

The value of trees for...

Water, Carbon, Biodiversity and Food security



Importance of open forests, woodlands, agroforests, and degraded areas

- TripleL – Vi Forest, Kenya (<http://www.triplel.se/>)
- Sida Capacity building – Tanzania, Mozambique (Ethiopia, Burkina Faso)
- IKEA funded rainforest restoration project – Borneo

Ulrik Ilstedt, Aida Bargués-Tobella, Anders Malmer, Daniel Murdiyarso, Douglas Sheil, Gert Nyberg, Hjalmar Laudon, Hugues Baziè, Josias Sanou, Laura Benégas, ...

No. 1 Research Question Forest Management:

How can degraded tropical ecosystems be restored to meet the objectives of biodiversity conservation, ecosystem function, ecosystem resilience, and sustainability of rural livelihoods?



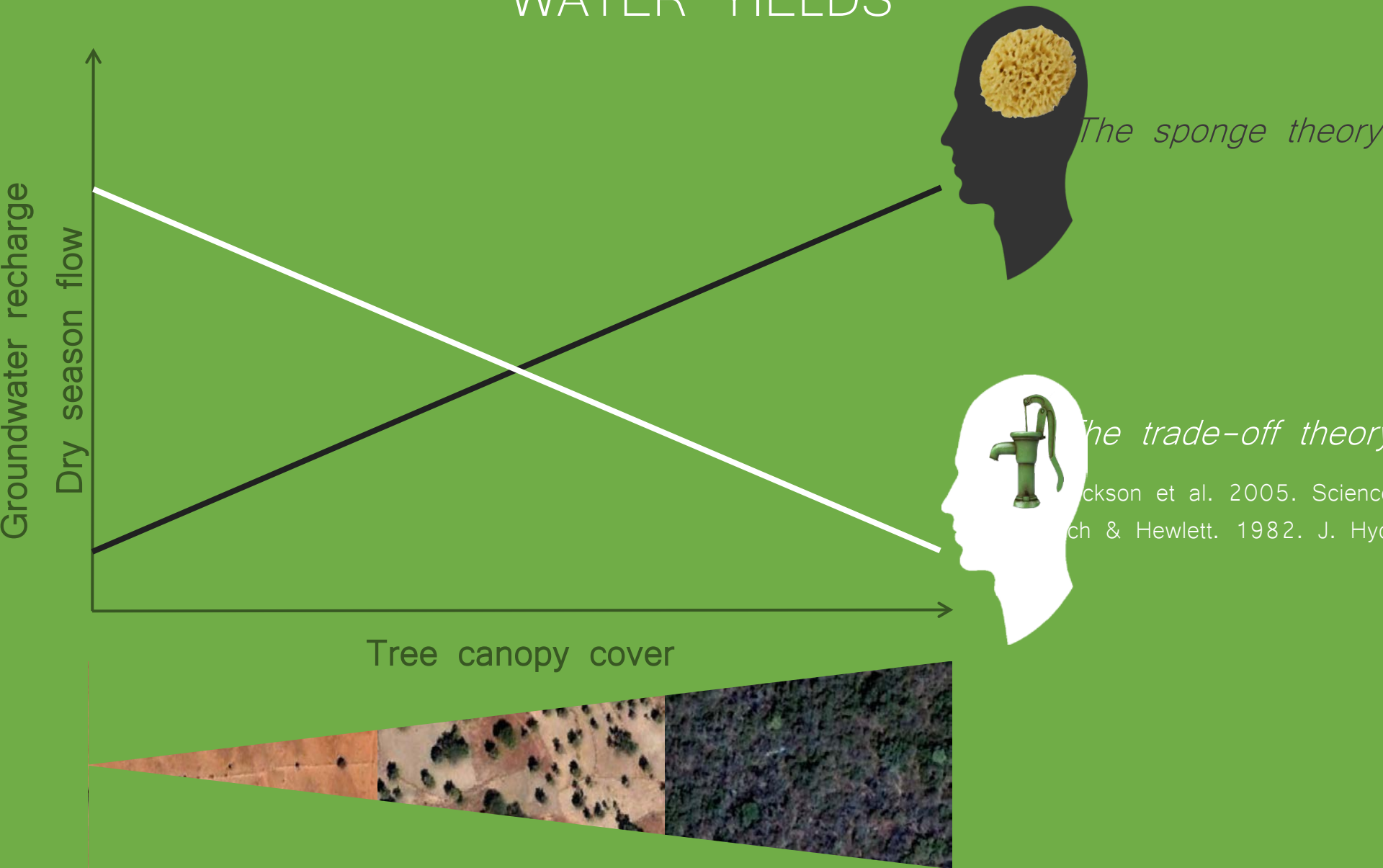
CONTRASTING VIEWS ON (DE)FORESTATION AND WATER YIELDS



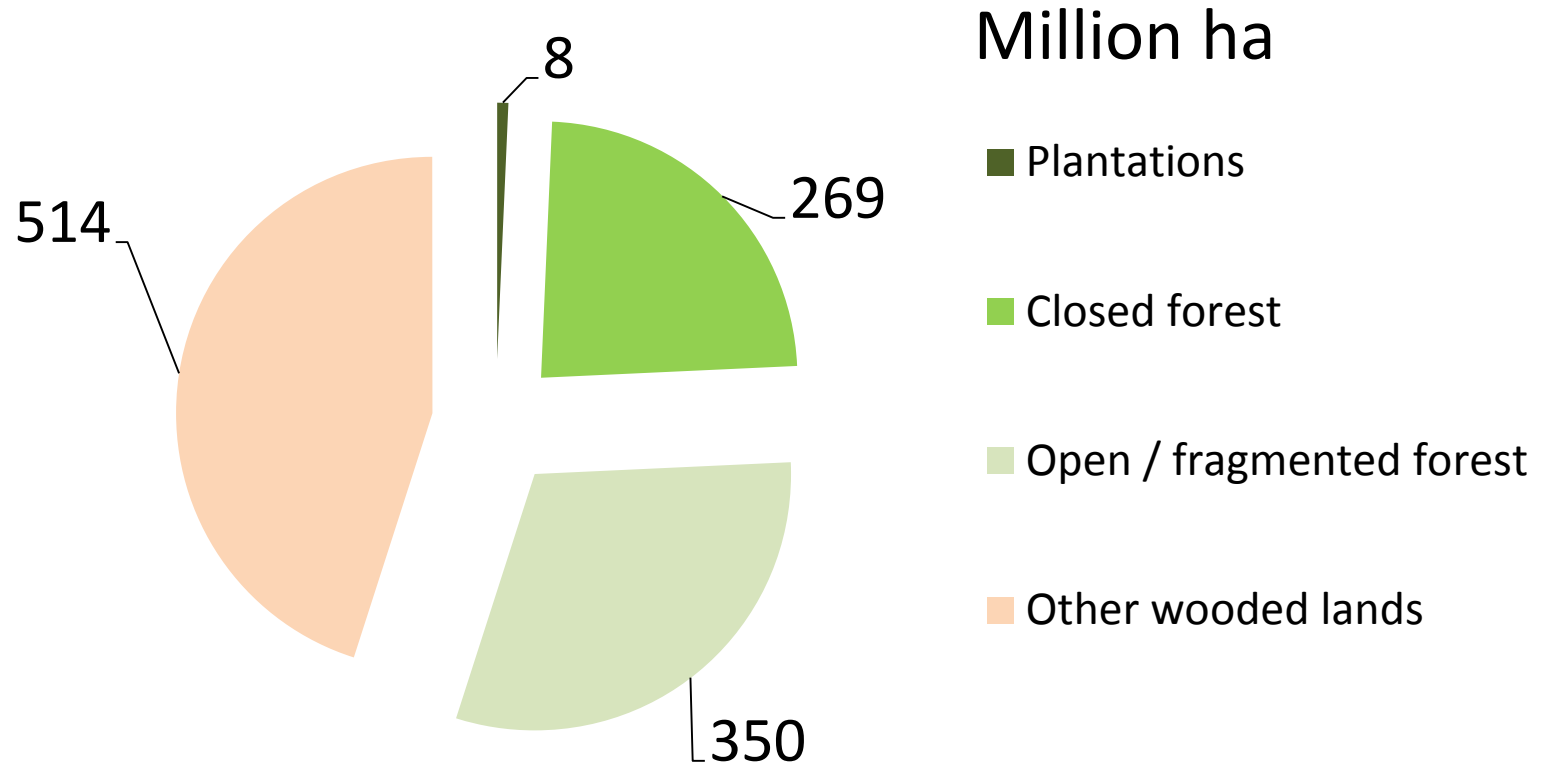
Forests maintain dry season
flows
Deforestation dries up streams
Forestation increases water yields
Deforestation increases water yields
Forestation reduces water yields
Deforestation increases water yields in dry season



