Wetland Conservation at The Mekong Delta, Vietnam:

The integrated farming systems

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Location of Vietnam in the Southeast Asia

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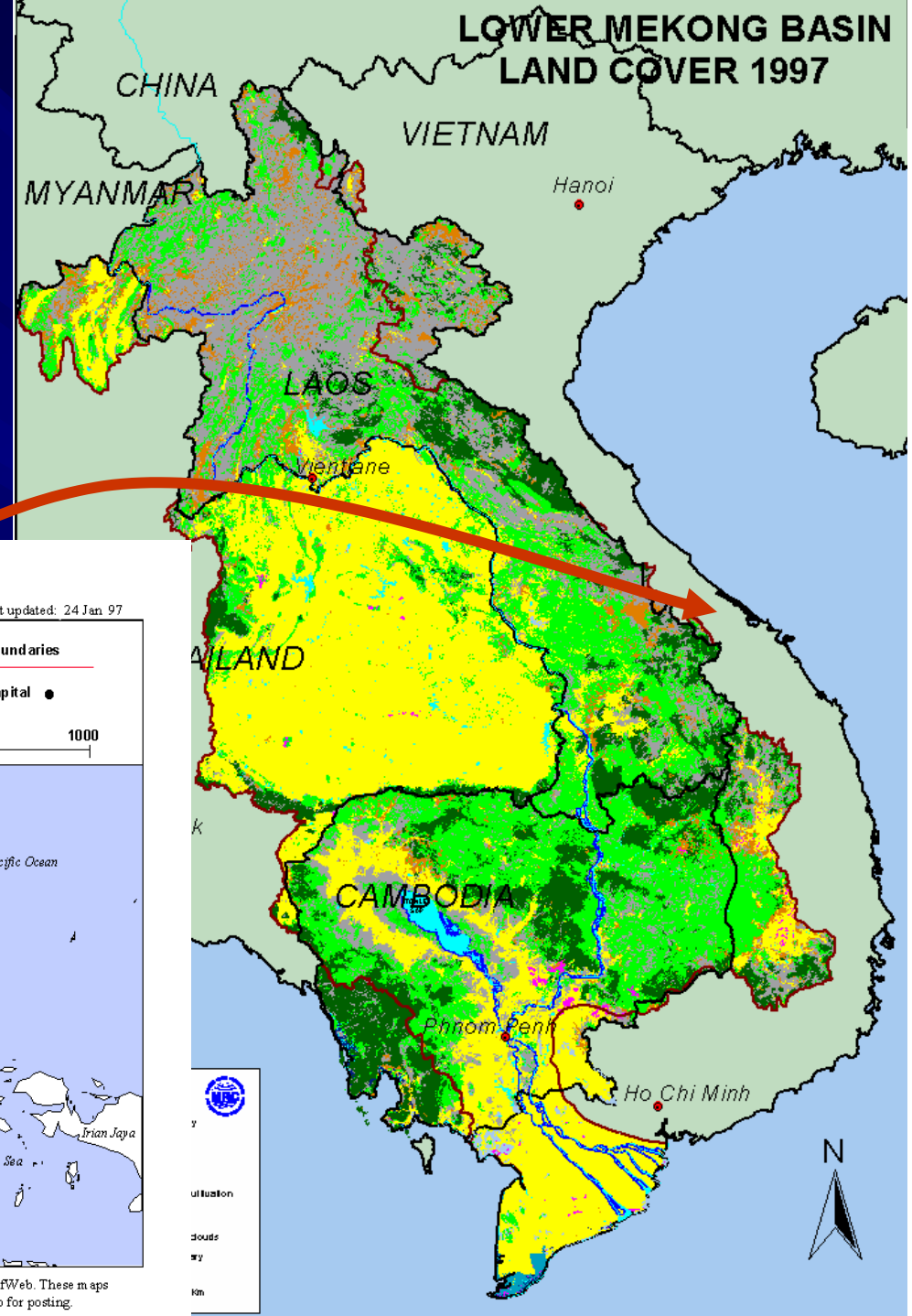
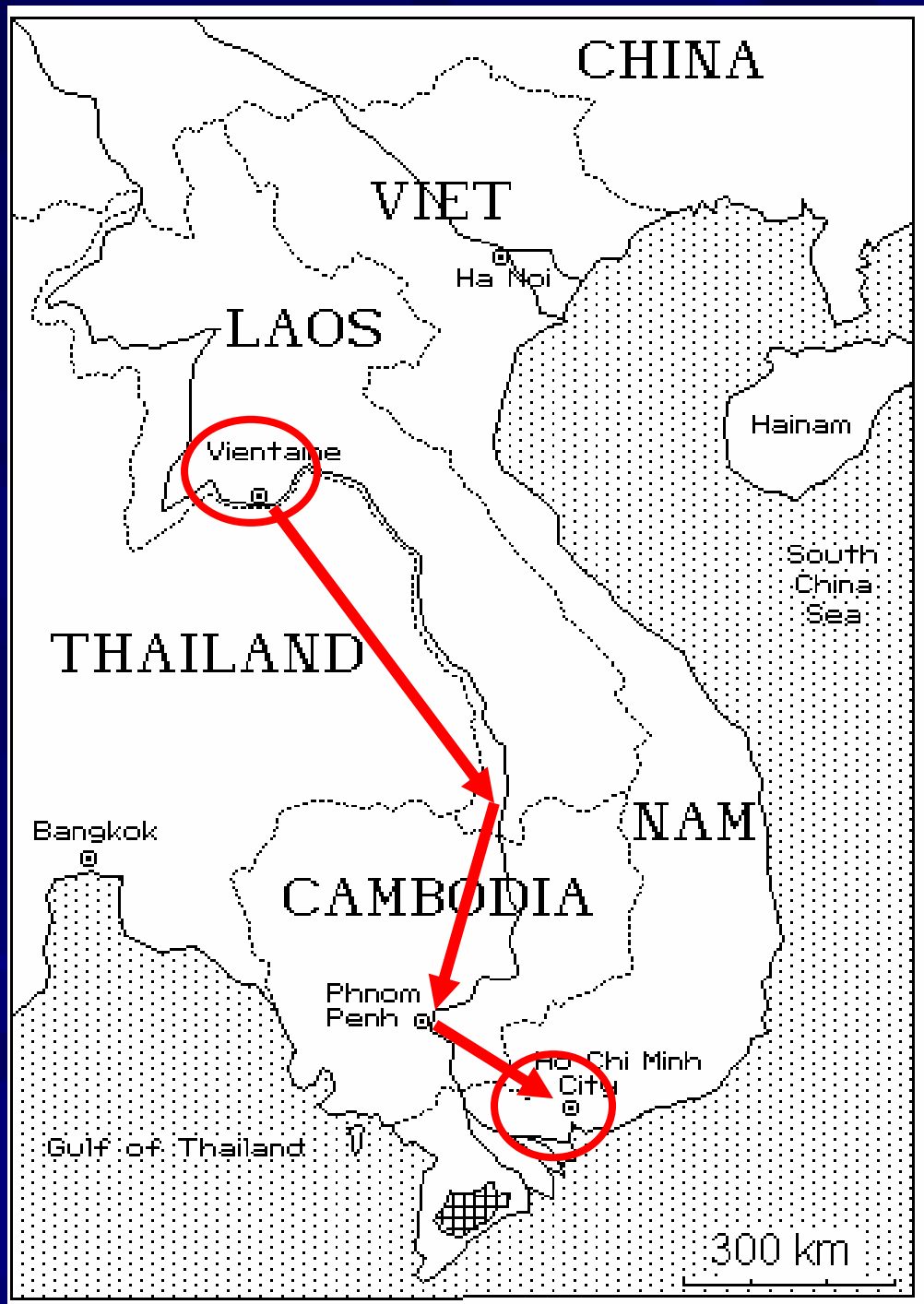


The whole Mekong Delta ~ 5M Ha:

- **In Cambodia ~ 1M Ha**
- **In Vietnam ~ 4M Ha (3,957)**

From now onwards, the word "Mekong Delta" is only in Vietnam part



Sky-tour from Vientiane to Ho-Chi-Minh city


LAO PDR


LAO PDR


LAO PDR


CAMBODIA

CAMBODIA

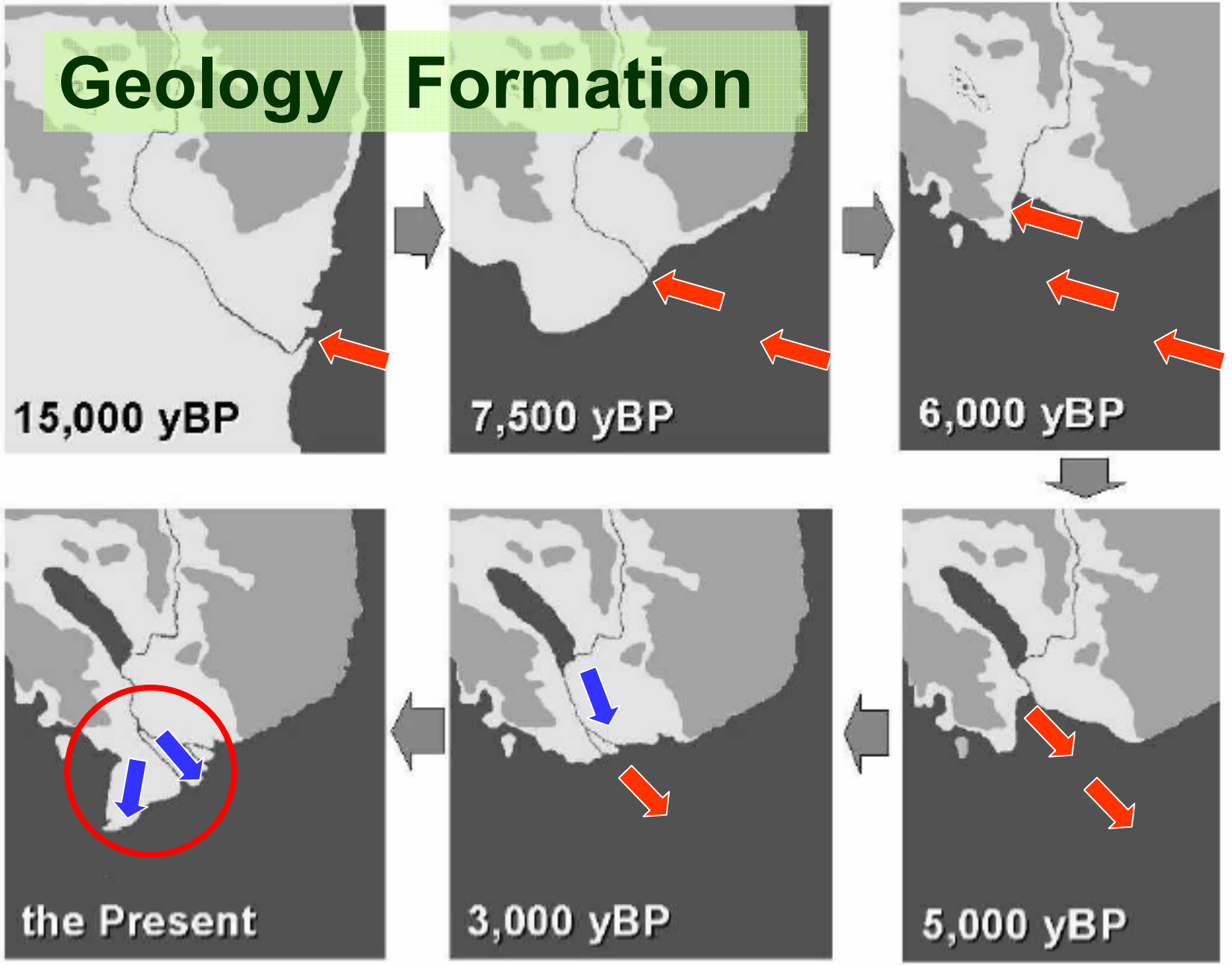

VIETNAM

VIETNAM: Rural area


Vietnam: Urban area

Soil Formation

Geology Formation



Soil formation (> 6,000yBP)

