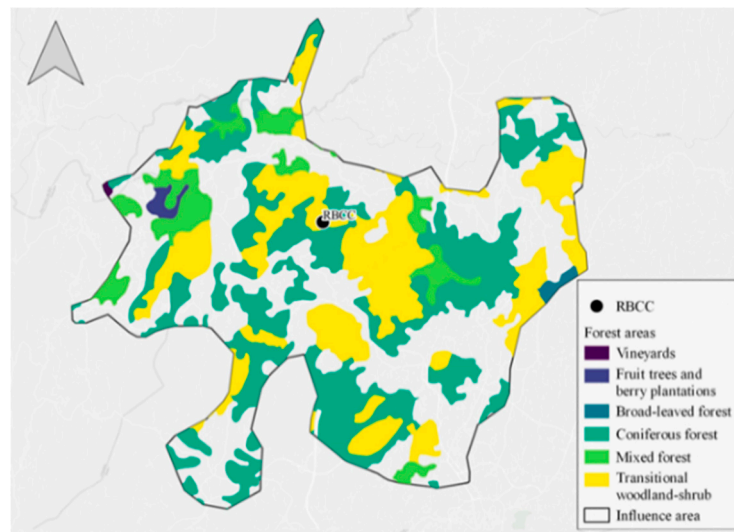
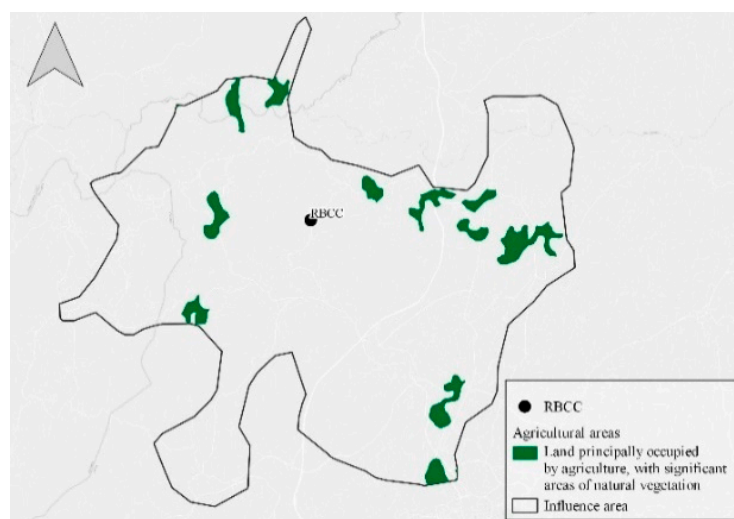


## Supplementary Materials

Forest and agricultural soils areas evaluated by the Corine Land Cover (CLC) 2018.



**Figure S1.** Flora characterization of the region under study (CLC 2018).



**Figure S2.** Region agricultural areas (CLC 2018).

**Table S1.** Assessment of the residual biomass productivity rate (P) [28]

CLC	Description	Selected species	P [ton/ha]
<b>Broad-leaved forest</b>	Vegetation formation composed principally of trees, including shrub and bush understorey, where broad-leaved species predominate	Cork oak	0.66
		Holm oak	
		Oak	
<b>Coniferous forest</b>	Vegetation formation composed principally of trees, including shrub and bush understorey, where coniferous species predominate	Pinus Pinaster	0.88
		Other conifers	
<b>Fruit trees and berry plantations</b>	Cultivated parcels planted with fruit trees and shrubs, intended for fruit production, including nuts. The planting pattern can be by single or mixed fruit species, both in association with permanently grassy surfaces	Fruit farm	2.00
<b>Mixed forest</b>	Vegetation formation composed principally of trees, including shrub and bush understorey, where neither broad-leaved nor coniferous species predominate	Eucalyptus	0.68
		Cork oak	
		Holm oak	
		Oak	
		Pinus Pinaster	
		Other conifers	
<b>Transitional woodland-shrub</b>	Transitional bushy and herbaceous vegetation with occasional scattered trees.	Herbaceous	0.31
<b>Vineyards</b>	Areas planted with vines, vineyard parcels covering >50% and determining the land use of the area.	Vineyard	7.00
<b>Land principally occupied by agriculture, with significant areas of natural vegetation</b>	Areas principally occupied by agriculture, interspersed with significant natural or semi-natural areas (including forests, shrubs, wetlands, water bodies, mineral outcrops) in a mosaic pattern.	Fruit farm	2.69
		Cereal cultivation	
		Herbaceous	
		Vineyard	

