

Land Cover Change of the Middle Reaches of the Amur River and the Relationship with Geomorphologic Landform Series

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Background

Land cover change

- Development and reclamation steering into wet land decreasing
- Development leading to sedimentation and the river bed and increasing
- Sophisticate farming and land use change making ecological change
- Forest fire leading to land cover change

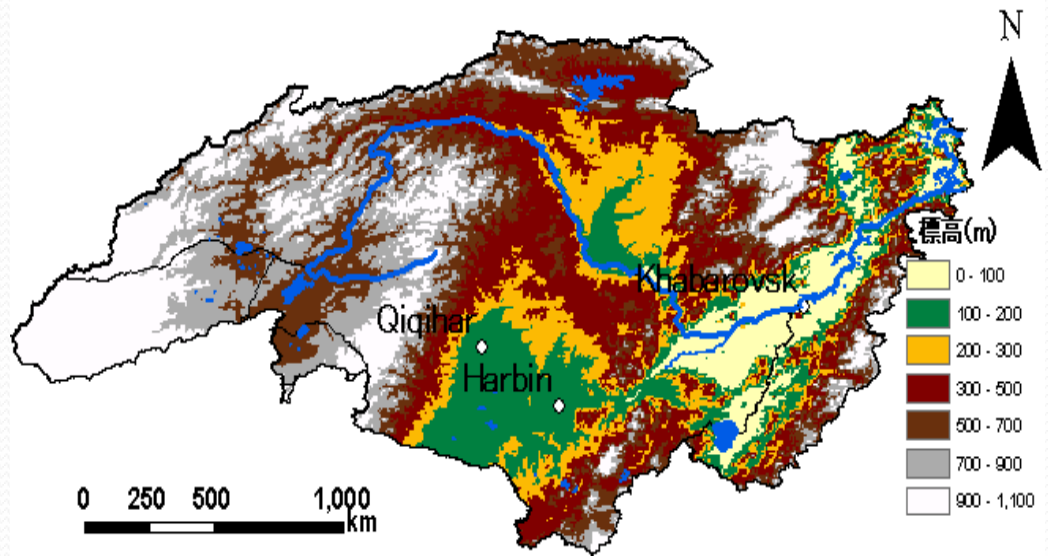


Background

The Amur River Basin

Economic growth and urbanization and industrialization and rapid land use change in China

Space difference of land cover change in the Amur River Basin



Influence for biological production of Okhotsk Sea from the Amur watershed change, Shiraiwa(2005)

Properly influence evaluation of natural environment in movement induced by great land cover change of the Amur river basin

Objectives

1. Demonstrate the land cover change using trend analysis of PAL dataset of the Amur River Basin last 20 years

Remarkable land cover change area distilling from NDVI (Normalized Difference Vegetation Index) and analysis of their trend

