



# Managed flood releases

An aerial photograph of the Kafue Flats in Zambia. The landscape is a vast, flat expanse of land, characterized by a complex network of small, interconnected water bodies and channels. The water appears dark, while the surrounding land is a lighter, brownish-grey color. The overall scene depicts a large-scale, managed flood release system.

**Kafue Flats, Zambia**

# Structure of the presentation

- Project description
- Area description
- Problem description
- Research questions
- Methodology
- Kafriba model
- Results
- Conclusion

# Where are the Kafue Flats?



# Integrated Water Resources Management Project for the Kafue Flats

## *Dam Operation rules and Managed Floods*

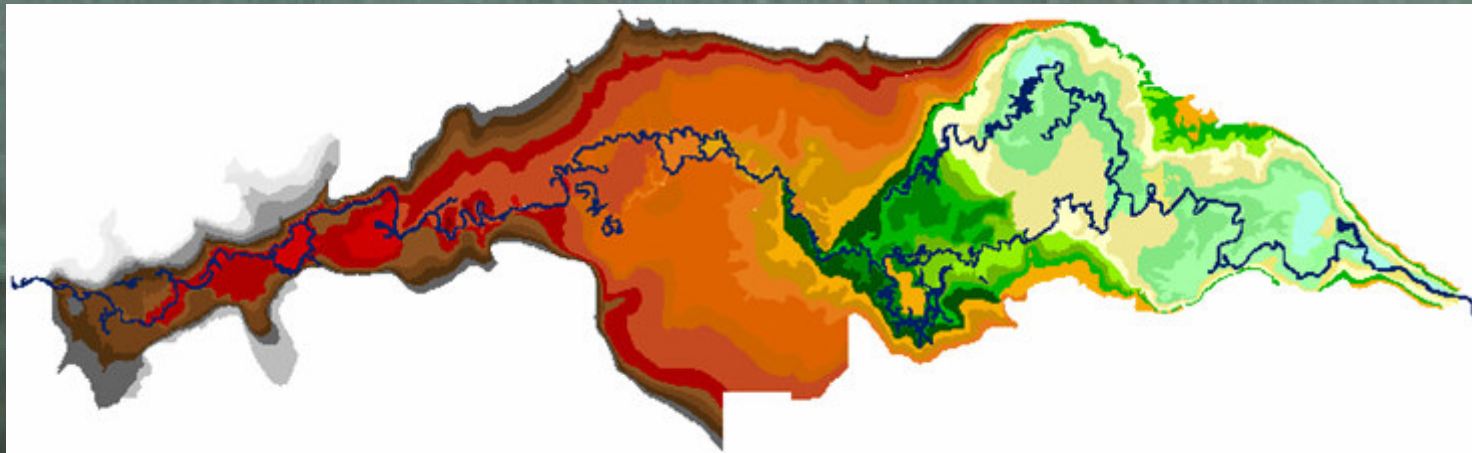


# Goal of the project

Review the dam operation rules in order to mimick to a certain the natural flooding pattern in the Kafue Flats without jeopardizing power generation

# Area description

- 6500 km<sup>2</sup>
- Very flat
- Valuable wetland ecosystem



# Problem description

- Kafue Gorge Dam downstream
- Itezhi-tezhi Dam upstream
- Hydrological regime disturbed



An aerial photograph of a river delta at sunset. The sun is low on the horizon, casting a golden glow over the water and the surrounding landscape. The river channels are visible, branching out into the sea. The sky is filled with soft, golden light, and the water reflects the colors of the sunset.

# Research questions

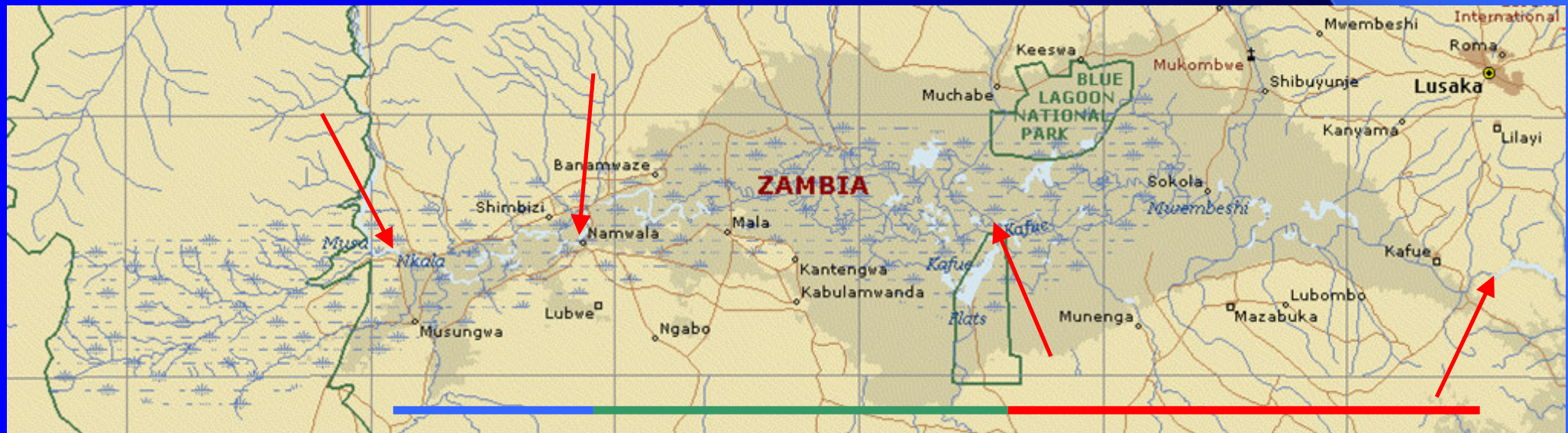
- What were the characteristics of the natural regime?
- What are the effects of the dams on this regime?
- What should the managed flood look like?

