Tree Crops' CO_2 Removal Capacity

Report

Action C.4

LIFE CLIMATREE

(LIFE14 CCM/GR/000635)

A novel approach for accounting & monitoring carbon sequestration of tree crops and their potential as carbon sink areas

Athens, November 2020

INTRODUCTION

The current Report is the Deliverable of **Action C.4** which was implemented in the framework of the LIFE CLIMATREE project (LIFE14 CCM/GR/000635) [www.lifeclimatree.eu].

The LIFE CLIMATREE project was co-financed by the European Commission in the framework of the Programme LIFE Climate Change Mitigation.

In the context of the LIFE CLIMATREE project, a specialized algorithm (**CO_2RCA**: CO_2 Removal Capacity Algorithm) was designed and developed to efficiently and accurately calculate the tree crops' capacity to remove CO_2 from atmosphere. CO_2RCA's design principles provide calculation of the tree crop's carbon balance which is strictly related to atmosphere's CO_2 (CO_2 related carbon). More specifically, it calculates the annual balance between the mass of CO_2 which is captured from atmosphere throughout the biological cycle of the tree to produce new wood biomass as well as fruits biomass, and the mass of CO_2 which is emitted to atmosphere by the applied agricultural practices. Moreover, it calculates and takes into account in the calculation of the CO_2 balance, the annual CO_2 gain which results from the application of "green" agricultural practices.

CO_2RCA was designed and formulated by the scientific team of TERRA NOVA Ltd.:

Ioannis Spanos	*Chemical Engineer, MSc. (Action C.4 Leader)*
Andreas Sotiropoulos	*Environmental Scientist, MSc.*
Leta Karava	*Forester, MSc.*

Based on the CO_2RCA, a tree crops' CO_2 Removal Capacity Calculation Tool (**CO_2RCCT**) was designed, developed and tested.
CO_2RCCT was applied at pilot scale to 5 tree species [Olive (*Olea europaea*), Apple (*Malus domestica*), Orange (*Citrus sinensis*), Peach (*Prunus persica*) and Almond (*Amygdalus communis*)] in three countries [Greece, Italy, Spain].

CO_2RCCT was designed and developed by the scientific team of TERRA NOVA Ltd.:

Ioannis Spanos	*Chemical Engineer, MSc. (Action C.4 Leader)*
Andreas Sotiropoulos	*Environmental Scientist, MSc.*
Leta Karava	*Forester, MSc.*
Stavroula Barafaka	*Chemical Engineer, MSc.*
Roula Chandrinou	*Environmental Scientist, MSc.*
Kostis Dramitinos	*Environmental Scientist*
Dimitris Ntinopoulos	*Environmental Engineer*

in close collaboration with:

a. The scientific team of the Agricultural University of Athens (AUA) regarding the currently applied cultivation practices for the 5 pilot tree species, as well as regarding best, "green", practices that could be alternatively applied:

   Serko Haroutounian*, Professor at the Department of Nutritional Physiology and Feeding, School of Agriculture, Engineering and Environment*
   Petros Roussos*, Associate Professor at the Department of Crop Science, Laboratory of Pomology*
   Epameinondas Evergetis*, Scientific Assistant at the Department of Nutritional Physiology and Feeding, School of Agriculture, Engineering and Environment*

b. The Institute of Urban Environment and Human Resources of the Panteion University of Athens (UEHR) regarding the development of the equations supporting the Soil section:

   Angelos Mimis*, Associate Professor at the Department of Economic and Regional Development*

The operation of the CO_2RCCT is supported by an extended back-end database, which was specifically developed for the purpose to provide data and coefficients to the CO_2RCA. This database was developed by:

A. The above scientific team of TERRA NOVA
B. The above scientific team of the Agricultural University of Athens
C. The scientific team of the University of Basilicata (UNIBAS) regarding coefficients for the specific tree crops' cultivation in Italy as well as statistical data at national scale:

   Giuseppe Montanaro *Associate Professor*
   Teodoro Berloco *Post doc fellowship*
   Giuseppe Acinapura *Post lauream fellowship*

D. The scientific team of the Spanish National Research Council (CSIC) regarding coefficients for the specific tree crops' cultivation in Spain as well as statistical data at national scale:

   Diego Intrigliolo *Agriculture Engineer, PhD, Senior Scientist at CSIC*

The current Report presents:

i. the CO_2 Removal Capacity Algorithm (CO_2RCA)
ii. the CO_2 Removal Capacity Calculation Tool (CO_2RCCT)
iii. the results of various CO_2RCCT runs
iv. the analysis of the results and the extracted conclusions
v. the emerging potentials derived for the further use of the CO_2RCA and the CO_2RCCT

1. Tree Crops CO_2 Removal Capacity Algorithm (CO_2RCA)

1.1 Algorithm's Design Principles and Characteristics

The scope of the CO_2 Removal Capacity Algorithm (CO_2RCA) is to efficiently and accurately calculate the tree crops' capacity to remove CO_2 from atmosphere.

The Algorithm (CO_2RCA) was designed to calculate the balance between:

- the mass of CO_2 which is removed from atmosphere by tree crops to produce new biomass, and
- the mass of CO_2 which is emitted to atmosphere by the applied agricultural practices.

CO_2RCA takes into account:

- ✓ the biological cycle of the tree
- ✓ the practices applied for its cultivation, maintenance, protection and harvesting.

It is underlined that CO_2RCA calculates the carbon balance which is strictly related to atmosphere's CO_2 (CO_2 related carbon).

The calculations boundaries of the CO_2RCA are:

a) Investigated subject: the tree itself and subsequently the tree crop land in terms of a specific farm or broader areas which are exclusively used for the cultivation of tree crops.

b) Time period: 1 entire calendar year (e.g., 2019) taking into account that within a year a full cultivation cycle can be considered as a completed one and thus a full productive cycle of the tree crop will be performed.

1.2 ALGORITHM DESCRIPTION

Algorithm's structure

The Algorithm (CO_2RCA) consists of a backbone set of equations, which are divided in 4 sections:

i. CO_2 Removal from the atmosphere for the development of tree's new biomass
ii. CO_2 Storage into the soil beneath and around the tree
iii. CO_2 Emissions to the atmosphere due to the currently applied cultivation practices
iv. CO_2 Gain as a result of the application of "green" agricultural practices

CO_2RCA is described by the following main equation:

$$\mathbf{ARC} = \mathbf{TAR} - \mathbf{TAE} + \mathbf{TAG} = \mathbf{AR_B} + \mathbf{AS_S} - \mathbf{TAE} + \mathbf{TAG} \quad [1]$$

where:

ARC: CO_2 Annual Removal Capacity [in *tn of CO_2 per year*]

TAR: CO_2 Total Annual Removals [in *tn of CO_2 per year*]

TAE: CO_2 Total Annual Emissions [in *tn of CO_2 per year*]

TAG: CO_2 Total Annual Gain [in *tn of CO_2 per year*]

AR_B: CO_2 Annual Removal due to the biomass change of the tree [in *tn of CO_2 per year*]

AS_S: CO_2 Annual Storage in soil as carbon of the fallen biomass [in *tn of CO_2 per year*]

It has to be underlined an important difference between ARC and TAR; ARC is the result of the CO_2 mass balance between (a) the total quantity of CO_2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO_2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

CO_2 Removal Capacity due to the production of new biomass

The biomass change of the tree is analysed into 2 main categories:

- ✓ the annual production of fruits
- ✓ the annual production of new trunk, branches and roots.

$$\mathbf{AR_B} = \mathbf{AR_{BF}} + \mathbf{AR_{BW}} \quad [2]$$

where:

AR_{BF}: CO_2 Annual Removal due to the production of fruits biomass [in *tn of CO_2 per year*]

AR_{BW}: CO_2 Annual Removal due to the production of wood biomass [in *tn of CO_2 per year*]

(a) CO_2 removal from atmosphere for the production of fruits biomass

The quantity of CO_2 which is absorbed by the tree from the surrounding atmosphere to be used for the production of the fruits' biomass, is calculated by the following equation:

$$\mathbf{AR_{BF}} = \mathbf{C_f} \times \mathbf{K_1} \times \mathbf{Y} = \mathbf{C_f} \times \mathbf{K_1} \times \mathbf{TYD} \times \mathbf{S} \times \mathbf{(1+I_Y)} \quad [3]$$

where:

AR_{BF}: CO_2 Annual Removal due to the production of fruits biomass [in *tn of CO_2 per year*]

C_f: carbon content of fresh fruit [in *tn C per tn of fresh fruit*]

K_1: mass conversion coefficient from C to CO_2 = 3.66419

Y: total yield of the farm or the broader area regarding fruit production [in *tn per year*]

TYD: typical yield density of the tree crop cultivation [in *tn per ha per year*]

S: surface of the tree crop cultivation [in *ha*]

I_Y: increase of yield due to the application of an alternative agricultural practice [in *%*]

(b) CO_2 removal from atmosphere for the production of wood biomass

The quantity of CO_2 which is annually absorbed by the tree from the surrounding atmosphere to be utilized for the production of new woody biomass (new trunk, branches and roots), is calculated by the following equation:

$$\mathbf{AR_{BW}} = (\mathbf{JP} \times \mathbf{PD} \times \mathbf{S} \times \mathbf{ADR_1} \times \mathbf{C_w} \times \mathbf{K_1}) + (\mathbf{MP} \times \mathbf{PD} \times \mathbf{S} \times \mathbf{ADR_2} \times \mathbf{C_w} \times \mathbf{K_1}) + \mathbf{AR_{BPr}} \quad [4]$$

where:

AR_{BW}: CO_2 Annual Removal due to the production of wood biomass [in *tn of CO_2 per year*]

JP: percentage of the orchard's trees that are in the Juvenile Phase [in *%*]

MP: percentage of the orchard's trees that are in the Mature Phase [in *%*]

PD: planting density of the tree crop cultivation [in *number of trees per ha*]

S: surface of the tree crop cultivation [in *ha*]

ADR_1: annual development rate of tree's biomass (trunk, branches, roots) in Juvenile Phase [in *tn of dry wood per tree per year*]

ADR_2: annual development rate of tree's biomass (trunk, branches, roots) in Mature Phase [in *tn of dry wood per tree per year*]

C_w: carbon content of dry wood = 0.475 *tn C per tn of dry wood*

(this is an average value applicable to practically all types of wood)

K_1: mass conversion coefficient from C to CO_2 = 3.66419

AR_{BPr}: CO_2 Annual Removal due to the management of prunings biomass [in *tn of CO_2 per year*]

The trees of an orchard are developed in time through 2 Development Phases:

- ☑ The Juvenile Phase, which initiates at time point T_0 when the tree is transferred from the nursery and it is planted in the farm. The Juvenile Phase ends at time point T_1 when the full production period of the tree initiates.
- ☑ The Mature Phase, which follows the Juvenile Phase. It initiates at time point T_1 and lasts until time point T_2. It is the period through which the tree achieves its full production performance. T_2 is the time point that the tree's life in the orchard ends and the tree is replaced by a young one transferred from the nursery. At this point it has to be noted that for specific species, like olive trees, there isn't a predefined T_2 time point, since these trees can extend their full productive life span almost indefinitely.

Each Development Phase is characterized by an individual Annual Development Rate of tree's woody biomass:

- → ADR_1 for the Juvenile Phase
- → ADR_2 for the Mature Phase.

Thus, the knowledge of the age of the trees in an orchard is important for the calculation of the AR_{BW}, since the appropriate ADR factor must be selected to be used in equation [4].

A significant assumption regarding the development process of the tree is that the ADRs of each Phase (Juvenile and Mature respectively) are considered each to be represented by a constant value, meaning that the development of the tree through each Phase is illustrated by a linear line and not a curve.

Furthermore, it is underlined that ADR exclusively refers to the annual change of the woody biomass of the tree (trunk, branches, roots including rootlets). It does not include the biomass of the produced fruits.

AR_{BPr} is a correction factor of the AR_{BW} equation regarding the CO_2 related to the biomass of the branch prunings, which is actually included in the first 2 sections (Juvenile and Mature Phase) of equation [4]. More specifically the value of AR_{BPr} depends on the practice which is applied for the management of prunings, as it is presented in the following set of equations [5]:

	AR_{BPr}	
Prunings are left in the field	$-(M_{Pr} \times DW/FW \times MP \times PD \times S \times C_w \times K_1)$	it is deducted because the CO_2 quantity related to the specific biomass returns to the atmosphere except of this taken into account in the equations of the Soil section (AS_S)
Prunings are burnt in the field		it is deducted because the CO_2 quantity related to the specific biomass returns to the atmosphere
Prunings are used as a solid fuel outside the field		
Prunings have another use different than burning	0	it is already calculated in the first 2 parts of equation [5]

[5]

where:

AR_{BPr}: CO_2 Annual Removal due to the management of prunings biomass [in *tn of CO_2 per year*]

M_{Pr}: annual mass of produced prunings [in *tn of fresh wood per tree per year*]

DW/FW: coefficient indicating wood moisture [in *tn of dry wood per tn of fresh wood*]

MP: percentage of the orchard's trees that are in the Mature Phase [in *%*]

Important note: the MP coefficient is used because the prunings process is applied mainly to trees being in the Mature Phase

PD: planting density of the tree crop cultivation [in *number of trees per ha*]

S: surface of the tree crop cultivation [in *ha*]

C_w: carbon content of dry wood = 0.475 *tn C per tn of dry wood*

(this is an average value applicable to practically all types of wood)

K_1: mass conversion coefficient from C to CO_2 = 3.66419

CO_2 Storage in soil as carbon of the fallen biomass

The specific section of the CO_2RCA is based on the RothC model (*version 26.3*). It calculates the quantity of atmosphere's CO_2 that is eventually stored into the soil in form of carbon through the decomposition of tree's fallen biomass.

The following parts of the tree are considered as Fallen Biomass:

- ✓ fruits from thinning processes (tree self-thinning or/and intentionally by the farmer)
- ✓ leaves from both types of trees (the whole quantity of leaves from deciduous trees and percentage of the annually replaced leaves in evergreen trees)
- ✓ hulls left in the field after harvesting (e.g. almond hulls)
- ✓ prunings left in the field.

An additional parameter affecting the above calculation is the existence or not of soil cover crops (surface vegetation) underneath the trees. This particular practice actually increases the quantity of CO_2 that eventually is removed from atmosphere due to the storage of a part of that carbon, which initially has been used for the development of this type of vegetation, into the soil.

$$\mathbf{AS_S = C_{FB} \times K_1 \times e^{-a \times b \times c \times k \times t}} \quad [6]$$

where:

AS_S: CO_2 Annual Storage in soil as carbon of the fallen biomass [in *tn of CO_2 per year*]

C_{FB}: carbon content of fallen biomass [in *tn of C per year*]

K_1: mass conversion coefficient from C to CO_2 = 3.66419

a: rate for temperature, given by $a = 47.9/(1 + e^{106/(T+18.3)})$

b: rate for moisture, which is a function of rainfall, pan evaporation and clay content of the soil

c: retainment factor [*0.6 when the soil is vegetated, otherwise 1.0*]

k: decomposition rate

t: 1, since k represents an annual decomposition rate.

T: Mean annual temperature of the cultivated area [in *°C*]

$$\mathbf{C_{FB} = C_{FB\_fruits} + C_{FB\_leaves} + C_{FB\_hulls} + C_{FB\_Pr\_lf}} \text{ [in } \textit{tn of C per year}\text{]} \quad [6.1]$$

where:

C_{FB_fruits}: carbon content of fallen fruits [in *tn of C per year*]

C_{FB_leaves}: carbon content of fallen leaves [in *tn of C per year*]

C_{FB_hulls}: carbon content of hulls remaining in the field after harvesting [in *tn of C per year*]

$C_{FB\_Pr\_lf}$: carbon content of prunings left in the field [in *tn of C per year*]

$C_{FB\_fruits} = (Z_{fruits}/(1-Z_{fruits})) \times Y \times C_f$ [6.2]

where:

C_{FB_fruits}: carbon content of fallen fruits [in *tn of C per year*]

Z_{fruits}: the percentage of total product losses (thinning) throughout a full cultivation cycle [in *%*]

Important note: Z_{fruits} is not a percentage of the Yield, but a percentage of the Total Potential fruits biomass, meaning that *Y = Total Potential fruits biomass x $(1 - Z_{fruits})$*

Y: total yield of the farm or the broader area regarding fruit production [in *tn per year*]

C_f: carbon content of fresh fruit's biomass [in *tn C per tn of fresh fruit*]

$C_{FB\_leaves} = M_{leaves} \times PD \times S \times C_w$ [6.3]

where:

C_{FB_leaves}: carbon content of fallen leaves [in *tn of C per year*]

M_{leaves}: annual mass (dry matter) of fallen leaves or newly generated leaves per tree [in *tn dry matter of leaves per tree per year*]

Important note: At the mature phase of the tree, approximately the annual mass of fallen leaves is equal to the mass of the new leaves generated. This is applicable to both types of trees (evergreen & deciduous). The total mass of leaves in evergreen trees is fully renewed within a period of approximately 3 years, while in deciduous trees it is fully renewed annually.

PD: planting density of the tree crop cultivation [in *number of trees per ha*]

S: surface of the tree crop cultivation [in *ha*]

C_w: carbon content of dry wood = 0.475 *tn C per tn of dry wood*

Assumption: the dry matter of leaves approximates dry wood in terms of carbon content

$C_{FB\_hulls} = M_{hulls} \times Z_{hulls} \times PD \times S \times C_w$ [6.4]

where:

C_{FB_hulls}: carbon content of hulls remaining in the field after harvesting [in *tn of C per year*]

M_{hulls}: mass of hulls of the produced fruits [in *tn of hulls per tree per year*]

Z_{hulls}: percentage of hulls remaining in the field after harvesting [in *%*]

PD: planting density of the tree crop cultivation [in *number of trees per ha*]

S: surface of the tree crop cultivation [in *ha*]

C_w: carbon content of dry wood = 0.475 *tn C per tn of dry wood*

(this is an average value applicable to practically all types of wood)

$$C_{FB\_Pr\_If} = Z_{Pr\_If} \times M_{Pr} \times DW/FW \times MP \times PD \times S \times C_w \quad [6.5]$$

where:

$C_{FB\_Pr\_If}$: carbon content of prunings left in the field [in *tn of C per year*]

Z_{Pr_If}: percentage of prunings left in the field [in *%*]

M_{Pr}: annual mass of produced prunings [in *tn of fresh wood per tree per year*]

DW/FW: coefficient indicating wood moisture [in *tn of dry wood per tn of fresh wood*]

MP: percentage of the orchard's trees that are in the Mature Phase [in *%*]

Important note: the MP coefficient is used because the prunings process is applied mainly to trees being in the Mature Phase

PD: planting density of the tree crop cultivation [in *number of trees per ha*]

S: surface of the tree crop cultivation [in *ha*]

C_w: carbon content of dry wood = 0.475 *tn C per tn of dry wood*

(this is an average value applicable to practically all types of wood)

CO_2 Emissions due to the currently applied cultivation practices

The CO_2 emissions which are attributed to the applied agricultural practices are analysed into 3 categories:

- use of fertilizers
- use of pesticides
- consumption of fossil fuels and electricity.

The third category (fossil fuels and electricity) represents the actual use of mechanical (internal combustion and electrical respectively) equipment and machinery, which are used through the various cultivation activities (tillage, trimming, spaying, irrigation, harvesting, etc.).

$$TAE = AE_f + AE_p + AE_{ff\&e} \quad [7]$$

where:

TAE: CO_2 Total Annual Emissions [in *tn of CO_2 per year*]

AE_f: CO_2 Annual Emissions due to the use of fertilizers [in *tn of CO_2 per year*]

AE_p: CO_2 Annual Emissions due to the use of pesticides [in *tn of CO_2 per year*]

$AE_{ff\&e}$: CO_2 Annual Emissions due to the use of fossil fuels & electricity [in *tn of CO_2 per year*]

Each category of emissions is illustrated respectively by the following equations:

$$\mathbf{AE_f = ((R_N \times M_N \times EF_N) + (R_K \times M_K \times EF_K) + (R_P \times M_P \times EF_P)) \times K_1 \times S} \quad [8]$$

where:

AE_f: CO_2 Annual Emissions due to the use of fertilizers [in *tn of CO_2 per year*]

R_N, R_K, R_P: content of fertilizer in Nitrogen (N), Potassium (K), Phosphorus (P) respectively [in *%*]

M_N, M_K, M_P: quantity (mass) of the N-fertilizer, K-fertilizer, P-fertilizer respectively, used within a year [in *tn of fertilizer per ha per year*]

EF_N, EF_K, EF_P: emission factor regarding the carbon emissions (equivalent) for the production, transportation, storage and transfer of the N-fertilizer, K-fertilizer, P-fertilizer respectively [in *tn of C per tn of N, K, P respectively*]

K_1: mass conversion coefficient from C to CO_2 = 3.66419

S: surface of the tree crop cultivation [in *ha*]

$$\mathbf{AE_p = ((M_{H\_ai} \times ED_{H\_ai}) + (M_{I\_ai} \times ED_{I\_ai}) + (M_{F\_ai} \times ED_{F\_ai}) + (M_{GR\_ai} \times ED_{GR\_ai})) \times EF_{GE} \times K_2 \times S} \quad [9]$$

where:

AE_p: CO_2 Annual Emissions due to the use of pesticides [in *tn of CO_2 per year*]

M_{H_ai}, M_{I_ai}, M_{F_ai}, M_{GR_ai}: quantity (mass) of the active ingredient (ai) of the Herbicide, Insecticide, Fungicide, Growth Regulator respectively, used within a year [in *tn of pesticide ai per ha per year*]

ED_{H_ai}, ED_{I_ai}, ED_{F_ai}, ED_{GR_ai}: energy demand for the production, formulation, packaging and transportation of Herbicide, Insecticide, Fungicide, Growth Regulator respectively [in *MJ per tn of ai*]

EF_{GE}: emission factor representing the global carbon intensity of electricity generated [in *tn of CO_2 per KWh*]

K_2: conversion coefficient from MJ to KWh = 0.27778 KWh/MJ

S: surface of the tree crop cultivation [in *ha*]

Note: the global carbon intensity of electricity generated is used as carbon emission factor since it is not always known the specific country where each pesticide was produced.

$$\mathbf{AE_{ff\&e} = AE_D + AE_G + AE_{EL} = (M_D \times EF_D \times S) + (M_G \times EF_G \times S) + (M_{EL} \times EF_{EL} \times S)} \quad [10]$$

where:

$AE_{ff\&e}$: CO_2 Annual Emissions due to the use of fossil fuels & electricity [in *tn of CO_2 per year*]

AE_D: CO_2 Annual Emissions due to the use of diesel [in *tn of CO_2 per year*]

AE_G: CO_2 Annual Emissions due to the use of gasoline [in *tn of CO_2 per year*]

AE_{EL}: CO_2 Annual Emissions due to the use of electricity [in *tn of CO_2 per year*]

M_D: annual consumption of diesel [in *lt per ha per year*]

M_G: annual consumption of gasoline [in *lt per ha per year*]

M_{EL}: annual consumption of electricity [in *KWh per ha per year*]

EF_D: emission factor regarding the CO_2 emissions due to the production (Well to Tank) and combustion of diesel [in *tn CO_2 per lt of diesel*]

EF_G: emission factor regarding the CO_2 emissions due to the production (Well to Tank) and combustion of gasoline [in *tn CO_2 per lt of gasoline*]

EF_{EL}: emission factor regarding the CO_2 emissions due to the production and transportation of electricity [in *tn CO_2 per KWh of electricity*]

S: surface of the tree crop cultivation [in *ha*]

CO_2 Gain due to the application of "green" cultivation practices

Depending on the application of potential "green" cultivation practices, a CO_2 gain can result which subsequently leads to the reduction of the CO_2 Total Annual Emission (TAE). By this way the overall performance of the tree crop cultivation in terms of CO_2 can be further improved (the CO_2 Annual Removal Capacity, ARC, is increased).

