International Meeting on Land Cover/Land Use Change (LCLUC)
in South/Southeast Asia and Synthesis

Climate Change and Disaster Risk Reduction in Urban and Coastal Areas, case studies of the Vietnamese Mekong Delta

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Background of the research

- Combine the different research fields in Vietnam University, Vietnam National University Hanoi:
  - Climate change and Development
  - Civil Engineering

- What: Climate change impact (most prominently, disaster risks)
- On: Infrastructure, land use change
- Where: Mekong River Delta, coastal and urban areas
- Why: the need to quantify the damage and integration into the land use plan

Institutional tools:

Decree 120/NQ-CP dated 17 Nov 2017

- The main opinion: Respect the natural law, avoid ruthless interference to the nature, living together with floods

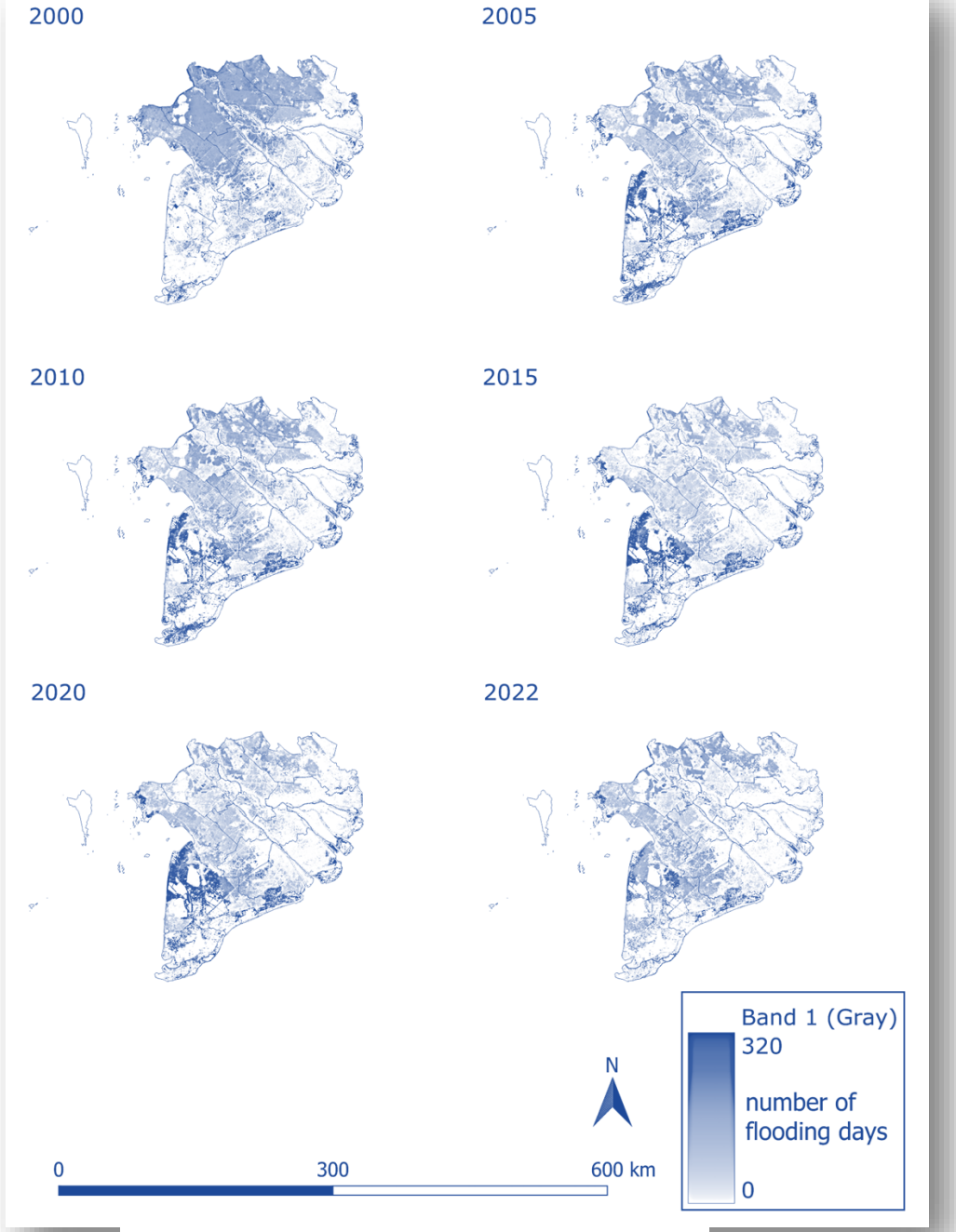
  Encourage the research and scenarios of adaptation to floods, storms, draughts and salinity intrusion.

- Direction: Acknowledge climate change and sea level rise is the obvious trend and to turn challenge into opportunities

Decision 287/QĐ-TTg dated 28 Feb 2022 on the Regional plan of the Vietnamese Mekong River Delta for the period 2021-2030

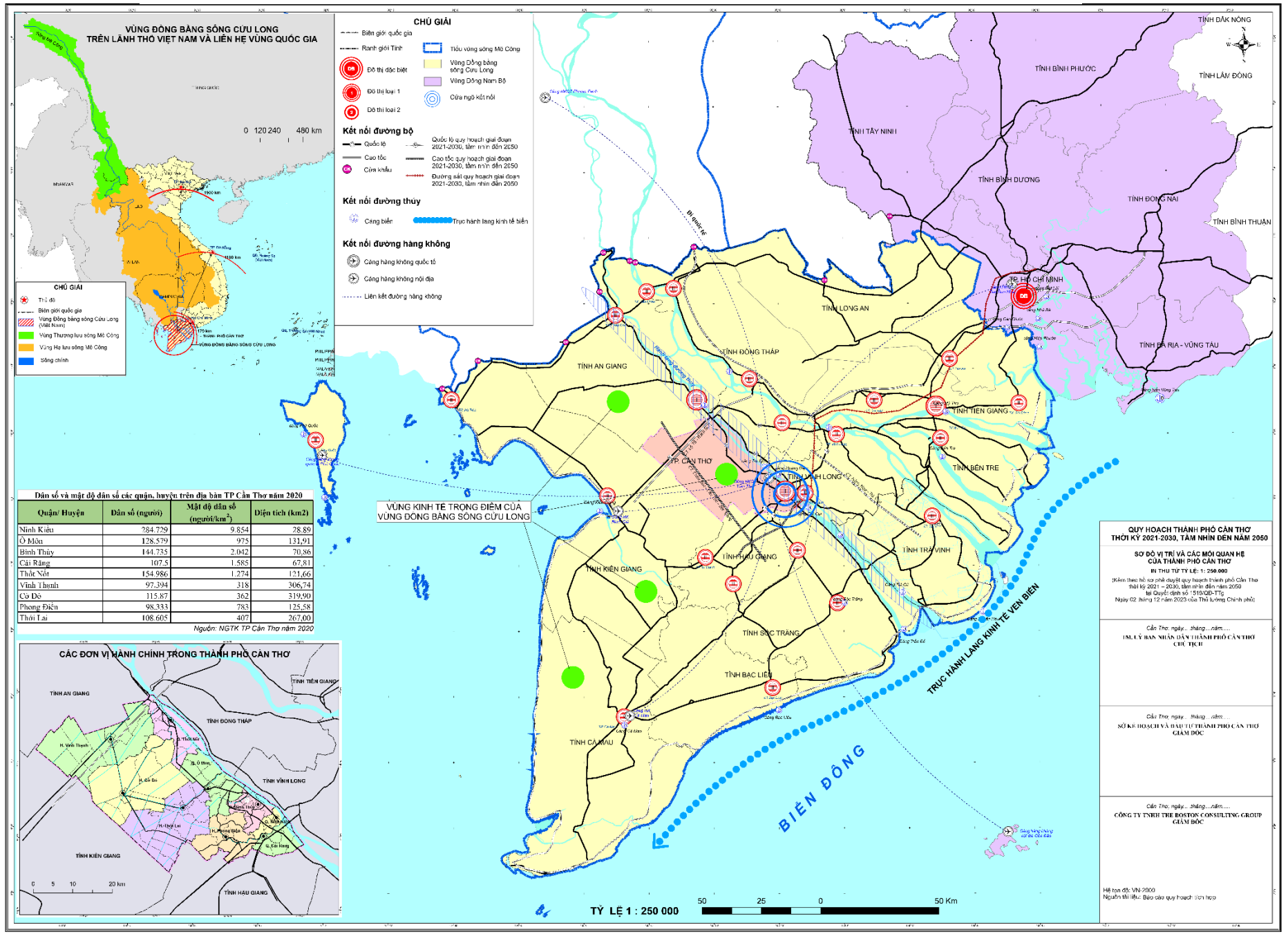
Objectives

- Evaluate the impacts of climate change and natural disasters (floods, sea level rise) on agriculture, land use, and infrastructure in the Vietnamese MRD.
  - To assess adverse impacts of floods (rainfall, sea level rise) on agriculture in the Vietnamese MRD
  - To analyze impacts of climate change on land use, find driving forces of land use change in the context of climate change in the Vietnamese MRD
  - To apply geospatial techniques (GIS and remote sensing) for flood monitoring and damage assessment in Can Tho city - a central urban area in the Vietnamese MRD
  - To propose technical solutions for adapting and mitigating the impacts of climate change and natural disaster on agriculture, land use, and infrastructure in the Vietnamese MRD