Sea water level

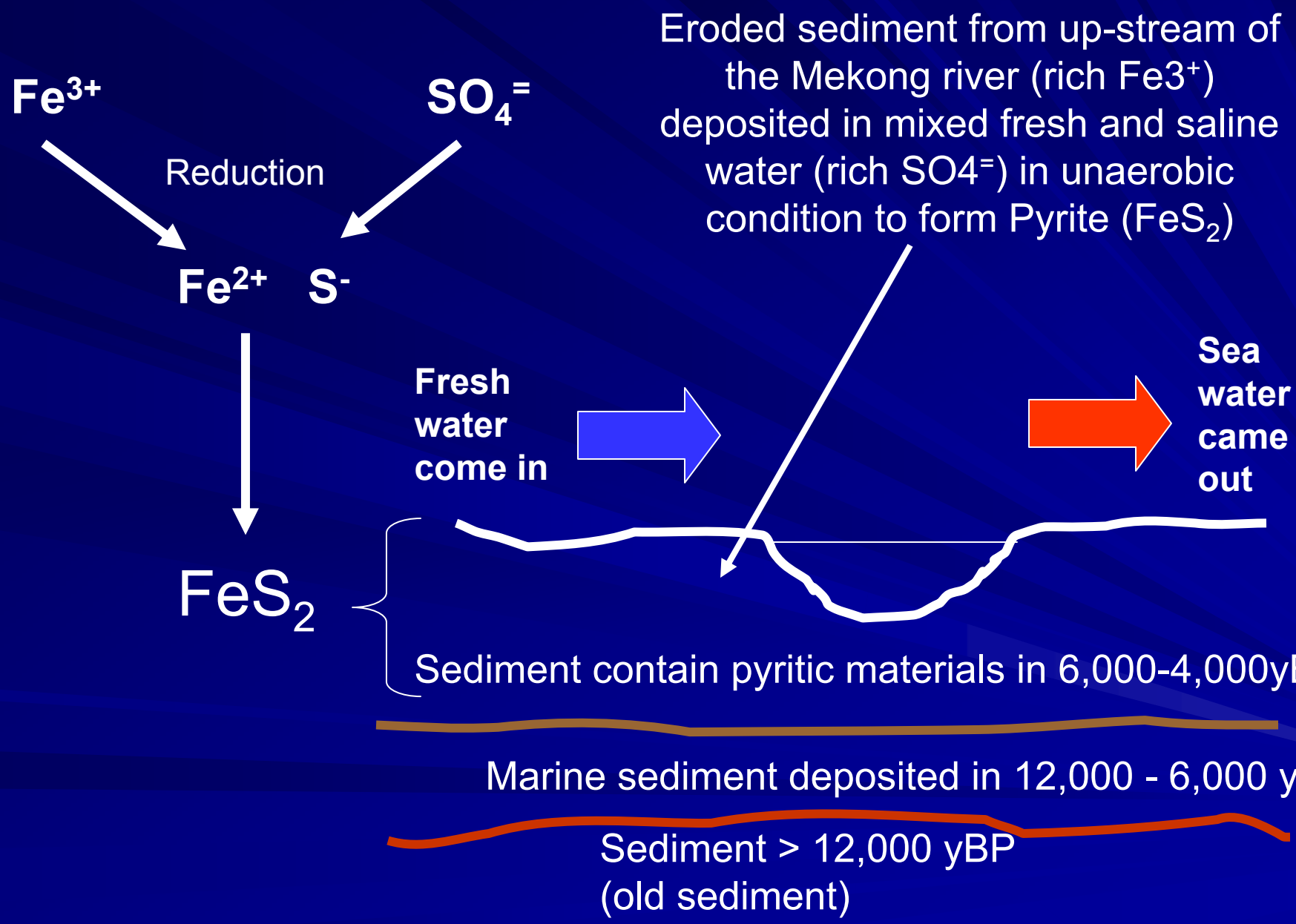
Marine sediment deposited and shell appeared

Sea water level rise

12,000-6,000 yBP

Sediment >12,000 yBP (old sediment)

Soil formation (6,000 – 4,000yBP)

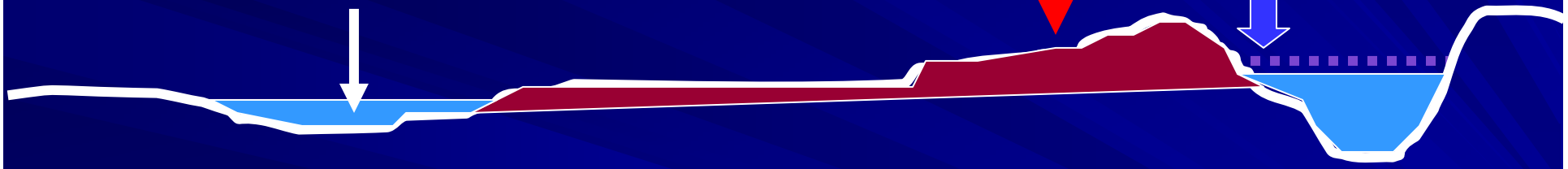


Soil formation (<3,000yBP to date)

Later on the fresh water sediment deposited on top to form the delta and build river bands

U-Minh Thuong located far from the Mekong river then the recently fresh water sediment was not deposited

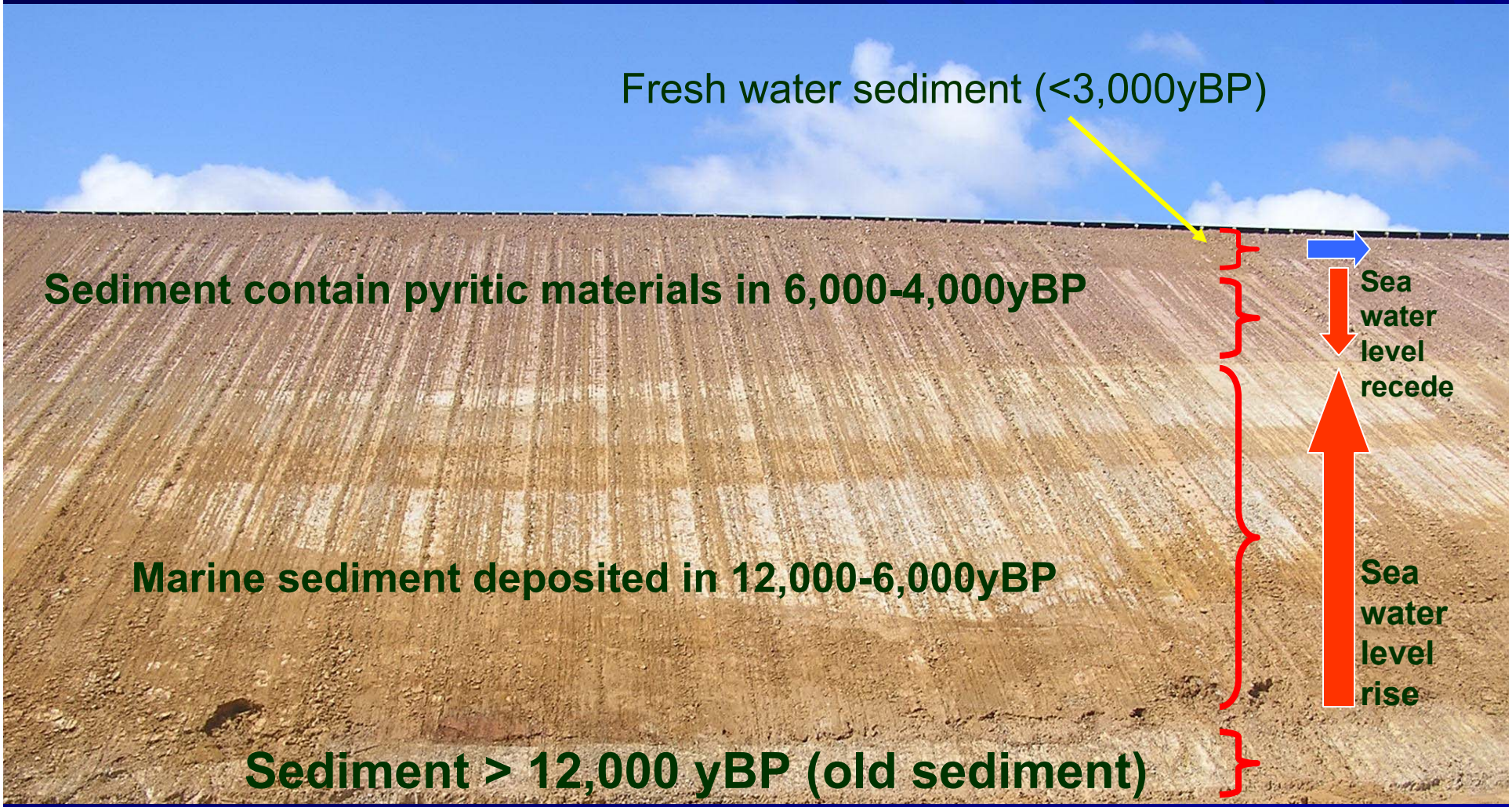
Water level in the dry season



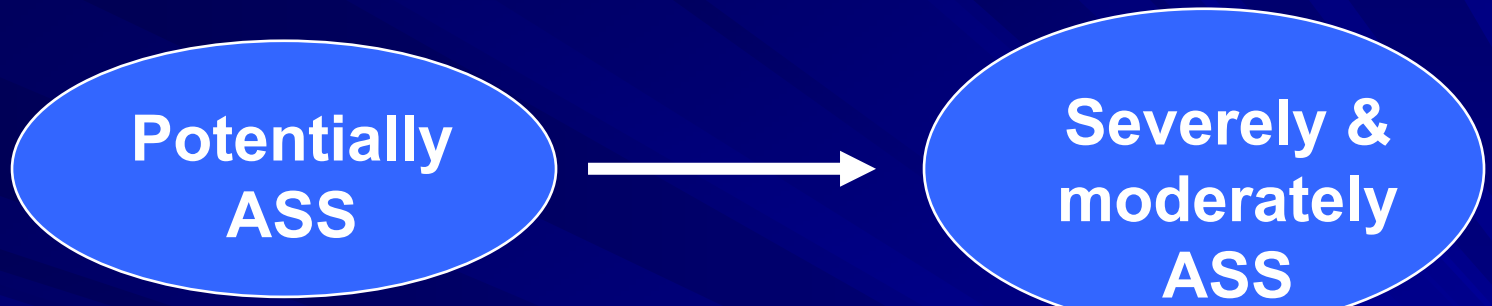
Sediment contain pyritic materials in 6,000-4,000yBP

