

# Short-Term Scientific Mission- WP2

## Assessing the effectiveness of woodland creation for reducing agricultural diffuse pollution – developing value ranges to create look-up tables

**COST Action CA15206:**

**Payments for Ecosystem Services (Forests for Water)**

*Workshops, Working Group Meetings and Management Committee*

**Opatija, Croatia**

**From 17th to 19th October 2017**

**Ignacio Pérez-Silos<sup>1(\*)</sup>, Tom Nisbet<sup>2</sup> & Martyn Silgram<sup>3</sup>**



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<sup>2</sup> Forest Research, UK

<sup>3</sup> ADAS, UK

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**Funding: 2500 €**

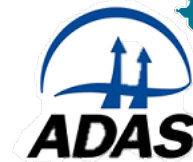
**Host Centre: Alice Holt Research Station**

September 2017

M	T	W	T	F	S	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

October 2017

M	T	W	T	F	S	S
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2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					



Martyn Silgram



**Forest Research**

Tom Nisbet



Ignacio Pérez-Silos

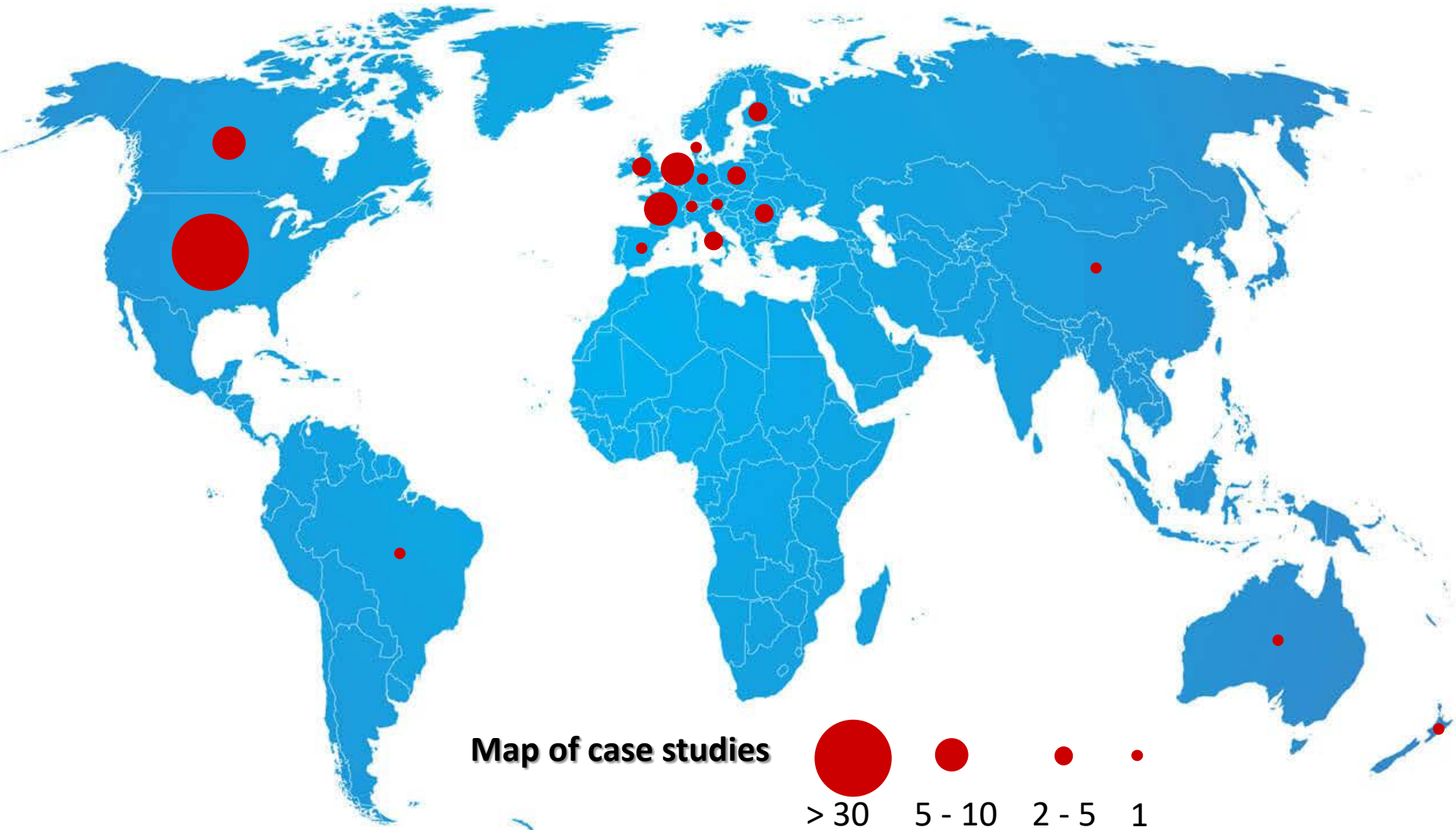
## Cost Action Working Group 2

Assessing the **environmental effectiveness of woodland planting** in reducing a range of **agricultural diffuse pollutants** (e.g. sediment, nitrate, phosphate, pesticides and Faecal Indicator Organisms).

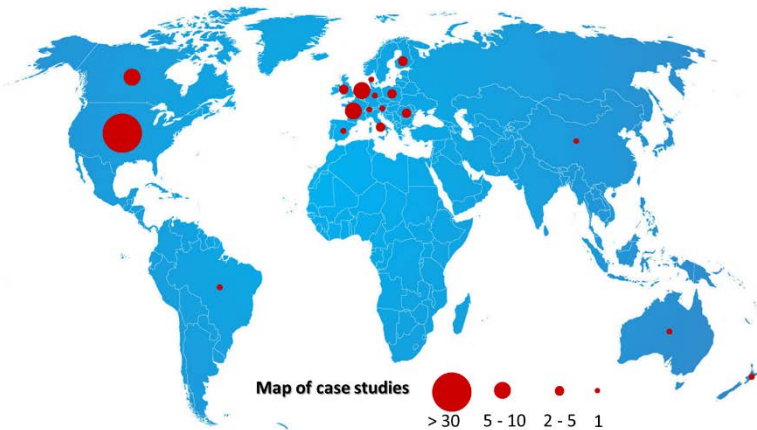
### Short-Term Scientific Mission

- V** 1. **Review** published and grey literature on the impact of woodland planting on agricultural diffuse pollution and runoff.
- V** 2. **Extract numbers** from the literature on observed and modelled changes to pollutant loads and concentrations resulting from tree planting, as well as record relevant contextual information on woodland measures.
- X** 3. Use these numbers to **tabulate value ranges on the effectiveness** of different woodland measures for reducing diffuse pollution in agrarian landscapes. Also record potential effects on water resources.

61 published papers of experimental-empirical studies (years 1973 – 2015) were reviewed.



## 1 The review (61 published papers)



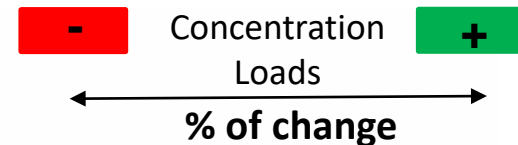
Impact of woodland planting on agricultural diffuse pollution and runoff

## 2 Tree Plantation/Woodland Features

- Type of forest
- Methodology
- Plantation design (species, separation, etc)
- Extension
- Year
- Land use in the catchment
- etc

## 3 Quantitative assessment over water quality and runoff

Water Quality Variable



Negative Effects

Positive Effects

## 2 Tree Plantation/Woodland Features

### General features of the area

- 1) Location
- 2) Climate
- 3) Year (and duration of the study)
- 4) Land use in the catchment (fertilizer application?)
- 5) Soils and geomorphology features
- 6) Effluents?

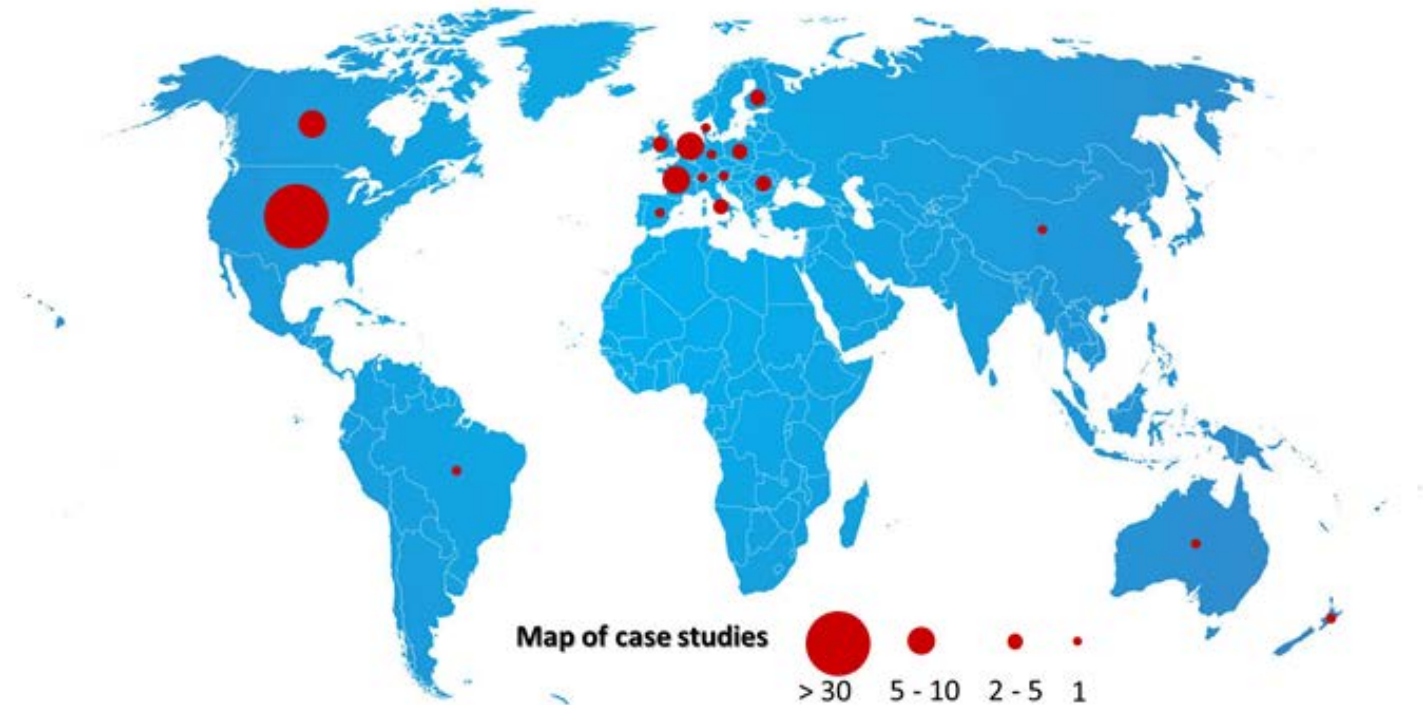
### Specific plantation/woodland features

- 1) Type of forest/plantation
- 2) Origin
- 3) Objective of the plantation
- 4) Age
- 5) Main species
- 6) Width
- 7) Design-structure
- 8) Drainage
- 9) Drainage area (or, in this absence, watershed area)
- 10) Diseases?