A set of promising "green" cultivation practices was selected and the respective equations for the calculation of the CO_2 gain of each individual practice were designed, formulated and incorporated as separate factors in the Total Annual Gain (TAG) equation:

$$\mathbf{TAG = AG_{N\text{-}f\_LCC} + AG_{f\_FGT} + AG_{H\_cc/m} + AG_{I\_im/mt} + AG_{WF} + AG_{RES} + AG_{EL\_m} + AG_{D\_FGT}} \quad [11]$$

where:

TAG: CO_2 Total Annual Gain

$AG_{N\text{-}f\_LCC}$: CO_2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)

AG_{f_FGT}: CO_2 Annual Gain due to fertilizers reduction (use of fertigation)

$AG_{H\_cc/m}$: CO_2 Annual Gain due to herbicides reduction (use of cover crops/mulching)

$AG_{I\_im/mt}$: CO_2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)

AG_{WF}: CO_2 Annual Gain due to the use of wood fuel instead of diesel to produce the same calorific result

AG_{RES}: CO_2 Annual Gain due to the use of Renewable Energy Sources

AG_{EL_m}: CO_2 Annual Gain due to electricity reduction (use of mulching)

AG_{D_FGT}: CO_2 Annual Gain due to diesel reduction (use of fertigation)

All above are expressed in [*tn of CO_2 per year*]

Below, the equations of each particular CO_2 gain factor are presented:

$$\mathbf{AG_{N\text{-}f\_LCC} = N_L \times EF_N \times K_1 \times S} \quad [12]$$

where:

$AG_{N\text{-}f\_LCC}$: CO_2 Annual Gain due to N-fertilizer reduction (use of Leguminosae cover crops) [in *tn of CO_2 per year*]

N_L: mean value of nitrogen provided by the Leguminosae cover crops [in *tn of N per ha per year*]

EF_N: emission factor regarding the carbon emissions (equivalent) for the production, transportation, storage and transfer of N-fertilizer [in *tn of C per tn of N*]

K_1: mass conversion coefficient from C to CO_2 = 3.66419

S: surface of the tree crop cultivation [in *ha*]

$$\mathbf{AG_{f\_FGT} = RF_{f\_FGT} \times ((R_N \times TM_N \times EF_N) + (R_K \times TM_K \times EF_K) + (R_P \times TM_P \times EF_P)) \times K_1 \times S} \quad [13]$$

where:

AG_{f_FGT}: CO_2 Annual Gain due to fertilizers reduction (use of fertigation) [in *tn of CO_2 per year*]

RF_{f_FGT}: reduction factor of fertilizers demands due to the application of fertigation [in *%*]

R_N, R_K, R_P: content of fertilizer in Nitrogen (N), Potassium (K), Phosphorus (P) respectively [in *%*]

TM_N, TM_K, TM_P: typical quantity (mass) of N-fertilizer, K-fertilizer, P-fertilizer respectively, used within a year [in *tn of fertilizer per ha per year*]

EF_N, EF_K, EF_P: emission factor regarding the carbon emissions (equivalent) for the production, transportation, storage and transfer of the N-fertilizer, K-fertilizer, P-fertilizer respectively [in *tn of C per tn of N, K, P respectively*]

K_1: mass conversion coefficient from C to CO_2 = 3.66419

S: surface of the tree crop cultivation [in *ha*]

$$\mathbf{AG_{H\_cc/m} = RF_H \times TM_{H\_ai} \times ED_{H\_ai} \times EF_{GE} \times K_2 \times S} \quad [14]$$

where:

$AG_{H\_cc/m}$: CO_2 Annual Gain due to Herbicides reduction (use of cover crops and/or mulching) [in *tn of CO_2 per year*]

RF_H: reduction factor of Herbicides consumption if cover crops and/or mulching are used [in *%*]

TM_{H_ai}: typical quantity (mass) of active ingredient (ai) of Herbicide used within a year [in *tn of pesticide ai per ha per year*]

ED_{H_ai}: energy demand for the production, formulation, packaging and transportation of Herbicide [in *MJ per tn of ai*]

EF_{GE}: emission factor representing the global carbon intensity of electricity generated [in *tn of CO_2 per KWh*]

K_2: conversion coefficient from MJ to KWh = 0.27778 KWh/MJ

S: surface of the tree crop cultivation [in *ha*]

Note: the global carbon intensity of electricity generated is used as carbon emission factor since it is not always known the specific country where each pesticide was produced.

$$\mathbf{AG_{I\_im/mt} = RF_I \times TM_{I\_ai} \times ED_{I\_ai} \times EF_{GE} \times K_2 \times S} \quad [15]$$

where:

$AG_{I\_im/mt}$: CO_2 Annual Gain due to Insecticides reduction (insects monitoring or/and mass trapping) [in *tn of CO_2 per year*]

RF_I: reduction factor of Insecticides consumption if insects monitoring or/and mass trapping is applied [in *%*]

TM_{I_ai}: typical quantity (mass) of active ingredient (ai) of Insecticide used within a year [in *tn of pesticide ai per ha per year*]

ED_{I_ai}: energy demand for the production, formulation, packaging and transportation of Insecticide [in *MJ per tn of ai*]

EF_{GE}: emission factor representing the global carbon intensity of electricity generated [in *tn of CO_2 per KWh*]

K_2: conversion coefficient from MJ to KWh = 0.27778 KWh/MJ

S: surface of the tree crop cultivation [in *ha*]

Note: the global carbon intensity of electricity generated is used as carbon emission factor since it is not always known the specific country where each pesticide was produced.

$AG_{WF} = Z_{Pr\_WF} \times M_{Pr} \times PD \times S \times 1{,}000{,}000 \times NCV_W \times EF_D/(NCV_D \times d_D)$ [16]

where:

AG_{WF}: CO_2 Annual Gain due to the use of wood fuel instead of diesel to produce the same calorific result [in *tn of CO_2 per year*]

Z_{Pr_WF}: percentage of prunings used as wood fuel [in *%*]

M_{Pr}: annual mass of produced prunings [in *tn of fresh wood per tree per year*]

PD: planting density of the tree crop cultivation [in *number of trees per ha*]

S: surface of the tree crop cultivation [in *ha*]

NCV_W: Net Calorific Value of fresh wood [in *GJ/tn*]

NCV_D: Net Calorific Value of diesel [in *GJ/tn*]

d_D: density of diesel [in *Kg/m^3*]

EF_D: emission factor regarding the CO_2 emissions due to the production (Well to Tank) and combustion of diesel [in *tn CO_2 per lt of diesel*]

$AG_{RES} = RF_{RES} \times TM_{EL} \times EF_{EL} \times S$ [17]

where:

AG_{RES}: CO_2 Annual Gain due to the use of Renewable Energy Sources [in *tn of CO_2 per year*]

RF_{RES}: percentage of the farm's electricity needs covered by RES [in *%*]

TM_{EL}: typical annual consumption of electricity [in *KWh per ha per year*]

EF_{EL}: emission factor regarding the CO_2 emissions due to the production and transportation of electricity [in *tn CO_2 per KWh of electricity*]

S: surface of the tree crop cultivation [in *ha*]

$AG_{EL\_m} = RF_{EL\_m} \times TM_{EL} \times EF_{EL} \times S$ [18]

where:

AG_{EL_m}: CO_2 Annual Gain due to electricity reduction (use of mulching) [in *tn of CO_2 per year*]

RF_{EL_m}: reduction factor of the consumption of irrigation water [in *%*]

TM_{EL}: typical annual consumption of electricity [in *KWh per ha per year*]

EF_{EL}: emission factor regarding the CO_2 emissions due to the production and transportation of electricity [in *tn CO_2 per KWh of electricity*]

S: surface of the tree crop cultivation [in *ha*]

Note: electricity is mainly used for the operation of the irrigation pumps, thus when the irrigation needs are reduced, the electricity consumption is reduced by approximately the same percentage

$$\mathbf{AG_{D\_FGT} = RF_{D\_FGT} \times TM_D \times EF_D \times S} \quad [19]$$

where:

AG_{D_FGT}: CO_2 Annual Gain due to diesel reduction (use of fertigation) [in *tn of CO_2 per year*]

RF_{D_FGT}: reduction factor of the consumption of diesel due to the application of fertigation [in *%*]

TM_D: typical annual consumption of diesel [in *lt per ha per year*]

EF_D: emission factor regarding the CO_2 emissions due to the production (Well to Tank) and combustion of diesel [in *tn CO_2 per lt of diesel*]

S: surface of the tree crop cultivation [in *ha*]

2. TREE CROPS CO_2 REMOVAL CAPACITY CALCULATION TOOL (CO_2RCCT)

Based on the CO_2RCA, an e-tool (Tree crops' CO_2 Removal Capacity Calculation Tool [CO_2RCCT]) was developed incorporating CO_2RCA's equations and enabling the calculation of tree crops CO_2 removal capacity under different scenarios (e.g., cultivation practices, trees protection, fuels, energy, etc.).

CO_2RCCT was developed within Action C.4 in excel format. Moreover, a web-based e-tool was developed in the context of Action C.3, which was based on the CO_2RCCT. Both versions are available at the official web-site of the LIFE CLIMATREE project [www.lifeclimatree.eu].

CO_2RCCT was developed at a pilot scale incorporating 5 tree species:

- ✓ Orange [*Citrus sinensis*]
- ✓ Apple [*Malus domestica*]
- ✓ Peach [*Prunus persica*]
- ✓ Almond [*Amygdalus communis* or *Prunus dulcis*]
- ✓ Olive [*Olea europaea*]

in 3 countries:

- ☑ Greece
- ☑ Italy
- ☑ Spain.

It is operational in 4 languages:

- ➲ English
- ➲ Greek
- ➲ Italian
- ➲ Spanish.

CO_2RCCT is designed and developed in such a way to be able to operate and extract reliable and accurate results even if the user has no knowledge of all requested input data. Thus, the CO_2RCCT can be used equal effectively by both; users having the technical know-how a specific cultivation (e.g., the farmer, the agronomist) as well as by users having a general aspect of the issue (e.g., decision/ policy makers).

The CO_2RCCT results can be useful tools for:

- ☑ policy makers to evaluate agricultural policies, assess them and improve them or modify them accordingly towards the direction of promoting "green" and environmentally friendly agricultural practices and enhancing the sustainability of the agricultural sector while simultaneously combating climate change.
- ☑ farmers and agronomists to analyse the agricultural practices that are applied to real case studies tree crop farms and determine the specific points that require improvement or modification towards the increase of the "climate" performance of these cultivations.

In Annex I of the current Report, the CO_2RCCT User Manual is presented which includes instructions on how to use and operate effectively the tool.

CO_2RCCT back-end database

The operation of CO_2RCCT is supported by an extended back-end database, which includes data and coefficients appropriate to be used in the CO_2RCA equations. More specifically, the sources of these data are presented below:

Type of data and coefficients	Source
Cultivation performance data (e.g., yield, planting density, cultivated surface)	▪ Official statistical data of each country for the last 5 successive years (2012-2016)
Wood biomass data	▪ Field experiments performed during the previous 4 years by the team of the Agricultural University of Athens
Fertilizers and pesticides data	▪ International literature
Fossil fuels data	▪ Greenhouse Gas Protocol Tool - Mobile Combustion GHG Emissions Calculation Tool, Version 2.6, World Resources Institute (2015)
Electricity data	▪ European Environment Agency ▪ International Energy Agency, "Global Energy & CO_2 Status Report, The latest trends in energy and emissions in 2018", 2019
Agricultural practices data	▪ Information collected and analyzed by the team of the Agricultural University of Athens through a questionnaire survey which was addressed to over 300 Greek farmers.

In Annex II, the back-end database of the currently uploaded version (r.14) of the CO_2RCCT, is presented.

CO_2Removal Capacity Indexes (RCI)

Through a series of appropriately designed Indexes (CO_2 Removal Capacity Indexes - **RCI**), CO_2RCCT produces results that can be used to efficiently compare alternative cultivation scenarios as well as the actual impact of potentially applied "green" agricultural practices.

RCIs consist of 3 categories:

- ☑ CO_2 per unit of cultivated area [in *tn CO_2/hectare/year*]
- ☑ CO_2 per unit of harvested fruits [in *tn CO_2/tn of yield/year*]
- ☑ CO_2 per tree unit [in *tn CO_2/tree/year*]

These Indexes were proved substantial tools to assess the performance of a tree crop cultivation in terms of Climate Change as well as to investigate and determine the reasons why a specific cultivation does not perform efficiently or/and it presents a significant deviation from the expected performance.

CO_2RCCT optimization

CO_2RCCT was run and tested by a multidisciplinary pool of users and it was optimized based on their remarks and comments.

51 draft versions of CO_2RCCT were developed prior to its launching on the project's website. Even then, CO_2RCCT was kept on being optimized. Today the 14th released version of the CO_2RCCT (.xlsx) is uploaded to the project's website and is freely available to any interested scientist, stakeholder or policy maker.

3. RUNS OF THE CO_2RCCT

The tree crops CO_2RCCT was operated for a series of different scenarios (runs) based on:

- ✓ the country
- ✓ the tree crops species.

Moreover, a series of "green" alternative agricultural practices were examined by using the CO_2RCCT:

- ✓ use of cover crops
- ✓ use of Leguminosae cover crops
- ✓ application of mulching
- ✓ application of fertilizers via fertigation
- ✓ application of insects monitoring and/or mass trapping
- ✓ valorization of prunings as solid fuel instead of diesel
- ✓ use of Renewable Energy Sources,

and their impact on tree crops' "climate" performance was analyzed in depth.

Indicative runs of various case studies are presented below. The detailed results of each run are presented in Annex III of the current Report.

run#	Country	Tree species	Agricultural practice
1	Greece	orange	conventional
2	Greece	apple	conventional
3	Greece	peach	conventional
4	Greece	almond	conventional
5	Greece	olive	conventional
6	Italy	orange	conventional
7	Italy	apple	conventional
8	Italy	peach	conventional
9	Italy	almond	conventional
10	Italy	olive	conventional
11	Spain	orange	conventional
12	Spain	apple	conventional
13	Spain	peach	conventional
14	Spain	almond	conventional
15	Spain	olive	conventional
16	Greece	olive	use of cover crops
17	Greece	olive	use of cover crops of the Leguminosae family
18	Greece	olive	application of fertilizers through fertigation
19	Greece	orange	use of cover crops of the Leguminosae family

run#	Country	Tree species	Agricultural practice
20	Greece	apple	use of cover crops of the Leguminosae family
21	Greece	peach	use of cover crops of the Leguminosae family
22	Greece	almond	use of cover crops of the Leguminosae family
23	Greece	olive	use of prunings as wood fuel
24	Greece	orange	use of prunings as wood fuel
25	Greece	apple	use of prunings as wood fuel
26	Greece	peach	use of prunings as wood fuel
27	Greece	almond	use of prunings as wood fuel
28	Greece	orange	cover of electricity needs by 100% RES
29	Greece	orange	use of insects' mass trapping
30	Greece	orange	use of cover crops

4. Analysis of the Results of the CO_2RCCT Runs

The following Table summarizes the comparative results of the CO_2RCCT runs for the 5 tree species (orange, apple, peach, almond, olive) per each of the 3 countries (Greece, Italy, Spain), when they are cultivated by using conventional agricultural practices (runs 1 to 15 of Annex III).

Table 1

CO_2RCCT results for the conventional cultivation of the pilot trees in Greece, Italy and Spain

Greece		**Orange**	**Apple**	**Peach**	**Almond**	**Olive**
ARC	tn CO_2/year	218,437	9,768	280,022	70,437	3,047,921
AR_{BW}	tn CO_2/year	300,878	58,443	403,408	101,011	4,549,120
AS_S	tn CO_2/year	7,224	2,069	2,719	2,305	54,879
AE_f	tn CO_2/year	37,063	15,213	32,746	9,047	635,916
AE_p	tn CO_2/year	25,353	5,981	32,739	11,609	492,126
$AE_{ff\&e}$	tn CO_2/year	27,248	29,550	60,620	12,223	428,037
ARC_{area}	tn CO_2/hectare/year	6.44625	0.87465	7.12835	5.29610	3.73945
$ARC_{product}$	tn CO_2/tn of yield/year	0.27844	0.03866	0.45389	2.29570	0.89183
ARC_{tree}	tn CO_2/tree/year	0.01446	0.00118	0.01623	0.01899	0.02157
TAE/TAR		0.29102	0.83857	0.31051	0.31824	0.33798

Italy		**Orange**	**Apple**	**Peach**	**Almond**	**Olive**
ARC	tn CO_2/year	544,000	144,815	-45,766	-81,653	-432,427
AR_{BW}	tn CO_2/year	791,664	313,581	136,115	33,706	1,765,111
AS_S	tn CO_2/year	20,505	35,737	18,578	19,144	135,218
AE_f	tn CO_2/year	72,709	32,607	41,374	38,250	602,340
AE_p	tn CO_2/year	63,163	28,041	56,860	50,760	681,448
$AE_{ff\&e}$	tn CO_2/year	132,296	143,854	102,226	45,492	1,048,968
ARC_{area}	tn CO_2/hectare/year	6.44393	2.76564	-0.67081	-1.40407	-0.38314
$ARC_{product}$	tn CO_2/tn of yield/year	0.30873	0.06122	-0.03219	-1.03453	-0.15651
ARC_{tree}	tn CO_2/tree/year	0.02685	0.00205	-0.00103	-0.00520	-0.00246
TAE/TAR		0.33019	0.58544	1.29585	2.54502	1.22755

Spain		**Orange**	**Apple**	**Peach**	**Almond**	**Olive**
ARC	tn CO_2/year	1,072,597	21,311	-53,901	55,887	13,717,511
AR_{BW}	tn CO_2/year	1,364,264	138,480	78,832	1,074,843	16,840,922
AS_S	tn CO_2/year	41,335	5,469	5,433	100,949	592,428
AE_f	tn CO_2/year	134,041	33,189	35,081	251,313	985,823
AE_p	tn CO_2/year	102,510	15,350	37,156	432,868	1,466,719
$AE_{ff\&e}$	tn CO_2/year	96,451	74,098	65,929	435,723	1,263,297
ARC_{area}	tn CO_2/hectare/year	7.82865	0.74348	-1.20901	0.11269	5.64687
$ARC_{product}$	tn CO_2/tn of yield/year	0.32876	0.03891	-0.04626	0.29248	2.13593
ARC_{tree}	tn CO_2/tree/year	0.01879	0.00150	-0.00242	0.00047	0.01227
TAE/TAR		0.23691	0.85195	1.63965	0.95247	0.21315

General results

The apparent conclusion of the figures presented in Table 1 is that tree crops present a significant CO_2 Annual Removal Capacity (ARC) and thus they can have an important role as a mitigation measure in confronting Climate Change. More specifically, the total ARC of the 5 types of tree crops that were examined in the 3 countries sum up to 18,568,959 tn CO_2/year.

Nevertheless, there are cultivation cases that can be improved either to increase their "climate" performance (blue values) or to reverse their negative carbon balance (red values).

The performance of a tree crop cultivation is represented by the TAE/TAR Index (Total Annual Emissions divided by the Total Annual Removals). This is a very important Index, which indicates in a direct way the percentage of the CO_2 emissions which actually "consumes" the profit derived by the CO_2 removals and thus leads to the decrease of the CO_2 Removal Capacity. High TAE/TAR values give a clear signal that measures have to be taken to decrease the CO_2 emissions of the applied agricultural practices.

Especially when the value of TAE/TAR is greater than 1, this means that the quantity of CO_2 emitted due to the applied agricultural practices is larger than the CO_2 quantity absorbed by the atmosphere to create the tree's woody biomass. This is an alarming indication that immediate drastic measures must be taken to reverse this negative condition.

Results of the Greece case

Specifically regarding the results presented in Table 1 for Greece, it is concluded that:

- ✓ Peach and orange are the trees presenting the highest ARC_{area} Index, a fact that is mainly attributed to the intensive cultivation practices applied which demand high values of Planting Densities (439,32 trees/ha and 445,91 trees/ha respectively. Nevertheless, apple cultivation although applied at the highest Planting Density (PD: 739 trees/ha), it presents the lowest ARC_{area}, which is due to the high value of the TAE/TAR Index. This particular Index although is lower than 1, reveals that the CO_2 emissions due to the applied cultivation practices are significantly high leading by this way to the substantial diminishing of any significant carbon profit that could be extracted.
- ✓ Olive presents the highest ARC_{tree} Index mainly due to the typical size of olive trees which are considerably larger than the trees of the rest examined species.

- ✓ Regarding the TAE/TAR Index, all four tree species (orange, peach, almond, olive) present similar values fluctuating at a close range, except of the apple which demonstrates a TAE/TAR value almost 2.5 times higher.

The role of soil

Another important result extracted by the above runs is that although AS_s values do not constitute soil as a principal component of the CO_2 Annual Removal Capacity (ARC), still it participates consistently in storing CO_2 as carbon of the fallen biomass.

More specifically, regarding the 5 tree species examined in Greece, Italy and Spain, every year 1,043,992 tn CO_2 (total AS_S) are stored into the soil beneath the trees of these orchards. This quantity corresponds to the 3.74% of the quantity of CO_2 which is removed from atmosphere to create the wood biomass of the trees (total AR_{BW}: 27,950,378 tn CO_2).

Table 2 presents the respective AS_s Index per tree (AS_{S_tree}), e.g., for the cultivation of olive. The differences in the values are mainly attributed to the way the tree is cultivated (growth, formulation, prunings management) since the quantity of the carbon stored into the soil is directly depended on the quantity of the fallen biomass.

Table 2

CO_2 storage in soil in olive farms conventionally cultivated in Greece, Italy and Spain

		Greece	Italy	Spain
AS_{S_tree}	tn CO_2/tree/year	0.00039	0.00077	0.00053

Use of Leguminosae cover crops

As far as concerning various alternative cultivation practices, the results of the CO_2RCCT runs 5, 16, 17 and 18 for the cultivation of olive in Greece (conventional, use of cover crops, use of Leguminosae cover crops, application of fertilizers via fertigation respectively), presented in the following Table 3, lead to interesting conclusions in terms of "climate" performance vs cultivation practices.

Table 3

ARC, TAR and TAE for alternative olive cultivation practices in Greece

Cultivation practice	ARC (tn CO_2/year)	Increase	TAR (tn CO_2/year)	Increase	TAE (tn CO_2/year)	Reduction
Conventional	3,047,921		4,604,000		1,556,079	
Use of cover crops	3,402,006	11.62%	4,648,405	0.96%	1,246,399	19.90%
Use of Leguminosae cover crops	3,712,610	21.81%	4,648,405	0.96%	935,795	39.86%
Use of fertigation	3,194,791	4.82%	4,604,331	0.01%	1,409,540	9.42%

More specifically:

- There is a substantial increase of ARC in the case of using cover crops and even higher when these cover crops belong to the Leguminosae family (nitrogen slow releasers), while on the other hand the respective increase in the case of fertigation is not that impressive. This is a useful conclusion when a decision process is in progress to plan investments for the improvement of the "climate" performance of this cultivation. It is apparent that the use of cover crops, or even better the use of Leguminosae cover crops, a practice of significantly lower capital cost compared to fertigation, can lead to impressive results regarding the increase of ARC.
- Another interesting conclusion derived by the above values is that the respective increase of ARC is not attributed to a substantial increase of TAR, but to the significant decrease of TAE due to the CO_2 Annual Gain ($AG_{N\text{-}f\_LCC}$) because of the reduction on the use of Nitrogen-fertilizers.

Respectively, the use of Leguminosae cover crops in the cultivation of orange, apple, peach and almond can lead to significant increase of ARC, as it is resulted by CO_2RCCT runs 19-22 (see Table 4 below).

Table 4

Positive impact of the use of Leguminosae cover crops in orange, apple, peach and almond cultivations in Greece

ARC (tn CO_2/year)	Orange	Apple	Peach	Almond
Conventional	218,437	9,768	280,022	70,437
Use of Leguminosae cover crops	250,031	18,518	315,093	82,419
Increase	14.46%	89.58%	12.52%	17.01%

At this point it has to be clarified that apparently the ARC increase percentage is not following the same pattern for all 5 tree species, since their needs in Nitrogen fertilization vs Potassium and Phosphorus fertilization are not the same, thus affecting dissimilarly the TAE reduction.

Use of prunings as solid fuel

Another important result derived by CO_2RCCT is the significant contribution of the applied prunings management practice in the values of ARC. Specifically, the use of prunings as a solid fuel (wood fuel) outside the field instead of conventional fossil fuels (i.e., diesel), is a Climate Change mitigation measure acknowledged by FAO. The Annual CO_2 Gain (AG_{WF}) that derives by this particular management practice is incorporated in the Annual CO_2 Removal due to the production of wood biomass (AR_{BW}), which in its turn is incorporated in the calculation of ARC.

Table 5 presents the percentages of the current main prunings management practices applied in Greece, while Table 6 proposes an alternative distribution of the respective management practices.

Table 5

Currently applied prunings management practices in Greece

Current Management practices	Orange	Apple	Peach	Almond	Olive
left in the field	40.00%	80.00%	40.00%	20.00%	
burnt in the field			40.00%	20.00%	20.00%
use as a solid fuel outside the field	60.00%	20.00%	20.00%	60.00%	70.00%
other use different than burning					10.00%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Table 6

Proposed distribution of prunings management practices in Greece

Proposed Management practices	Orange	Apple	Peach	Almond	Olive
left in the field	10.00%	10.00%	10.00%	10.00%	
burnt in the field					
use as a solid fuel outside the field	90.00%	90.00%	90.00%	90.00%	90.00%
other use different than burning					10.00%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

The above proposed change in the prunings management practices leads to a significant increase of AG_{WF} as it is presented in the following Table 7, and subsequently to increase of ARC.

