“Climate change effect mitigation through cultivation practices in olive trees”

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presented by
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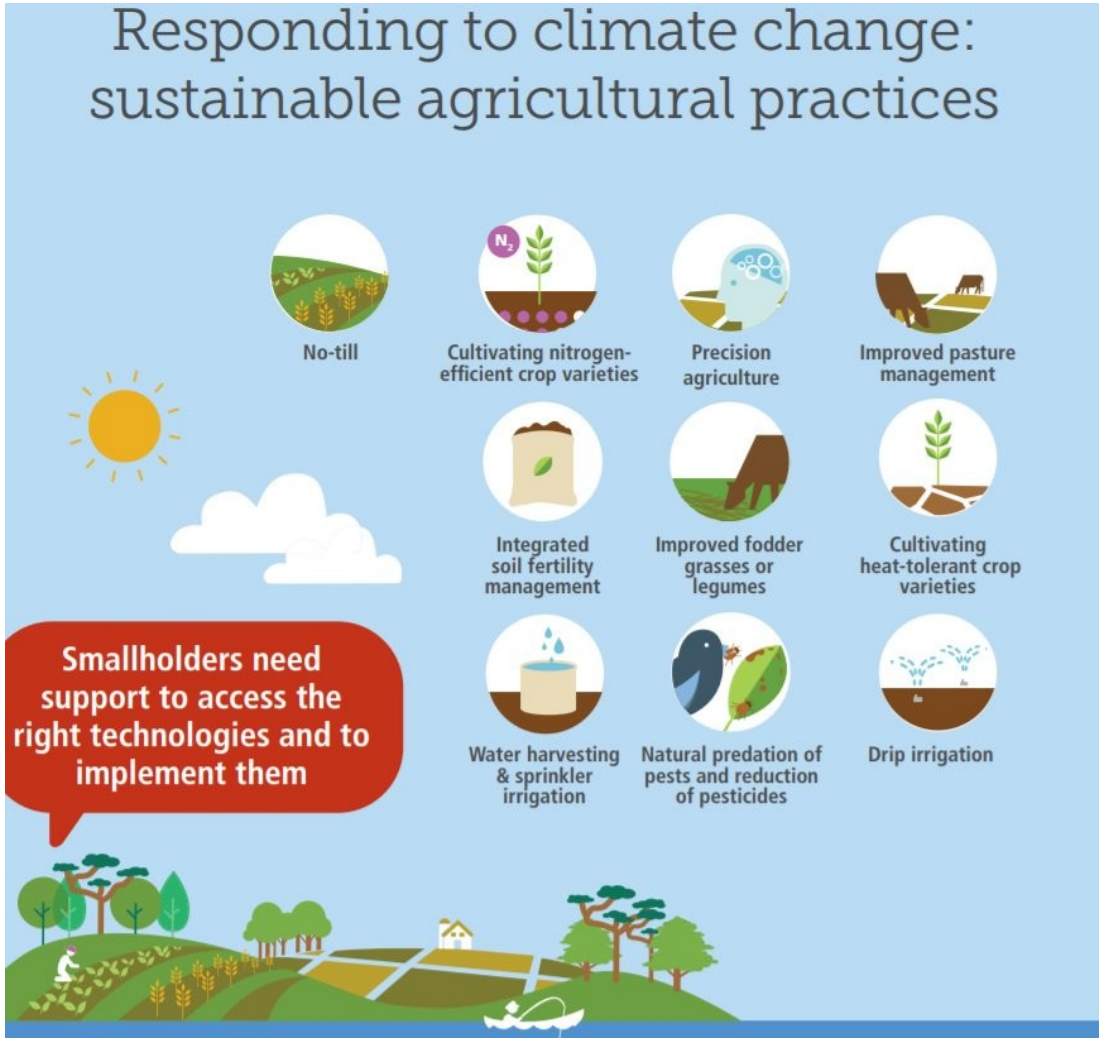

Πηγή: **Food and Agriculture Organization of the United Nations**
http://www.fao.org/home/en/

Agriculture is considered **responsible for 14% of global GHG** emissions in CO_2 equivalents **land use change** for agriculture development, causes **17 % of global emissions.**

Land use changes account for some **12% of all the greenhouse gas** emissions that lead to global warming.

