Impacts of land-use change on hydrology of a mountainous watershed: Water resource tension in northern Thailand

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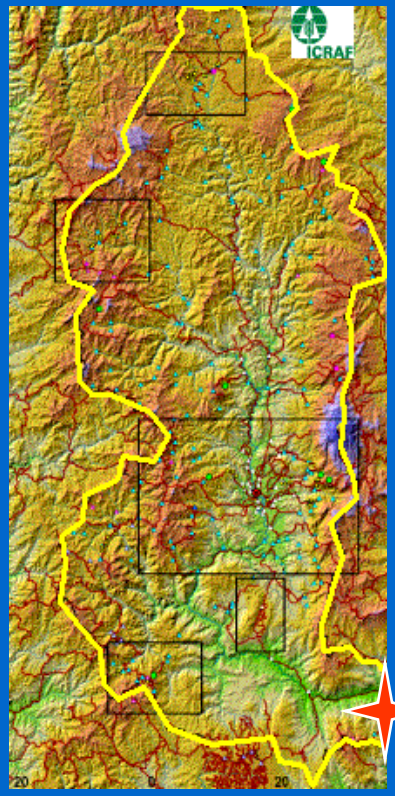
Outlines

- Study site
- Water resource problem
- Research objective
- Implementation
- Results
- Conclusions
- Management implications

Study Area - Mae Chaem, Thailand

MAE CHAEM



Basin outlet

3853 km^2

What is the problem?

- Conflict of water resource between hill tribes and valley people in Mae Chaem
- “Upland cultivation & deforestation cause storm flooding and less dry-season flow”
- “Lowland agriculture has high water demand for irrigation”

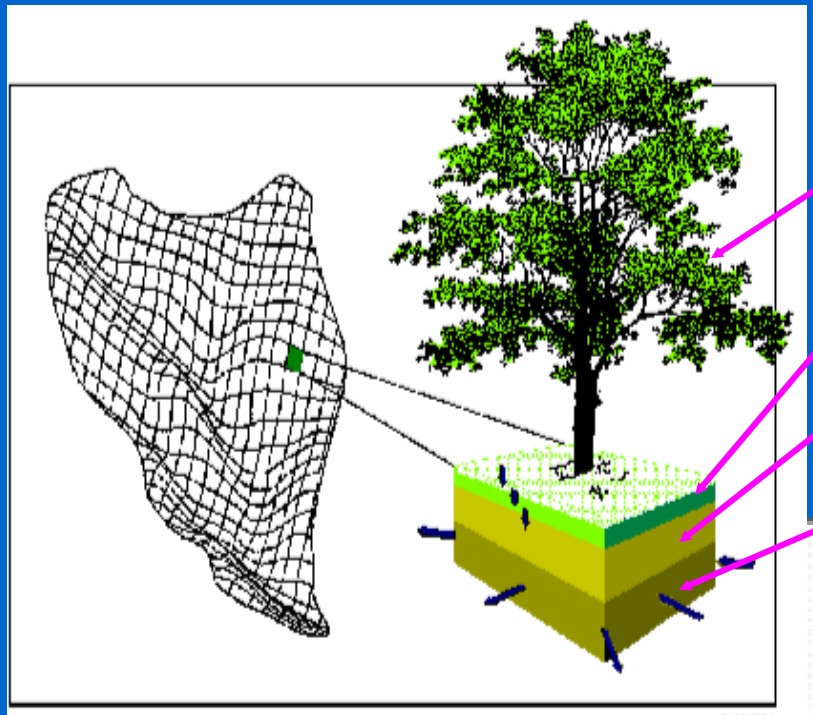
Objectives

How does land-use change affect the water resource – annual & seasonal yields?

How far downstream can we observe changes to stream flow ?

