



FRISCO

Managing fire-induced risks
of water quality contamination

Assessing the Effectiveness of SLM Measures in Restoring Forest Ecosystem Services Disturbed by Forest Fires

SSS7.6 - Restoration, rehabilitation and management of degraded soils and ecosystems

EGU General Assembly – 23rd to 27th May 2022

Beatriz Faria – Centre for Ecology, Evolution and Environmental Changes (cE3c), Sciences Faculty, University of Lisbon, Portugal, fc49346@alunos.fc.ul.pt

João Pedro Nunes – Soil Physics and Land Management Group, Wageningen University & Research, the Netherlands, joao.carvalhonunes@wur.nl

Jinfeng Wu – State Key Laboratory of Hydrosience and Engineering, Dept. of Hydraulic Engineering, Tsinghua University, China, jinfengwu2020@163.com

Jantiene Baartman - Soil Physics and Land Management group, Wageningen University & Research, the Netherlands, jantiene.baartman@wur.nl

Sergio Prats – Mediterranean Institute for Agriculture, Environment and Development, University of Évora, Portugal, sergio.prats@uevora.pt

Luís Dias – Centre for Ecology, Evolution and Environmental Changes (cE3c), Sciences Faculty, University of Lisbon, Portugal, lfdias@fc.ul.pt

This work was produced in the framework of project FRISCO - managing Fire-induced RISks of water quality Contamination (PCIF/MPG/0044/2018), and funding attributed to the CE3C research center (UIDB/00329/2020).



Partners:



Funded by:

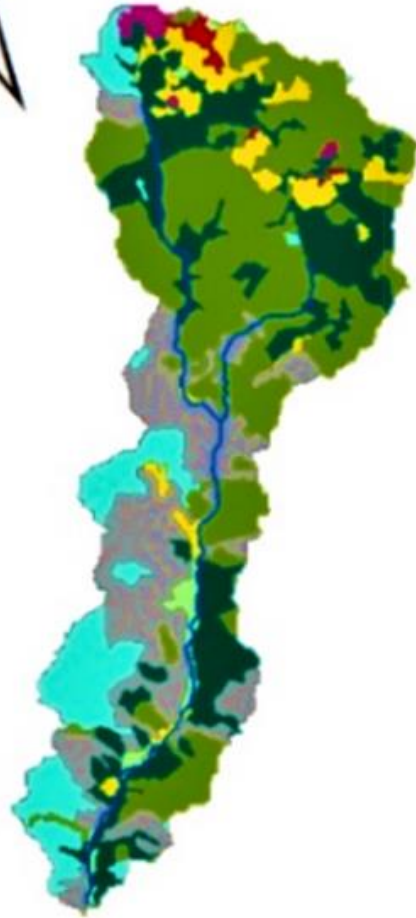


Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR



FRISCO

Context



Legend

— Channel system

Land use

■ Buildings

■ Complex crop patterns

■ Pasture

■ Mediterranean oaks

■ Eucalypts

■ Pines

■ Shrubs

■ Young eucalypts

- In Portugal, the forest fires of 2003 and 2005 burnt 430K and 300K hectares of forest and shrub land.
- 2003 and 2005 were known for their dry summer and extreme drought conditions.
- After a fire season, heavy rainfall in the burnt mountain areas leads to soil loss, erosion and floods. There is also increasing risk of stream water contamination (IFFN, 2006).