Our study addressed a multiplicity of environmental issues:

- Carbon dioxide surplus in the air, lost from soil – Erosion & Desertification
- Nutrients losses are replaced by environmentally damaging inorganic fertilizers
- Nitrogen losses – Obstacle to the expansion of organic farming
- Wood burning –Toxicological issues and more GHG emissions
- Olive Oil Mill Waste Water

Agriculture is widely considered as a major part of the climate problem. The sustainable agricultural practices are on top of priorities at European and national level.

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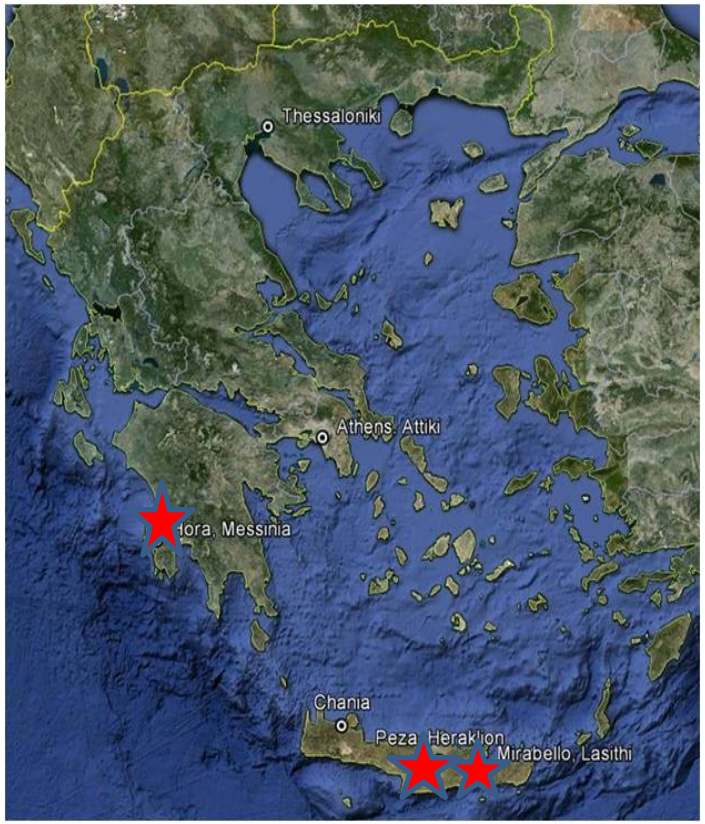
What do we do in olive clima project?



Climate change mitigation

Adaptation to new climate conditions

The Cultivation practices

✓return of organic matter

Recycling pruning material directly

Composting

Returning waste from olive mills to the soil

✓improve the balance of CO_2

Improving indigenous flora

Pruning to increase CO_2 capture

Non cultivation of soil, to reduce the release of CO_2

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Olive tree pruning

Among the practices introduced, the most important seems to be pruning. It has become obvious to olive growers that oLIVE CLIMA pruning can smoothen the year-to-year alternate bearing of olive trees, a situation that exhausts the trees in the “on” years, rendering them susceptible to adverse conditions in the “off” years, with detrimental effect on yields and production cost. Sustainability of olive growing is possible, and the threat of abandonment can be deterred. Olive growers, especially the most experienced among them believe that oLIVE CLIMA pruning and other practices will help them in the long run.

https://www.youtube.com/watch?v=9J1w7f0Tghk

The project succeeded to demonstrate to farmers and their consultants working practices alternative to the traditional ones, which enhance CO_2 absorption from the atmosphere, increase carbon sequestration in biomass and carbon storage in soil and wood.

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Ολιστική διαχείριση ελαιώνα / Holistic olive grove management

Compared to wood burning, wood shredding exposes the citizens less to nasty gases created by the bonfires (mainly due to incomplete burning). When shredded wood is spread on the ground or composted, it can reduce fertilizers use by the olive grower, as 1000Kg of dry wood can replace 6.5, 9.0 and 3.0 Kg/Ha of N, P and K respectively, according to the analyses performed on shredded wood by IOTSP. At the same time, it adds 0.55T of C/Ha to enrich soil organic matter (SOM), but the environmental benefit of avoiding the extraction of 300-400 kg of heating fuel (per 1000 Kg of dry wood) is still debatable in the context of the PEFCR development, for the fear of possible double counting, as it happens sometimes with biofuels.

https://www.youtube.com/watch?v=ZnqqvnlL95Q&feature=youtu.be

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"Most techniques are indeed applicable and reap immediate, visible, and positive financial benefits."