CONTRASTING VIEWS ON (DE)FORESTATION AND WATER YIELDS



Closed vs. open forest - Africa



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Forest geography

Mapping forests of the dryland biome

WOLFGANG KAEHLER/LIGHTROCKET VIA
GETTY IMAGES

RESEARCH

FOREST ECOLOGY

The extent of forest in dryland biomes

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Çağlar Bassüllü,¹² Adia Bey,¹ Monica Garzuglia,¹ Luis G. García-Montero,¹³
Nikée Groot,³ Greg Guerin,⁶ Lars Laestadius,¹⁴ Andrew J. Lowe,¹⁵ Bako Mamane,¹⁶
Giulio Marchi,¹ Paul Patterson,¹⁷ Marcelo Rezende,¹ Stefano Ricci,¹ Ignacio Salcedo,¹⁸
Alfonso Sanchez-Paus Diaz,¹ Fred Stolle,¹⁹ Venera Surannaeva,²⁰ Rene Castro^{1*}

Global dryland forests

467 million ha
never reported



Global dryland forests

1 327 million ha
> 10% tree-cover



Global dryland forests

550 million ha
10-40% tree-cover

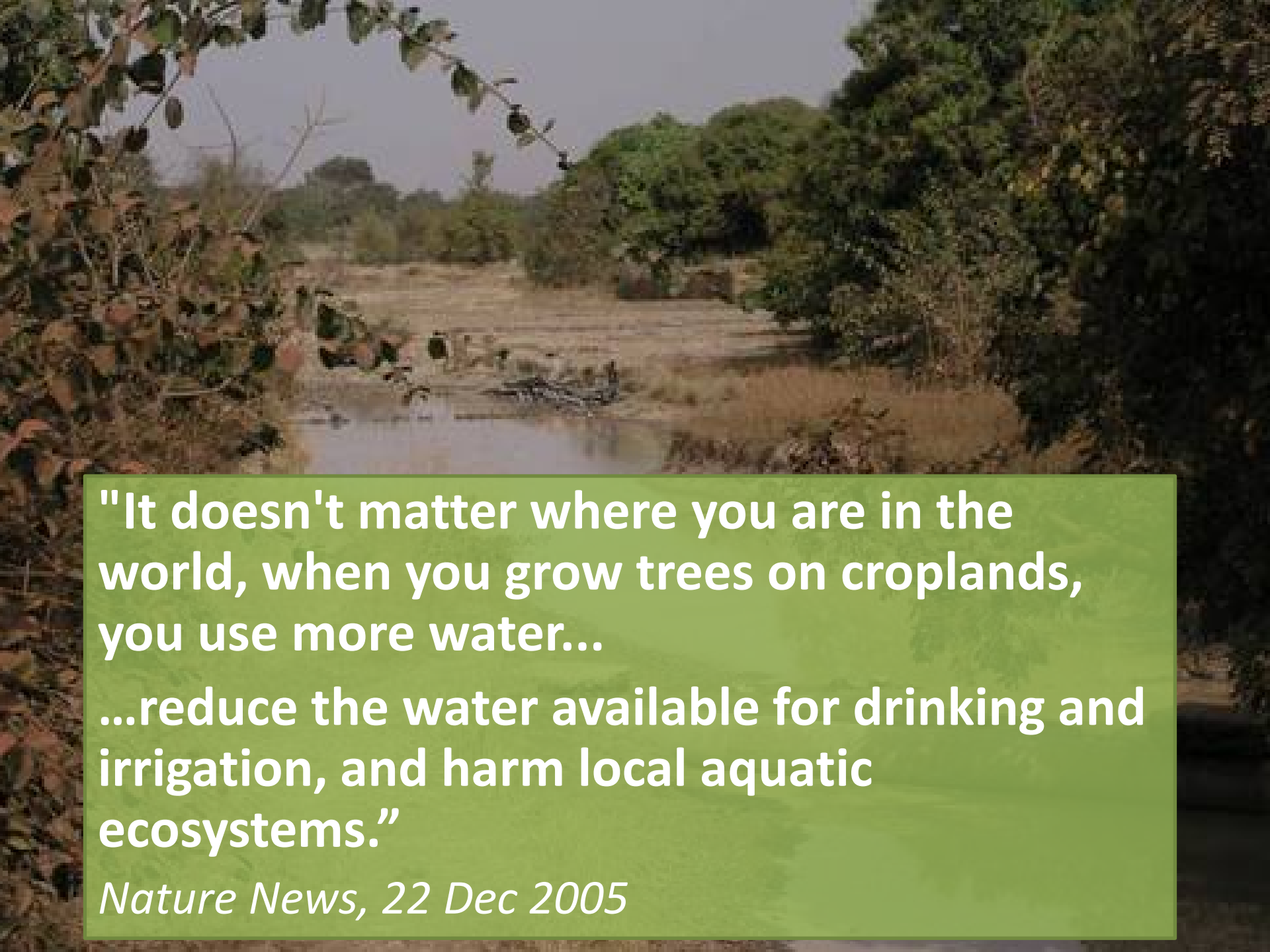


The Public View on Trees and Water:

“REDD could therefore contribute towards gradual restoration and sustenance of water flows...contribute to averting the looming water stress in East Africa.”

Kimbowa et al. 2011. REDD Net



A photograph of a dry, arid landscape. In the foreground, there is a small, shallow pool of water reflecting the sky. The surrounding area is covered with dry, brownish vegetation and sparse green shrubs. In the background, there are more trees and a clear sky. The overall scene suggests a water-scarce environment.

"It doesn't matter where you are in the world, when you grow trees on croplands, you use more water...

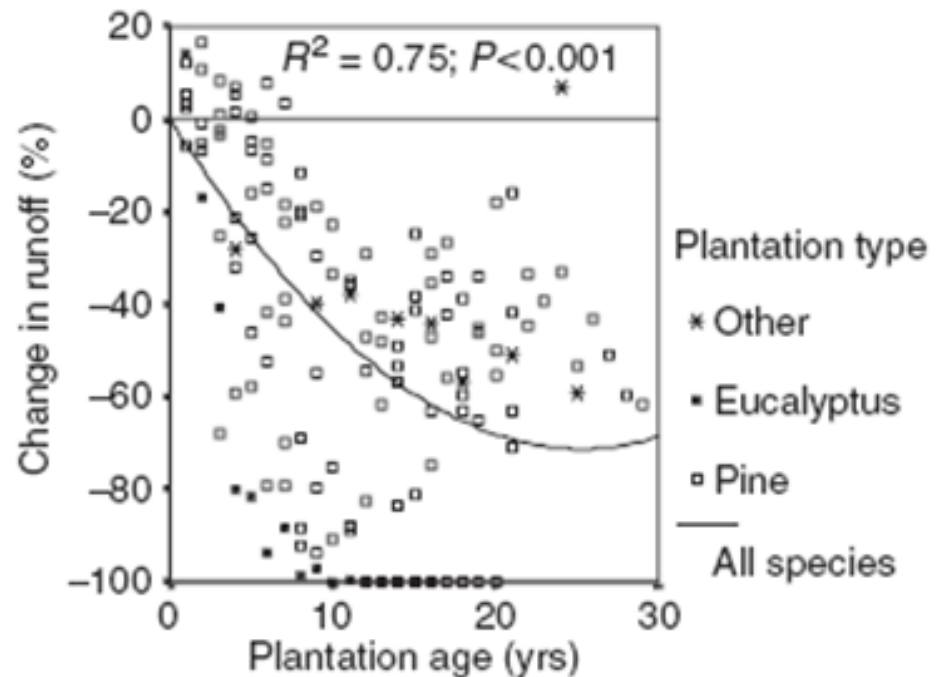
...reduce the water available for drinking and irrigation, and harm local aquatic ecosystems."

