CAUSAL EFFECTS OF HUMAN-INDUCED PRESSURES ON CHANGES AND STATUS OF RIPARIAN VEGETATION

AN EVIDENCE-BASED REVIEW

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RIPA-1 : First International Conference on Riparian Ecosystems Science and Management
6 th to 7th April 2022 in Bratislava (Slovakia)

INTRODUCTION

- Riparian corridors frequently support **multiple pressures** which alter the taxonomic, landscape and functional characteristics of riparian vegetation

- A precise **knowledge of causality** between pressures and vegetation changes is needed to design proper management options

- The design of **conceptual diagrams** linking altered variables and vegetation status must be at the beginning of the **understanding of the involved process-based relationships**

AIMS OF THE WORK:

- Create **simplified diagrams** stating potential effects of pressures on vegetation atttributes

- Explore **scientific evidences** of vegetation responses to pressures

- Identify **gaps and limitations** of the existing literature reporting eco-evidenced vegetation responses

METHODOLOGY

Causal Criteria Analysis Approach

Eco-Evidence framework *(*Nichols *et al.,* 2011)

1º. Identification of main pressures and impacts

2º. Literature review and expert criteria

3º. Simplified generalized conceptual model

4º. Arrangement of drivers and responses

5º. Classfication by study types

6º. Scoring evidences

7º. Simplified specific diagramms relating pressures with veg responses

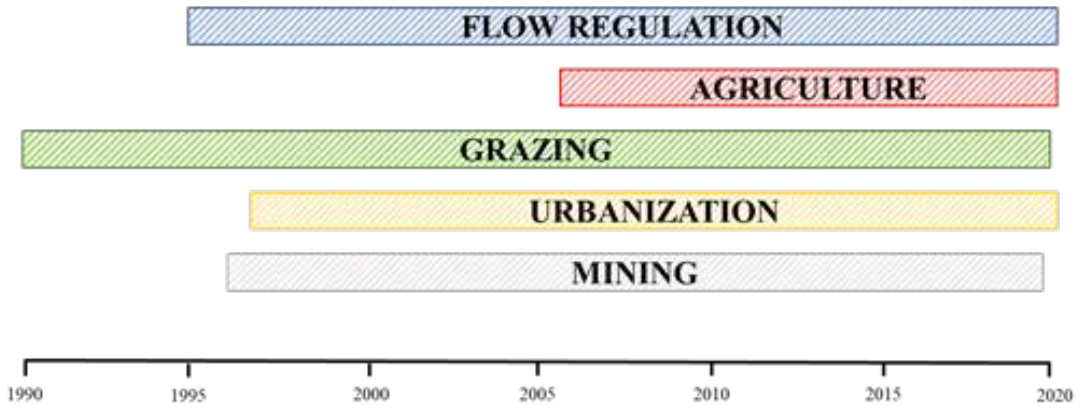
Web of Science + Scopus, since 1970 : Peer-reviewed literature

("riparian vegetation") AND (response OR effect OR change) AND (river OR riparian OR floodplain OR stream) NOT (coast* OR estuar* OR mangrove OR tidal), AND (type of pressure))

Searching for observed data, Results from models were excluded

METHODOLOGY

STUDIED PRESSURES



Number of peer-reviewed articles an type of article

(BA: Before-After; CI: Control-Impact; AI: After-Impact; BACI: BeforeAfter-ControlImpact; SG: Spatial gradient)

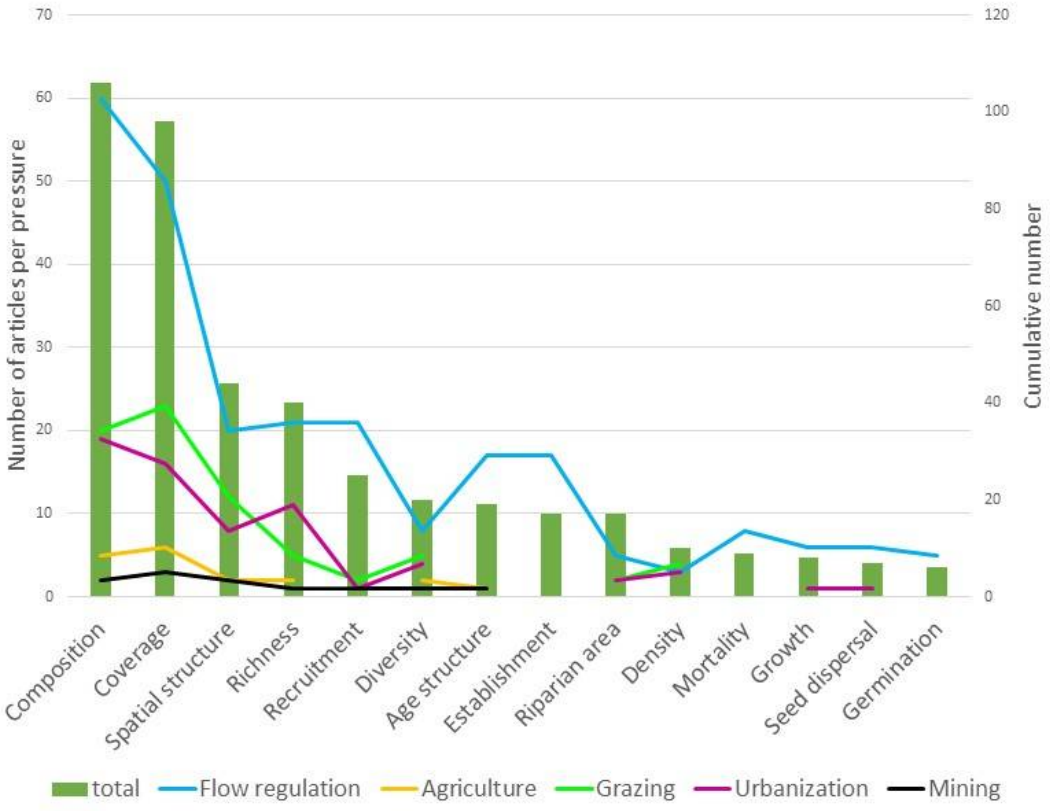
PRESSURE	Total reviewed articles	Selected articles for Eco-evidence	Type of article				
			BA	CI	AI	BACI	SG
FLOW REGULATION	304	88	36	28	7	10	7
AGRICULTURE	106	15	7	6	1	1	0
GRAZING	213	41	5	28	1	7	0
MINNING	52	7	2	3	0	1	1
URBANIZATION	181	26	6	6	1	0	13
TOTAL	856	177	56	71	10	19	21