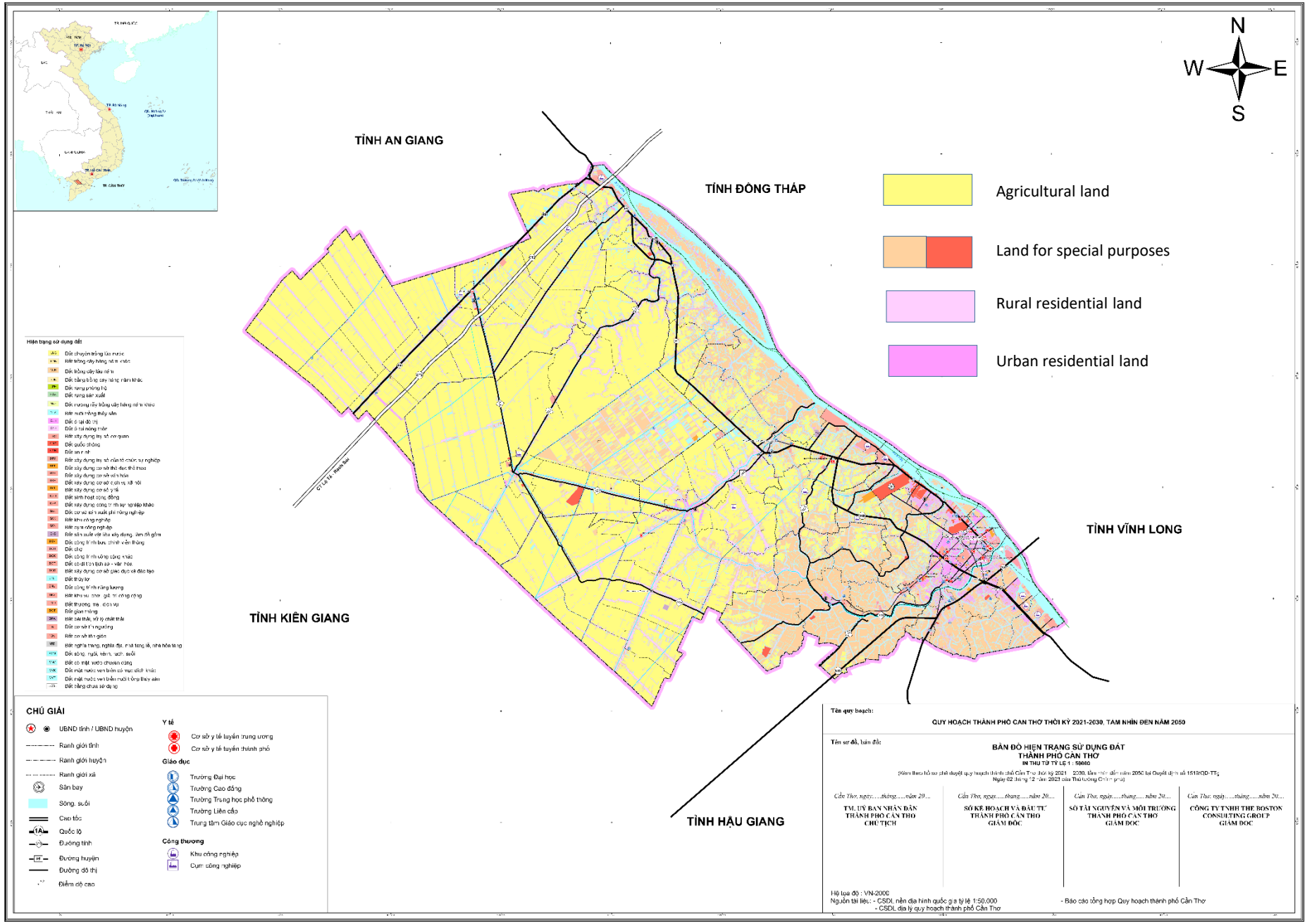
VMRD flood map from 2000 to 2022

Location of Can Tho city and the connected paths to surrounding



Source: Master plan of Can Tho 2021-2030

Land use map of Can Tho city



Source: Master plan of Can Tho 2021-2030

Data and methods

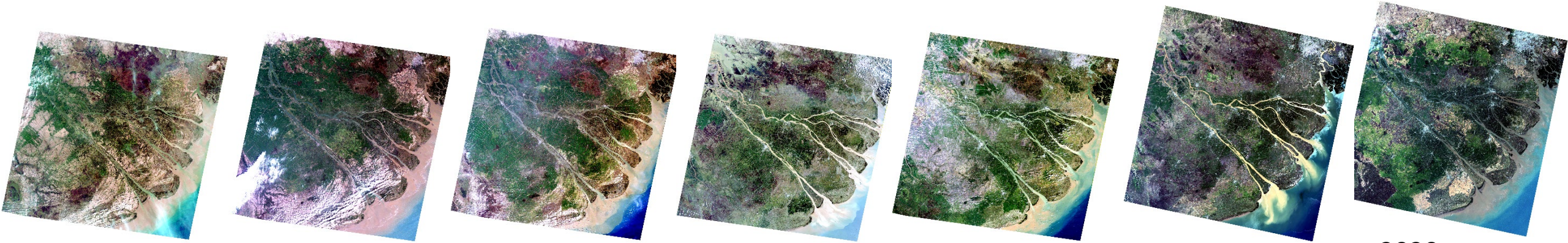
GIS database	Collected and edited data, spatial analysis
Meteorological data	Collected data
Remote sensing data	Remote sensing data collection and analysis Ground-truth observation
Census data	Non-structured interview

Data

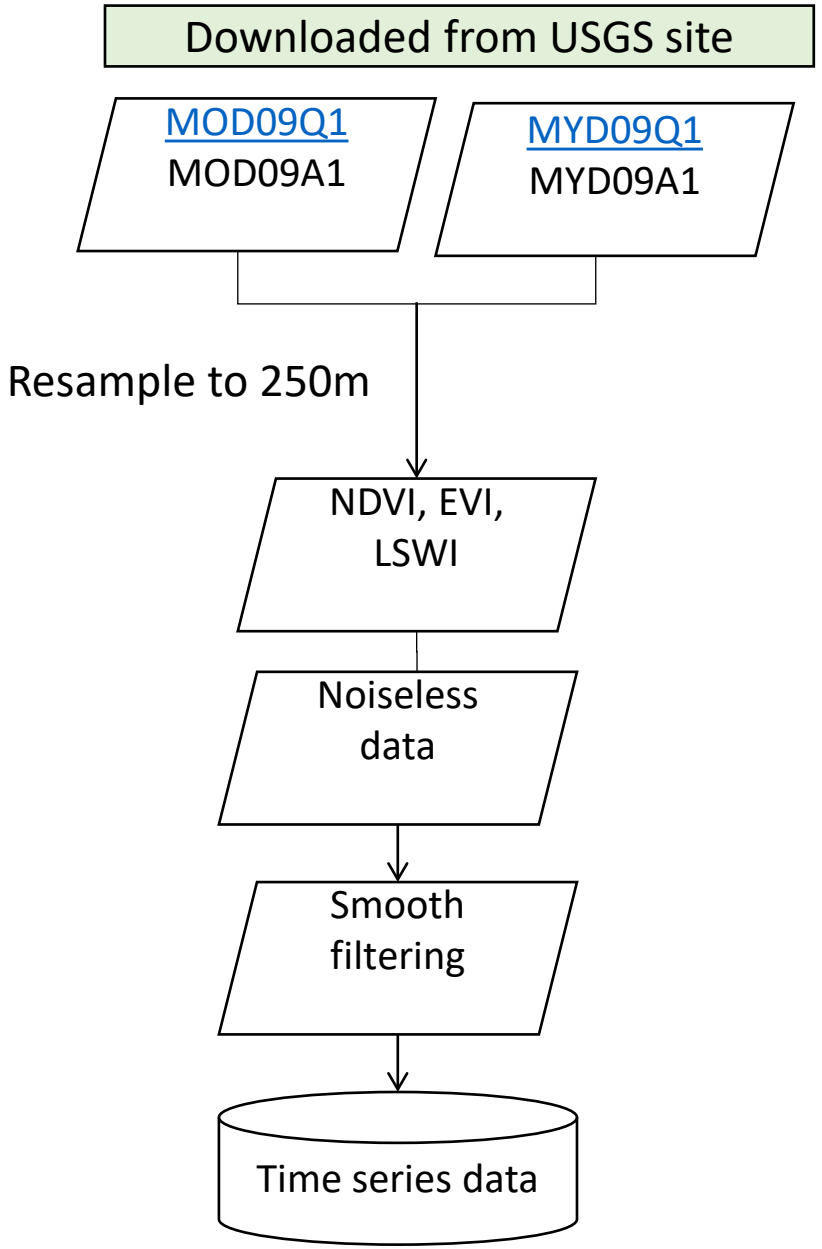
- Landsat series: 5 - 9
- MODIS 8-day series: 2000-2020

Product Name	Terra Product ID	Aqua Product ID
Surface Reflectance 8-Day L3 Global 250m	MOD09Q1	MYD09Q1
Surface Reflectance 8-Day L3 Global 500m	MOD09A1	MYD09A1

