

# LINEAR WOODY FEATURES ON HOMEGARDENS IN EUROPEAN UNION

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## Abstract

Homegardens are probably the most difficult agroforestry practice to map because of their size and presence in non-agricultural outlines. The combination of the fields of “homegardens” and “woody component” at LUCAS point level revealed that around 60% of the homegardens in Europe can be considered agroforestry. However, agroforestry could also be identified in the rest (40%) if we the transects besides the points of the LUCAS database are considered. The objective of this paper is to map and quantify the agroforestry homegardens in Europe by using the LUCAS database based on the transects to fine tune the amount of the homegarden agroforestry practice in Europe. The paper shows that Europe has 14,461.04 km<sup>2</sup> of homegardens, 41.26 of which aren't permanent cover homegardens, but 42.34% of them have linear woody features and they can be considered agroforestry as they have a woody component integrated with an agricultural product in the understory.

**Keywords:** LUCAS database; hedgerow; isolated tree, landscape features

## Introduction

The Land Use and Land Cover Survey (LUCAS) defines homegardens as “gardens, where the crops are planted heterogeneously and mainly for own consumption. These areas are mostly fenced (by metal fences or hedges) and mostly situated in residential areas or as allotment gardens” (Eurostat 2015). These land use type is key to provide local and more sustainable healthy food within a smart cities concept linking urban and rural areas as described the EIP-Smart cities and Communities (2017).

When a woody component, usually a fruit tree, is combined with vegetable production in the understory, homegardens are considered an agroforestry practice (Mosquera-Losada et al. 2016). Agroforestry homegardens (AFh) are difficult to map because linear woody features are not registered directly in the cover databases and homegarden areas are presumably identified as a residential area due to the small size of these plots around the house.

In Santiago-Freijanes et al. (2018), the extent of AFh in EU based on maps developed from the LUCAS classification with two covers and two uses and integrating fruit trees were developed. But, AFh could also have woody component that is not a permanent crop. The inventory of these non-fruit based AFh can be carried out thanks to the survey of LUCAS carried out with (EU).

This paper aims to identify homegarden agroforestry practices not linked to permanent crops, but linear woody features and to evaluate the extent of this type of agroforestry practice across EU.

## Material and methods

EU homegardens were mapped by using LUCAS survey carried out in 2015. Surveyors filled established forms including two questions related with the two land covers and two land uses

found in each point. Surveyors also took four photos from each point in the direction of the four cardinal points (North, West, East and South) and another photo of the point itself ten meters away from the point. Data are included in a database free available from Eurostat, LUCAS data are taken during the visit of the surveyors to previously defined points. In each point a transect of 250 meters long taken from the point itself to the East, is delineated and each defined woody feature recorded.

To examine the LUCAS data, we use free software LibreOffice-Calc and QGIS 2.18. We select the points that they presented as primary or secondary use (fields LU1 and LU2 of the database) the value U113, called "Kitchen garden", which refers to homegardens. From those points we select the no woody covers in the primary or secondary covers fields (LC1 and LC2 in the database). We exclude woody covers, identified as the cover fields of the database named as forestry (coded as Cxx and being "xx" of the code a number that identifies types of forests species), permanent crops (coded as B7x and being the "x" of the code a number that identifies specific species) and other permanent crops (coded as B8x and being the "x" of the code a number that identifies specific species), and grassland with sparse trees or shrubs (coded as E10), and shrubland with sparse trees (coded as D10). In addition to the two covers and to uses and other fields characteristics LUCAS have a transect 250 meters long from the point itself to the East. This transect record all the features localized with the LUCAS cover codes, but also, to refer features typically linear or punctual add specific codes, these codes appear when the feature is narrower than 3 metres (Eurostat 2015). To the propose of this work the codes are: 10. Single bushes/trees; 11. Avenue trees or other lines of trees; 12. Conifer hedges; 13. Managed bush or tree hedges or coppices; 14. Not managed bush or tree hedges; 15. Grove/Woodland margins (if no hedgerow).

To our purpose we consider the feature coded with number 10 as the category "isolated trees" and the rest of the before mentioned codes (11, 12, 13, 14 and 15) as linear features or hedgerows.

## Results

In the AFh without permanent crops as woody vegetation cover, both Luxembourg and Malta are not included in the study, because they have no homegardens registered in LUCAS (2015) and Finland and Ireland because 100% of their homegardens have permanent crops. Afh without permanent crops as woody vegetation cover represents the 41.26% of homegardens in EU (Table 1).