2. Bringing out land cover change on each landform with wetland decreasing

Study Area



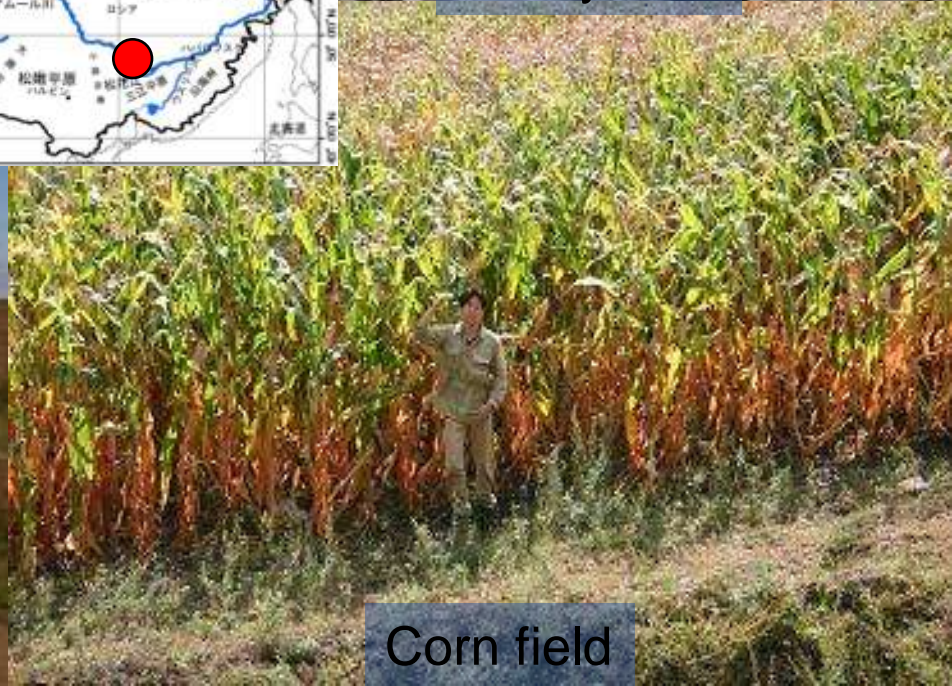
wet land



Paddy field



Soy bean field



Corn field

Data and Method

1. NOAA/AVHRR PAL dataset

Trend analysis in recent 19 years

36scenes/1year, 684scenes/19years

Space resolution $0.1^{\circ} \times 0.1^{\circ}$

Ch1 (visible ray) Ch2 (near infrared red)

Ch4.5 (thermal infrared red)

Index of NDVI for land cover change

NDVImax Σ NDVI NDVIstd TRJ

2. Long Term Statistical data

Planting area of agriculture, production, changes of irrigation area

Data set and method

parameter meaning

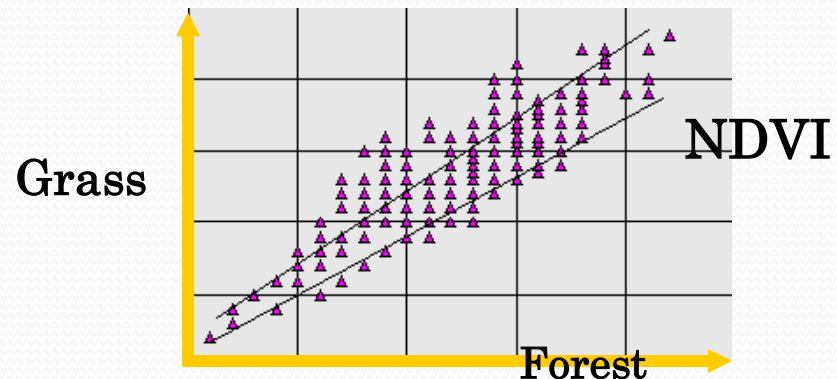
NDVImax:index for showing vegetation growing condition in each year