Marine sediment deposited in 12,000 - 6,000yBP

Sediment > 12,000 yBP (old sediment)


Fresh water sediment (<3,000yBP)
Sediment contain pyritic materials in 6,000-4,000yBP
Sea water level recede
Marine sediment deposited in 12,000-6,000yBP
Sea water level rise
Sediment > 12,000 yBP (old sediment)

Pyritic materials exposed to the air



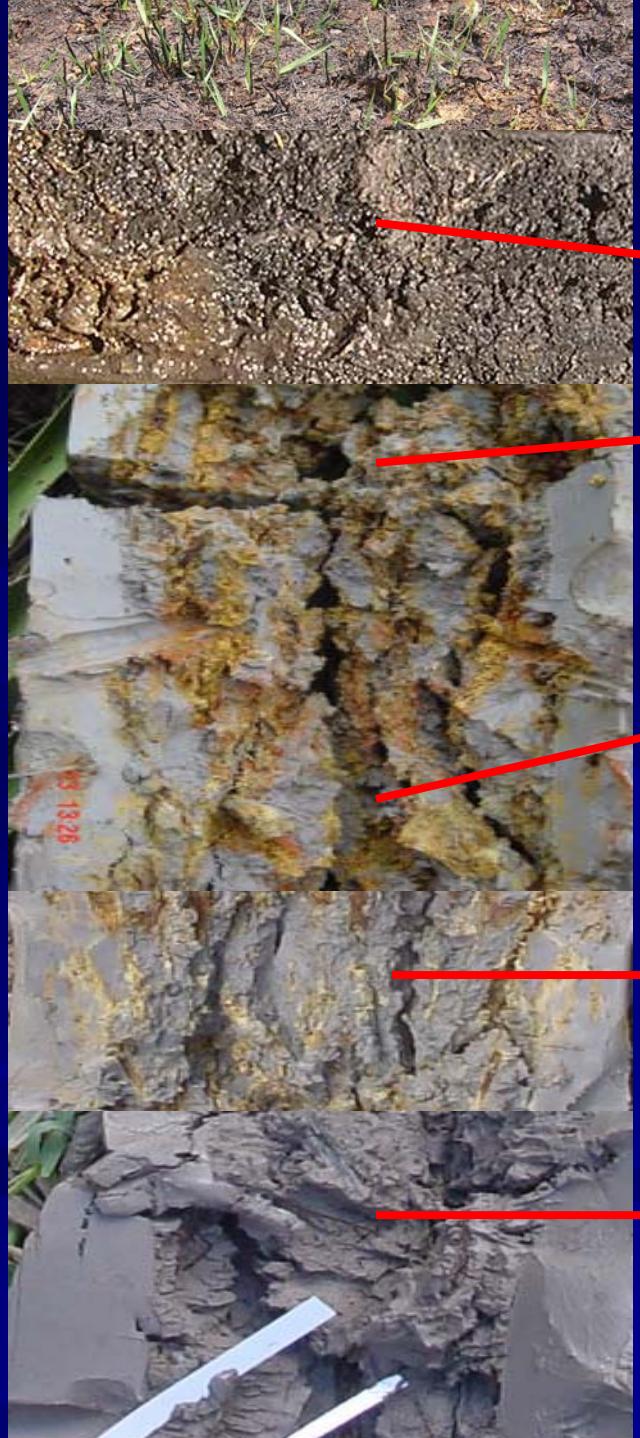
Reduce $\underset{\text{flooding/bacteria}}{\overset{\text{air/bacteria}}{\rightleftharpoons}}$ Oxidize

Fe(II)(TOXIC) Sulfide → **Fe(III)-red hydroxide** Sulphate H^+ (ACIDITY)

Pyrite FeS_2 → **Jarosite** $KFe_3(SO_4)_2(OH)_6$

Aluminium (solid) $\underset{\text{acid (pH<4)}}{\overset{}{\rightleftharpoons}}$ **Al^{3+}(aq.)(TOXIC)**

A typical profile of Acid Sulphate Soil



A: Horizon with Organic matters

Bg: Horizon (with Brown/Red mottles)

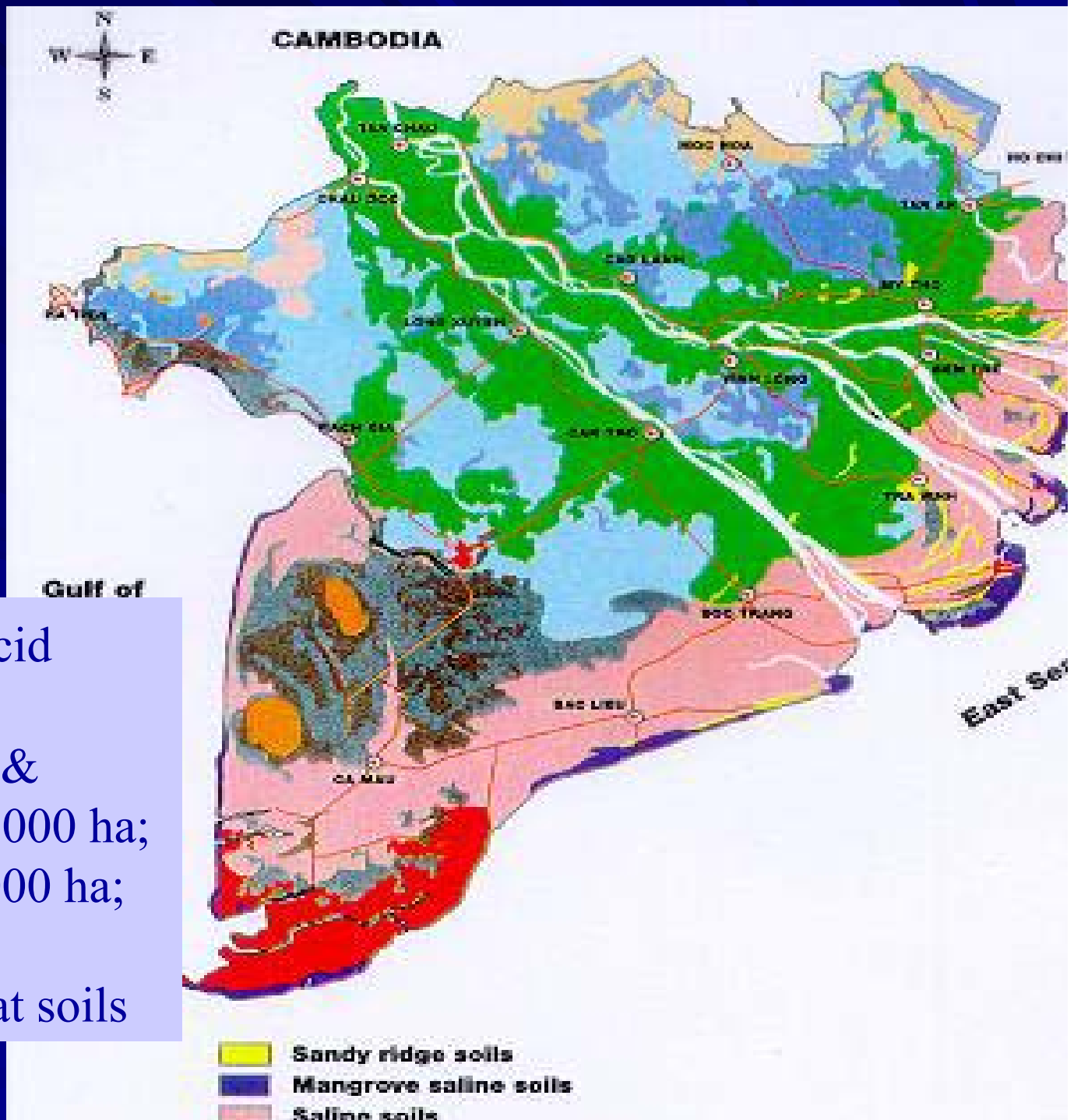
Bj: Horizon (with Brown and/or Jarosite mottles)

