Thamnop Irrigation and Natural Hydrology in Northeast Thailand

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Northeast Thailand: a rain-fed rice cultivation area

However, Northeast Thailand also has history and tradition of irrigation for rice cultivation. It was widely practiced before the expansion of rice area. Still in use.
"...paddy fields in Phanchana District mostly depend on water from *thamnop* as this district has many streams. Lam Chiang Krai River is one of the most important streams. Some *thamnop* on it are supplying water to paddy fields. If there are no *thamnop* in the district, rice cultivation should depend only on rainfall, and transplantation has not finished by until this month..."

*Thamnop* (ตำนบ): dike, dam, embankment, weir

"Structures that block stream flow and prevent water from flowing downstream (สิ่งก่อสร้างกั้นลำน้ำไม่ไหลผ่าน)"

Report of Ministry of Agriculture in 1912 (KS13/743)
Topics

• How is *thamnop* irrigation?
• How does it work?
  – Structure and function different from “ordinary” irrigation weirs
• Why *thamnop*?
  – Local hydrological environment and thamnop
Earthen weir that blocks up rivers completely

How is Thamop?

Especially seen in Southern part of Northeast Thai and around Siemriap, Cambodia

Thamnop Nonburi
Surin Province, Thailand
Thamnop Khon Muang
Nakhon Ratchasima Province,
Thailand
Blocked rivers sometimes make a detour through alternative channels.
Thumnup (Thamnop) around Angkor Wat
Almost whole stream water directly flows into paddy fields around *thamnop*

Flooded water reaches sometimes several kilometers from a *thamnop*
Characteristics of *Thamnopol* irrigation systems

**Structure**

- They **block up streams completely** with embankments that are often several times longer than width of river channels.
- **No water gate to regulate water intake.**

**Function**

- Quantity of water intake is not controllable.
- **It depends on amount of river runoff.**
- As a consequence, *thamnopol* often make flood damage on rice plants.
They sometimes cause flood damage on rice plants.
“Ordinary” weirs: raise and maintain river water level, but not block flow completely (allow overflow)
“Ordinary” diversion weir

- Water gate that regulate quantity of water intake
- Diversion channel to send water to paddy fields
- Weir that can release excess water
- Spillway along a diversion canal to discharge excess water in a channel
- Sophisticated system to take **stable (or intended)** amount of water from rivers
Design and functions are basically same.
Spatial distribution of *Thamnop* irrigation

*Thamnop* are constructed along “montainless” rivers.
### Hydrology of mountainless rivers

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<thead>
<tr>
<th></th>
<th>Runoff velocity</th>
<th>Sensitivity to rainfall</th>
<th>Runoff ratio (runoff/rain)</th>
<th>Shape of peaks</th>
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### Why thamnop?

- **Rainfall**
- **Evaporation**
- **Runoff ratio** = Runoff/Rainfall

\[
\text{Runoff ratio} = \frac{\text{Runoff (observed)}}{\text{Runoff (initial)}}
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### Why thamnop?

**Mun Riv., Northeast Thai (thamnop)**
- 390km² (M101)
- Annual prec: 1180mm
- Annual runoff: 233mm
- Runoff ratio: 0.20

**Ping Riv., North Thai (weir irrigation)**
- 515 km² (P021)
- Annual prec: 1180mm
- Annual runoff: 369mm
- Runoff ratio: 0.31
Quick runoff and slow runoff

Rainfall

Quick runoff (surface runoff)

Slow runoff (subsurface)

Base runoff

Peak runoff

Runoff

Stream

Why thamnop?
Hydrology of a **weir irrigation** river

- Runoff consists of peak flow and base flow.
- Stable and rich base flow.

There is no reason to dare to use peak runoff, as peaks are sharp and short lasting.
Hydrology of a *thamnoph* irrigation river

- Difficult to separate base flow and peak flow because of long lasting low peaks and unstable base flow
- Water resource is rather limited because of low runoff ratio.

It is better to take whole runoff at every moment.
Conclusions

• *Thamnop* irrigation much depends on river runoff.

• This does not mean that thamnop irrigation is less efficient than weir irrigation.

• The *thamnop* irrigation system is well designed by local people for mountailess rivers.