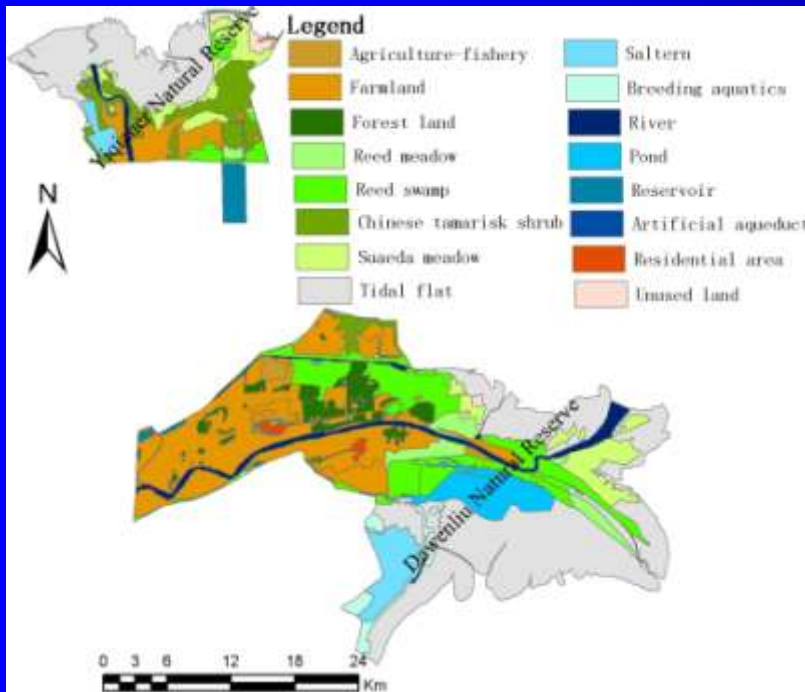


C, on 28th Oct., 2004

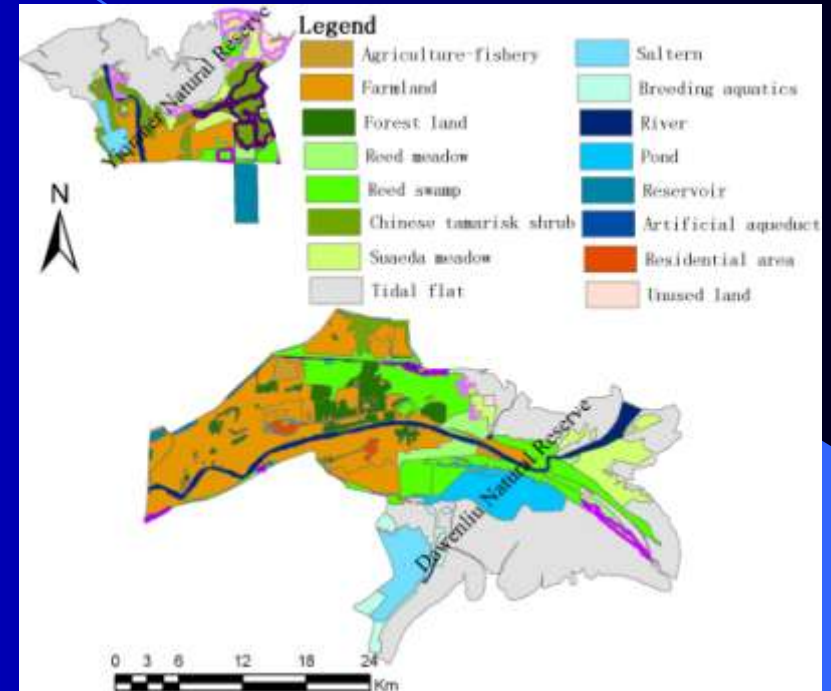


D, on 2th Oct., 2006

# 3、 Results and Discussions



E, on 2th Oct., 2008



F, unchanged area from 1999 to 2008

# 3、 Results and Discussions

Table 2 Natural vegetation community change from 1999 to 2008

( UN-Unit Number; ATP-Area Transition Probability; UTP-Unit Transition Probability)

Years		1999	2001	2004	2006	2008
Suaeda meadow	Area	97.01	67.46	26.94	14.79	14.50
	(km <sup>2</sup> )		69.5%	27.8%	15.2%	15.0%
	UN	15	57 (12)	44 (3)	18 (6)	21(8)
	ATP		69.5%	39.9%	54.9%	98.1%
	UTP		21.1%	6.8%	33.3%	38.1%
Chinese tamarisk shrubs	Area	44.22	34.40	19.64	17.69	17.67
	(km <sup>2</sup> )		77.8%	44.4%	40.0%	40.0%
	UN	6	25(5)	19(4)	15(5)	13(5)
	ATP		77.8%	57.1%	90.1%	99.9%
Reed swamp	Area	11.51	9.34	2.86	2.56	2.56
	(km <sup>2</sup> )		81.1%	24.8%	22.2%	22.2%
	UN	7	20(6)	20(7)	17(9)	15(11)
	ATP		81.1%	30.6%	89.6%	99.9%
Reed meadow	Area	84.41	53.22	15.48	3.18	3.18
	(km <sup>2</sup> )		63.1%	18.3%	3.8%	3.8%
	UN	13	59(15)	52(9)	22(4)	5(2)
	ATP		63.1%	29.1%	20.5%	99.9%
Reed meadow	UTP		25.4%	17.3%	18.2%	40.0%

These unchanged area identification is useful, which indicate the locations of the relatively stable ecosystem. Through the reasons and affective factors analysis, it is important for restoring and protecting the natural ecosystems in YRD.



# 4、 Conclusions and Discussions



# 4、 Conclusions and Discussions

## □ Conclusions

(1) From 1999 to 2008, only 15.0% of Suaeda meadow, 40.0% of Chinese tamarisk shrubs, 22.2% of Reed swamp and 3.8% of Reed meadow had kept unchanged at all time.

(2) The pioneer ecosystem Suaeda meadow and the high level ecosystem Reed meadow is the most unstable and easy to change.

(3) The integration of satellite remote sensing, GIS and transition probability matrix provided a method to study the dynamic succession processes of natural vegetation community.



# 4、 Conclusions and Discussions

## □ Discussions

(1) If the dynamic succession processes of vegetation community were not taken into account, the relatively changed regions in the YRD could be easily extracted through intersecting between 1999 and 2008. In the recent ten years, the regions in which the inverse succession (83.64km<sup>2</sup>) happened were 2.07-fold that of progressive succession (40.36km<sup>2</sup>), which reflected ecological fragility of YRD.

(2) The fine time-scale of transition matrix must be considered when land cover change is used to reflect the ecosystem process.

(3) With given an official approval for highly efficient eco-economy's development in the YRD by state department of China in 2009, land cover change in the YRD must be faster, and need be better studied for guiding land use development and protecting the wetland ecosystems.



# Thank you!

**Not only change, but also the unchanged need pay attention!**