## 2 Tree Plantation/Woodland Features

### General features of the area

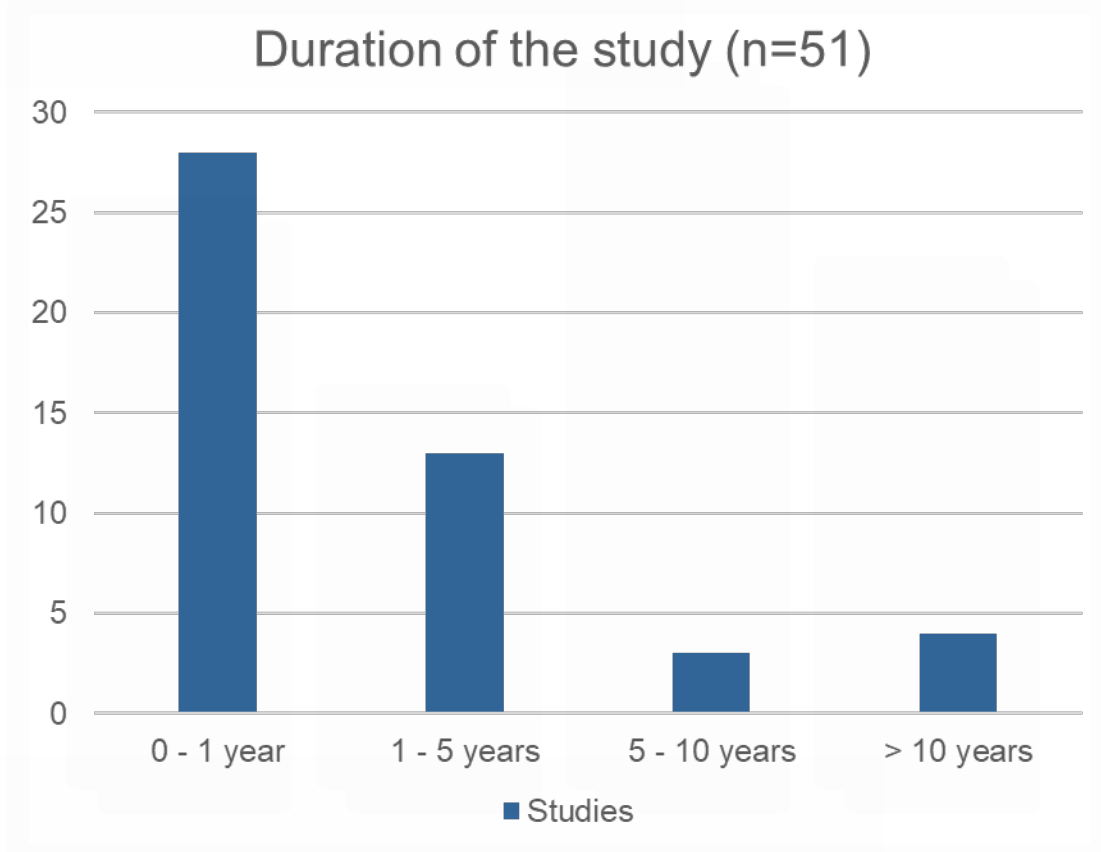
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>95% studies: intensive, semi-intensive agricultural catchments.

### Main Cultives:

Corn  
Soybean  
Wheat

42.6% studies: some reference about fertilizer application.

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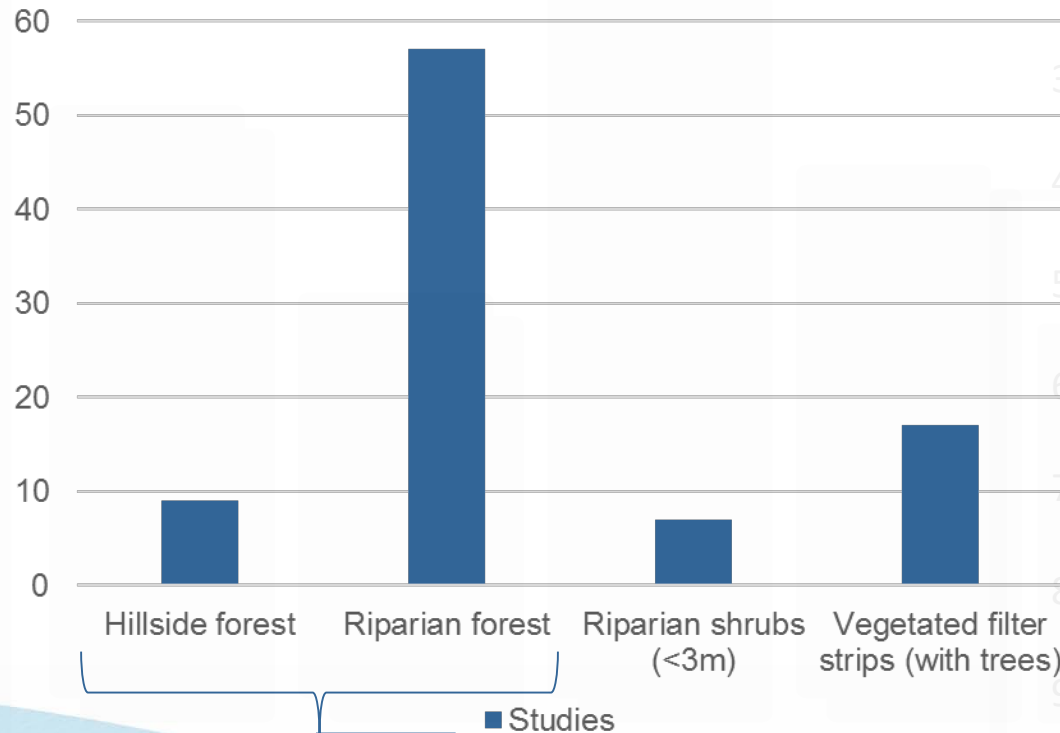
Only 2 studies with urban effluents cases (6 treatments)

## 2 Tree Plantation/Woodland Features

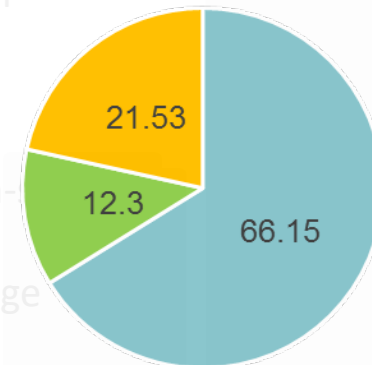
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Type of Treatments

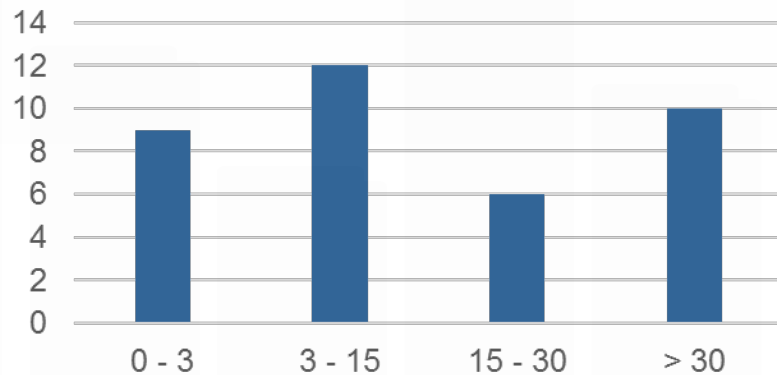


Origin

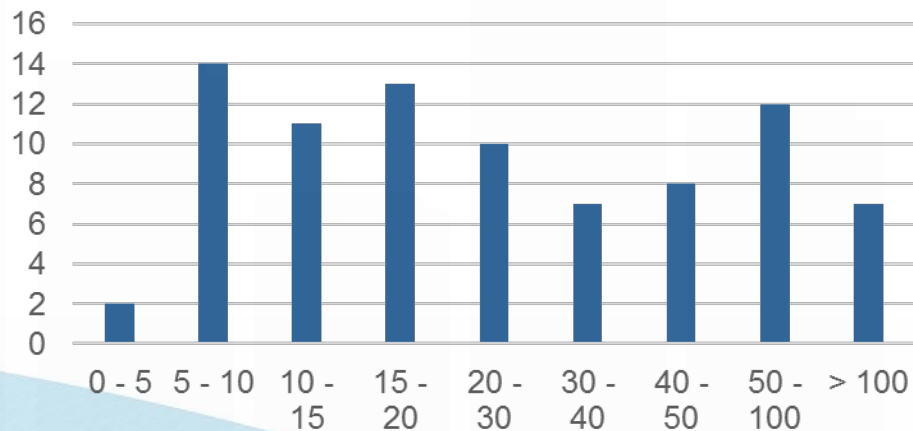


## 2 Tree Plantation/Woodland Features

Age of the Treatments (n=39)