Simulate & forecast stream flow using a hydrology model

Distributed Hydrology Soil-Vegetation Model

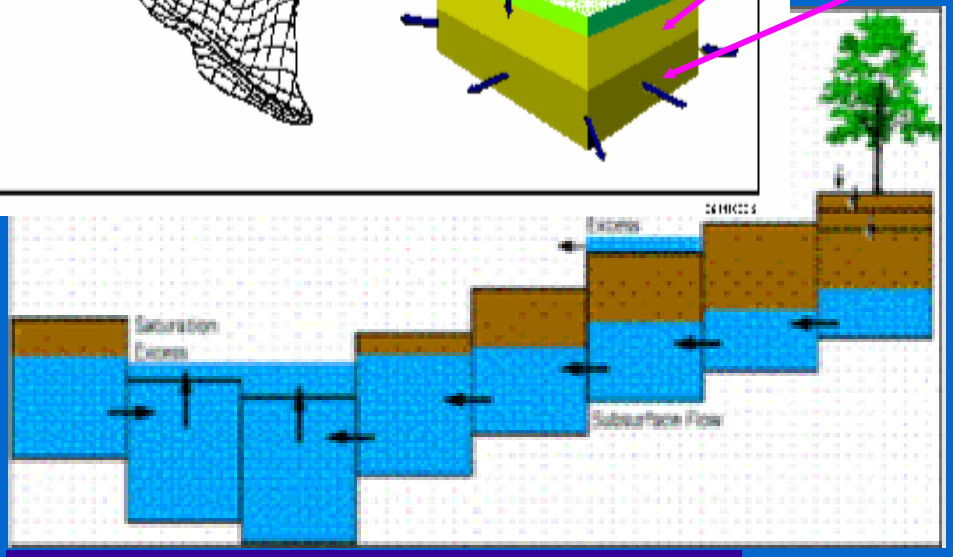


Overstory

Upper rooting zone

Lower rooting zone

Saturated zone



The model calculates water components in the basin & route water into channels.

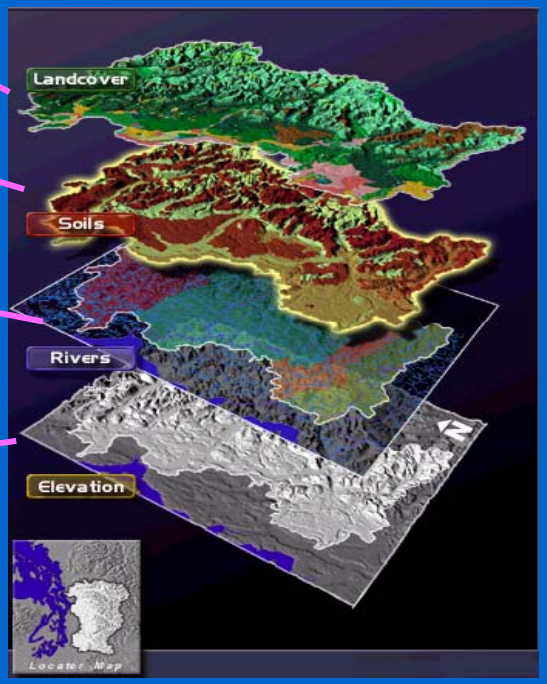
Implementation

Vegetation

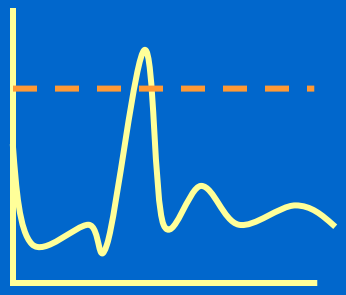
Soils

Rivers

Digital Elevation Model (DEM)

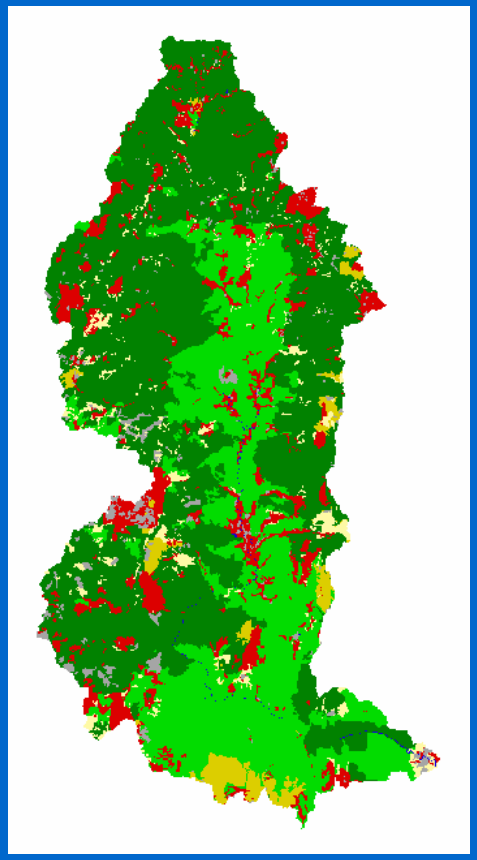


Hydrology model (DHSVM)