FRISCO

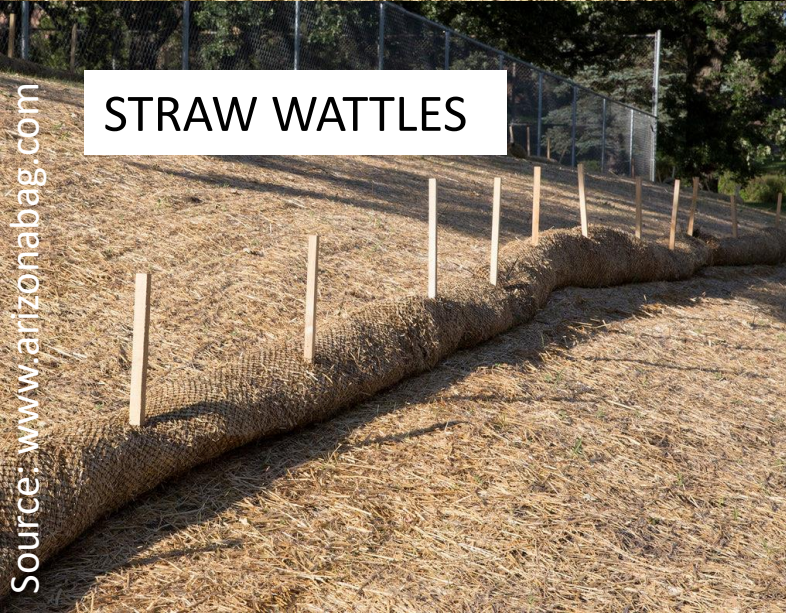
SLM Measures

MULCHING



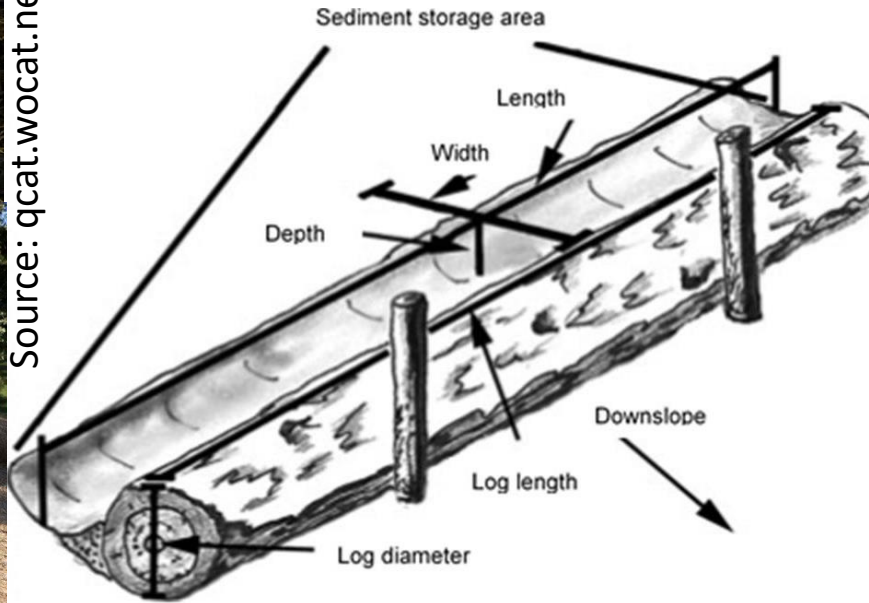
Source: afterwildfirenm.org

STRAW WATTLES



Source: www.arizonabag.com

CONTOUR-FELLED LOGS



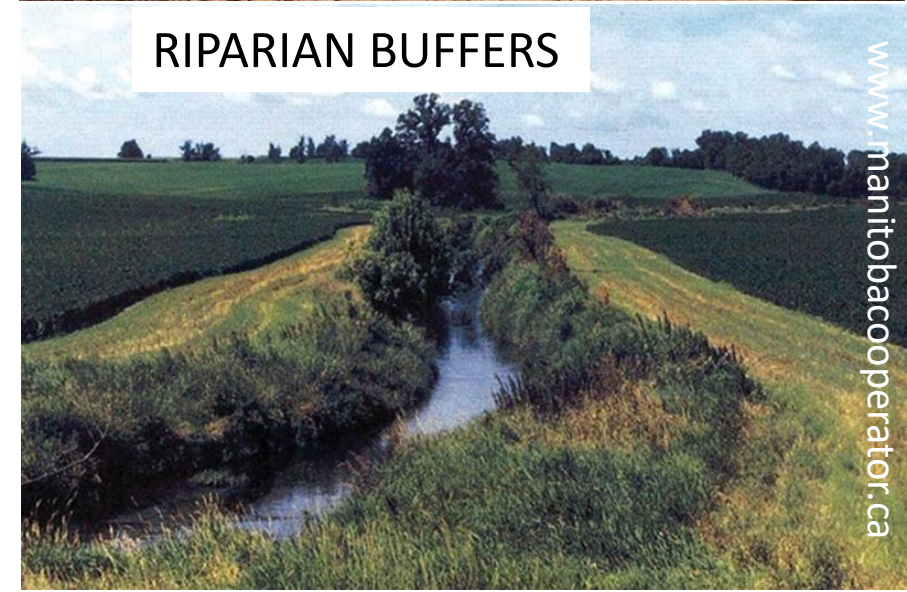
Source: qcat.wocat.net

CONTOUR BUNDS



Source: webstreaming.com.br

RIPARIAN BUFFERS



www.manitobacooperator.ca



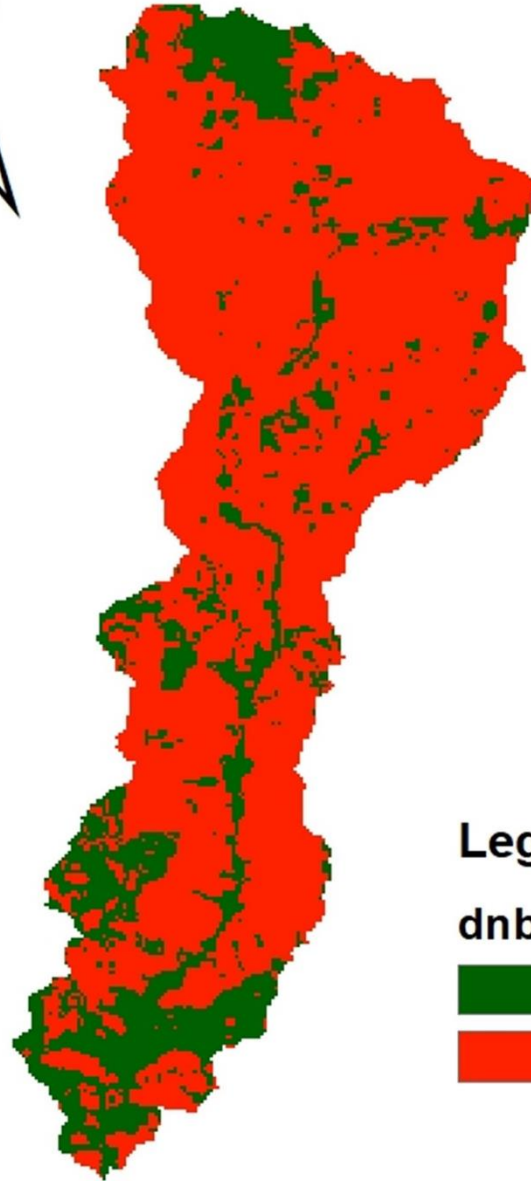
FRISCO

MULCHING

Source: afterwildfirenm.org

STRAW WATTLES

Source: www.arizonabag.com



Legend

dnbr10.map

0

1

0 0.5 1 2 3 4 Kilometers

LM Measures

RIPARIAN BUFFERS

Source: www.manitobacooperator.ca

CONTOUR BUNDS

Source: webstreaming.com.br



OpenLISEM model



- Previously calibrated and validated for pre- and post-fire conditions using data from 2003 forest fires (Wu et al, 2021).
- Run model with 5-year return period rainfall event
- Creation of SLM measures in the model:
 - Mulching: ground cover maps
 - Erosion barriers + riparian buffers: model tools (sediment traps & grasstrips)

Conservation measures

- ☒ Sediment traps/fences (needs sedretmax.map, max volume sed. trapped in m3)
 - Manning's n sediment trap: 0.8
 - Bulk density of deposited layer(kg/m3): 1400.0
- ☐ Include grasstrips (needs graswidtht.map, ksatgras.map, poregras.map and cohgras.map)
 - Manning's n grass strip: 0.2



