Natural needle carper protecting the soil from soil erosion (Sergio Prats Alegre)

Post-fire Natural Mulching (Portugal)

No intervention, needle carpet, caruma (Portuguese)

DESCRIPTION

In certain situations, the leaves from the burnt trees created a natural carpet that protect the soil from being eroded.

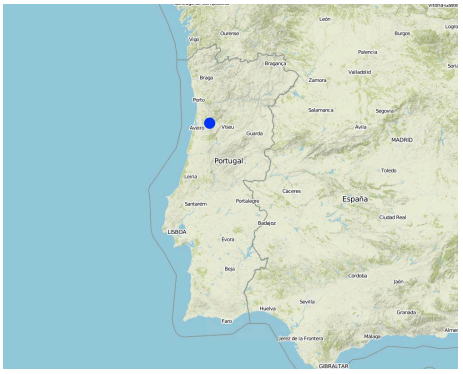
In the 2007 summer a wildfire affected the locality of Pessegueiro do Vouga, municipality of Sever do Vouga, north-central Portugal. The area was afforested with eucalypt and pine plantations. The research team of the University of Aveiro checked that in some burnt areas the crown damage was very small, despite the litter and underground vegetation were totally consumed by fire. The pine site presented a markedly lower fire severity, with the canopies only partially consumed by the fire, so it allow to study the effect of fire severity on soil erosion by comparison with adjacent slopes burned a high severity.

Purpose of the Technology: In a wildfire that affected a pine plantation in central Portugal in 2007, the research team of the University of Aveiro set up an experiment in order to test the effect of forest residue mulching as a soil erosion mitigation treatment. However, the low fire severity resulted in an elevated litter cover prior any technique was applied. The objective is to determine were “no action” in post-fire management will still result in low soil erosion values.

Establishment / maintenance activities and inputs: The high litter cover will decrease post-fire soil erosion by reducing raindrop impact over the ashes and the bare soil, and decrease the runoff amount by increasing water surface storage, decrease of runoff velocity, and increase infiltration. As the needle litter cover was natural, no action was needed. After a simple assessment of the remaining ground cover in the burnt area, the "no intervention" option should be selected if the soil is covered by litter, leaves or needles. The benefits of this are not only the mitigation of soil erosion (and associated soil fertility losses) immediately after forest fires, but also the long-term conservation of the soil resources without additional costs.

Natural / human environment: The landscape reflects a long history of intense land management, with a mosaic of (semi-)natural and man-made agricultural and afforested lands. Since the 1980´s, however, wildfires have increased dramatically in frequency and extent, aided by a general warming and drying trend but driven primarily by socio-economic changes.

LOCATION



Location: Sever do Vouga, Pessegueiro de Vouga, Portugal, Aveiro, Portugal

No. of Technology sites analysed:

Geo-reference of selected sites
- -8.34789, 40.72911

Spread of the Technology: evenly spread over an area (approx. < 0.1 km2 (10 ha))

In a permanently protected area?:

Date of implementation: less than 10 years ago (recently)

Type of introduction
- [ ] through land users' innovation
- [ ] as part of a traditional system (> 50 years)
- [x] during experiments/ research
- [ ] through projects/ external interventions

Leaves protecting the soil in a burned slope

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- improve production
- reduce, prevent, restore land degradation
- conserve ecosystem
- protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- reduce risk of disasters
- adapt to climate change/ extremes and its impacts
- mitigate climate change and its impacts
- create beneficial economic impact
- create beneficial social impact

Land use

Forest/ woodlands

- Tree plantation, afforestation

Tree types: Pinus species (pine)
Products and services: Timber, Fuelwood

Water supply

- rainfed
- mixed rainfed-irrigated
- full irrigation

Purpose related to land degradation

- prevent land degradation
- reduce land degradation
- restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Degradation addressed

soil erosion by water - Wt: loss of topsoil/ surface erosion, Wo: offsite degradation effects

physical soil deterioration - Pk: slaking and crusting

SLM group

- improved ground/ vegetation cover

SLM measures

agronomic measures - A1: Vegetation/ soil cover

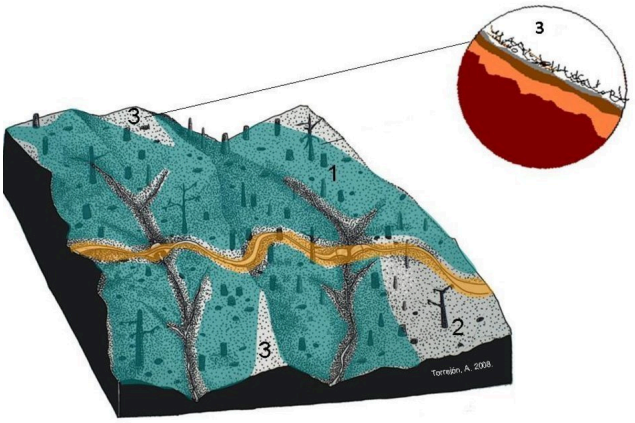
TECHNICAL DRAWING

Technical specifications

Natural mulch is often present in areas burnt at low severity or only partially burnt (3). This areas as well as planar areas (2) must be areas for no mitigation treatment or "no action" after forest fires.