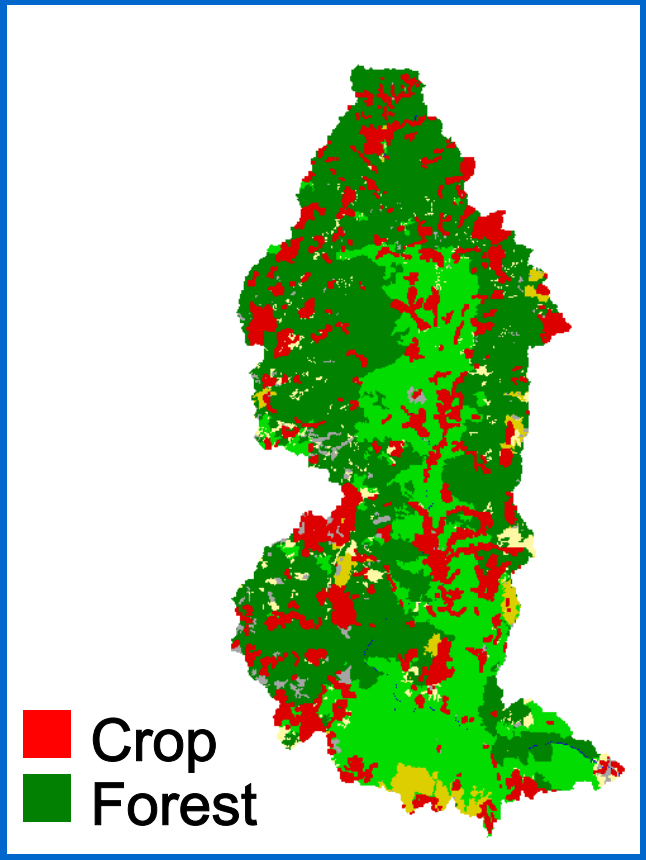


Climate records

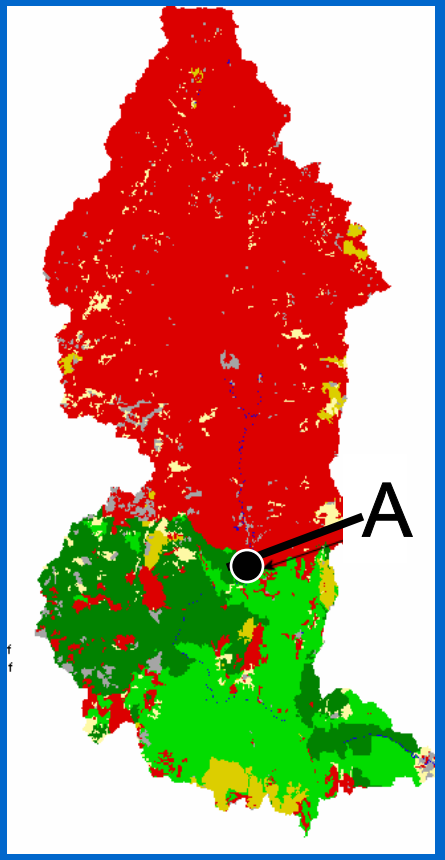
Vegetation scenarios



Land-cover 2000
(crop = 10%)



