LIFE **Lugo +**
Biodinámico

At the forefront of **sustainable** urbanism

Native hardwood forestry and energy crops in urban areas

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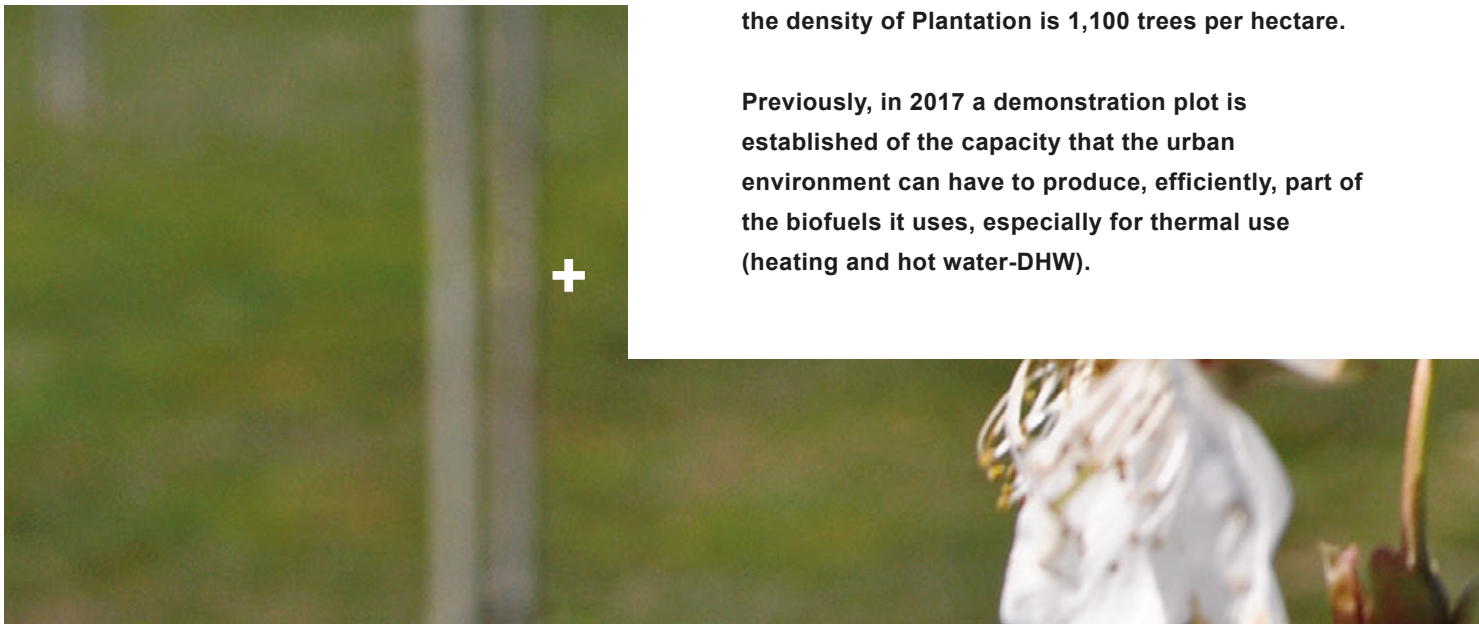
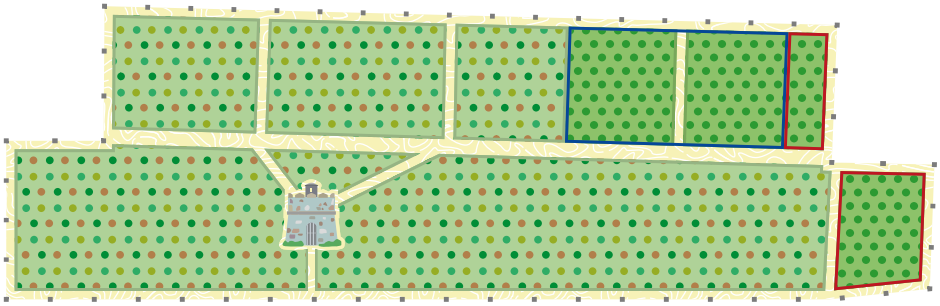
LIFE Lugo + Biodinámico is a European project promoted by the Concello de Lugo, pioneer in eco-sustainable planning in medium-sized cities, taking advantage of the use of natural resources and boosting the green economy. Among the measures to be developed are the construction of the first public building built with Galician wood, the design of the first multi-ecological neighbourhood in Spain and the elaboration of a catalogue of sustainable urban solutions, exportable to other European cities.

