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UTILIZATION OF FLOOD PREVENTION FUNCTION OF PADDIES AS AN ADAPTIVE COUNTER-MEASURE

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1) In 2011 Cho Phraya R. B. in Thailand experienced a heavy storm in June, followed by tropical low-pressure storms from July thr. Sep. It continued into Oct.
   - North & Central low lands → regional floods
2) ①Total rainfall = 1.2 -1.8 times of the normal (1/50-y R.P.) → ②Damage in low-lying agri. Lands, ③ Destructive one in Industrial & residential areas of North-Central BKK
3) What kind of roles were carried out by water storage of paddies adjacent to the megalopolis against urban floods ?

Chao Phraya R. Basin and Important Agricultural Facilities [Thailand]

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i) Upstream: Ping Wang, Yom, Nan Rivers joints at Nakhon Sawan.
ii) Downstream: a delta area with elevation below 20m
iii) Huge perennial-stor.-type dams (irrig. & hydro-power): Bhumibol (S.C., 13.5 bill.m^3) and Sirikit (9.5 b.m^3) Dams

Catchment Area: 160,000km^2

Characteristics or the Targeted Irrigation Paddies

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i) RID controls and manages Diversion Dam at Chainat for irrigation and floods.
ii) At Ayuthaya, Pasak River (14,500km^2) with a dam (flood control, 0.96 bill.m^3) joints.
iii) An irrigated paddy region (5 sections, 2,260km^2) ringed by the main stream, the Chainat-Pasak Canal and the Pasak River

Target area: 2,500km^2

State of the Flood and Damage

Upstream

- 1 month early rain start + successive 6 storms
- Full storage at Bhumibol D. (early Oct.) and Sirikit D. (early Sep.)

1) No rooms to store floods by the Dams
2) Flooding at Nakcon Sawan (Sep.), Max dis.: 4,690m^3/s (10/13) [Left overflow Q>2,500m^3/s]

Downstream

- Upstream floods return to the main stream thr. tributaries

1) Max: 3,700m^3/s on 21 Sep.
2) Overflows and dike breaks (10 pts.,9/14-10/7)
3) Devastating floods at BKK (business areas)

Record Flood in the lower Chao Phraya River (2011, Bangkok, Thailand)

Black part: flooded area

Along Ntnl. Road No.1

Industrial area of Japanese companies

Flooding Situation in the lower Chao Phraya River

Don Mueang Intl. Airport

Flooding along Rangsit Canal, north of BKK (Road: evacuation parking)

Flood protection by sand bags

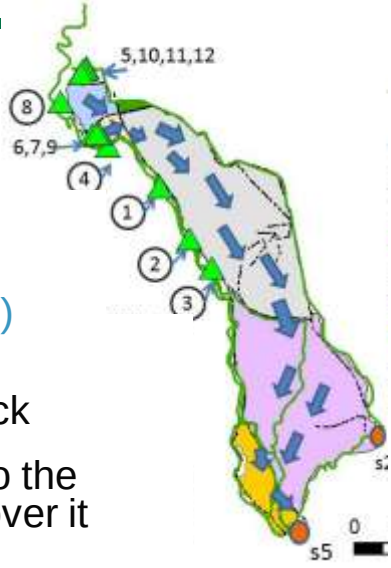
Flood Storage Function of Paddy Areas to the Total Delta

Assumed flooding process in paddies

i) Flooded water thr. dike breaks: stored in a divided block by main roads and/or river dikes (served as roads)

ii) Fulfilled in a block → Weir flow over roads → Next block

iii) At the end, drained back into the Pasak River or discharged over it into the downstream



Flooding Process in Paddy Areas (1)

Photo: Flooding process (2nd Dike with road function as No.⑧)

Photo Right side: paddy area, The left: drainage canal, main road (out of photo), and paddy area

Flooding Process in Paddy Areas (2)

(a)Flow from the upper-left to the lower-right

(b)Flow from the left to the right

Photo Situation of the flow on main roads after when fully stored in paddy area (left)

Flood Marks

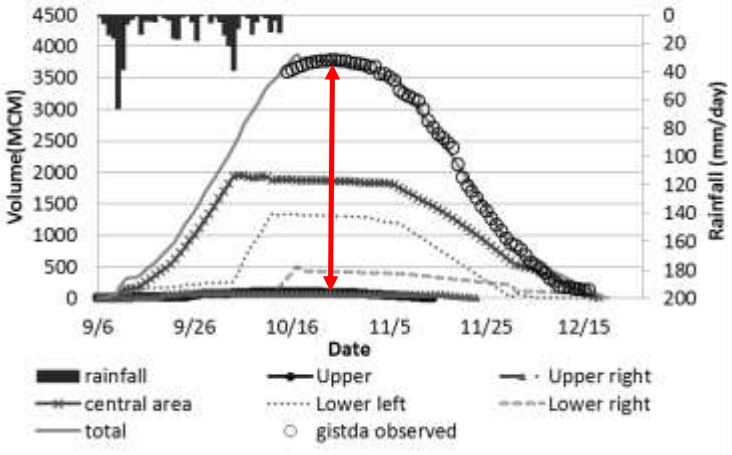
Max. Flood Depth

Photo: Flood mark on utility poles (overflow from the left to the right); the overflow starts on the road with the left paddies filled full of water.