- GIS database of the VMRD
- Ground truth data



Methods



NDVI = (NIR-RED) / (NIR+RED),

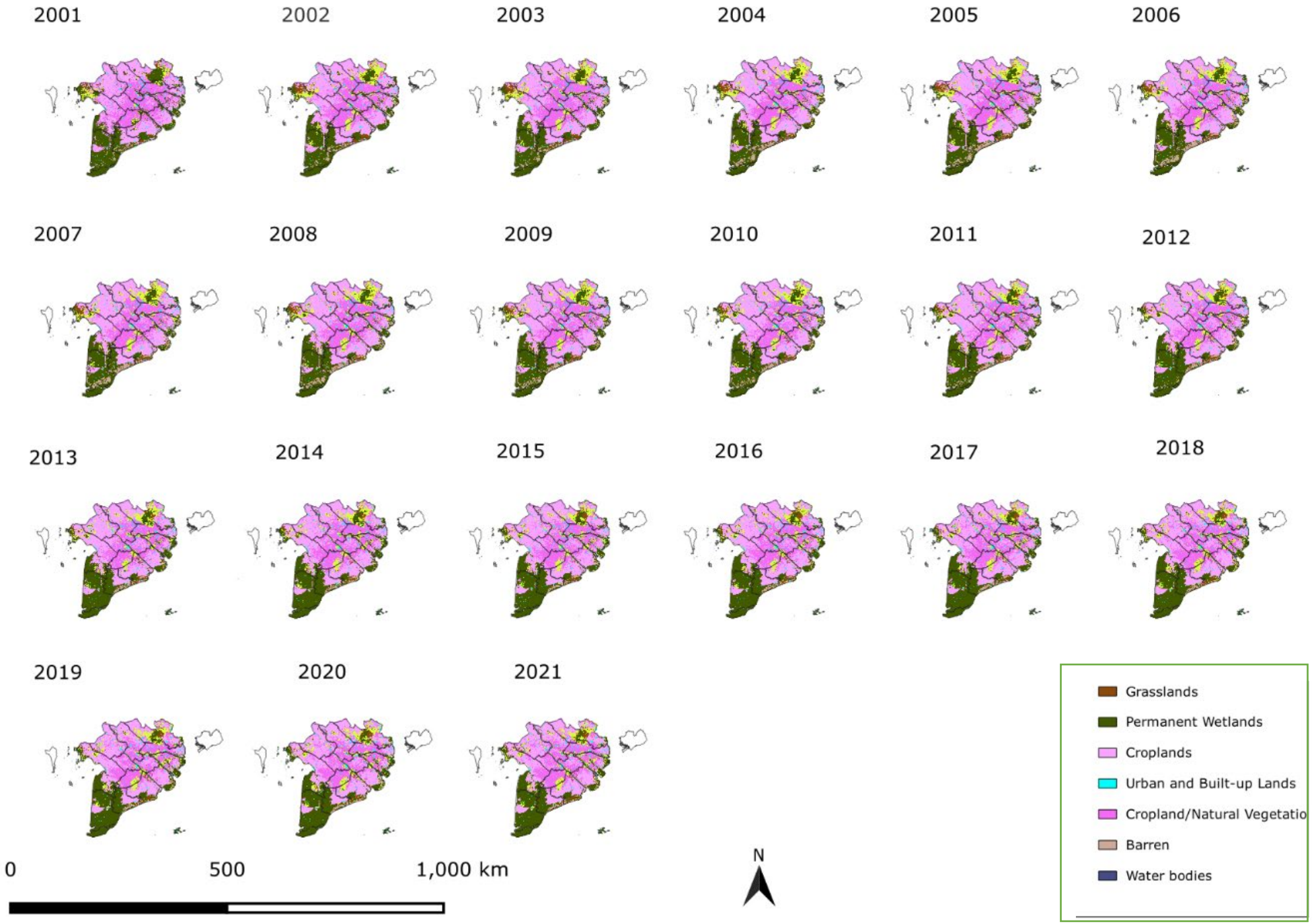
EVI = G × (NIR-RED) / (NIR+C1·RED-C2·BLUE+L),

LSWI = (NIR-SWIR) / (NIR+SWIR),

G is the gain factor (G = 2.5).

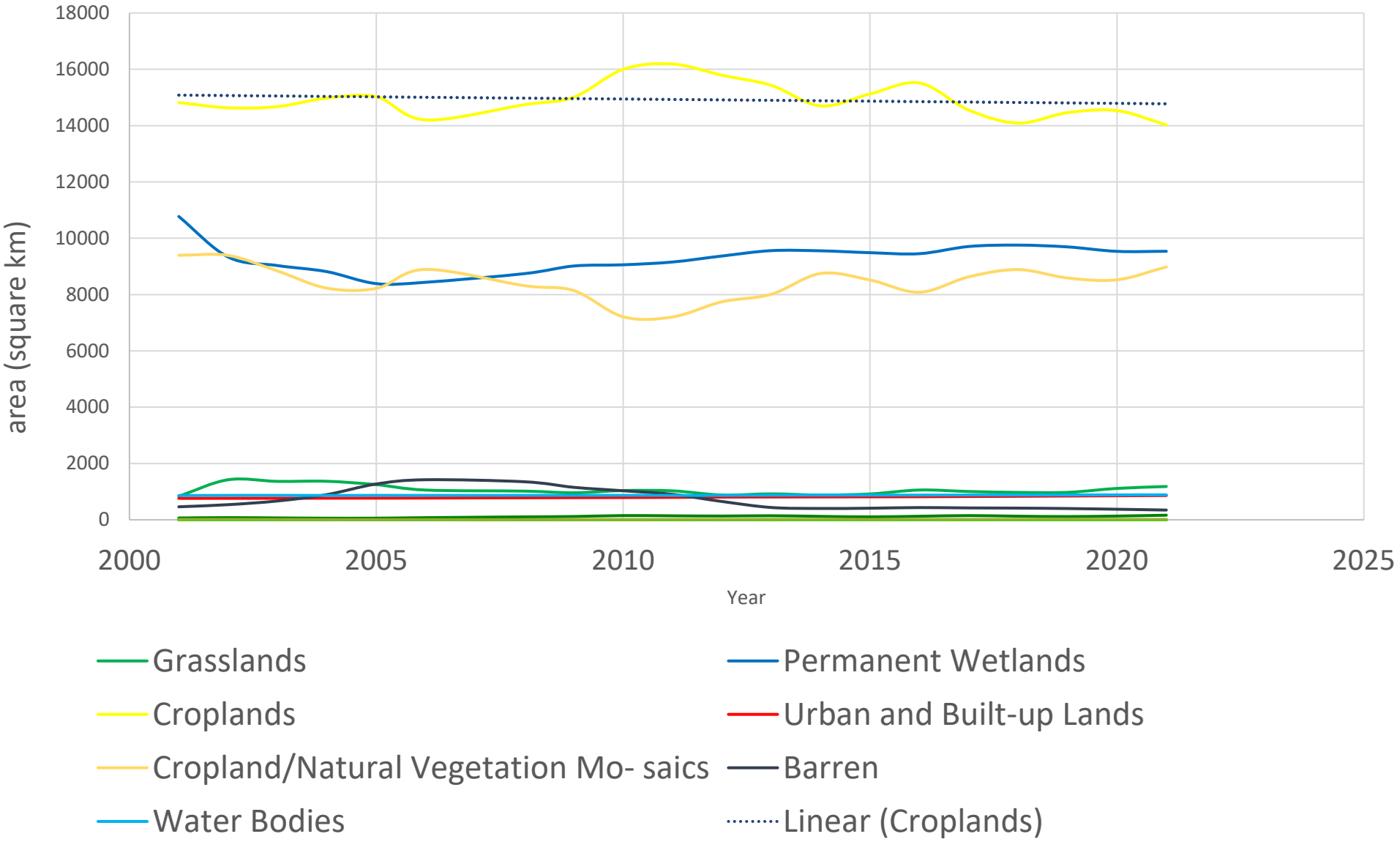
C1 and C2 are the coefficients of the aerosol-resistance term, which uses the 500- m blue band of MODIS to correct aerosol influences on the red band (C1 = 6.0 and C2 = 7.5).