In addition, informative spaces will be created for the scientific community and society in general with plantations of tree species and autochthonous shrubs that demonstrate their potential for the development of sustainable urbanism.

In the industrial estate of As Gándaras (Lugo), a demonstration experience is established in 2018 of the possibilities of the forestry of four species of Galician autochthonous deciduous hardwoods, with quality wood production potential: oak (Quercus robur), cherry (Prunus avium), ash (Fraxinus excelsior) and maple (Acer pseudoplatanus). This experience occupies 4.1 hectares (41,000 m2) and the density of Plantation is 1,100 trees per hectare.

Previously, in 2017 a demonstration plot is established of the capacity that the urban environment can have to produce, efficiently, part of the biofuels it uses, especially for thermal use (heating and hot water-DHW).





Native hardwood forestry
(Oak, Cherry tree, Ash, Maple)

Energy crops
(Miscanthus, Populus)

Miscanthus x giganteus

Populus spp.

Urban native hardwood forestry

1. The species

The quality of the plant used will determine the subsequent success of the plantation.

A poor quality plant will increase the mortality rate of the plants and the growth of those that survive may be less. Deciduous hardwoods are planted when the plant is dormant (when the leaves fall to the ground), and are usually bare rooted.

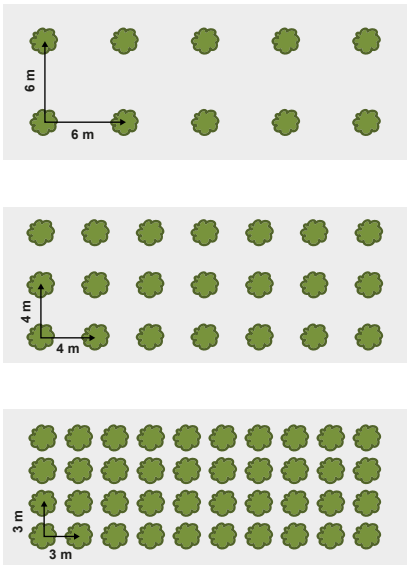
Origin of the plant used in As Gándaras.

SPECIES:	REGION OF ORIGIN:
Oak	Selected stand ES01-Galicia
Cherry	Galicia: Mountains-Inner Plains
Ash	Selection of trees plus Xunta de Galicia
Maple	Galicia: Mountains-Inner Plains

2. Planting Density

The initial planting density (number of plants per unit area) defines the initial investment and subsequent maintenance effort for the plantation. Thus, low initial densities decrease initial planting costs (fewer trees per area) but increase subsequent maintenance costs (clearing and pruning). Conversely, high initial densities mean a higher initial investment but are offset by lower subsequent maintenance requirements (clearing and pruning).

INITIAL PLANT DENSITY



In oak, cherry, ash and maple it is important to maintain high densities in the early years of planting to encourage lateral competition and the formation of straight shafts: hardwoods should be planted dense

3. Cultural care in the hardwoods

The key to the success of hardwood plantations is the achievement of a chain of interventions that allow their implementation in the plot. The links in the chain are: choice of genetic material - choice of plant type - clearing of the plot - soil preparation - planting - planting fertilisation - placement of stakes - control of vegetation competition - irrigation - replacement of dead plant.