Nature News, 22 Dec 2005

506 'observations globally'

- Annual stream flow decrease 33-44%
- Proportionally worse at dry sites
- Dry season: larger reduction

Grasslands



But less than global

(Jackson et al 2005; Ilstedt et al 2007; Malmer et al. 2010)

- 506 observations 'globally' BUT only 17 locations
- Only 3 locations in the tropics
- *None on degraded sites*
- None in the dryer tropics (<1000 mm/yr)
- All but three planted with *Eucalyptus* or *Pinus*



The effect of afforestation on water infiltration in the tropics: A systematic review and meta-analysis

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2-5 times higher infiltration capacity in forests or agroforests
(than in croplands/pastures)

Soil infiltration capacity Burkina



Under Trees

Small Gap

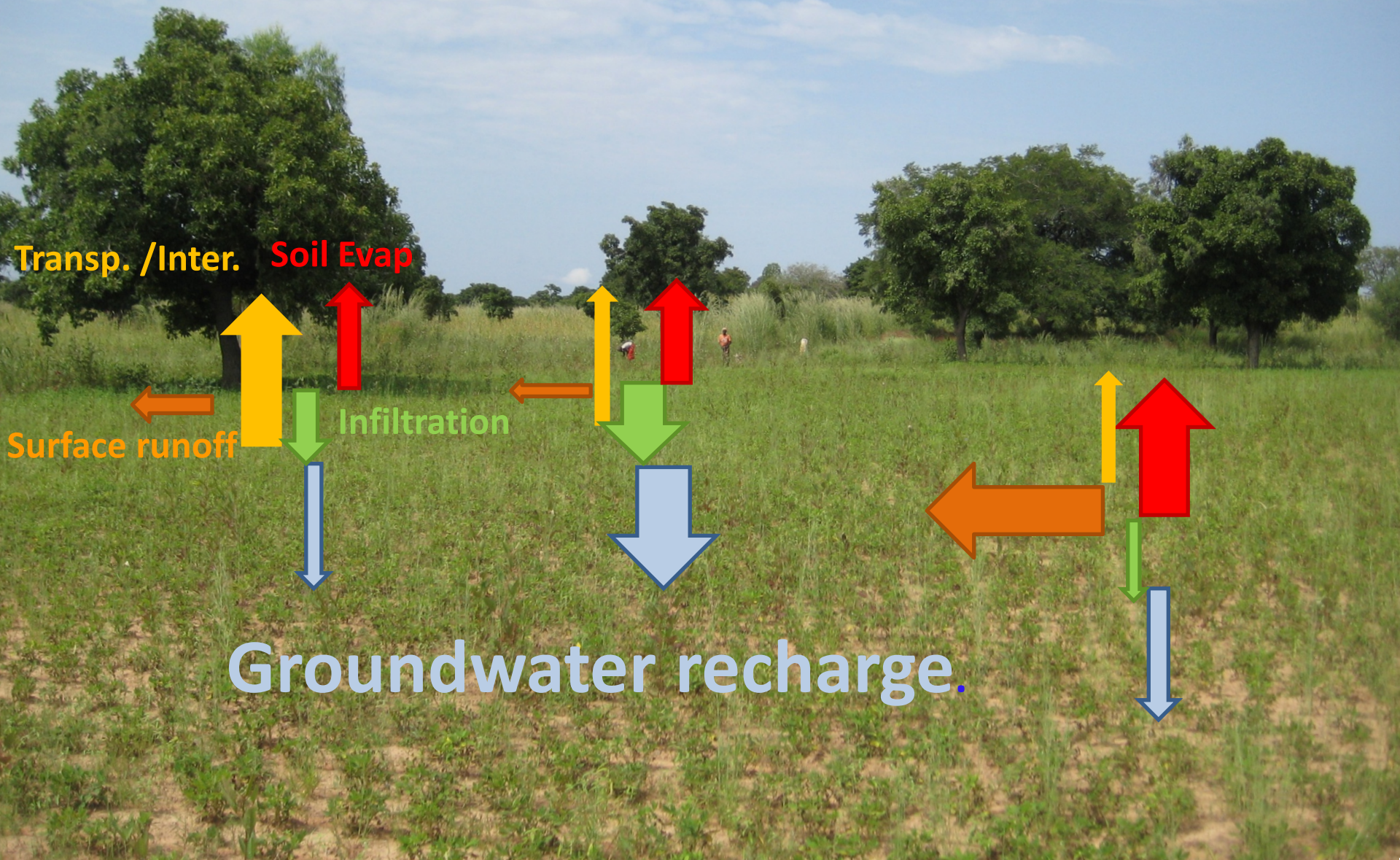
Large Gap

Transp. /Inter. Soil Evap

Surface runoff

Infiltration

Groundwater recharge.



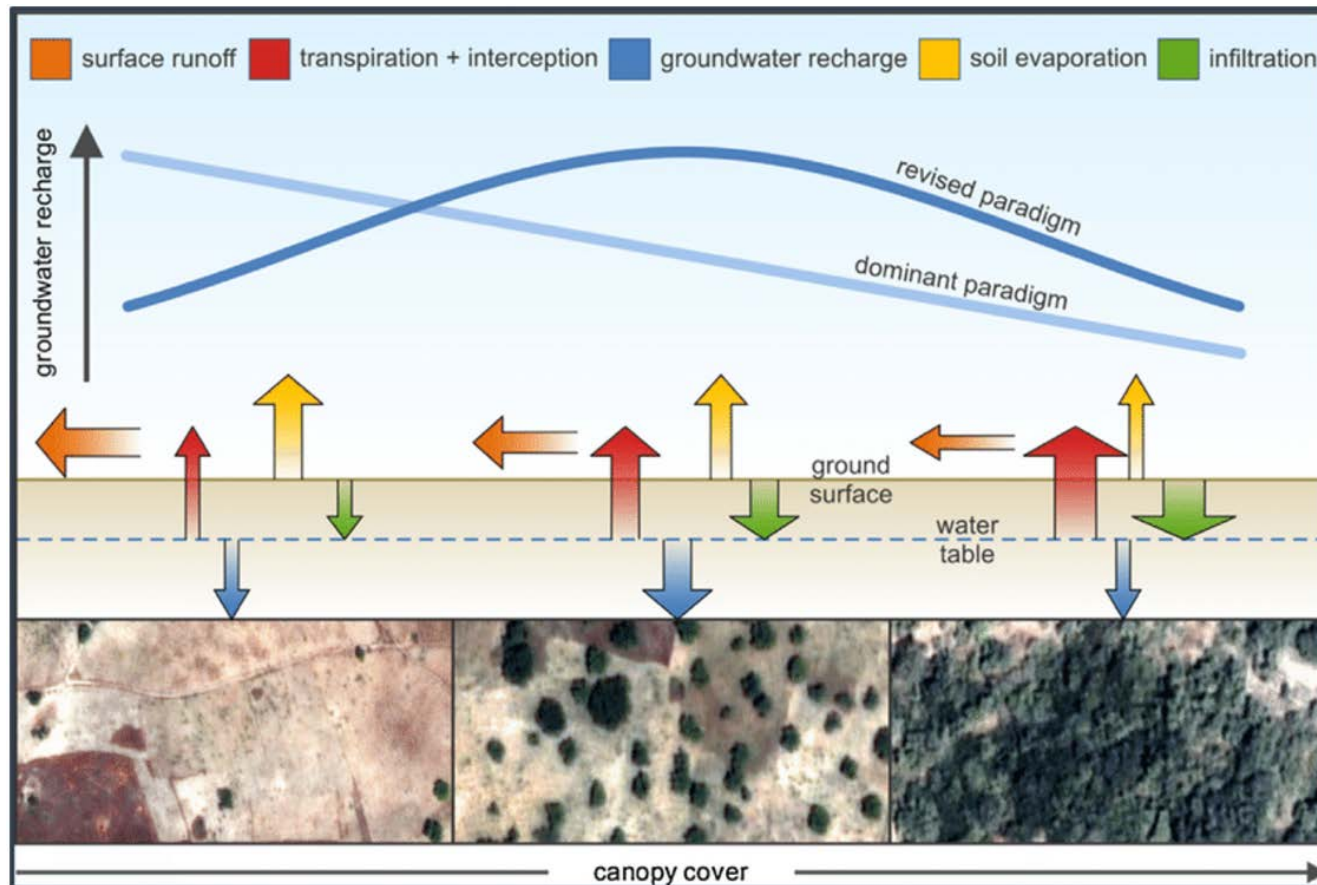
OPEN

Intermediate tree cover can maximize groundwater recharge in the seasonally dry tropics