L is the canopy background adjustment (L = 1) [

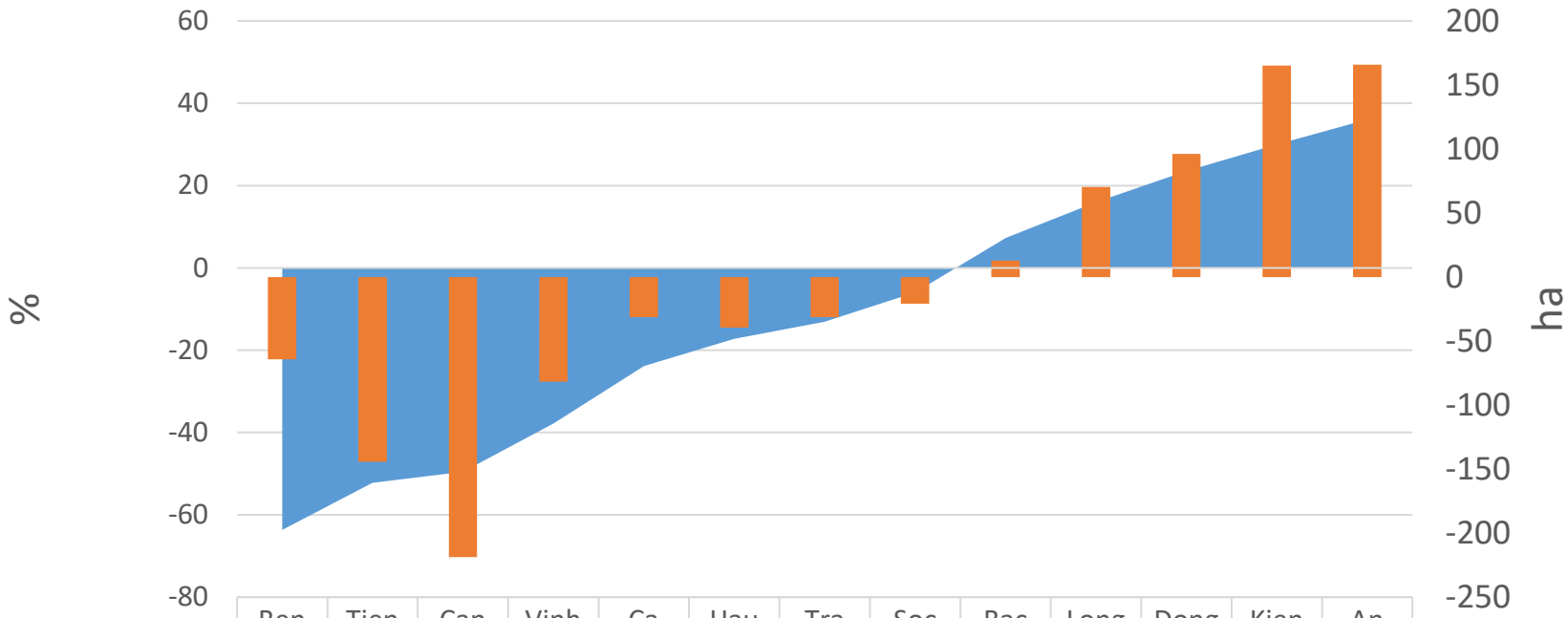


Land use/land cover map Derived from International Geosphere-Biosphere Programme classification scheme

LULC change in VMRD from 2001-2021

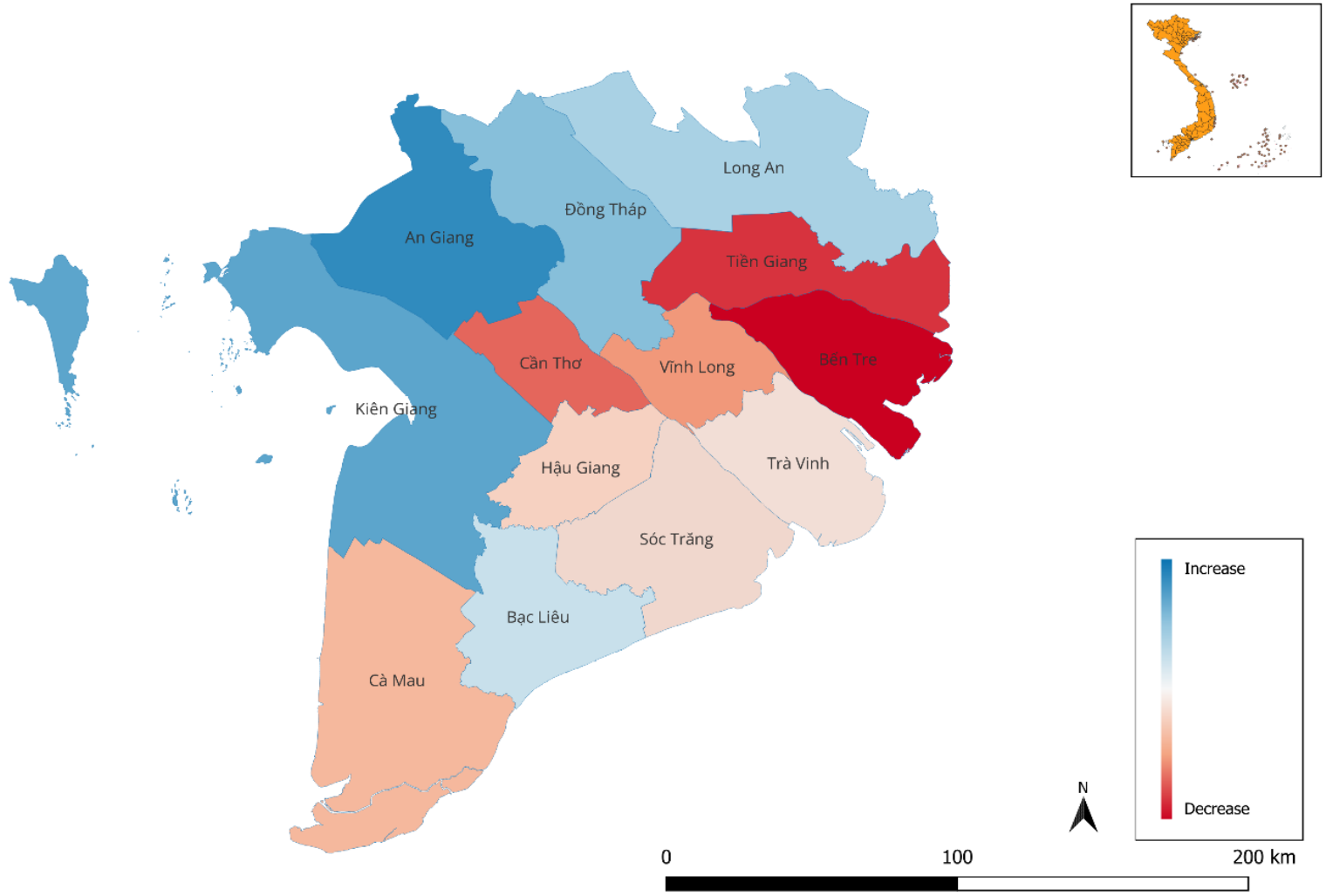


Differences in planted area of paddy by provinces in the whole period from 2001 to 2021 (% and ha)



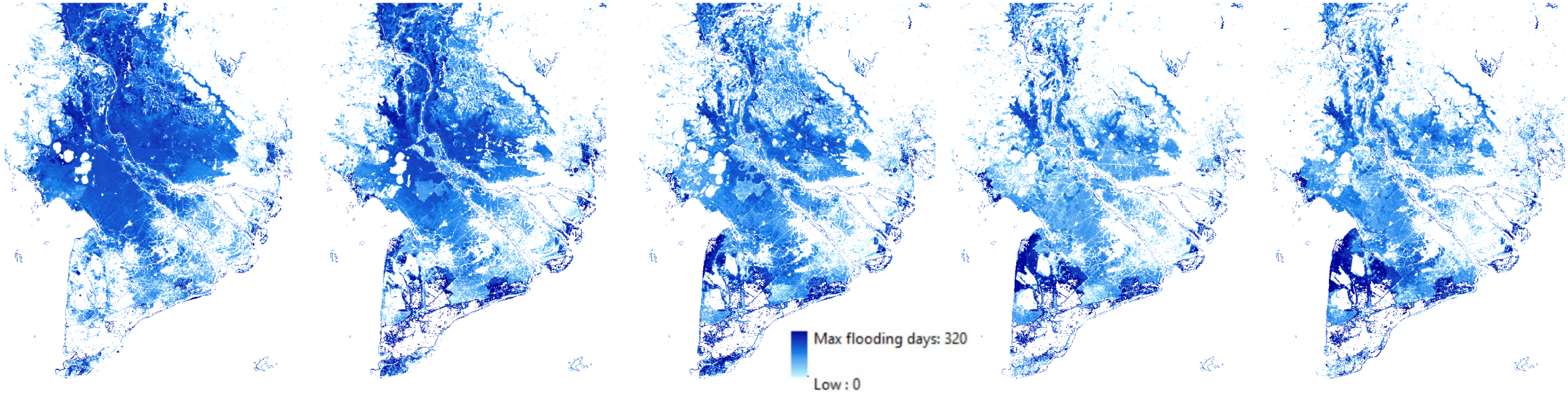
	Ben Tre	Tien Giang	Can Tho	Vinh Long	Ca Mau	Hau Giang	Tra Vinh	Soc Trang	Bac Lieu	Long An	Dong Thap	Kien Giang	An Giang
Differences (%)	-63.69	-52.23	-49.58	-37.82	-23.88	-17.25	-13.06	-5.992	7.2431	15.967	23.537	29.985	36.114
Difference (ha)	-64.2	-144.2	-218.7	-81.8	-31.4	-39.4	-31.4	-20.9	12.9	70.4	96.1	165.1	165.8

