APFW

Stream 3: Forests and Water in Action

Forest-water relationships: What does the science tell us?

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Forest-water relations

- There is a solid body of scientific information, developed over past 50 years, for understanding and interpreting forest-water relations;
- There is also a parallel and deeply entrenched "popular narrative" often based on folklore, myth, or misunderstanding that often runs counter to the consensus views of the forest hydrology scientific community.

Overview of presentation

1. Describe key aspects of the commonly held beliefs (“popular narrative”) around interactions between forests and water;
2. Summarise the scientific consensus on forest–water relationships;
3. Discuss relevance of the disconnect between the “popular narrative” and scientific consensus for forest policy and practice.

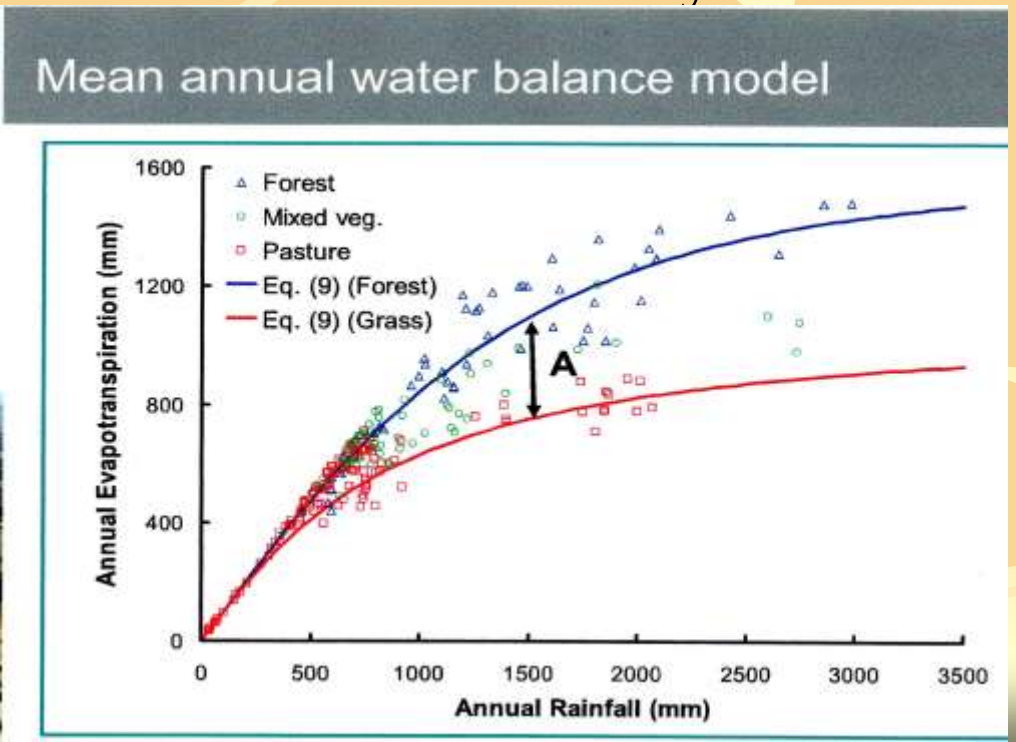
Main points of "popular narrative" on forest-water interactions

1. Forests increase water yield (and conversely, removal of forests decreases water yield)
2. Forests reduce floods (and conversely, removal of forests increases floods)
3. Forests increase base (i.e. dry season) flows (and conversely, removal of forests decreases base flows)
4. Forests reduce erosion (and conversely, removal of forests increases erosion)

1. Forests and water yield (1)

Popular narrative 1: ***Forests increase water yield (and conversely, removal of forests decreases water yield)***

Scientific consensus: Forests use more water than shorter forms of vegetation. Hence humid forested catchments yield lower total volumes of water (for wells, springs and streams) than humid catchments covered by shorter forms of vegetation.