FRISCO

Methodology

MCA

Economic criteria

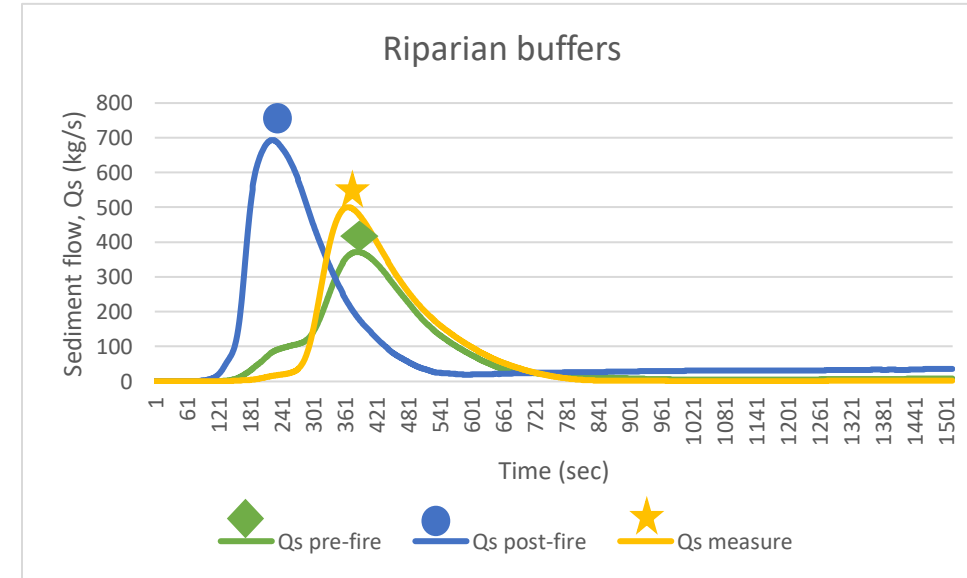
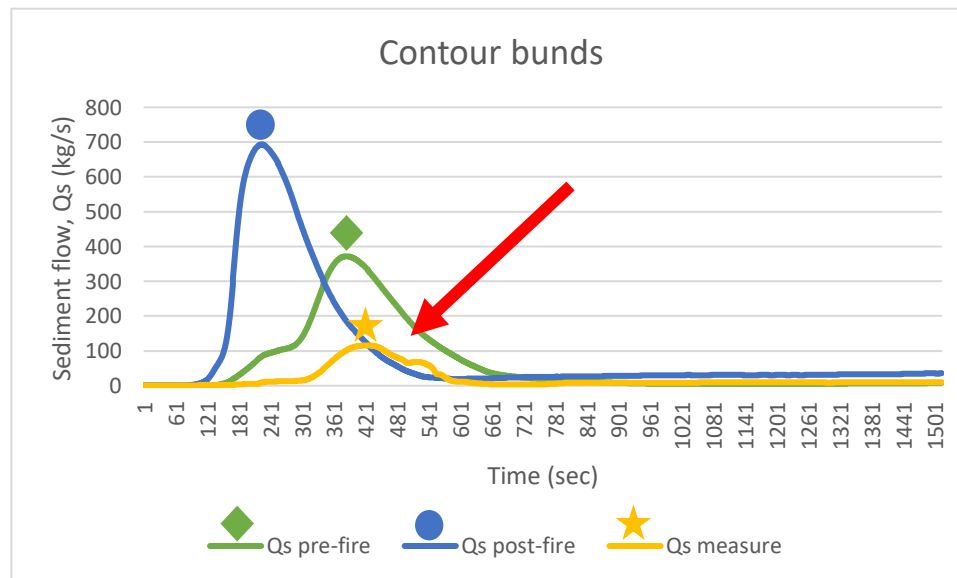