Provinces



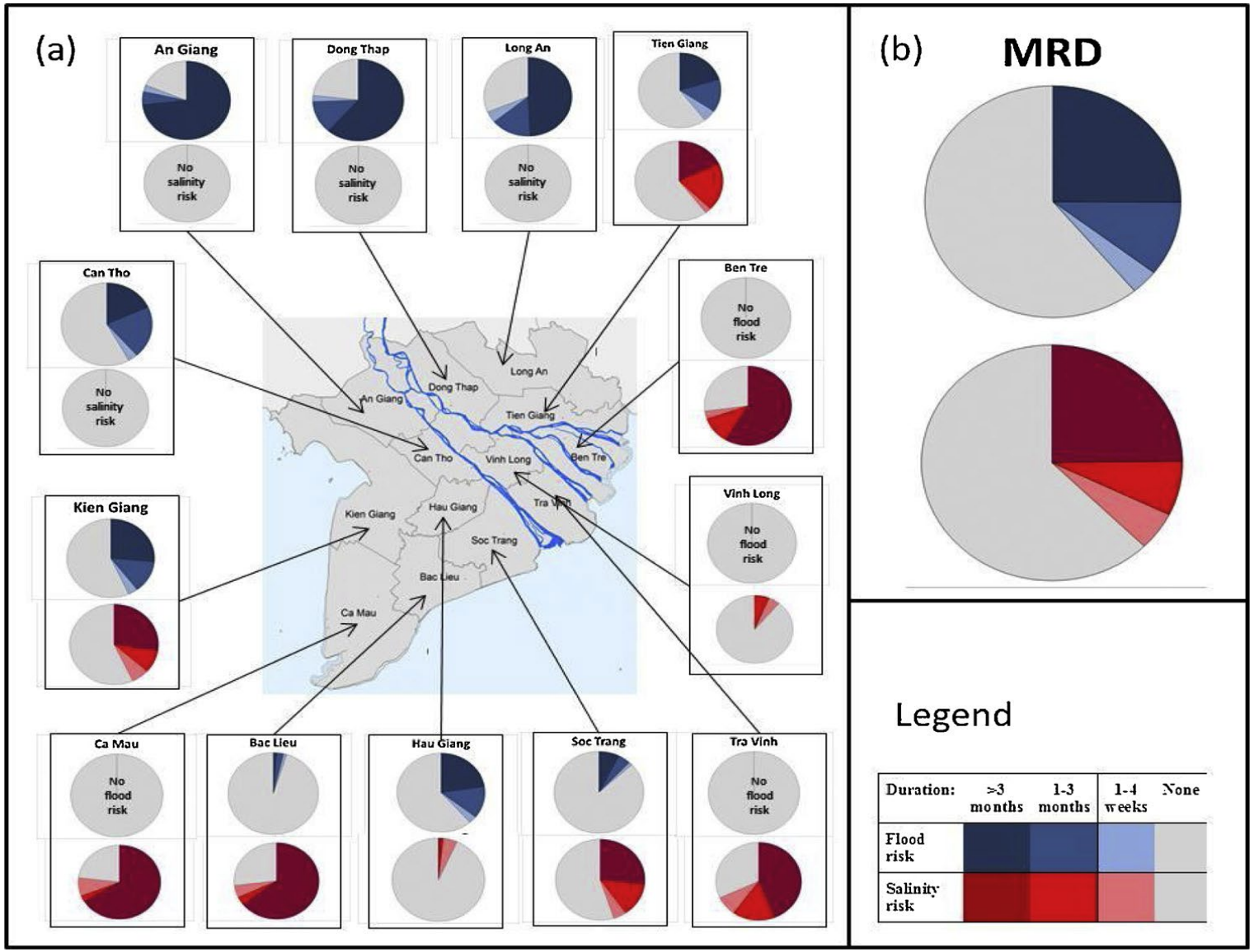
Map of changes in planted area of paddy in VMRD by provinces from 2001 to 2021 (census data)

Flood and cropping frequency in VMRD



2000 2005 2010 2015 2020

Decreasing the number of inundated days, narrowing the flood areas in An Giang and Dong Thap province

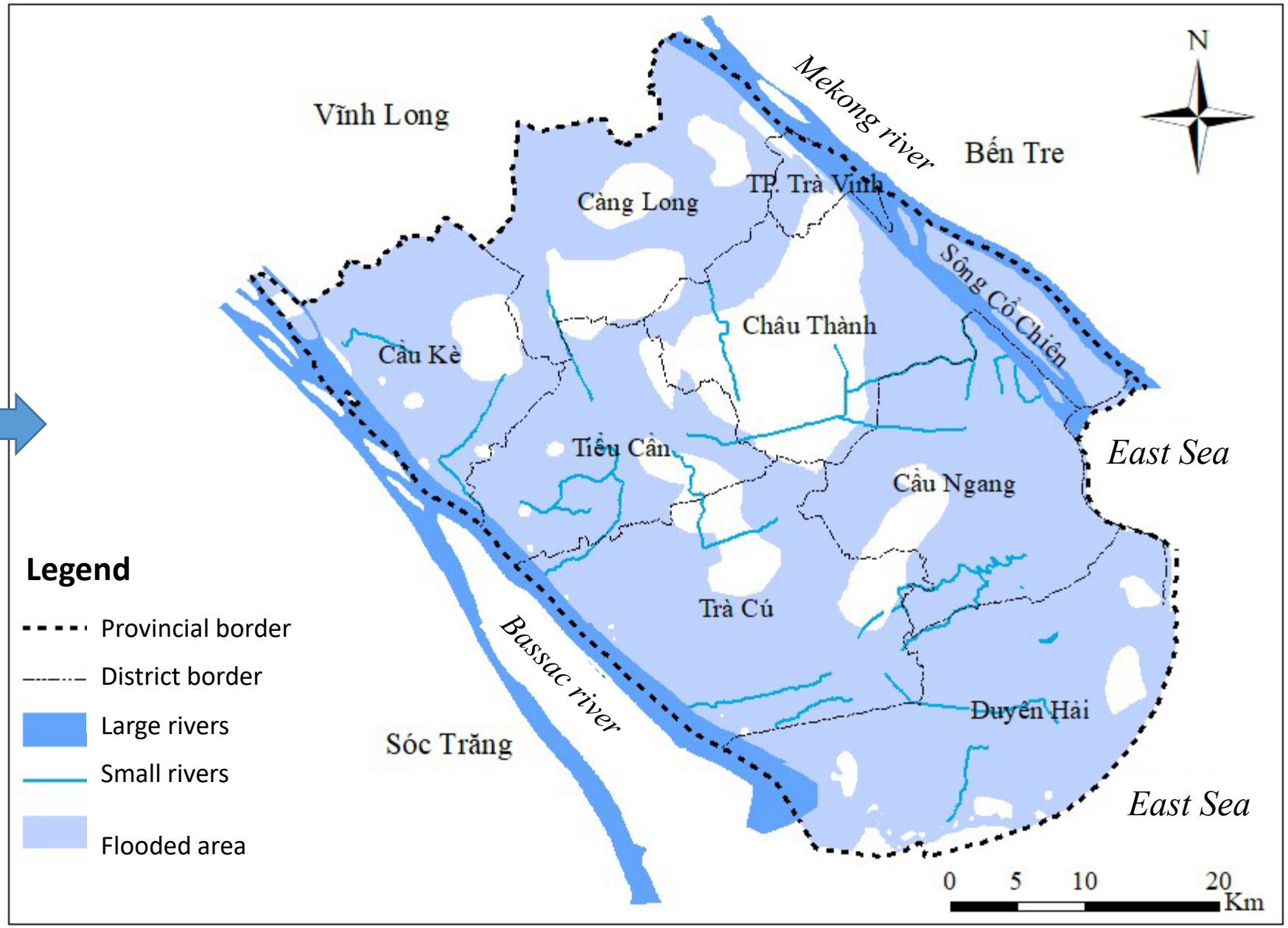


Provincial flood and salinity risk in VMRD

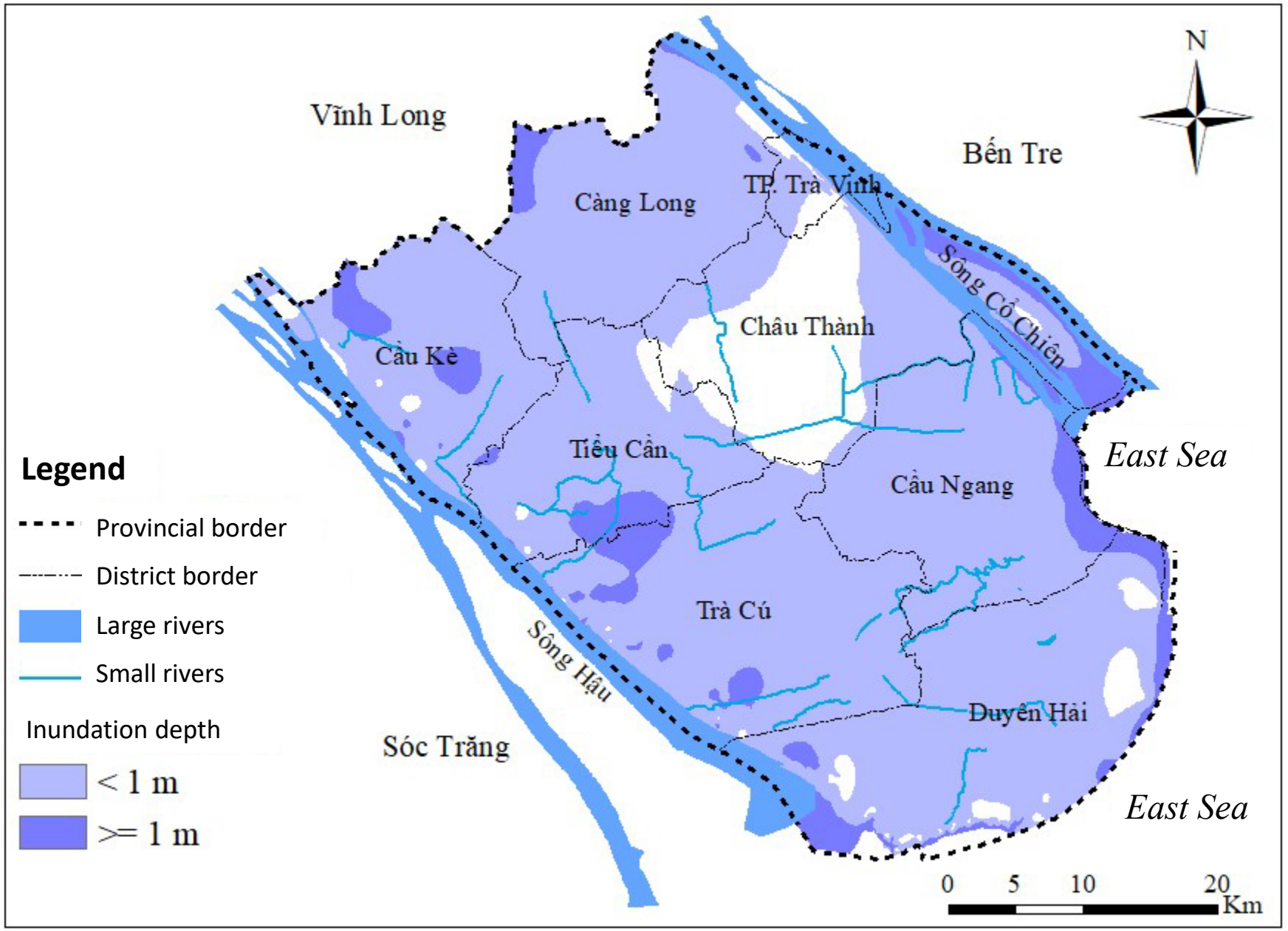
(Wassmann et al., 2019)