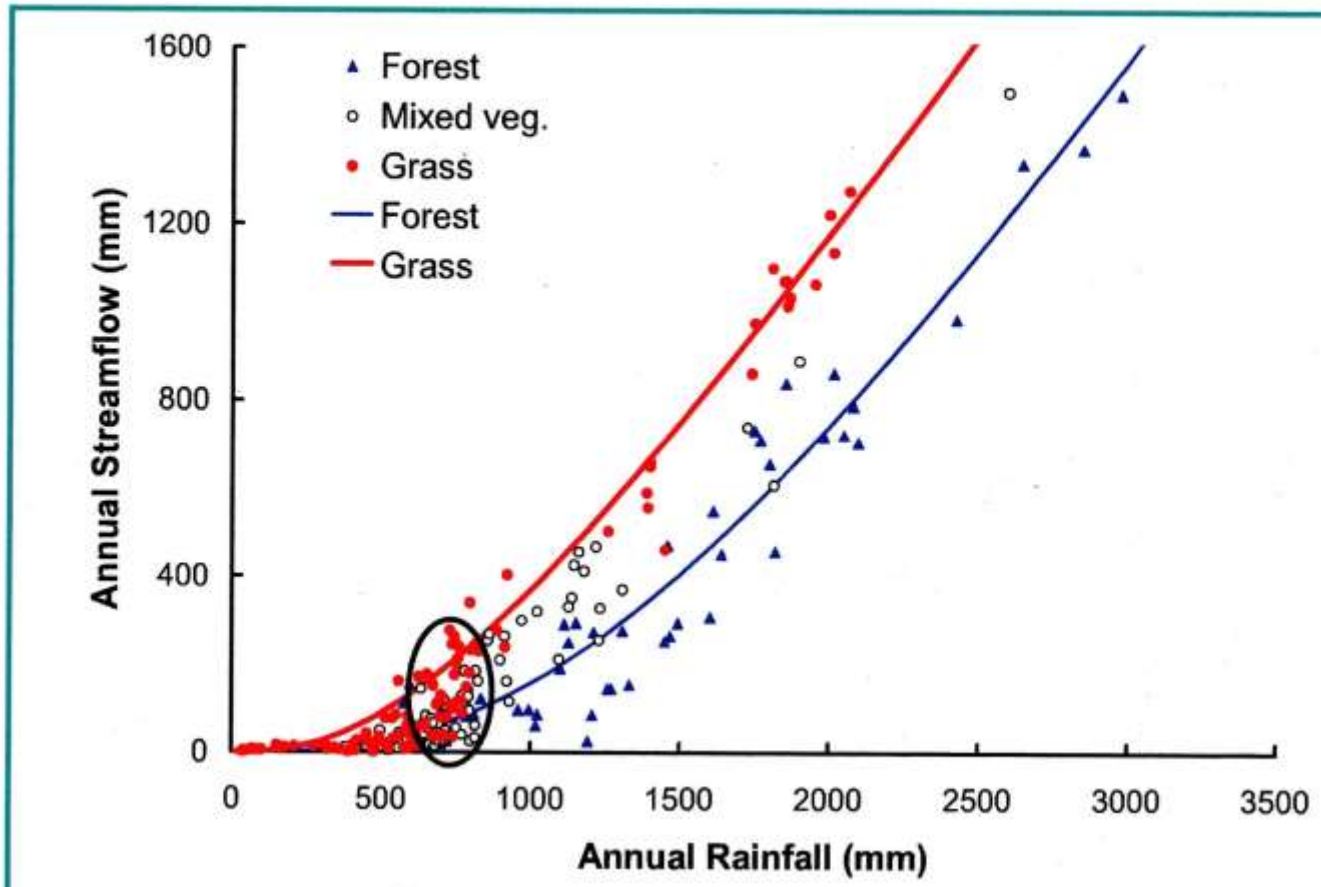
Water usage of different vegetation types (250 catchment studies in 29 countries).

Forests have deeper roots and higher LAI than shorter forms of vegetation

Mean Annual Water Yield

Annual water yield of different vegetation types (250 catchment studies in 29 countries).

Below about 500 mm annual rainfall, there is little difference between forest and grass cover—WHY?



Policy implications: Replacing grass and shrubs with trees is likely to lead to a reduction in total water yield (for wells, springs and streams).

2. Forests and floods

Popular narrative 2: ***Forests reduce floods (and conversely, removal of forests increases floods)***

Scientific consensus: (1) Increases in flood flows as a result of cutting trees are observable for small to medium size rainfall events in small catchments—less than about 10 km^2.

(2) The major determinants of large scale flooding at all catchment scales are: rainfall amount and intensity, antecedent rainfall and catchment geomorphology—not vegetation type.

3. Forests and dry season flows (1)

Popular narrative: 3. ***Forests increase dry season flows (and conversely, removal of forests decreases dry season flows)***

But—there are also some local claims to the contrary

República

Locals blame pine trees for declining water sources

REPUBLICA
KAVRE, Nov 18

Pine trees in the community forests of Chaubas VDC of Kavre district have become a nuisance for the locals. The trees are being held responsible for escalating water scarcity in the VDC and for sucking most of the nearby water sources dry.

"There used to be a water source in Chappani near Chaubas forest where most of us went to get water. Now it is completely

sands of pine trees were planted on the vacant grounds of the VDC. In 10 community forests of the VDC, the number of pine trees far exceeds other trees.