# Methodology

- Model study
- Historical simulation years 1951-1978
- Natural situation  $\longleftrightarrow$  situation with dams
- Inundated areas
- Three sub-areas

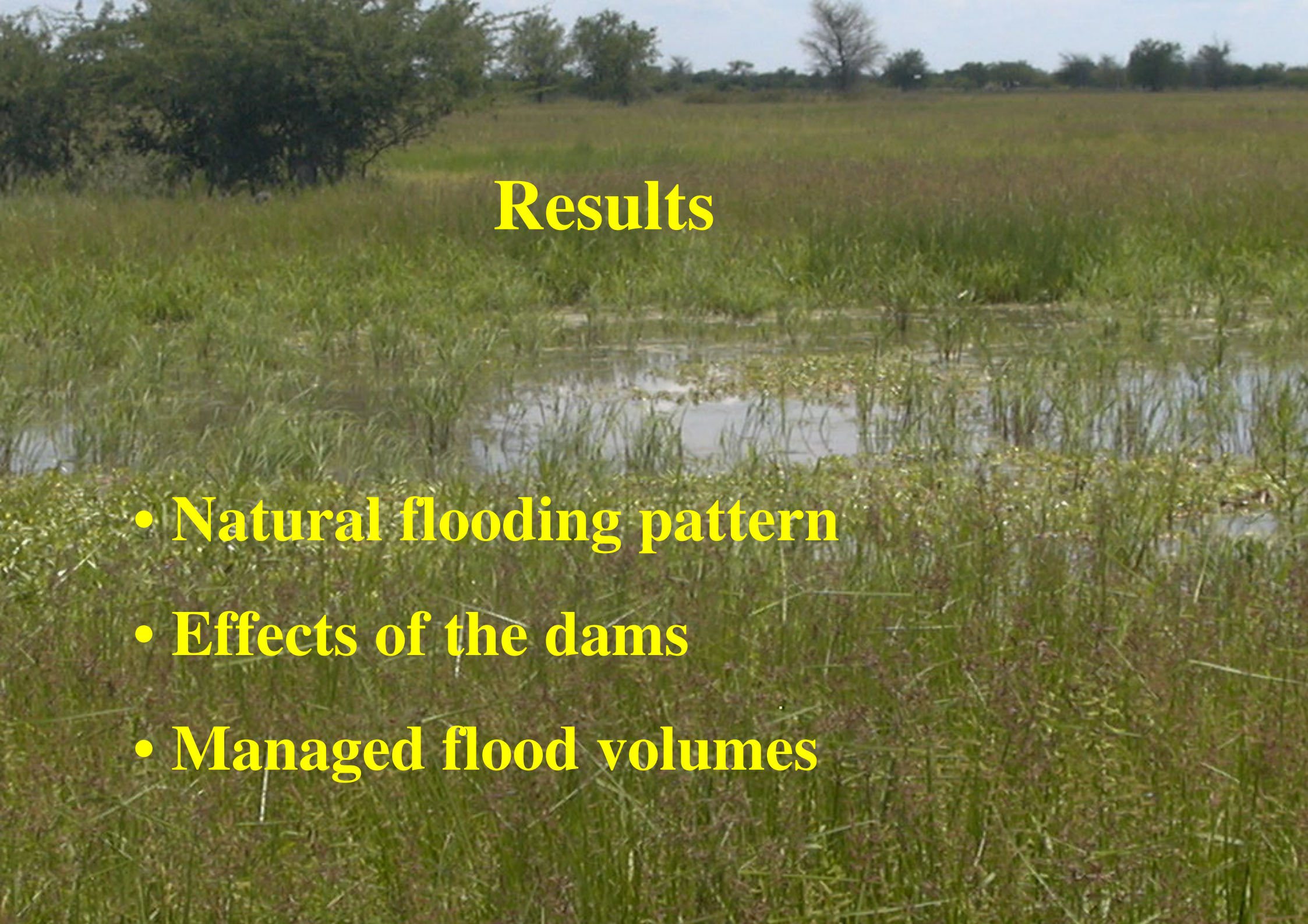
# Division in three sub-areas

- Itezi-Itezi to Namwala
- Namwala to Nyimba
- Nyimba to Kafue Gorge



# Kafriiba model

- Flow model and waterbalance model combined
- 125 cells
- River and storage cells
- Waterbalance for each sub-area

A photograph of a flooded grassy field. The foreground and middle ground are filled with tall, green grasses. A shallow pool of water is visible in the center, reflecting the sky and the surrounding vegetation. In the background, there is a line of trees under a clear blue sky.

