



# Life cycle assessment of a novel tannin-boron association for wood protection

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*25<sup>th</sup>-26<sup>th</sup> Sep. 2015*



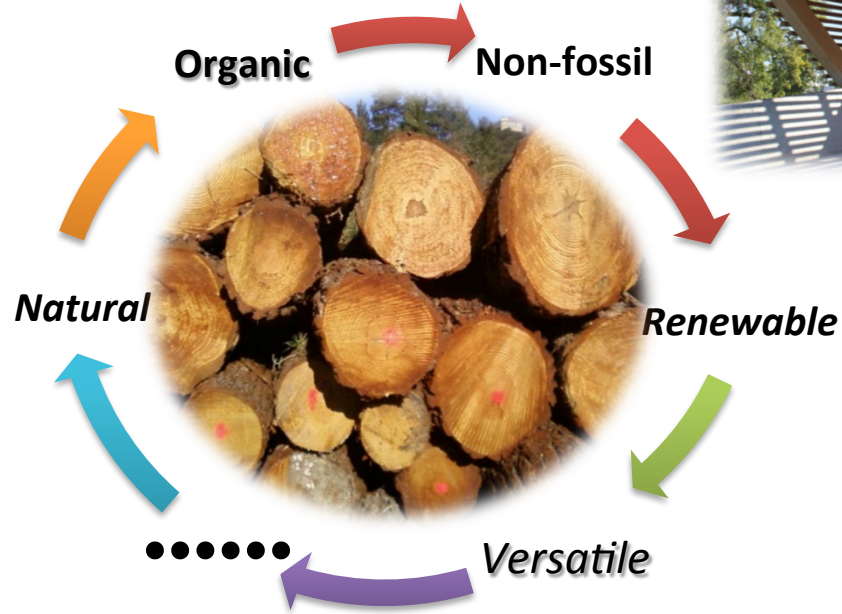
ModWoodLife



COST is supported by the  
EU Framework Programme  
Horizon 2020

# Introduction

Ancients  
in the wooden house



# Introduction

Natural durability

Use class

Moisture, sunlight or inappropriate timber specification

Different organisms



## TIMBER DURABILITY CHART



EN 350-2 (1994) Durability of wood and wood-based products: Natural durability of solid wood



# Introduction



EU  
Directives



**BORIC ACID < 5.5%(M/M)**

## Boron compounds – Boric Acid

- *Used in wood preservation sector for centuries*

- **Many advantages:**

**Efficient/wood destroying organisms**

**Soluble into water**

**Environmentally friendly**

- **Inconvenients:**

**Leachable**

**Classified as reprotoxic class 3 in EU only**

- Need for fixation

Fixation very important because of EU restriction



# Introduction

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

 ScienceDirect

 ELSEVIER

Bioresource Technology 99 (2008) 7312–7322

 BIORESOURCE  
TECHNOLOGY

Reducing leaching of boron-based wood preservatives –  
A review of research

Diana N. Obanda<sup>a,1</sup>, Todd F. Shupe<sup>a,\*</sup>, H. Michael Barnes<sup>b,2</sup>

- Surface treatments
- Organo boron compounds
- Boron–silicon compounds
- Protein borates
- Boron/linseed oil
- Tannin auto condensation