Main technical functions: control of raindrop splash, control of dispersed runoff: retain / trap, control of concentrated runoff: retain / trap, improvement of ground cover, increase of surface roughness, increase of infiltration, sediment retention / trapping, sediment harvesting, increase of biomass (quantity)

Secondary technical functions: control of dispersed runoff: impede / retard, control of concentrated runoff: impede / retard, improvement of surface structure (crusting, sealing), improvement of topsoil structure (compaction), increase in organic matter, increase in nutrient availability (supply, recycling,...), increase / maintain water stored in soil



Mulching
Material/ species: natural needle carpet
Remarks: Up to 50% litter cover

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated:
- Currency used for cost calculation: **n.a.**
- Exchange rate (to USD): 1 USD = n.a
- Average wage cost of hired labour per day: n.a

Most important factors affecting the costs

No cost are envisaged for this technology. Visual assessment of the soil cover can be susceptible for costs, for example consulting, but we think it is not eligible.

Establishment activities

1. Natural cover (Timing/ frequency: None)

Maintenance activities

n.a.

NATURAL ENVIRONMENT

Average annual rainfall

- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1,000 mm
- [x] 1,001-1,500 mm
- [ ] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone

- [x] humid
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate

Thermal climate class: subtropics

Thermal climate class: temperate

Slope

- [ ] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [x] hilly (16-30%)
- [x] steep (31-60%)
- [ ] very steep (>60%)

Landforms

- [ ] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [x] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude

- [ ] 0-100 m a.s.l.
- [x] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in

- [ ] convex situations
- [ ] concave situations
- [ ] not relevant

Soil depth

- [x] very shallow (0-20 cm)
- [x] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)

- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)

- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content

- [x] high (>3%)
- [ ] medium (1-3%)
- [ ] low (<1%)

Groundwater table

- [ ] on surface
- [ ] < 5 m
- [ ] 5-50 m
- [x] > 50 m

Availability of surface water

- [ ] excess
- [ ] good
- [x] medium
- [ ] poor/ none

Water quality (untreated)

- [x] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to:

Is salinity a problem?

- [ ] Ja
- [ ] Nee

Occurrence of flooding

- [ ] Ja
- [ ] Nee

Species diversity

- [ ] high

Habitat diversity

- [ ] high

- [ ] medium
- [x] low

- [ ] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [ ] mixed (subsistence/ commercial)
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [x] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [x] poor
- [x] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [ ] manual work
- [ ] animal traction
- [ ] mechanized/ motorized

Sedentary or nomadic
- [ ] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [ ] individual/ household
- [x] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [ ] youth
- [ ] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [x] company
- [ ] communal/ village
- [ ] group
- [x] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

Water use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor	good
education	poor	good
technical assistance	poor	good
employment (e.g. off-farm)	poor	good
markets	poor	good
energy	poor	good
roads and transport	poor	good
drinking water and sanitation	poor	good
financial services	poor	good

IMPACTS

Socio-economic impacts
wood production

decreased — increased

Some reduced wood production can be associated to the technique by carrying out selective felling.

Socio-cultural impacts
SLM/ land degradation knowledge

reduced — improved

Public awareness of the technology is very limited. It is necessary to show it to landowners and stakeholders and increase dissemination.

Improved livelihoods and human well-being

decreased — yes

Ecological impacts

surface runoff	increased	decreased
evaporation	increased	decreased
soil moisture	decreased	increased
soil cover	reduced	improved
soil loss	increased	decreased
soil crusting/ sealing	increased	reduced
soil compaction	increased	reduced
fire risk	increased	decreased

Off-site impacts

downstream flooding (undesired)	increased	reduced
damage on neighbours' fields	increased	reduced
damage on public/ private infrastructure	increased	reduced

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative	very positive ✓
Long-term returns	very negative	very positive ✓

Benefits compared with maintenance costs

Short-term returns	very negative	very positive ✓
Long-term returns	very negative	very positive ✓

As natural mulching has no cost, any benefit is always very positive

CLIMATE CHANGE

Gradual climate change

annual temperature increase	not well at all	very well ✓

Climate-related extremes (disasters)

local rainstorm	not well at all ✓	very well
local windstorm	not well at all	very well ✓

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- single cases/ experimental
- 1-10%
- 11-50%
- > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- 0-10%
- 11-50%
- 51-90%
- 91-100%

Has the Technology been modified recently to adapt to changing conditions?

- Ja
- Nee

To which changing conditions?

- climatic change/ extremes
- changing markets
- labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- No cost

Strengths: compiler's or other key resource person's view

- It is a technology with no associated cost and with low failure possibilities and a strong soil erosion control.

  How can they be sustained / enhanced? Inform land owners and forest managers to avoid post-fire logging in areas with natural mulching and therefore avoid the decrease in the technology effeciency. Some times logging after fire reduces the natural mulching capacity to prevent post-fire erosion.

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- No possible to harvest the logs during the first period after the fire Assume the cost of selective felling

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- Some people argue that can increase fire risk Fire risk will not be probably increase as the surrounded areas were frequently also burned

REFERENCES

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Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_1298/

Linked SLM data
n.a.

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Key references

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