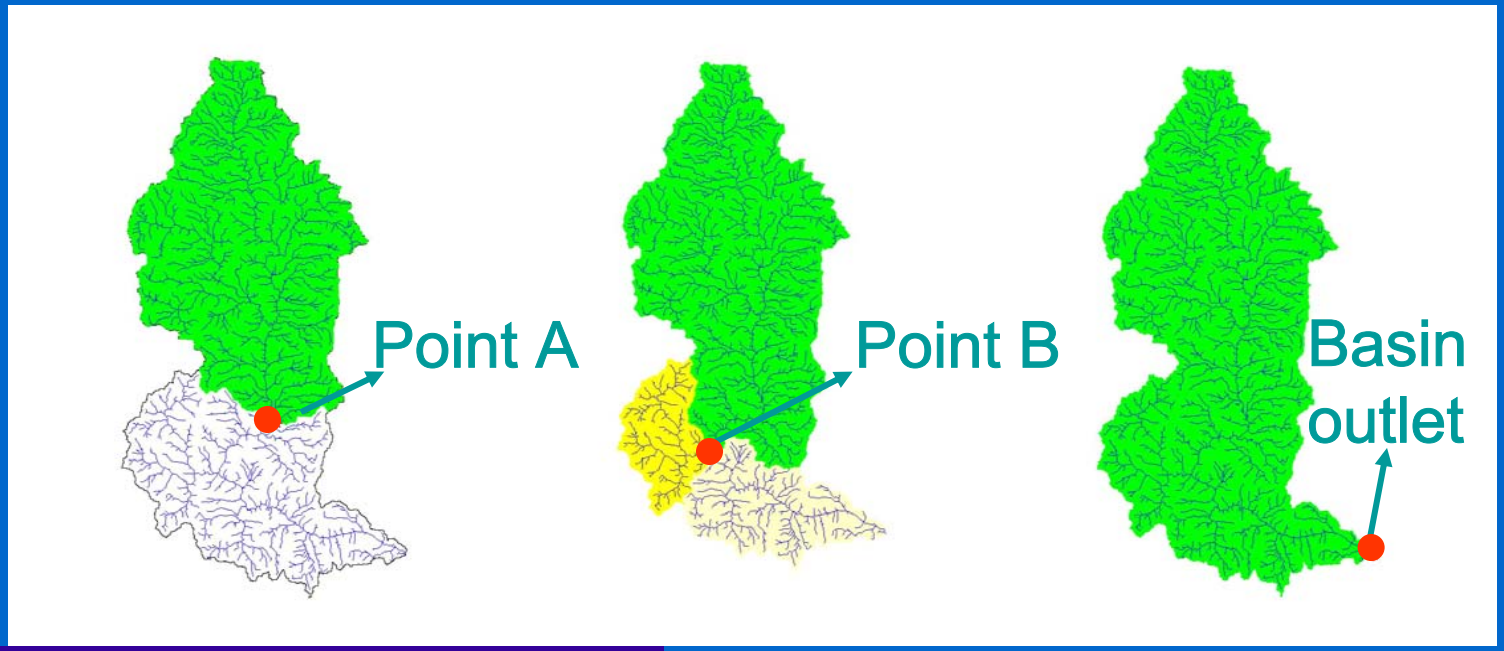
Scenario I
(crop = 20%)