METHODOLOGY

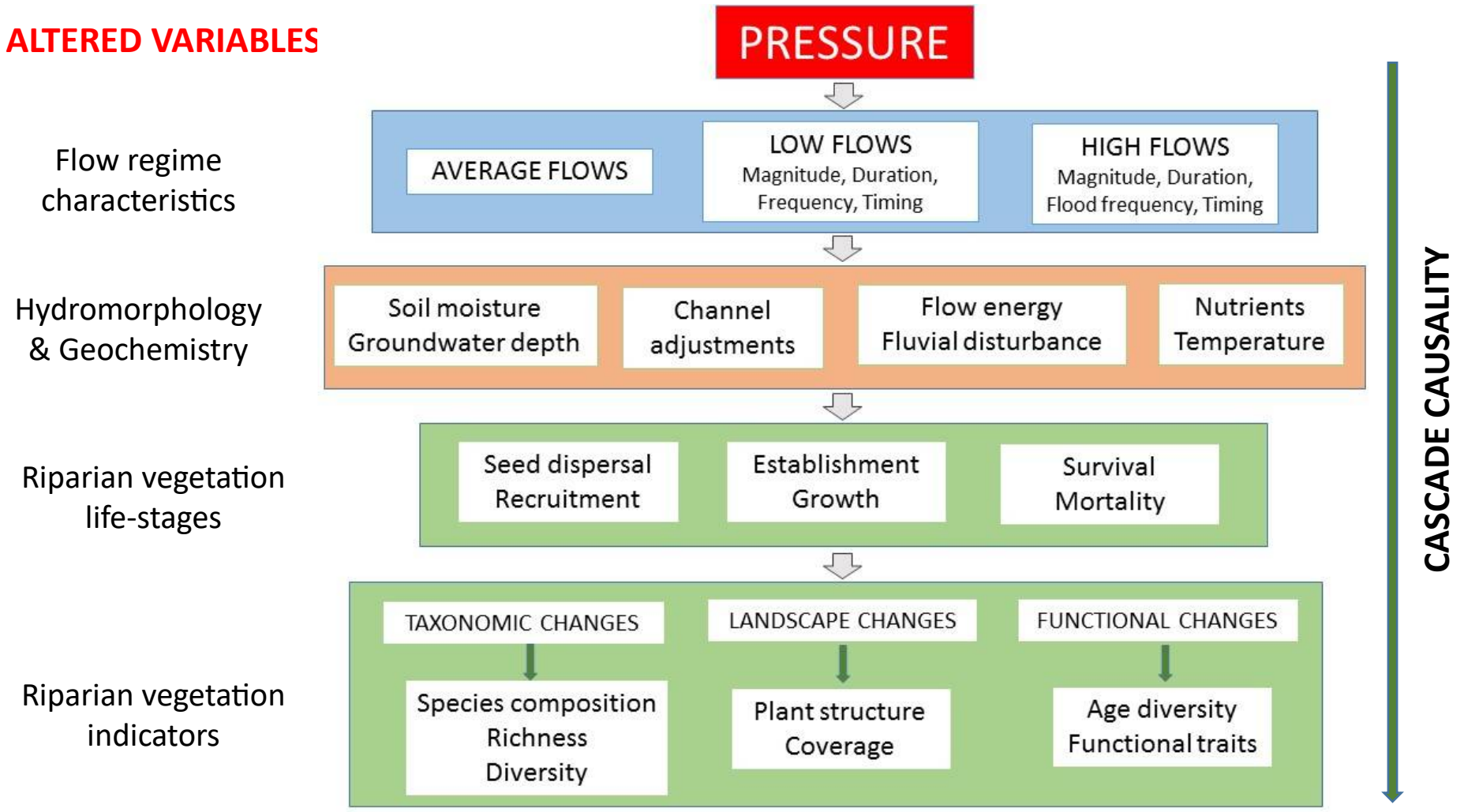
ALTERED VARIABLES

PRESSURE	VARIABLE	Nº art.	%
FLOW REGULATION	High flows	38	43
	Low flows	25	28
	Average flows	24	27
	Flood frequency	18	20
	Sediment supply	18	20
	Flood magnitude	13	13
	Timing	11	13
AGRICULTURE	Agricultural area	15	100
	Suspended solids	6	40
	Nutrients	5	33
	Channel narrowing	3	20
	Average flow	2	13
GRAZING	Grazing land	41	100
	Soil nutrients	4	10
	Soil moisture	2	5
URBANIZATION	Urban land	26	100
	Impervious área	8	31
	Soil moisture	2	8
MINING	Mining area	6	86
	Pollutants	2	29
	Channel incision	2	29

VEGETATION RESPONSES



HYPOTHESIZED CAUSE-EFFECT RELATIONSHIPS: SIMPLIFIED CONCEPTUAL MODEL



OVERARCHING QUESTION: What are the impacts of each pressure on riparian vegetation?