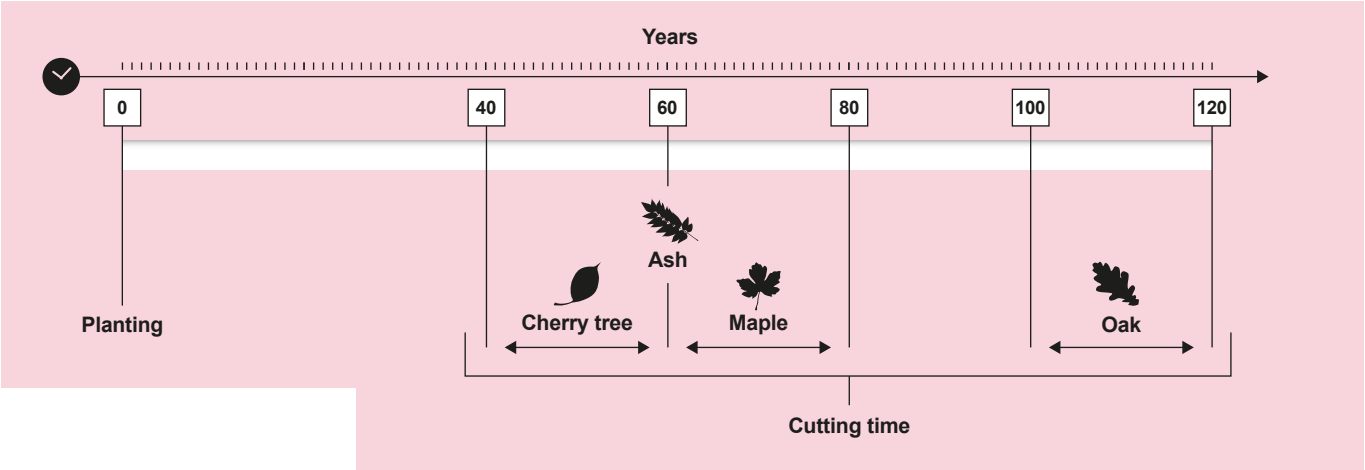
Some of these jobs must be repeated several times each year for at least the first 5 years. The installation of a hardwood plantation is therefore a complex objective that requires continuity in the work.

In the case of the As Gándaras plantation, the sequence of work was: installation of the fence - cultivation and re-growing of plants of the four species of Galician origin - transfer and nursery of surplus plant - clearing of the entire surface - preparation of 60x60x60 cm holes with additional topsoil - planting - installation of two 2 m stakes per plant - fertilisation with complex fertiliser - manual digging around the plants - mechanised clearing of the streets - manual watering - replacement of bushes - contribution of biomass ashes - installation of drip irrigation - additional clearing.

4. Forestry and forestry treatments

Forestry covers techniques applied to forest stands to obtain from them a continuous and sustainable production of goods and services.

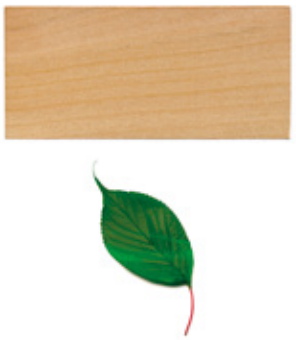
To obtain a quality wood, destined to produce veneer or board, the trees must reach a high height, with a straight shaft without branches or knots, of important diameter, with a cylindrical form and a reduced crown. This is achieved through the application of appropriate silviculture consisting of pruning, roughing and raking that allows quality wood to be obtained when the species reaches the cutting season (optimum age and size for the use of the species), which in cherry is 40-60 years, in ash 60 years, in maple 60 years and 80 years and in oak 100-120 years.



5. The wood

Oak

Hardness is the main characteristic of oak wood and it is therefore widely used in the manufacture of floors, furniture, windows and boat building.

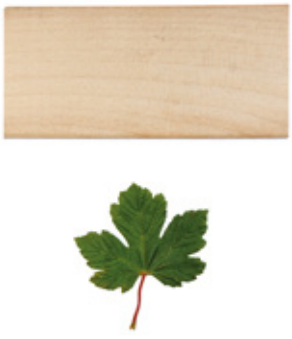


Cherry tree

Cherry wood is heavy, hard and polishable, easily sawn and reddish in colour. It is appreciated in luxury cabinetmaking, interior construction, turnery and marquetry.

Ash

Ash wood stands out for its flexibility, density and toughness. It is used in the manufacture of all kinds of objects that need to be bent and resistant, as well as floors, furniture and musical instruments.