Pilot sites: Tra Vinh province

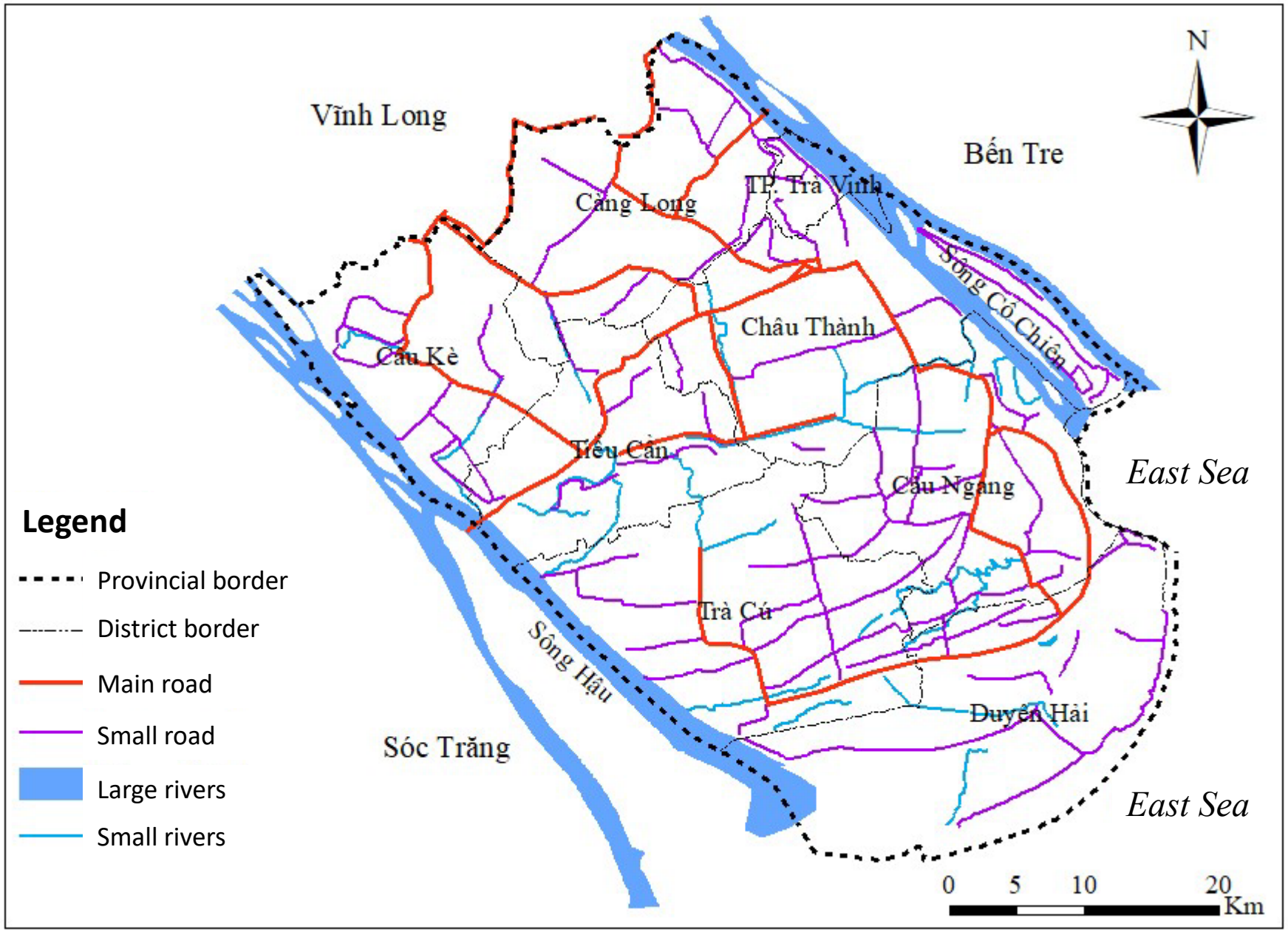
DEM, LULC data
Rainfall, Evaporation, Discharge, River cross sections,



Flooded map as resulted from combination of MIKE 11 model and the sea level rise scenario by MOET, assuming the areas will be flooded most heavily. Then, 1,811 km^2 or 81% of the total area is flooded.

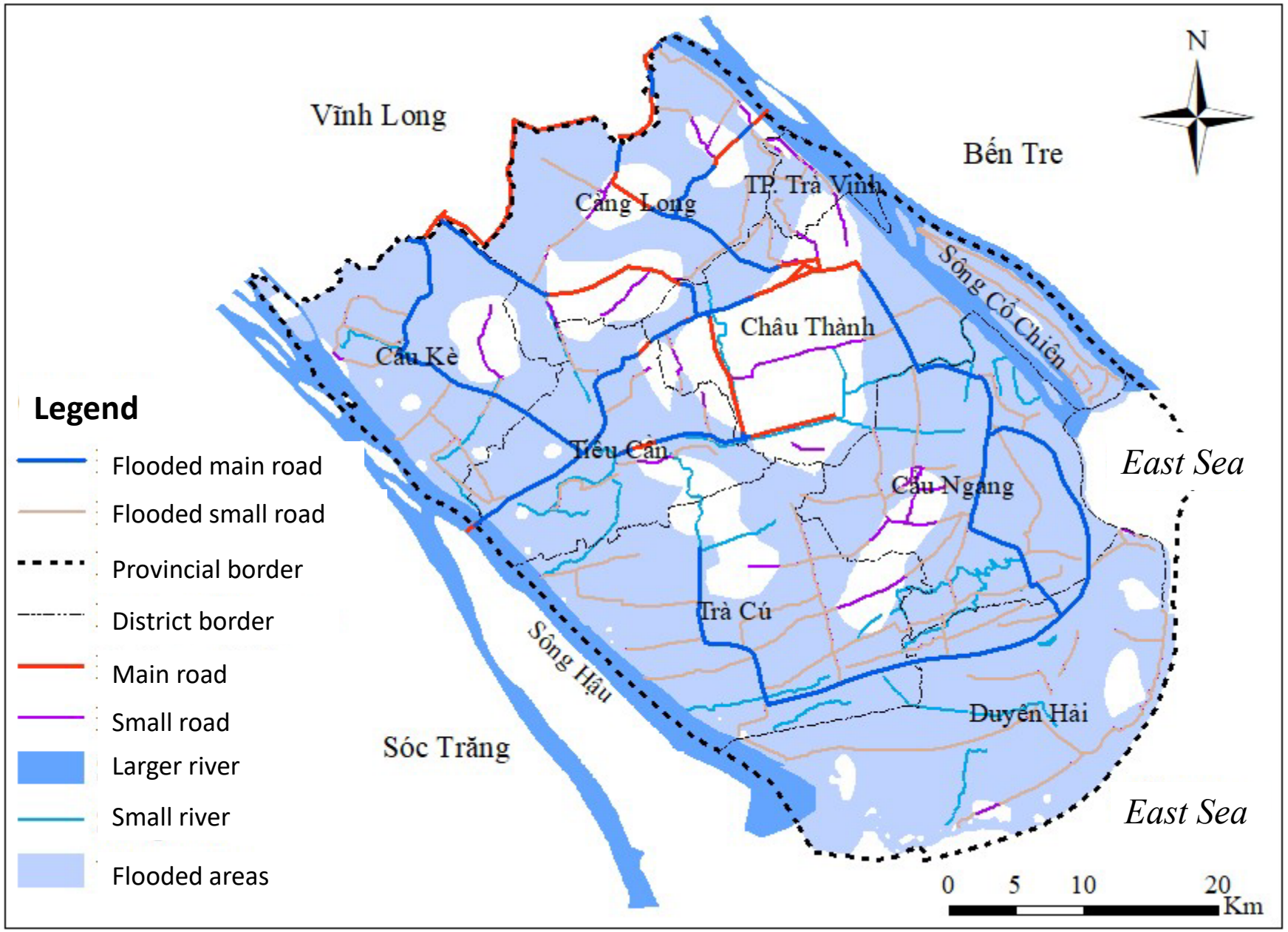


Inundation depth under the associated impacts of sea level rise and storm surge


Vĩnh Long
Bến Tre
TP. Trà Vinh
Càng Long
Châu Thành
Cầu Kè
Tiểu Cần
Cầu Ngang
Trà Cú
Duyên Hải
Sóc Trăng
Sông Cổ Chiên
Sông Hậu
East Sea
East Sea
N
0 5 10 20
Km
Legend
Provincial border
District border
Main road
Small road
Large rivers
Small rivers