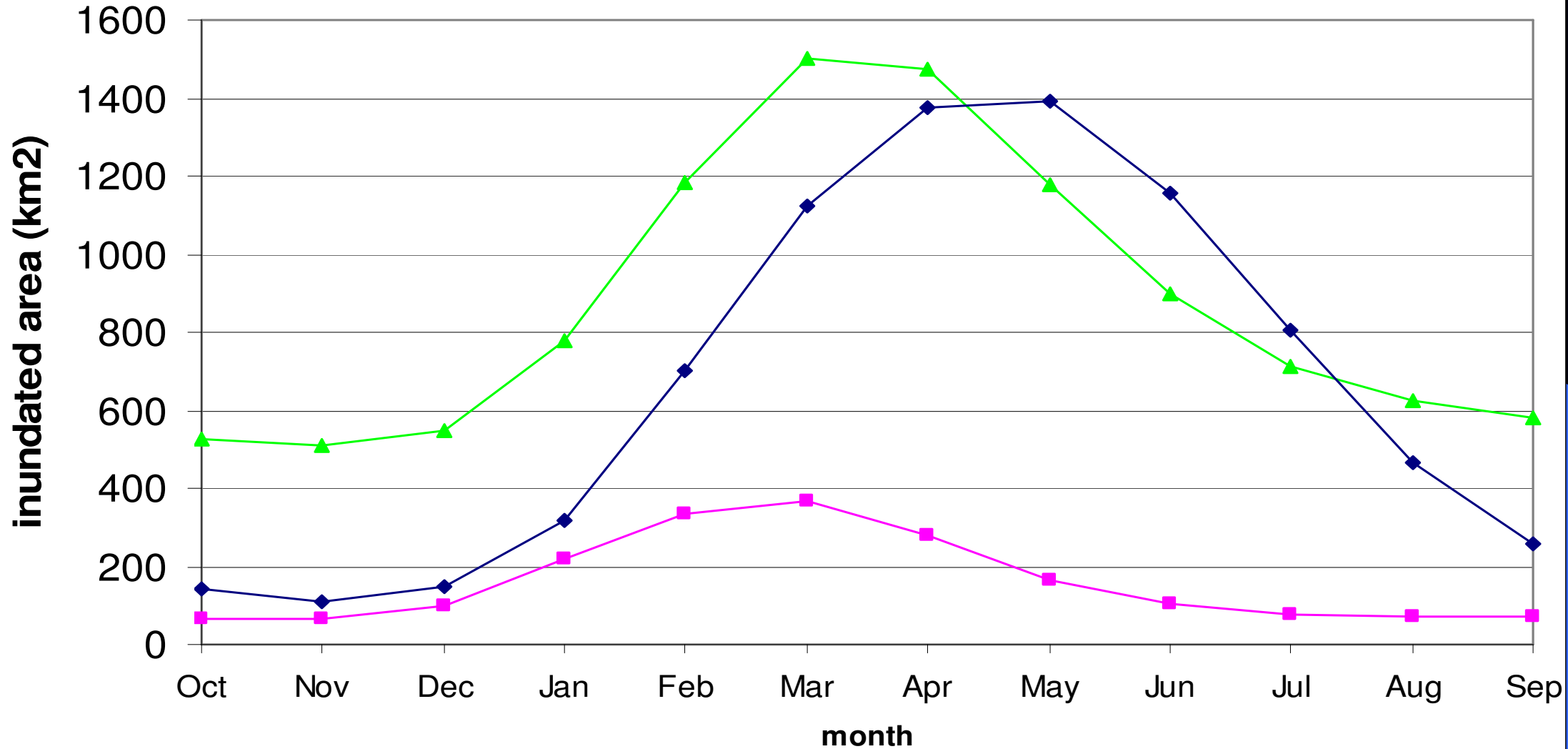
# Results

- **Natural flooding pattern**
- **Effects of the dams**
- **Managed flood volumes**