Maple

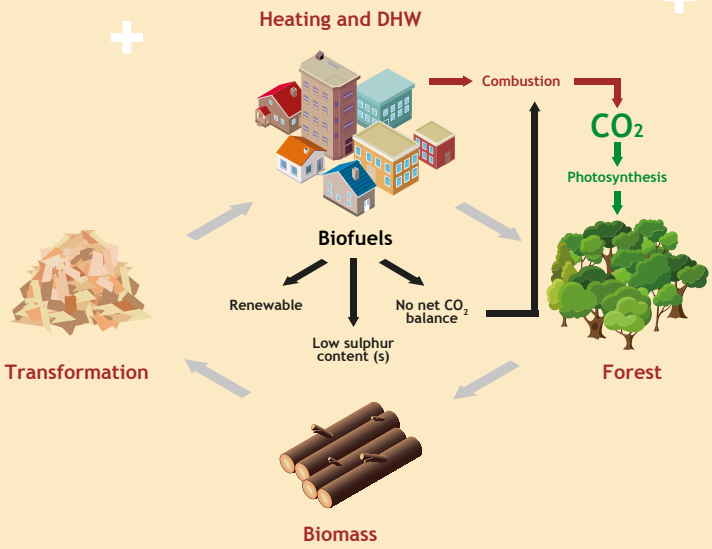
Maple wood is white, easy to work with, light, hard and has good mechanical resistance. It is highly valued in cabinetmaking, carpentry and turnery.

In addition to producing quality wood, a carbon-neutral product, these species provide firewood, mushrooms, contribute to reducing atmospheric CO_2 and increase biodiversity.

Energy crops in urban areas: highly energy-efficient biofuels

The production of renewable energy through sustainably managed energy crops can have the following environmental advantages that contribute to reducing the greenhouse effect:

- **Reduction of sulphur emissions.**
- **Reduction of particles in suspension (dust).**
- **Neutral CO_2 emissions without contributing to the greenhouse effect.**



Biomass production cycle

Miscanthus x giganteus

Fast growing perennial gramineae that can reach 4m in height. Non-invasive species as it does not produce viable seeds and its propagation is only vegetative.

Miscanthus x giganteus giganteus has low water and fertilization needs and a high capacity to fix CO_2.

Miscanthus x giganteus rhizome

Miscanthus x giganteus is used in the manufacture of paper, building materials, as a nitrogen fixer, in the recovery of media altered by pollutants, but its main use is the production of energy, having a calorific value of 17 MJ kg^{-1} – 20 MJ kg^{-1}.

Miscanthus x giganteus sprout

Populus spp.

Trees with straight boles and easy to reproduce by cuttings. Its rapid growth and high rate of transpiration make it one of the most effective tree species in fixing atmospheric carbon. Poplar plantations for energy purposes are made at high density in order to reduce the cost of planting and subsequent harvest. Poplar energy crops are harvested in vegetative stop, when the leaves have already fallen to the ground, with rotations of 2 to 4 years.

Poplar stake

Poplar sprout

The vegetal materials used:
In the case of *Miscanthus*, the Picoplant clone was used, consisting of rhizomes collected in the experimental plot of the USC of Meixonfrío. In the case of poplars, the Trichobel clones (*Populus trichocarpa*) and the Raspalje clone (*Populus deltoides x trichocarpa*), both resistant to acid soils.

Programme of actions

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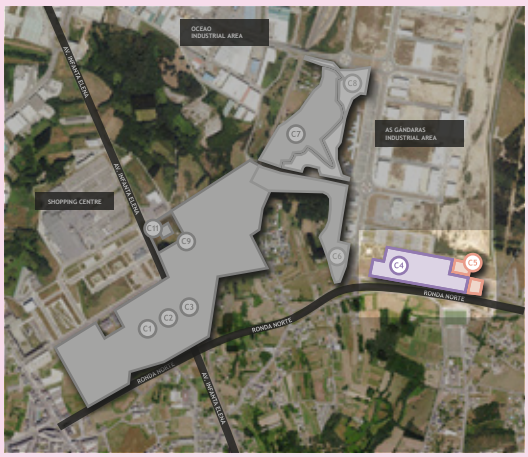

URBAN PLANNING ACTIONS	
C1	Urban Design Solutions Catalogue
C2	Strategic plan for ecological infrastructures: Special Biodynamic Plan
C3	Detailed planning of residential climate comfort zones (RCCZ)
DEMONSTRATIVE ACTIONS	
C4	Hardwoods
C5	Energy crops
C6	Souto. Chestnut trees of traditional varieties
C7	Restoration of a wetland - NALI (Natural Area of Local Interest)
C8	Arboretum
C9	Urban agriculture
C11	Impulso Verde Building

Impulsed by:

Concello de Lugo

Financed by:

Concello de Lugo

DEPUTACIÓN DE LUGO

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Project partners:

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