Table 1: Extension and percentage of homegardens by countries.

Countries	Area	Homegardens		No permanent cover homegardens	
	km <sup>2</sup>	km <sup>2</sup>	%	km <sup>2</sup>	%
Austria	83944	304.08	0.36	76.02	25.00
Belgium	30666	63.51	0.21	63.51	100.00
Bulgaria	110995	621.62	0.56	260.21	41.86
Croatia	56539	561.22	0.99	240.52	42.86
Cyprus	9249	48.34	0.52	5.37	11.11
Czech Rep.	78874	1270.38	1.61	124.28	9.78
Denmark	43162	35.44	0.08	11.81	33.32
Estonia	45347	86.24	0.19	17.25	20.00
France	549059	1436.22	0.26	672.52	46.83
Germany	357745	1372.58	0.38	363.33	26.47
Greece	131912	402.78	0.31	84.80	21.05
Hungary	93013	648.05	0.70	360.03	55.56
Italy	300576	1541.36	0.51	618.64	40.14
Latvia	65519	390.14	0.60	134.11	34.37
Lithuania	65412	493.79	0.75	261.42	52.94
Netherlands	37824	60.47	0.16	45.35	75.00
Poland	313851	1502.46	0.48	710.26	47.27
Portugal	88847	355.19	0.40	276.26	77.78
Romania	239068	1287.39	0.54	915.48	71.11
Slovakia	49026	837.29	1.71	231.59	27.66
Slovenia	20277	84.27	0.42	21.07	25.00
Spain	498502	793.40	0.16	337.19	42.50
Sweden	449896	84.62	0.02	16.92	20.00
U.K.	165152	138.09	0.08	118.36	85.71
EU-28	4295513	14461.04	0.34	5966.29	41.26

In Figure 1 and Table 1 we can see that Romania, Poland, France and Italy have the largest extensions of AFh without permanent crops as woody vegetation cover while Cyprus, Denmark, Sweden and Estonia have less than 20 km<sup>2</sup>. Belgium (with 100%), United Kingdom, Portugal, Netherlands and Romania have the largest proportions of AFh without permanent crops as woody vegetation cover, while Czech Republic, Cyprus, Estonia and Sweden only have AFh without permanent crops as woody vegetation cover proportions lower than 20%. As we can see in Figure 2, there is a clear trend from the South and West countries with a 50% or more of their AFh without permanent crops as woody vegetation cover that have any type of the woody linear features involved. On the other hand, those countries placed in the northern and central part of EU do not have linear feature in their AFh without permanent crops as woody vegetation cover.

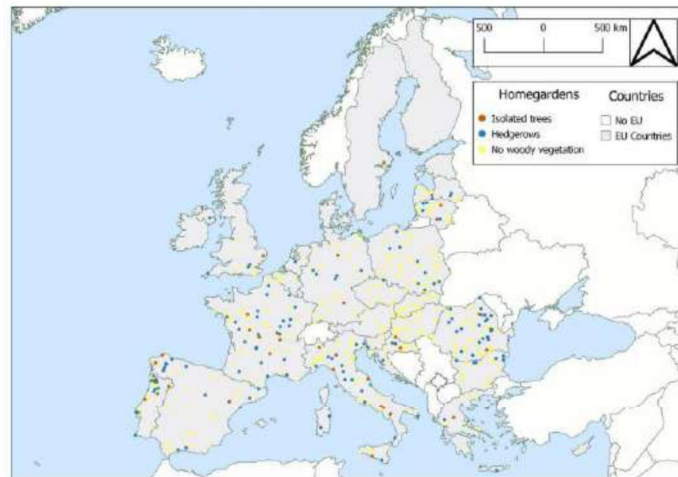


Figure 1: Agroforestry homegardens without permanent crops as woody vegetation cover in eu countries.