Width of the Treatments (n=84); m



■ Studies

### Specific plantation/woodland features

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## 2 Tree Plantation/Woodland Features

- Descriptive class (**Well, moderate, poor**)
- Drainage direction (**Lateral de SW, vertical to GW, both**)
- Slope
- Functioning artificial drains (**Present, no present**)

### Specific plantation/woodland features

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## 3 Quantitative assessment of water quality and quantity

### Water Quality

- 1) Sediments
- 2) Nitrogen
- 3) Phosphorous
- 4) Pesticides
- 5) Fecal Indicator Organisms
- 6) Temperature

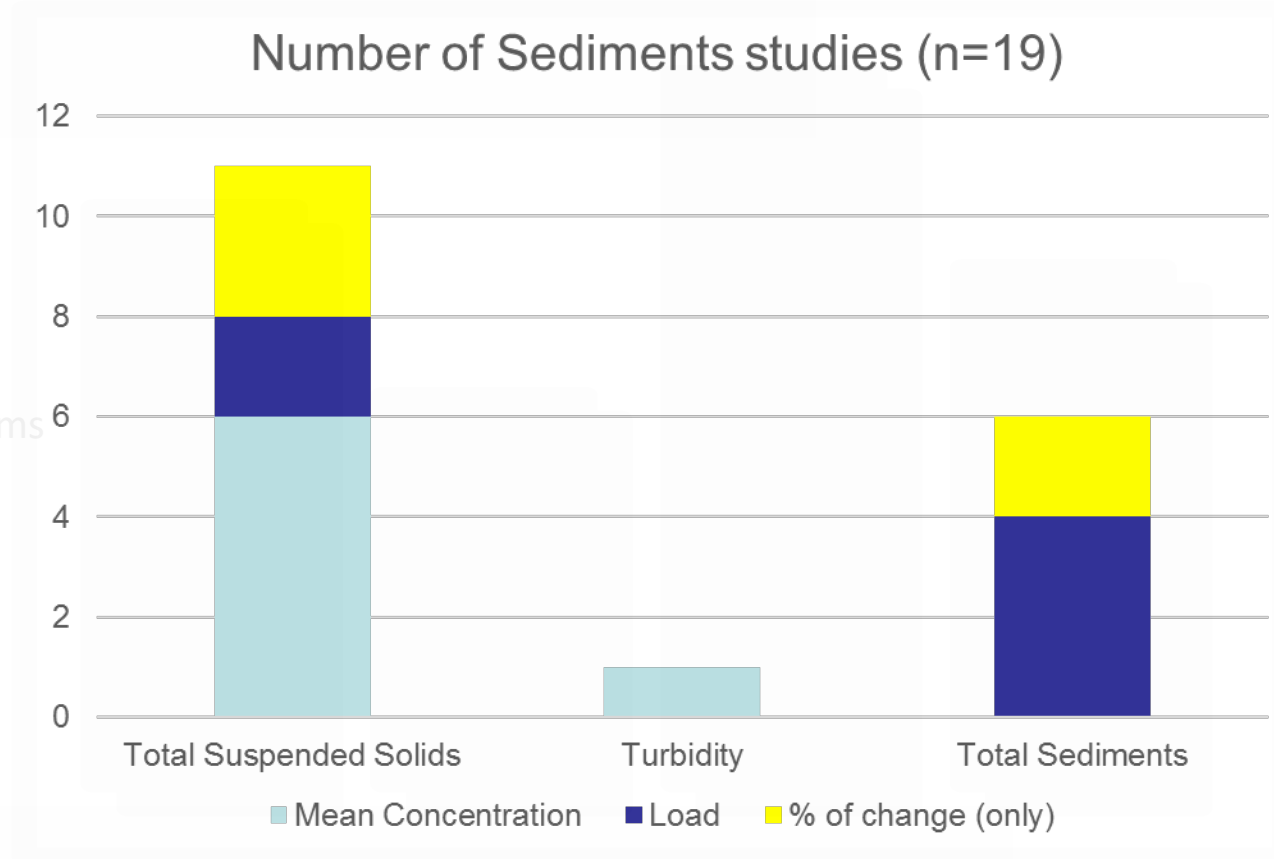
### Water Quantity

- 1) Runoff

## 3 Quantitative assessment of water quality and quantity

### Water Quality

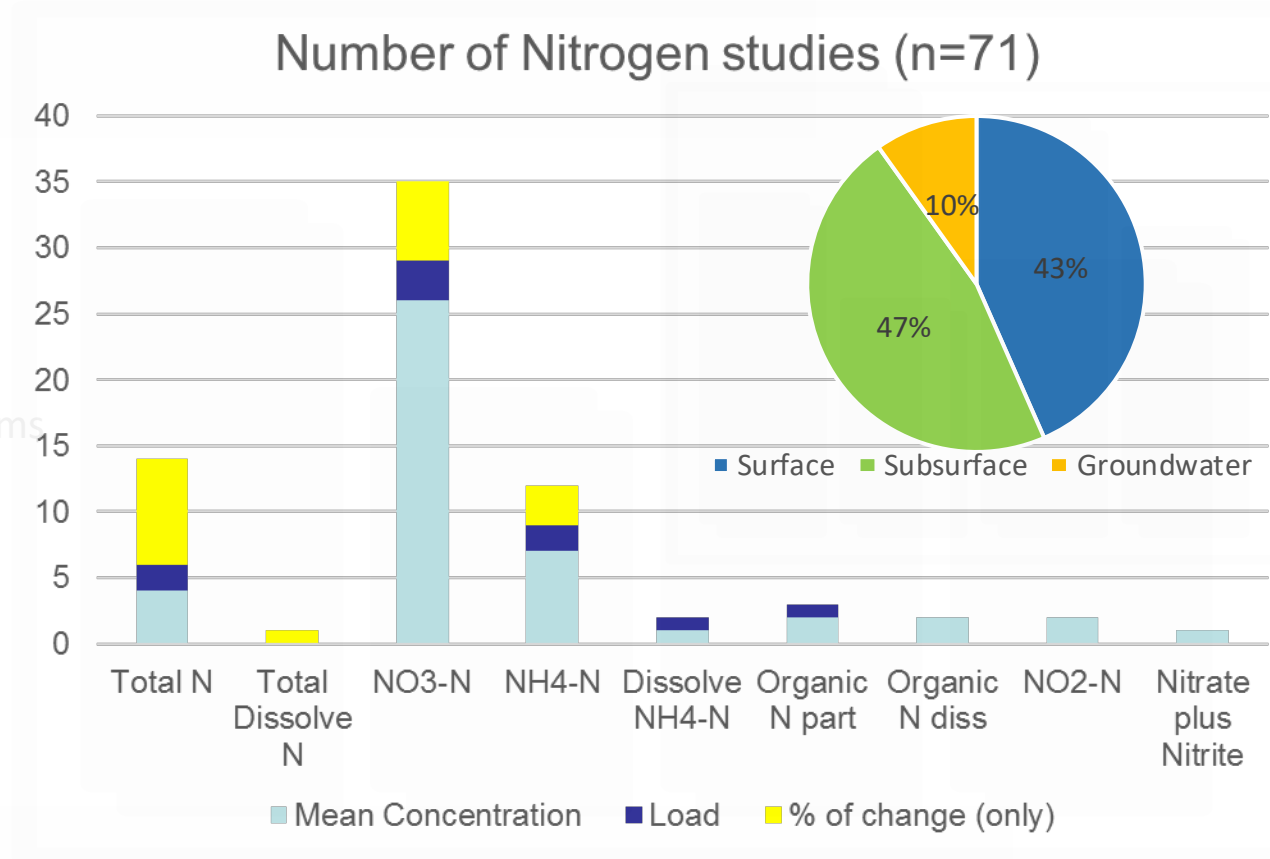
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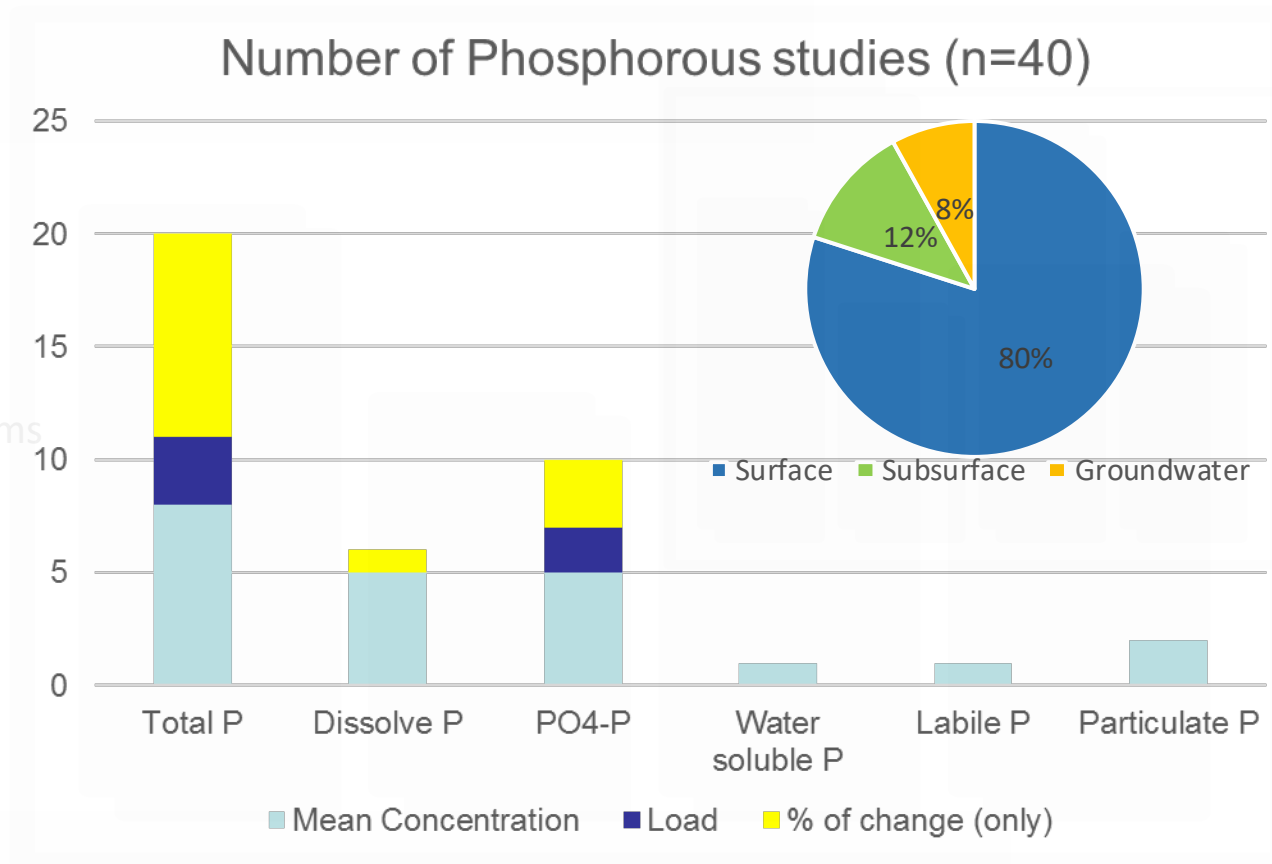