# Natural situation

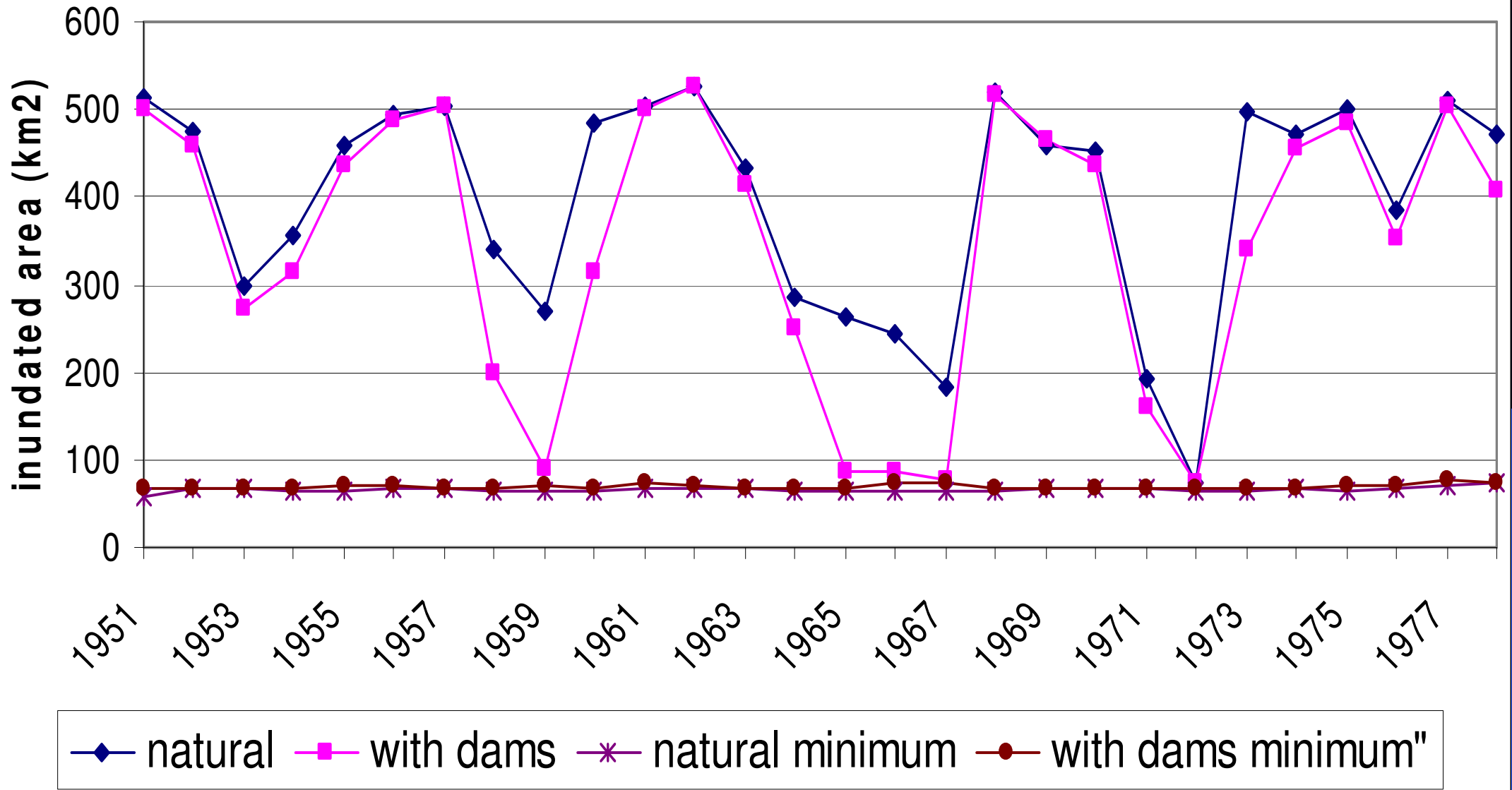
- Succession of peaks
- River water determines size of flooding
- Discharge in river 6 months smaller than  $215 \text{ m}^3/\text{s}$
- In dry years managed flood not possible

## Average inundated area natural situation



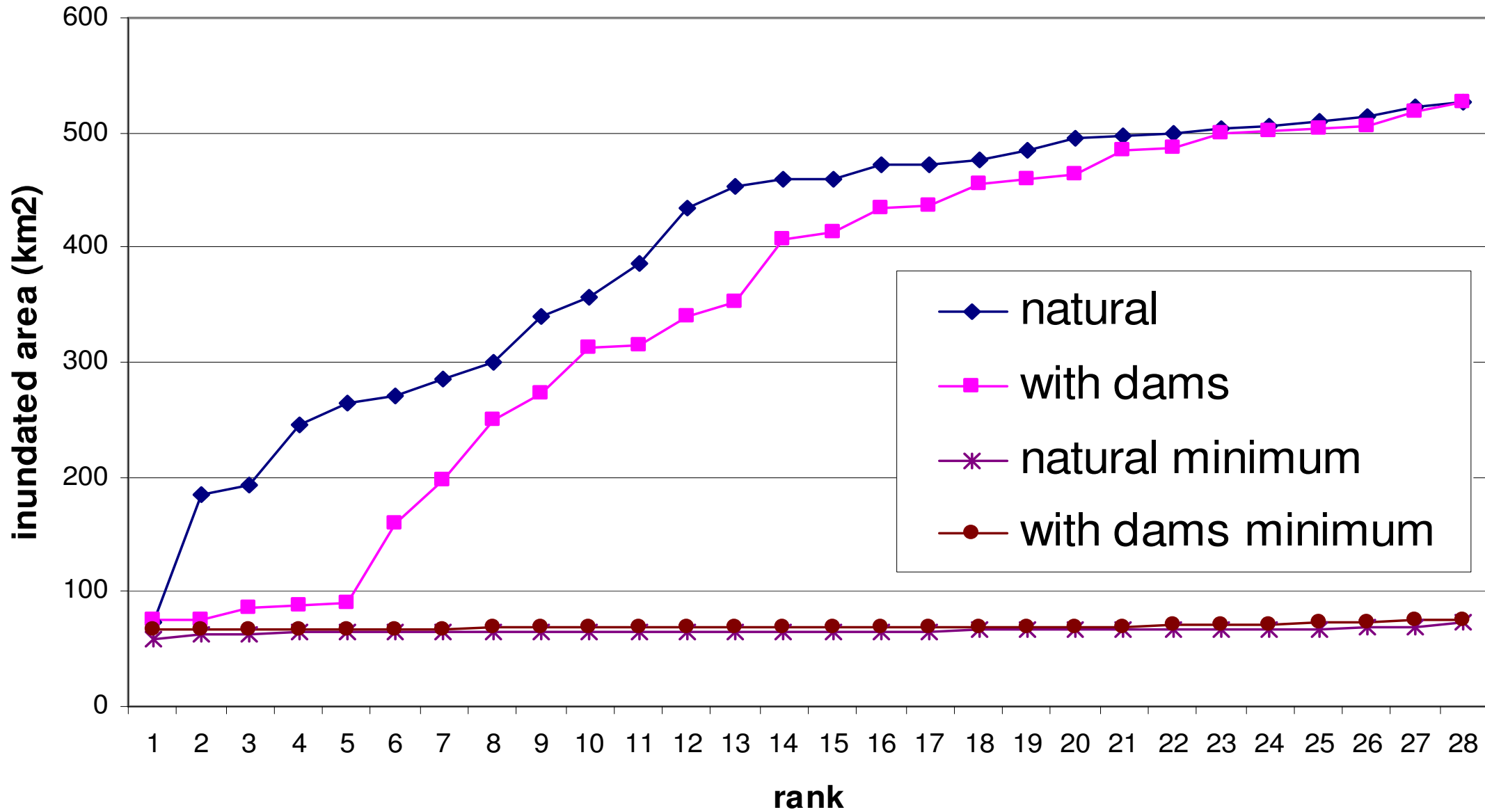
■ Itezhi-tezhi-Namwala ▲ Namwala-Nyimba ◆ Nyimba-Kafue Gorge