## Fixation of boron with tannins



Tannin : natural product +  
cheap + available + very  
reactive

Previous studies

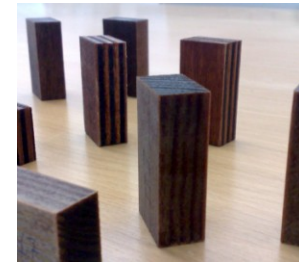
# Introduction



*Termite attack*



*Unsterile soil-bed tests*



Eur. J. Wood Prod.  
DOI 10.1007/s00107-012-0603-1

ORIGINALS ORIGINALARBEITEN

## **Tannin-boron preservatives for wood buildings: mechanical and fire properties**

G. Tondi · S. Wieland · T. Wimmer · M.F. Thevenon ·  
A. Pizzi · A. Petutschnigg

*Fungi decay*



*Larvae infestation*

# Materials and methods

## Scenario



Landscape, use class 3  
30-year service life

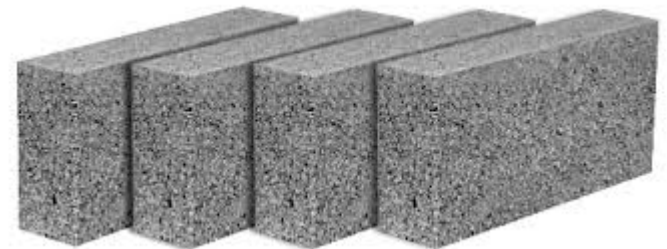
Tannin-boron  
treated timber



ACQ-treated timber

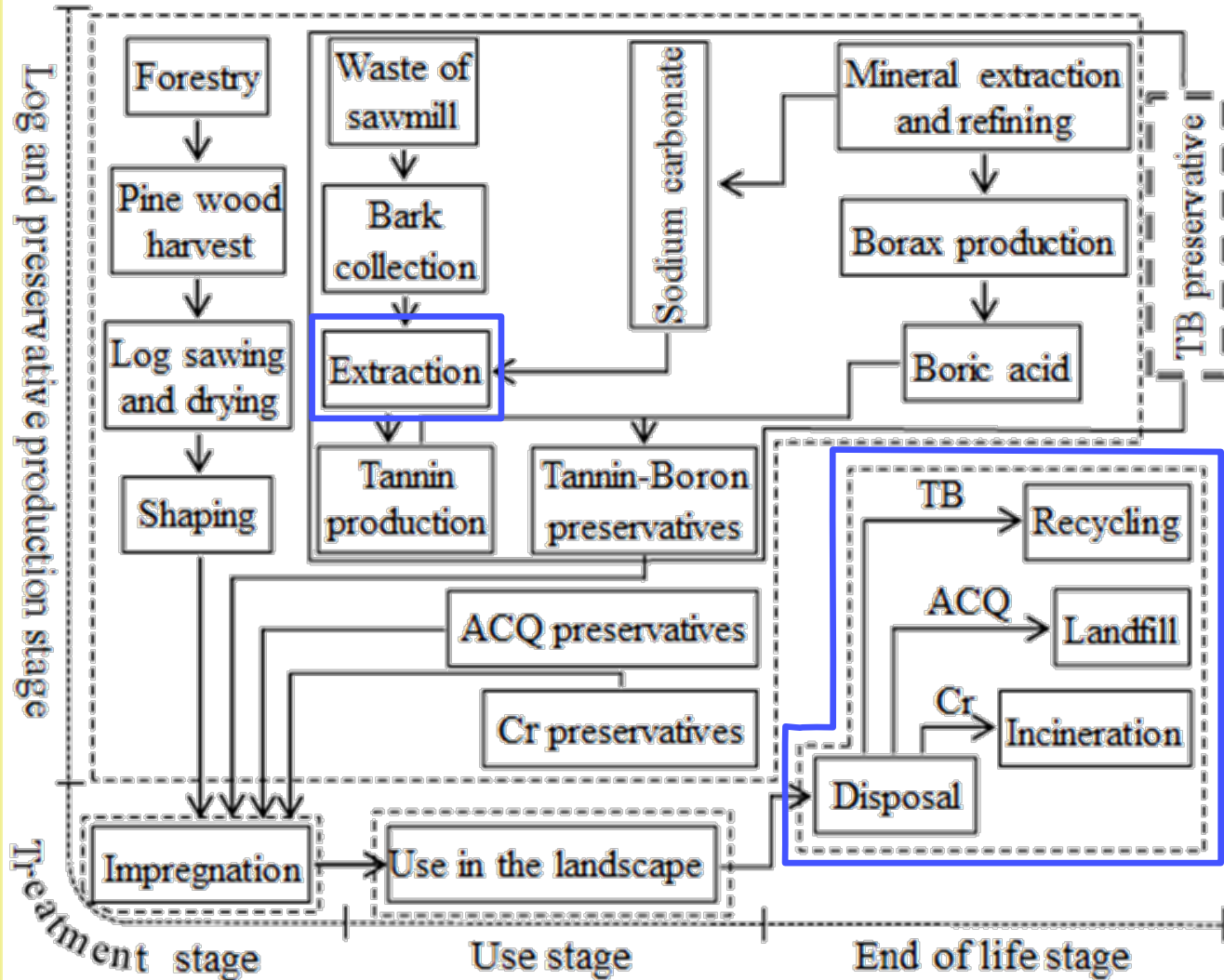


Cr-treated timber



Concrete