Table 7

Alteration of AG_{WF} at country level (Greece) based on the proposed management practices of Table 6

AG_{WF} (tn CO_2/year)	Orange	Apple	Peach	Almond	Olive
Current status	80,021	12,246	23,147	16,335	1,028,170
Proposed scheme	120,032	55,105	104,161	24,503	1,321,932
Increase	50.00%	349.98%	350.00%	50.00%	28.57%

Comparative analysis of alternative "green" agricultural practices

CO_2RCCT can be used to compare alternative "green" agricultural practices regarding their "climate" performance vs investment requirements. A characteristic example is the examination of the application of a Renewable Energy Sources plant (e.g., photovoltaic) specifically dedicated to cover the electricity needs of a particular tree crop farm.

For the purposes of this example, the orange cultivation in Greece will be used as a case study, since the specific cultivation is the most demanding in terms of electricity consumption compared to the cultivation of other tree species (Table 8).

Table 8

Typical annual mean consumption of electricity

	TM_{EL} (KWh/ha/year)
Orange	280.00
Apple	170.00
Peach	180.00
Almond	113.00
Olive	14.29

The electricity needs will be covered by 100% by RES (run 28). This scenario will be compared in terms of CO_2 Annual Gain to the application of insects' mass trapping (run 29) and to the application of cover crops (run 30). The extracted comparative results are presented in the following Table 9.

Table 9

Comparison of alternative "green" agricultural practices

	Conventional	**RES 100%**	**Insects' mass trapping**	**Use of cover crops**
ARC (tn CO_2/year)	218,437	224,348	227,660	237,118
TAE (tn CO_2/year)	89,664	83,753	80,442	76,790
CO_2 Annual Gain (tn CO_2/year)		5,911	9,223	12,874
Increase of CO_2 Annual Gain compared to RES (%)			56.03%	117.80%

Based on the above results, it is apparent that simpler to apply and by far more economical, regarding the required capital cost, agricultural practices can deliver significantly higher CO_2 Annual Gains compared to the application of RES.

The role of fruits biomass for regulating climate

Although the fruits' biomass is not taken into account by the current official systems for the calculation of agriculture's CO_2 budgeting due to the short life cycle of the fruit as a product, it is apparent that the amounts of CO_2 that are removed from atmosphere, even temporarily, to create the fruits' biomass are considerably high.

More specifically, concerning the 5 types of tree crops examined within the project, the mass of CO_2 which is removed from atmosphere to create the fruits' biomass (AR_{BF}) has been calculated by the CO_2RCCT and it is presented in the following Table 10:

Table 10

CO_2 Annual Removal due to the production of fruit biomass

AR_{BF} tn CO_2/year	Orange	Apple	Peach	Almond	Olive	Total per country
Greece	55,365	18,746	29,229	66,792	1,889,674	**2,059,806**
Italy	56,979	228,564	220,123	21,922	713,386	**1,240,974**
Spain	230,246	40,640	55,205	415,962	3,551,048	**4,293,101**
Total per tree crop	**342,590**	**287,950**	**304,557**	**504,676**	**6,154,108**	**7,593,881**

The total mass of CO_2 which is removed from atmosphere to create the fruits' biomass (AR_{BF}) sum up to 7,593,881 tn CO_2/year, which, although with a limited life span in terms of being outside the system of the atmosphere, offers a 40.90% overplus above the total CO_2 Annual Removal Capacity (ARC) of the 5 tree crops in the 3 countries (18,568,959 tn CO_2/year).

Examining this issue from another angle, every year the 5 examined tree crops in the 3 pilot countries absorb from the atmosphere 36,588,251 tn CO_2 of which:

- → 76.40% (27,950,378 tn CO_2) is used to create the new wood biomass of the trees (AR_{BW})
- → 20.75% (7,593,881 tn CO_2) is used to create the fruits' biomass (AR_{BF})
- → 2.85% (1,043,992 tn CO_2) is stored into the soil beneath the trees as carbon of the fallen biomass (AS_S).

It is revealed by the above analysis that the, even temporary, contribution of the fruits in the confrontation of Climate Change through the removal of CO_2 from the atmosphere, can be considered as a substantial one.

The important role of the fruits' biomass in the issue of the current analysis, can be illustrated in a micro scale if considering the carbon content of the mass of the fruits (see Table 11), which is directly attributed to the CO_2 removed from the atmosphere by the trees.

Table 11

Carbon content of fresh fruits' biomass

	[g C / Kg fresh fruit]	[g CO_2 absorbed from atmosphere / Kg fresh fruit]*
Orange	19.26	70.57
Apple	20.25	74.20
Peach	12.93	47.38
Almond	594.10	2,176.90
Olive	150.90	552.93

*To calculate the CO_2 mass by the respective carbon (C) content, the K_1 coefficient (3.66419) is used.

All the above mentioned data substantiate the importance of fruits and consequently the importance of the corresponding tree crop farms as a significant Climate Change mitigation measure. Tree crops through their fruits' biomass can serve as a Climate Regulator.

The specific CO_2 mass can be considered as a "short-term climate loan", which enables the planet, instead of dealing with an X_1 quantity of CO_2 steadily existing in the atmosphere and thus contributing to the formulation of the climate, to deal with a smaller quantity X_2 fluctuating gradually throughout a calendar year from X_1 to 0 and then back to X_1 when the fruits will be consumed, depending on the product after a period of 1 month to 4 years (during the period between harvesting and final consumption, X_2 is constantly 0) [*see* Diagram 1].

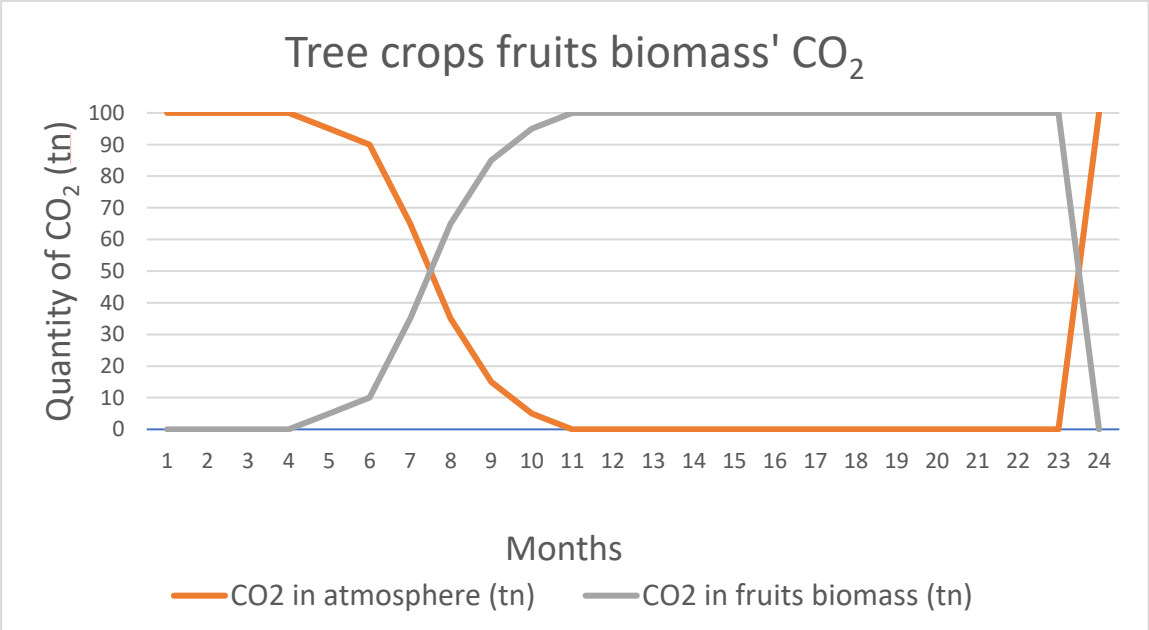

Diagram 1: Transfer of CO_2 between atmosphere and fruits biomass

5. Conclusions Regarding the Tree Crops CO_2 Removal Capacity

Concluding, based on all the above, tree crops are proved to be of significant importance for the regulation of the climate, acting as a Climate Change mitigation measure.

In this context, the expansion of areas covered by tree crops combined with the adoption of "green" cultivation practices that entail lower CO_2 emissions, appears to be of paramount importance towards the achievement of the Climate Change goals.

On top of that, an expansion of the area used for tree crop cultivation could further contribute substantially to the sector of Food Security providing adequate quantities of food of good quality to cover the needs of more people.

Prerequisite for accomplishing the above mentioned (tree crops areas expansion, adoption of "green" cultivation practices), is the respective decision making for planning of policies and strategies that will aim at mobilizing the farmers towards this direction through:

- ✓ extended awareness raising
- ✓ provision of financial incentives
- ✓ elimination of bureaucratic barriers and speed-up of licensing procedures.

6. EMERGING POTENTIALS FOR USING THE CO_2RCA AND THE CO_2RCCT

A series of rising potentials for using the CO_2RCA and the CO_2RCCT appear to be significantly promising regarding the expected impacts on the climate, the sustainable agricultural development and the economy.

The quantified results regarding the tree crops' CO_2 Annual Removal Capacity as well as its constituting parameters, can provide the necessary data:

- to the farmers, as well as to the consulting agronomists, towards the improvement of the "climate" performance of their tree crop farms through the adoption of best/ "green" agricultural practices.
- to the policy/decision makers towards the improvement of the relevant agricultural climate change indexes through the effective planning, organization and promotion of the appropriate required policies, strategies and measures (e.g., financial incentives, "green" subsidies, supporting infrastructure, etc.) to enhance the development of the agricultural sector in a sustainable and simultaneously viable way.
- to the financial institutions to develop "green" banking products for the agricultural sector that will be based on a CO_2 reduction incentive concept (e.g., lower "green" interest rate) by taking into account the "climate" performance of the specific tree crop farm for which the farmer requests financing.
- to a voluntary carbon off-setting market through which the farmers themselves will be able to financially exploit the CO_2 credits of their own tree crop farms.

The above potential uses of the CO_2RCA and the CO_2RCCT can lead to a series of significant advantages:

- ☑ Financial support to the European Union's agricultural sector.
- ☑ Development of financial incentives (e.g., "green" subsidies, "green" loans, etc.) for the farmers towards the adoption of "green" agricultural practices, which can lead to less CO_2 emissions and consequently to increased CO_2 Annual Removal Capacity of their orchards.
- ☑ Avoidance of currency export to third, non-EU countries for purchasing CO_2 credits in the case of the voluntary carbon off-setting market.
- ☑ Development of a new market of services within EU that will provide:
  - ✓ consultation to the farmers for "greening" the applied agricultural practices
  - ✓ calculation of the CO_2 Annual Removal Capacity of the orchards
  - ✓ certification of the calculated CO_2 credits
  - ✓ brokering of the certified CO_2 credits.

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Annex I

CO_2RCCT User Manual

Instructions for using the Tree crops' CO_2 Removal Capacity Calculation Tool (CO_2RCCT)

Tool settings	The first step is the User to enter worksheet "Tool settings" (light green colour tab) and select the Country (Greece, Italy or Spain) on which CO_2RCCT will be applied and then the language that will be used by CO_2RCCT. The available language options depend on the selected Country (English is a common option to all 3 Countries).
Input	In the worksheet "Input" (coral colour tab) the User has to insert information and data for the tree crop cultivation of interest. Questions Q1 and Q2 are mandatory and must be answered prior to the rest Questions. Regarding the rest Questions (Q3 to Q13.5), even if the User has no available data or knowledge to answer them, the design of CO_2RCCT ensures the extraction of reliable results by retrieving the non filled-in, missing data by the back-end supporting Database. If fields Q9.1, Q10.1, Q10.3, Q10.5, Q10.7 are not filled-in by the User, CO_2RCCT will consider the corresponding answer as an affirmative one (e.g. yes fertilizers are used) and it will proceed to the calculations using data that will be retrieved by the back-end Database. In case the User decides to change the Country option in worksheet "Tool settings" while there is in progress an on-going "run" of CO_2RCCT, he must change respectively the selection of the geographical area in Question Q2 otherwise CO_2RCCT will not continue to operate appropriately. Finally, it has to be underlined that the User is important to read and follow the instructions which are included in each individual Question of worksheet "Input".
Results	The results that are extracted by the operation of the CO_2RCCT are presented in the worksheet "Results" (light blue colour tab). The overall results are presented (CO_2 Annual Removal Capacity, CO_2 Total Annual Removals, CO_2 Total Annual Emissions) as well as the results of the sub-sections of the CO_2RCA (CO_2 Annual Removal due to Biomass of Wood, CO_2 Annual Removal due to Biomass of Fruits, CO_2 Annual Storage in soil as carbon of the fallen biomass, CO_2 Annual Emissions due to the use of fertilizers, pesticides, fossil fuels and electricity). For each sub-section, the constituent parameters are also calculated and presented. Furthermore, the CO_2 Gain due to the application of "green" agricultural practices, is calculated and presented per case. For all the above results, the respective CO_2 Removal Capacity Indexes (per unit of cultivated area, per unit of harvested fruits, per tree unit) are calculated and presented. Note: if #DIV/0! appears instead of a numerical result, this means that one or more of the corresponding statistical data YD (Yield Density), PD (Planting Density) and S (Surface of tree crop plantation) for the specific selected geographical area are not available in the back-end Database.
Database	The back-end Database that supports the operation of CO_2RCCT contains various coefficients and data that have been acquired by several sources which are referenced accordingly. This Database is included in the worksheets of the current .xlsx file with the black colour tabs. These worksheets also include the equations, assumptions and logical paths that constitute the CO_2 Removal Capacity Algorithm (CO_2RCA) based on which CO_2RCCT performs its calculations. Although these worksheets are accessible by the User, it is strongly adviced not to alter or modify any data or equations because in such a case the CO_2RCCT may not operate appropriately. The only data that the User could replace with other probably more suitable for his case study, are the ones included in the black cells with the white characters.

Annex II

CO_2RCCT backend database

Tree crops

	Species
Orange	*Citrus sinensis*
Apple	*Malus domestica*
Peach	*Prunus persica*
Almond	*Amygdalus communis**
Olive	*Olea europaea*

*synonym: *Prunus dulcis*

Trunk, branches and roots biomass development						
	T_1	T_2	ADR_1	ADR_2	% Juvenile Phase (Phase 1)	% Mature Phase (Phase 2)
Greece	years		tn **dry matter**/tree/year		(at national level)	
Orange	6	50	0.00380	0.01220	12.00%	88.00%
Apple	4	20	0.00360	0.00572	20.00%	80.00%
Peach	4	15	0.00572	0.01760	26.67%	73.33%
Almond	5	30	0.00887	0.01680	16.67%	83.33%
Olive	7	150	0.00970	0.01859	4.67%	95.33%
Italy	(years)		tn **dry matter**/tree/year		(at national level)	
Orange	6	40	0.00500	0.02870	15.00%	85.00%
Apple	3	20	0.00169	0.00530	15.00%	85.00%
Peach	3	10	0.00100	0.00451	30.00%	70.00%
Almond	5	25	0.00590	0.00290	20.00%	80.00%
Olive	8	100	0.00875	0.01000	8.00%	92.00%
Spain	(years)		tn **dry matter**/tree/year		(at national level)	
Orange	6	40	0.02000	0.01220	15.00%	85.00%
Apple	4	25	0.01300	0.00572	16.00%	84.00%
Peach	4	15	0.00572	0.00200	26.67%	73.33%
Almond	5	25	0.00887	0.00400	20.00%	80.00%
Olive	7	100	0.01224	0.00800	7.00%	93.00%

C_f	
Carbon content of fresh fruits biomass	
Greece	[g C / Kg **fresh** fruit]
Orange	19.260
Apple	20.250
Peach	12.930
Almond	594.100
Olive	150.900
Italy	[g C / Kg **fresh** fruit]
Orange	8.825
Apple	26.370
Peach	42.252
Almond	75.800
Olive	70.465
Spain	[g C / Kg **fresh** fruit]
Orange	19.260
Apple	20.250
Peach	12.930
Almond	594.100
Olive	150.900

Annual Prunings Biomass			
	M_{Pr}	Kg **dry matter**/tree/year	
	Greece	Italy	Spain
Orange	3.17500	3.17500	3.32500
Apple	2.60000	2.60000	2.50000
Peach	2.41667	2.41667	2.31657
Almond	2.83333	2.83333	2.75000
Olive	4.50000	4.50000	3.90000

	Prunings DW/FW
Orange	0.4983
Apple	0.4855
Peach	0.4992
Almond	0.5347
Olive	0.5998

Prunings management

Greece

	Management practices (%)	Orange	Apple	Peach	Almond	Olive
	left in the field	40.00%	80.00%	40.00%	20.00%	
	burnt in the field			40.00%	20.00%	20.00%
Z_{Pr_WF}	use as a solid fuel outside the field	60.00%	20.00%	20.00%	60.00%	70.00%
	other use different than burning					10.00%
	Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Italy

	Management practices (%)	Orange	Apple	Peach	Almond	Olive
	left in the field	80.00%	80.00%	80.00%	80.00%	20.00%
	burnt in the field	20.00%	20.00%	20.00%	20.00%	80.00%
Z_{Pr_WF}	use as a solid fuel outside the field					
	other use different than burning					
	Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Spain

	Management practices (%)	Orange	Apple	Peach	Almond	Olive
	left in the field	40.00%	80.00%	40.00%	20.00%	
	burnt in the field			40.00%	20.00%	20.00%
Z_{Pr_WF}	use as a solid fuel outside the field	60.00%	20.00%	20.00%	60.00%	70.00%
	other use different than burning					10.00%
	Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Product losses throughout a full cultivation cycle

Note: the intentional thinning is included

	Z_{fruits}	Percentage of **total potential** fruits biomass
i	**Orange**	20.00%
ii	**Apple**	20.00%
iii	**Peach**	20.00%
iv	**Almond**	10.00%
v	**Olive**	10.00%

Note: NOT percentage of the yield

Sources: i, ii, iii: FAO 2011 / SIK 2013, Table 33

iv, v: P. Roussos/Agricultural University of Athens

Annual biomass (dry matter) of fallen leaves			
	M_{leaves}	Kg **dry matter**/tree/year	
	Greece	**Italy**	**Spain**
Orange	7.05357	7.05357	7.05357
Apple	2.57143	2.57143	2.57143
Peach	1.91453	1.91453	1.91453
Almond	2.56604	2.56604	2.56604
Olive	6.21103	6.21103	6.21103

Hulls mass (M_{hulls}):	10.16667	Kg/tree/year
70.00%	of which, remain in the field	

GREECE

Processed data obtained originally by ELSTAT (Ελληνική Στατιστική Αρχή/ Hellenic Statistical Authority)

Mean values of years: 2012 to 2016

YD (in tn of fruits produced per ha) [Yield Density]

PD (in trees planted per ha) [Planting Density]

S (in ha) [Surface of tree crop plantation]

Regions	Orange trees			Apple trees			Peach trees			Almond trees			Olive trees		
	YD (tn/ha)	PD (trees/ha)	S (ha)	YD (tn/ha)	PD (trees/ha)	S (ha)	YD (tn/ha)	PD (trees/ha)	S (ha)	YD (tn/ha)	PD (trees/ha)	S (ha)	YD (tn/ha)	PD (trees/ha)	S (ha)
GREECE (total)	**23.15**	**445.91**	**33,885.94**	**22.62**	**739.00**	**11,168.26**	**15.70**	**439.32**	**39,282.78**	**2.31**	**278.87**	**13,299.76**	**4.19**	**173.39**	**815,072.90**
EASTERN MACEDONIA & THRACE (total)	**5.63**	**243.75**	**0.32**	**13.19**	**755.49**	**187.46**	**7.83**	**420.58**	**206.26**	**3.95**	**283.95**	**1,259.02**	**4.69**	**192.70**	**16,070.40**
Rodopi				14.09	427.65	37.84	6.70	266.17	12.32	3.56	219.17	68.76	6.62	207.04	955.22
Drama				15.95	495.72	25.72	7.23	352.65	11.24	2.02	254.36	41.32	5.53	258.15	694.96
Evros	1.00	190.00	0.20	9.92	1,217.64	60.18	2.69	578.19	36.52	1.72	264.04	108.06	1.95	180.87	2,251.86
Thasos				5.77	218.79	2.98	4.34	205.00	9.40	1.48	237.39	15.38	1.03	137.36	7,289.40
Kavala	13.33	333.33	0.12	21.26	563.94	34.76	11.12	302.96	83.58	4.46	292.42	1,007.72	12.33	280.26	4,132.28
Xanthi				5.67	737.47	25.98	8.16	585.36	53.20	2.03	284.48	17.78	2.96	204.83	746.68
CENTRAL MACEDONIA (total)	**4.98**	**251.49**	**3.50**	**24.52**	**711.47**	**3,105.20**	**14.85**	**429.59**	**34,772.80**	**2.76**	**254.01**	**2,708.10**	**6.31**	**218.54**	**41,089.18**
Thessaloniki	0.00	710.00	0.02	13.88	456.52	61.36	12.92	344.77	65.78	2.08	277.61	315.40	3.70	215.33	3,377.92
Imathia				27.01	754.91	1,404.50	17.32	421.65	15,480.78	6.43	337.48	65.42	10.74	262.60	304.76
Kilkis	0.00	200.00	0.02	4.70	339.46	14.32	8.48	331.99	37.84	2.23	261.47	149.88	4.44	271.66	449.14
Pella				23.38	681.16	1,412.66	12.77	436.48	18,865.04	1.76	292.03	69.60	4.73	301.62	800.76
Pieria				23.56	811.03	144.80	21.31	454.55	235.62	2.79	261.27	102.80	5.10	288.66	3,375.46
Serres	15.00	400.00	0.04	17.34	734.59	40.56	10.45	514.13	42.42	2.84	245.75	1,933.34	3.66	265.19	5,231.68
Chalkidiki	4.84	247.37	3.42	6.37	245.53	27.00	11.59	264.32	45.32	2.56	234.10	71.66	7.27	197.72	27,549.46
WESTERN MACEDONIA (total)	**0.00**	**500.00**	**0.04**	**33.10**	**1,325.70**	**2,483.92**	**27.21**	**627.86**	**1,731.78**	**3.60**	**549.84**	**490.60**	**7.00**	**277.09**	**232.76**
Kozani	0.00	500.00	0.04	36.25	1,880.84	955.62	22.12	648.87	783.40	4.04	716.09	291.48	7.03	277.34	232.02
Grevena				13.03	703.01	42.04	3.15	250.42	1.44	0.99	155.42	58.08	0.00	196.22	0.74
Kastoria				35.54	966.70	1,155.66	17.57	544.80	1.00	3.51	322.98	11.48			
Florina				18.26	1,055.12	330.60	31.60	611.12	945.94	3.88	372.72	129.56			
EPIRUS (total)	**22.60**	**439.11**	**4,273.20**	**4.37**	**263.84**	**75.46**	**8.01**	**334.22**	**35.24**	**1.75**	**181.92**	**70.88**	**5.26**	**121.60**	**24,648.44**
Ioannina	5.75	273.53	0.34	3.48	225.03	14.68	6.57	301.19	18.80	1.97	190.31	16.84	3.95	159.52	60.48
Arta	22.23	436.94	3,724.08	3.45	250.36	50.04	9.19	419.54	6.90	1.64	189.28	8.58	5.92	200.35	4,951.90
Thesprotia	32.67	491.10	336.52	12.74	335.95	8.24	11.19	340.46	6.12	1.24	186.29	27.46	4.99	87.11	11,080.64
Preveza	13.56	395.09	212.26	6.94	523.68	2.50	7.55	332.46	3.42	2.00	163.89	18.00	5.19	120.43	8,555.42
THESSALY (total)	**6.37**	**286.04**	**23.42**	**20.09**	**526.29**	**3,732.66**	**23.64**	**464.57**	**1,906.98**	**2.32**	**302.97**	**6,099.78**	**3.56**	**228.41**	**34,034.10**
Larissa	29.55	322.00	0.10	28.36	791.03	1,804.68	24.94	474.35	1,745.58	2.79	321.95	3,943.32	6.21	275.15	8,173.26
Karditsa	5.45	300.00	0.22	4.36	365.75	32.48	6.18	289.16	5.72	0.44	138.12	44.22	2.88	202.83	116.88
Magnesia	6.63	285.94	22.98	12.89	268.40	1,736.32	11.44	334.02	87.92	1.51	271.85	2,048.12	2.67	207.62	21,664.34
Sporades Islands	4.07	250.00	0.12	4.46	304.76	0.84				0.96	211.55	30.00	0.66	234.68	2,531.16
Trikala				11.57	370.95	158.34	10.82	397.00	67.76	2.73	272.40	34.12	5.94	264.19	1,548.46
CENTRAL GREECE (total)	**9.53**	**341.80**	**169.76**	**13.40**	**540.26**	**221.70**	**10.12**	**307.23**	**118.62**	**0.99**	**196.34**	**1,054.56**	**3.24**	**159.91**	**90,209.90**
Pthiotida	4.22	222.22	1.26	22.88	856.09	118.36	11.79	321.42	78.98	1.89	268.97	409.78	3.84	189.93	37,980.90
Viotia	12.23	377.55	0.98	2.92	106.26	6.36	8.48	395.63	2.88	0.43	143.94	168.28	1.61	137.11	17,484.52
Evia	9.64	361.41	123.76	6.73	188.93	59.92	8.20	269.64	36.30	1.51	193.59	127.70	4.16	139.15	27,197.70
Evritania				2.62	234.46	11.48	2.73	257.89	0.38	1.28	187.27	1.10	0.26	138.57	678.38
Fokida	9.87	288.96	43.76	1.12	147.01	25.58	4.05	412.50	0.08	0.18	137.15	347.70	0.63	136.19	6,868.40
IONIAN ISLANDS (total)	**10.22**	**344.88**	**334.10**	**4.96**	**256.26**	**35.30**	**4.31**	**277.73**	**14.10**	**1.47**	**225.96**	**135.62**	**5.72**	**147.08**	**38,315.30**
Corfu	11.12	366.91	245.40	5.39	269.37	32.26	4.22	279.77	13.20	1.74	236.78	89.62	4.53	149.24	19,214.12
Zakynthos	12.08	310.54	29.22	3.85	166.67	0.12	5.30	228.85	0.52	2.08	191.58	1.90	15.72	172.61	8,454.04
Ithaka	2.85	300.20	2.02	0.57	100.00	0.04				0.34	125.00	2.84	0.84	103.46	1,102.64
Kefallonia	7.92	272.43	40.56	1.38	109.40	2.34	3.88	273.68	0.38	1.27	214.50	31.88	1.84	123.81	3,919.50
Lefkada	2.48	263.67	16.90	1.29	140.74	0.54				0.73	199.10	9.38	0.39	126.12	5,625.00
WESTERN GREECE (total)	**14.38**	**351.94**	**5,430.24**	**8.08**	**306.72**	**120.08**	**10.91**	**347.09**	**75.70**	**2.24**	**196.65**	**383.58**	**4.92**	**186.89**	**70,083.12**
Achaia	11.25	320.38	298.02	8.04	278.78	87.92	10.41	294.83	27.36	2.08	196.30	103.06	7.33	170.18	13,721.74
Etoloakarnania	12.26	301.50	2,701.98	9.31	402.87	26.50	9.20	307.92	16.28	2.20	196.26	235.74	3.13	186.29	22,840.44
Ilia	17.24	411.89	2,430.24	8.37	290.53	5.66	12.66	411.57	32.06	2.69	199.51	44.78	5.11	194.14	33,520.94
PELOPONNESE (total)	**27.67**	**474.00**	**18,856.58**	**15.04**	**411.66**	**883.54**	**14.37**	**414.82**	**303.54**	**1.30**	**189.20**	**490.30**	**4.94**	**168.24**	**209,369.84**
Arkadia	15.05	376.96	73.48	18.48	463.75	613.60	6.62	269.48	22.94	0.58	155.46	213.22	4.61	147.26	16,946.64
Argolida	32.62	496.55	9,344.32	13.76	613.14	8.22	18.61	477.22	172.68	2.59	277.31	59.30	3.12	136.39	27,908.94
Korinthia	9.68	347.04	807.76	8.85	301.44	215.18	9.48	314.84	92.30	1.25	204.04	135.06	2.73	143.20	20,882.96
Lakonia	24.79	470.99	8,150.36	4.43	215.62	20.98	14.97	674.85	10.18	1.59	181.50	61.28	3.09	176.66	65,878.92
Mesinia	14.56	315.05	480.66	4.30	185.45	25.56	7.77	256.73	5.44	2.59	209.65	21.44	7.95	183.85	77,752.38
ATTICA (total)	**10.31**	**338.45**	**70.26**	**6.94**	**340.00**	**0.10**	**15.76**	**377.38**	**9.30**	**1.74**	**253.18**	**116.68**	**1.56**	**122.23**	**23,155.22**
Athens Central Section															
Athens North Section	1.50	66.67	0.06							0.66	135.00	0.40	1.70	181.01	11.44
Athens West Section													1.01	125.67	13.40
Athens South Section															
Athens East Section	4.51	196.03	29.96	6.98	340.00	0.10	22.76	441.27	6.44	2.16	267.29	70.68	1.68	130.66	9,273.12