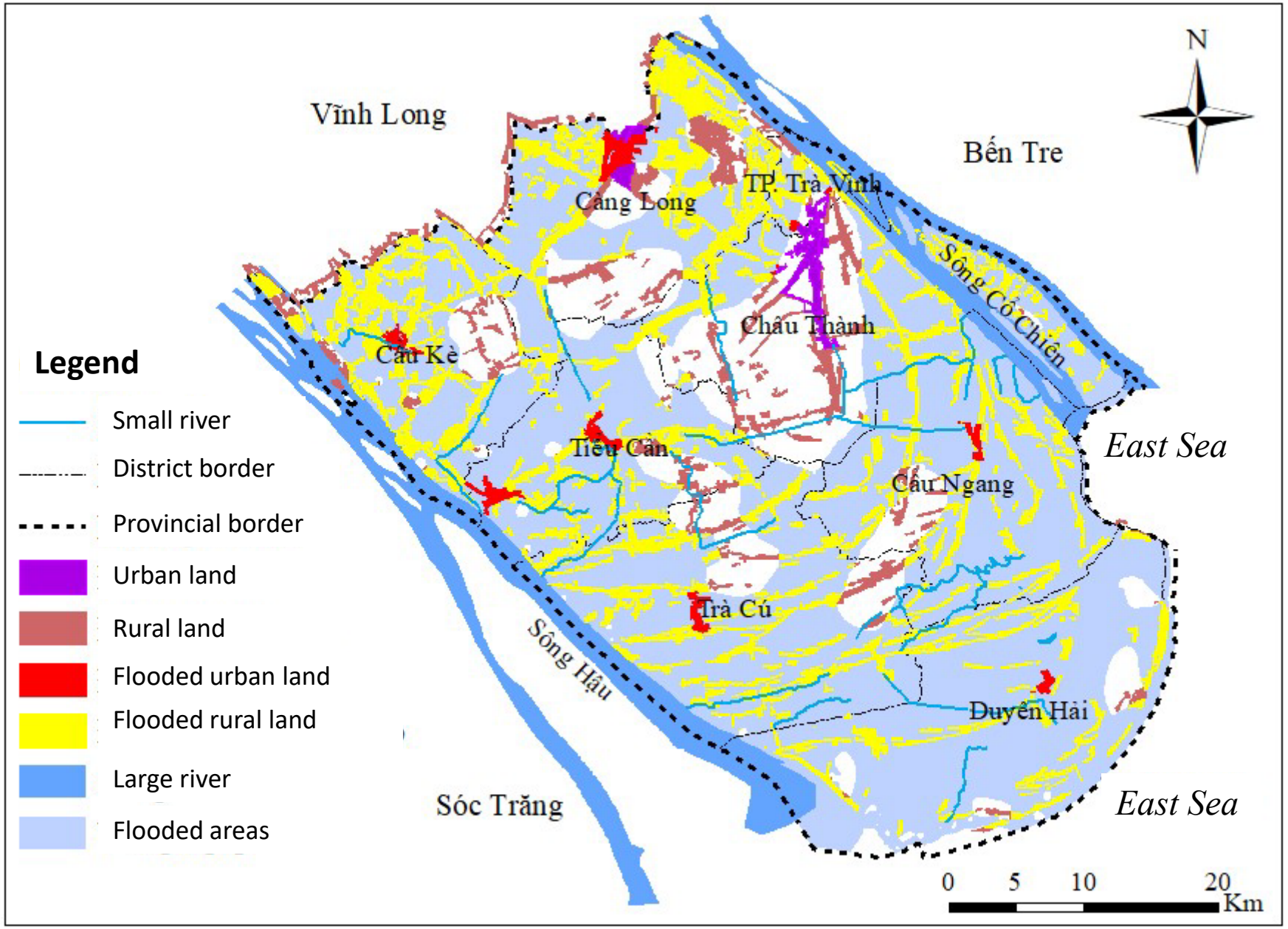
Total length of flooded main roads:189 km ~ 68% total length of main roads