Σ NDVI:index for showing bio-mass in each year

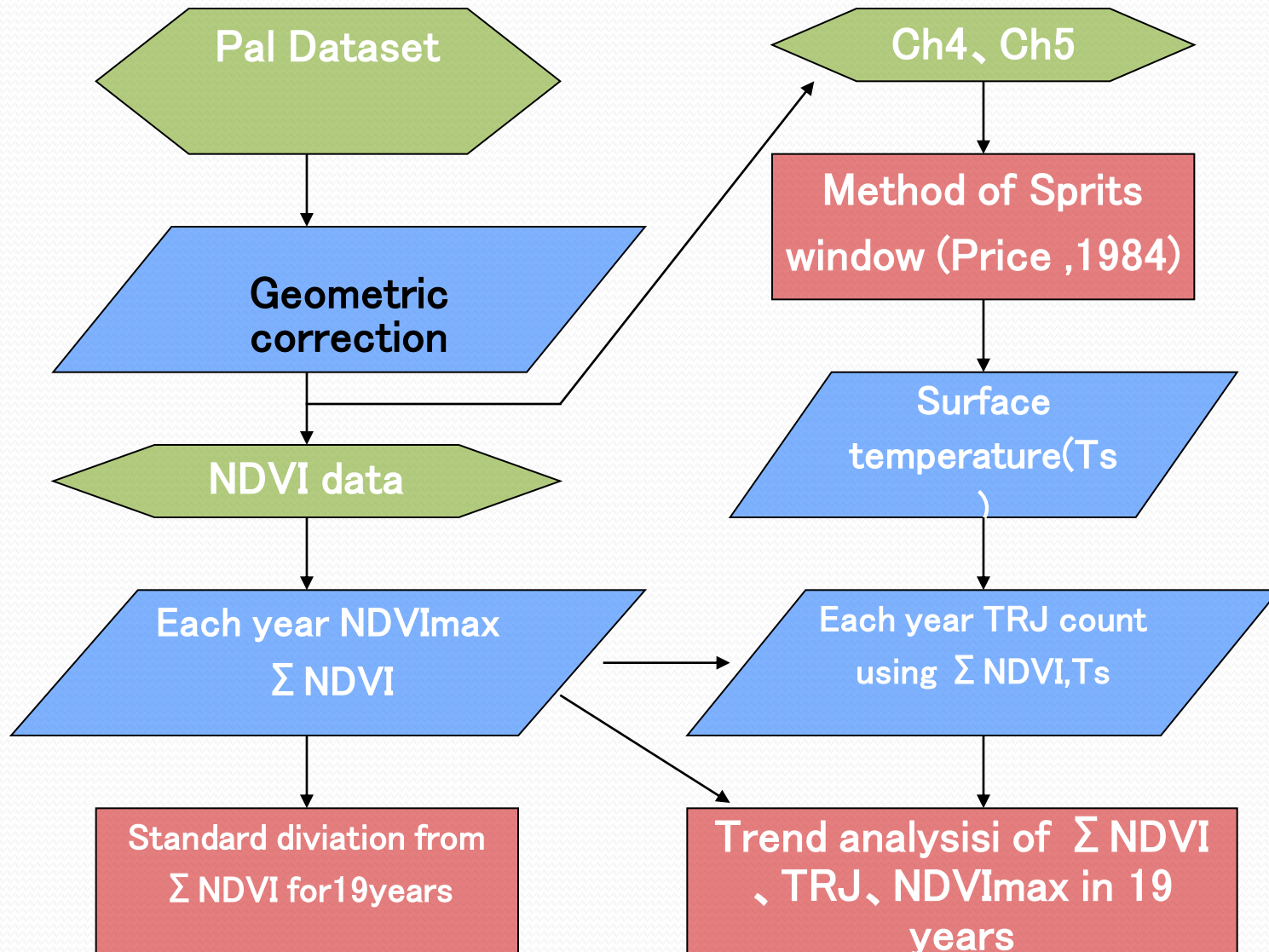
NDVlstd:index for trend of increasing and decreasing of bio-mass in each year, index for showing of disturbance of vegetation

TRJ:NDVI in the year, tendency of surface temperature (T_s) in two dimension dispersion graph is difference in each land cover condition (Nemani and Running 1997)

(Land cover change should be clear using trend analysis of the tendency in each land cover change in 19years, for example, smaller tendency reveals vegetation change from grassland to forest)