## System boundaries



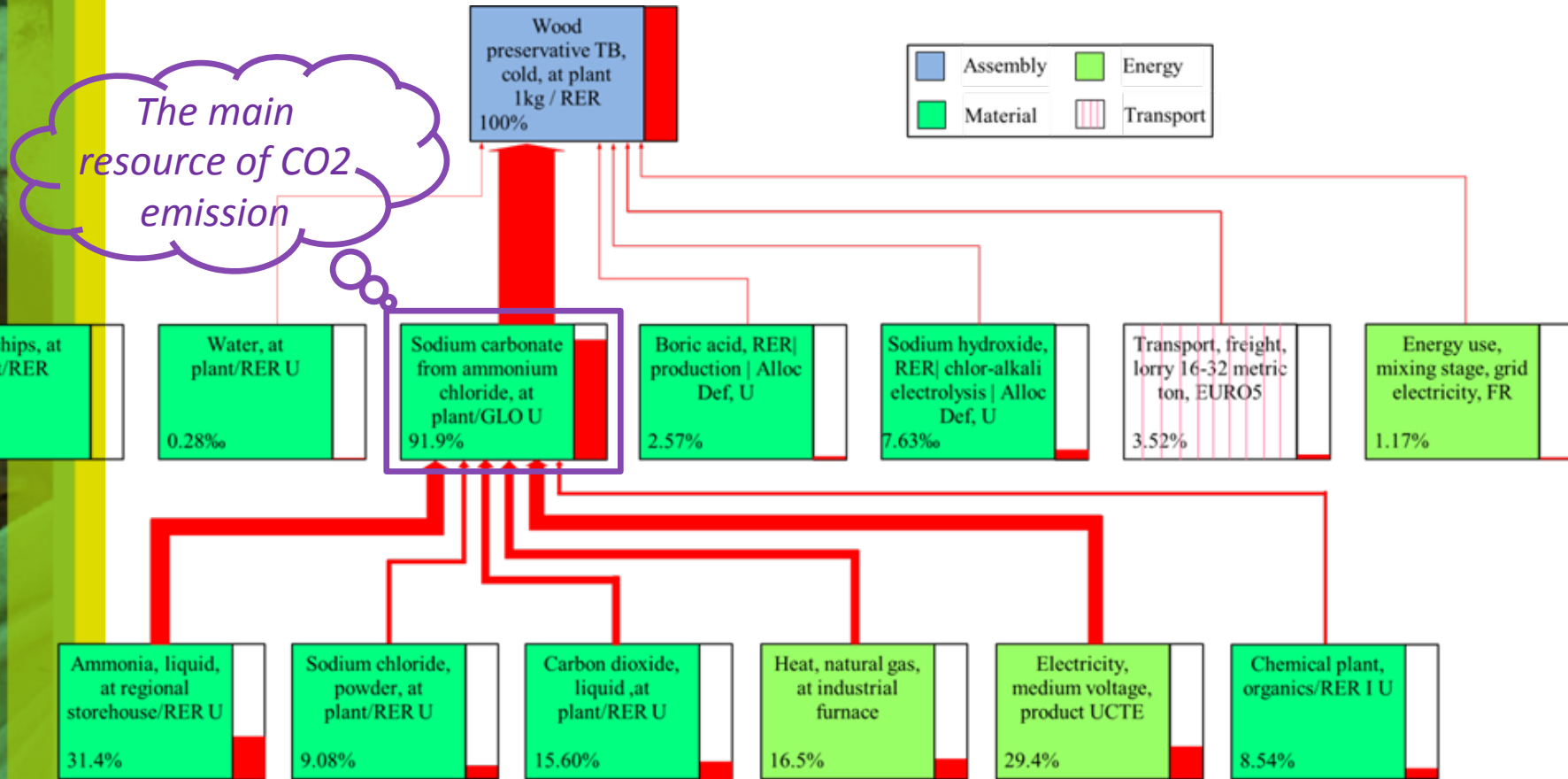
Reference:  
Vieira et al.,  
2011

Chemical  
substance



# Results and discussion

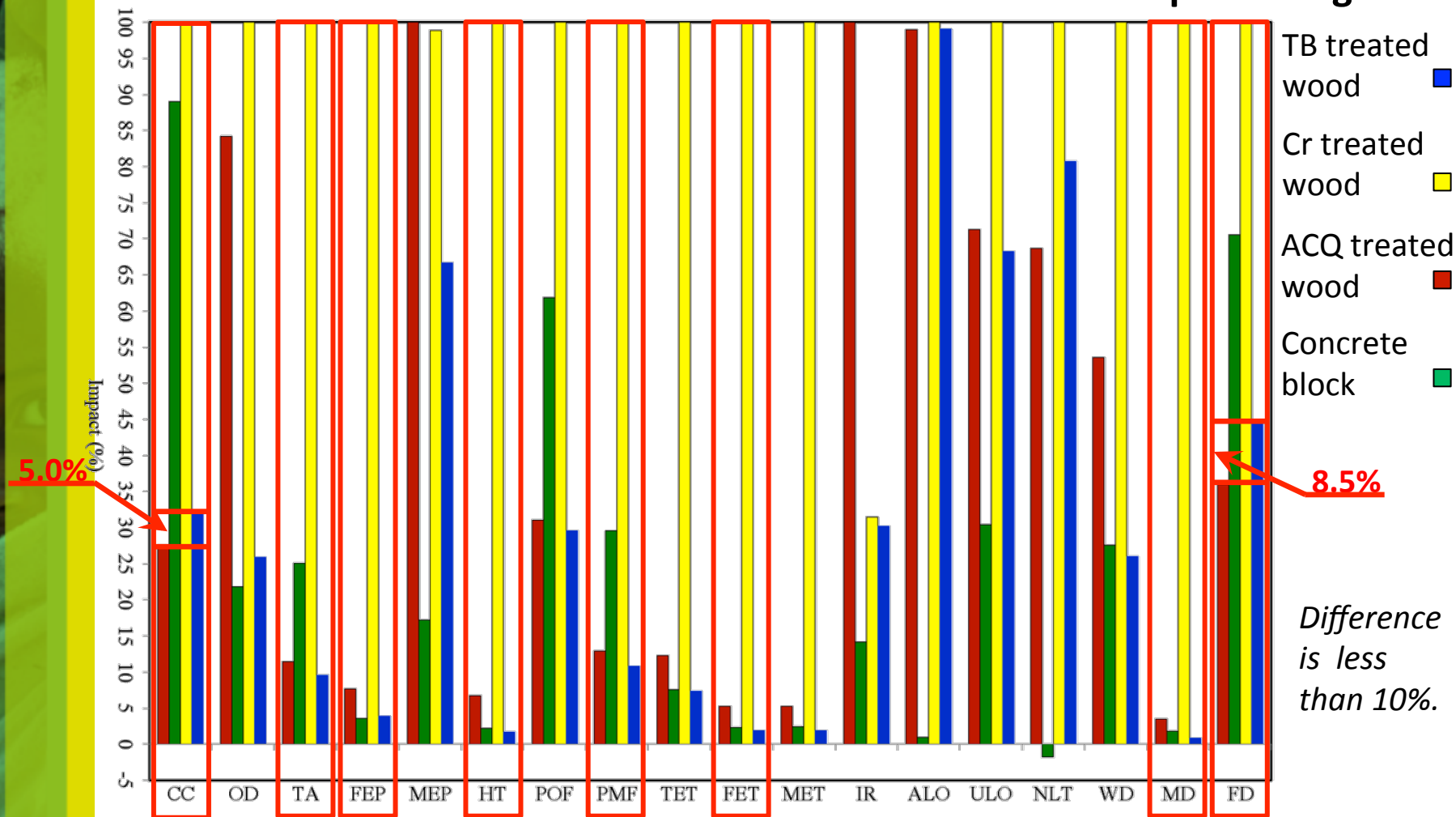
## Main contributions of TB process to global warming potential



*# The lab extraction process was chosen in this study. However, the industry process in South Africa only used hot water.*