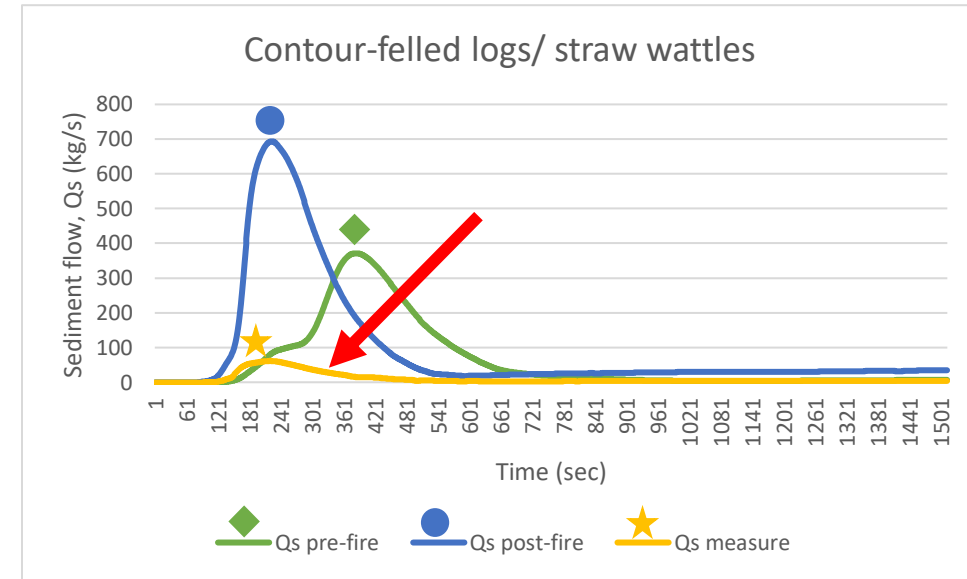
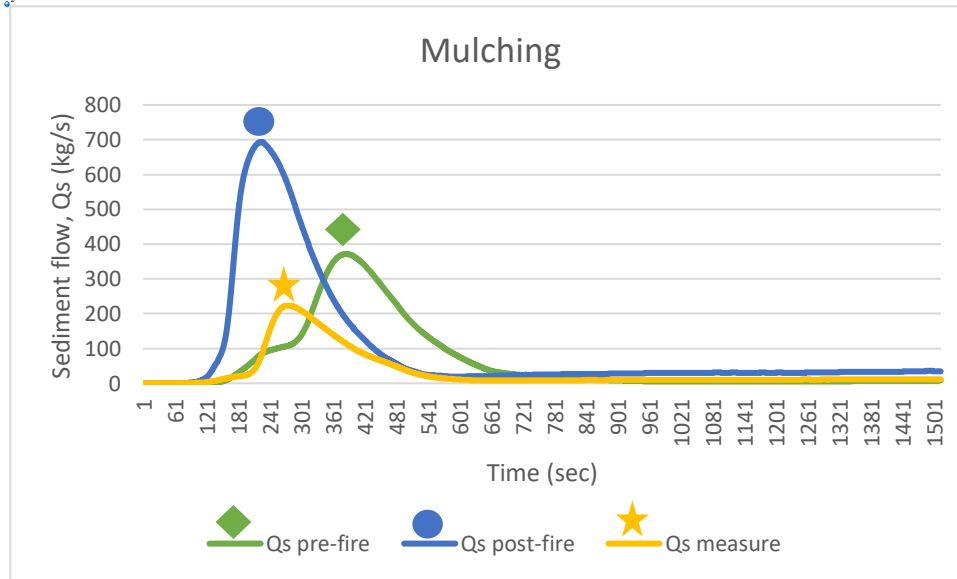
Environmental
criteria