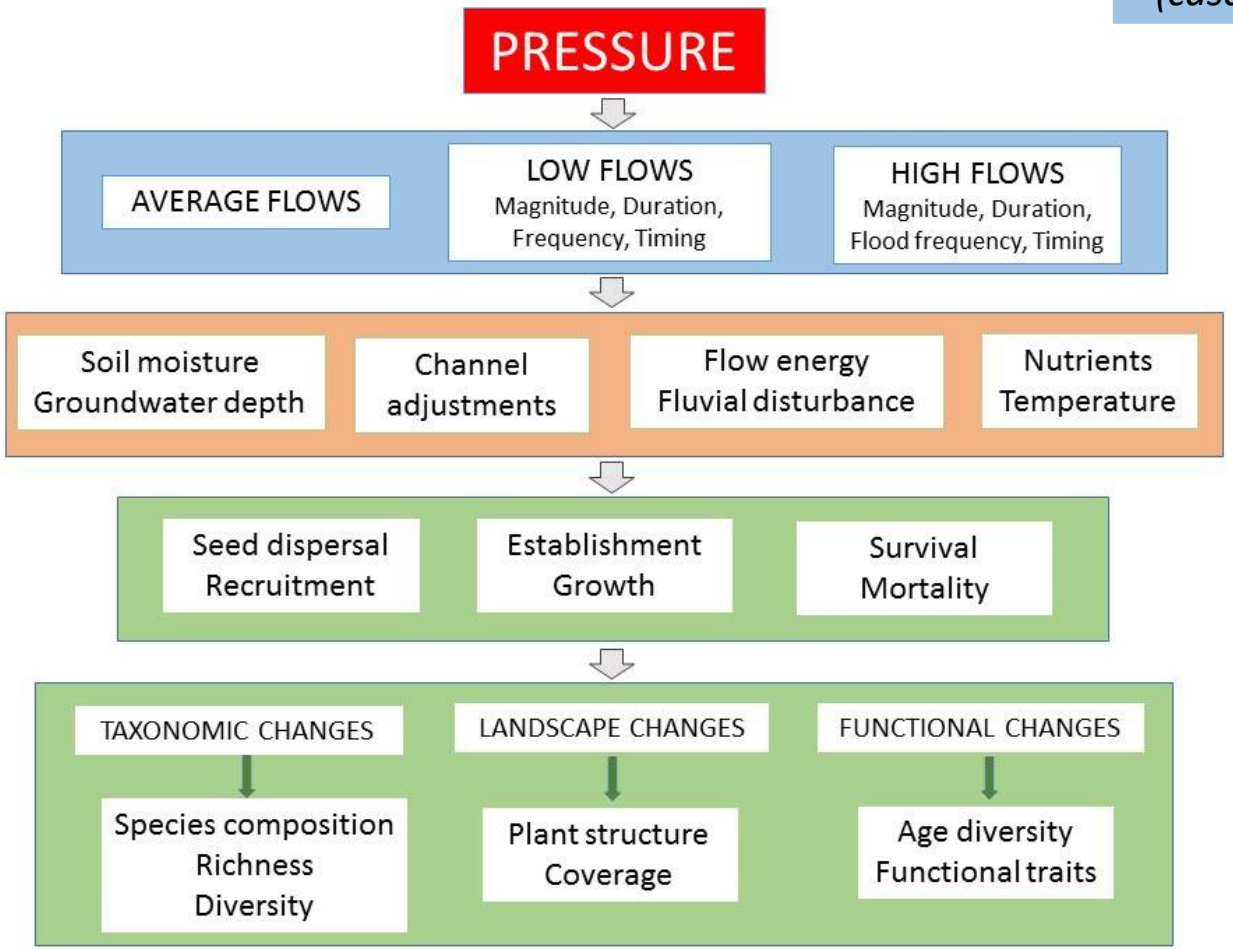
RESULTS

Strong support

Direct effects
(black-box effects)