**Table S2.** Equivalent processes and materials in SimaPro and characterisation of the LCIA results.

Process	Equivalent in SimaPro
Ashes (landfilling)	Wood ash mixture, pure {Europe without Switzerland}   treatment of wood ash mixture, pure, sanitary landfill   APOS, U
Biomass shredding	Wood chipping, forwarder with terrain chipper, in forest {GLO}   market for   APOS, U
Electricity, from country mix	Electricity, high voltage {PT}   electricity production, natural gas, combined cycle power plant   APOS, U
KCl	Potassium chloride {RER}   potassium chloride production   APOS, U
Land use	Occupation, urban, green areas
Transportation of forest residual biomass	Machine operation, diesel, $\geq 18.64$ kW and $< 74.57$ kW, steady-state GLO}   market for   APOS, U
Transportation of agricultural residual biomass	
Transportation to fields	
Transportation to Biomass Power Plant	Transport, freight, lorry 16-32 metric ton, euro5 {RER}   market for transport, freight, lorry 16-32 metric ton, EURO5   APOS, U
TSP	Triple superphosphate {RER}   triple superphosphate production   APOS, U
Urea	Urea {RER}   urea production   APOS, U
Water (treatment)	Water, deionised {Europe without Switzerland}   water production, deionised   APOS, U
Material	Equivalent in SimaPro
CH <sub>4</sub>	Methane, biogenic
CO	Carbon monoxide, biogenic
CO <sub>2</sub>	Carbon dioxide, biogenic
COV	VOC, volatile organic compounds as C
H <sub>2</sub> O	Water
K- emitted to soil	Potassium
NH <sub>3</sub>	Ammonia, PT
NO <sub>x</sub>	Nitrogen oxides, PT
NO <sub>x</sub> , as NO <sub>2</sub>	Nitrogen dioxide, PT
NO <sub>3</sub> <sup>-</sup>	Nitrate
N <sub>2</sub> O	Dinitrogen monoxide
NM VOC	NM VOC, non-methane volatile organic compounds
Oxygen	Oxygen
P- emitted to soil	Phosphorus, PT
TP	Particulates, SPM
Water	Water, unspecified natural origin, PT

Categories indicators results for the mulching, composting and energetic valorization.

