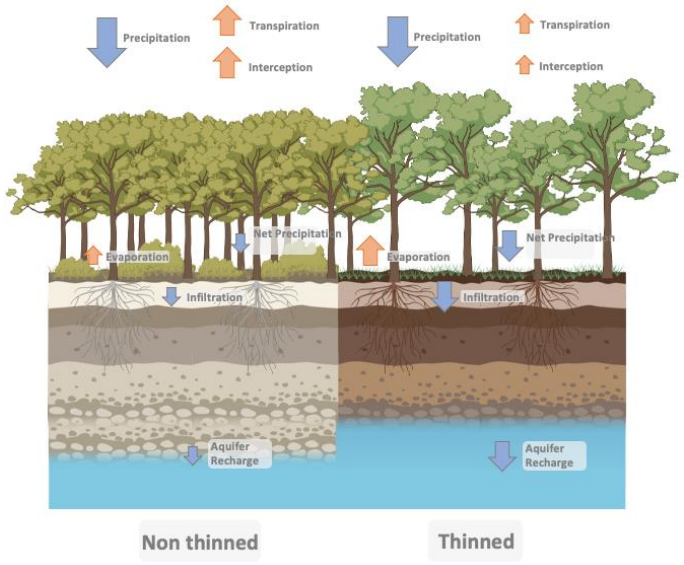
IUFRO INTERNATIONAL UNION OF FOREST RESEARCH ORGANIZATIONS

All-IUFRO Conference
21-23 September 2022; online and Vienna, Austria

IUFRO Forest and Water Task Force



Thinning and Hydrology

A global synthesis on the effects of thinning on hydrological processes: implications for forest management

- Antonio del Campo
- Kyoichi Otsuki
- Yusuf Serengil
- Juan A. Blanco
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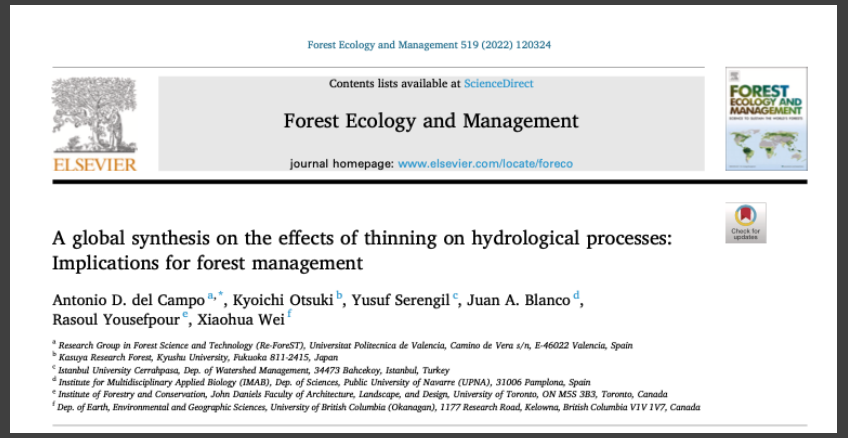

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A global synthesis on the effects of thinning on hydrological processes: Implications for forest management