Total length of flooded small roads: 446.7 km, ~82% of the total

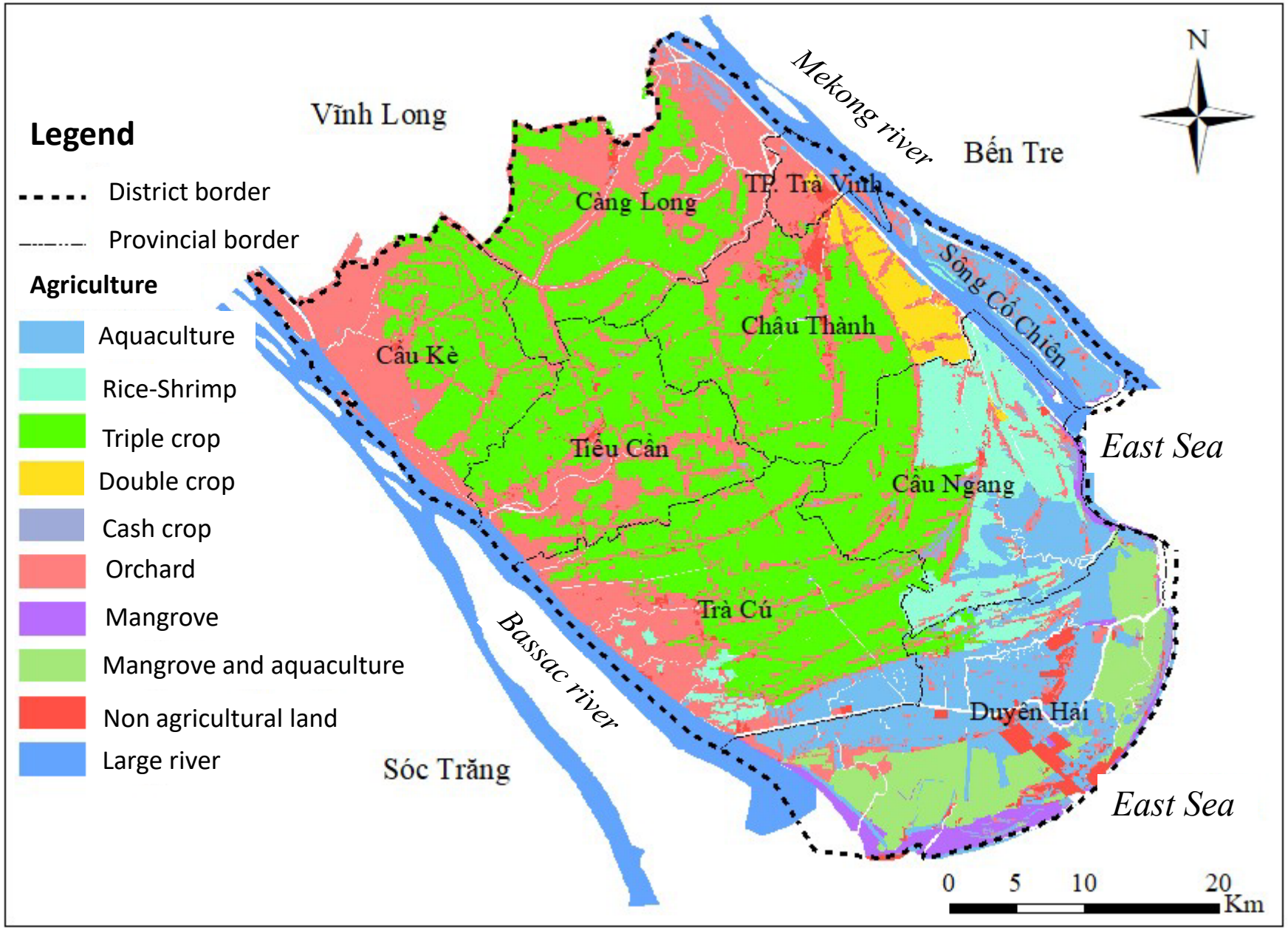


~53%, ~ 16.9 km^2 urban land is flooded

78%, ~ 265.4 km^2 rural land is flooded

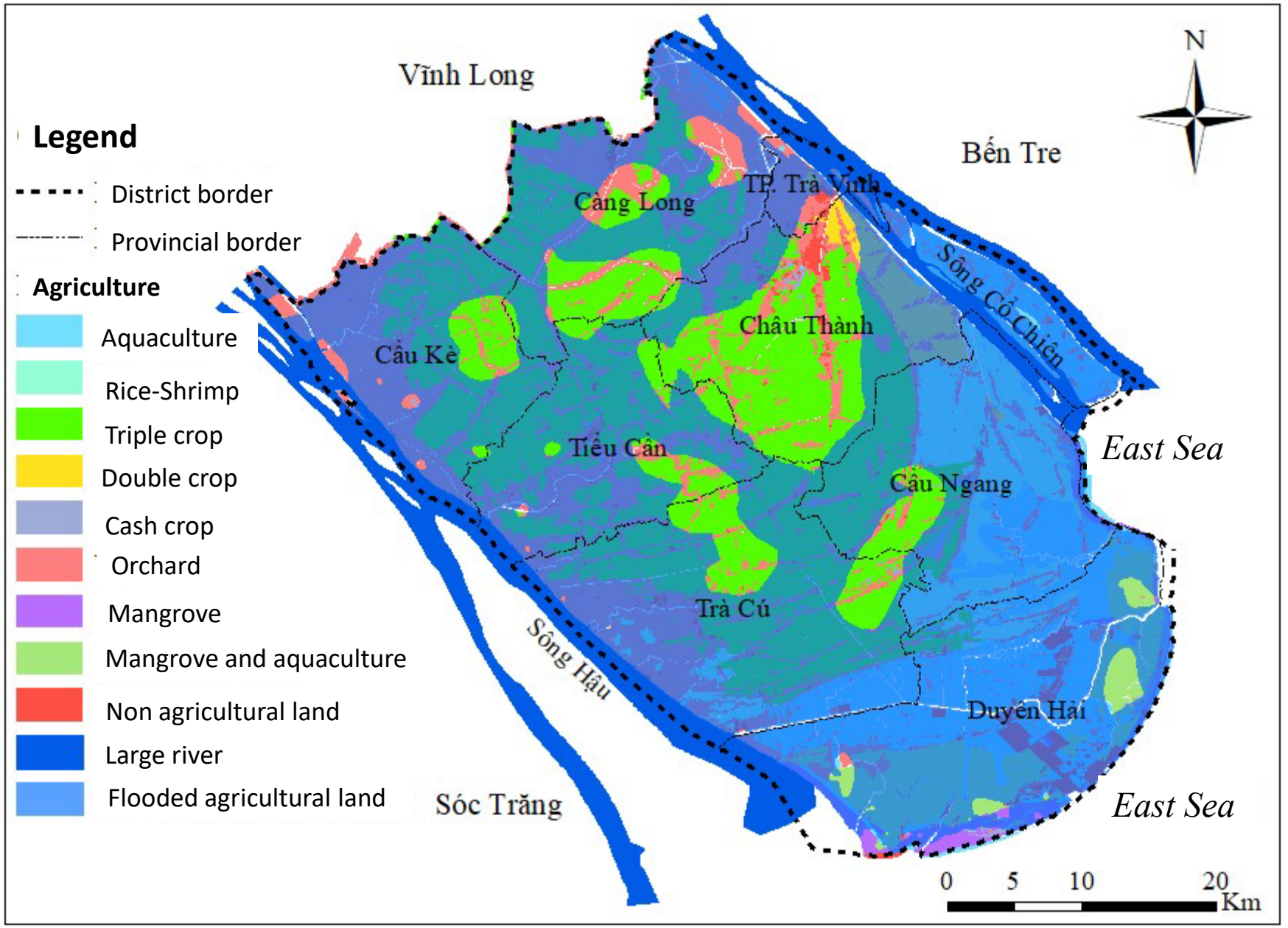


Flooded residential area due to sea level rise and heavy rain



Agricultural map of Tra Vinh

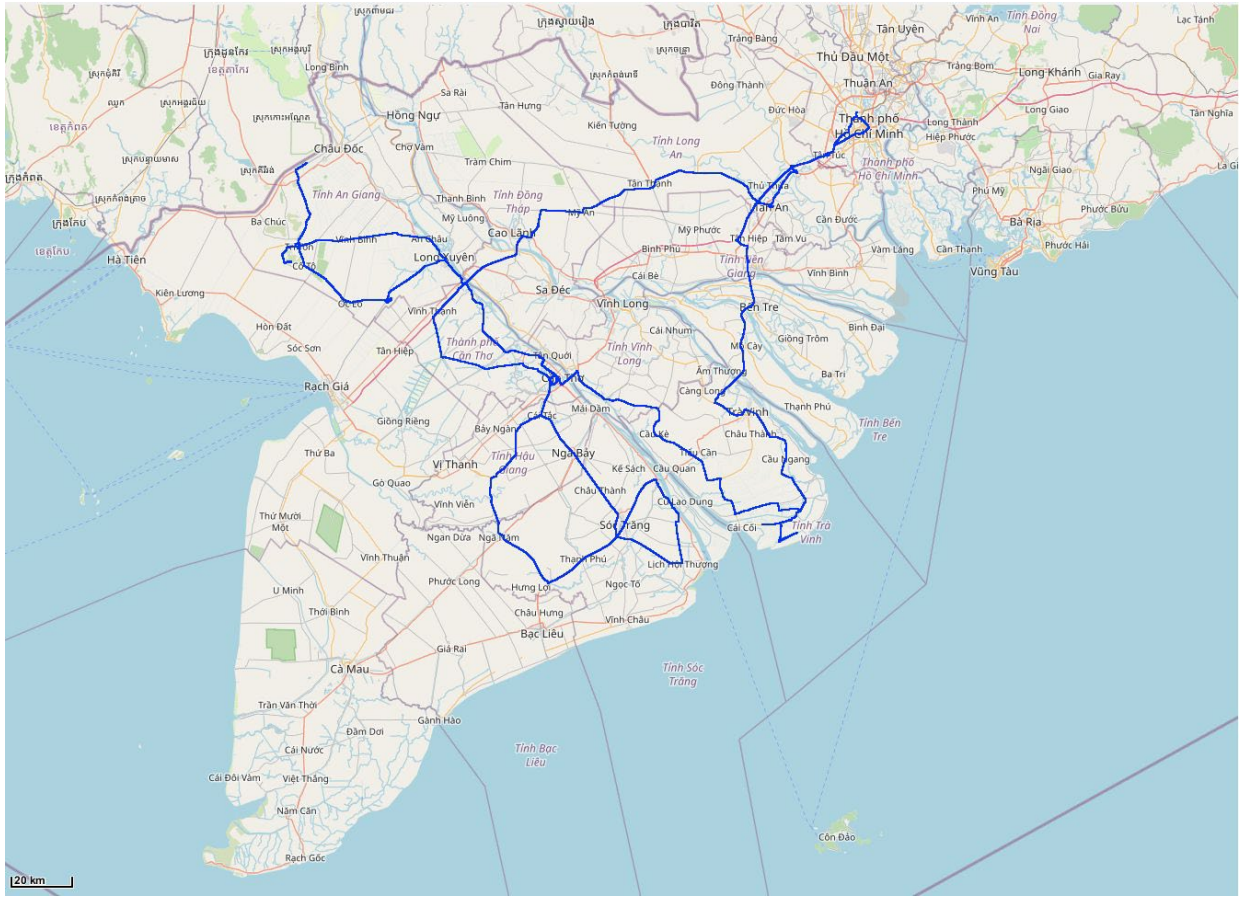
96% of the total area of aquaculture or 259.6 km^2 , and 97% or shimp-rice 132 km^2 is flooded

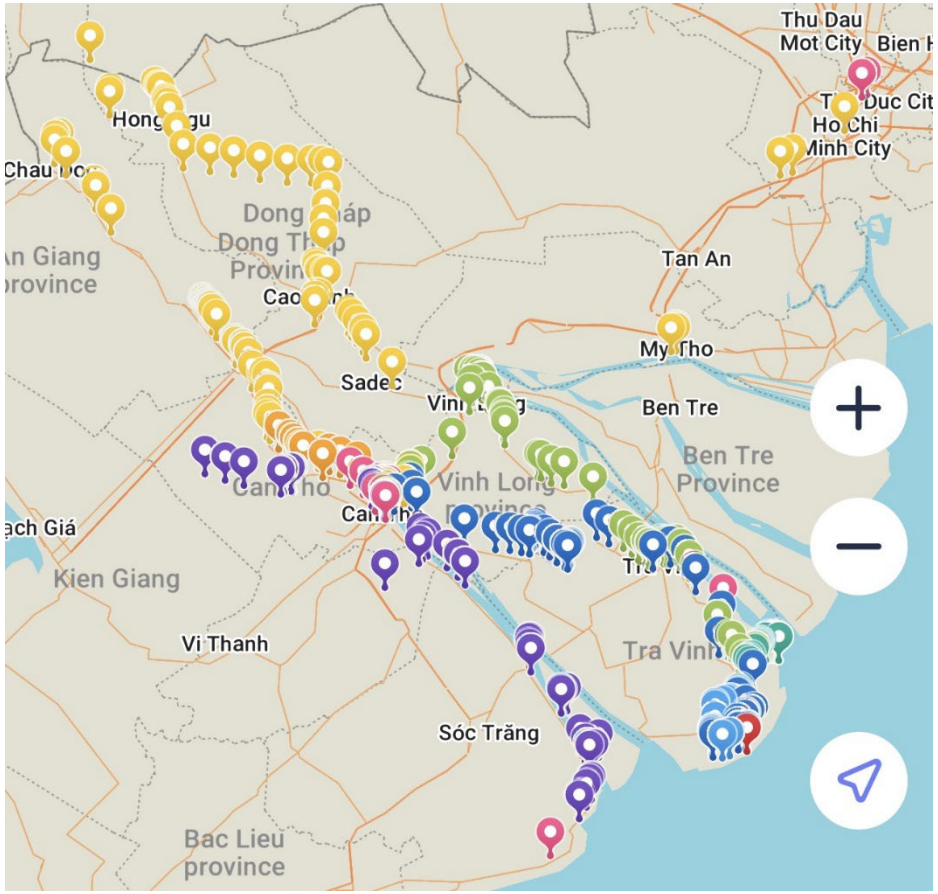


Flooded agricultural area due to sea level rise and heavy rain

Validation

Collect ground truth data and interview



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Future directions

- Increase accuracy of the classification in the vegetation layers, combine with object oriented based classification.
- Collect ground truth data in different seasons
- Survey the dyke systems impact on the flood areas
- Investigate the effect of salinity intrusion in crop transitions
- Make more pilot sites to quantify the damage of floods (and erosion) on infrastructure and livelihoods, combine with higher resolution images

THANK YOU

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