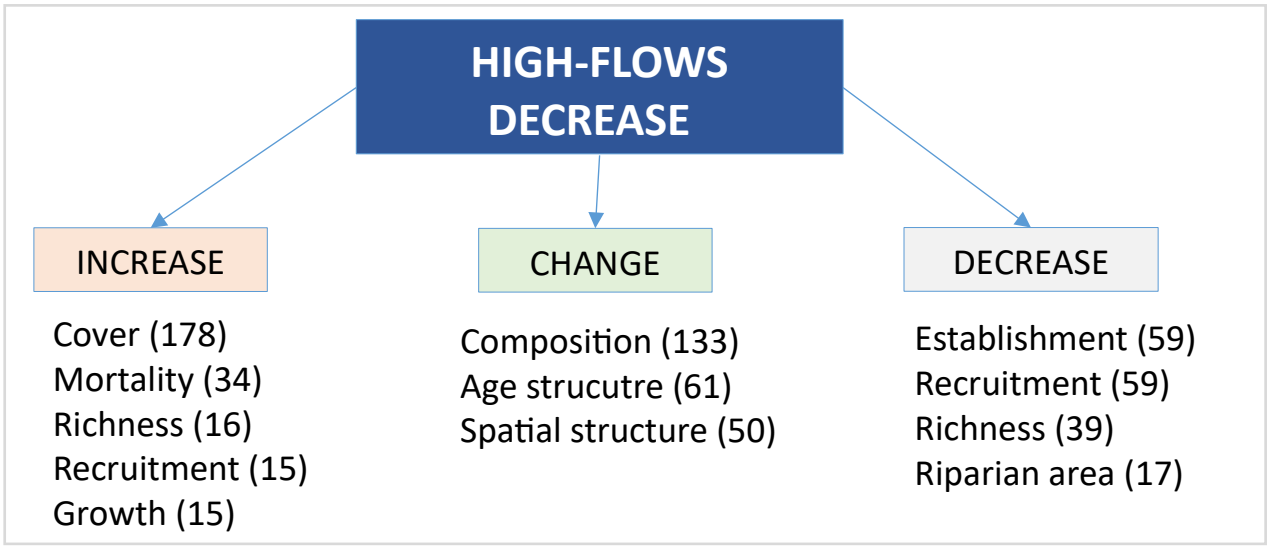
Weak support

Process-based
(cascade) **effects**



Insuficient understanding of the mechanisms inducing vegetation changes

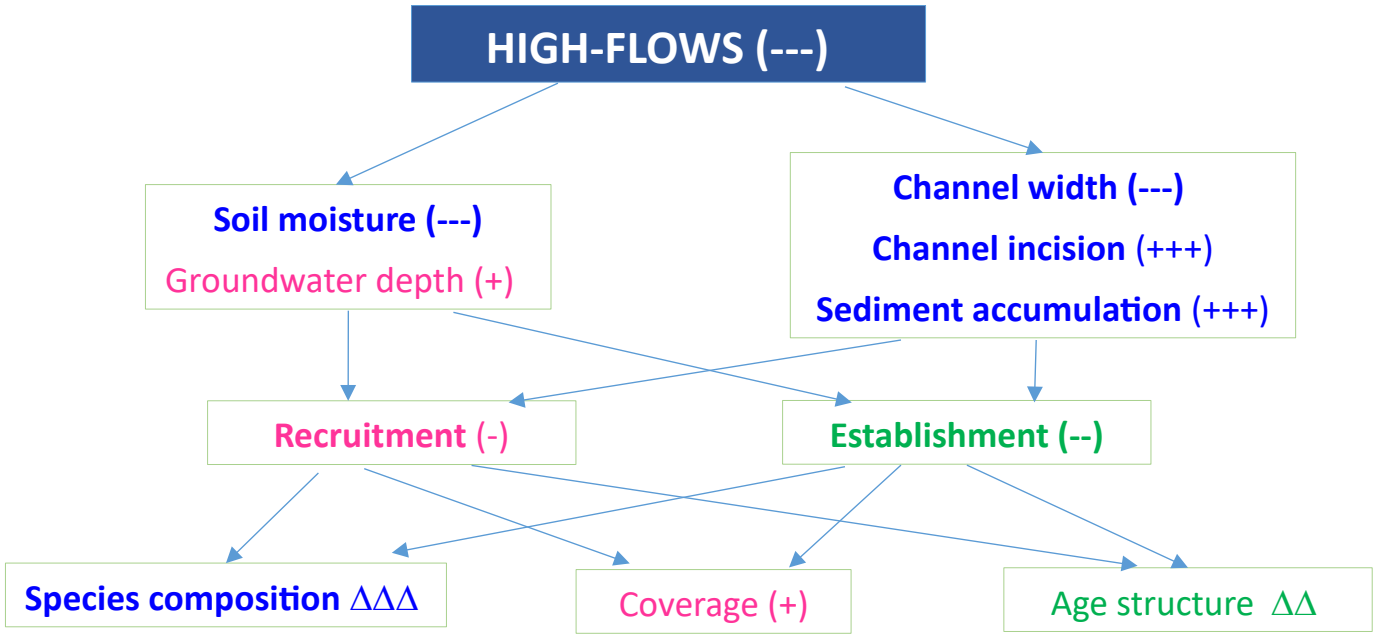
FLOW REGULATION SCORED EVIDENCE



DIRECT EFFECTS:

Eco-evidence score:

>20 Supported Evidence
< 20 No evidence

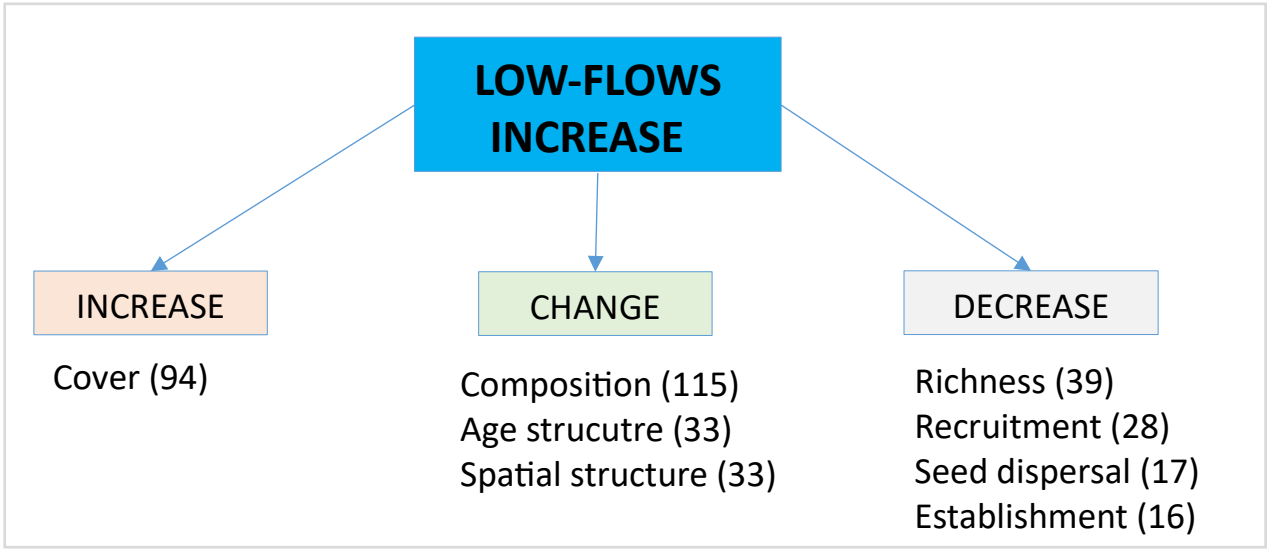


PROCESS-BASED EFFECTS:

Eco-evidence score:

>50
50-30
30-20
- Decrease
+ Increase
Δ Change

FLOW REGULATION SCORED EVIDENCE



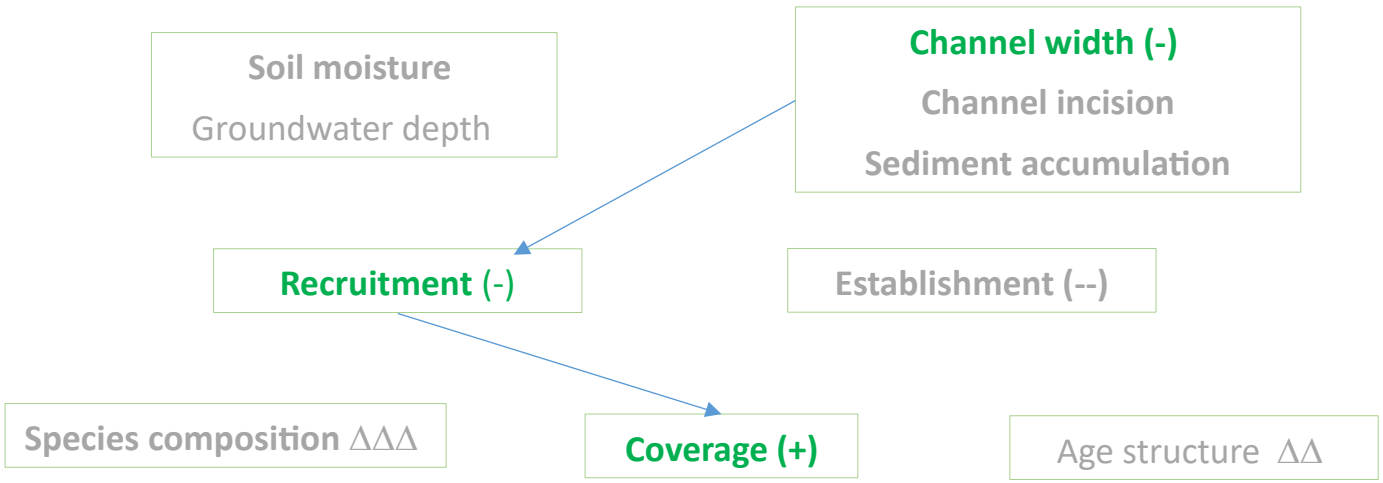
DIRECT EFFECTS:

Eco-evidence score:

>20 Supported Evidence
< 20 No evidence

LOW FLOWS (+++)

Frequently simultaneous with high-flows decrease



PROCESS-BASED EFFECTS:

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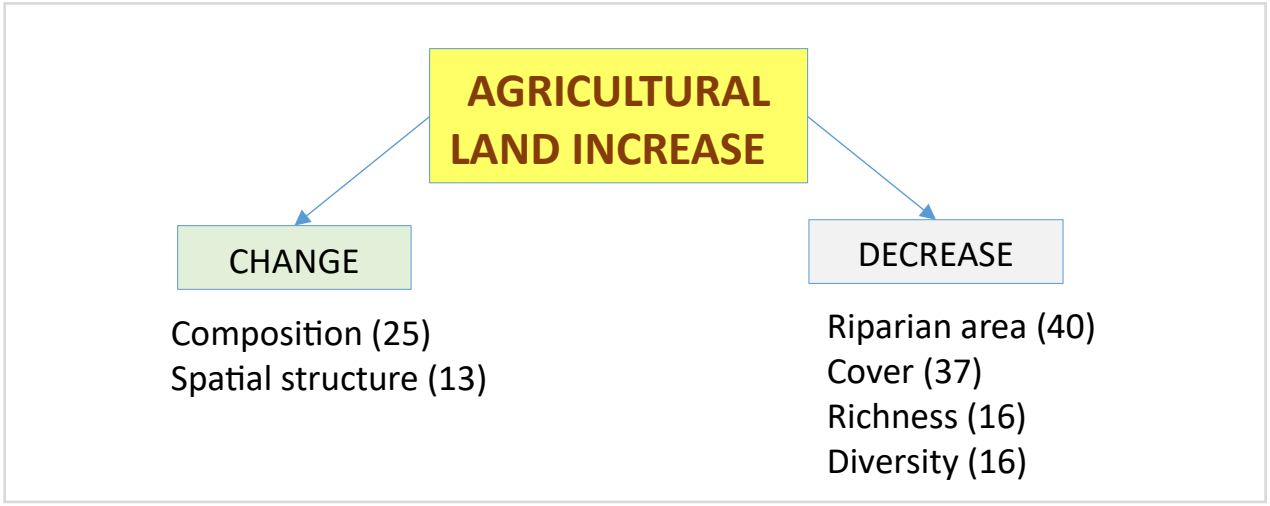
Δ Change

AGRICULTURE SCORED EVIDENCE



DIRECT EFFECTS:

Eco-evidence score:

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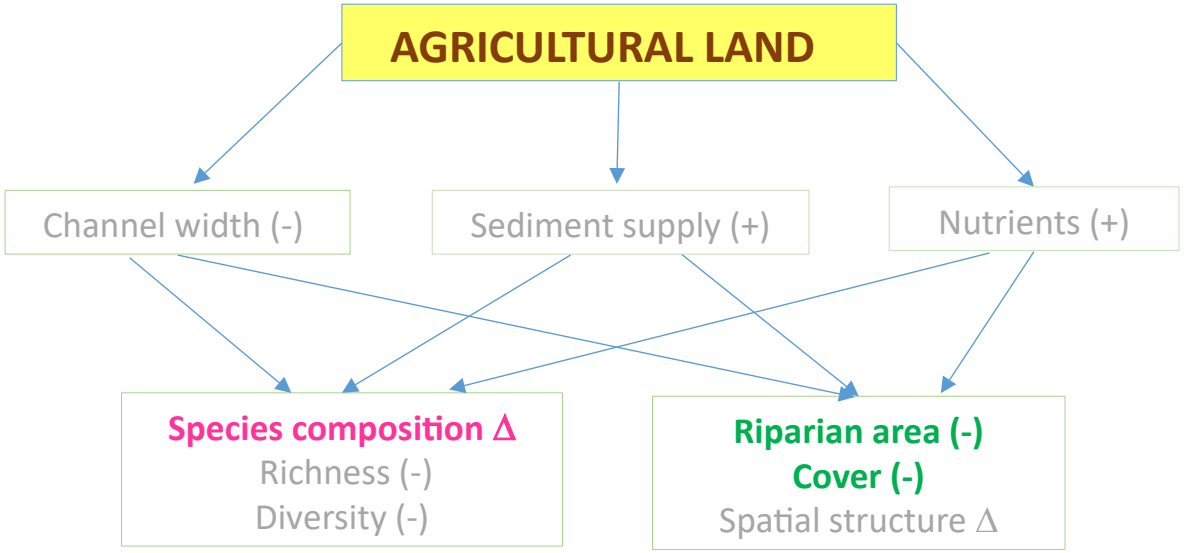

PROCESS-BASED EFFECTS:

Eco-evidence score:

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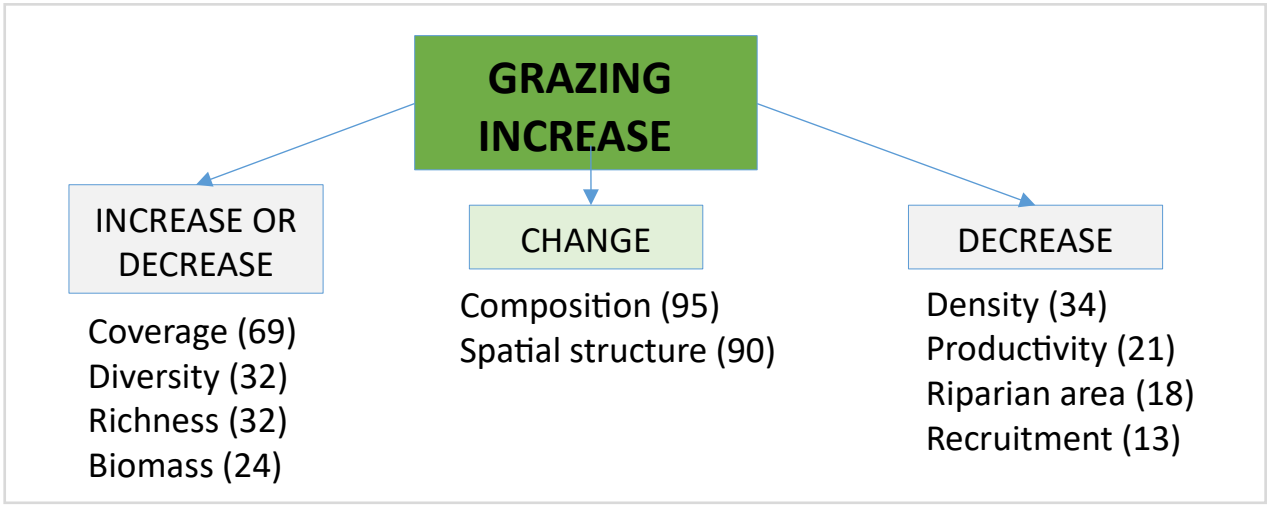
50-30
30-20
- Decrease
+ Increase
Δ Change