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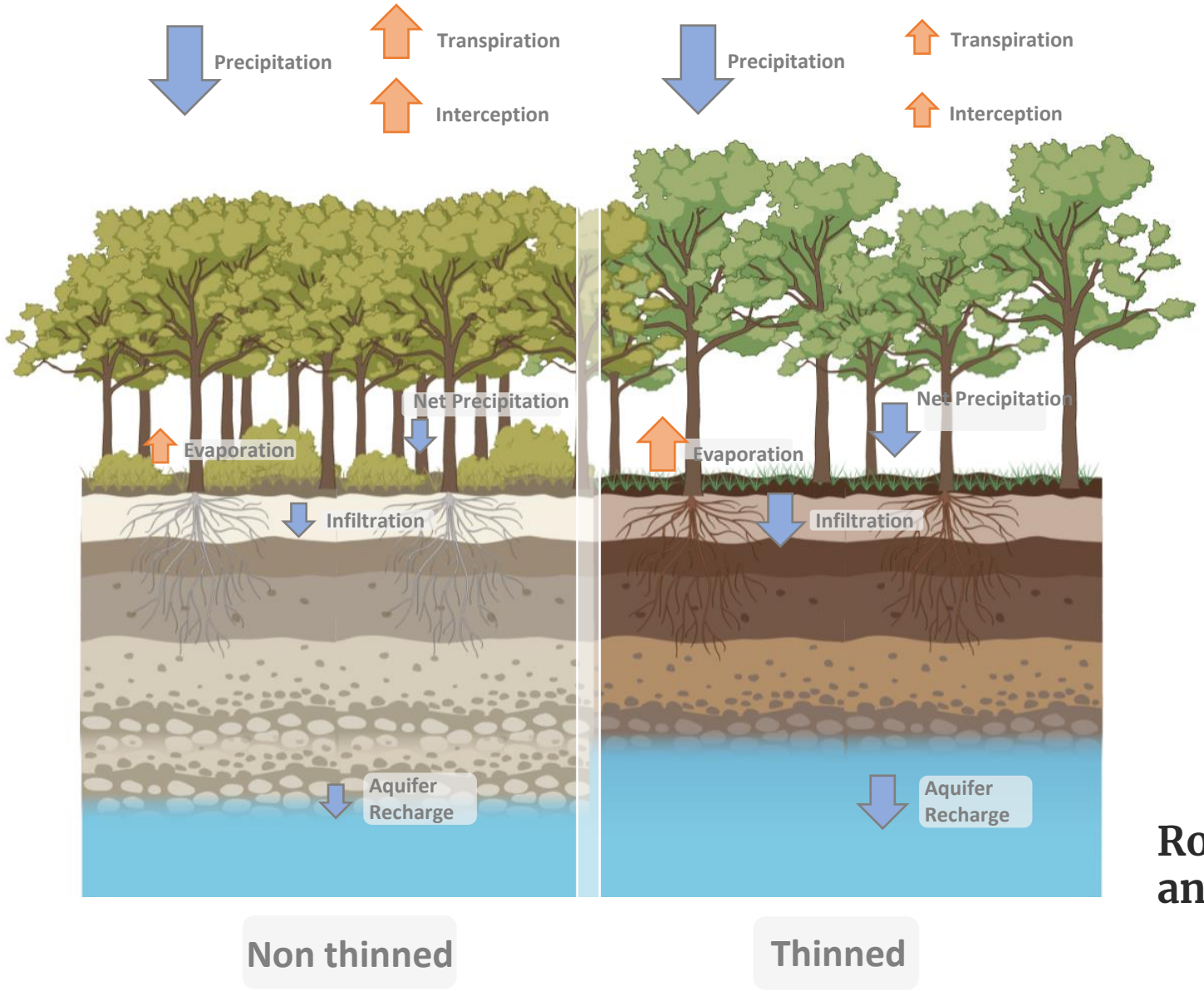
WHY?