# Results and discussion

## Contributions of impact categories

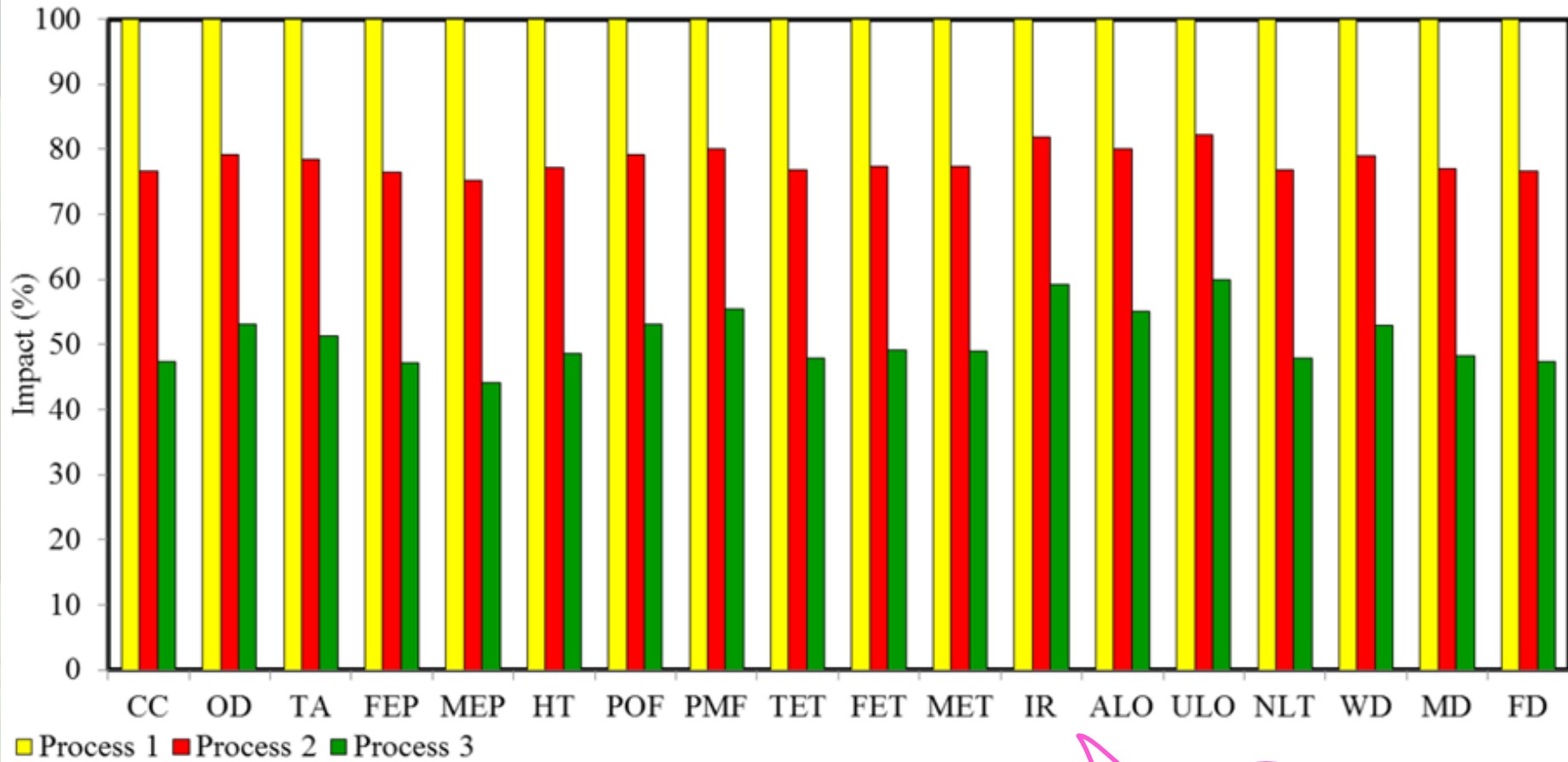


*Difference is less than 10%.*

CC	Climate change	TA	Terrestrial acidification	FEP	Freshwater eutrophication
HT	Human toxicity	PMF	Particulate matter formation	FET	Freshwater ecotoxicity
WD	Water depletion	FD	Fossil depletion		

# Results and discussion

## Sensitive analysis



N° process	Liquor / bark ratio	Na <sub>2</sub> CO <sub>3</sub> concentration
1	15:1	8.0%
2	12:1	7.5%
3	7.5:1	7.0%

*The sodium carbonate is primary factor to the environmental impact.*

## Conclusion



*Overall, the results demonstrated that tannin-boron preservatives can be regarded as a low-environmental impact formulation.*

*However, the influential parameters of tannin processing at industrial scale should now be investigated further and more in depth as different studies and opinions exist and are available on this point.*

*Additionally, an economic analysis of the development of a commercially-viable tannin-boron preservative would now be timely.*



**cirad**

LA RECHERCHE AGRONOMIQUE  
POUR LE DÉVELOPPEMENT

Innovons  
ensemble  
pour les  
agricultures  
de demain

**Merci !**

*Thanks!*