- George Michalopoulos, oLIVE CLIMA agronomist

The pruning method proposed by the project focuses on two results, a) to increase as much as possible the soil cover with olive tree foliage, so as to increase photosynthesis and carbon dioxide assimilation, and b) to increase yield in Kg of fruit/Ha and olive oil content % of fruit (mostly affected by exposure to sun), i.e. finally the yield in Kg olive oil per hectare. Both results are products of the same process, good quality pruning.

During the initial phase of the project, serious differences were recorded between the approaches that the three farmers' groups had against pruning, as follows:

•Merabello: Occasional / empirical pruning, rarely every year, often every 3-5 years.

•Peza: Early spring pruning, mostly every year, professionally trained operators.

•Nileas: Winter pruning every year by professionally trained operators. Almost 3 out of the four olive groves in this area are additionally subject to detailed summer pruning.

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•Pruned wood shredding and spreading was applied 204 times, adding up to 172 Ha, whilst it was also used 21 times (11 Has) on control parcels.

•Pruned wood was burnt 76 times (29 Ha) on control parcels, and 17 times (21 Ha) on the implementation parcels, especially in Crete in the first year of the project.

•At the same time primary wood was removed to be used as fuel in houses, from 22 control parcels (18 Ha) and from 69 intervention parcels (108 Ha).

•The lower number for the control is justified because of the habit of not pruning every year, especially in Crete.

•Out of the 228 times (222 Ha) that pruned wood was processed in any way, 45 times (67 Ha) it was (partially) removed from the olive grove as shredded, to be used as fuel, in a pellet sense, and 38 times (62 Ha) to be part of the compost mix.

•The first option (pellet type fuel) was also tested one time in a control parcel (2 Ha). The olive growers had a chance to realize the versatility of this intervention.

A collateral problem to increase production cost is the adverse effect of low yields on the environmental footprint of olive oil, since yield in Kg /Ha is the denominator of the entire environmental burden due to the olive grove management.

The pruned wood also offers two options if shredded. To replace part of the fertilizer used and furnish carbon for SOM increase, if spread on the ground, or to replace heating fuel, if collected and sold in the market.

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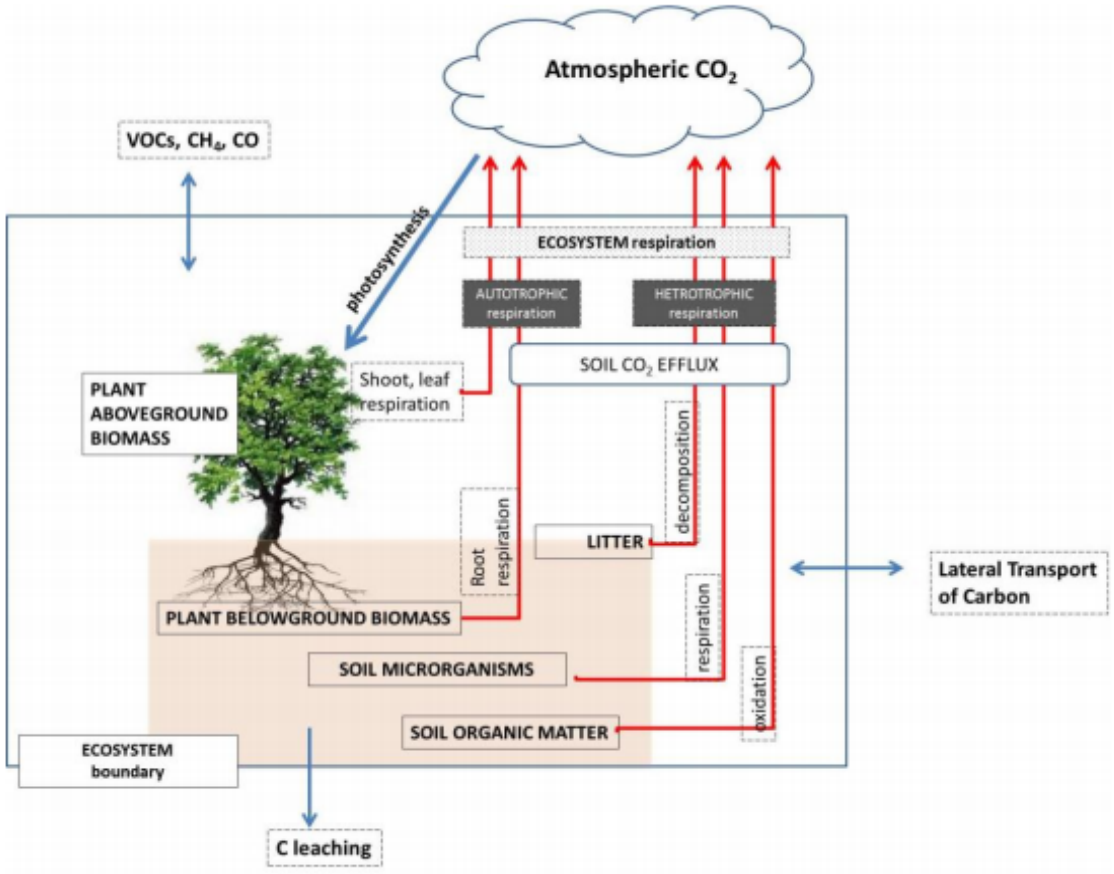
Schematic representation of the main carbon fluxes in ecosystem