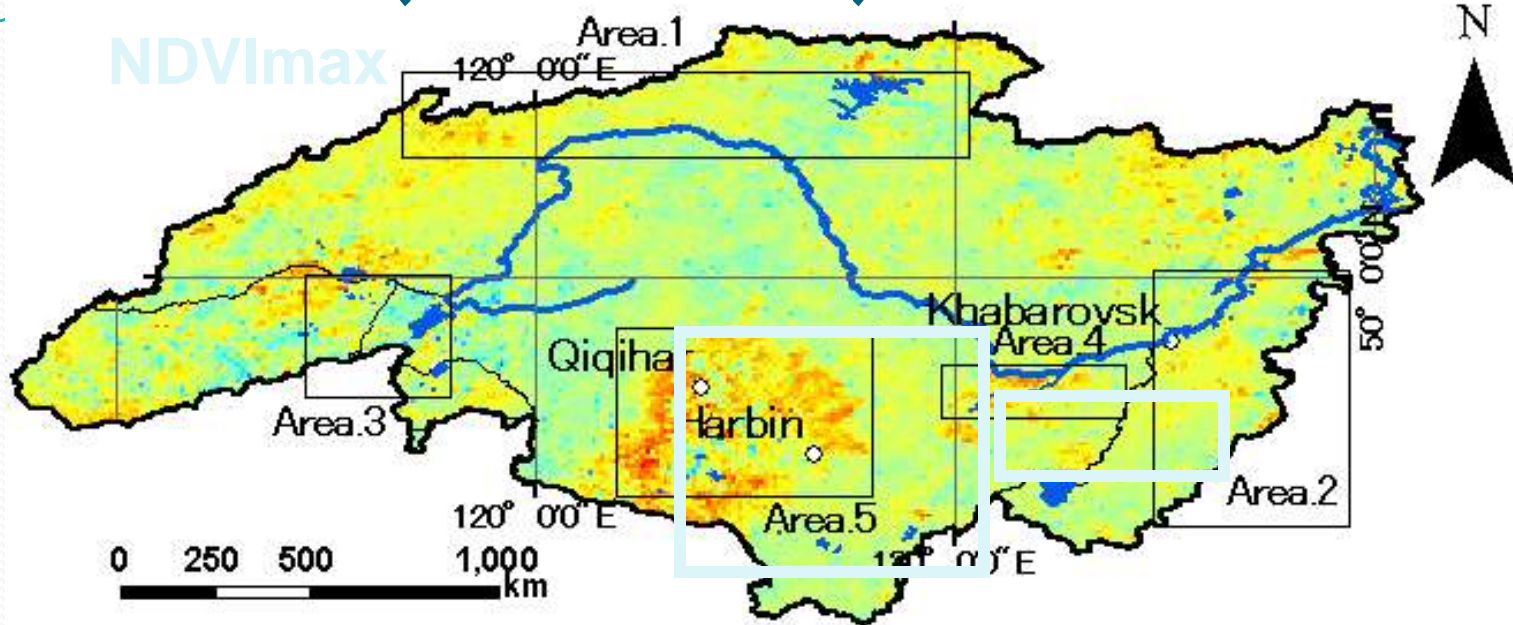
Data and Method



Flow chart of analysis of PAL data set

Result (Area4.5)

NDVImax



— 0.01  0.01/year

Irrigation area expansion 3times in
last 19 years

Size of development enlargement

(from 670.5 thousand ha to 2032.thousand ha)

Rice cultivation area : 7.5times in 19years

production: 14.6times in 19years



Production change in Heilongjan province

Sanjiang Plain



Corn field



Amur River



Wetland on the flood plain



Rice paddy

- The Sanjiang Plain where it lies between the courses of the Songhua, Amur, and Ussuly river is neighboring to Russia .
- Development and reclamation has resulted in a considerable increase farmland. The wet land was decreasing.
- Western Sanjiang Plain, the cultivated area was 607,000 ha, the soybean area was 36%, the rice area was 24%, the corn area was 17% in 2000. Especially, the rice yields were much increased from 3,880,000 tons in 1993 to 9,540,000 tons in 1999 (Ganzey, 2005).