Ground water level during the dry season

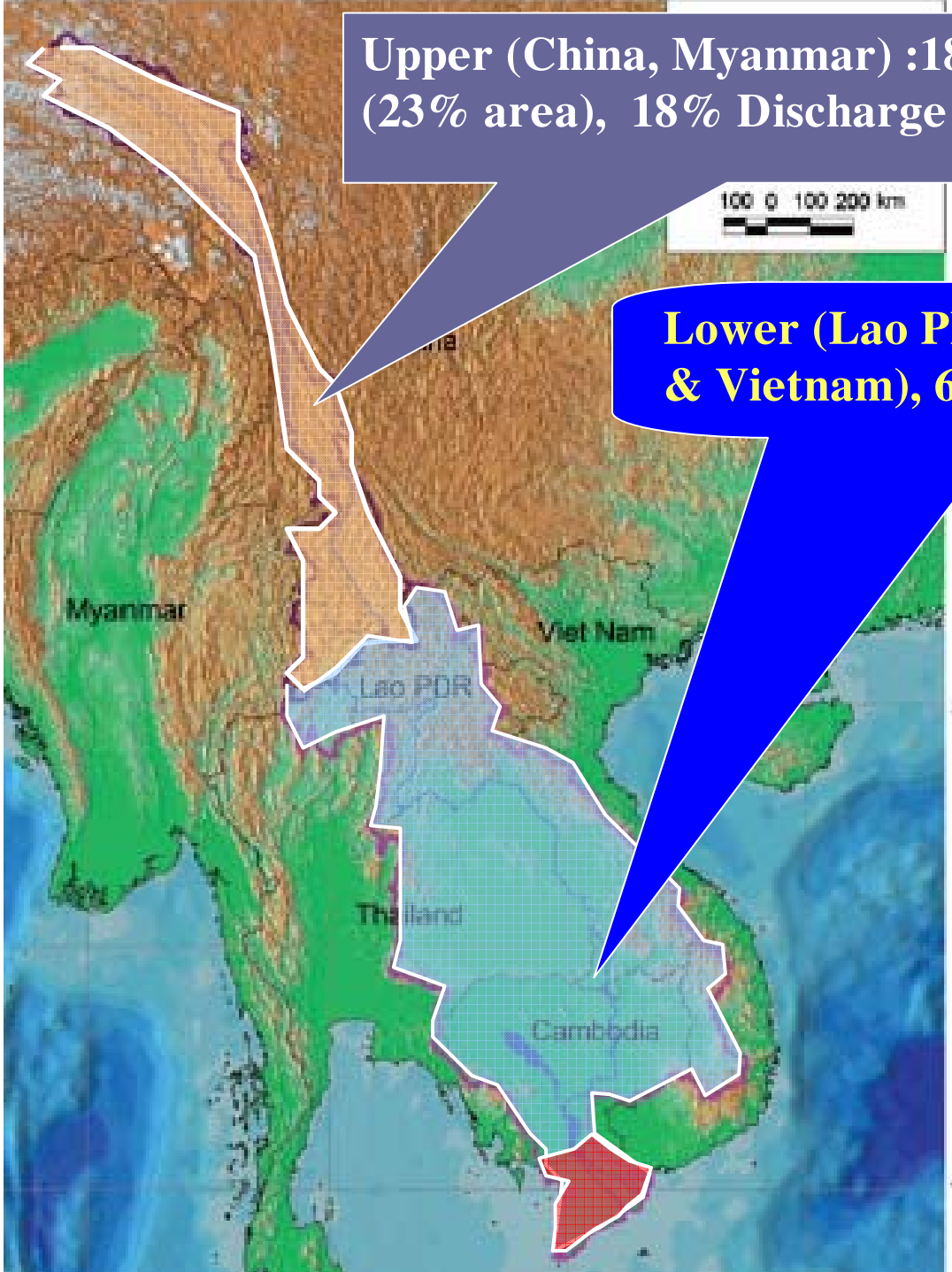
C: Horizon (with Pyritic materials)

Soil map of the Mekong Delta

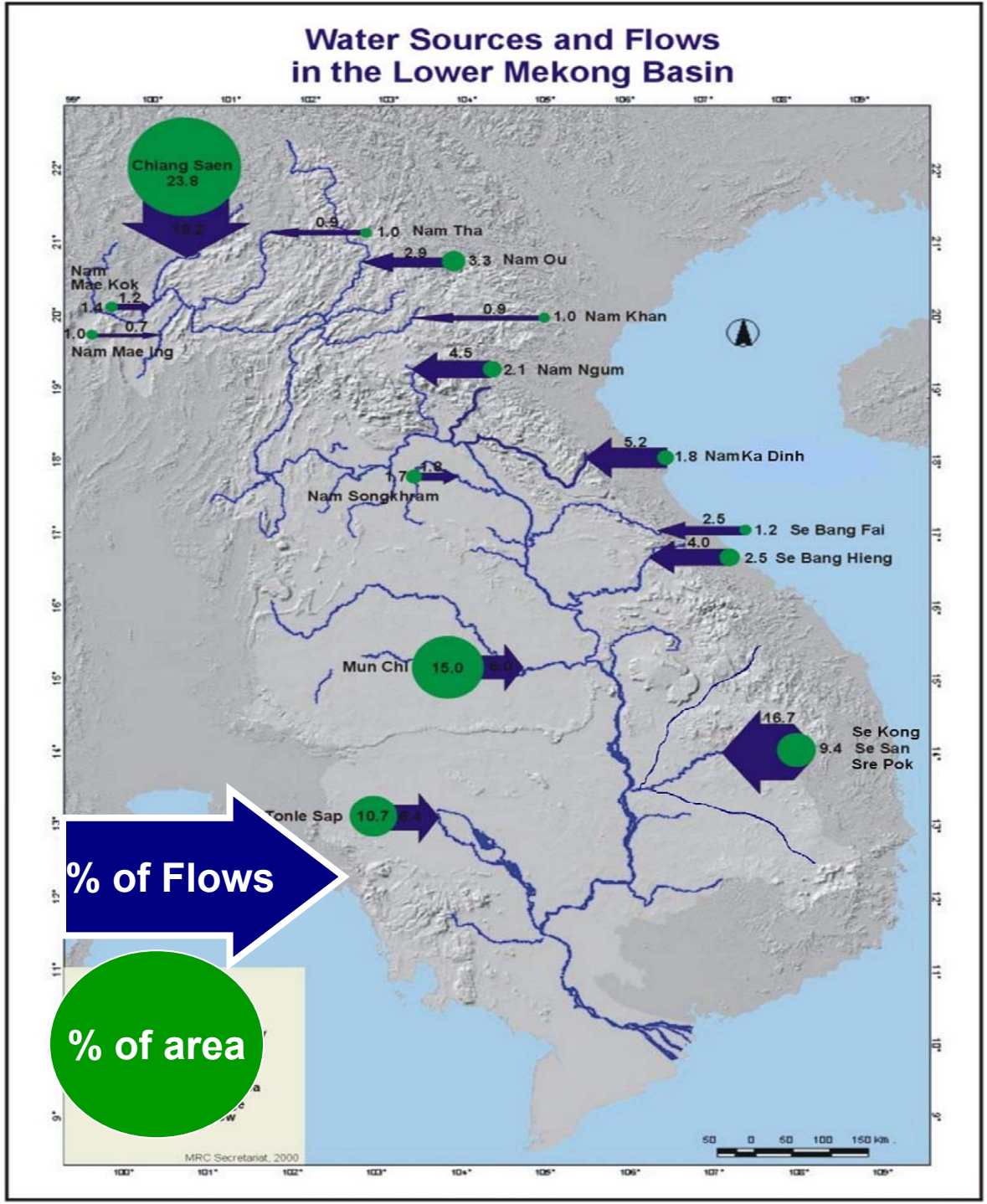
- Major soil types: acid sulphate soils (ASS) 1,590,000 ha; saline & potential ASS 1,080,000 ha; alluvial soils 1,100,000 ha; the remain soils are mountainous and peat soils