West Attica	3.06	194.78	0.46				2.81	238.27	2.66	2.40	263.98	20.28	1.24	124.98	4,763.54
Piraeus													0.00	94.00	0.30
Attica Islands	16.15	447.79	39.78				2.47	170.00	0.20	0.80	207.01	25.32	1.66	112.12	9,093.42
NORTHERN AEGEAN (total)	**9.47**	**550.31**	**387.12**	**3.70**	**240.54**	**55.90**	**2.78**	**254.03**	**11.02**	**0.92**	**226.08**	**252.60**	**1.30**	**172.41**	**57,972.60**
Lesvos	3.93	231.85	84.54	3.60	235.19	42.20	2.32	191.04	5.36	2.21	198.99	25.10	1.54	183.33	43,779.50
Ikaria	9.13	264.76	5.42	9.02	179.59	2.94	2.78	175.00	1.68	0.72	113.63	32.00	0.91	122.65	1,997.16
Limnos	2.72	216.67	0.18	4.97	219.33	0.60	0.81	62.58	1.86	0.87	270.84	91.18	0.87	200.83	85.68
Samos	6.33	292.45	81.74	2.69	281.63	10.16	4.84	694.77	1.72	1.74	354.29	2.94	1.02	142.21	8,305.88
Chios	12.47	780.79	215.24				3.28	425.00	0.40	0.27	224.30	101.38	0.27	138.25	3,804.38
SOUTHERN AEGEAN (total)	**5.46**	**390.68**	**598.88**	**13.25**	**600.96**	**3.54**	**24.92**	**543.94**	**74.22**	**2.17**	**198.31**	**36.72**	**2.16**	**132.47**	**18,258.80**
Syros	6.94	302.35	3.40							3.60	273.08	3.90	5.29	235.71	40.60
Andros	13.96	388.39	4.48	3.73	280.00	0.02				1.91	264.71	0.68	5.81	172.04	186.88
Santorini	5.08	268.18	0.22							4.30	645.64	0.78	2.19	169.97	150.86
Kalimnos	7.78	411.44	17.12	5.31	1,121.43	0.28	12.22	1,675.00	0.28	0.78	304.00	1.00	1.33	117.97	602.78
Karpathos	2.17	233.67	1.20	3.87	266.67	0.18	3.08	254.55	0.66	0.65	149.17	2.18	0.23	99.52	1,105.58
Kythnos	8.41	279.76	1.68				7.45	450.00	0.12	3.09	149.14	11.60	2.93	126.22	86.66
Kos	10.11	288.03	17.98	2.91	400.00	0.08	10.50	371.62	1.48	3.48	275.52	0.58	2.57	197.34	2,082.12
Milos	5.98	267.46	5.04				1.50	250.00	0.10	0.68	297.62	0.84	1.14	143.43	495.80
Mykonos	3.80	212.00	1.00										4.84	217.51	5.94
Naxos	12.23	332.44	49.10	7.52	413.48	0.46	2.86	134.72	2.50	4.03	205.47	2.74	2.64	153.85	1,038.24
Paros	5.09	257.09	5.92	3.00	150.00	0.04	2.40	236.36	0.44	1.33	211.05	3.62	2.58	241.07	623.86
Rhodes	3.70	404.65	490.66	29.48	701.70	2.12	28.78	563.99	68.52	1.25	160.36	8.44	2.17	114.46	11,707.68
Tinos	4.40	200.56	1.08	1.52	122.22	0.36	2.32	166.67	0.12	1.67	233.33	0.36	1.79	195.85	131.80
CRETE (total)	**22.14**	**463.45**	**3,738.52**	**5.34**	**304.41**	**263.40**	**5.80**	**305.18**	**29.03**	**0.96**	**163.72**	**201.32**	**4.08**	**181.53**	**191,633.24**
Heraklion	23.72	420.59	404.82	4.57	212.84	191.20	7.77	318.28	5.22	2.38	373.86	12.44	3.40	173.59	87,939.56
Lasithi	12.56	733.92	43.82	10.62	669.11	40.22	4.62	300.54	1.84	0.74	147.52	180.96	3.29	196.09	33,068.60
Rethymno	8.85	426.96	173.30	3.75	272.71	11.80	3.68	308.98	1.96	0.84	222.20	5.36	2.62	160.22	27,744.10
Chania	23.39	467.24	3,116.58	7.68	463.60	20.18	8.61	425.20	14.20	1.25	165.63	2.56	7.07	200.35	42,880.98

ITALY

Processed data obtained originally by ISTAT (Istituto Nazionale di Statistica/ Italian National Institute of Statistics)

Mean values of years: 2012 to 2016

YD (in tn of fruits produced per ha) **[Yield Density]**

PD (in trees planted per ha) **[Planting Density]**

S (in ha) **[Surface of tree crop plantation]**

Regions	ORANGE TREES			APPLE TREES			PEACH TREES			ALMOND TREES			OLIVE TREES		
	YD (tn/ha)	PD (trees/ha)	S (ha)	YD (tn/ha)	PD (trees/ha)	S (ha)	YD (tn/ha)	PD (trees/ha)	S (ha)	YD (tn/ha)	PD (trees/ha)	S (ha)	YD (tn/ha)	PD (trees/ha)	S (ha)
ITALIA (total)	**20.87**	**240.00**	**84,420.60**	**45.18**	**1,350.00**	**52,362.00**	**20.84**	**650.00**	**68,225.60**	**1.36**	**270.00**	**58,154.60**	**2.45**	**156.00**	**1,128,634.20**
PIEMONTE (total)				**32.91**	**1,350.00**	**4,553.60**	**27.98**	**650.00**	**3,791.00**				**1.91**	**156.00**	**76.80**
Torino				28.90	1,350.00	472.60	19.33	650.00	158.60				1.91	156.00	16.00
Vercelli				18.52	1,350.00	12.40	14.18	650.00	120.80						
Novara				27.57	1,350.00	28.00	15.00	650.00	9.00				2.11	156.00	15.20
Cuneo				34.61	1,350.00	3,739.60	30.19	650.00	2,987.40				1.72	156.00	20.00
Asti				14.94	1,350.00	159.60	14.76	650.00	93.60				2.00	156.00	10.00
Alessandria				24.90	1,350.00	125.40	22.87	650.00	415.60				1.90	156.00	12.60
Biella				18.27	1,350.00	13.40	14.45	650.00	4.40				2.34	156.00	1.40
Verbano Cusio Ossola				11.83	1,350.00	2.60	10.64	650.00	1.60				1.64	156.00	1.60
VALLE D' AOSTA (total)				**17.25**	**1,350.00**	**306.00**	**12.50**	**650.00**	**0.80**						
Aosta				17.25	1,350.00	306.00	12.50	650.00	0.80						
LOMBARDIA (total)				**28.35**	**1,350.00**	**1,651.60**	**20.09**	**650.00**	**403.00**	**1.89**	**270.00**	**2.60**	**1.95**	**156.00**	**2,313.20**
Varese				22.00	1,350.00	9.00	12.27	650.00	11.40				3.43	156.00	1.20
Como				23.40	1,350.00	13.00							1.13	156.00	64.40
Sondrio				31.53	1,350.00	1,123.00	12.50	650.00	0.80				0.40	156.00	1.60
Milano				16.84	1,350.00	5.00	9.08	650.00	3.60						
Bergamo				11.57	1,350.00	49.00	13.42	650.00	11.40				1.57	156.00	126.40
Brescia				15.65	1,350.00	72.20	10.61	650.00	60.80				2.03	156.00	2,036.00
Pavia				21.73	1,350.00	213.20	19.92	650.00	82.60	1.69	270.00	2.20	0.52	156.00	7.00
Cremona				24.71	1,350.00	16.80	17.72	650.00	11.60						
Mantova				27.78	1,350.00	142.60	24.01	650.00	217.80				1.30	156.00	19.20
Lecco				11.00	1,350.00	1.20							1.08	156.00	57.40
Lodi				12.80	1,350.00	2.00	12.18	650.00	2.20						
Monza e della Brianza				18.93	1,350.00	4.60	13.00	650.00	0.80	3.00	270.00	0.40			
LIGURIA (total)	**10.21**	**240.00**	**14.00**	**9.24**	**1,350.00**	**56.40**	**9.84**	**650.00**	**110.60**				**1.65**	**156.00**	**15,396.00**
Imperia	10.53	240.00	3.80	6.29	1,350.00	7.00	11.39	650.00	3.60				2.31	156.00	5,880.00
Savona	10.00	240.00	9.20	8.77	1,350.00	23.40	10.46	650.00	72.80				1.60	156.00	2,196.00
Genova				8.67	1,350.00	12.00	8.51	650.00	31.60				0.89	156.00	6,200.00
La Spezia	11.00	240.00	1.00	12.00	1,350.00	14.00	6.54	650.00	2.60				2.43	156.00	1,120.00
TRENTINO ALTO ADIGE (total)				**58.13**	**1,350.00**	**27,478.00**	**9.14**	**650.00**	**6.40**				**4.41**	**156.00**	**383.40**
Bolzano/Bozen				61.32	1,350.00	17,788.00									
Trento				52.27	1,350.00	9,690.00	9.14	650.00	6.40				4.41	156.00	383.40
VENETO (total)				**42.02**	**1,350.00**	**5,553.40**	**19.03**	**650.00**	**2,964.80**	**0.99**	**270.00**	**2.00**	**3.07**	**156.00**	**4,140.80**
Verona				43.61	1,350.00	4,327.80	18.95	650.00	2,531.80				3.01	156.00	3,078.80
Vicenza				35.89	1,350.00	88.00	16.91	650.00	23.40	0.20	270.00	0.40	3.56	156.00	462.80
Belluno				29.18	1,350.00	64.60	14.00	650.00	0.20						
Treviso				33.88	1,350.00	109.60	19.44	650.00	69.20				3.06	156.00	284.80
Venezia				38.94	1,350.00	193.60	20.12	650.00	58.80				2.38	156.00	1.60
Padova				43.13	1,350.00	333.80	18.31	650.00	152.20	1.19	270.00	1.60	2.99	156.00	311.60
Rovigo				32.02	1,350.00	436.00	21.16	650.00	129.20				3.02	156.00	1.20
FRIULLI VENEZIA GIULIA (total)				**32.34**	**1,350.00**	**706.60**	**23.79**	**650.00**	**188.60**	**5.71**	**270.00**	**1.60**	**2.69**	**156.00**	**204.00**
Udine				32.54	1,350.00	406.40	24.22	650.00	106.80	6.83	270.00	1.20	2.90	156.00	68.80
Gorizia				25.59	1,350.00	15.00	24.10	650.00	21.00				2.68	156.00	42.60
Trieste				16.03	1,350.00	2.40	18.85	650.00	5.20				2.87	156.00	38.60

Pordenone				32.54	1,350.00	282.80	23.30	650.00	55.60	2.35	270.00	0.40	2.30	156.00	54.00
EMILIA ROMAGNA (total)				**37.97**	**1,350.00**	**3,979.80**	**24.56**	**650.00**	**15,286.40**				**1.70**	**156.00**	**3,134.00**
Piacenza				21.07	1,350.00	49.80	19.64	650.00	27.20				0.74	156.00	11.60
Parma				17.27	1,350.00	24.80	17.61	650.00	11.40				0.44	156.00	9.00
Reggio nell' Emilia				30.02	1,350.00	81.40	25.45	650.00	29.40				0.97	156.00	12.40
Modena				34.05	1,350.00	376.80	18.99	650.00	220.80				1.06	156.00	15.00
Bologna				42.84	1,350.00	411.40	24.37	650.00	1,601.20				1.86	156.00	245.00
Ferrara				39.69	1,350.00	1,796.80	19.60	650.00	857.60						
Ravenna				37.14	1,350.00	933.00	27.22	650.00	8,101.20				2.14	156.00	381.80
Forlì Cesena				35.40	1,350.00	296.20	21.02	650.00	4,305.00				1.37	156.00	902.80
Rimini				30.00	1,350.00	9.60	22.53	650.00	132.60				1.78	156.00	1,556.40
TOSCANA (total)	**17.46**	**240.00**	**8.20**	**24.81**	**1,350.00**	**884.80**	**17.01**	**650.00**	**1,190.00**	**2.69**	**270.00**	**25.80**	**1.19**	**156.00**	**85,560.80**
Massa Carrara				10.47	1,350.00	41.40	7.35	650.00	11.40				1.73	156.00	660.20
Lucca	13.47	240.00	2.00	20.22	1,350.00	54.80	21.34	650.00	53.40				2.74	156.00	2,625.00
Pistoia				7.37	1,350.00	21.00	7.48	650.00	10.60				0.83	156.00	7,566.60
Firenze				32.29	1,350.00	73.00	28.32	650.00	116.00	6.00	270.00	3.00	1.64	156.00	18,086.00
Livorno	25.11	240.00	3.60	24.46	1,350.00	35.00	15.13	650.00	236.60				1.36	156.00	4,560.60
Pisa				12.89	1,350.00	63.60	10.85	650.00	299.80	2.69	270.00	2.80	0.70	156.00	7,407.40
Arezzo				28.46	1,350.00	482.00	20.11	650.00	202.80				1.27	156.00	10,383.80
Siena				12.97	1,350.00	52.80	11.79	650.00	20.40	3.60	270.00	1.00	1.10	156.00	14,994.60
Grosseto	9.92	240.00	2.60	30.24	1,350.00	59.60	18.86	650.00	239.00	2.11	270.00	19.00	0.85	156.00	17,180.00
Prato				12.05	1,350.00	1.60							1.06	156.00	2,096.60
UMBRIA (total)				**13.58**	**1,350.00**	**236.00**	**10.83**	**650.00**	**135.20**	**1.05**	**270.00**	**4.00**	**1.41**	**156.00**	**27,183.00**
Perugia				13.52	1,350.00	233.00	10.82	650.00	127.00				1.47	156.00	18,138.40
Terni				18.00	1,350.00	3.00	10.98	650.00	8.20	1.05	270.00	4.00	1.31	156.00	9,044.60
MARCHE (total)				**20.14**	**1,350.00**	**186.20**	**18.11**	**650.00**	**797.40**	**1.34**	**270.00**	**23.00**	**2.76**	**156.00**	**9,533.00**
Pesaro e Urbino				11.37	1,350.00	12.20	8.11	650.00	140.80	1.34	270.00	23.00	1.28	156.00	764.20
Ancona				9.08	1,350.00	62.60	8.35	650.00	148.20				2.32	156.00	1,730.00
Macerata				20.09	1,350.00	42.60	15.50	650.00	69.60				2.15	156.00	2,369.00
Ascoli Piceno				32.57	1,350.00	41.60	25.32	650.00	230.80				3.47	156.00	3,016.20
Fermo				30.63	1,350.00	27.20	24.71	650.00	208.00				3.47	156.00	1,653.60
LAZIO (total)	**8.89**	**240.00**	**515.40**	**16.31**	**1,350.00**	**481.20**	**12.29**	**650.00**	**1,921.20**	**0.55**	**270.00**	**20.60**	**1.93**	**156.00**	**79,693.00**
Viterbo				21.60	1,350.00	109.60	13.33	650.00	165.00				2.11	156.00	13,422.00
Rieti				6.35	1,350.00	55.00	5.63	650.00	60.00				1.28	156.00	11,320.00
Roma	8.30	240.00	5.00	10.30	1,350.00	163.00	11.78	650.00	1,254.80	0.53	270.00	20.20	1.91	156.00	23,856.00
Latina	8.72	240.00	503.60	26.23	1,350.00	105.60	15.40	650.00	361.20				2.08	156.00	12,735.00
Frosinone	22.21	240.00	6.80	14.21	1,350.00	48.00	9.21	650.00	80.20	1.50	270.00	0.40	2.11	156.00	18,360.00
ABRUZZO (total)	**13.50**	**240.00**	**5.60**	**24.85**	**1,350.00**	**552.60**	**15.51**	**650.00**	**2,397.60**	**0.24**	**270.00**	**142.60**	**2.78**	**156.00**	**41,837.20**
L'Aquila				29.98	1,350.00	150.20	10.08	650.00	55.80	0.02	270.00	130.00	1.31	156.00	2,084.00
Teramo				22.22	1,350.00	95.40	21.59	650.00	429.40	1.80	270.00	4.80	3.12	156.00	5,776.20
Pescara				26.42	1,350.00	143.60	19.54	650.00	450.40	2.93	270.00	7.80	3.54	156.00	10,376.00
Chieti	13.50	240.00	5.60	20.30	1,350.00	163.40	12.69	650.00	1,462.00				2.49	156.00	23,601.00
MOLISE (total)				**15.53**	**1,350.00**	**430.00**	**8.74**	**650.00**	**573.20**	**3.50**	**270.00**	**15.00**	**3.48**	**156.00**	**14,307.60**
Campobasso				16.00	1,350.00	400.00	9.58	650.00	454.00	3.50	270.00	15.00	3.53	156.00	11,640.40
Isernia				9.20	1,350.00	30.00	5.55	650.00	119.20				3.28	156.00	2,667.20
CAMPANIA (total)	**18.62**	**240.00**	**1,027.00**	**20.01**	**1,350.00**	**3,298.60**	**19.82**	**650.00**	**19,276.00**	**2.53**	**270.00**	**13.00**	**2.66**	**156.00**	**74,442.60**
Caserta	17.99	240.00	334.00	20.44	1,350.00	2,346.80	19.89	650.00	14,823.60				2.56	156.00	8,864.60
Benevento				16.93	1,350.00	333.80	16.42	650.00	184.60				2.52	156.00	13,550.00
Napoli	19.34	240.00	253.60	20.83	1,350.00	274.20	19.86	650.00	2,872.20				4.72	156.00	2,114.00
Avellino	20.16	240.00	7.40	17.36	1,350.00	93.80	16.81	650.00	14.60	2.67	270.00	10.40	2.21	156.00	8,060.00
Salerno	18.66	240.00	432.00	20.24	1,350.00	250.00	19.48	650.00	1,381.00	1.96	270.00	2.60	2.72	156.00	41,854.00
PUGLIA (total)	**26.41**	**240.00**	**4,024.20**	**17.77**	**1,350.00**	**228.00**	**20.26**	**650.00**	**4,121.80**	**1.10**	**270.00**	**20,378.80**	**2.79**	**156.00**	**376,406.00**
Foggia	16.57	240.00	429.60	12.89	1,350.00	76.00	19.79	650.00	670.00	1.96	270.00	1,466.00	3.22	156.00	51,280.00
Bari	18.75	240.00	64.00	20.15	1,350.00	54.00	21.14	650.00	312.00	0.93	270.00	12,780.00	2.44	156.00	99,690.00