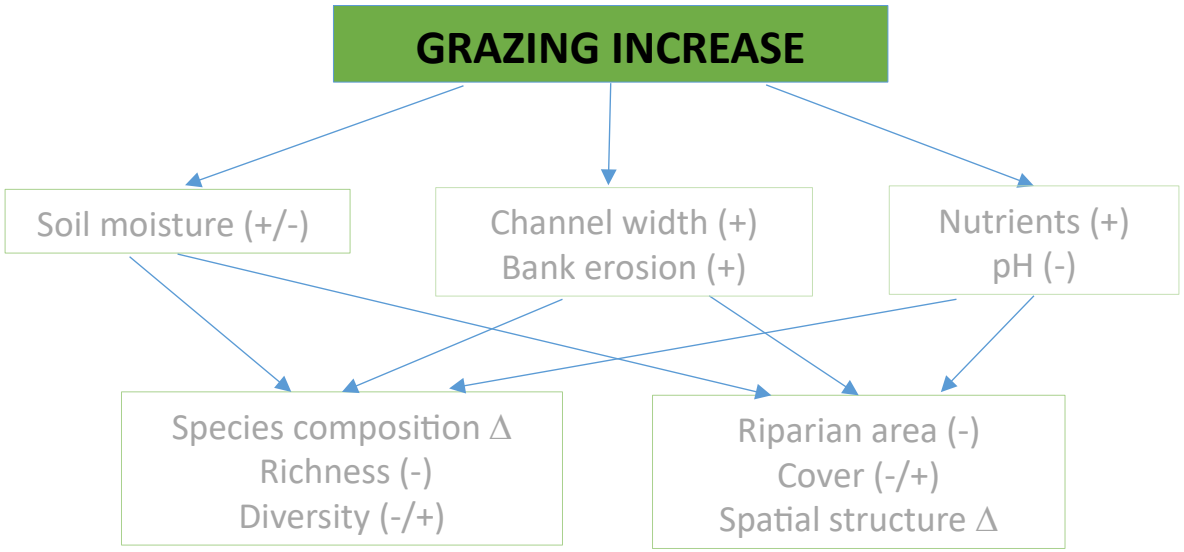
GRAZING SCORED EVIDENCE



DIRECT EFFECTS:

Eco-evidence score:

>20 Supported Evidence
< 20 No evidence



PROCESS-BASED EFFECTS:

Eco-evidence score:

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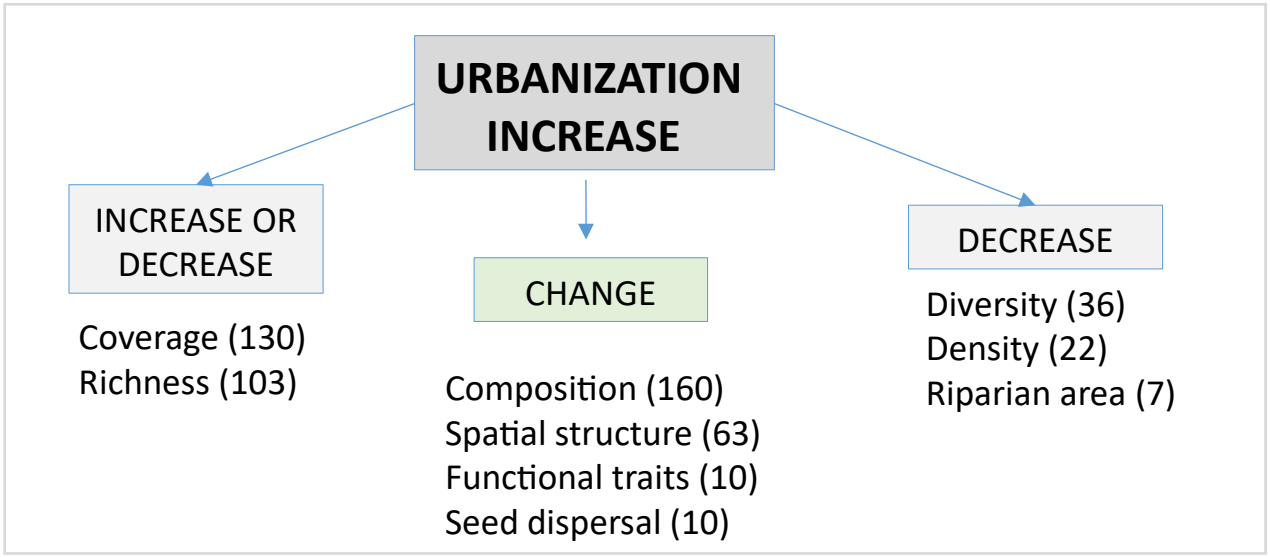
50-30
30-20
- Decrease
+ Increase
Δ Change