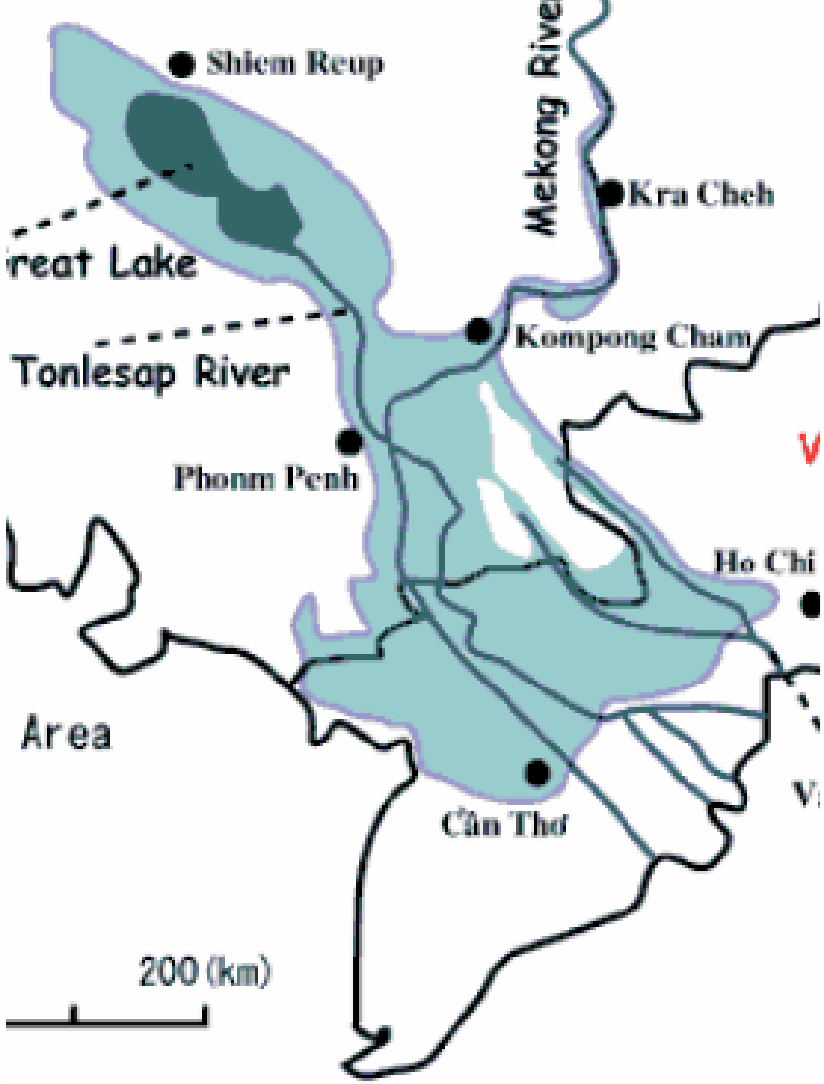
Hydrology



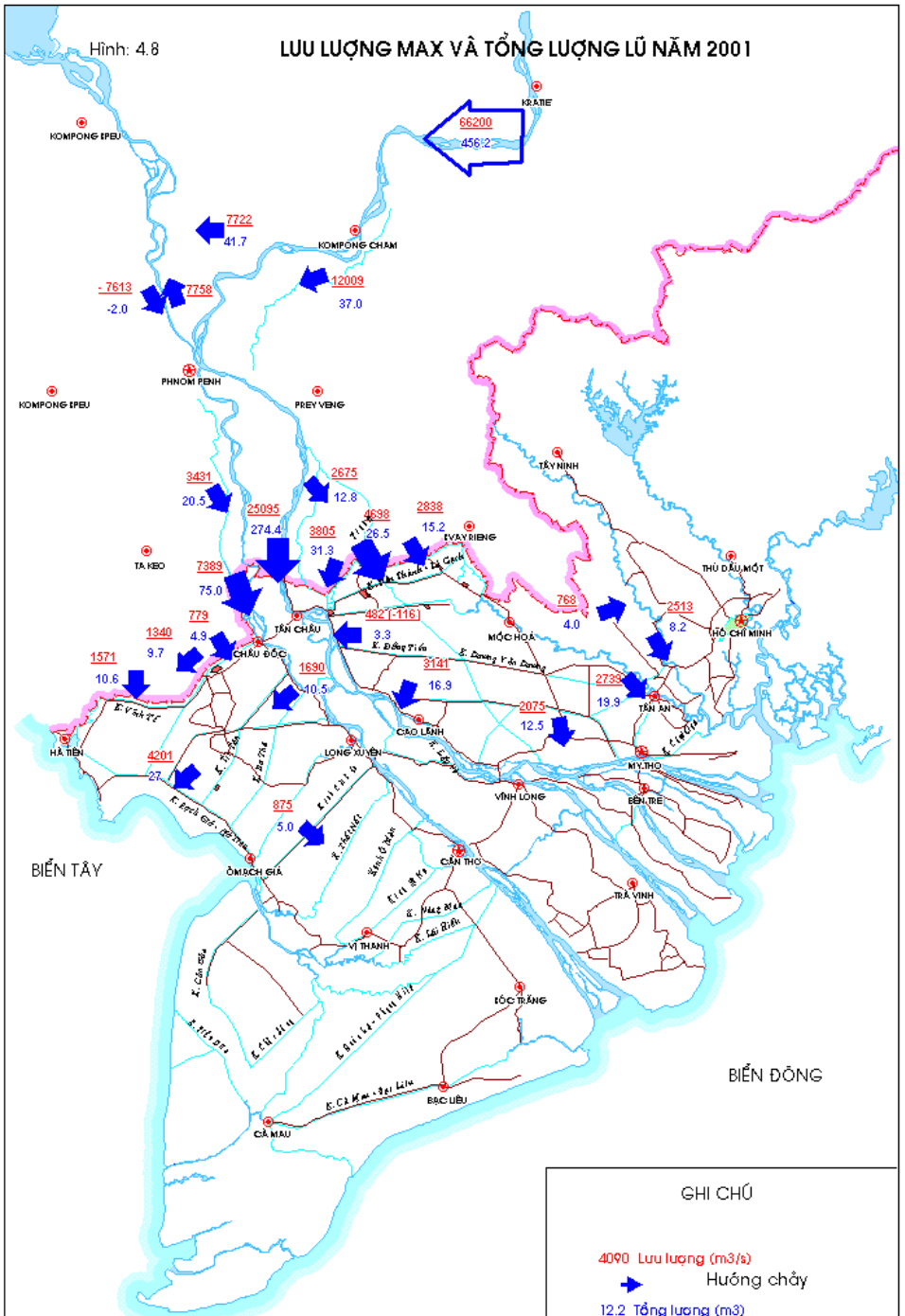
Discharge of Mekong River Watershed



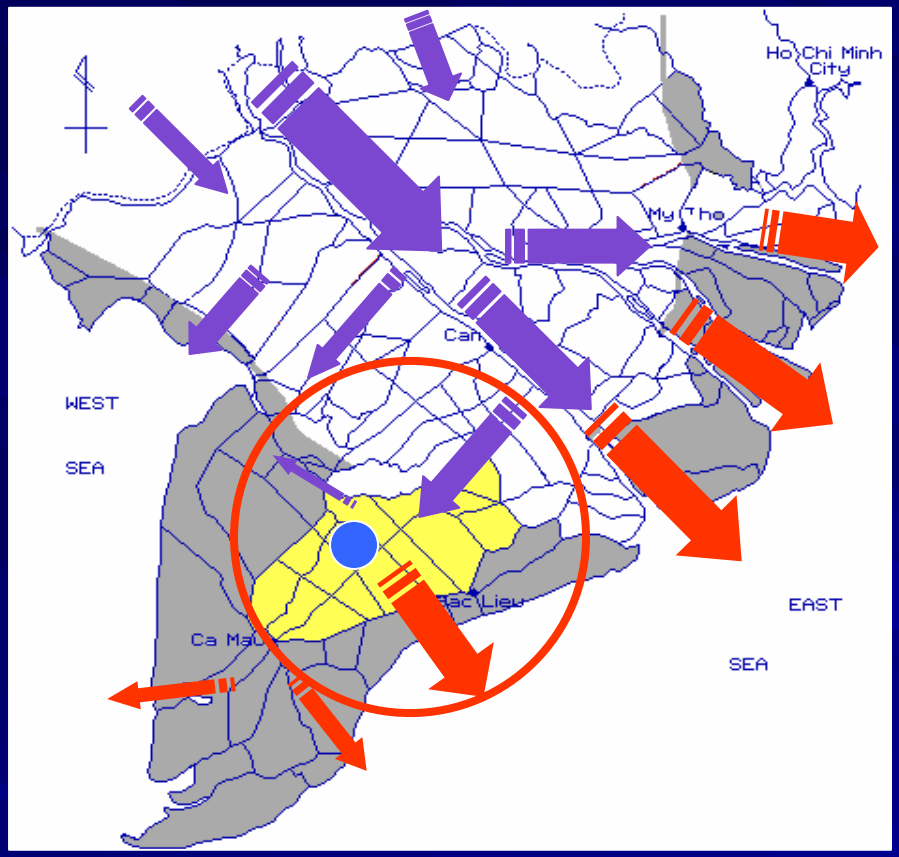
Water Sources and Flows in the Mekong Basin