Chemical Composition of wood smoke

Species	Grams per Kilogram of Wood
Carbon monoxide	80 to 370
Methane	14 to 25
Volatile organic compounds (C2–C7)	7 to 27
Aldehydes	0.6 to 5.4
Substituted furans	0.15 to 1.7
Benzene	0.6 to 4.0
Alkyl benzenes	1 to 6
Toluene	0.15 to 1.0
Acetic acid	1.8 to 2.4
Formic acid	0.06 to 0.08
Nitrogen oxides (NO, NO_2)	0.2 to 0.9
Sulfur dioxide	0.16 to 0.24
Methyl chloride	0.01 to 0.04
Naphthalene	0.24 to 1.6
Substituted naphthalenes	0.3 to 2.1
Oxygenated monoaromatics	1 to 7
Total particle mass	7 to 30
Particulate organic carbon	2 to 20
Oxygenated PAHs	0.15 to 1
Varied PAHs	
Benzo[a]pyrene	3×10^{-4} to 5×10^{-3}
Dibenzo[a,h]pyrene	3×10^{-4} to 1×10^{-3}
Dibenz[a,h]anthracene	2×10^{-5} to 2×10^{-3}
Particulate elemental carbon	0.3 to 5
Normal alkanes (C24–C30)	1×10^{-3} to 6×10^{-3}
Cyclic di- and triterpenoids	
Dehydroabietic acid	0.01 to 0.05
Isopimaric acid	0.02 to 0.10
Lupenone	2×10^{-3} to 8×10^{-3}
Friedelin	4×10^{-6} to 2×10^{-5}
Chlorinated dioxins	1×10^{-5} to 4×10^{-5}
Particulate acidity	7×10^{-3} to 7×10^{-2}

Definition of abbreviation: PAH = polycyclic aromatic hydrocarbon.

[1] U.S. Environmental Protection Agency. A summary of the emissions characterization and non-cancer respiratory effects of wood smoke. Washington, DC: Environmental Protection Agency; 1993. Publication No. EPA-453/R-93–036

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oLIVE-CLIMA partners did their best!

Partners promoted the funding of the purchase of machinery for prune wood shredding, at the 4th amendment of the Rural Development Program 2014-2020.

And they continue with new projects regarding Climate change:

1. SUSTAINOLIVE –PRIMA 2019-2023
2. Freeclimb - PRIMA 2019-2022

One more potential benefit for the olive growers is that by implementing oLIVE-CLIMA practices they can reliably demonstrate in a quantitative way the improvements of the product's environmental performance by using Product Environmental Footprint "PEF" to potentially promote their olive oil in the market.

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