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- 6 studies of: Atrazine

- 2 studies of: Alachlor, Azoxystrobin and Cyproconazole

- 1 studies of: Chlorpyrifos, Fluazifop-p-butyl, Lambda-cyhalothrin, Lactofen, Permethrin, Chlorothalonil, Napropamide, Prosulfocarb, Fenpropidine, Isoproturon, Ethofumesate, Chlorotoluron, S-metolachor, Metazachlor, Aclonifen, Diflufenican, Tebuconazole, Mefenpyr-dietyl, Epoxiconazole, Terbutylazine.

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**1 study: Total and fecal coliform bacteria**

## 3 Quantitative assessment of water quality and quantity

### Water Quality

1) Sediments

2) Nitrogen

3) Phosphorous

4) Pesticides

5) Fecal Indicator Organisms

6) Temperature

- **4** Mean daily maximum temperature in summer

- **1** Mean temperature during summer

- **1 Normal ranges** during the summer

- **1** Estimation over **temperature impact** (reference stream temperature of 11 °C)

- **1** Mean weekly maximum temperatures

## 3 Quantitative assessment of water quality and quantity

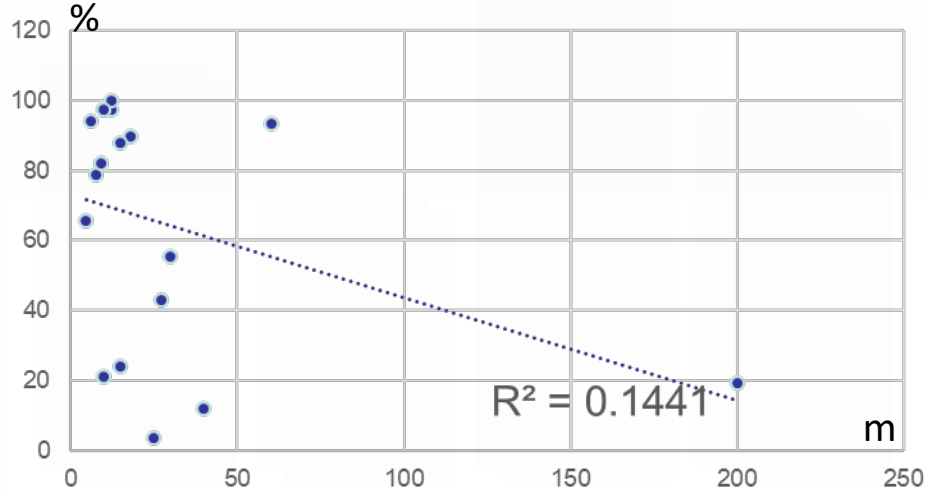
### Water Quantity

#### 1) Runoff

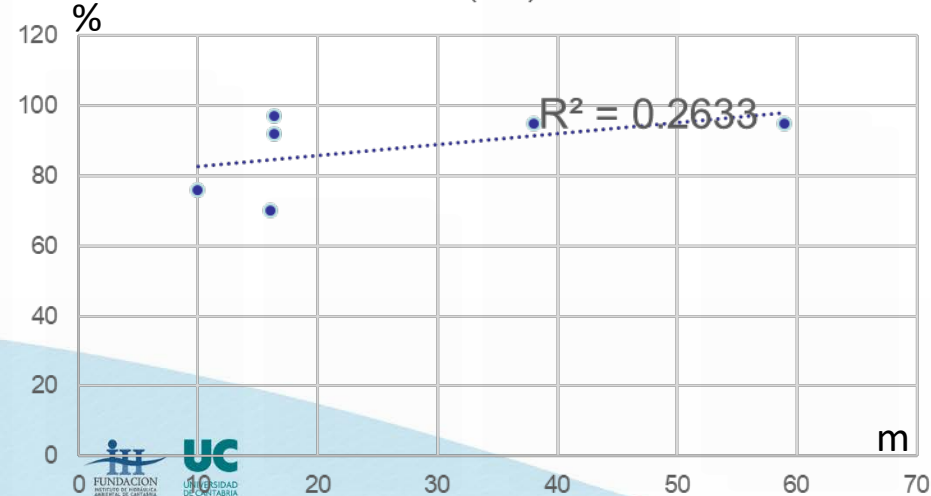
- 5 Surface runoff volume (l)
- 5 Surface runoff depth (mm)

## 1 Sediments

% reduction (SS) v.s Width

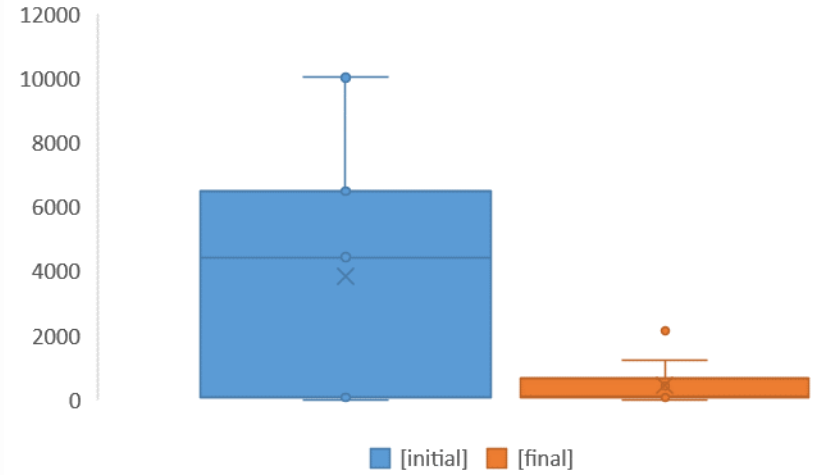


% reduction (TS) v.s Width



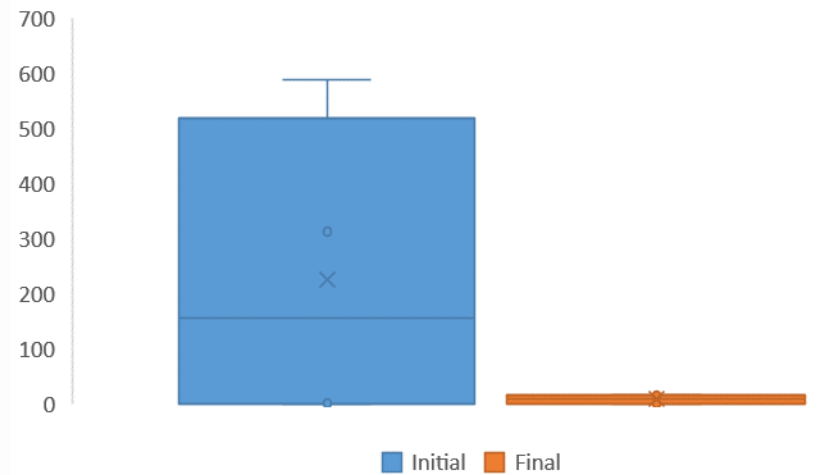
mg/l

[SS]