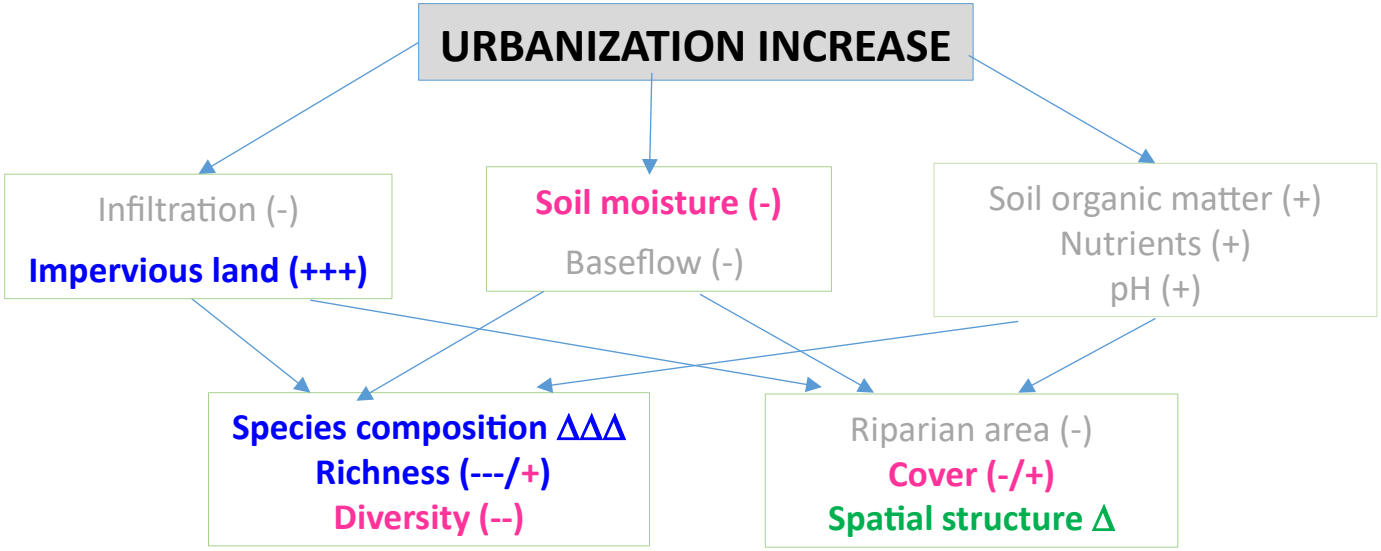
URBANIZATION SCORED EVIDENCE



DIRECT EFFECTS:

Eco-evidence score:

>20 Supported Evidence
< 20 No evidence



PROCESS-BASED EFFECTS:

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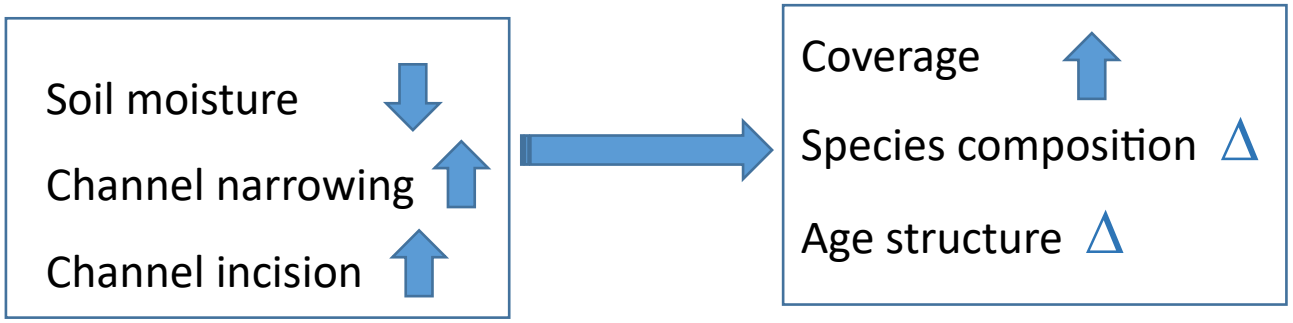
CONCLUSIONS

- **MOST RESEARCH FOCUS ON REPORTING DIRECT EFFECTS** of pressures on vegetation attributes, **without evidencing the mechanisms** or involved processes **explaining these changes**

- **FLOW REGULATION** is the best documented pressure, with **high scores of causality**

  e.g. HIGH SUPPORT FOR HIGH-FLOWS DECREASE INDUCING:



"mitigation measures" are feasible (e.g. recruitment box)

- For the **REST OF PRESSURES, INSUFFICIENT OR INCONSISTENT EVIDENCE of causal mechanisms** is frequently found

CONCLUSIONS

- **DIFICULTY IN CAUSAL CRITERIA COMPLIANCE:**
  - High diversity of approaches and results
  - No significant number of studied sites with similar targets
- **STRONG SITE-SPECIFICITY OF CAUSALITY:**
  - Site-specific **external agents** influencing responses
  - Different multiple pressures acting simultaneously
- **OBSERVED SIMILAR RESPONSES FROM DIFFERENT PRESSURES AND ALTERED VARIABLES:**
  - Uncertainty of causal agents and potential mitigation measures
- Our Eco-evidence results provide an **objective causality framework** but highlights **NEEDS OF RESEARH** reporting **INVOLVED PROCESSES,** to which **MANAGEMENT ACTIONS SHOULD BE ADRESSED**

CONVERGES
European Riparian Ecosystems

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THANK YOU FOR YOUR ATTENTION ¡

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