Forest Management and water

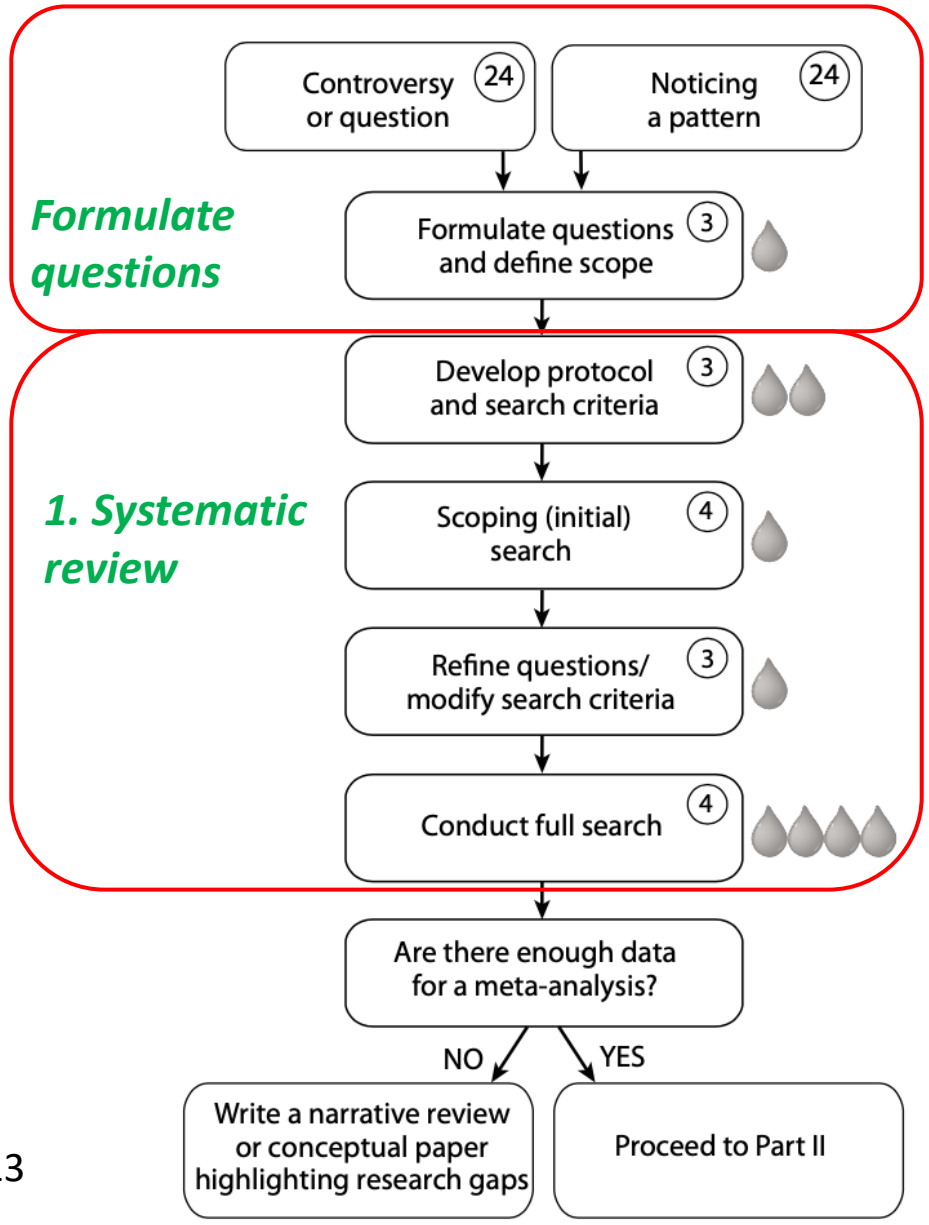
- Hibbert's hypotheses (Goeking & Tarboton 2020):