Effectiveness
information gathered
from the model

CRITERIA	Units	Type of criteria	MCA_0	MCA_1	MCA_2	MCA_3	MCA_4
Economic impacts							
Labour input	Person/ ha	Negative	1	10	1	1	1
Material input	€/ ha	Negative	1	10	1	1	1
Application Rate	ton/ ha	Negative	1	10	1	1	1
Transport requirements	€/ ha	Negative	1	10	1	1	1
TOTAL COSTS	€/ha	Negative	1	10	1	1	1
Cost-effectiveness	€/ ton	Negative	1	10	1	1	1
Erosion Control/ Soil Conservation							
Average soil loss	ton/ ha	Negative	1	1	10	10	1
Flow detachment (land)	ton	Negative	1	1	10	10	1
Splash detachment (land)	ton	Negative	1	1	10	10	1
Water Conservation							
Flow detachment (channel)	ton	Negative	1	1	10	1	10
Sum sediment yield	ton	Negative	1	1	10	1	10
	% Reduction	Positive	1	1	10	1	10
Flood protection							
Peak runoff flow	l/s	Negative	1	1	10	1	1
	% Reduction	Positive	1	1	10	1	1
Other							
Compromises slope stabilization?	YES/NO	Negative	1	1	10	10	1
Compromises vegetation regrowth?	YES/NO	Negative	1	1	10	10	1
Know how	-	Negative	1	10	1	1	1 ⁶