"In 414 hectares of total community forest area, 75 percent of the trees are pine," Lok Bahadur Kuwar Forest Warden of Chaubas Ranger Post.

In order to encourage locals into wood and furniture business, the pine trees plantation program had established a community saw-mill in the VDC, which was the first

tic animals when there is insufficient water for their family in the first place," said Swathani Chimauriya, who heads Naya Goreto Women Development Group.

Even the amount of annual rain fall has been decreasing in our region, informed Chimauriya. "The 2000 ropani fields of Paachkhal VDC was nourished by water source running through the forest but today it is just a sweet memory," said Rajan Adhikari, chief of Rajkulo Consumer Committee.

According to Kavre District

3. Forests and dry season flows (2)

Popular narrative: 3. ***Forests increase dry season flows (and conversely, removal of forests decreases dry season flows)***

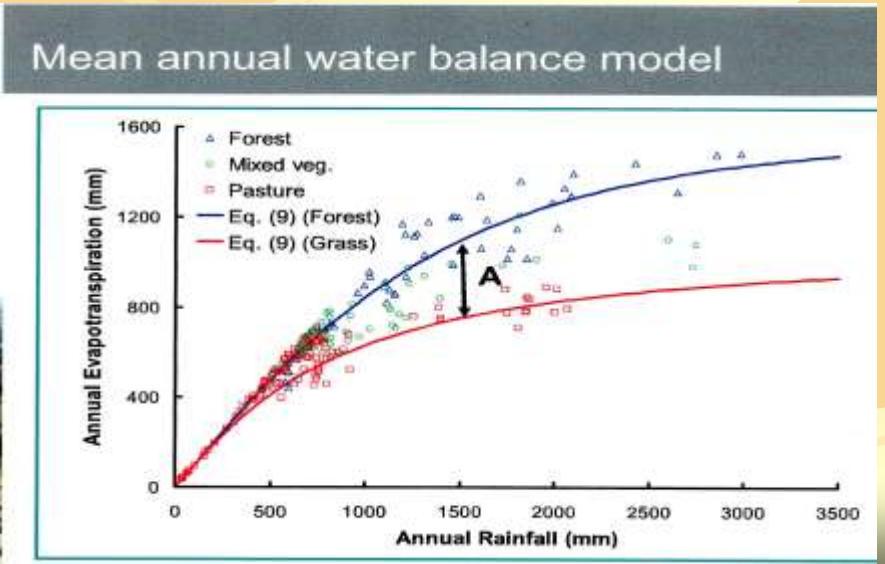
Scientific consensus: (1) Reforestation generally results in a decrease in dry season flows that may last for several decades. The impacts are likely to be most noticeable in small catchments.

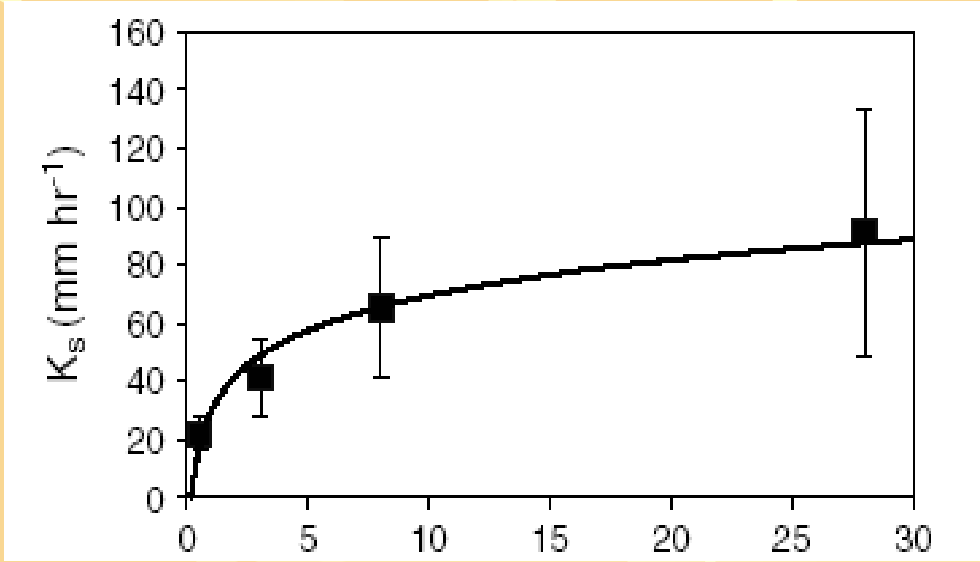
(2) Heavy reduction in forest cover or deforestation generally results in an increase in dry season flows but the longevity of the increase will depend on the future condition of the catchment, particularly the infiltration capacity of the surface soil.