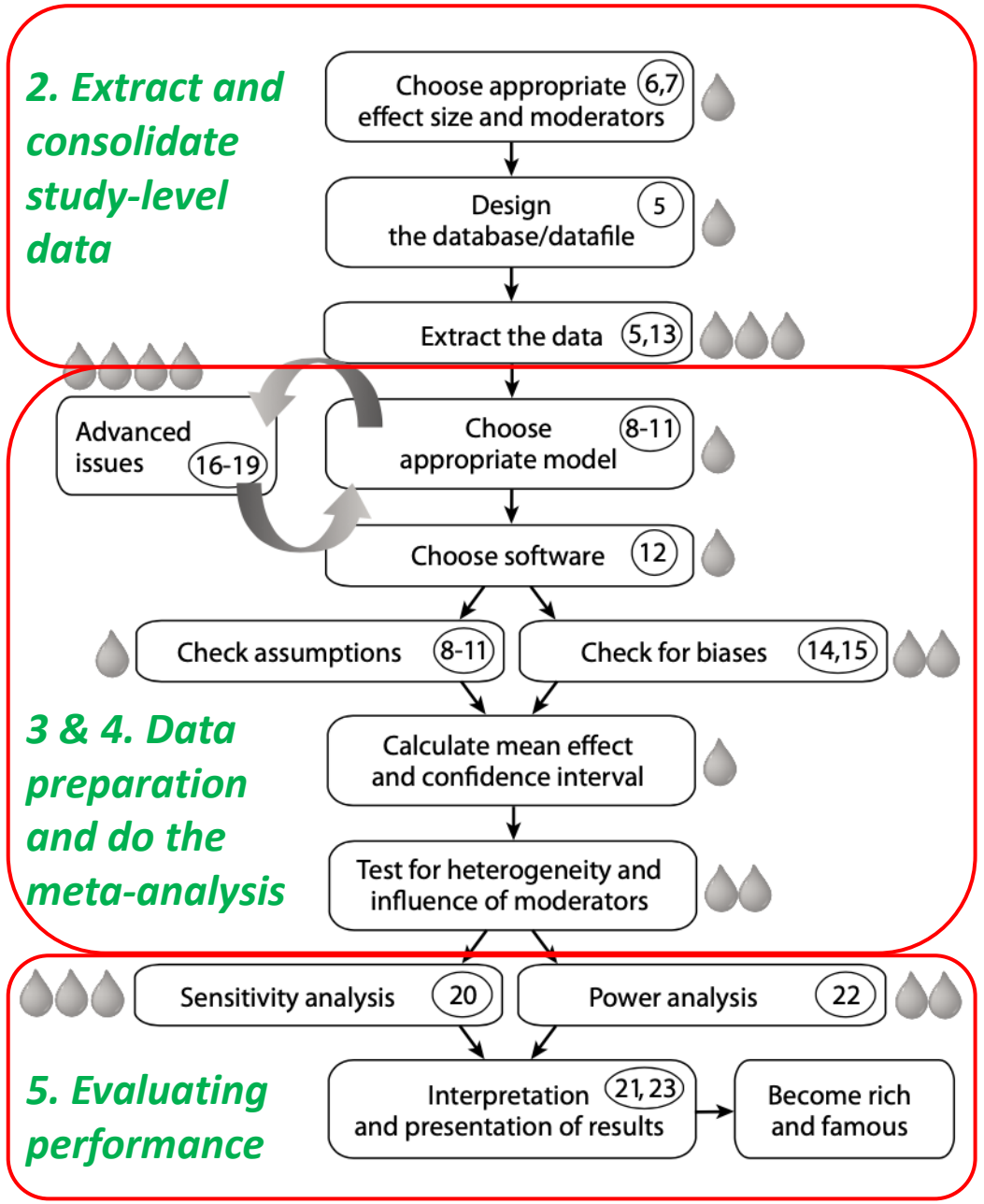
1. Reduction of forest cover increases water yield.
2. Establishment of forest cover on sparsely vegetated land decreases water yield.
3. Response to treatment is highly variable, and, for the most part, unpredictable.