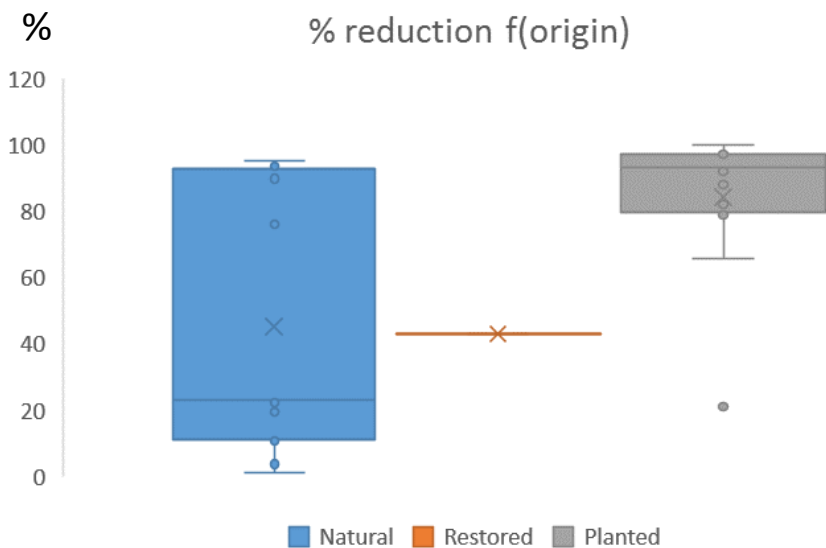
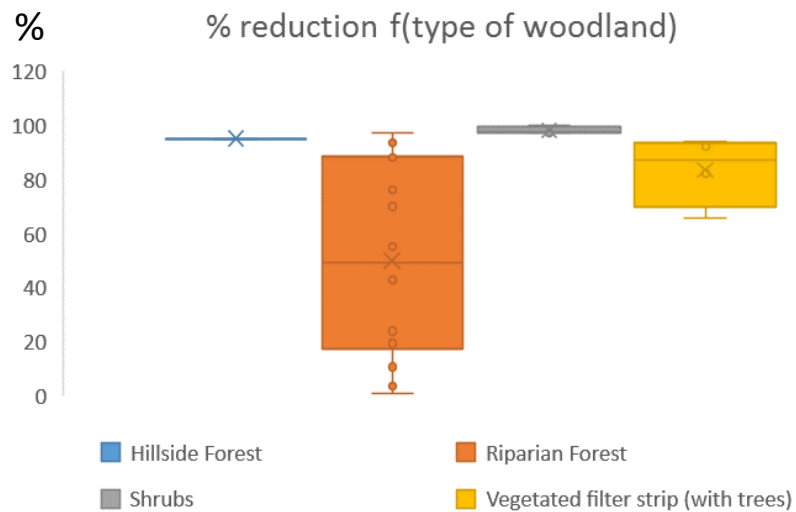


kg/ha

TS load

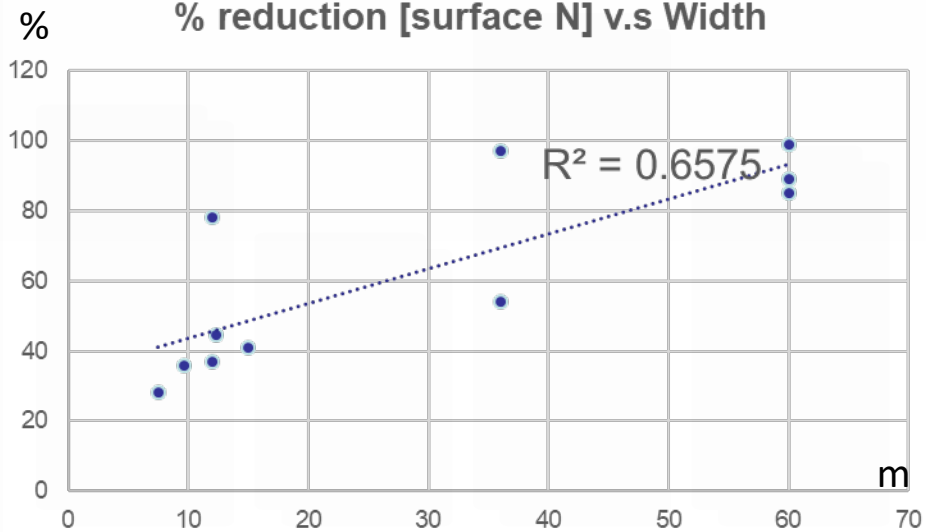


## 1 Sediments

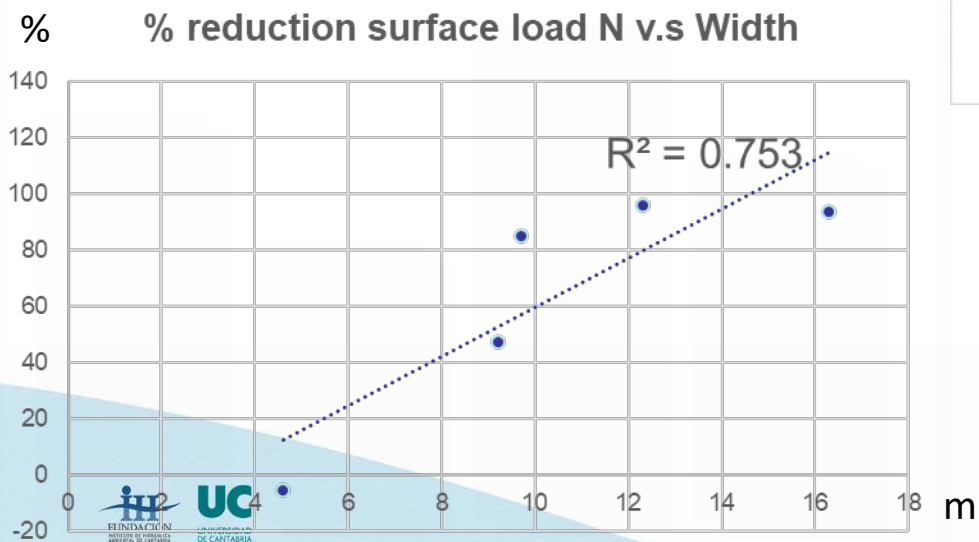


## 2 Nitrogen

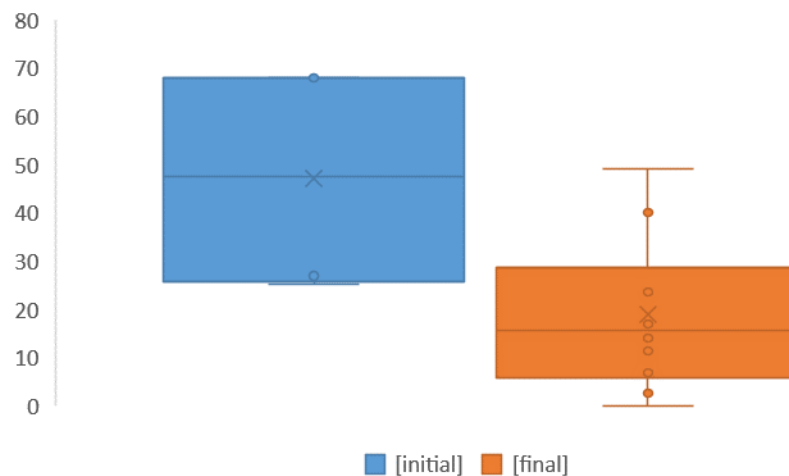
% reduction [surface N] v.s Width



% reduction surface load N v.s Width

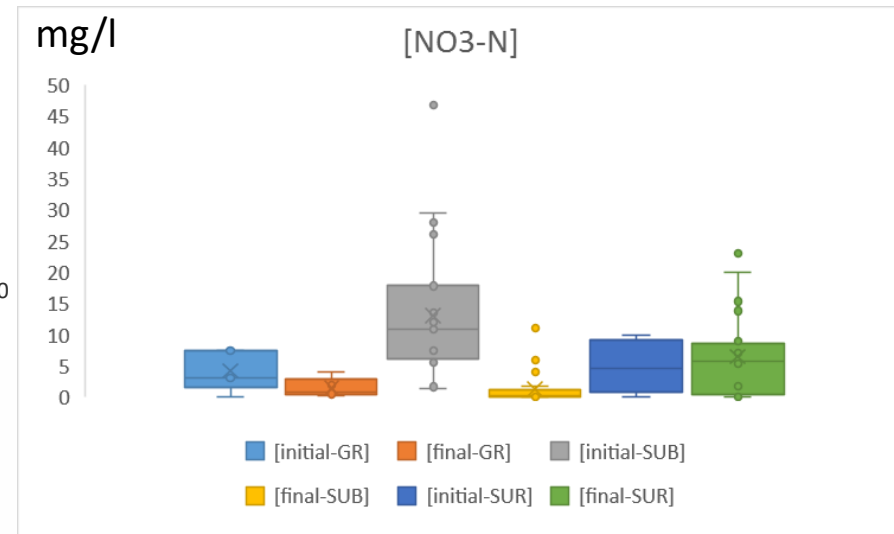
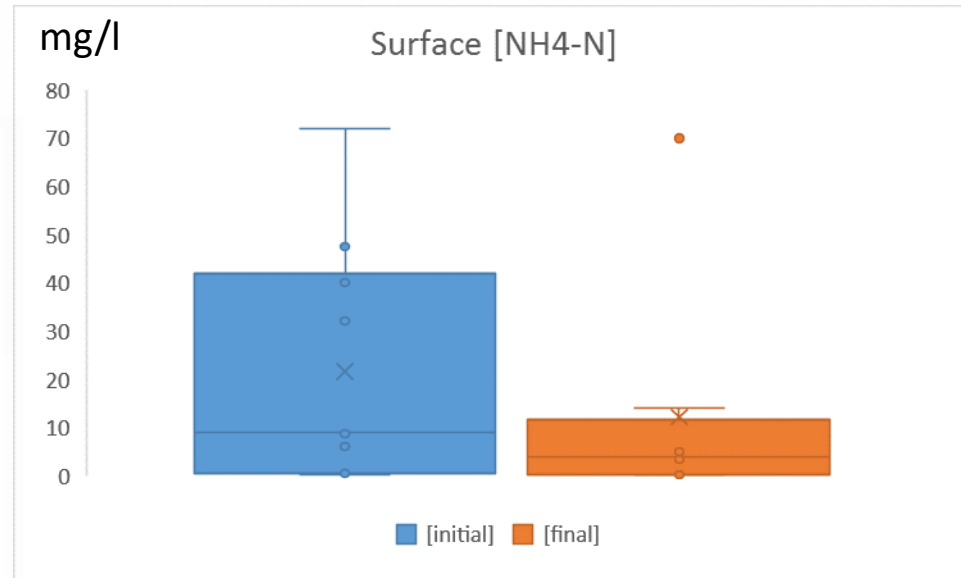
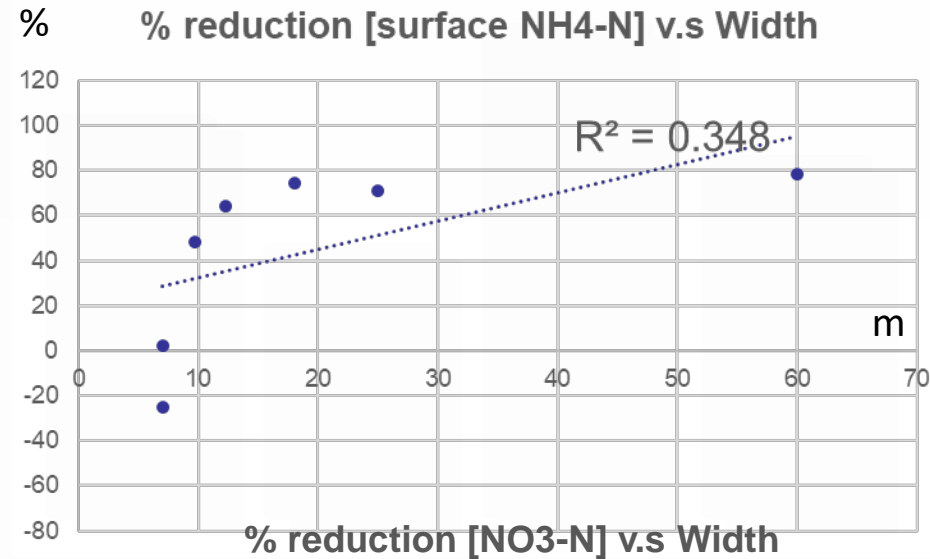