Water Quality Results

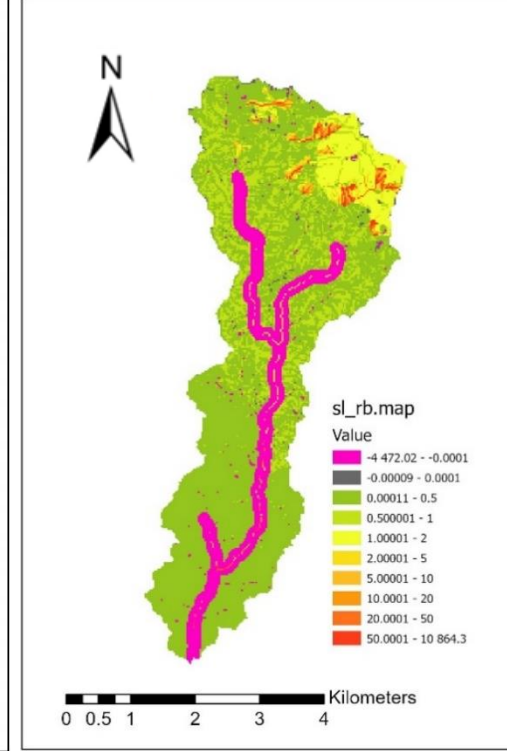
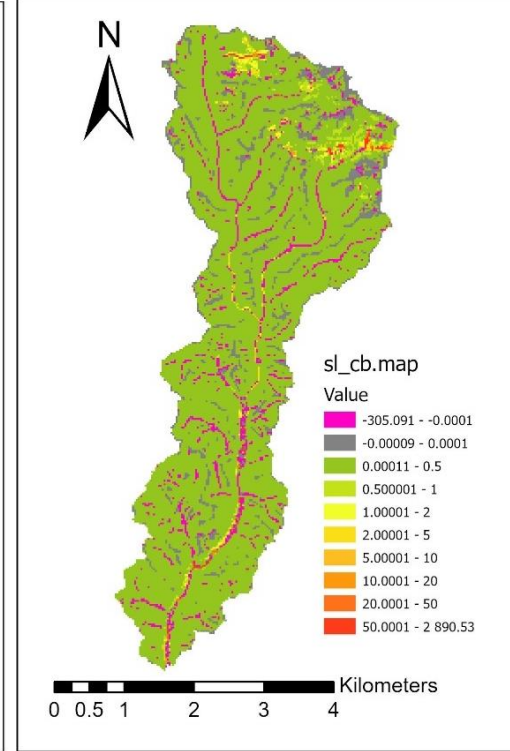
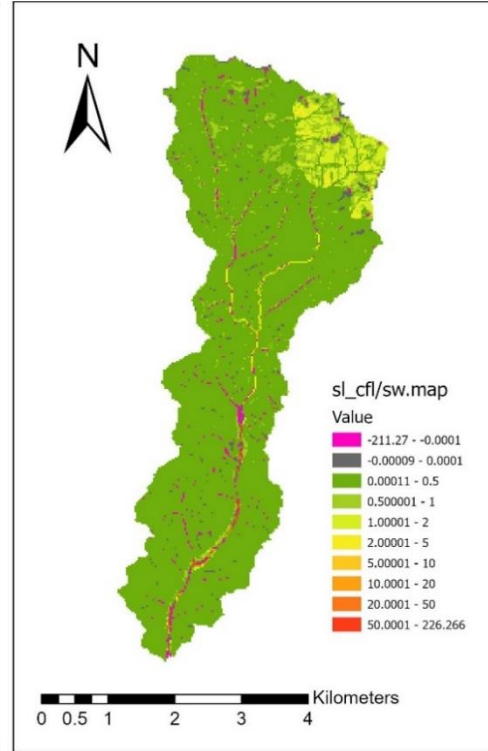
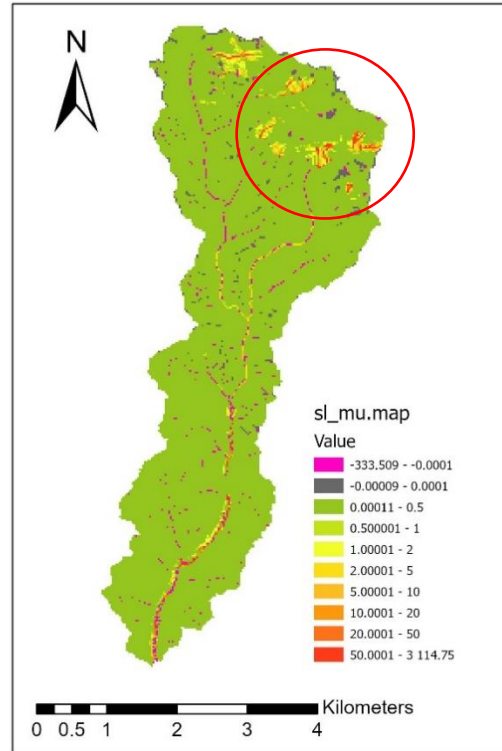
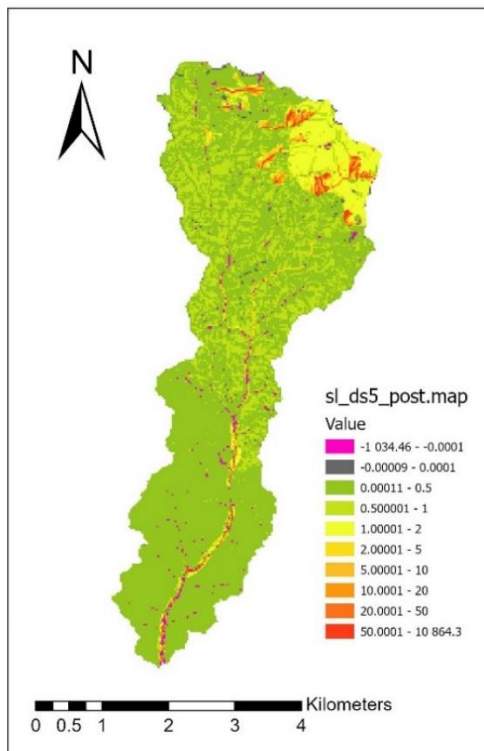