Role of thinning to increase resistance and resilience of forests to global change

HOW?

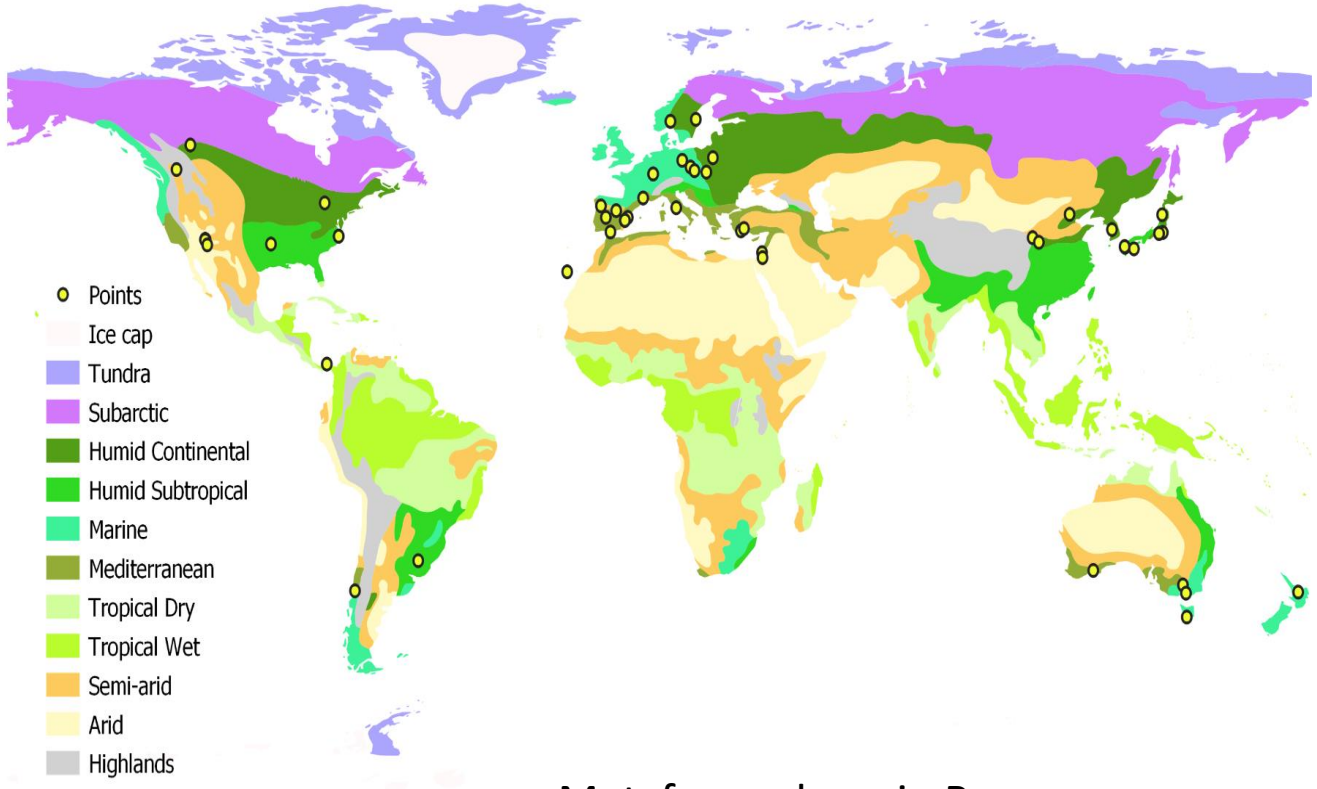
Meta-analysis

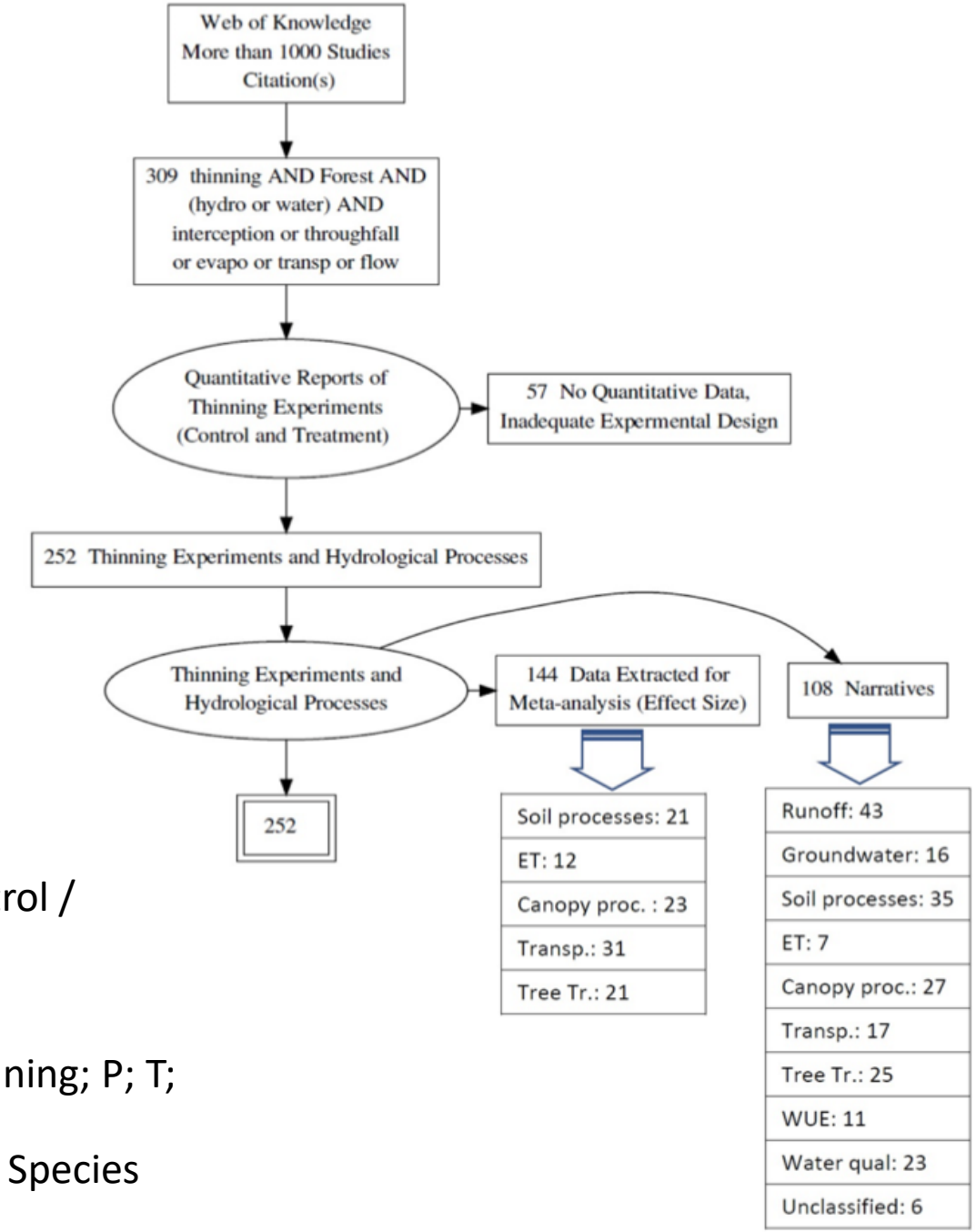




Koricheva et al., 2013

HOW ?