Taranto	28.99	240.00	3,080.00	21.44	1,350.00	57.00	17.98	650.00	102.00	2.86	270.00	504.00	3.00	156.00	35,804.00
Brindisi	23.76	240.00	59.00	22.11	1,350.00	18.00	20.48	650.00	920.00	1.09	270.00	4,760.00	2.72	156.00	63,680.00
Lecce	18.60	240.00	382.00	15.07	1,350.00	18.00	18.43	650.00	203.80	1.51	270.00	78.80	2.51	156.00	93,154.00
Barletta Andria Trani	16.52	240.00	9.60	18.60	1,350.00	5.00	20.50	650.00	1,914.00	1.16	270.00	790.00	3.90	156.00	32,798.00
BASILICATA (total)	**20.73**	**240.00**	**4,920.60**	**20.13**	**1,350.00**	**375.00**	**20.14**	**650.00**	**3,213.20**	**4.76**	**270.00**	**71.40**	**1.24**	**156.00**	**26,650.00**
Potenza	13.29	240.00	21.40	20.24	1,350.00	349.80	16.05	650.00	223.60	4.34	270.00	19.40	1.18	156.00	11,106.60
Matera	20.76	240.00	4,899.20	18.52	1,350.00	25.20	20.44	650.00	2,989.60	4.91	270.00	52.00	1.29	156.00	15,543.40
CALABRIA (total)	**26.92**	**240.00**	**16,542.40**	**15.01**	**1,350.00**	**536.40**	**27.98**	**650.00**	**3,038.80**	**4.37**	**270.00**	**166.60**	**3.38**	**156.00**	**182,633.40**
Cosenza	35.26	240.00	2,545.60	15.73	1,350.00	183.60	29.75	650.00	2,270.40	2.28	270.00	16.60	3.21	156.00	53,497.40
Catanzaro	29.48	240.00	2,415.80	14.40	1,350.00	171.40	26.57	650.00	530.80	2.74	270.00	54.00	1.92	156.00	41,774.20
Reggio di Calabria	26.19	240.00	9,000.60	19.19	1,350.00	108.60	16.43	650.00	108.00	6.08	270.00	81.40	5.00	156.00	49,791.20
Crotone	17.06	240.00	1,236.00	10.64	1,350.00	36.40	7.27	650.00	69.40	3.56	270.00	12.80	2.01	156.00	21,204.80
Vibo Valentia	20.47	240.00	1,344.40	6.15	1,350.00	36.40	18.01	650.00	60.20	1.30	270.00	1.80	4.51	156.00	16,365.80
SICILIA (total)	**19.05**	**240.00**	**54,288.80**	**18.80**	**1,350.00**	**682.00**	**18.94**	**650.00**	**6,749.80**	**1.56**	**270.00**	**33,423.60**	**1.91**	**156.00**	**157,028.20**
Trapani	17.71	240.00	276.00				10.20	650.00	70.00	3.67	270.00	11.60	2.43	156.00	25,500.00
Palermo	15.81	240.00	393.60	17.00	1,350.00	50.00	15.07	650.00	872.40	1.59	270.00	2,266.00	2.77	156.00	21,356.00
Messina	17.45	240.00	2,040.00	12.14	1,350.00	112.00	13.89	650.00	610.00	1.40	270.00	400.00	0.69	156.00	35,473.20
Agrigento	22.66	240.00	4,855.20	25.48	1,350.00	75.00	20.21	650.00	2,469.80	1.30	270.00	10,606.00	1.86	156.00	24,521.00
Caltanissetta	9.00	240.00	172.00	4.00	1,350.00	4.00	22.24	650.00	1,640.00	1.05	270.00	4,770.00	1.57	156.00	8,208.00
Enna	17.80	240.00	2,902.00	18.00	1,350.00	19.00	15.00	650.00	234.20	1.62	270.00	5,560.00	1.52	156.00	11,820.00
Catania	17.32	240.00	24,870.00	19.76	1,350.00	422.00	20.66	650.00	534.40	1.11	270.00	2,520.00	3.19	156.00	13,610.00
Ragusa	26.49	240.00	1,880.00				18.45	650.00	71.00	1.99	270.00	2,230.00	2.39	156.00	6,240.00
Siracusa	20.34	240.00	16,900.00				13.18	650.00	248.00	2.57	270.00	5,060.00	1.94	156.00	10,300.00
SARDEGNA (total)	**16.27**	**240.00**	**3,074.40**	**14.60**	**1,350.00**	**185.80**	**12.13**	**650.00**	**2,059.80**	**0.76**	**270.00**	**3,864.00**	**0.96**	**156.00**	**27,711.20**
Sassari	15.12	240.00	74.80	12.74	1,350.00	27.80	12.28	650.00	175.40	0.68	270.00	40.40	1.00	156.00	6,983.40
Nuoro	17.01	240.00	266.40	16.49	1,350.00	38.20	10.52	650.00	114.20	0.74	270.00	912.20	1.09	156.00	4,025.60
Cagliari	16.16	240.00	1,952.60	12.86	1,350.00	43.80	11.49	650.00	938.00	0.72	270.00	1,639.40	0.83	156.00	6,759.80
Oristano	17.50	240.00	324.00	13.64	1,350.00	15.40	13.24	650.00	111.60	0.72	270.00	377.40	0.90	156.00	3,747.40
Olbia Tempio	15.90	240.00	33.40	17.14	1,350.00	10.80	10.98	650.00	71.20	0.92	270.00	6.60	1.08	156.00	492.60
Ogliastra	15.55	240.00	235.80	11.34	1,350.00	17.40	11.33	650.00	209.60	0.86	270.00	256.40	1.19	156.00	1,847.60
Medio Campidano	15.70	240.00	93.20	11.84	1,350.00	14.60	14.23	650.00	401.40	0.88	270.00	608.00	0.78	156.00	2,263.60
Carbonia Iglesias	15.62	240.00	94.20	22.46	1,350.00	17.80	12.91	650.00	38.40	0.88	270.00	23.60	1.11	156.00	1,591.20

SPAIN

Processed data obtained originally by Ministerio de Agricultura Pesca y Alimentación (MAPA) - Anuario de Estadística Agraria/ Spanish Ministry of Agriculture, Fishery and Food - Agrarian statistics yearbook

Mean values of years: 2012 to 2016
YD (in tn of fruits produced per ha) [Yield Density]
PD (in trees planted per ha) [Planting Density]
S (in ha) [Surface of tree crop plantation]

Regions	ORANGE TREES			APPLE TREES			PEACH TREES			ALMOND TREES			OLIVE TREES		
	YD (tn/ha)	PD (trees/ha)	S (ha)	YD (tn/ha)	PD (trees/ha)	S (ha)	YD (tn/ha)	PD (trees/ha)	S (ha)	YD (tn/ha)	PD (trees/ha)	S (ha)	YD (tn/ha)	PD (trees/ha)	S (ha)
ESPANA (total)	**23.81**	**416.68**	**137,009.20**	**19.11**	**495.28**	**28,663.60**	**26.14**	**500.00**	**44,582.40**	**0.39**	**238.10**	**495,924.40**	**2.64**	**460.21**	**2,429,222.20**
GALICIA (total)	**6.73**	**416.67**	**94.60**	**13.60**	**500.00**	**6,165.40**	**5.13**	**500.00**	**1,120.20**				**0.97**	**476.19**	**225.20**
A Coruna	7.00	416.67	60.40	11.44	500.00	2,524.80	5.45	500.00	561.40						
Lugo	6.13	416.67	2.00	12.93	500.00	1,903.00	4.22	500.00	184.60				0.90	476.19	208.00
Ourense	12.43	416.67	1.00	18.11	500.00	792.80	5.62	500.00	177.20				1.28	476.19	5.00
Pontevedra	5.88	416.67	31.20	16.50	500.00	944.80	4.38	500.00	197.00				2.13	476.19	12.20
PAIS VASCO (total)				**5.84**	**500.00**	**1,727.40**	**3.70**	**500.00**	**11.20**	**0.77**	**238.10**	**75.00**	**0.43**	**141.47**	**919.60**
Alava				5.25	500.00	81.20	4.38	500.00	1.00	57.52	238.10	75.00	1.46	476.19	270.20
Guipuzcoa				5.67	500.00	1,385.20							0.18	476.19	3.00
Vizcaya				6.60	500.00	261.00	3.05	500.00	10.20						
P. DE ASTURIAS (total)				**3.16**	**500.00**	**4,170.40**									
CANTABRIA (total)	**2.78**	**416.67**	**0.60**	**0.00**	**0.00**	**6.40**				**1.50**	**238.10**	**2.00**			
NAVARRA (total)				**25.04**	**500.00**	**557.80**	**27.98**	**500.00**	**510.80**	**0.84**	**238.10**	**3,408.60**	**3.71**	**476.19**	**5,765.00**
LA RIOJA (total)						**349.40**		**500.00**	**390.40**	**0.45**	**238.10**	**6,089.60**	**2.35**	**476.19**	**4,558.60**
ARAGON (total)				**27.46**	**500.00**	**3,144.80**	**20.31**	**500.00**	**11,682.60**	**0.60**	**238.10**	**63,974.40**	**1.30**	**475.34**	**46,512.60**
Huesca					500.00	661.60		500.00	5,595.00	6,945.20	238.10	9,632.00	1.29	475.50	7,329.60
Teruel					500.00	26.00		500.00	1,741.40	10,078.40	238.10	20,850.40	0.80	476.19	24,001.20
Zaragoza					500.00	2,457.20		500.00	4,346.20	21,100.60	238.10	33,492.00	2.11	473.93	15,181.80
CATALUNA (total)	**11.67**	**416.67**	**1,970.40**	**31.33**	**500.00**	**8,563.20**	**20.87**	**500.00**	**10,032.80**	**0.40**	**238.10**	**37,496.40**	**1.28**	**475.07**	**112,565.20**
Barcelona		416.67	2.00	112.62	500.00	70.20	52.23	500.00	534.20	358.13	238.10	815.80	1.23	476.19	2,782.20
Girona					500.00	2,197.20		500.00	105.60	16.00	238.10	27.00	1.19	476.16	3,368.20
Lleida				145.81	500.00	6,228.00	131.82	500.00	7,790.40	6,661.93	238.10	16,832.40	1.03	476.19	40,561.60
Tarragona		416.67	1,968.40		500.00	67.80		500.00	1,602.60	8,100.20	238.10	19,821.20	1.45	474.27	65,853.20
BALEARES (total)	**7.89**	**416.67**	**1,450.00**	**27.41**	**500.00**	**67.00**	**26.03**	**500.00**	**51.00**	**0.40**	**238.10**	**18,151.80**	**0.57**	**469.98**	**6,060.20**
CASTILLA Y LEON (total)	**8.99**	**416.67**	**2.80**	**22.54**	**500.00**	**1,723.60**	**5.70**	**500.00**	**64.40**	**0.48**	**238.10**	**1,308.40**	**1.47**	**452.54**	**7,334.80**
Avila				5.56	500.00	118.40	6.04	500.00	25.00	11.26	238.10	13.40	1.52	476.19	3,510.80
Burgos				5.26	500.00	392.20				33.95	238.10	71.00			
Leon				13.86	500.00	408.60	7.11	500.00	5.00	14.11	238.10	15.00			
Palencia				14.81	500.00	16.80				3.90	238.10	6.80			
Salamanca	10.42	416.67	2.80	1.31	500.00	26.00	1.80	500.00	5.00	223.82	238.10	652.00	0.98	413.19	2,753.40
Segovia				3.46	500.00	20.20				28.10	238.10	23.60			
Soria					500.00	481.60				185.00	238.10	370.40			
Valladolid				6.84	500.00	21.40		500.00	2.40	40.80	238.10	32.40	2.68	476.19	834.80
Zamora					500.00	238.40		500.00	27.00	85.00	238.10	123.80	1.55	476.19	235.80
MADRID (total)				**9.39**	**500.00**	**6.80**	**8.32**	**500.00**	**1.00**	**0.84**	**238.10**	**552.40**	**1.10**	**474.70**	**17,748.80**
CASTILLA-LA MANCHA (total)				**9.82**	**500.00**	**283.60**	**64.11**	**500.00**	**1,518.20**	**0.44**	**238.10**	**57,078.60**	**1.39**	**476.00**	**347,046.40**
Albacete					500.00	17.80		500.00	902.00	10,147.60	238.10	32,272.60	1.44	474.40	33,259.00
Ciudad Real				13.39	500.00	89.00	3.77	500.00	36.40	4,593.61	238.10	4,386.60	1.73	476.19	141,256.40
Cuenca				5.68	500.00	92.60	4.00	500.00	0.60	5,190.25	238.10	12,442.00	0.49	476.03	36,725.60
Guadalajara				4.99	500.00	38.00				93.00	238.10	119.60	0.61	476.19	17,322.00
Toledo				13.29	500.00	46.20	3.25	500.00	579.20	4,795.62	238.10	7,857.80	1.35	476.19	118,483.40
C. VALENCIANA (total)	**12.92**	**416.67**	**65,325.60**	**16.76**	**500.00**	**889.80**	**35.43**	**500.00**	**1,985.60**	**0.35**	**238.10**	**89,677.40**	**1.15**	**475.03**	**86,135.80**
Alicante		416.67	12,880.20	11.57	500.00	613.80	8.74	500.00	365.40	13,023.83	238.10	23,150.60	1.26	473.19	26,801.40
Castellon		416.67	5,149.80		500.00	96.00		500.00	344.80	9,182.20	238.10	36,238.80	0.91	476.00	31,835.80
Valencia		416.67	47,295.60		500.00	180.00		500.00	1,275.40	9,329.60	238.10	30,288.00	1.30	475.71	27,498.60
R. DE MURCIA (total)		**416.67**	**8,710.60**		**500.00**	**91.60**	**56.54**	**500.00**	**9,221.40**	**0.35**	**238.10**	**67,864.60**	**2.69**	**465.29**	**19,604.60**
EXTREMADURA (total)	**9.78**	**416.67**	**38.60**	**22.50**	**500.00**	**24.80**	**17.88**	**500.00**	**3,646.40**	**0.78**	**238.10**	**2,924.20**	**1.37**	**419.01**	**258,467.60**
Badajoz		416.67	36.00		500.00	16.20		500.00	3,135.40	1,980.40	238.10	2,546.80	1.53	430.06	184,123.00

Caceres		416.67	2.60		500.00	8.60		500.00	511.00	301.20	238.10	377.40	0.99	391.64	74,344.60
ANDALUCIA (total)	**819.39**	**416.67**	**58,340.80**	**26.21**	**500.00**	**570.40**	**88.50**	**500.00**	**4,228.80**	**0.28**	**238.10**	**147,118.00**	**3.41**	**461.06**	**1,516,060.80**
Almeria		416.67	4,646.20		500.00	28.60		500.00	40.60	9,250.60	238.10	54,610.40	3.14	475.13	18,109.00
Cadiz		416.67	2,016.00		500.00	15.00		500.00	67.40	177.00	238.10	201.40	2.22	476.16	21,883.00
Cordoba		416.67	10,641.20		500.00	77.80		500.00	331.20	678.40	238.10	801.40	3.82	473.43	338,550.20
Granada	7.71	416.67	867.80	18.26	500.00	292.00	15.20	500.00	720.60	23,122.03	238.10	71,544.20	2.58	476.17	184,185.60
Huelva		416.67	11,312.00		500.00	25.00		500.00	722.00	315.20	238.10	368.60	1.16	447.34	32,622.80
Jaen	7.52	416.67	4.80	20.08	500.00	64.80	19.40	500.00	203.20	1,577.78	238.10	3,030.20	3.48	475.99	581,771.80
Malaga		416.67	4,464.40		500.00	52.40		500.00	120.20	3,504.20	238.10	14,837.60	2.90	464.12	124,778.40
Sevilla		416.67	24,388.40		500.00	14.80		500.00	2,023.60	2,527.20	238.10	1,724.20	4.03	385.52	214,160.00
CANARIAS (total)	**5.98**	**416.67**	**1,075.20**	**5.55**	**500.00**	**321.20**	**7.31**	**500.00**	**117.60**	**0.23**	**238.10**	**203.00**	**1.76**	**406.41**	**217.00**
Las Palmas	7.20	416.67	637.80	9.65	500.00	137.40	10.46	500.00	51.20	9.73	238.10	40.40	1.65	394.29	181.40
S.C. de Tenerife	4.42	416.67	437.40	3.15	500.00	183.80	5.33	500.00	66.40	35.68	238.10	162.60	2.40	468.16	35.60

Mean Annual Temperature (°C)

Greece	
GREECE (total)	14.00
EASTERN MACEDONIA & THRACE (total)	12.00
Rodopi	12.00
Drama	11.00
Evros	12.00
Thasos	13.00
Kavala	13.00
Xanthi	12.00
CENTRAL MACEDONIA (total)	12.00
Thessaloniki	13.00
Imathia	12.00
Kilkis	13.00
Pella	12.00
Pieria	12.00
Serres	12.00
Chalkidiki	13.00
WESTERN MACEDONIA (total)	10.00
Kozani	11.00
Grevena	11.00
Kastoria	9.00
Florina	10.00
EPIRUS (total)	13.00
Ioannina	11.00
Arta	14.00
Thesprotia	14.00
Preveza	14.00
THESSALY (total)	12.00
Larissa	12.00
Karditsa	12.00
Magnesia	13.00
Sporades Islands	13.00
Trikala	12.00
CENTRAL GREECE (total)	12.00
Pthiotida	12.00
Viotia	13.00
Evia	14.00
Evritania	10.00
Fokida	11.00
IONIAN ISLANDS (total)	16.00
Corfu	16.00
Zakynthos	16.00
Ithaka	16.00
Kefallonia	16.00

Lefkada	16.00
WESTERN GREECE (total)	14.00
Achaia	13.00
Etoloakarnania	14.00
Ilia	16.00
PELOPONNESE (total)	13.00
Arkadia	12.00
Argolida	12.00
Korinthia	12.00
Lakonia	15.00
Mesinia	15.00
ATTICA (total)	14.00
Athens Central Section	14.00
Athens North Section	14.00
Athens West Section	14.00
Athens South Section	13.00
Athens East Section	14.00
West Attica	14.00
Piraeus	16.00
Attica Islands	16.00
NORTHERN AEGEAN (total)	15.00
Lesvos	14.00
Ikaria	15.00
Limnos	14.00
Samos	15.00
Chios	15.00
SOUTHERN AEGEAN (total)	16.00
Syros	16.00
Andros	16.00
Santorini	16.00
Kalimnos	16.00
Karpathos	16.00
Kythnos	16.00
Kos	16.00
Milos	16.00
Mykonos	16.00
Naxos	16.00
Paros	16.00
Rhodes	16.00
Tinos	16.00
CRETE (total)	14.00
Heraklion	15.00
Lasithi	14.00
Rethymno	14.00
Chania	15.00

Mean Annual Temperature (°C)

Italy	
ITALIA (total)	9.00
PIEMONTE (total)	9.00
Torino	7.00
Vercelli	8.00
Novara	10.00
Cuneo	8.00
Asti	10.00
Alessandria	10.00
Biella	9.00
Verbano Cusio Ossola	6.00
VALLE D' AOSTA (total)	4.00
Aosta	4.00
LOMBARDIA (total)	9.00
Varese	10.00
Como	9.00
Sondrio	4.00
Milano	10.00
Bergamo	8.00
Brescia	9.00
Pavia	10.00
Cremona	10.00
Mantova	11.00
Lecco	9.00
Lodi	10.00
Monza e della Brianza	10.00
LIGURIA (total)	11.00
Imperia	11.00
Savona	10.00
Genova	10.00
La Spezia	11.00
TRENTINO ALTO ADIGE (total)	6.00
Bolzano/Bozen	5.00
Trento	6.00
VENETO (total)	10.00
Verona	10.00
Vicenza	10.00
Belluno	6.00
Treviso	11.00
Venezia	11.00
Padova	11.00
Rovigo	11.00
FRIULLI VENEZIA GIULIA (total)	10.00
Udine	9.00

Gorizia	11.00
Trieste	11.00
Pordenone	10.00
EMILIA ROMAGNA (total)	10.00
Piacenza	9.00
Parma	9.00
Reggio nell' Emilia	9.00
Modena	10.00
Bologna	10.00
Ferrara	11.00
Ravenna	11.00
Forlì Cesena	10.00
Rimini	10.00
TOSCANA (total)	11.00
Massa Carrara	11.00
Lucca	11.00
Pistoia	10.00
Firenze	11.00
Livorno	13.00
Pisa	12.00
Arezzo	10.00
Siena	11.00
Grosseto	13.00
Prato	11.00
UMBRIA (total)	12.00
Perugia	11.00
Terni	12.00
MARCHE (total)	11.00
Pesaro e Urbino	10.00
Ancona	11.00
Macerata	11.00
Ascoli Piceno	10.00
Fermo	11.00
LAZIO (total)	13.00
Viterbo	13.00
Rieti	11.00
Roma	14.00
Latina	15.00
Frosinone	13.00
ABRUZZO (total)	10.00
L'Aquila	9.00
Teramo	10.00
Pescara	11.00
Chieti	11.00
MOLISE (total)	12.00
Campobasso	12.00

Isernia	11.00
CAMPANIA (total)	13.00
Caserta	14.00
Benevento	13.00
Napoli	15.00
Avellino	12.00
Salerno	13.00
PUGLIA (total)	14.00
Foggia	13.00
Bari	13.00
Taranto	14.00
Brindisi	14.00
Lecce	15.00
Barletta Andria Trani	14.00
BASILICATA (total)	13.00
Potenza	12.00
Matera	14.00
CALABRIA (total)	14.00
Cosenza	13.00
Catanzaro	14.00
Reggio di Calabria	14.00
Crotone	14.00
Vibo Valentia	14.00
SICILIA (total)	15.00
Trapani	16.00
Palermo	14.00
Messina	14.00
Agrigento	16.00
Caltanissetta	16.00
Enna	14.00
Catania	15.00
Ragusa	16.00
Siracusa	16.00
SARDEGNA (total)	14.00
Sassari	14.00
Nuoro	13.00
Cagliari	15.00
Oristano	15.00
Olbia Tempio	14.00
Ogliastra	13.00
Medio Campidano	15.00
Carbonia Iglesias	15.00

Mean Annual Temperature (°C)

Spain	
ESPANA (total)	11.00
GALICIA (total)	12.00
A Coruna	13.00
Lugo	12.00
Ourense	12.00
Pontevedra	13.00
PAIS VASCO (total)	12.00
Alava	11.00
Guipuzcoa	12.00
Vizcaya	13.00
P. DE ASTURIAS (total)	11.00
CANTABRIA (total)	12.00
NAVARRA (total)	11.00
LA RIOJA (total)	11.00
ARAGON (total)	11.00
Huesca	11.00
Teruel	11.00
Zaragoza	12.00
CATALUNA (total)	12.00
Barcelona	12.00
Girona	12.00
Lleida	10.00
Tarragona	13.00
BALEARES (total)	16.00
CASTILLA Y LEON (total)	11.00
Avila	11.00
Burgos	10.00
Leon	9.00
Palencia	10.00
Salamanca	12.00
Segovia	11.00
Soria	10.00
Valladolid	12.00
Zamora	11.00
MADRID (total)	12.00
CASTILLA-LA MANCHA (total)	12.00
Albacete	12.00
Ciudad Real	14.00
Cuenca	12.00
Guadalajara	11.00
Toledo	14.00
C. VALENCIANA (total)	13.00
Alicante	15.00

Castellon	12.00
Valencia	13.00
R. DE MURCIA (total)	14.00
EXTREMADURA (total)	15.00
Badajoz	15.00
Caceres	14.00
ANDALUCIA (total)	16.00
Almeria	14.00
Cadiz	18.00
Cordoba	16.00
Granada	13.00
Huelva	17.00
Jaen	15.00
Malaga	15.00
Sevilla	17.00
CANARIAS (total)	11.00
Las Palmas	11.00
S.C. de Tenerife	11.00

I_Y	
Increase of yield due to:	**5%**
only fertigation	5.00%
only mulching	5.00%
only cover crops	5.00%
fertigation & mulching	10.00%
fertigation & cover crops	10.00%
cover crops & mulching	8.00%
fertigation & mulching & cover crops	12.00%

mean clay content of soil %	23.4

		Content R_N, R_K, R_P			
Nitrogen fertilizers	Ammonium bicarbonate	17.718%	N		
	Ammonium nitrate	34.998%	N		
	Ammonium sulphate	21.200%	N		
	Ammonium sulphate nitrate (ASN)	26.000%	N		
	Anhydrous ammonia	82.245%	N		
	Calcium ammonium nitrate (CAN)	27.000%	N		
	Calcium nitrate	15.000%	N		
	Urea	46.646%	N		
	Urea ammonium nitrate solution (UAN) 32	32.000%	N		
	Urea ammonium nitrate solution (UAN) 30	30.000%	N		
	Urea ammonium nitrate solution (UAN) 28	28.000%	N		
Potassium fertilizers	Potassium sulphate	54.055%	K_2O		
	Muriate of potash (MOP) / Potassium chloride	60.000%	K_2O		
Phosphorus fertilizers	Rock Phosphate	28.000%	P_2O_5		
	Single super phosphate (SSP)	20.000%	P_2O_5		
	Triple super phosphate (TSP)	45.000%	P_2O_5		
Complex fertilizers	Diammonium phosphate (DAP)	18.000%	N	46.000%	P_2O_5
	Monoammonium phosphate (MAP)	12.000%	N	52.000%	P_2O_5

Estimates of carbon emission for production, transportation, storage and transfer of fertilizers

		CE	CO_2	
N	EF_N	1.300	4.763	tn CO_2/tn of fertilizer
P_2O_5	EF_K	0.200	0.733	tn CO_2/tn of fertilizer
K_2O	EF_P	0.150	0.550	tn CO_2/tn of fertilizer

CE Carbon Equivalent

Source:

R. Lal, Carbon emission from farm operations, 2004 (Table 5)

Fertilization strategy

	Greece			Italy			Spain		
TM_N	range		mean value	range		mean value	range		mean value
N	(tn/ha/year)		(tn/ha/year)	(tn/ha/year)		(tn/ha/year)	(tn/ha/year)		(tn/ha/year)
Orange	0.1200	0.3000	0.2100	0.1400	0.1700	0.1550	0.1200	0.2500	0.1850
Apple	0.2000	0.3000	0.2500	0.0850	0.1350	0.1100	0.2000	0.2200	0.2100
Peach	0.1000	0.2000	0.1500	0.0800	0.1300	0.1050	0.1000	0.2000	0.1500
Almond	0.1000	0.1500	0.1250	0.0900	0.1400	0.1150	0.0750	0.1250	0.1000
Olive	0.0867	0.1734	0.1300	0.0700	0.1150	0.0925	0.0800	0.0900	0.0850
	Greece			Italy			Spain		
TM_P	range		mean value	range		mean value	range		mean value
P_2O_5	(tn/ha/year)		(tn/ha/year)	(tn/ha/year)		(tn/ha/year)	(tn/ha/year)		(tn/ha/year)
Orange	0.0600	0.0900	0.0750	0.0180	0.0250	0.0215	0.0600	0.1000	0.0800
Apple	0.0500	0.0800	0.0650	0.0070	0.0300	0.0185	0.0500	0.0800	0.0650
Peach	0.0400	0.0600	0.0500	0.0500	0.0900	0.0700	0.0400	0.0600	0.0500
Almond	0.0200	0.0240	0.0220	0.0200	0.0400	0.0300	0.0200	0.0240	0.0220
Olive	0.0173	0.0312	0.0243	0.0450	0.0950	0.0700	0.0001	0.0002	0.0001
	Greece			Italy			Spain		
TM_K	range		mean value	range		mean value	range		mean value
K_2O	(tn/ha/year)		(tn/ha/year)	(tn/ha/year)		(tn/ha/year)	(tn/ha/year)		(tn/ha/year)
Orange	0.0500	0.0900	0.0700	0.1400	0.2500	0.1950	0.0500	0.0900	0.0700
Apple	0.1500	0.3000	0.2250	0.1250	0.1850	0.1550	0.1500	0.2500	0.2000
Peach	0.1000	0.2000	0.1500	0.0700	0.1300	0.1000	0.0600	0.0700	0.0650
Almond	0.1000	0.1500	0.1250	0.1200	0.2000	0.1600	0.0200	0.0320	0.0260
Olive	0.1734	0.3468	0.2601	0.0420	0.1100	0.0760	0.0010	0.0020	0.0015

If **cover crops by the Leguminosae family** are used, the requirements for Nitrogen-fertilizers are reduced by:		
N_L	**0.08**	tn N/ha/year for all species

	RF_{f_FGT}	
If **fertigation** is used, there is a	**15.00%**	reduction (average value) on the quantity of fertilizers used

Pesticides categories		
Herbicides	H	include herbicides, dessicants, defoliants
Insecticides	I	include insecticides, acaricides, nematocides, mineral oils
Fungicides	F	include fungicides, bactericides, seed treatment
Plant Growth Regulators	GR	

References

[1] Lal, R., "Carbon emission from farm operations", Environment International, Elsevier, pp. 981-990, 2004 (doi:10.1016/j.envint.2004.03.005)

[2] Audsley, E., Stacey, K., Parsons, D.J., Williams, A.G., Cranfield University, "Estimation of the greenhouse gas emissions from agricultural pesticide manufacture and use", August 2009

[3] Green, M.B., "Energy in pesticide manufacture, distribution and use", Energy in Plant Nutrition and Pest Control, Elsevier, Amsterdam, p.165-177, 1987

ED_{H_ai}, ED_{I_ai}, ED_{F_ai}, ED_{GR_ai}		Value of CO_2 emissions due to production, formulation, packaging and transportation of pesticides		
MJ/Kg a.i.	Source	Kg CO_2/Kg a.i.	Active Ingredient (a.i.)	Category
		24.550	Herbicides (general)	H
107.00	[2] (Table 8)	14.118	2,4-D	H
155.00	[2] (p. 13)	20.451	2,4,5-T	H
297.50	[2] (p. 13)	39.253	Alachlor	H
453.60	[2] (p. 13)	59.850	Bentazon	H
160.80	[2] (p. 13)	21.217	Butylate	H
190.00	[2] (p. 13)	25.069	Chloramben	H
385.40	[2] (p. 13)	50.851	Chlorsulfuron	H
221.00	[2] (Table 8)	29.160	Cyanazine	H
315.00	[2] (p. 13)	41.563	Dicamba	H
100.00	[2] (p. 13)	13.194	Dinoseb	H
420.00	[2] (Table 8)	55.417	Diquat	H
294.50	[2] (p. 13)	38.858	Diuron	H
179.80	[2] (p. 13)	23.724	EPTC	H
538.00	[2] (p. 13)	70.986	Fluazifop-butyl	H
374.60	[2] (p. 13)	49.426	Fluometuron	H
474.00	[2] (Table 8)	62.542	Glyphosate	H
310.00	[2] (Table 8)	40.903	Linuron	H
148.00	[2] (Table 8)	19.528	MCPA	H
295.80	[2] (p. 13)	39.029	Metolachlor	H
479.40	[2] (p. 13)	63.254	Paraquat	H
310.00	[2] (p. 13)	40.903	Propachlor	H
171.00	[2] (Table 8)	22.563	Trifluralin	H
240.00	[2] (p. 13)	31.667	Propanil	H
302.00	[2] (Table 8)	39.847	Bromoxynil	H
302.00	[2] (Table 8)	39.847	Carbetamide	H
291.00	[2] (Table 8)	38.396	Chloridazon	H
367.00	[2] (Table 8)	48.424	Chlorotoluron	H
432.00	[2] (Table 8)	57.000	Clopyralid	H
540.00	[2] (Table 8)	71.250	Diflufenican	H
367.00	[2] (Table 8)	48.424	Ethofumesate	H
691.00	[2] (Table 8)	91.174	Florasulam	H
648.00	[2] (Table 8)	85.500	Flufenacet	H
518.00	[2] (Table 8)	68.347	Fluroxypyr	H
691.00	[2] (Table 8)	91.174	Iodosulfuron-methyl-sodium	H
378.00	[2] (Table 8)	49.875	Isoproturon	H
194.00	[2] (Table 8)	25.597	Mecoprop-P	H
659.00	[2] (Table 8)	86.951	Mesosulfuron-methyl	H
691.00	[2] (Table 8)	91.174	Mesotrione	H
432.00	[2] (Table 8)	57.000	Metamitron	H
388.00	[2] (Table 8)	51.194	Metazachlor	H
518.00	[2] (Table 8)	68.347	Metsulfuron-methyl	H
594.00	[2] (Table 8)	78.375	Nicosulfuron	H
421.00	[2] (Table 8)	55.549	Pendimethalin	H
345.00	[2] (Table 8)	45.521	Phenmedipham	H
561.00	[2] (Table 8)	74.021	Propaquizafop	H
410.00	[2] (Table 8)	54.097	Propyzamide	H

626.00	[2] (Table 8)	82.597	Prosulfuron	H
540.00	[2] (Table 8)	71.250	Thifensulfuron-methyl	H
270.00	[2] (Table 8)	35.625	Tri-allate	H
540.00	[2] (Table 8)	71.250	Tribenuron-methyl	H
432.00	[2] (Table 8)	57.000	Triclopyr	H
680.00	[2] (Table 8)	89.722	Trifloxystrobin	H
		20.153	Insecticides (general)	I
180.00	[2] (p. 13)	23.750	Methyl parathion	I
229.00	[2] (p. 13)	30.215	Phorate	I
474.00	[2] (p. 13)	62.542	Carbofuran	I
173.00	[2] (p. 13)	22.826	Carbaryl	I
78.00	[2] (p. 13)	10.292	Toxaphene	I
600.00	[2] (Table 8)	79.167	Cypermethrin	I
270.20	[2] (p. 13)	35.651	Chlordimeform	I
248.80	[2] (p. 13)	32.828	Malathion	I
158.00	[2] (p. 13)	20.847	Parathion	I
89.80	[2] (p. 13)	11.849	Methoxychlor	I
226.00	[2] (Table 8)	29.819	1,3-dichloropropene	I
518.00	[2] (Table 8)	68.347	Alpha-cypermethrin	I
324.00	[2] (Table 8)	42.750	Chlorpyrifos	I
334.00	[2] (Table 8)	44.069	Ethoprophos	I
529.00	[2] (Table 8)	69.799	Lambda-cyhalothrin	I
148.00	[2] (Table 8)	19.528	Metaldehyde	I
345.00	[2] (Table 8)	45.521	Oxamyl	I
486.00	[2] (Table 8)	64.125	Tau-fluvalinate	I
615.00	[2] (Table 8)	81.146	Zeta-cypermethrin	I
		15.756	Fungicides (general)	F
101.00	[2] (p. 13)	13.326	Ferbam	F
119.00	[2] (p. 13)	15.701	Maneb	F
135.00	[2] (p. 13)	17.813	Captan	F
417.00	[2] (p. 13)	55.021	Benomyl	F
615.00	[2] (Table 8)	81.146	Azoxystrobin	F
713.00	[2] (Table 8)	94.076	Boscalid	F
410.00	[2] (Table 8)	54.097	Carbendazim	F
313.00	[2] (Table 8)	41.299	Chlorothalonil	F
442.00	[2] (Table 8)	58.319	Cymoxanil	F
551.00	[2] (Table 8)	72.701	Cyproconazole	F
637.00	[2] (Table 8)	84.049	Cyprodinil	F
626.00	[2] (Table 8)	82.597	Epoxiconazole	F
475.00	[2] (Table 8)	62.674	Fenpropimorph	F
594.00	[2] (Table 8)	78.375	Fluazinam	F
637.00	[2] (Table 8)	84.049	Fluoxastrobin	F
529.00	[2] (Table 8)	69.799	Flusilazole	F
518.00	[2] (Table 8)	68.347	Kresoxim-methyl	F
280.00	[2] (Table 8)	36.944	Mancozeb	F
659.00	[2] (Table 8)	86.951	Metalaxyl-M	F
615.00	[2] (Table 8)	81.146	Metconazole	F
713.00	[2] (Table 8)	94.076	Metrafenone	F
453.00	[2] (Table 8)	59.771	Prochloraz	F
464.00	[2] (Table 8)	61.222	Propamocarb hydrochloride	F
475.00	[2] (Table 8)	62.674	Prothioconazole	F

702.00	[2] (Table 8)	92.625	Pyraclostrobin	F
669.00	[2] (Table 8)	88.271	Spiroxamine	F
		15.756	Sulphur	F
551.00	[2] (Table 8)	72.701	Tebuconazole	F
264.00	[2] (Table 4)	34.833	Growth Regulators (general)	GR
270.00	[2] (Table 8)	35.625	Chlormequat	GR
194.00	[2] (Table 8)	25.597	Ethephon	GR
518.00	[2] (Table 8)	68.347	Imazaquin	GR
151.00	[2] (Table 8)	19.924	Maleic hydrazide	GR
583.00	[2] (Table 8)	76.924	Trinexapac-ethyl	GR

Currently applied pesticides practices

Orange		TM_{ai}				
Type of pesticide	Active Ingredient (a.i.)	Total Annual Quantity of a.i. (Kg a.i./ha/year)	Kg CO_2/Kg a.i.	Kg CO_2/ha/year	tn CO_2/ha/year	
H	Glyphosate	6.7500	62.542	422.156	0.42216	
			Herbicides Total	**422.156**	**0.42216**	**tn CO_2/ha/year**
I	Acetamiprid	0.2000	20.153	4.031	0.00403	
I	Parrafinic oil	14.7750	20.153	297.761	0.29776	
I	Abamectin	0.0180	20.153	0.363	0.00036	
I	Deltamethrin	0.0125	20.153	0.252	0.00025	
			Insecticides Total	**302.407**	**0.30241**	**tn CO_2/ha/year**
F	Copper	1.5000	15.756	23.634	0.02363	
			Fungicides Total	**23.634**	**0.02363**	**tn CO_2/ha/year**
GR					0.00000	
			Plant Growth Reg. Total	**0.000**	**0.00000**	**tn CO_2/ha/year**

Apple		TM_{ai}				
Type of pesticide	Active Ingredient (a.i.)	Total Annual Quantity of a.i. (Kg a.i./ha/year)	Kg CO_2/Kg a.i.	Kg CO_2/ha/year	tn CO_2/ha/year	
H	Glyphosate	6.7500	62.542	422.156	0.42216	
			Herbicides Total	**422.156**	**0.42216**	**tn CO_2/ha/year**
I	Acetamiprid	0.1400	20.153	2.821	0.00282	
I	Deltamethrin	0.0250	20.153	0.504	0.00050	
I	Beta-cyfluthrin	0.0250	20.153	0.504	0.00050	
I	Abamectin	0.0360	20.153	0.726	0.00073	
I	Hexythiazox	0.0500	20.153	1.008	0.00101	
			Insecticides Total	**5.562**	**0.00556**	**tn CO_2/ha/year**
F	Difeconazole	0.2250	15.756	3.545	0.00355	
F	Trifloxystrobin	0.1500	89.722	13.458	0.01346	
F	Cyprodinil	0.5000	84.049	42.024	0.04202	
F	Myclobutanil	0.1920	15.756	3.025	0.00303	
F	Dodine	0.8000	15.756	12.605	0.01260	
F	Kresoxim methyl	0.3000	15.756	4.727	0.00473	
F	Dithianon	0.4200	15.756	6.618	0.00662	
F	Tebuconazole	0.3000	72.701	21.810	0.02181	
			Fungicides Total	**107.812**	**0.10781**	**tn CO_2/ha/year**
GR					0.00000	
			Plant Growth Reg. Total	**0.000**	**0.00000**	**tn CO_2/ha/year**

Peach		TM_{ai}				
Type of pesticide	Active Ingredient (a.i.)	Total Annual Quantity of a.i. (Kg a.i./ha/year)	Kg CO_2/Kg a.i.	Kg CO_2/ha/year	tn CO_2/ha/year	
H	Glyphosate	8.1000	62.542	506.588	0.50659	
			Herbicides Total	**506.588**	**0.50659**	**tn CO_2/ha/year**
I	Paraffinic oil	9.8500	20.153	198.508	0.19851	
I	Acetamiprid	0.0600	20.153	1.209	0.00121	
I	Abamectin	0.0180	20.153	0.363	0.00036	
I	Chlorantraniliprole	0.1200	20.153	2.418	0.00242	
			Insecticides Total	**202.498**	**0.20250**	**tn CO_2/ha/year**
F	Ziram	2.2800	15.756	35.924	0.03592	
F	Captan	2.4900	17.813	44.353	0.04435	
F	Thiophanate-methyl	0.7000	15.756	11.029	0.01103	
F	Myclobutanil	0.0960	15.756	1.513	0.00151	
F	Sulphur	2.0000	15.756	31.512	0.03151	
			Fungicides Total	**124.331**	**0.12433**	**tn CO_2/ha/year**
GR					0.00000	
			Plant Growth Reg. Total	**0.000**	**0.00000**	**tn CO_2/ha/year**

Almond		TM_{ai}				
Type of pesticide	Active Ingredient (a.i.)	Total Annual Quantity of a.i. (Kg a.i./ha/year)	Kg CO_2/Kg a.i.	Kg CO_2/ha/year	tn CO_2/ha/year	
H	Glyphosate	6.7500	62.542	422.156	0.42216	
			Herbicides Total	**422.156**	**0.42216**	**tn CO_2/ha/year**
I	Parrafinic oil	19.7000	20.153	397.015	0.39702	
I	Deltamethrin	0.0250	20.153	0.504	0.00050	
			Insecticides Total	**397.519**	**0.39752**	**tn CO_2/ha/year**
F	Copper	3.3750	15.756	53.177	0.05318	
			Fungicides Total	**53.177**	**0.05318**	**tn CO_2/ha/year**
GR					0.00000	
			Plant Growth Reg. Total	**0.000**	**0.00000**	**tn CO_2/ha/year**

Olive		TM_{ai}				
Type of pesticide	Active Ingredient (a.i.)	Total Annual Quantity of a.i. (Kg a.i./ha/year)	Kg CO_2/Kg a.i.	Kg CO_2/ha/year	tn CO_2/ha/year	
H	Glyphosate	6.7500	62.542	422.156	0.42216	
			Herbicides Total	**422.156**	**0.42216**	**tn CO_2/ha/year**
I	Lamda cyhalothrin	0.0400	20.153	0.806	0.00081	
I	Pyriproxyfen	0.3000	20.153	6.046	0.00605	
I	Thiacloprid	0.3600	20.153	7.255	0.00726	
			Insecticides Total	**14.107**	**0.01411**	**tn CO_2/ha/year**
F	Dodine	1.6320	15.756	25.714	0.02571	
F	Copper	9.0000	15.756	141.804	0.14180	
			Fungicides Total	**167.518**	**0.16752**	**tn CO_2/ha/year**
GR					0.00000	
			Plant Growth Reg. Total	**0.000**	**0.00000**	**tn CO_2/ha/year**

Reduction of Herbicides consumption if cover crops and/or mulching are used		
RF_H	cover crops	mulching
Orange	90.00%	20.00%
Apple	60.00%	20.00%
Peach	90.00%	20.00%
Almond	90.00%	20.00%
Olive	90.00%	20.00%

Reduction of Insecticides consumption if insects monitoring and/or mass trapping are applied		
RF_I	monitoring	mass trapping
Orange	60.00%	90.00%
Apple	50.00%	50.00%
Peach	40.00%	50.00%
Almond	70.00%	30.00%
Olive	60.00%	70.00%

	CO_2 Emission Factors			
EF_{EL}	Electricity generation (Greece 2016)	0.000623	tn CO_2/KWh	**Source**
	Electricity generation (Italy 2016)	0.000256	tn CO_2/KWh	European Environment Agency
	Electricity generation (Spain 2016)	0.000265	tn CO_2/KWh	
	Electricity generation (input to Algorithm)	**0.000623**	tn CO_2/KWh	

Fossil Fuel	**Diesel**	**Gasoline**	**Source**
Net Calorific Value [NCV] (GJ/tn)	43.00	44.30	IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2, Chapter 1 [Table 1.2], 2006
Carbon content (Kg C/GJ)	20.20	18.90	IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2, Chapter 1 [Table 1.3], 2006
Density (Kg/m^3)	832.00	745.00	JRC, TANK-TO-WHEELS (TTW) Report, Version 3, October 2008 [Table 2.1]
CO_2 emissions			
Mobile combustion (Kg CO_2/TJ)	74,100.00	69,300.00	IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2, Chapter 3 [Table 3.2.1], 2006
Mobile combustion (Kg CO_2/GJ)	74.10	69.30	
WTT [Well To Tank] (Kg CO_2/GJ)	14.70	13.10	JRC, WELL-TO-TANK (WTT) Report, Version 4a, January 2014, doi:10.2790/95629
CO_2 Emissions (Kg CO_2/lt)	3.18	2.72	
CO_2 Emissions (tn CO_2/lt)	**0.003177**	**0.002719**	
	EF_D	**EF_G**	

Fuel	Wood	Diesel	Source
Net Calorific Value [NCV] (GJ/tn)	15.60	43.00	IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2, Chapter 1 [Table 1.2], 2006
Carbon content (Kg C/GJ)	30.50	20.20	IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2, Chapter 1 [Table 1.3], 2006
Density (Kg/m^3)		832.00	JRC, TANK-TO-WHEELS (TTW) Report, Version 3, October 2008 [Table 2.1]
CO_2 emissions			
Stationary combustion (Kg CO_2/TJ)	112,000.00	74,100.00	IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2, Chapter 2 [Tables 2.3, 2.4, 2.5], 2006
Stationary combustion (Kg CO_2/GJ)	112.00	74.10	
WTT [Well To Tank] (Kg CO_2/GJ)		14.70	JRC, WELL-TO-TANK (WTT) Report, Version 4a, January 2014, doi:10.2790/95629
CO_2 Emissions (Kg CO_2/lt)		3.18	
CO_2 Emissions (tn CO_2/lt)		0.003177	

1 tn of Wood is equal in terms of NCV to	0.3628	tn of Diesel	=	436.04651 lt of Diesel
Burning **1 tn of Wood*** as solid fuel saves	**1.38528**	**tn CO_2**	that would be emitted if Diesel was used	

*Fresh Wood, not Dry Wood

EF_{GE}: Global carbon intensity of electricity generated (2018 value)	475.000	gCO_2/KWh
	0.475	$KgCO_2$/KWh

Source **:** International Energy Agency, "Global Energy & CO_2 Status Report, The latest trends in energy and emissions in 2018", 2019

1.00	MJ		=	0.27777777778 KWh	**K_2**

K_1	3.66419	mass conversion coefficient from C to CO_2

	Typical Annual consumptions of fossil fuels & electricity		
	TM_D	TM_G	TM_{EL}
Greece	Diesel (lt/ha/year)	Gasoline (lt/ha/year)	Electricity (KWh/ha/year)
Orange	187.50	12.50	280.00
Apple	758.45	47.97	170.00
Peach	433.33	20.00	180.00
Almond	250.00	20.00	113.00
Olive	141.10	25.00	14.29
Italy	Diesel (lt/ha/year)	Gasoline (lt/ha/year)	Electricity (KWh/ha/year)
Orange	460.00	12.50	280.00
Apple	810.00	47.97	170.00
Peach	440.00	20.00	180.00
Almond	220.00	20.00	113.00
Olive	270.00	25.00	14.29
Spain	Diesel (lt/ha/year)	Gasoline (lt/ha/year)	Electricity (KWh/ha/year)
Orange	187.50	12.50	280.00
Apple	758.45	47.97	170.00
Peach	433.33	20.00	180.00
Almond	250.00	20.00	113.00
Olive	141.10	25.00	14.29

Reduction of Diesel consumption if fertigation is applied	
	RF_{D_FGT}
	%
Orange	12.00%
Apple	5.00%
Peach	12.00%
Almond	20.00%
Olive	14.00%

	RF_{EL_m}	
If mulching is applied, a	**30.00%**	reduction on the consumption of irrigation water is achieved and therefore the same reduction on the electricity demands (electricity is mainly used for the operation of the irrigation pumps)

Coefficients

Symbol	Value	Unit	Definition
C_w	0.47500	tn C/tn of **dry** wood	carbon content of wood
K_1	3.66419		mass conversion coefficient from C to CO_2

Atomic Masses

Element	Symbol	Value
Carbon	C	12.01070
Oxygen	O	15.99940
Nitrogen	N	14.00670
Hydrogen	H	1.00794
Sulfur	S	32.06500
Calcium	Ca	40.07800
Potassium	K	39.09830
Phosphorus	P	30.97376
Chlorine	Cl	35.45300

Molecular Masses

Molecule	Symbol	Value
Carbon dioxide	CO_2	44.00950
Ammonium bicarbonate	NH_4HCO_3	79.05530
Ammonium nitrate	NH_4NO_3	80.04336
Ammonium sulphate	$(NH_4)_2SO_4$	132.13952
Ammonium sulphate nitrate (ASN)	$2NH_4NO_3$ x $(NH_4)_2SO_4$	292.22624
Anhydrous ammonia	NH_3	17.03052
Calcium ammonium nitrate (CAN)	$5Ca(NO_3)_2$ x $NH_4NO_3 \bullet 10H_2O$	1,080.63516
Calcium nitrate	$Ca(NO_3)_2$	164.08780
Urea	CH_4N_2O	60.05526
Potassium sulphate	K_2SO_4	174.25920
Potassium chloride	KCl	74.55130
Diammonium phosphate		

Annex III

CO_2RCCT runs

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Run 1	Agricultural practice:	Conventional

Designed and developed by TERRA NOVA Ltd.

terra nova

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Orange
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1	ARC	273,802.4302	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	218,437.3456	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	55,365.0845	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	300,878.0321	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	7,223.6095	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	363,466.7262	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	308,101.6417	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	37,063.1211	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	25,353.3549	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	27,247.8201	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	89,664.2960	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	20,184.8514	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	1,151.9053	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	5,911.0634	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	27,247.8201	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	80,021.1785	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	80,021.1785	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	8.08012	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.34901	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.01812	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	6.44625	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.27844	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.01446	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.24669	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.29102	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	10.72618	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.46330	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.02405	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	9.09232	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.39273	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.02039	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	1.63387	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.07057	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00366	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	8.87914	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.38352	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.01991	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.21317	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.00921	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00048	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	2.64606	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.11429	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00593	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	1.09376	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.04724	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00245	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.74820	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.03232	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00168	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.80410	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.03473	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00180	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.59567	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.02573	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00134	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.03399	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00147	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00008	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.17444	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00753	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00039	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	2.36149	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.10200	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00530	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	2.36149	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.10200	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00530	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Designed and developed by TERRA NOVA Ltd.

terra nova

Run 2	Agricultural practice:	Conventional

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Apple
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1	ARC	28,514.7385	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	9,768.3514	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	18,746.3871	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	58,442.8502	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	2,069.4325	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	79,258.6698	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	60,512.2827	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	15,212.9910	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	5,980.9490	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	29,549.9912	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	50,743.9312	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	26,910.2182	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	1,456.9426	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	1,182.8304	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	29,549.9912	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	12,245.5992	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	12,245.5992	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	2.55319	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.11286	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.00345	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	0.87465	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.03866	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.00118	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.64023	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.83857	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	7.09678	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.31371	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.00960	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	5.41824	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.23951	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.00733	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	1.67854	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.07420	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00227	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	5.23294	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.23132	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.00708	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.18530	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.00819	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00025	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	4.54358	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.20085	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00615	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	1.36216	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.06021	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00184	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.53553	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.02367	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00072	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	2.64589	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.11696	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00358	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	2.40953	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.10651	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00326	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.13045	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00577	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00018	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.10591	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00468	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00014	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	1.09646	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.04847	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00148	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	1.09646	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.04847	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00148	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Run 3	Agricultural practice:	Conventional

Designed and developed by TERRA NOVA Ltd.

terra nova

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Peach
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1	ARC	309,250.4976	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	280,021.5420	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	29,228.9555	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	403,407.7541	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	2,719.3361	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	435,356.0457	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	406,127.0902	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	32,746.2619	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	32,738.8993	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	60,620.3870	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	126,105.5482	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	54,078.6348	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	2,136.5813	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	4,405.1709	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	60,620.3870	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	23,146.9701	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	23,146.9701	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	7.87242	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.50127	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.01792	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	7.12835	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.45389	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.01623	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.28966	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.31051	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	11.08262	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.70568	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.02523	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	10.33855	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.65830	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.02353	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	0.74407	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.04738	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00169	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	10.26933	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.65389	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.02338	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.06922	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.00441	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00016	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	3.21020	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.20441	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00731	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.83360	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.05308	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00190	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.83342	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.05307	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00190	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	1.54318	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.09826	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00351	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	1.37665	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.08766	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00313	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.05439	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00346	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00012	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.11214	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00714	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00026	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	0.58924	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.03752	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00134	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	0.58924	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.03752	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00134	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Designed and developed by TERRA NOVA Ltd.