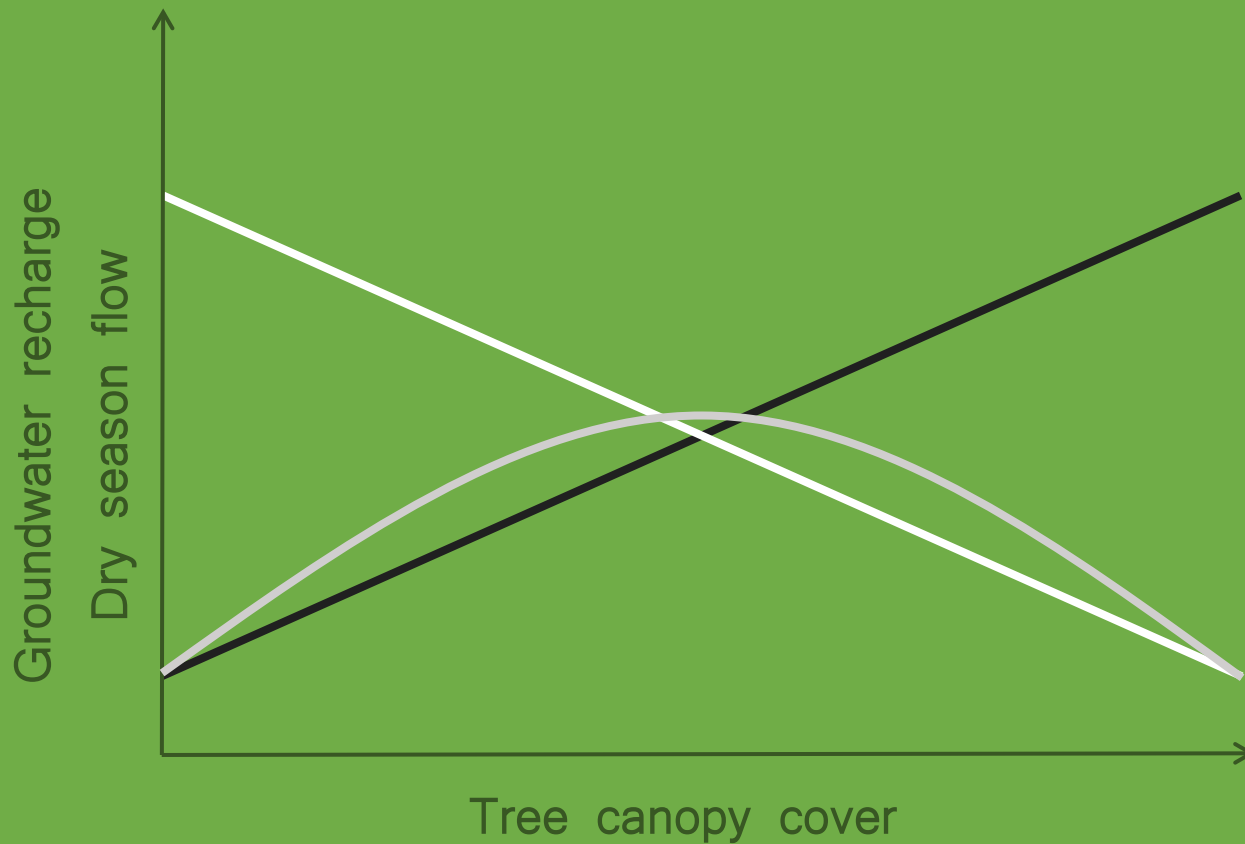
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Conclusion: More trees can improve groundwater recharge



The sponge theory



The optimum tree cover theory



The trade-off theory