Rural landscape



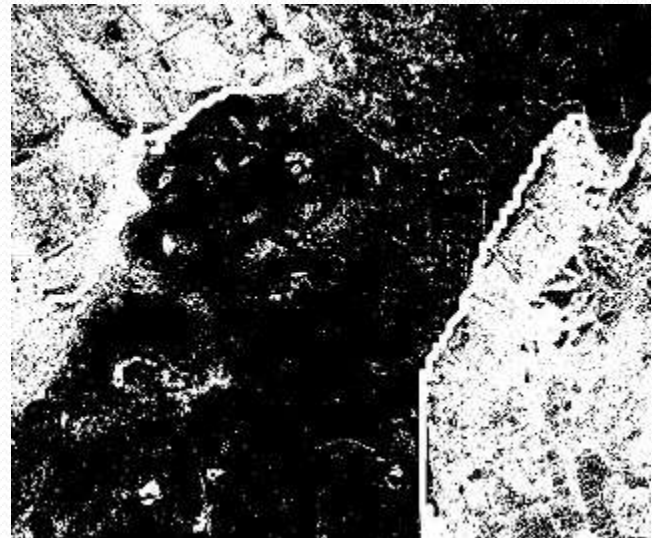
Rural landscape



Rural landscape



Geomorphologic land classification mapping using JER-1 SAR data



1 pixel 12.5m × 12.5m。



① Lower Flood Plain



② Swampy Area on the Terrace



③ Alluvial Plain



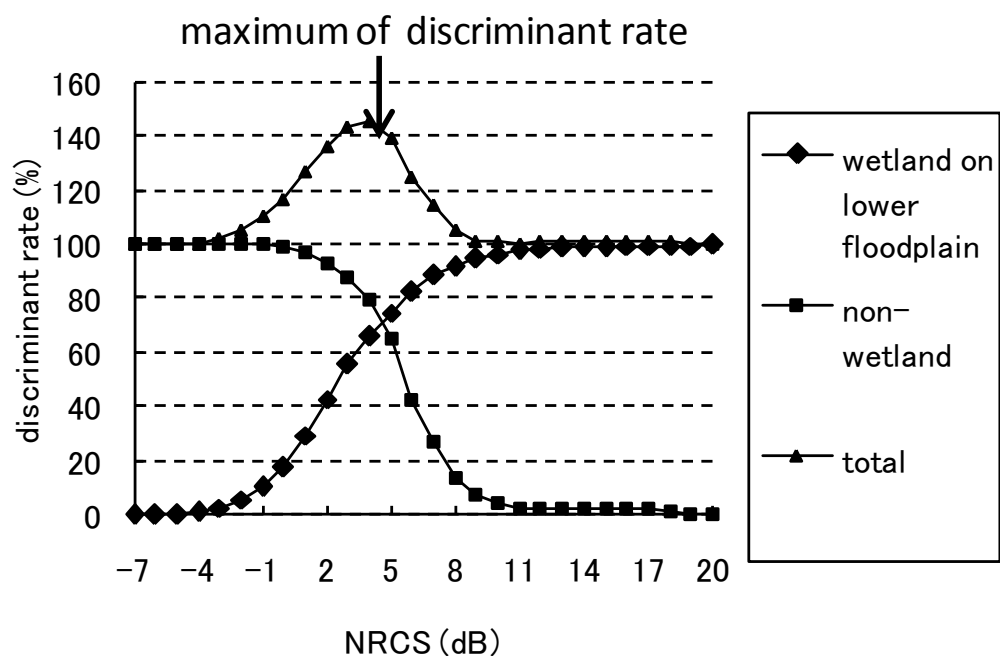
④ Dissected Terrace



Wetlands on the selected landforms

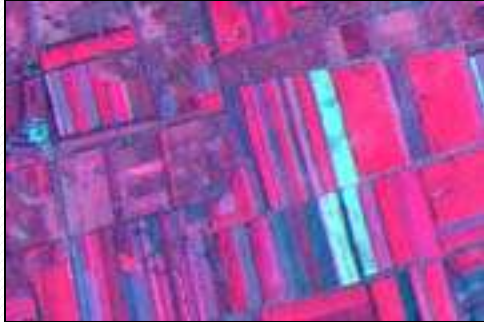
Threshold

- Empirical cumulative distributions for NRCS of wetland on selected landforms and non-wetland.
- Sum of two distributions is discriminant rate. When threshold moves upper from -25 dB, more pixels are classified as wetland and less pixels are classified as non-wetland.

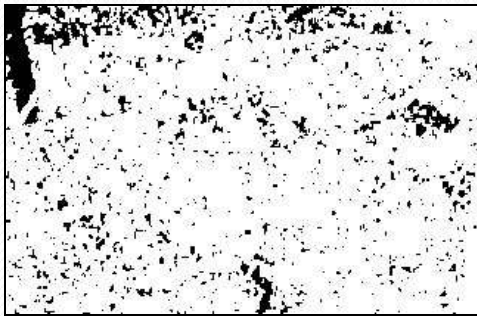


	Discriminant rate of wetland		Threshold NRCS	
	1992	1996	1992	1996
Alluvial Plain	90%	84%	4.88	4.84
Dissected Terrace Valley	73%	72%	3.17	3.56
Swampy Area on the Terrace	98%	68%	2.06	4.76
Lower Floodplain	72%	63%	6.03	4.45
Mountains	95%	56%	6.26	4.04