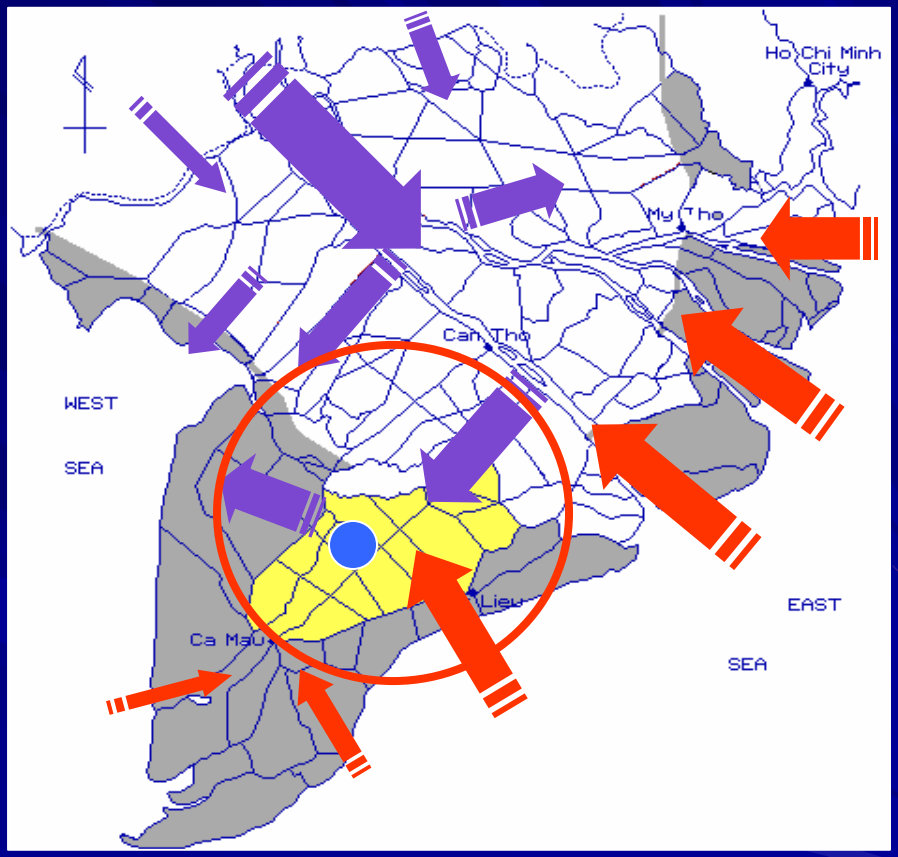
Flood areas of Cambodia and Vietnam



Flows of Mekong river and Tidal movement at The delta



Low Tide

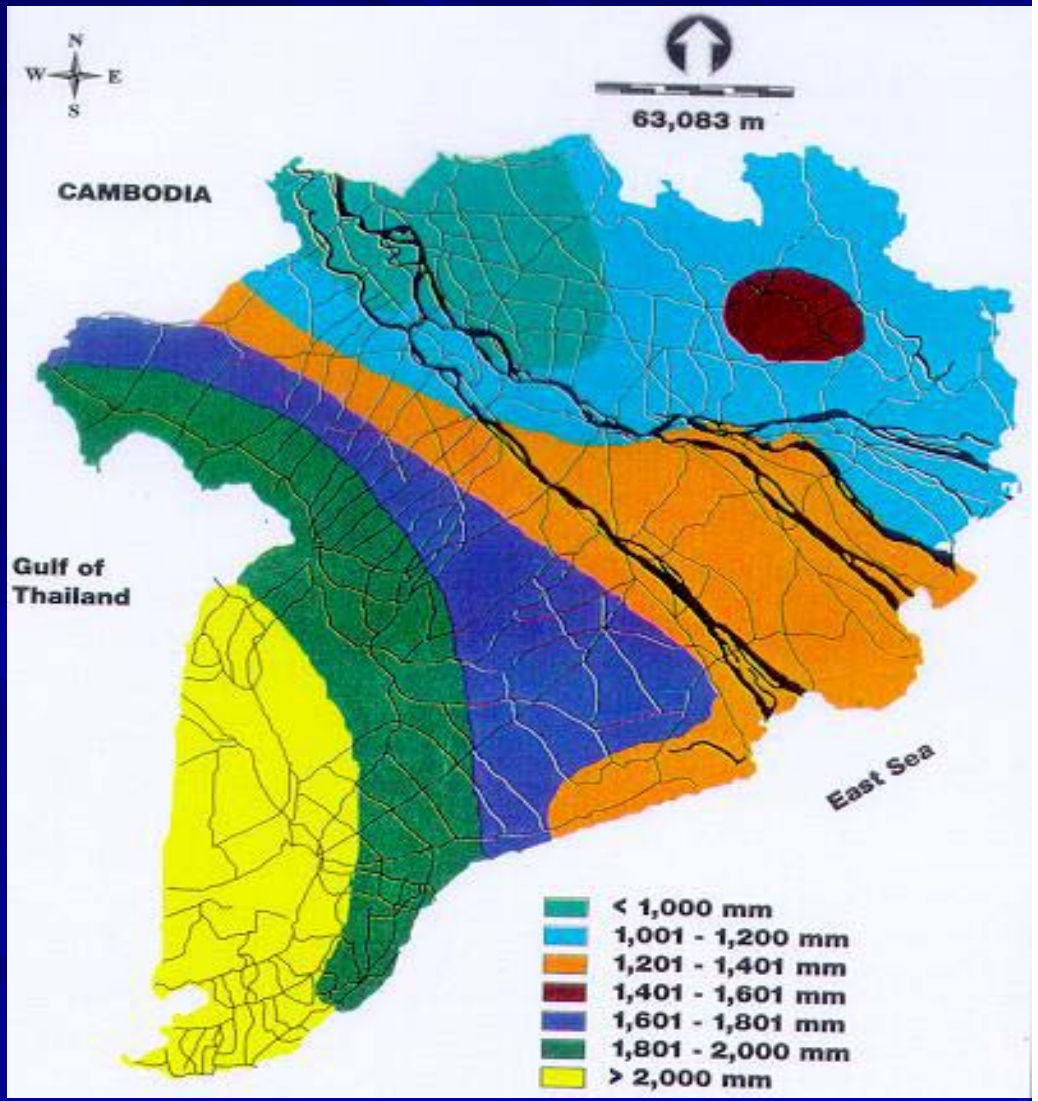


High Tide

Rainfall distribution in the Mekong Delta

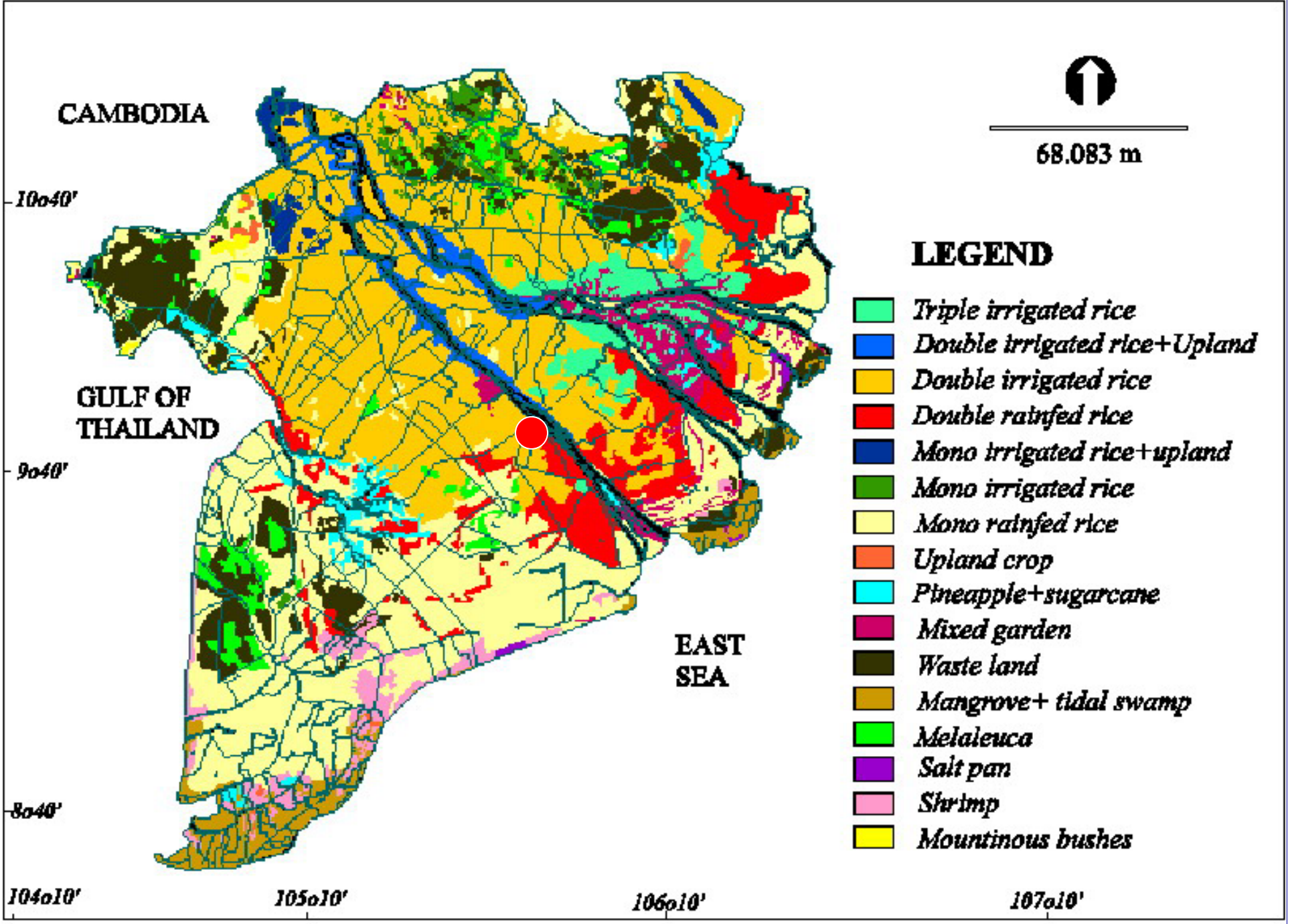
There are two seasons, the rainy and the dry in the MD of Vietnam,

- ❖ The rainy season lasts from May to November (supplied 80% of rainfall)
- ❖ The dry season lasts from December to April.

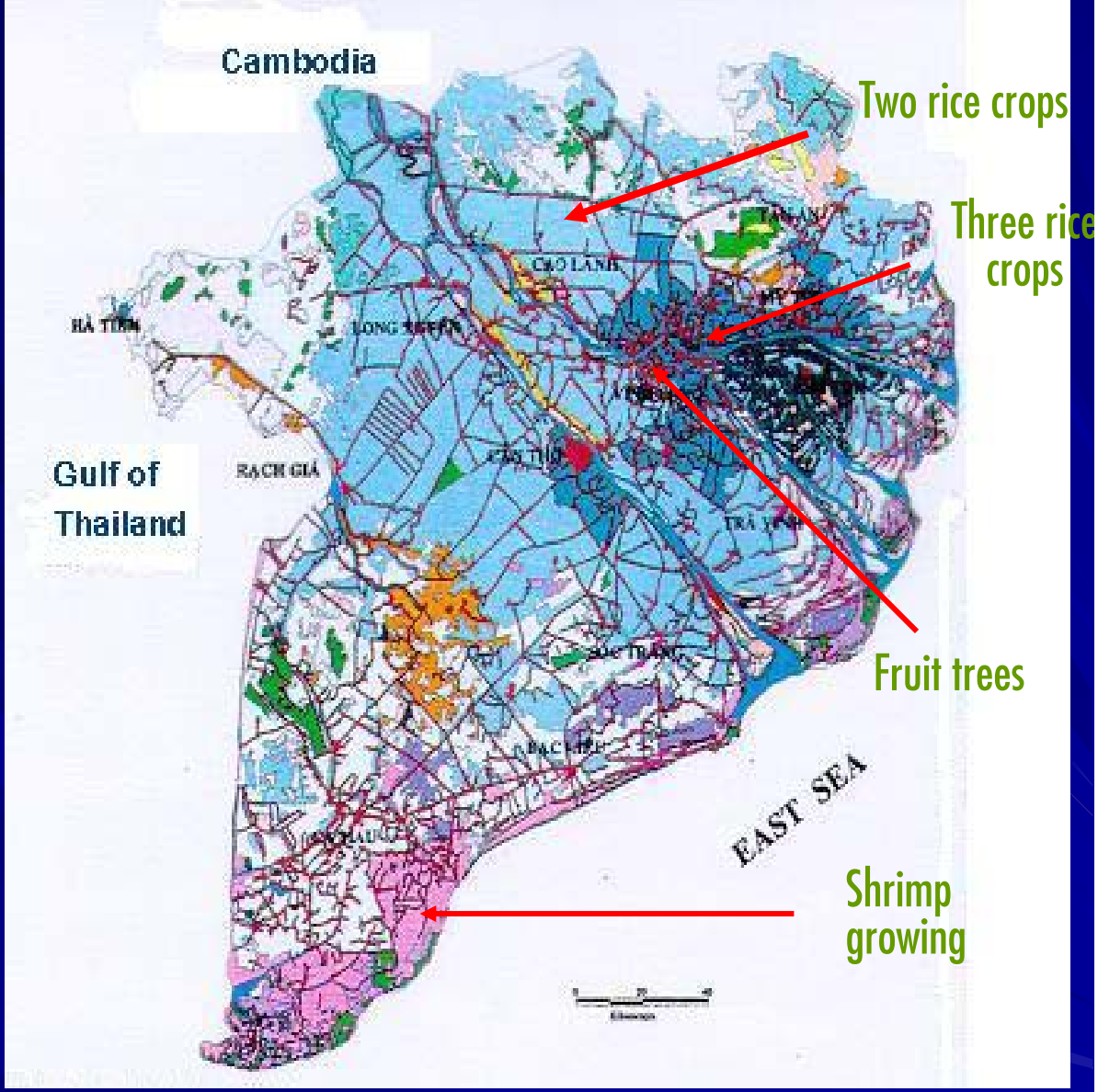


Source: Sanh et al. (1998)

Land Uses


CAMBODIA
GULF OF THAILAND
EAST SEA
68.083 m
10o40'
9o40'
8o40'
104o10'
105o10'
106o10'
107o10'
LEGEND
Triple irrigated rice
Double irrigated rice+Upland
Double irrigated rice
Double rainfed rice
Mono irrigated rice+upland
Mono irrigated rice
Mono rainfed rice
Upland crop
Pineapple+sugarcane
Mixed garden
Waste land
Mangrove+ tidal swamp
Melaleuca
Salt pan
Shrimp
Mountinous bushes

Though the Mekong Delta, as its fertile through the Mekong River system, is the most favorable for rice growing, it is also suitable for fruit trees, aquaculture, etc.



Rice farming often depends on large amount of surface water and is threatened by flood (wet season) and saline water intrusion (dry season).


In the flooded zone, crops can
be done during the dry season,
December-May


In the fresh and shallow
water depth zone, cultivation
is occurred whole year round