mg/l Surface [N]

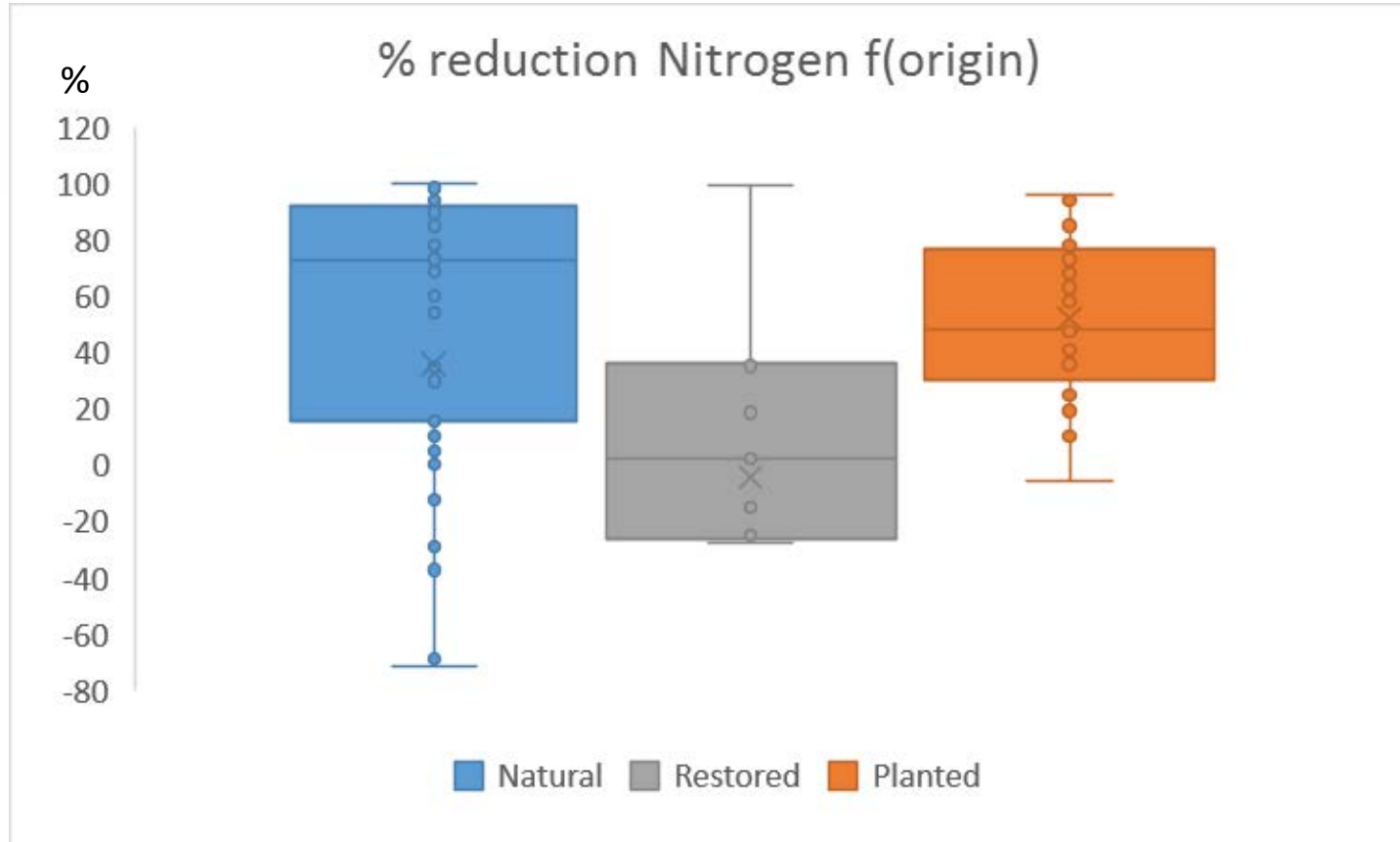




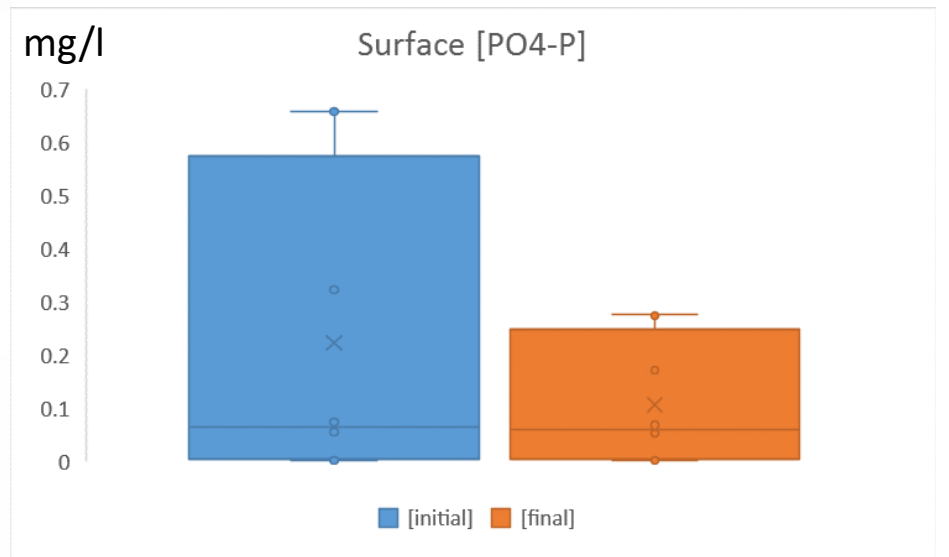
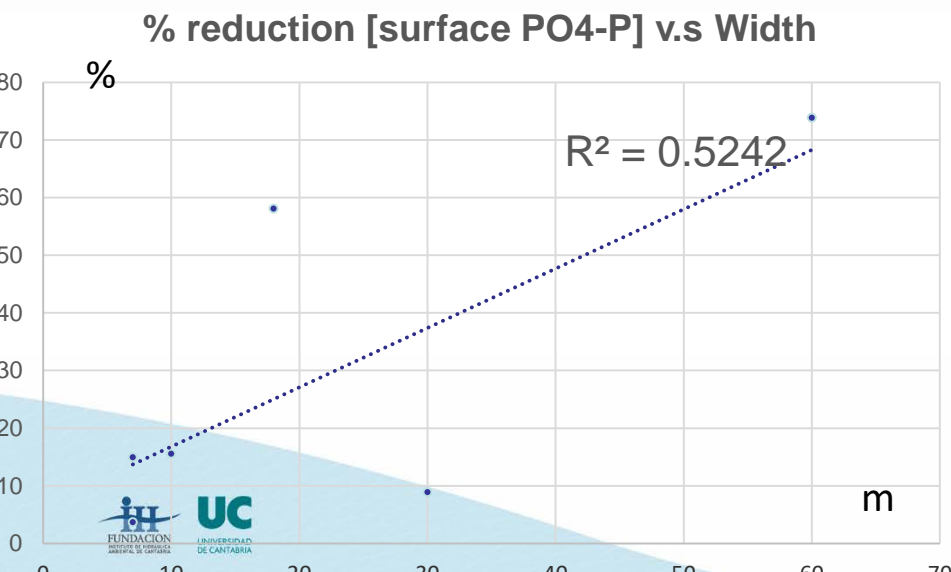
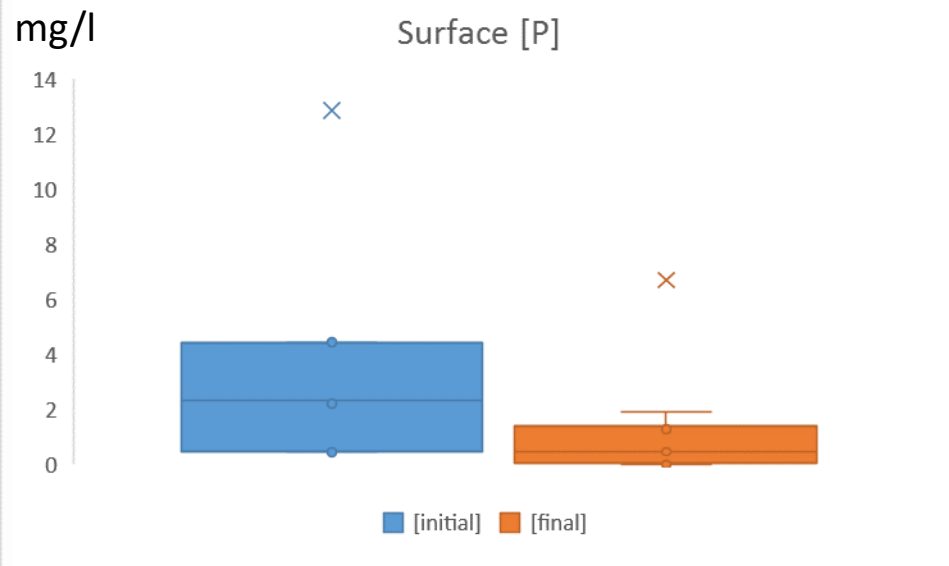
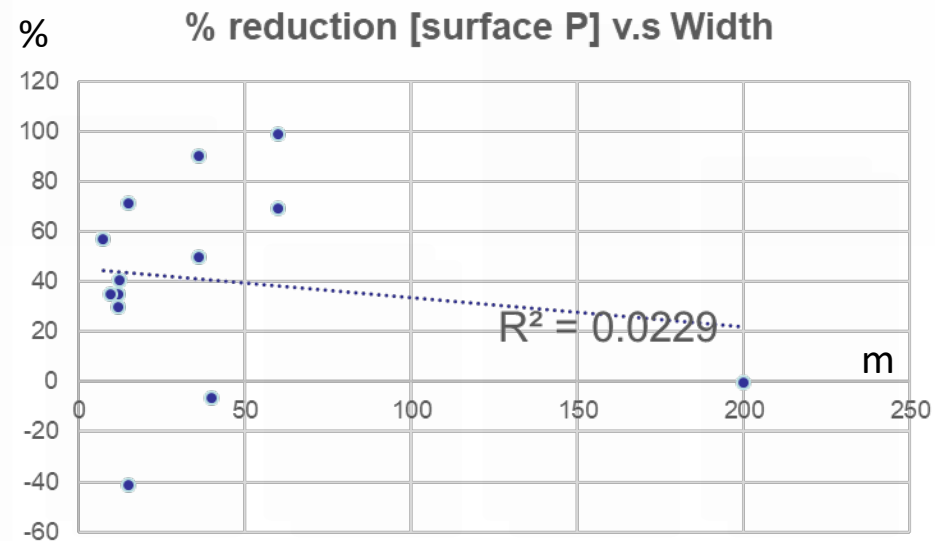
## 2 Nitrogen