Calculating Crop Land

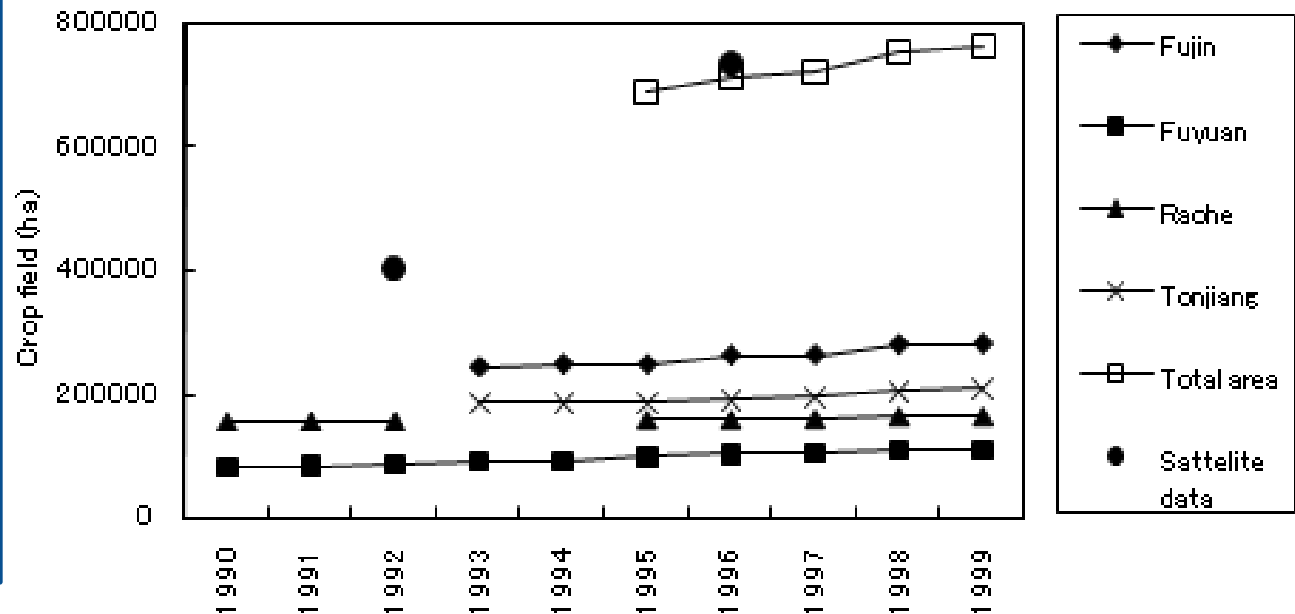


TM false color



wetland by SAR

Local Area Changes of Crop Field from 1990 to 1999



(Statistical Yearbook of Heilongjiang)

Reclaimed land (TM false color)
– Wetland in reclaimed land (SAR)

Concluison

- NDVI_{max}, Σ NDVI, NDVI_{std}, TRJ are good signal for land cover change of the Amur river basin. Area 4 and 5 are clearly indicated for land cover change in the basin.
- Land cover change of the area 4 and 5 is meaning the wet lands decreasing and the wet lands' dryness
- Compared with geomorphologic land classification map and wetlands, 1) Wet lands on the Pleistocene terrace, the dissected valley and hill are remained (were not targeted for development) compared with other landforms, 2) wet lands on the lower alluvial plain, old swampy area and the former river course are mostly changed to farmland recent 20 years.
- Characteristics of the wet lands are depending on the geomorphologic landform. The vegetation and ecological feature of the wet lands of each landform are different.

The cultivated land per farmer increased and the non-cultivated land per farmer decreased more than the population of work force in farm land

Cultivation of wetland caused the high frequency of flood and soil erosion.

Thank you for your attention.