Run 4	Agricultural practice:	Conventional

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Almond
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1		ARC	137,228.7802 tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2		ARC	70,436.9178 tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	66,791.8624 tn CO2/year	CO2 Annual Removal due to the production of fruit biomass	
R2.2		AR_{BW}	101,010.9724 tn CO2/year	CO2 Annual Removal due to the production of wood biomass	
R2.3		AS_S	2,304.6118 tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass	
R2.4		TAR	170,107.4467 tn CO2/year	CO2 Total Annual Removals	(BF is included)
R2.5		TAR	103,315.5843 tn CO2/year	CO2 Total Annual Removals	(BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	9,047.2559 tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	11,608.7189 tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	12,222.6918 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	32,878.6665 tn CO2/year	CO2 Total Annual Emissions

R4.1		AE_D	10,563.0311 tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2		AE_G	723.3709 tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3		AE_{EL}	936.2898 tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4		$AE_{ff\&e}$	12,222.6918 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000 tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000 tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000 tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	16,335.0994 tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000 tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000 tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	16,335.0994 tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	10.31814	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	4.47259	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.03700	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	5.29610	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	2.29570	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.01899	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.19328	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.31824	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	12.79026	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	5.54418	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.04586	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	7.76823	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	3.36729	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.02786	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	5.02204	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	2.17690	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.01801	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	7.59495	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	3.29217	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.02723	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.17328	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.07511	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00062	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	2.47212	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	1.07159	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00886	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.68026	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.29487	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00244	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.87285	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.37835	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00313	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.91902	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.39836	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00330	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.79423	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.34427	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00285	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.05439	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.02358	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00020	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.07040	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.03052	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00025	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	1.22823	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.53240	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00440	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	1.22823	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.53240	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00440	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

Run 5	Agricultural practice:	Conventional

Designed and developed by TERRA NOVA Ltd.

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Olive
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1		ARC	4,937,594.8670 tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2		ARC	3,047,921.1645 tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	1,889,673.7025 tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	4,549,120.3612 tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	54,879.4248 tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	6,493,673.4886 tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	4,603,999.7860 tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	635,915.8293 tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	492,125.8637 tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	428,036.9286 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	1,556,078.6215 tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	365,366.0711 tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	55,414.5324 tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	7,256.3251 tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	428,036.9286 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000 tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000 tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000 tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	1,028,169.7216 tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000 tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000 tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	1,028,169.7216 tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	6.05786	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	1.44476	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.03494	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	3.73945	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.89183	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.02157	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.23963	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.33798	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	7.96698	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	1.90008	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.04595	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	5.64857	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	1.34715	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.03258	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	2.31841	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.55293	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.01337	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	5.58124	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	1.33109	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.03219	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.06733	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.01606	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00039	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	1.90913	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.45532	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.01101	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.78020	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.18607	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00450	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.60378	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.14400	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00348	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.52515	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.12525	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00303	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.44826	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.10691	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00259	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.06799	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.01621	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00039	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.00890	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00212	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00005	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	1.26145	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.30085	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00728	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	1.26145	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.30085	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00728	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Run 6	Agricultural practice:	Conventional

Designed and developed by TERRA NOVA Ltd.

terra nova

Results

Country where the Tool is applied:	Italy
Species of tree crop:	Orange
Geographical area of the cultivation:	ITALIA (total)

CO2 Annual Removal Capacity

R1.1		ARC	600,979.7346 tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2		ARC	544,000.5018 tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	56,979.2328 tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	791,664.1442 tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	20,504.5275 tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	869,147.9045 tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	812,168.6717 tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	72,708.7712 tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	63,163.2304 tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	132,296.1683 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	268,168.1699 tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	123,370.4116 tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	2,869.7605 tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	6,055.9962 tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	132,296.1683 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000 tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000 tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000 tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	0.0000 tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000 tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000 tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	0.0000 tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	7.11888	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.34106	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.02966	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	6.44393	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.30873	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.02685	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.30854	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.33019	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	10.29545	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.49325	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.04290	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	9.62050	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.46091	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.04009	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	0.67494	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.03234	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00281	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	9.37762	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.44928	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.03907	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.24289	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.01164	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00101	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	3.17657	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.15219	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.01324	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.86127	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.04126	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00359	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.74820	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.03585	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00312	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	1.56711	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.07508	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00653	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	1.46138	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.07001	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00609	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.03399	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00163	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00014	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.07174	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00344	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00030	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	0.00000	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.00000	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00000	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Run 7	Agricultural practice:	Conventional

Designed and developed by TERRA NOVA Ltd.

terra nova

Results

Country where the Tool is applied:	Italy
Species of tree crop:	Apple
Geographical area of the cultivation:	ITALIA (total)

CO2 Annual Removal Capacity

R1.1	ARC	373,378.7555	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	144,814.5249	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	228,564.2306	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	313,581.0816	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	35,736.5972	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	577,881.9094	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	349,317.6789	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	32,607.3504	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	28,041.4722	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	143,854.3313	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	204,503.1540	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	134,742.9319	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	6,830.8249	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	2,280.5745	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	143,854.3313	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	0.0000	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	7.13072	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.15784	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.00528	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	2.76564	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.06122	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.00205	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.35388	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.58544	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	11.03628	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.24429	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.00818	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	6.67121	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.14767	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.00494	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	4.36508	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.09662	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00323	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	5.98871	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.13256	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.00444	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.68249	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.01511	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00051	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	3.90556	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.08645	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00289	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.62273	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.01378	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00046	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.53553	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.01185	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00040	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	2.74730	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.06081	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00204	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	2.57330	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.05696	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00191	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.13045	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00289	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00010	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.04355	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00096	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00003	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	0.00000	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.00000	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00000	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Designed and developed by TERRA NOVA Ltd.

Run 8	Agricultural practice:	Conventional

Results

Country where the Tool is applied:	Italy
Species of tree crop:	Peach
Geographical area of the cultivation:	ITALIA (total)

CO2 Annual Removal Capacity

R1.1	ARC	174,357.0409	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	-45,766.2368	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	220,123.2777	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	136,114.8504	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	18,578.3688	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	374,816.4969	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	154,693.2192	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	41,373.6158	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	56,860.3099	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	102,225.5303	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	200,459.4560	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	95,368.4640	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	3,710.7746	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	3,146.2918	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	102,225.5303	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	0.0000	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	2.55560	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.12263	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.00393	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	-0.67081	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	-0.03219	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	-0.00103	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.53482	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	1.29585	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	5.49378	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.26362	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.00845	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	2.26738	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.10880	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.00349	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	3.22640	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.15482	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00496	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	1.99507	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.09573	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.00307	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.27231	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.01307	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00042	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	2.93819	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.14099	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00452	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.60642	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.02910	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00093	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.83342	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.03999	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00128	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	1.49835	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.07190	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00231	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	1.39784	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.06708	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00215	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.05439	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00261	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00008	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.04612	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00221	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00007	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	0.00000	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.00000	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00000	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Designed and developed by TERRA NOVA Ltd.

Run 9	Agricultural practice:	Conventional

Results

Country where the Tool is applied:	Italy
Species of tree crop:	Almond
Geographical area of the cultivation:	ITALIA (total)

CO2 Annual Removal Capacity

R1.1	ARC	-59,731.1118	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	-81,652.8940	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	21,921.7821	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	33,705.5152	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	19,143.5479	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	74,770.8453	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	52,849.0632	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	38,249.5774	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	50,760.3447	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	45,492.0351	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	134,501.9571	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	40,645.4093	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	3,163.0152	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	1,683.6106	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	45,492.0351	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	0.0000	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	-1.02711	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	-0.75679	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	-0.00380	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	-1.40407	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	-1.03453	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	-0.00520	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	1.79886	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	2.54502	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	1.28573	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.94734	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.00476	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	0.90877	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.66959	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.00337	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	0.37696	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.27775	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00140	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	0.57958	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.42705	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.00215	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.32918	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.24255	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00122	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	2.31283	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	1.70413	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00857	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.65772	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.48462	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00244	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.87285	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.64313	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00323	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.78226	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.57638	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00290	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.69892	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.51497	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00259	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.05439	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.04008	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00020	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.02895	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.02133	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00011	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	0.00000	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.00000	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00000	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Run 10	Agricultural practice:	Conventional

Designed and developed by TERRA NOVA Ltd.

terra nova

Results

Country where the Tool is applied:	Italy
Species of tree crop:	Olive
Geographical area of the cultivation:	ITALIA (total)

CO2 Annual Removal Capacity

R1.1	ARC	280,958.5780	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	-432,427.2651	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	713,385.8431	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	1,765,110.9643	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	135,218.3339	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	2,613,715.1412	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	1,900,329.2981	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	602,340.1465	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	681,448.3471	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	1,048,968.0697	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	2,332,756.5632	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	968,103.3389	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	76,732.6904	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	4,132.0404	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	1,048,968.0697	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	0.0000	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	0.24894	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.10169	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.00160	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	-0.38314	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	-0.15651	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	-0.00246	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.89251	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	1.22755	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	2.31582	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.94598	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.01485	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	1.68374	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.68779	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.01079	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	0.63208	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.25820	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00405	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	1.56394	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.63885	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.01003	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.11981	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.04894	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00077	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	2.06688	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.84430	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.01325	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.53369	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.21801	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00342	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.60378	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.24664	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00387	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.92941	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.37965	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00596	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.85777	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.35039	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00550	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.06799	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.02777	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00044	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.00366	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00150	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00002	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	0.00000	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.00000	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00000	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Run 11 | Agricultural practice: | Conventional

Designed and developed by TERRA NOVA Ltd.

terra nova

Results

Country where the Tool is applied:	Spain
Species of tree crop:	Orange
Geographical area of the cultivation:	ESPANA (total)

CO2 Annual Removal Capacity

R1.1	ARC	1,302,842.7452	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	1,072,596.5436	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	230,246.2016	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	1,364,264.0835	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	41,334.9536	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	1,635,845.2386	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	1,405,599.0370	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	134,041.4468	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	102,509.8573	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	96,451.1893	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	333,002.4934	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	81,612.3250	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	4,657.4366	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	10,181.4277	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	96,451.1893	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	316,618.9769	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	316,618.9769	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	9.50916	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.39933	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.02282	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	7.82865	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.32876	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.01879	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.20357	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.23691	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	11.93967	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.50140	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.02865	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	10.25916	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.43083	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.02462	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	1.68052	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.07057	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00403	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	9.95746	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.41816	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.02390	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.30169	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.01267	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00072	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	2.43051	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.10207	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00583	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.97834	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.04108	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00235	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.74820	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.03142	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00180	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.70398	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.02956	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00169	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.59567	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.02501	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00143	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.03399	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00143	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00008	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.07431	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00312	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00018	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	2.31093	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.09705	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00555	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	2.31093	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.09705	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00555	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Designed and developed by TERRA NOVA Ltd.

Run 12	Agricultural practice:	Conventional

Results

Country where the Tool is applied:	Spain
Species of tree crop:	Apple
Geographical area of the cultivation:	ESPANA (total)

CO2 Annual Removal Capacity

R1.1		ARC	61,950.7916 tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2		ARC	21,310.9162 tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	40,639.8753 tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	138,479.5387 tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	5,468.9824 tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	184,588.3965 tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	143,948.5211 tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	33,189.1349 tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	15,350.2453 tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	74,098.2247 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	122,637.6049 tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	69,065.7032 tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	3,739.2772 tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	1,293.2443 tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	74,098.2247 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000 tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000 tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000 tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	20,253.3357 tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000 tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000 tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	20,253.3357 tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	2.16131	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.11311	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.00436	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	0.74348	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.03891	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.00150	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.66438	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.85195	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	6.43982	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.33702	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.01300	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	5.02200	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.26282	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.01014	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	1.41782	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.07420	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00286	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	4.83120	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.25283	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.00975	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.19080	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.00999	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00039	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	4.27851	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.22391	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00864	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	1.15788	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.06060	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00234	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.53553	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.02803	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00108	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	2.58510	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.13529	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00522	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	2.40953	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.12610	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00487	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.13045	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00683	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00026	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.04512	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00236	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00009	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	0.70659	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.03698	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00143	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	0.70659	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.03698	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00143	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Designed and developed by TERRA NOVA Ltd.

terra nova

Run 13	Agricultural practice:	Conventional

Results

Country where the Tool is applied:	Spain
Species of tree crop:	Peach
Geographical area of the cultivation:	ESPANA (total)

CO2 Annual Removal Capacity

R1.1	ARC	1,304.2763	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	-53,900.6287	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	55,204.9049	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	78,832.4621	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	5,432.7932	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	139,470.1603	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	84,265.2553	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	35,081.2235	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	37,155.6876	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	65,928.9729	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	138,165.8840	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	61,374.3561	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	2,424.8264	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	2,129.7904	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	65,928.9729	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	28,659.8430	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	28,659.8430	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	0.02926	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.00112	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.00006	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	-1.20901	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	-0.04626	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	-0.00242	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.99065	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	1.63965	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	3.12837	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.11970	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.00626	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	1.89010	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.07232	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.00378	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	1.23827	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.04738	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00248	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	1.76824	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.06766	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.00354	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.12186	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.00466	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00024	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	3.09911	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.11858	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00620	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.78689	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.03011	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00157	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.83342	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.03189	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00167	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	1.47881	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.05658	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00296	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	1.37665	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.05267	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00275	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.05439	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00208	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00011	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.04777	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00183	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00010	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	0.64285	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.02460	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00129	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	0.64285	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.02460	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00129	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

Run 14	Agricultural practice:	Conventional

Designed and developed by TERRA NOVA Ltd.

Results

Country where the Tool is applied:	Spain
Species of tree crop:	Almond
Geographical area of the cultivation:	ESPANA (total)

CO2 Annual Removal Capacity

R1.1		ARC	471,849.6289 tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2		ARC	55,887.4182 tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	415,962.2107 tn CO2/year	CO2 Annual Removal due to the production of fruit biomass	
R2.2		AR_{BW}	1,074,842.6145 tn CO2/year	CO2 Annual Removal due to the production of wood biomass	
R2.3		AS_S	100,949.4920 tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass	
R2.4		TAR	1,591,754.3172 tn CO2/year	CO2 Total Annual Removals	(BF is included)
R2.5		TAR	1,175,792.1065 tn CO2/year	CO2 Total Annual Removals	(BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	251,313.4729 tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	432,868.4828 tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	435,722.7326 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	1,119,904.6884 tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	393,876.6476 tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	26,973.2131 tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	14,872.8719 tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	435,722.7326 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000 tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000 tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000 tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	504,751.3747 tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000 tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000 tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	504,751.3747 tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	0.95145	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	2.46938	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.00400	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	0.11269	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.29248	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.00047	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.70357	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.95247	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	3.20967	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	8.33028	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.01348	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	2.37091	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	6.15339	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.00996	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	0.83876	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	2.17690	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00352	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	2.16735	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	5.62508	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.00910	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.20356	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.52831	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00085	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	2.25822	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	5.86091	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00948	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.50676	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	1.31522	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00213	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.87285	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	2.26537	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00367	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.87861	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	2.28031	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00369	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.79423	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	2.06131	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00334	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.05439	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.14116	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00023	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.02999	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.07784	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00013	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	1.01780	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	2.64156	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00427	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	1.01780	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	2.64156	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00427	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Run 15	Agricultural practice:	Conventional

Designed and developed by TERRA NOVA Ltd.

terra nova

Results

Country where the Tool is applied:	Spain
Species of tree crop:	Olive
Geographical area of the cultivation:	ESPANA (total)

CO2 Annual Removal Capacity

R1.1	ARC	17,268,559.0164	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	13,717,511.3640	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	3,551,047.6525	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	16,840,922.0217	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	592,428.0450	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	20,984,397.7192	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	17,433,350.0667	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	985,822.8828	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	1,466,719.2017	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	1,263,296.6183	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	3,715,838.7028	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	1,088,927.5929	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	165,156.0398	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	9,212.9855	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	1,263,296.6183	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	7,048,798.7725	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	7,048,798.7725	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	7.10868	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	2.68885	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.01545	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	5.64687	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	2.13593	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.01227	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.17708	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.21315	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	8.63832	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	3.26744	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.01877	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	7.17652	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	2.71451	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.01559	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	1.46180	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.55293	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00318	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	6.93264	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	2.62227	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.01506	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.24388	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.09225	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00053	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	1.52964	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.57859	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00332	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.40582	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.15350	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00088	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.60378	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.22838	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00131	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.52004	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.19671	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00113	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.44826	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.16955	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00097	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.06799	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.02572	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00015	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.00379	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00143	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00001	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	2.90167	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	1.09755	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00631	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	2.90167	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	1.09755	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00631	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Designed and developed by TERRA NOVA Ltd.

Run 16	Agricultural practice:	Use of cover crops

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Olive
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1	ARC	5,386,163.1879	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	3,402,005.8002	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	1,984,157.3877	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	4,549,120.3612	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	99,284.7535	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	6,632,562.5023	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	4,648,405.1147	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	635,915.8293	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	182,446.5566	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	428,036.9286	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	1,246,399.3145	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	365,366.0711	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	55,414.5324	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	7,256.3251	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	428,036.9286	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	309,679.3070	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	1,028,169.7216	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	1,337,849.0286	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	6.60820	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	

R6.2	$ARC_{product}$	1.50097	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.03811	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	4.17387	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.94804	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.02407	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.18792	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.26813	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	8.13739	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	1.84830	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.04693	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	5.70305	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	1.29537	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.03289	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	2.43433	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.55293	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.01404	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	5.58124	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	1.26771	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.03219	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.12181	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.02767	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00070	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	1.52919	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.34733	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00882	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.78020	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.17721	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00450	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.22384	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.05084	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00129	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.52515	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.11928	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00303	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.44826	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.10182	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00259	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.06799	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.01544	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00039	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.00890	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00202	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00005	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	1.64139	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.37282	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00947	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.37994	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.08630	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00219	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	1.26145	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.28652	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00728	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

Run 17	Agricultural practice:	Use of cover crops of the Leguminosae family

Designed and developed by TERRA NOVA Ltd.

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Olive
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1	ARC	5,696,767.8056	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	3,712,610.4180	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	1,984,157.3877	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	4,549,120.3612	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	99,284.7535	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	6,632,562.5023	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	4,648,405.1147	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	325,311.2115	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	182,446.5566	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	428,036.9286	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	935,794.6967	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	365,366.0711	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	55,414.5324	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	7,256.3251	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	428,036.9286	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	310,604.6178	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	309,679.3070	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	1,028,169.7216	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	1,648,453.6464	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	6.98927	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	1.58752	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.04031	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	4.55494	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	1.03460	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.02627	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.14109	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.20132	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	8.13739	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	1.84830	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.04693	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	5.70305	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	1.29537	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.03289	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	2.43433	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.55293	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.01404	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	5.58124	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	1.26771	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.03219	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.12181	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.02767	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00070	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	1.14811	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.26078	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00662	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.39912	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.09065	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00230	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.22384	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.05084	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00129	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.52515	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.11928	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00303	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.44826	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.10182	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00259	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.06799	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.01544	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00039	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.00890	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00202	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00005	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	2.02246	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.45938	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.01166	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.38108	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.08656	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00220	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{F\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.37994	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.08630	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00219	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	1.26145	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.28652	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00728	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

Run 18	Agricultural practice:	Application of fertilizers through fertigation

Designed and developed by TERRA NOVA Ltd.

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Olive
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1		ARC	5,178,948.7197 tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2		ARC	3,194,791.3321 tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	1,984,157.3877 tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	4,549,120.3612 tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	55,210.9681 tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	6,588,488.7169 tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	4,604,331.3293 tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	540,528.4549 tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	492,125.8637 tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	376,885.6786 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	1,409,539.9972 tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	314,214.8212 tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	55,414.5324 tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	7,256.3251 tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	376,885.6786 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000 tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	95,387.3744 tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000 tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000 tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	1,028,169.7216 tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000 tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000 tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	51,151.2500 tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	1,174,708.3459 tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	6.35397	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	1.44322	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.03665	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	3.91964	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.89029	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.02261	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.21394	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.30613	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	8.08331	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	1.83602	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.04662	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	5.64898	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	1.28309	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.03258	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	2.43433	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.55293	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.01404	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	5.58124	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	1.26771	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.03219	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.06774	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.01539	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00039	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	1.72934	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.39280	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00997	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.66317	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.15063	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00382	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.60378	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.13714	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00348	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.46240	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.10503	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00267	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.38551	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.08756	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00222	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.06799	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.01544	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00039	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.00890	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00202	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00005	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	1.44123	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.32736	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00831	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.11703	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{F\_FGT\_product}$	0.02658	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00067	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	1.26145	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.28652	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00728	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Designed and developed by TERRA NOVA Ltd.

Run 19	Agricultural practice:	Use of cover crops of the Leguminosae family

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Orange
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1	ARC	308,164.2067	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	250,030.8679	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	58,133.3388	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	300,878.0321	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	13,029.3724	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	372,040.7433	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	313,907.4046	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	24,150.0068	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	12,478.7097	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	27,247.8201	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	63,876.5366	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	20,184.8514	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	1,151.9053	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	5,911.0634	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	27,247.8201	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	12,913.1142	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	12,874.6452	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	80,021.1785	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	105,808.9379	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	9.09416	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.37410	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.02039	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	7.37860	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.30353	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.01655	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.17169	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.20349	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	10.97921	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.45165	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.02462	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	9.26365	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.38108	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.02077	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	1.71556	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.07057	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00385	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	8.87914	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.36526	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.01991	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.38451	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.01582	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00086	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	1.88505	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.07754	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00423	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.71269	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.02932	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00160	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.36826	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.01515	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00083	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.80410	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.03308	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00180	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.59567	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.02450	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00134	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.03399	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00140	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00008	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.17444	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00718	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00039	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	3.12250	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.12845	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00700	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.38108	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.01568	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00085	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{F\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.37994	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.01563	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00085	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	2.36149	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.09714	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00530	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Designed and developed by TERRA NOVA Ltd.

terra nova

Run 20	Agricultural practice:	Use of cover crops of the Leguminosae family

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Apple
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1	ARC	38,202.1563	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	18,518.4499	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	19,683.7065	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	58,442.8502	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	3,734.7260	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	81,861.2827	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	62,177.5762	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	10,957.0366	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	3,152.0986	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	29,549.9912	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	43,659.1263	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	26,910.2182	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	1,456.9426	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	1,182.8304	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	29,549.9912	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	4,255.9544	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	2,828.8505	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	12,245.5992	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	19,330.4041	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	3.42060	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.14401	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.00463	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	1.65813	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.06981	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.00224	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.53333	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.70217	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	7.32982	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.30858	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.00992	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	5.56735	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.23439	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.00753	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	1.76247	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.07420	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00238	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	5.23294	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.22031	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.00708	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.33441	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.01408	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00045	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	3.90921	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.16458	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00529	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.98109	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.04130	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00133	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.28224	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.01188	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00038	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	2.64589	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.11139	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00358	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	2.40953	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.10144	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00326	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.13045	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00549	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00018	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.10591	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00446	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00014	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	1.73083	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.07287	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00234	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.38108	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.01604	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00052	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.25329	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.01066	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00034	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	1.09646	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.04616	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00148	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Run 21	Agricultural practice:	Use of cover crops of the Leguminosae family

Designed and developed by TERRA NOVA Ltd.