# Maximum monthly inundated area ITT-Namwala

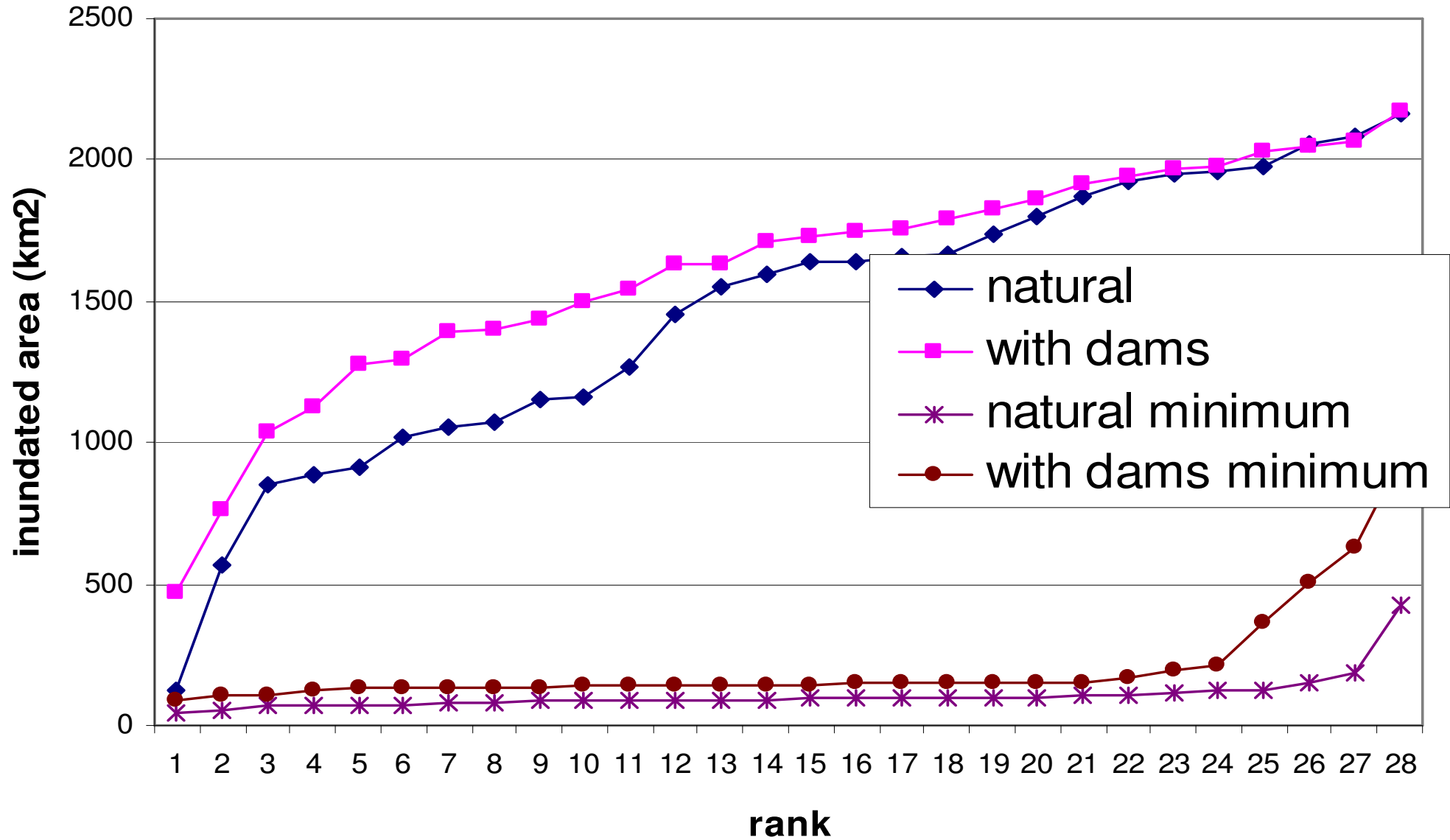




# Ranked inundated area ITT-Namwala

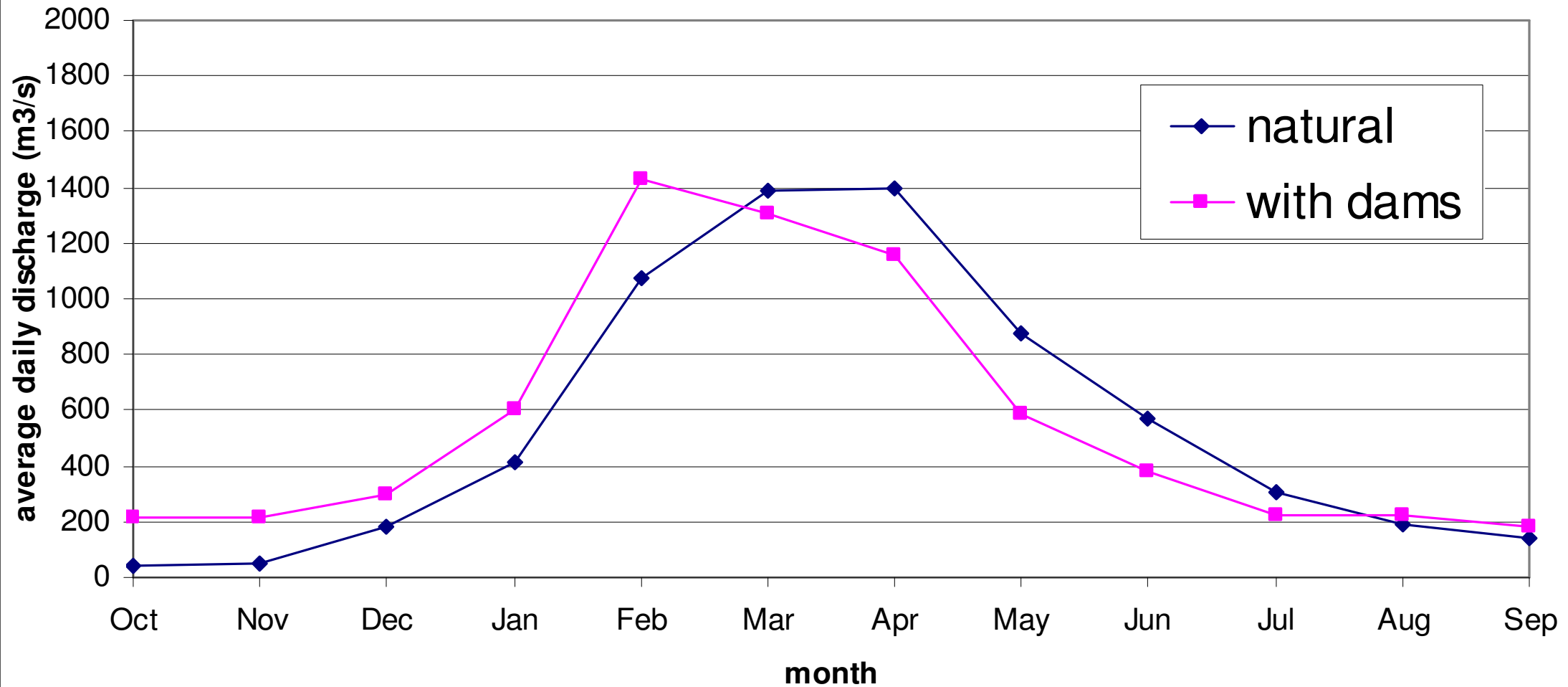


# Ranked inundated area Nyimba-KG



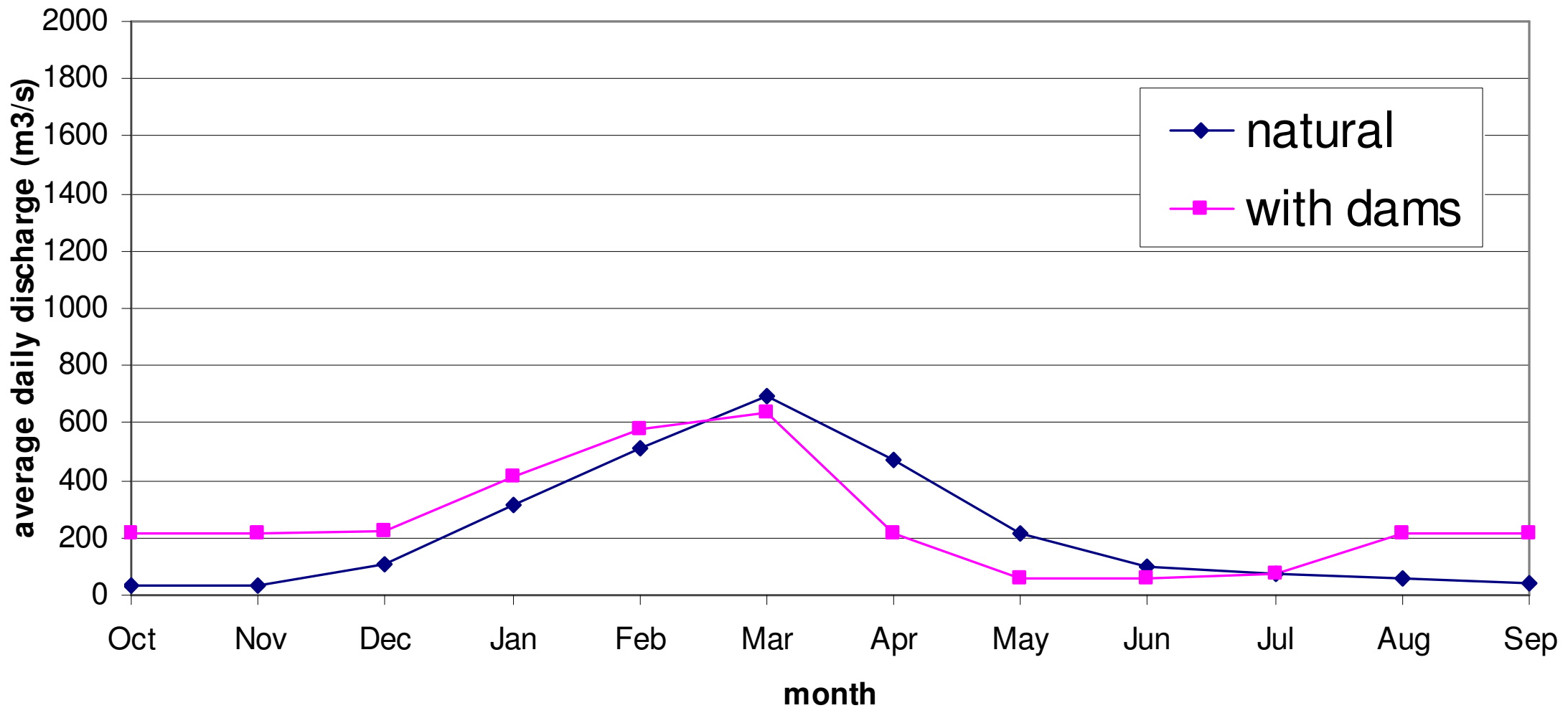
# Effect on discharge in a wet year

average daily discharge for each month