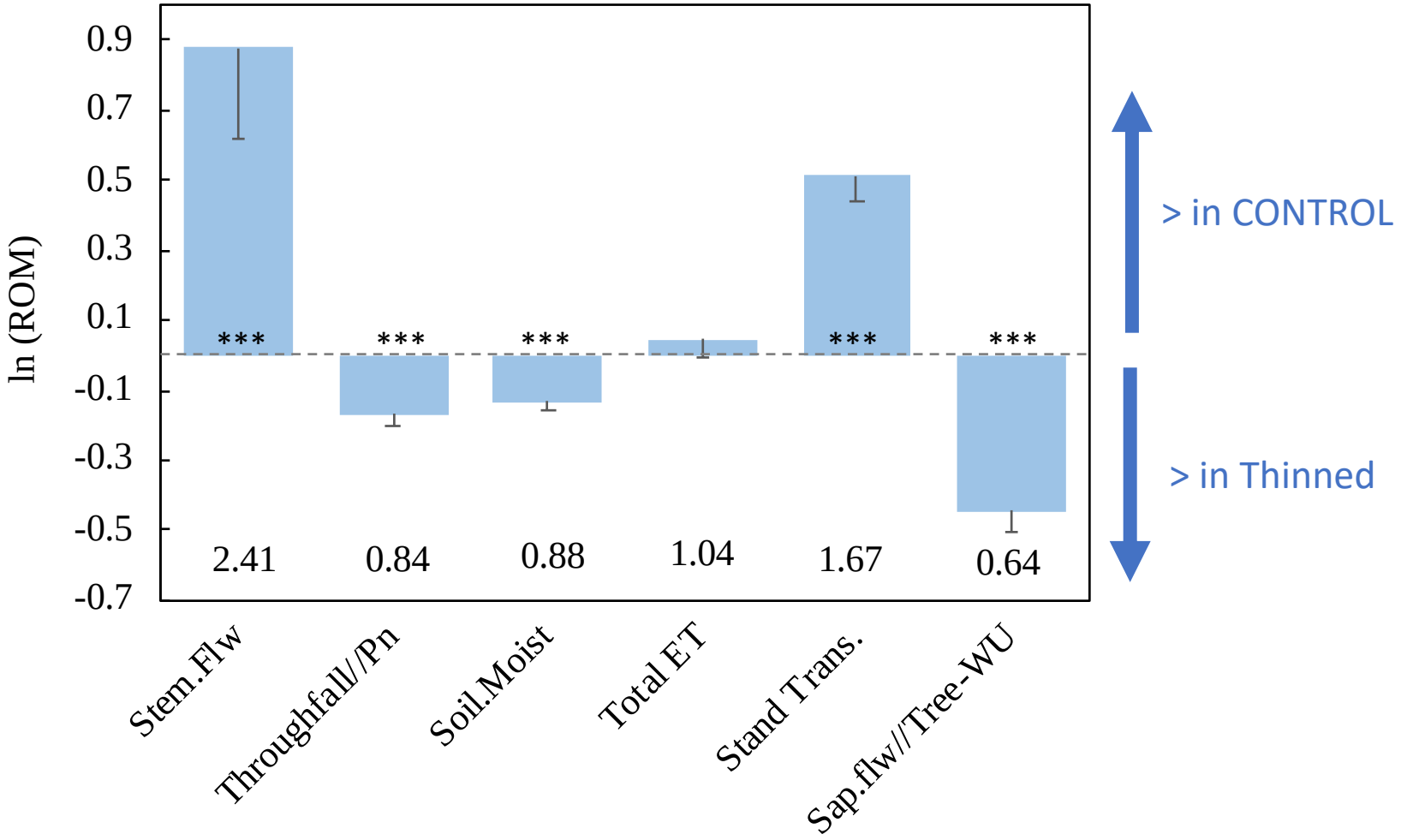




- Metafor package in R
- Effect size: ratio of means (RoM) = Control / Thinned
- **Moderators**:
  - Thinning Intensity; Years since thinning; P; T; AI; PET; Age
  - Forest type, Köppen–Geiger; Main Species

WHAT ?

In the hydrological processes meta-analyzed



Hydrological process
Stemflow
Throughfall and Net Precip.
Soil Moisture
Total ET
Stand Transpiration
Tree-WU

WHAT ?

In the **moderators** of the hydrological processes meta-analyzed

Hydrol. Process	Moderator	Intercept	R^2
Throughf. (40)	Intensity (%BA)	38.5	13.9%
	Years Thin	3.48	23.6%
Soil Moist. (55)	Intensity (%SD)	55.8	25.7%
	Years Thin	5.13	12.8%
	AI	0.55	10.2%
Transp. (69)	Intensity (%SD)	47.2	36.0%
	Years Thin	6.52	15.6%
	P	710.5	7.2%
	T	13.1	8.5%
	AI	0.56	11.1%
	Age	47.4	8.5%
Sap Flow (57)	Intensity (%SD)	52.6	21.0%
	P	1059.9	13.7%

WHAT ?