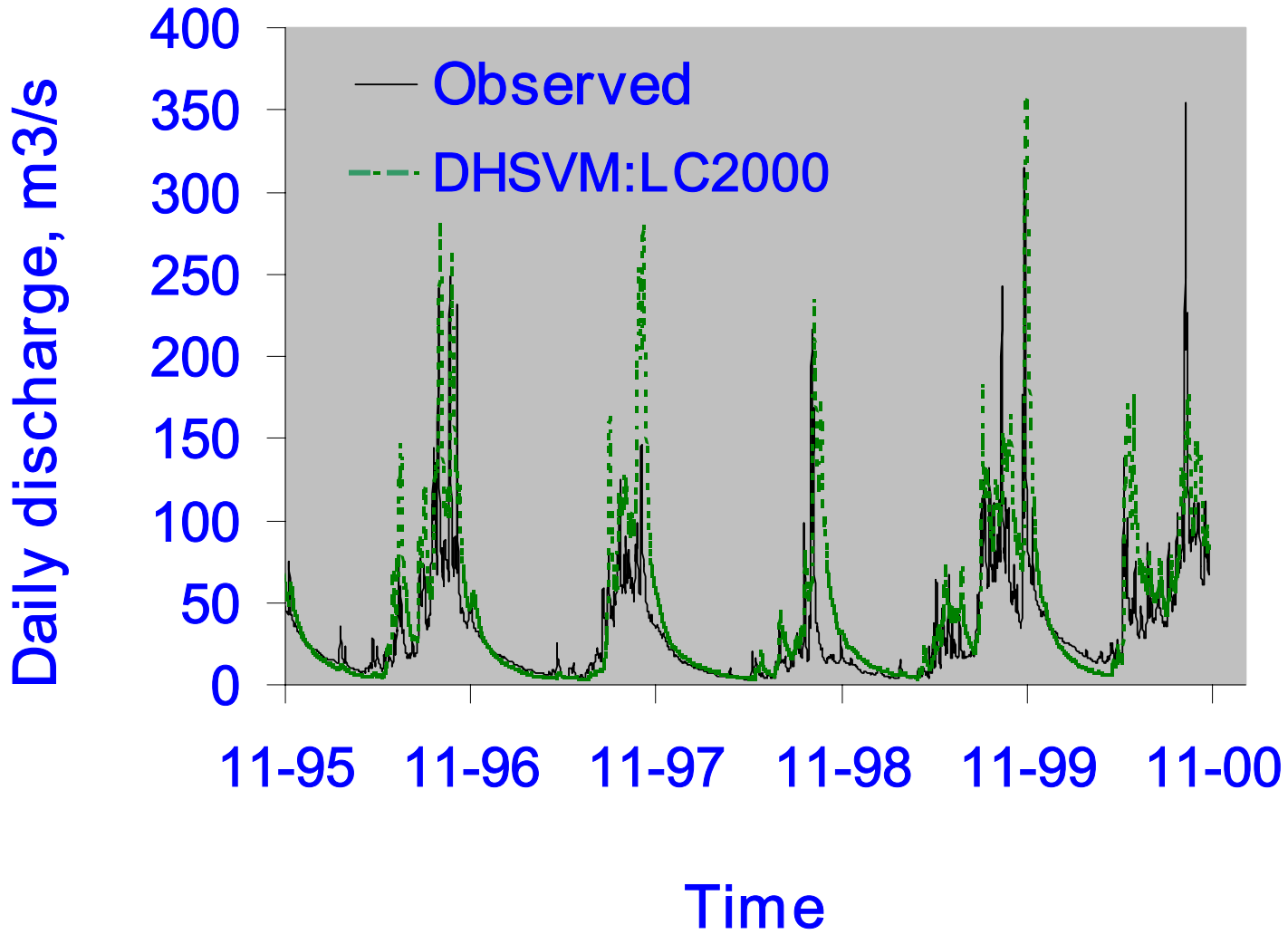
Scenario II
(crop = 60%)

What will we look at ?

- Comparison of simulation & observation
- Annual & seasonal water yields at basin outlet
- Downstream effects at 3 locations in river



Does the model work?



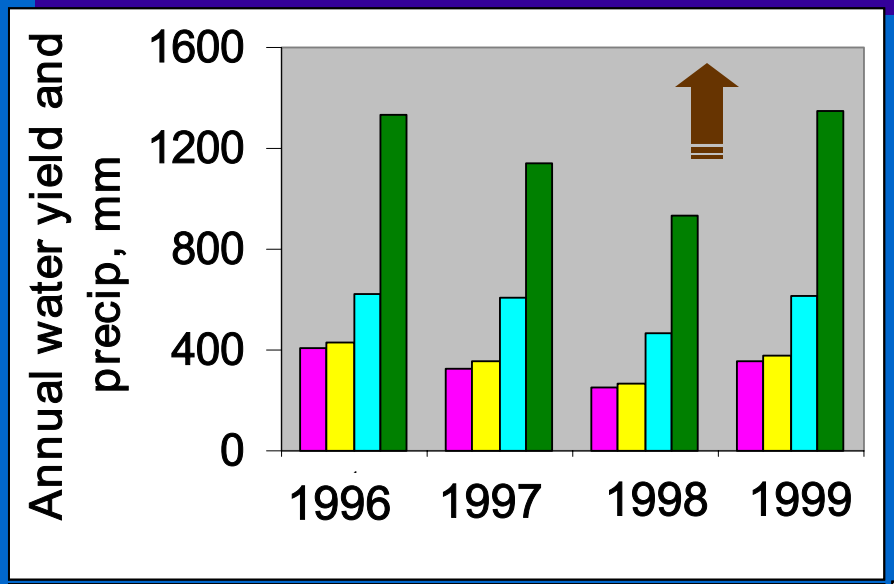
Recap

- Study site
- Water resource problem
- Research objective
- Implementation
- **Results**
- Conclusions
- Management implications