Transition of Paddy Storage Based on the Flooding Process

Flooded volume estimated

Maximum volume



Transition of Paddy Storage Based on the Flooding Process

i) Max inundation = 3,660MCM

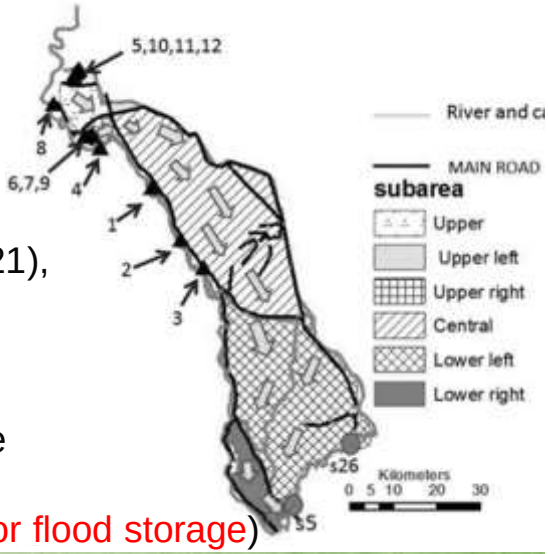
ii) Average inundated depth = 1.68m

iii) Time to be filled in Blocks

U: 8 days (Start: 9/21),
UR: 3 days (9/18),
C: 20 days (9/14),
LL: 10 days (10/3),
LR: 5 days (10/12)

iv)Max inundation in the Basin =10,000MCM

(=Functions of paddies for flood storage)



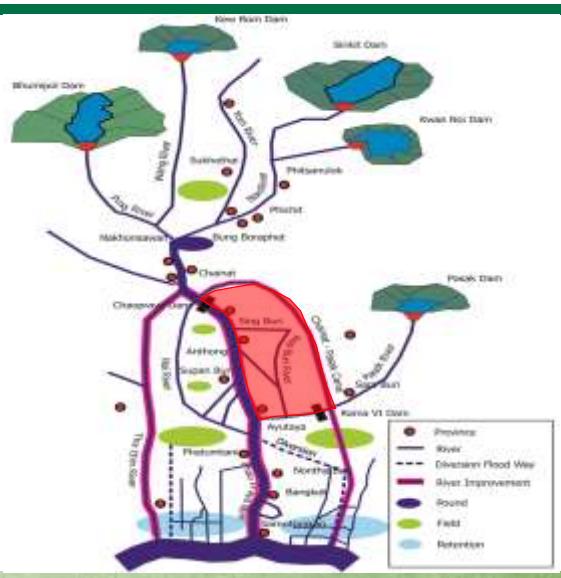
Flood Prevention

i) Floodway,

ii) Joint Drainage
OR
Separated Drainage,

iii) Utilization of paddy storage

etc.



Conclusion

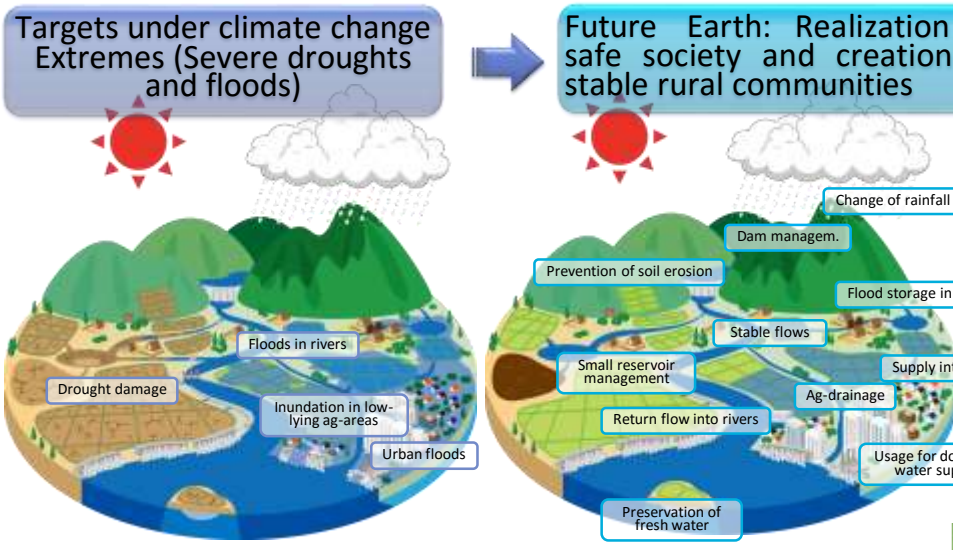
1. We analyzed the 2011 catastrophic flood due to consecutive rainfall in Thailand and surmised flood processes in paddies.
2. We estimated the effects of flood storage by paddy regions for the devastation flood in the Chao Phraya River.
3. The precise model development of a seamless calculation for agricultural water use and flood for the whole basin including urban areas (just undergoing) → Integration of flood storage by paddies in emergency into watershed management → Non-structural management

The End

Thank you for your attention.

[Proposal] Final Goal of the Management

- Future image (CC adaptation, Adaptive managem.)



Quantification of Roles of Paddies

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[A] Adaptation of flood prev. function of Paddies

1) Situation of flooding without paddy storage?
   - Without dike breaks ?
   - Assuming overflow ?
   - With all the volume flowed to the downstream ?
2) Details for activating its func. (Flood management) ?
   - Type selection of facilities
   - Problem of flood insurance
   - Determination of paddy levees
   - Selection of urgent pumping management
3) Comparison of future measures against floods

[B] Other causes ?

1) Affect of the release of Pasak Dam flooding in and around Ayutthaya area
2) Others