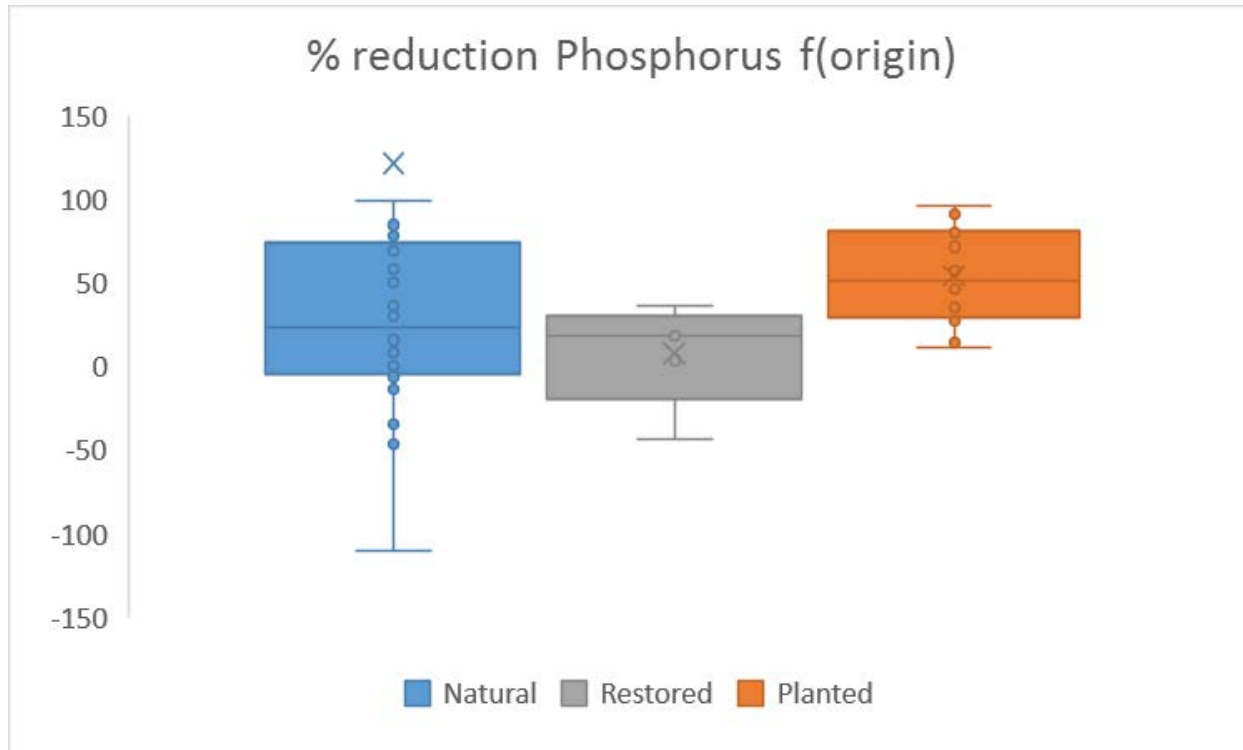
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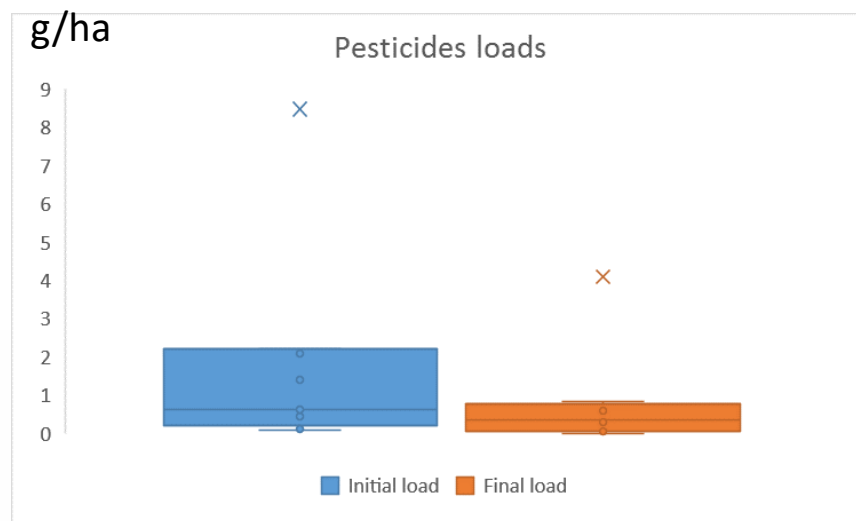
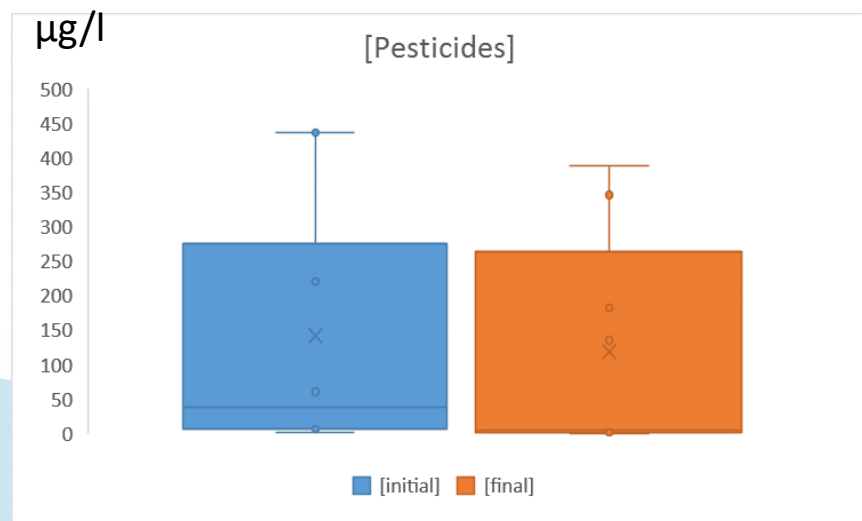
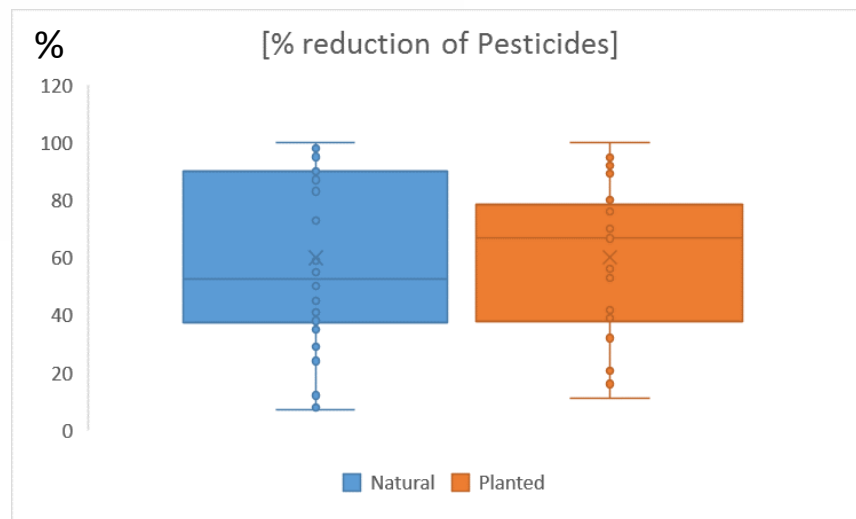
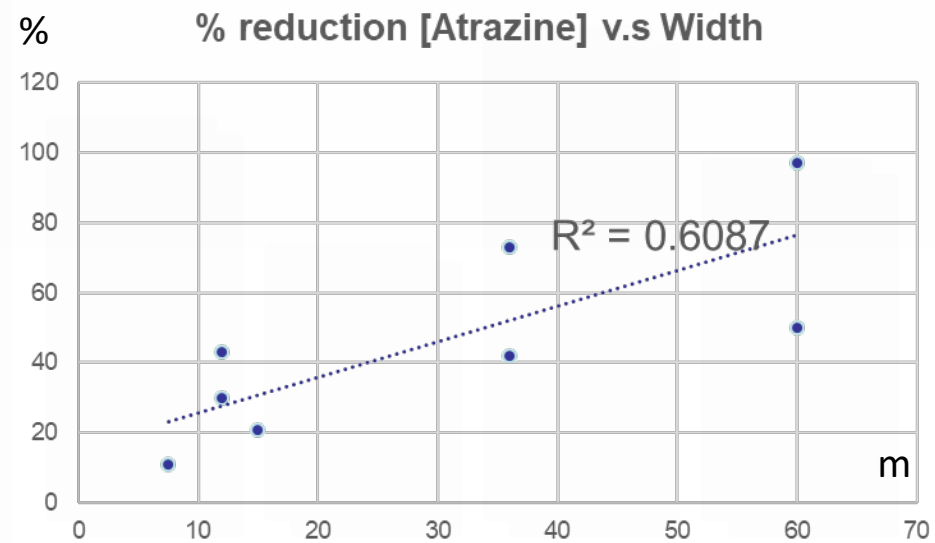
## 3 Phosphorous