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Peach
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1		ARC	345,783.3536 tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2		ARC	315,092.9503 tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	30,690.4033 tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	403,407.7541 tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	4,910.8758 tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	439,009.0333 tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	408,318.6299 tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	17,776.5422 tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	14,828.7505 tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	60,620.3870 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	93,225.6797 tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	54,078.6348 tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	2,136.5813 tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	4,405.1709 tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	60,620.3870 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	14,969.7197 tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	17,910.1488 tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000 tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	23,146.9701 tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000 tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000 tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	56,026.8386 tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	8.80242	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.53380	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.02004	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	8.02115	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.48642	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.01826	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.21235	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.22832	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	11.17561	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.67772	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.02544	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	10.39434	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.63034	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.02366	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	0.78127	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.04738	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00178	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	10.26933	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.62276	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.02338	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.12501	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.00758	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00028	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	2.37319	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.14392	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00540	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.45253	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.02744	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00103	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.37749	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.02289	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00086	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	1.54318	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.09358	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00351	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	1.37665	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.08348	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00313	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.05439	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00330	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00012	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.11214	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00680	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00026	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	1.42624	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.08649	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00325	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.38108	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.02311	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00087	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{F\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.45593	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.02765	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00104	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	0.58924	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.03573	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00134	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

Run 22	Agricultural practice:	Use of cover crops of the Leguminosae family

Designed and developed by TERRA NOVA Ltd.

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Almond
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1		ARC	152,550.5079 tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2		ARC	82,419.0524 tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	70,131.4555 tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	101,010.9724 tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	4,165.4097 tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	175,307.8376 tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	105,176.3821 tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	3,979.0382 tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	6,555.5997 tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	12,222.6918 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	22,757.3297 tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	10,563.0311 tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	723.3709 tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	936.2898 tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	12,222.6918 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	5,068.2177 tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	5,053.1191 tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000 tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	16,335.0994 tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000 tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000 tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	26,456.4362 tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	11.47017	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	4.73520	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.04113	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	6.19703	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	2.55831	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.02222	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.12981	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.21637	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	13.18128	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	5.44159	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.04727	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	7.90814	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	3.26470	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.02836	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	5.27314	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	2.17690	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.01891	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	7.59495	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	3.13540	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.02723	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.31319	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.12930	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00112	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	1.71111	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.70639	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00614	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.29918	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.12351	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00107	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.49291	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.20349	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00177	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.91902	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.37940	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00330	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.79423	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.32788	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00285	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.05439	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.02245	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00020	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.07040	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.02906	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00025	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	1.98924	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.82121	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00713	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.38108	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.15732	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00137	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{F\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.37994	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.15685	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00136	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	1.22823	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.50705	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00440	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Run 23	Agricultural practice:	Use of prunings as wood fuel

Designed and developed by TERRA NOVA Ltd.

terra nova

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Olive
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1	ARC	5,231,357.6446	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	3,341,683.9421	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	1,889,673.7025	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	4,842,883.1388	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	54,879.4248	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	6,787,436.2662	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	4,897,762.5636	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	635,915.8293	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	492,125.8637	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	428,036.9286	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	1,556,078.6215	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	365,366.0711	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	55,414.5324	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	7,256.3251	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	428,036.9286	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	1,321,932.4992	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	1,321,932.4992	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	6.41827	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	1.53072	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.03702	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	4.09986	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.97779	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.02365	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.22926	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.31771	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	8.32740	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	1.98603	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.04803	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	6.00899	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	1.43311	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.03466	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	2.31841	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.55293	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.01337	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	5.94166	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	1.41705	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.03427	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.06733	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.01606	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00039	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	1.90913	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.45532	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.01101	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.78020	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.18607	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00450	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.60378	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.14400	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00348	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.52515	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.12525	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00303	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.44826	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.10691	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00259	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.06799	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.01621	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00039	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.00890	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00212	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00005	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	1.62186	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.38680	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00935	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	1.62186	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.38680	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00935	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

Run 24	Agricultural practice:	Use of prunings as wood fuel

Designed and developed by TERRA NOVA Ltd.

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Orange
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1		ARC	313,116.8603 tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2		ARC	257,751.7757 tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	55,365.0845 tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	340,888.6214 tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	6,527.4504 tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	402,781.1563 tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	347,416.0718 tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	37,063.1211 tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	25,353.3549 tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	27,247.8201 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	89,664.2960 tn CO2/year	CO2 Total Annual Emissions

R4.1		AE_D	20,184.8514 tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2		AE_G	1,151.9053 tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3		AE_{EL}	5,911.0634 tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4		$AE_{ff\&e}$	27,247.8201 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000 tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000 tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000 tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	120,031.7677 tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000 tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000 tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	120,031.7677 tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	9.24032	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.39912	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.02072	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	7.60645	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.32855	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.01706	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.22261	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.25809	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	11.88638	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.51341	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.02666	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	10.25251	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.44284	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.02299	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	1.63387	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.07057	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00366	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	10.05988	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.43452	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.02256	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.19263	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.00832	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00043	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	2.64606	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.11429	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00593	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	1.09376	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.04724	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00245	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.74820	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.03232	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00168	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.80410	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.03473	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00180	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.59567	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.02573	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00134	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.03399	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00147	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00008	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.17444	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00753	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00039	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	3.54223	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.15300	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00794	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	3.54223	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.15300	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00794	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Run 25	Agricultural practice:	Use of prunings as wood fuel

Designed and developed by TERRA NOVA Ltd.

terra nova

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Apple
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1	ARC	70,713.8138	tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2	ARC	51,967.4267	tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	18,746.3871	tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	101,302.4475	tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	1,408.9104	tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	121,457.7450	tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	102,711.3579	tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	15,212.9910	tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	5,980.9490	tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	29,549.9912	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	50,743.9312	tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	26,910.2182	tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	1,456.9426	tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	1,182.8304	tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	29,549.9912	tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000	tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000	tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000	tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	55,105.1965	tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000	tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000	tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000	tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	55,105.1965	tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	6.33168	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.27989	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.00857	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	4.65314	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.20569	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.00630	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.41779	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.49404	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	10.87526	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.48074	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.01472	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	9.19672	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.40654	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.01244	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	1.67854	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.07420	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00227	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	9.07057	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.40096	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.01227	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.12615	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.00558	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00017	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	4.54358	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.20085	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00615	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	1.36216	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.06021	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00184	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.53553	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.02367	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00072	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	2.64589	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.11696	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00358	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	2.40953	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.10651	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00326	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.13045	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00577	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00018	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.10591	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00468	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00014	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	4.93409	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.21811	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00668	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	4.93409	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.21811	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00668	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Designed and developed by TERRA NOVA Ltd.

terra nova

Run 26	Agricultural practice:	Use of prunings as wood fuel

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Peach
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1		ARC	389,760.5551 tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2		ARC	360,531.5996 tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	29,228.9555 tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	484,422.1493 tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	2,214.9984 tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	515,866.1033 tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	486,637.1477 tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	32,746.2619 tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	32,738.8993 tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	60,620.3870 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	126,105.5482 tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	54,078.6348 tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	2,136.5813 tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	4,405.1709 tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	60,620.3870 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000 tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000 tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000 tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	104,161.3653 tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000 tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000 tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	104,161.3653 tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	9.92192	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0.63177	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.02258	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	9.17785	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0.58440	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.02089	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.24445	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.25914	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	13.13212	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0.83618	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.02989	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	12.38805	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0.78880	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.02820	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	0.74407	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0.04738	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.00169	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	12.33167	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0.78521	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.02807	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.05639	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.00359	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00013	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	3.21020	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0.20441	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00731	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.83360	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.05308	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00190	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.83342	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.05307	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00190	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	1.54318	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.09826	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00351	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	1.37665	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.08766	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00313	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.05439	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.00346	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00012	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.11214	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.00714	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00026	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	2.65158	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.16884	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00604	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	2.65158	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.16884	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00604	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

Run 27	Agricultural practice:	Use of prunings as wood fuel

Designed and developed by TERRA NOVA Ltd.

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Almond
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1		ARC	145,348.1950 tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2		ARC	78,556.3326 tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	66,791.8624 tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	109,178.5221 tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	2,256.4770 tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	178,226.8616 tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	111,434.9991 tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	9,047.2559 tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	11,608.7189 tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	12,222.6918 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	32,878.6665 tn CO2/year	CO2 Total Annual Emissions

R4.1		AE_D	10,563.0311 tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2		AE_G	723.3709 tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3		AE_{EL}	936.2898 tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4		$AE_{ff\&e}$	12,222.6918 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0.0000 tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0.0000 tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0.0000 tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	24,502.6491 tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0.0000 tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0.0000 tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0.0000 tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	24,502.6491 tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	10.92863	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	4.73722	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0.03919	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	5.90660	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	2.56033	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0.02118	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0.18448	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0.29505	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	13.40076	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	5.80881	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0.04805	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	8.37872	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	3.63192	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0.03005	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	5.02204	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	2.17690	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0.01801	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	8.20906	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	3.55837	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0.02944	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0.16966	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0.07354	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0.00061	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	2.47212	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	1.07159	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0.00886	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	0.68026	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0.29487	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0.00244	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0.87285	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0.37835	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0.00313	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0.91902	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0.39836	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0.00330	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0.79423	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0.34427	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0.00285	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0.05439	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0.02358	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0.00020	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0.07040	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0.03052	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0.00025	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	1.84234	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0.79860	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0.00661	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0.00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	1.84234	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0.79860	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0.00661	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0.00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0.00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0.00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

Run 28	Agricultural practice:	Electricity supply 100% by dedicated RES

Designed and developed by TERRA NOVA Ltd.

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Orange
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1		ARC	279.713,4935 tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2		ARC	224.348,4090 tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	55.365,0845 tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	300.878,0321 tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	7.223,6095 tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	363.466,7262 tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	308.101,6417 tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	37.063,1211 tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	25.353,3549 tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	21.336,7567 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	83.753,2327 tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	20.184,8514 tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	1.151,9053 tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	0,0000 tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	21.336,7567 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0,0000 tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0,0000 tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0,0000 tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0,0000 tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	80.021,1785 tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	5.911,0634 tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0,0000 tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0,0000 tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	85.932,2418 tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	8,25456	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0,35654	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0,01851	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	6,62069	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0,28597	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0,01485	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0,23043	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0,27184	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	10,72618	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0,46330	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0,02405	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	9,09232	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0,39273	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0,02039	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	1,63387	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0,07057	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0,00366	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	8,87914	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0,38352	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0,01991	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0,21317	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0,00921	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0,00048	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	2,47162	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0,10676	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0,00554	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	1,09376	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0,04724	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0,00245	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0,74820	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0,03232	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0,00168	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0,62966	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0,02720	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0,00141	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0,59567	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0,02573	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0,00134	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0,03399	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0,00147	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0,00008	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0,00000	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0,00000	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0,00000	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	2,53593	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0,10954	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0,00569	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0,00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0,00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0,00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0,00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0,00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0,00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0,00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0,00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0,00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0,00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0,00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0,00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	2,36149	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0,10200	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0,00530	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0,17444	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0,00753	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0,00039	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

Run 29 | Agricultural practice: | Use of insects mass trapping

Designed and developed by TERRA NOVA Ltd.

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Orange
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1		ARC	283.025,0291 tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2		ARC	227.659,9446 tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	55.365,0845 tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	300.878,0321 tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	7.223,6095 tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	363.466,7262 tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	308.101,6417 tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	37.063,1211 tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	16.130,7560 tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	27.247,8201 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	80.441,6971 tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	20.184,8514 tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	1.151,9053 tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	5.911,0634 tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	27.247,8201 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0,0000 tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0,0000 tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	0,0000 tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	9.222,5989 tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	80.021,1785 tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0,0000 tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0,0000 tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0,0000 tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	89.243,7774 tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	8,35229	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0,36076	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0,01873	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	6,71842	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0,29019	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0,01507	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0,22132	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0,26109	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	10,72618	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0,46330	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0,02405	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	9,09232	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0,39273	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0,02039	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	1,63387	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0,07057	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0,00366	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	8,87914	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0,38352	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0,01991	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0,21317	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0,00921	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0,00048	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	2,37390	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0,10254	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0,00532	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	1,09376	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0,04724	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0,00245	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0,47603	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0,02056	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0,00107	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0,80410	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0,03473	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0,00180	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0,59567	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0,02573	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0,00134	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0,03399	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0,00147	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0,00008	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0,17444	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0,00753	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0,00039	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	2,63365	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0,11376	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0,00591	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0,00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0,00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0,00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0,00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{f\_FGT\_product}$	0,00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0,00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0,00000	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0,00000	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0,00000	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0,27217	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0,01176	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0,00061	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	2,36149	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0,10200	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0,00530	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0,00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0,00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0,00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit

Tree crops' CO2 Removal Capacity Calculation Tool (CO2RCCT)

LIFE CLIMATREE

Designed and developed by TERRA NOVA Ltd. TERRAnova

Run 30	Agricultural practice:	Use of cover crops

Results

Country where the Tool is applied:	Greece
Species of tree crop:	Orange
Geographical area of the cultivation:	GREECE (total)

CO2 Annual Removal Capacity

R1.1		ARC	295.251,0925 tn CO2/year	CO2 Annual Removal Capacity	(BF is included)
R1.2		ARC	237.117,7537 tn CO2/year	CO2 Annual Removal Capacity	(BF is not included)

The term "CO2 Removal" means the abstraction of CO2 from atmosphere

BF: the fruits' biomass

Analysis

R2.1	CO2 Removals	AR_{BF}	58.133,3388 tn CO2/year	CO2 Annual Removal due to the production of fruit biomass
R2.2		AR_{BW}	300.878,0321 tn CO2/year	CO2 Annual Removal due to the production of wood biomass
R2.3		AS_S	13.029,3724 tn CO2/year	CO2 Annual Storage in soil as carbon of the fallen biomass
R2.4		TAR	372.040,7433 tn CO2/year	CO2 Total Annual Removals (BF is included)
R2.5		TAR	313.907,4046 tn CO2/year	CO2 Total Annual Removals (BF is not included)

a. It has to be underlined an important difference between ARC and TAR:
ARC is the result of the CO2 mass balance between (a) the total quantity of CO2 which is abstracted from the atmosphere [=TAR] by the tree in order to create biomass and (b) the total quantity of CO2 which is emitted to the atmosphere due to the agricultural practices which are applied for the cultivation of the tree.

b. The following are defined as fallen biomass: fallen leaves, fallen fruits (naturally fallen or as a result of a thinning process), other fallen biomass (e.g. almond hulls) as well as prunings which are left in the field.

R3.1	CO2 Emissions	AE_f	37.063,1211 tn CO2/year	CO2 Annual Emissions due to the use of fertilizers
R3.2		AE_p	12.478,7097 tn CO2/year	CO2 Annual Emissions due to the use of pesticides
R3.3		$AE_{ff\&e}$	27.247,8201 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity
R3.4		TAE	76.789,6508 tn CO2/year	CO2 Total Annual Emissions

R4.1	AE_D	20.184,8514 tn CO2/year	CO2 Annual Emissions due to the use of diesel
R4.2	AE_G	1.151,9053 tn CO2/year	CO2 Annual Emissions due to the use of gasoline
R4.3	AE_{EL}	5.911,0634 tn CO2/year	CO2 Annual Emissions due to the use of electricity
R4.4	$AE_{ff\&e}$	27.247,8201 tn CO2/year	CO2 Annual Emissions due to the use of fossil fuels & electricity

R5.1	CO2 Gain	$AG_{N\text{-}f\_LCC}$	0,0000 tn CO2/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (use of Leguminosae cover crops)
R5.2		AG_{f_FGT}	0,0000 tn CO2/year	CO2 Annual Gain due to fertilizers reduction (use of fertigation)
R5.3		$AG_{H\_cc/m}$	12.874,6452 tn CO2/year	CO2 Annual Gain due to herbicides reduction (use of cover crops/mulching)
R5.4		$AG_{I\_im/mt}$	0,0000 tn CO2/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping)
R5.5		AG_{WF}	80.021,1785 tn CO2/year	CO2 Annual Gain due to the use of wood fuels instead of diesel
R5.6		AG_{RES}	0,0000 tn CO2/year	CO2 Annual Gain due to the use of Renewable Energy Sources
R5.7		AG_{EL_m}	0,0000 tn CO2/year	CO2 Annual Gain due to electricity reduction (use of mulching)
R5.8		AG_{D_FGT}	0,0000 tn CO2/year	CO2 Annual Gain due to diesel reduction (use of fertigation)
R5.9		TAG	92.895,8237 tn CO2/year	CO2 Total Annual Gain

CO2 Removal Capacity Indexes

R6.1	ARC_{area}	8,71309	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area

R6.2	$ARC_{product}$	0,35843	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	(BF is included)
R6.3	ARC_{tree}	0,01954	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R7.1	ARC_{area}	6,99753	tn CO2/hectare/year	CO2 Annual Removal Capacity per unit of cultivated area	(BF is not included)
R7.2	$ARC_{product}$	0,28785	tn CO2/tn of yield/year	CO2 Annual Removal Capacity per unit of harvested fruits	
R7.3	ARC_{tree}	0,01569	tn CO2/tree/year	CO2 Annual Removal Capacity per tree unit	
R8.1	TAE/TAR	0,20640	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is included)
R8.2	TAE/TAR	0,24463	Total Annual CO2 Emissions/ Total Annual CO2 Removals		(BF is not included)
R9.1	TAR_{area}	10,97921	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is included)
R9.2	$TAR_{product}$	0,45165	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R9.3	TAR_{tree}	0,02462	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R10.1	TAR_{area}	9,26365	tn CO2/hectare/year	CO2 Total Annual Removals per unit of cultivated area	(BF is not included)
R10.2	$TAR_{product}$	0,38108	tn CO2/tn of yield/year	CO2 Total Annual Removals per unit of harvested fruits	
R10.3	TAR_{tree}	0,02077	tn CO2/tree/year	CO2 Total Annual Removals per tree unit	
R11.1	AR_{BF_area}	1,71556	tn CO2/hectare/year	CO2 Annual Removal due to the production of fruit biomass per unit of cultivated area	
R11.2	$AR_{BF\_product}$	0,07057	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of fruit biomass per unit of harvested fruits	
R11.3	AR_{BF_tree}	0,00385	tn CO2/tree/year	CO2 Annual Removal due to the production of fruit biomass per tree unit	
R12.1	AR_{BW_area}	8,87914	tn CO2/hectare/year	CO2 Annual Removal due to the production of wood biomass per unit of cultivated area	
R12.2	$AR_{BW\_product}$	0,36526	tn CO2/tn of yield/year	CO2 Annual Removal due to the production of wood biomass per unit of harvested fruits	
R12.3	AR_{BW_tree}	0,01991	tn CO2/tree/year	CO2 Annual Removal due to the production of wood biomass per tree unit	
R13.1	AS_{S_area}	0,38451	tn CO2/hectare/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of cultivated area	
R13.2	$AS_{S\_product}$	0,01582	tn CO2/tn of yield/year	CO2 Annual Storage in soil as carbon of the fallen biomass per unit of harvested fruits	
R13.3	AS_{S_tree}	0,00086	tn CO2/tree/year	CO2 Annual Storage in soil as carbon of the fallen biomass per tree unit	
R14.1	TAE_{area}	2,26612	tn CO2/hectare/year	CO2 Total Annual Emissions per unit of cultivated area	
R14.2	$TAE_{product}$	0,09322	tn CO2/tn of yield/year	CO2 Total Annual Emissions per unit of harvested fruits	
R14.3	TAE_{tree}	0,00508	tn CO2/tree/year	CO2 Total Annual Emissions per tree unit	
R15.1	AE_{f_area}	1,09376	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fertilizers per unit of cultivated area	
R15.2	$AE_{f\_product}$	0,04499	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fertilizers per unit of harvested fruits	
R15.3	AE_{f_tree}	0,00245	tn CO2/tree/year	CO2 Annual Emissions due to the use of fertilizers per tree unit	
R16.1	AE_{p_area}	0,36826	tn CO2/hectare/year	CO2 Annual Emissions due to the use of pesticides per unit of cultivated area	
R16.2	$AE_{p\_product}$	0,01515	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of pesticides per unit of harvested fruits	
R16.3	AE_{p_tree}	0,00083	tn CO2/tree/year	CO2 Annual Emissions due to the use of pesticides per tree unit	
R17.1	$AE_{ff\&e\_area}$	0,80410	tn CO2/hectare/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of cultivated area	
R17.2	$AE_{ff\&e\_product}$	0,03308	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per unit of harvested fruits	
R17.3	$AE_{ff\&e\_tree}$	0,00180	tn CO2/tree/year	CO2 Annual Emissions due to the use of fossil fuels & electricity per tree unit	
R18.1	AE_{D_area}	0,59567	tn CO2/hectare/year	CO2 Annual Emissions due to the use of diesel per unit of cultivated area	
R18.2	$AE_{D\_product}$	0,02450	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of diesel per unit of harvested fruits	
R18.3	AE_{D_tree}	0,00134	tn CO2/tree/year	CO2 Annual Emissions due to the use of diesel per tree unit	
R19.1	AE_{G_area}	0,03399	tn CO2/hectare/year	CO2 Annual Emissions due to the use of gasoline per unit of cultivated area	
R19.2	$AE_{G\_product}$	0,00140	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of gasoline per unit of harvested fruits	
R19.3	AE_{G_tree}	0,00008	tn CO2/tree/year	CO2 Annual Emissions due to the use of gasoline per tree unit	
R20.1	AE_{EL_area}	0,17444	tn CO2/hectare/year	CO2 Annual Emissions due to the use of electricity per unit of cultivated area	
R20.2	$AE_{EL\_product}$	0,00718	tn CO2/tn of yield/year	CO2 Annual Emissions due to the use of electricity per unit of harvested fruits	
R20.3	AE_{EL_tree}	0,00039	tn CO2/tree/year	CO2 Annual Emissions due to the use of electricity per tree unit	
R21.1	TAG_{area}	2,74143	tn CO2/hectare/year	CO2 Total Annual Gain per unit of cultivated area	

R21.2	$TAG_{product}$	0,11277	tn CO2/tn of yield/year	CO2 Total Annual Gain per unit of harvested fruits
R21.3	TAG_{tree}	0,00615	tn CO2/tree/year	CO2 Total Annual Gain per tree unit
R22.1	$AG_{N\text{-}f\_LCC\_area}$	0,00000	tn CO2/hectare/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of cultivated area
R22.2	$AG_{N\text{-}f\_LCC\_product}$	0,00000	tn CO2/tn of yield/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per unit of harvested fruits
R22.3	$AG_{N\text{-}f\_LCC\_tree}$	0,00000	tn CO2/tree/year	CO2 Annual Gain due to Nitrogen-fertilizers reduction (Leguminosae cover crops) per tree unit
R23.1	$AG_{f\_FGT\_area}$	0,00000	tn CO2/hectare/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of cultivated area
R23.2	$AG_{F\_FGT\_product}$	0,00000	tn CO2/tn of yield/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per unit of harvested fruits
R23.3	$AG_{f\_FGT\_tree}$	0,00000	tn CO2/tree/year	CO2 Annual Gain due to fertilizers reduction (fertigation) per tree unit
R24.1	AG_{H_cc/m_area}	0,37994	tn CO2/hectare/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of cultivated area
R24.2	$AG_{H\_cc/m\_product}$	0,01563	tn CO2/tn of yield/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per unit of harvested fruits
R24.3	AG_{H_cc/m_tree}	0,00085	tn CO2/tree/year	CO2 Annual Gain due to herbicides reduction (cover crops/mulching) per tree unit
R25.1	AG_{I_im/mt_area}	0,00000	tn CO2/hectare/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of cultivated area
R25.2	$AG_{I\_im/mt\_product}$	0,00000	tn CO2/tn of yield/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per unit of harvested fruits
R25.3	AG_{I_im/mt_tree}	0,00000	tn CO2/tree/year	CO2 Annual Gain due to insecticides reduction (insects monitoring/mass trapping) per tree unit
R26.1	AG_{WF_area}	2,36149	tn CO2/hectare/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of cultivated area
R26.2	$AG_{WF\_product}$	0,09714	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per unit of harvested fruits
R26.3	AG_{WF_tree}	0,00530	tn CO2/tree/year	CO2 Annual Gain due to the use of wood fuels instead of diesel per tree unit
R27.1	AG_{RES_area}	0,00000	tn CO2/hectare/year	CO2 Annual Gain due to the use of RES per unit of cultivated area
R27.2	$AG_{RES\_product}$	0,00000	tn CO2/tn of yield/year	CO2 Annual Gain due to the use of RES per unit of harvested fruits
R27.3	AG_{RES_tree}	0,00000	tn CO2/tree/year	CO2 Annual Gain due to the use of RES per tree unit