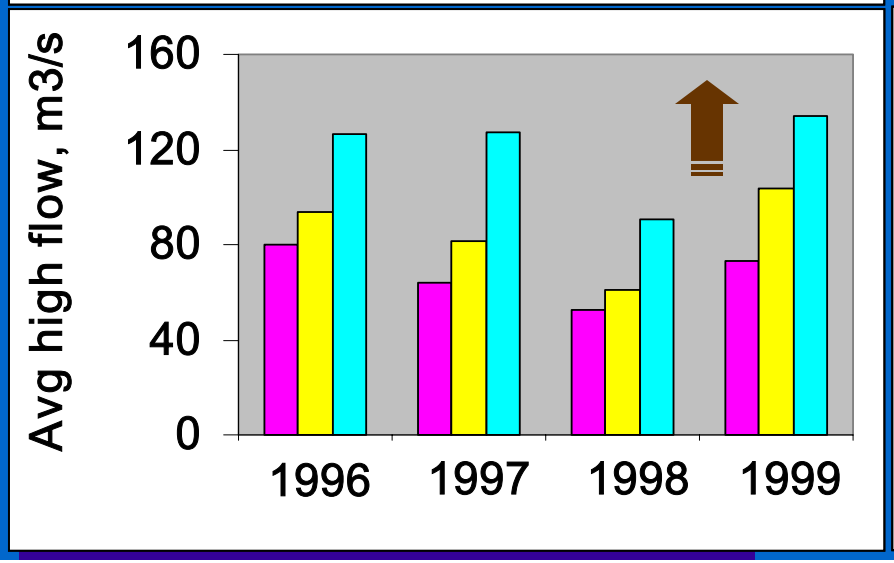
Yes, the model works !

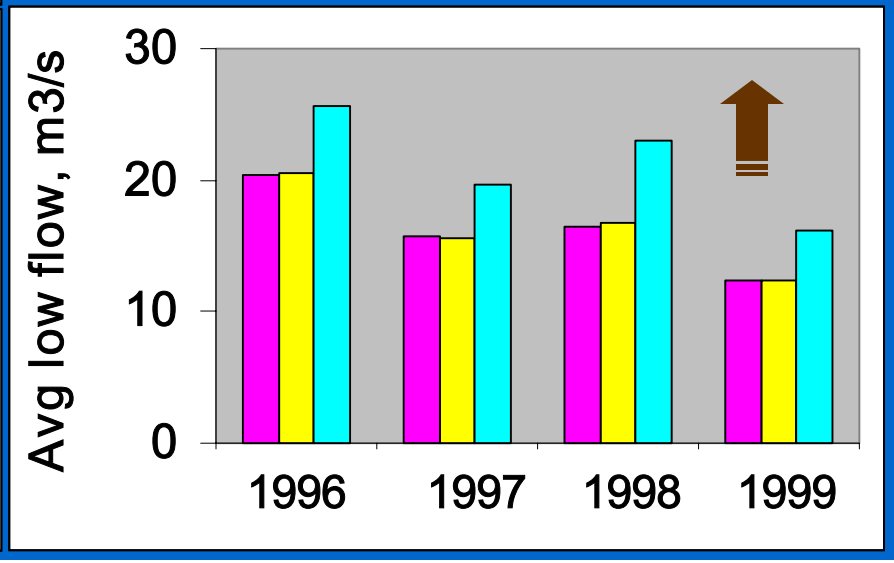
What kind of information can it tell us ?