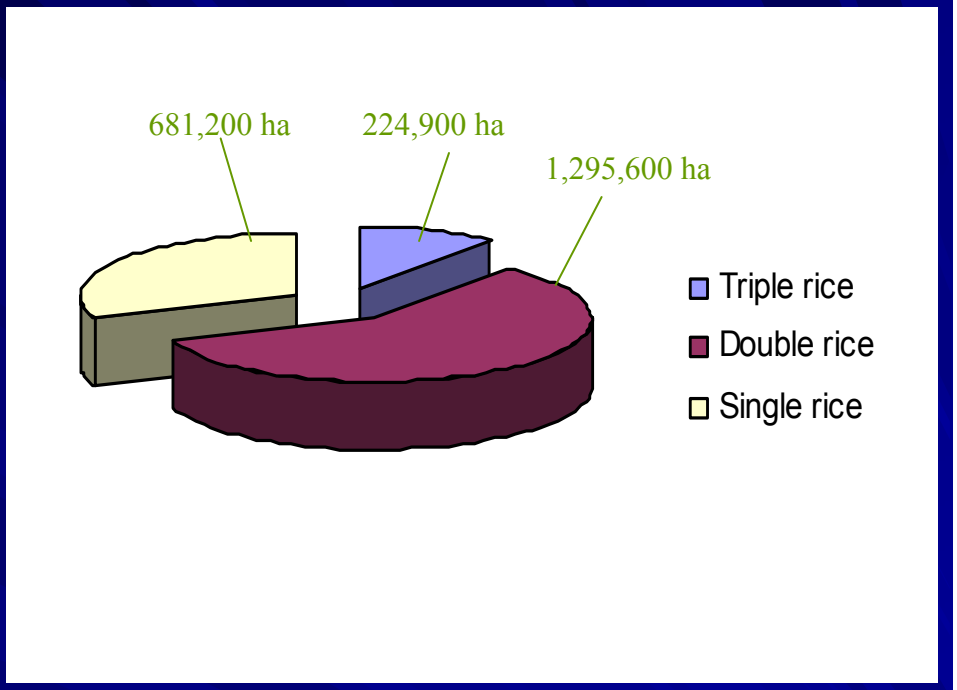

In the fresh-saline water interface zone
Rice farming only
Rice_Shrimp farming

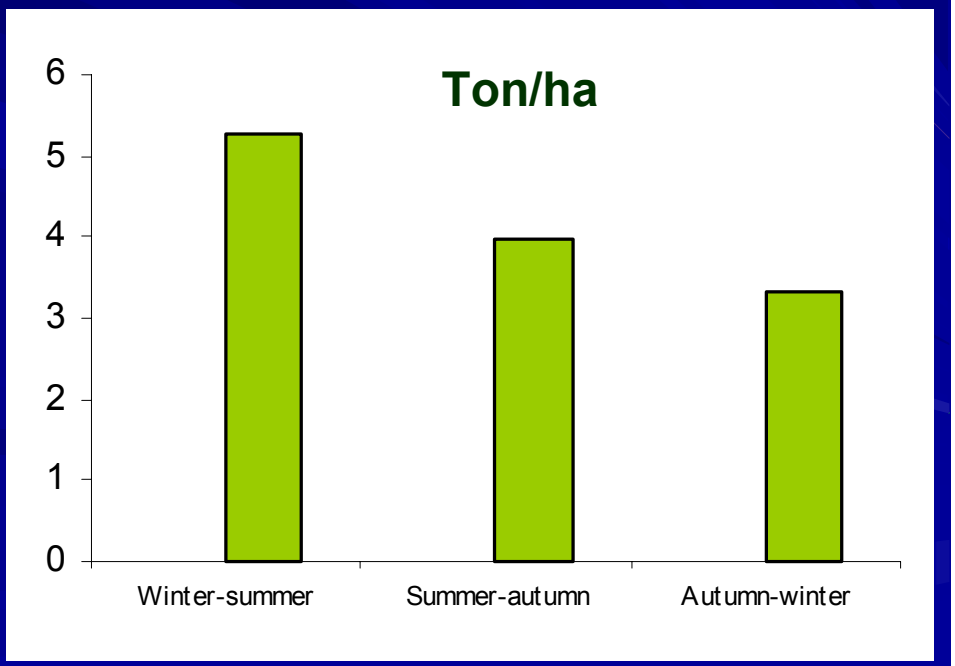

In the coastal zone: Intensive shrimp farming

Rice area and yield :

With about 2 million ha most favorable for rice, triple cropping covers 10% of total rice area; double cropping 59% and single cropping 31%

The winter-summer (WS) and summer-autumn (SA) rice are important crops. The yield of WS rice is the highest, about 5.3T/ha.





Rice: Production & Export

- The Mekong Delta is the rice bowl of Vietnam, it produces 17 million tons of paddy annually
- The surplus rice that entering the World markets is mainly from the Mekong Delta.

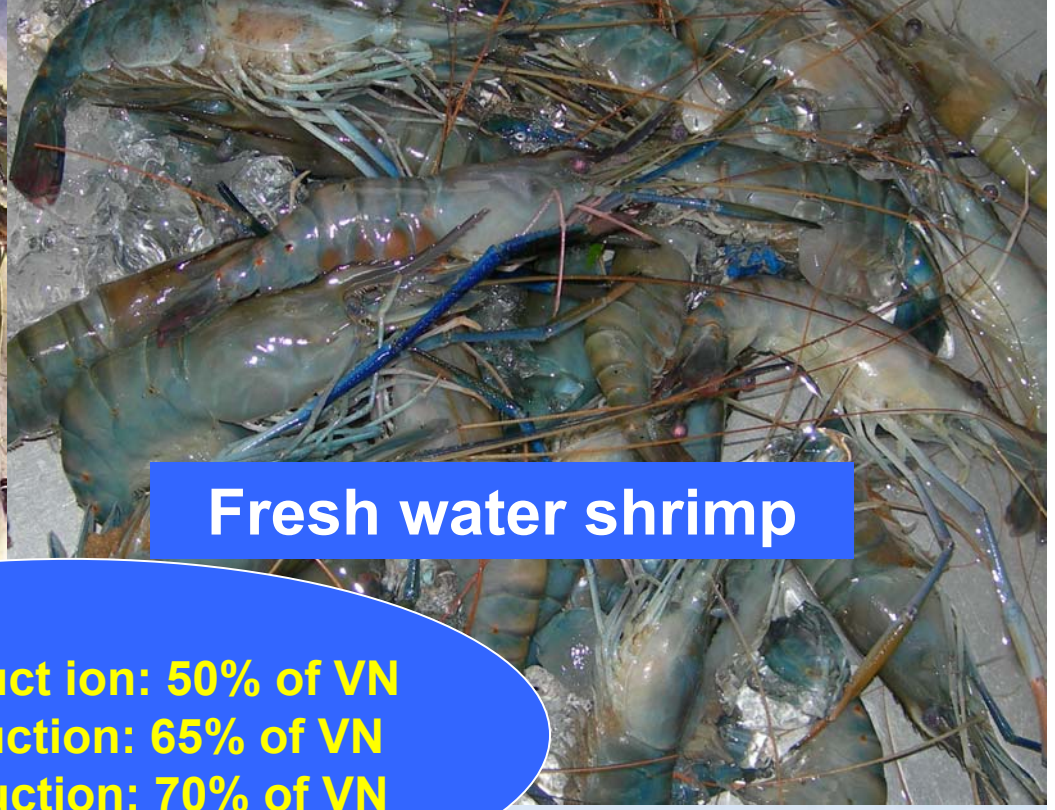
	Rice production (million ton)				Rice for export (million ton)			
	1999	2000	2001	% '00-'01	1999	2000	2001	% '00-'01
Asia	350.47	363.57	356.56	-1.93	18.59	16.45	16.35	-0.6
Thailand	15.59	16.50	16.83	2.00	6.68	6.55	6.30	-3.8
Vietnam	20.11	20.75	21.10	1.70	4.56	3.37	4.00	18.7
China	131.15	131.00	125.40	-4.27	2.71	2.95	3.00	1.7

Source: http://www.fao.org/inpho/vlibrary/t0567e/t0567E02.htm

Shrimp demand on the world increased (in x1000 metric tons)

Country	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
China	564.1	574.1	488.7	603.4	665.6	751.8	829.6	970.9	1,222.7	1,241.9
India	300.5	290.4	363.0	446.6	406.1	415.6	366.6	413.1	423.3	405.7
Thailand	289.9	300.6	343.1	385.0	389.3	370.8	350.8	345.4	370.9	398.5
Indonesia	296.8	312.1	300.7	317.1	334.7	343.3	382.2	345.5	384.5	398.4
USA	148.5	156.5	137.9	130.2	140.2	145.0	132.9	128.0	140.1	153.0
Vietnam	**81.3**	**86.2**	**94.6**	**111.7**	**138.1**	**135.9**	**147.7**	**148.4**	**148.9**	**151.1**
Canada	44.7	43.1	47.4	53.2	63.1	65.7	82.1	113.1	120.0	130.6
Malaysia	104.7	129.4	109.8	106.4	99.6	108.0	101.0	57.1	102.7	111.9
Mexico	70.6	66.2	79.8	77.3	85.9	78.9	88.5	90.3	95.6	95.1
Greenland	73.1	81.9	76.5	79.8	81.9	72.0	63.9	69.6	79.2	81.5
Philippines	84.9	118.8	130.1	126.6	127.5	113.2	74.5	72.3	73.1	79.4
Norway	49.0	49.1	49.0	38.2	39.3	41.5	42.0	57.1	64.2	66.2
Bangladesh	19.6	21.0	28.5	28.8	34.0	49.3	56.5	66.1	81.1	58.2
Brazil	42.3	44.0	38.4	38.5	43.0	38.9	44.1	42.8	47.7	56.6
Ecuador	118.8	127.0	97.5	98.7	112.1	112.9	137.2	147.4	121.0	51.4
Korea Rep.	55.8	67.1	68.0	58.1	42.5	40.9	41.1	47.6	44.7	37.2
Others	532.7	529.3	542.0	551.7	594.5	622.9	633.7	647.4	599.2	651.7
Total	**2,877**	**2,996.8**	**2,995.0**	**3,251.3**	**3,397.4**	**3,506.6**	**3,574.4**	**3,762.1**	**4,118.9**	**4,168.4**

Saline water shrimp



Fresh water shrimp

Food Product ion: 50% of VN
Fish Production: 65% of VN
Fruit Production: 70% of VN

“Basa” cat fish

Rice

Threats

Flooding

Erosion

Flooding in September to October

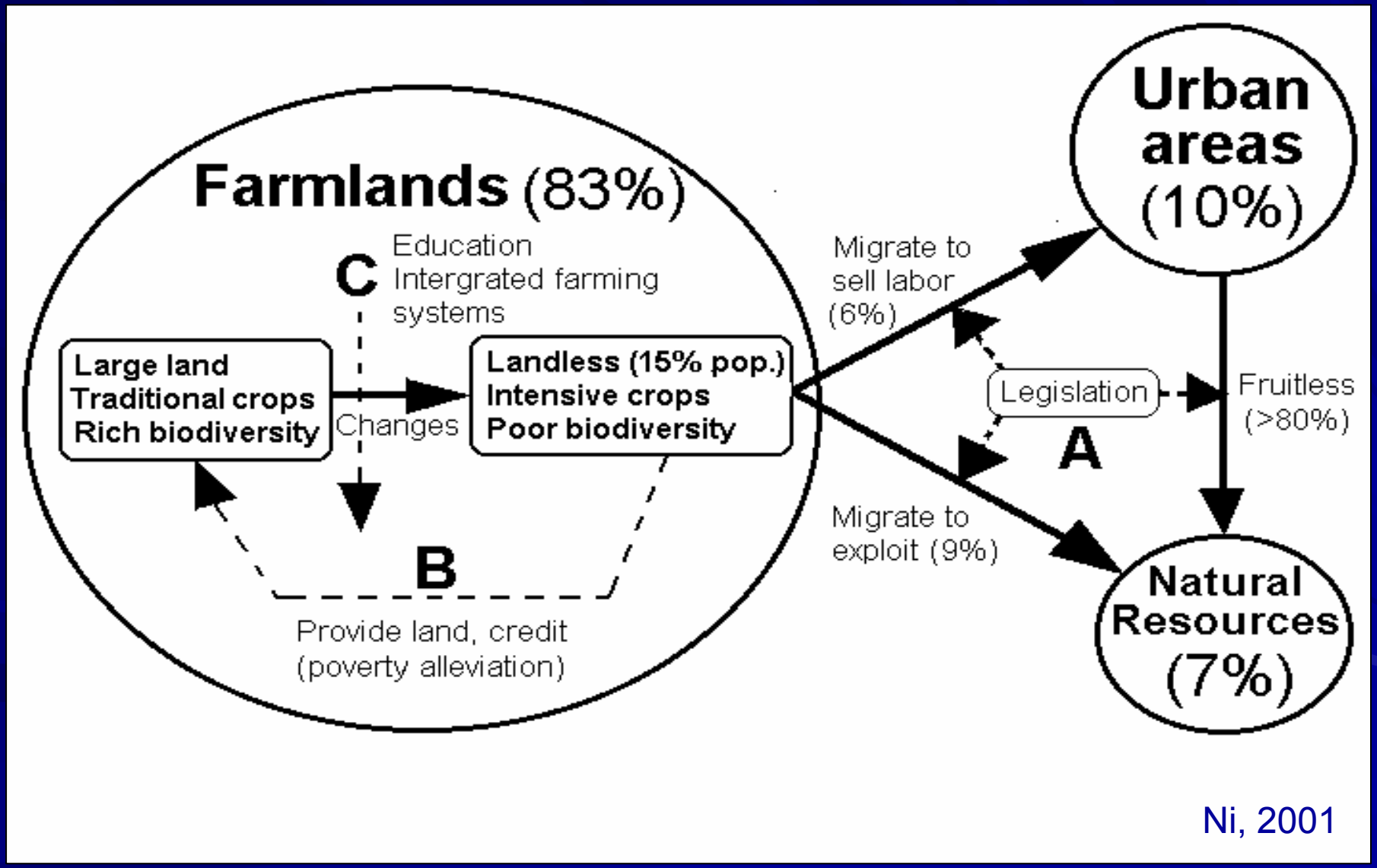
Salinity, acidity, pollution and diseases are major causes of yield loss (rice, shrimp and fish)