3. Forests and dry season flows (3)

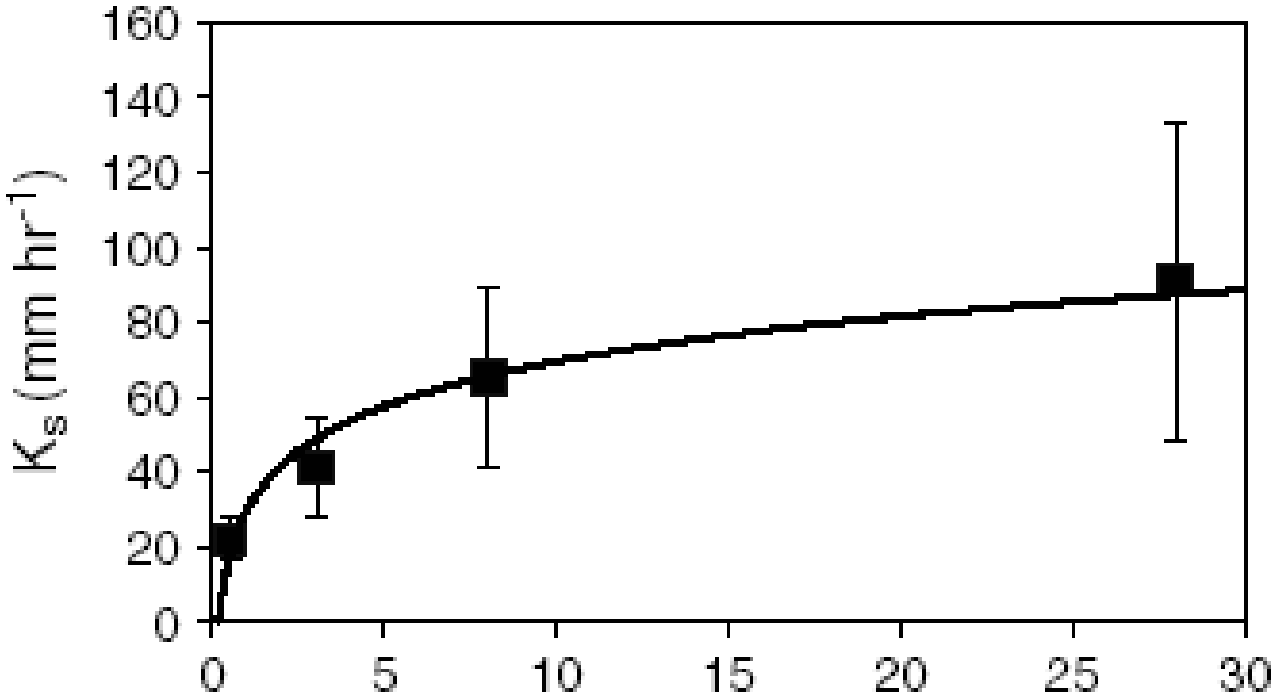
Caveat: Reforestation of catchments with heavily compacted soils can have variable effects on low flows depending on the ability of the soils to become more permeable and to absorb increased amounts of rain as reforestation proceeds.

There is a trade-off between:
> net water gain by improved infiltration
< extra ET (water usage) after tree planting





Increase in infiltration capacity of surface soils following site protection



Increase in infiltration capacity of surface soils following site protection

But:

Infiltration capacity needs to be balanced against rainfall intensity

So:

- What is the rainfall intensity?
- What proportion of the rainfall will not infiltrate into the soil surface?
- What is the permeability of the sub-surface soil?

4. Forests and erosion

Popular narrative 4: ***Forests reduce erosion (and conversely, removal of forests increases erosion)***

Scientific consensus: (1) Generally speaking, well managed forests, free of grazing and other disturbance, provide good catchment cover that minimizes hill slope erosion and produces high quality water free of sediment.

(2) Trees *per se* do not prevent erosion and under some conditions significant surface erosion can occur under undisturbed forests. The condition of the soil surface, and particularly the retention of understory vegetation, grasses and litter are the key determinants of surface erosion on hill slopes.

Policy implications

- There is a disconnect between the “popular narrative” and the science of forest-water relationships.
- The “popular narrative” has often achieved the status of a “myth” and provided a “charter for action” to define policy and set agendas for action, e.g. Nepal in 1970s/80s.
- In determining policy settings, we need to consider:
  - (i) location-specific factors, and
  - (ii) the aspects of forest-water relationships (water yield, floods, dry season flows, erosion, etc.) that are of concern.


Thank you