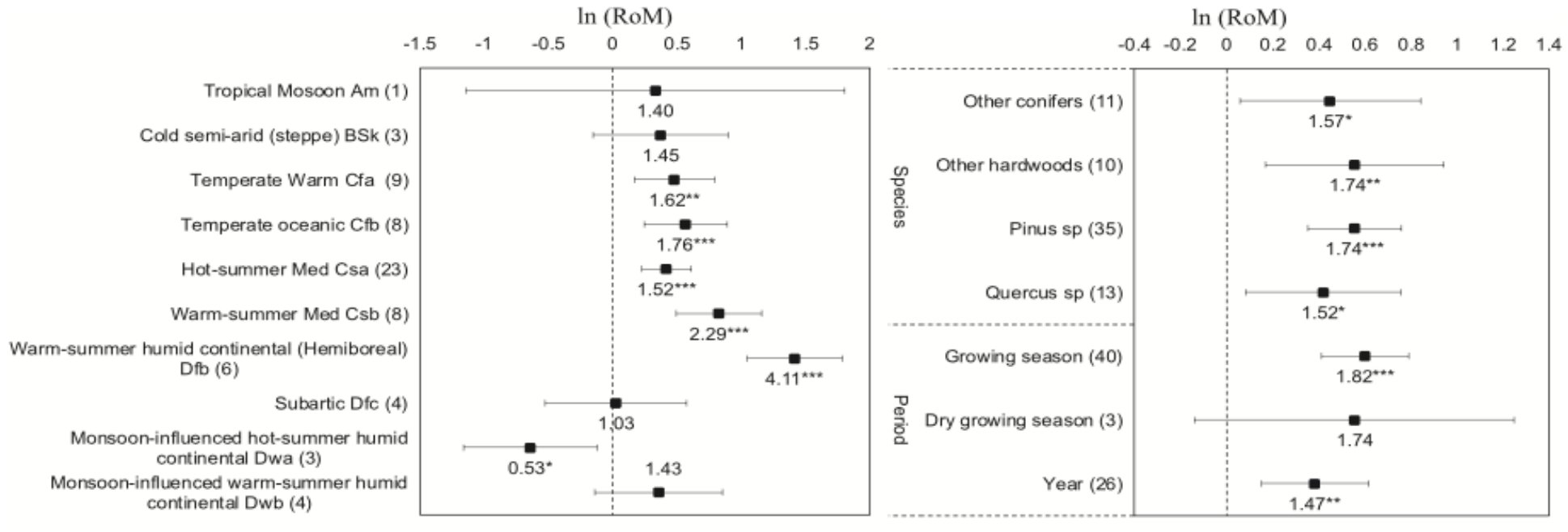
In the **moderators** of the hydrological processes meta-analyzed