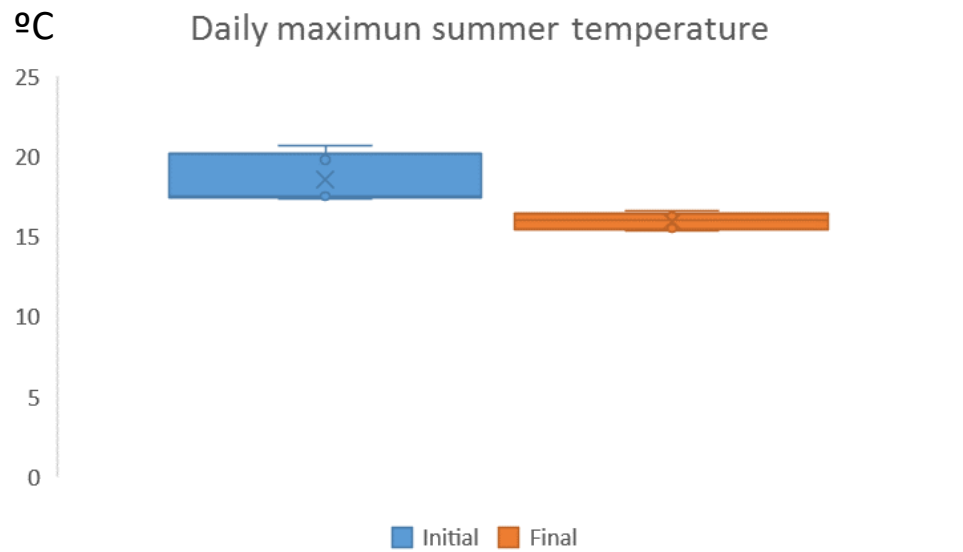
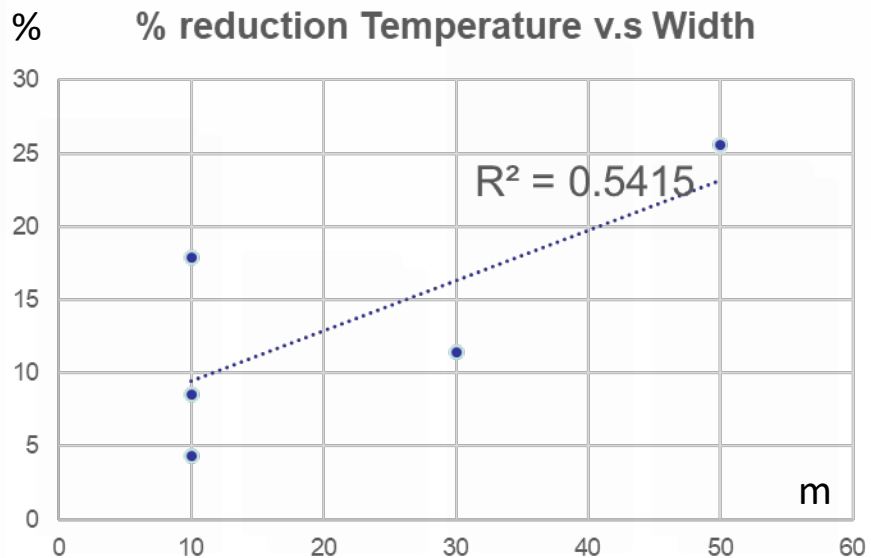
## 3 Phosphorous



## 4 Pesticides

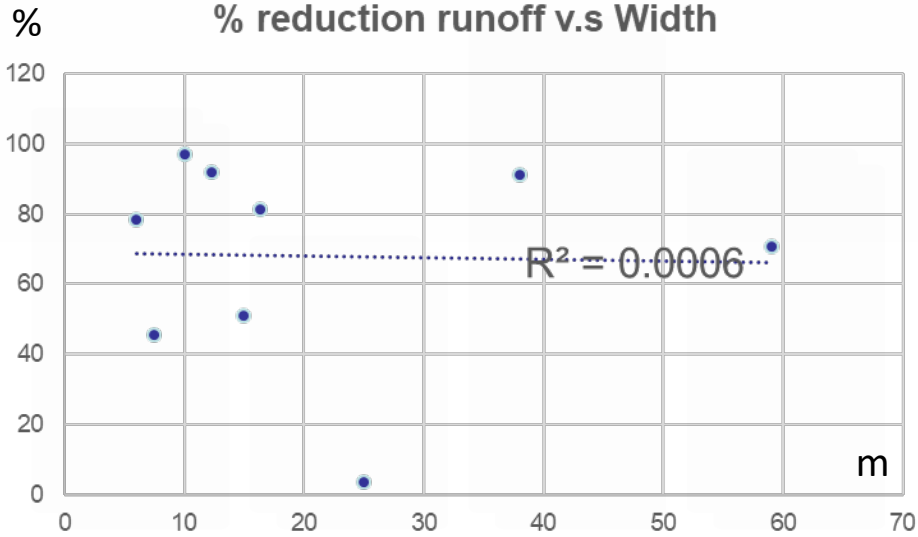


## 5 Temperature

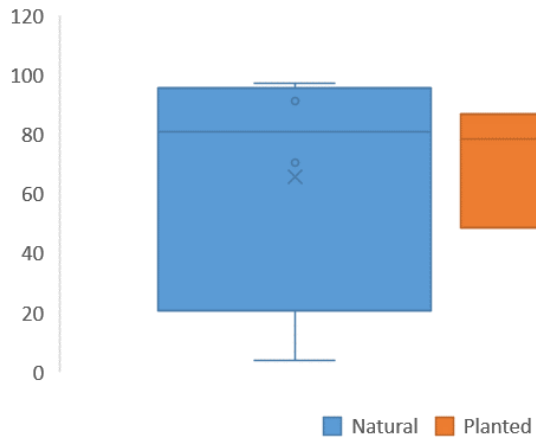


## 6 Runoff

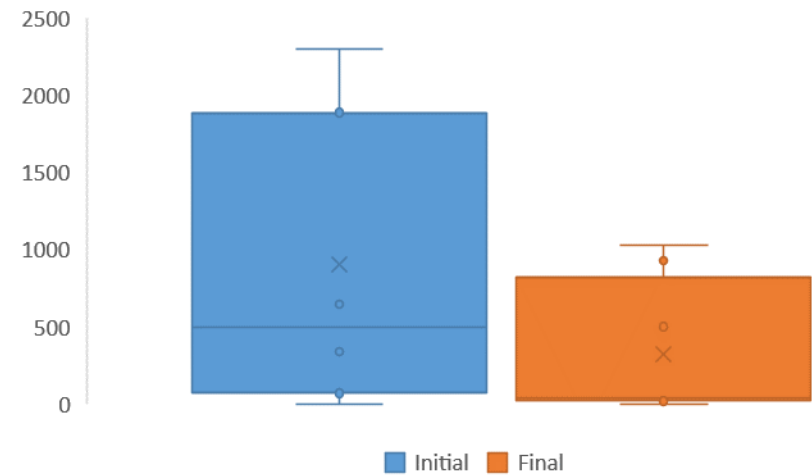
% reduction runoff v.s Width




% reduction of runoff f(origin)




Runoff volume (l)




## General results

- We can consider that **forest treatments** have had a **positive effect** over SS, TS, TN, NO<sub>3</sub>-N, NH<sub>4</sub>-N, TP, PO<sub>4</sub>-P, Pesticides, Temperature and runoff reductions.
- In some cases: >>**width**  > **positive effects**
- Design of **specific plantations** could improve **positive effects** over water quality

## ... however, it would be recommendable

- To include **more typologies of forest systems** (hillside, productive plantations, etc.)
- More **sophisticated data analysis**  (limited by the lack of some information!)



A wide-angle landscape photograph showing a valley. The left side of the valley is filled with dense, brown, leafless trees. The right side is a steep, green hillside with some rocky outcrops. In the distance, a range of hills or mountains is visible, with patches of snow on their peaks. The sky is a clear, bright blue. The text "Thanks a lot for your attention!" is overlaid in white on the left side of the image.

**Thanks a lot for your attention!**