Simulated annual & seasonal water yields

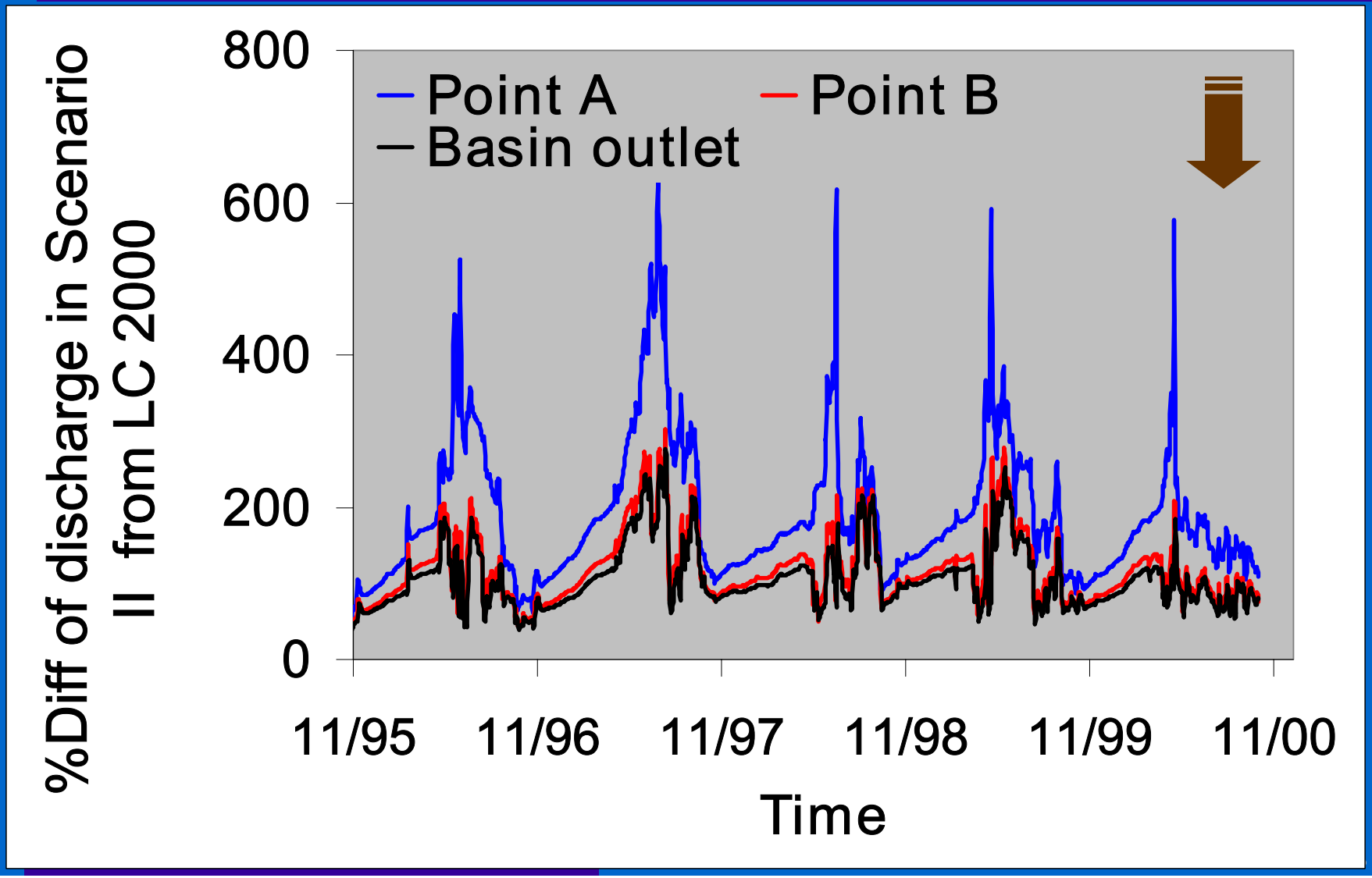


Land-cover 2000
20% croplands
60% croplands
Precipitation





Downstream effects : Scenario II



Conclusions

- Runoff ratio = 25% & High flow = 70% tot flow
- Vegetation type does affect stream flow

  More crops, Higher wet & Dry-season flows

- Downstream effect may be important in urban areas
- Other factors can influence stream flows : landscape pattern, soil compaction

Management Implications

- Water allocation, flow regulation, and local hydrological hazards
- Biodiversity conservation
- Policy brief for key people to assist them on economic development.

Example : World bank and partnerships' project on functional value of biodiversity.

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