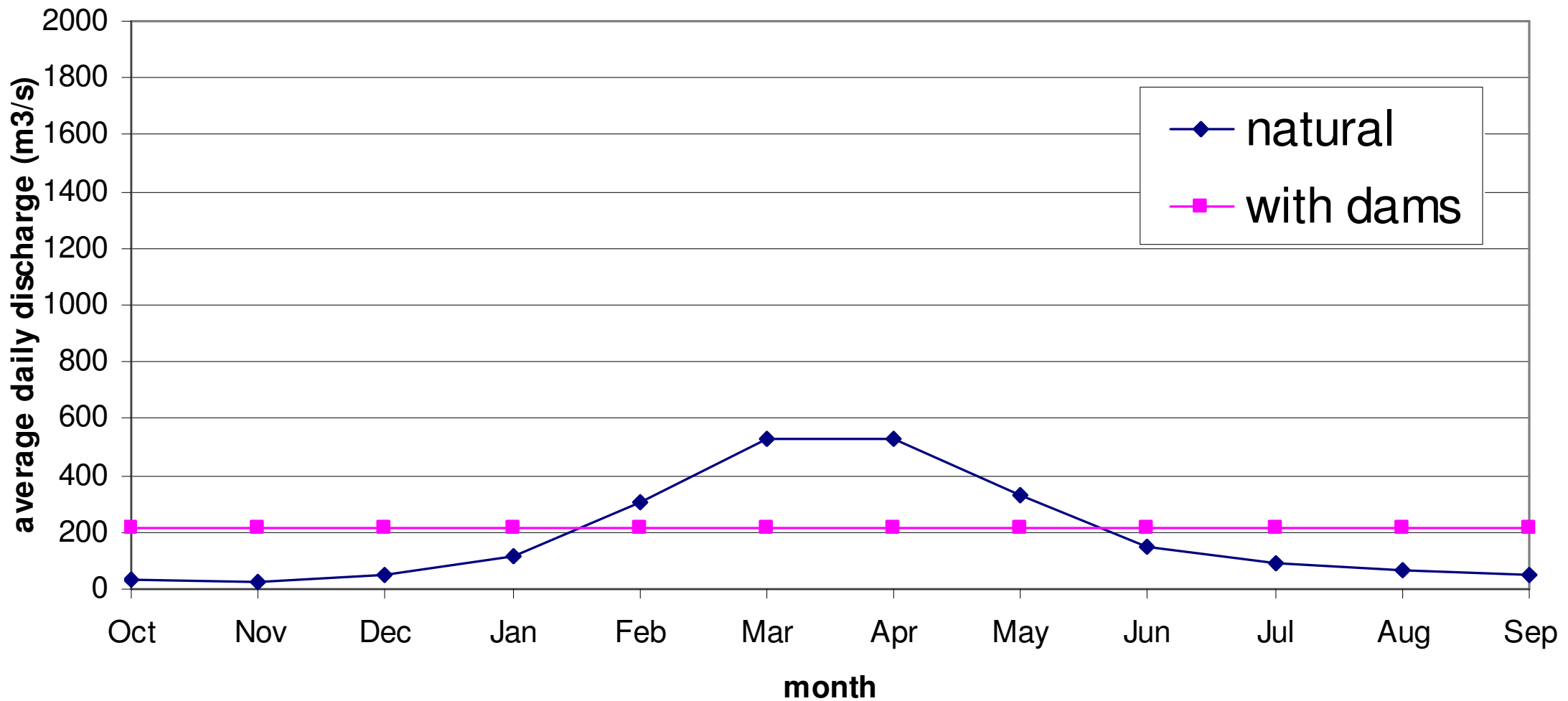
# Effect on discharge in average year

average daily discharge for each month

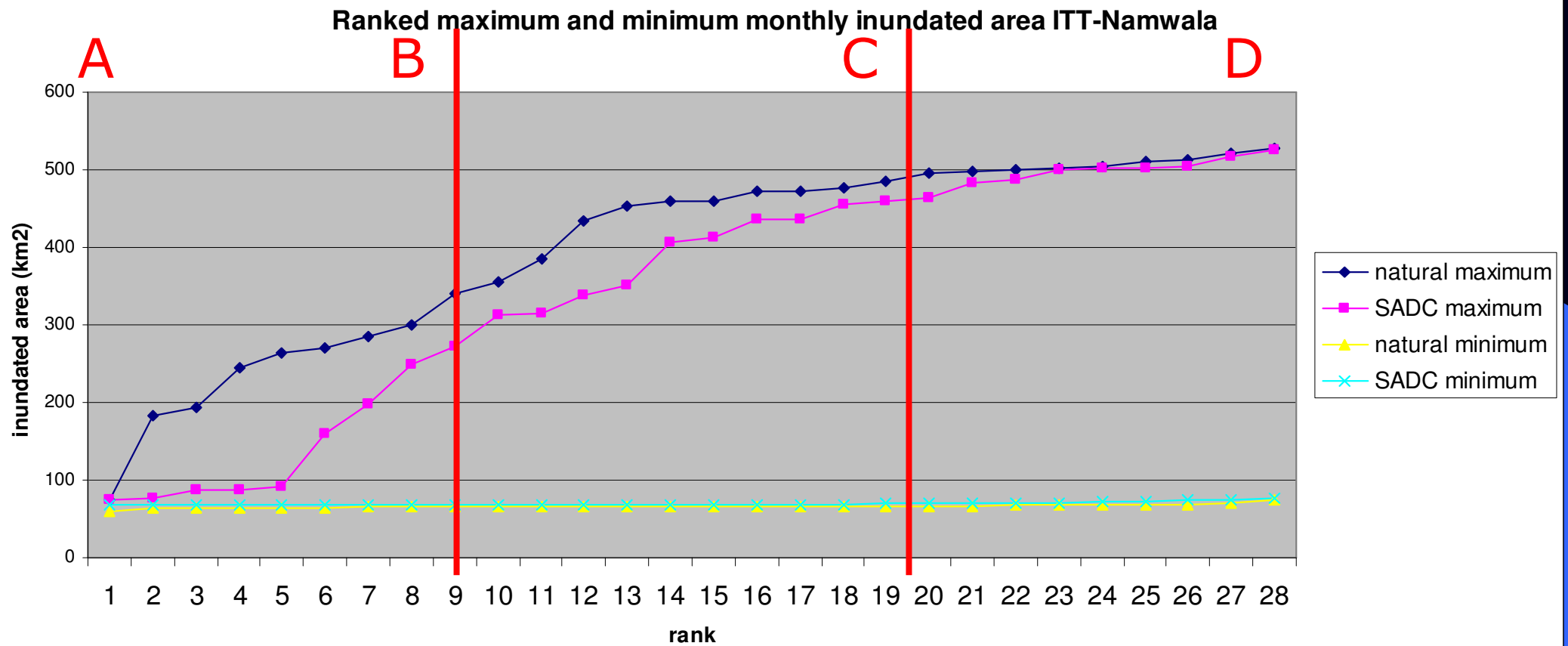


# Effect on discharge in dry year

average daily discharge for each month



# Selection representative years



# Managed flood volumes

	<b>Low rainfall &amp; tributary flow</b>	<b>Average rainfall &amp; tributary flow</b>	<b>High rainfall &amp; tributary flow</b>
<b>Small river flow</b>	1650	2020	3130
<b>Average river flow</b>	4050	6450	7000
<b>Large river flow</b>	9610	12430	18950

# Conclusions

- Kafue River flow determines size of maximum inundated area
- Especially in dry years large effect of dams
- Larger effect of dams on duration of the flooding than on the maximum inundated area
- Managed flood is possible, but limited in dry years
- Volume varies alot





Questions?