Biodiversity is totally depend on the disturbance of the soil-water environment.

Society differentiation


Migration and
Urbanization

Summary Relation between farming intensification, poverty situation, environmental degradation and strategy for sustainable development



Ni, 2001

Integrated Farming Systems: Research and Application

Fish and Shrimp (prawn) production during the flooding period (August to December) in the flooded zone

Integrated Rice-fish systems in fresh water zone

Agro-ecosystem: alluvial zone, irrigated, shallow inundation

Issues and problems:

- high investment for field construction
- less use of chemical
- high total productivity
- technical know-how and management

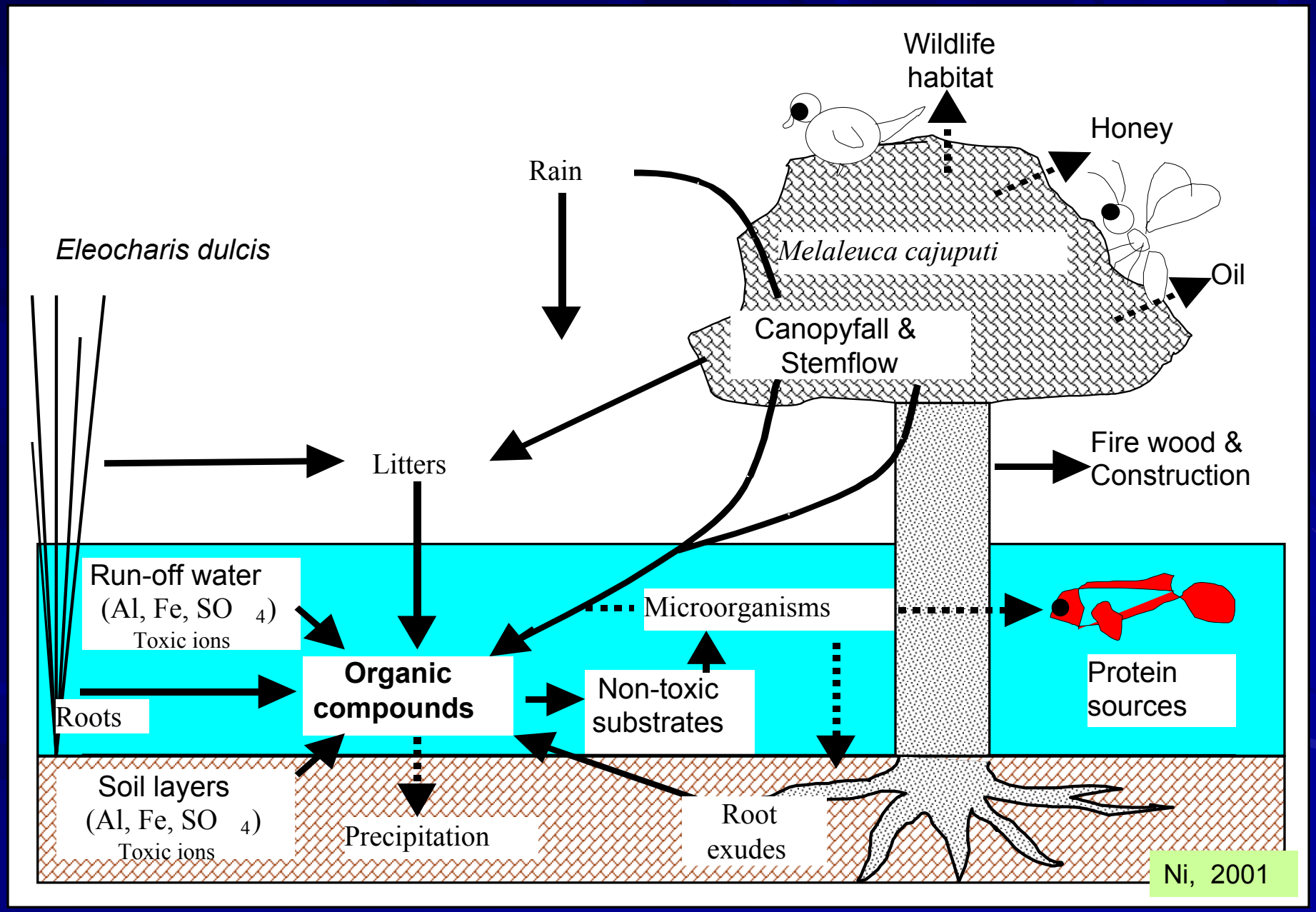
Ecology restoration in the coastal zone

- Adapt poly-culture with suitable technologies: Shrimp - Fish (tilapia, mud crab)
- Shrimp – Fish + Seagrass (*Scirpus littoralis)*

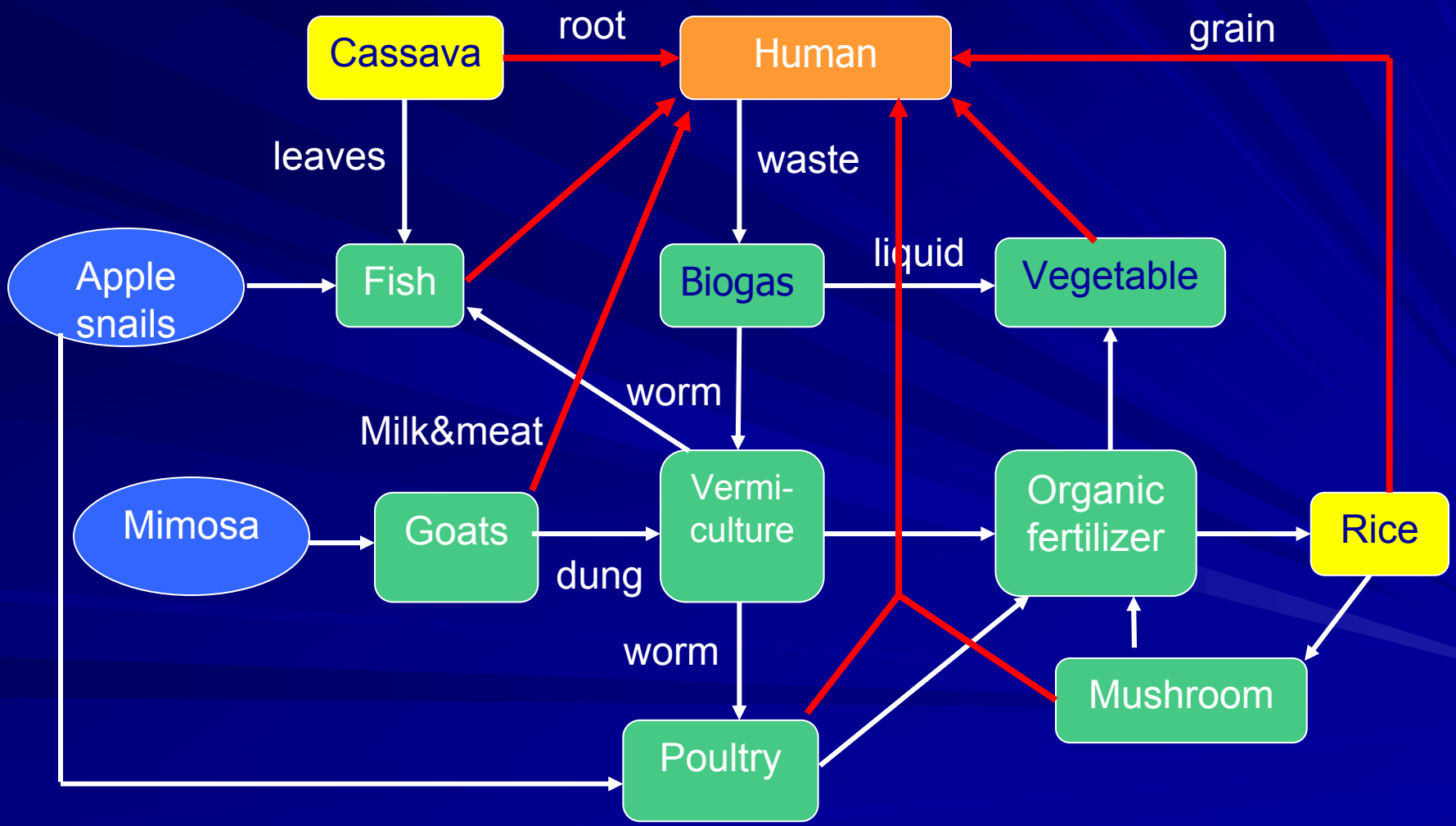


Integrated Melaleuca-Rice agro-forestry system

Melaleuca can improved acid water quality and served as wildlife habitat



An example: BIO-FARM on acid soils to control invasive species and environmental conservation



Invasive alien species

Apple snails

Mimosa pigra

Ipomoea (vegetable)

Vermi-composting

Mungbean

Human waste & Pig Manure

Biodigester (sludge)

Mungbean

Mushroom

Education

Training and Application on organic farming at schools and farm levels

Exchange local knowledge on organic farming

Regional building capacity and International cooperation

Lesson learnt

- The objectives of management of land, water and living resources are a matter of community's choice;
- Understanding the resources (physicals and socials) through research and apply results to existing farming systems for livelihood improvement and environmental conservation;
- Education is key to build capacity of the community and is top priority for sustainable development.

Thanks