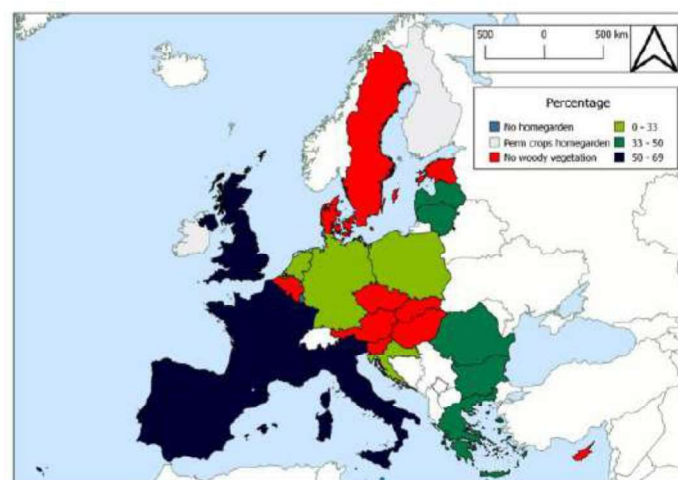


Figure 2: Agroforestry homegardens without permanent crops as woody vegetation cover with all types of woody linear feature in EU by countries.

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## Discussion

AFh without permanent crops as woody vegetation cover is the 41.26%, and its 42.34% have linear features. That's means that only 23.79% of homegardens in EU have AFh without permanent crops or linear features as woody vegetation cover, according LUCAS. Excluding the countries that have not registered any homegarden (Luxembourg and Malta) and those that have not their AFh without permanent crops as woody vegetation cover (Finland and Ireland), we have 24 countries that we can split into two blocks, the 14 that have some type of woody linear feature in their homegrowns and 10 who do not register any of these elements. There is a clear trend South West on one side and North on the other probably due to the highest presence of woody component as part of the landscape due to the role they play as protectors of wind erosion such as UK and France and droughts and erosion as happen in the south of EU (Mosquera-Losada et al. 2016) Compared with the regression between the homegardens presence with a woody component as a permanent crop, the AFh without permanent crops as woody vegetation cover have a lower relationship with the presence of homegardens, probably, due to the low presence of AFh without permanent crops as woody vegetation cover in the states where these elements are not recorded (Santiago-Freijanes et al. 2018).

The fact that transects only take the elements present in the 250 m to the East from the point itself avoids that some woody linear elements found in the plot are registered. In the case of isolated trees, it is more than likely the undervalue because, since they are punctual elements, their presence in the transect line is difficult to be recorded.

Table 2. Extension and percentage of homegardens by countries.

Countries	With isolated trees		With hedgerows		With woody features	
	km <sup>2</sup>	%	km <sup>2</sup>	%	km <sup>2</sup>	%
Austria	0.00	0.00	0.00	0.00	0.00	0.00
Belgium	0.00	0.00	0.00	0.00	0.00	0.00
Bulgaria	0.00	0.00	115.65	44.44	115.65	44.44
Croatia	32.07	13.33	48.10	20.00	80.17	33.33
Cyprus	0.00	0.00	0.00	0.00	0.00	0.00
Czech Rep.	0.00	0.00	0.00	0.00	0.00	0.00
Denmark	0.00	0.00	0.00	0.00	0.00	0.00
Estonia	0.00	0.00	0.00	0.00	0.00	0.00
France	68.39	10.17	398.95	59.32	467.34	69.49
Germany	26.91	7.41	94.20	25.93	121.11	33.33
Greece	10.60	12.50	31.80	37.50	42.40	50.00
Hungary	0.00	0.00	0.00	0.00	0.00	0.00
Italy	83.88	13.56	272.62	44.07	356.51	57.63
Latvia	12.19	9.09	48.77	36.36	60.96	45.45
Lithuania	29.05	11.11	72.62	27.78	101.66	38.89
Netherlands	0.00	0.00	15.12	33.33	15.12	33.33
Poland	0.00	0.00	150.25	21.15	150.25	21.15
Portugal	39.47	14.29	128.26	46.43	167.73	60.71
Romania	28.61	3.13	414.83	45.31	443.43	48.44
Slovakia	0.00	0.00	0.00	0.00	0.00	0.00
Slovenia	0.00	0.00	0.00	0.00	0.00	0.00
Spain	29.75	8.82	158.68	47.06	188.43	55.88
Sweden	0.00	0.00	0.00	0.00	0.00	0.00
UK	9.86	8.33	59.18	50.00	69.04	58.33
EU-28	406.22	6.81	2119.94	35.53	2526.15	42.34

## Conclusion

LUCAS database, and specifically the transects, is a useful tool to evaluate the current extent and the evolution of Agroforestry homegardens. This tool could be used in the future by the European Commission to evaluate the impact of homegardens promotion on agroforestry policies.

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