> in Thinned

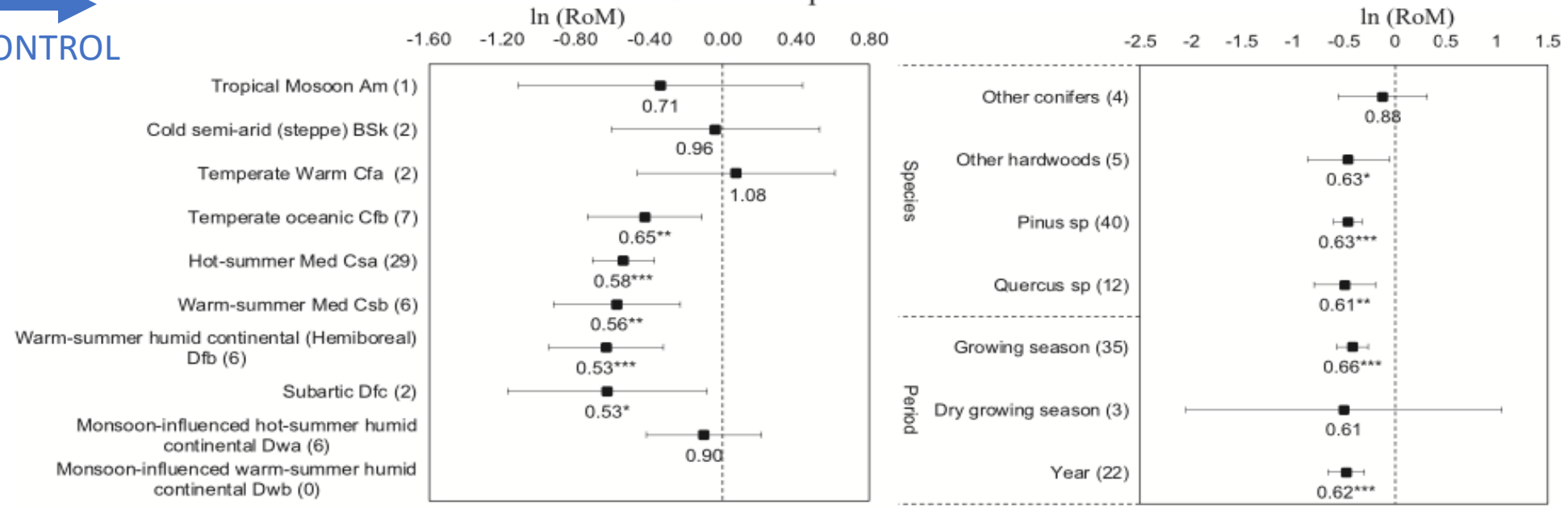
> in CONTROL

Stand Transp.

Tree water use



Stand transpiration



Tree water use and sap flow

WHAT ?

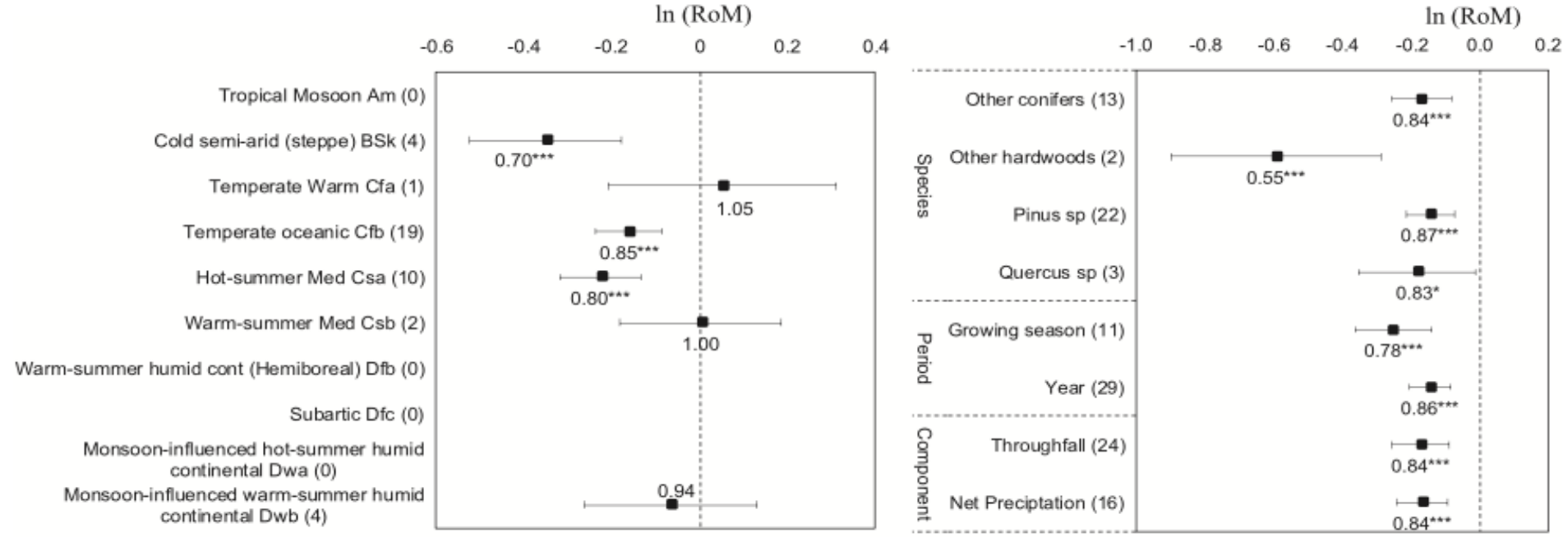
In the **moderators** of the hydrological processes meta-analyzed

> in Thinned

> in CONTROL

Throughfall

Soil moisture



CONCLUDING

- Significant effect of thinning on RP, SM, T, and SF
- Thinning intensities threshold 40–60%
- Thinning interval 3–8 years to sustain significant effects
- Thinning an effective mean for remaining trees to cope with climate change (drought)
- Large variations subject to climate, local site conditions and thinning operations.
- Need to report full results (mean, SD, and N) in units used in forest ecohydrology, i.e., mm, volumetric content, liter/tree, and meaningful timestep (day, growing season, year).

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