**Table S3.** Characterisation of the LCIA results for mulching

IC	Unit	Tot	P <sub>FRs</sub>	S <sub>AFRs</sub>	T <sub>M</sub>	T <sub>FRs</sub>	T <sub>ARs</sub>	RN	Urea	TSP	KCl
AD	kg Sb <sub>eq</sub>	-2.51E-04	9.16E-06	1.28E-05	1.81E-06	1.33E-06	4.31E-07	0.00E+00	-2.69E-04	-9.32E-07	-6.78E-06
Adff	MJ	-1.28E+02	1.33E+02	8.00E+01	4.55E+01	3.35E+01	1.08E+01	0.00E+00	-4.25E+02	-1.17E+00	-4.60E+00
GW	kg CO <sub>2eq</sub>	2.33E+01	9.80E+00	5.77E+00	3.35E+00	2.46E+00	7.97E-01	1.93E+01	-1.77E+01	-8.01E-02	-3.00E-01
OLD	kg CFC-11 <sub>eq</sub>	5.92E-07	1.68E-06	9.60E-07	5.66E-07	4.17E-07	1.35E-07	0.00E+00	-3.11E-06	-8.87E-09	-4.46E-08
HT	kg 1,4-DB <sub>eq</sub>	-9.72E+00	1.58E+00	1.64E+00	4.30E-01	3.16E-01	1.02E-01	8.52E-02	-1.34E+01	-1.26E-01	-3.45E-01
FE	kg 1,4-DB <sub>eq</sub>	-4.97E+00	1.34E+00	1.38E+00	3.44E-01	2.53E-01	8.20E-02	0.00E+00	-8.13E+00	-4.22E-02	-2.00E-01
ME	kg 1,4-DB <sub>eq</sub>	-8.99E+03	1.89E+03	2.06E+03	5.70E+02	4.20E+02	1.36E+02	0.00E+00	-1.26E+04	-1.15E+03	-3.38E+02
TE	kg 1,4-DB <sub>eq</sub>	6.95E-02	8.76E-02	4.06E-03	1.35E-03	9.94E-04	3.22E-04	0.00E+00	-2.37E-02	-6.53E-04	-5.53E-04
PO	kg C <sub>2</sub> H <sub>4eq</sub>	1.45E-02	1.56E-02	9.21E-04	5.66E-04	4.17E-04	1.35E-04	0.00E+00	-2.93E-03	-2.05E-04	-6.06E-05
A	kg SO <sub>2eq</sub>	8.07E-01	6.75E-02	1.53E-02	1.24E-02	9.13E-03	2.95E-03	7.73E-01	-6.70E-02	-5.08E-03	-1.42E-03
E	kg PO <sub>4<sup>---</sup>eq</sub>	6.86E-01	2.44E-02	3.51E-03	2.77E-03	2.04E-03	6.59E-04	6.69E-01	-1.59E-02	-4.86E-04	-3.74E-04

**Table S4.** Characterisation of the LCIA results for composting

IC	Unit	Tot	C <sub>EC</sub>	P <sub>FRs</sub>	S <sub>AFRs</sub>	T <sub>FRs</sub>	T <sub>ARs</sub>	T <sub>C</sub>	Urea	TSP	KCl
<b>AD</b>	kg Sb <sub>eq</sub>	-2.54 E-04	0.00 E+00	9.16 E-06	1.28 E-05	1.33 E-06	4.31 E-07	1.13 E-06	-1.86 E-04	-2.47 E-05	-6.81 E-05
<b>ADff</b>	MJ	-8.87E+01	0.00E+00	1.33E+02	8.00E+01	3.35E+01	1.08E+01	2.85E+01	-2.97E+02	-3.11E+01	-4.61E+01
<b>GW</b>	kg CO <sub>2</sub> <sub>eq</sub>	1.80E+01	1.47E+01	9.80E+00	5.77E+00	2.46E+00	7.97E-01	2.10E+00	-1.25E+01	-2.12E+00	-3.01E+00
<b>OLD</b>	kg CFC-11 <sub>eq</sub>	6.70E-07	0.00E+00	1.68E-06	9.60E-07	4.17E-07	1.35E-07	3.55E-07	-2.19E-06	-2.35E-07	-4.48E-07
<b>HT</b>	kg 1,4-DB <sub>eq</sub>	-1.22E+01	1.96E-03	1.58E+00	1.64E+00	3.16E-01	1.02E-01	2.69E-01	-9.36E+00	-3.33E+00	-3.47E+00
<b>FE</b>	kg 1,4-DB <sub>eq</sub>	-5.52E+00	0.00E+00	1.34E+00	1.38E+00	2.53E-01	8.20E-02	2.16E-01	-5.66E+00	-1.12E+00	-2.01E+00
<b>ME</b>	kg 1,4-DB <sub>eq</sub>	-3.77E+04	0.00E+00	1.89E+03	2.06E+03	4.20E+02	1.36E+02	3.57E+02	-8.78E+03	-3.04E+04	-3.39E+03
<b>TE</b>	kg 1,4-DB <sub>eq</sub>	5.43E-02	0.00E+00	8.76E-02	4.06E-03	9.94E-04	3.22E-04	8.46E-04	-1.67E-02	-1.73E-02	-5.55E-03
<b>PO</b>	kg C <sub>2</sub> H <sub>4</sub> <sub>eq</sub>	9.64E-03	2.81E-04	1.56E-02	9.21E-04	4.17E-04	1.35E-04	3.55E-04	-2.06E-03	-5.42E-03	-6.09E-04
<b>A</b>	kg SO <sub>2</sub> <sub>eq</sub>	-6.22E-02	3.14E-02	6.75E-02	1.53E-02	9.13E-03	2.95E-03	7.77E-03	-4.74E-02	-1.35E-01	-1.43E-02
<b>E</b>	kg PO <sub>4</sub> <sup>---</sup> <sub>eq</sub>	2.50E-02	2.05E-02	2.44E-02	3.51E-03	2.04E-03	6.59E-04	1.74E-03	-1.12E-02	-1.29E-02	-3.76E-03

**Table S5.** Characterisation of the LCIA results for energetic valorization

IC	Unit	Tot	C <sub>RF</sub>	P <sub>FRs</sub>	S <sub>AFRs</sub>	T <sub>FRs</sub>	T <sub>ARs</sub>	T <sub>C</sub>	Urea	TSP	KCl
AD	kg Sb <sub>eq</sub>	-2.80E-04	0.00E+00	9.16E-06	1.28E-05	1.33E-06	4.31E-07	1.13E-06	-2.07E-04	-2.47E-05	-7.30E-05
ADff	MJ	-1.23E+02	0.00E+00	1.33E+02	8.00E+01	3.35E+01	1.08E+01	2.85E+01	-3.28E+02	-3.11E+01	-4.95E+01
GW	kg CO <sub>2eq</sub>	1.66E+01	1.47E+01	9.80E+00	5.77E+00	2.46E+00	7.97E-01	2.10E+00	-1.37E+01	-2.12E+00	-3.23E+00
OLD	kg CFC-11 <sub>eq</sub>	4.31E-07	0.00E+00	1.68E-06	9.60E-07	4.17E-07	1.35E-07	3.55E-07	-2.40E-06	-2.35E-07	-4.80E-07
HT	kg 1,4-DB <sub>eq</sub>	-1.35E+01	1.96E-03	1.58E+00	1.64E+00	3.16E-01	1.02E-01	2.69E-01	-1.03E+01	-3.33E+00	-3.72E+00
FE	kg 1,4-DB <sub>eq</sub>	-6.27E+00	0.00E+00	1.34E+00	1.38E+00	2.53E-01	8.20E-02	2.16E-01	-6.27E+00	-1.12E+00	-2.15E+00
ME	kg 1,4-DB <sub>eq</sub>	-3.89E+04	0.00E+00	1.89E+03	2.06E+03	4.20E+02	1.36E+02	3.57E+02	-9.70E+03	-3.04E+04	-3.64E+03
TE	kg 1,4-DB <sub>eq</sub>	5.23E-02	0.00E+00	8.76E-02	4.06E-03	9.94E-04	3.22E-04	8.46E-04	-1.83E-02	-1.73E-02	-5.95E-03
PO	kg C <sub>2</sub> H <sub>4eq</sub>	9.40E-03	2.81E-04	1.56E-02	9.21E-04	4.17E-04	1.35E-04	3.55E-04	-2.26E-03	-5.42E-03	-6.53E-04
A	kg SO <sub>2eq</sub>	-6.75E-02	3.14E-02	6.75E-02	1.53E-02	9.13E-03	2.95E-03	7.77E-03	-5.16E-02	-1.35E-01	-1.53E-02
E	kg PO <sub>4<sup>---</sup>eq</sub>	2.37E-02	2.05E-02	2.44E-02	3.51E-03	2.04E-03	6.59E-04	1.74E-03	-1.23E-02	-1.29E-02	-4.03E-03