FRISCO

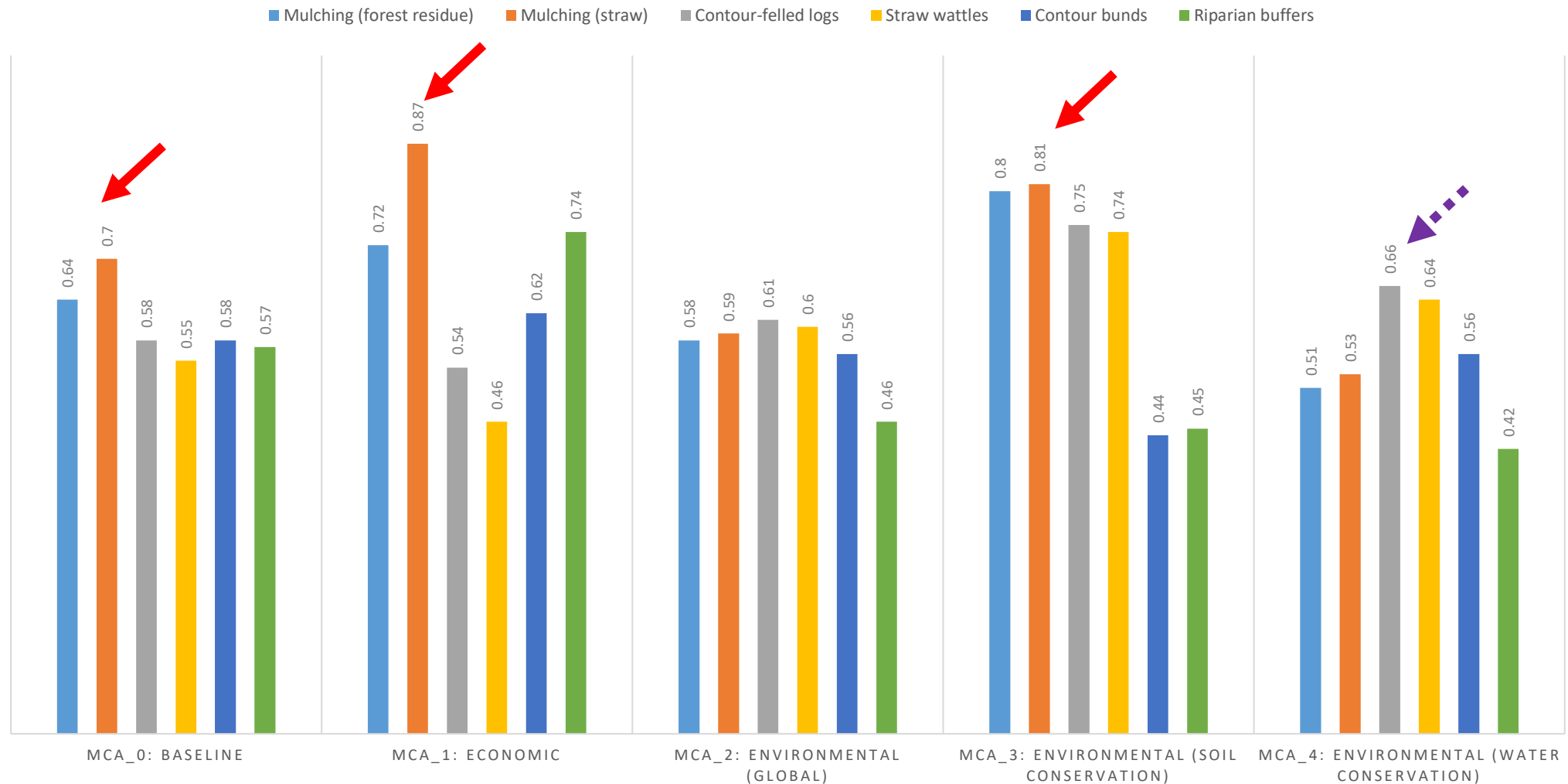
Soil Conservation Results

- Mulching: decreased erosion in the northeast area of the catchment.
- Erosion barriers: increased deposition all over the catchment (pink lines).
- Riparian buffers: Significant increase in deposition in the buffers' area.





TOTAL SCORES FOR THE SEVERAL MCA PERSPECTIVES





FRISCO

Managing fire-induced risks
of water quality contamination

Thank you for listening!

I'm available for questions & discussion of the work.

Beatriz Faria

Centre for Ecology, Evolution and Environmental Changes
(cE3c), Sciences Faculty , University of Lisbon, Portugal

fc49346@alunos.fc.ul.pt

Partners:



universidade
de aveiro

cesam
universidade de aveiro
centro de estudos do ambiente
e do mar



Funded by:



Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR