# Research and Development Protocol for Traditional Pollard Agroforestry in South-West France

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|---|---|
| **Project name** | AGFORWARD (613520) |
| **Work-package** | 3: Agroforestry for High Value Trees |
| **Specific group** | Bordure Trees in France |
| **Milestone** | Milestone 10 (3.3) Part of experimental protocol for WP3 |
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**Contents**




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## 1 Context

The AGFORWARD research project (January 2014-December 2017), funded by the European Commission, is promoting agroforestry practices in Europe that will advance sustainable rural development. The project has four objectives:

1. to understand the context and extent of agroforestry in Europe;
2. to identify, develop and field-test innovations (through participatory research) to improve the benefits and viability of agroforestry systems in Europe;
3. to evaluate innovative agroforestry designs and practices at a field-, farm- and landscape scale, and
4. to promote the wider adoption of appropriate agroforestry systems in Europe through policy development and dissemination.

This report contributes to the second objective. It contributes to the initial research and development protocol (Milestone 10 (3.3)) for the participative research and development network focused on the use of agroforestry in high value tree systems.

## 2 Background

In North-western France, pollarding is still a living practice linked to “bocage” landscapes, i.e. “traditional” hedgerows network on field boundaries (Bernand et al 2006). However pollards also exist in the South West of France. Large open-grown or pollarded trees occur at various densities in a mosaic of grazed grassland and woodland. However due to mechanisation and intensification of agriculture, trees have been progressively removed from grasslands and traditional agroforestry systems slowly disappeared. If pollards are to remain a part of such landscapes, an increased awareness of the importance of pollards is needed, and there is a need to combine the derivation of new products (e.g. wood pellets as a fuel or as animal bedding) while also obtaining a crop from the land underneath them (Read 2006).

## 3 Objective of protocol

The objectives of this protocol are:

- to produce quantitative information about branch biomass and volume production of pollarded ashes;
- to compare the branch biomass of trees in free growth in the field and trees competing for light in the hedge;
- to define allometric equations relating tree branch biomass with the trunk circumference at breast height.

This trial is being conducted by the Institute for Forest Development (IDF) in collaboration with the French Association of Agroforestry (AFAF) and the Pastoral Land Association of the town of Mont in the Hautes-Pyrénées.

## 4 System description

The trial will take place in a 3.6 ha "bocage" located at Mont in the department of Hautes-Pyrénées in South-West France. The agroforestry system is composed of traditional hedgerows of pollarded ashes (*Fraxinus excelsior* L.) orientated predominantly NNW to SSE) on rich grassland. Trees have a mean trunk circumference of 128 (± 33 SD) cm (n = 248) in the hedgerows (Figure 1) and 158 (± 32 SD) cm (n = 75) for isolated trees (Figure 2). Further details are given in Table 1.

Figure 1. Pollard ash hedgerow (Source: Philippe Van Lerberghe - April 2015)

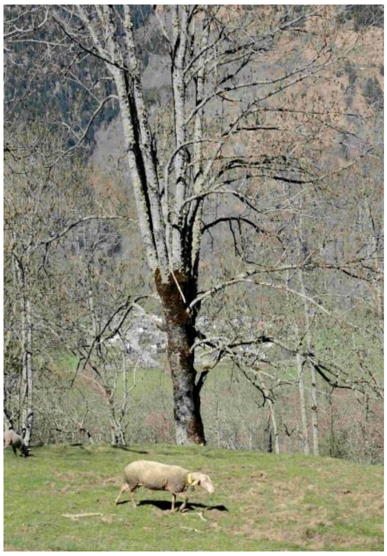

Figure 2. Isolated pollard ash (Source: Philippe Van Lerberghe - April 2015)

Table 1. Description of the site, with soil, tree, understorey and climate characteristics

| **Site characteristics** | |
|---|---|
| Area: | 3.6 ha |
| Co-ordinates: | 42°49'07.33"N - 0°25'27.97"E<br>Hautes-Pyrénées, South-West France |
| Site contact: | Philippe Van Lerberghe |
| Site contact email address | philippe.vanlerberghe@cnpf.fr |

| **Soil characteristics** | |
|---|---|
| Soil type | Brunisol (Baize 2009) |
| Soil depth | >70 cm |
| Soil texture (sand%, silt%, clay%) | Sandy clay loam |
| Additional soil characteristics | pH = 5 |

| **Tree characteristics** | | |
|---|---|---|
| System | Agroforestry system | Reference system* |
| Tree species | Ash (*Fraxinus excelsior* L.) | Ash (*Fraxinus excelsior* L.) |
| Additional details | Crown open-grown trees (lone trees in the grassland) | Trees in hedgerows |

| **Understorey characteristics** | | |
|---|---|---|
| System | Agroforestry system | Reference system* |
| Species | Grass | Grass |
| Coverage | Complete | Complete |

| **Climate data** | |
|---|---|
| Mean annual temperature | 6.01 - 7 °C |
| Mean annual precipitation | 751 - 825 mm |
| Details of data | Data (1961-90) from « SILVAE – Système d'Informations Localisées sur la Végétation, les Arbres et leur Environnement » 2015 |

## 5 Measurements

The protocol of data collection in the field and building tree volume and biomass allometric equations are based on work done in tropical Africa (Bauwens and Fayolle 2014; Picard et al 2012). The planned measurements to be taken are described in

Table 2. Letters [c], [l] and [f] respectively indicate that the variable is calculated, measured in the laboratory or measured in the field.

Table 2. List of measured and calculated tree variables

| Variable | Abbreviation and formula | Unit |
|---|---|---|
| **Tree** | | |
| [f] Reference circumference | $C_{ref}$ | m |
| [f] Reference circumference height | $H_{ref}$ | m |
| [f] Total height | $H_{tot}$ | m |
| [c] Total woody aerial biomass | $B_{tot} = B_{Sa} + B_{La} + B_{Ba}$ | kg |
| **Stump** | | |
| [f] Stump height | $H_S$ | m |
| [c] Stump surface | $S_S$ | $m^2$ |
| [c] Wet stump volume | $V_{Sw} = H_S \times S_S$ | $m^3$ |
| [l] Wet stump sample volume | $v_{Sw}$ | $m^3$ |
| [l] Wet stump sample biomass | $m_{Sw}$ | kg |
| [l] Dry stump sample biomass | $m_{Sd}$ | kg |
| [c] Infradensity of stump wood | $ID_S = m_{Sd}/v_{Sw}$ | Kg. $m^{-3}$ |
| [c] Water content of stump wood | $WC_S = (m_{Sw} - m_{Sd})/m_{Sw}$ | % |
| [c] Dry stump biomass | $B_{Sa} = V_{Sw} \times ID_S$ | kg |
| **Log** | | |
| [f] Length of piece$_i$ | $l_{pi}$ | m |
| [f] Wet biomass of piece$_i$ | $m_{pi}$ | kg |
| [f] Top diameter of piece$_i$ | $d_{ti}$ | m |
| [f] Butt diameter of piece$_i$ | $d_{bi}$ | m |
| [c] Log length | $L_L = \Sigma_i\, l_{pi}$ | m |
| [c] Volume of wet piece$_i$ | $v_{pi} = (\pi \times l_{pi}/12) \times (d_{ti}^2 + d_{bi}^2 + d_{ti} \times d_{bi})$ | $m^3$ |
| [c] Wet log volume (if cubing) | $V_{Lw} = \Sigma_i\, v_{pi}$ | $m^3$ |
| [c] Wet log biomass (if weighing) | $B_{Lw} = \Sigma_i\, m_{pi}$ | kg |
| [l] Wet log sample volume | $V_{Lw}$ | $m^3$ |
| [l] Dry log sample biomass | $m_{Ld}$ | kg |
| [c] Infradensity of log wood | $ID_L = m_{Ld}/V_{Lw}$ | Kg. $m^{-3}$ |
| [c] Water content of log wood | $WC_L = (m_{Lw} - m_{Ld})/m_{Lw}$ | % |
| [c] Dry log biomass (if cubing) | $B_{La} = V_{Lw} \times ID_L$ | kg |
| [c] Dry log biomass (if weighing) | $B_{La} = V_{Lw} \times (1 - WC_L)$ | kg |
| **Branches** | | |
| [f] Length of piece$_j$ | $l_{pj}$ | m |
| [f] Top diameter of piece$_j$ | $d_{tj}$ | m |
| [f] Butt diameter of piece$_j$ | $d_{bj}$ | m |
| [c] Volume of wet piece$_j$ | $v_{pj} = (\pi \times l_{pj}/12) \times (d_{tj}^2 + d_{bj}^2 + d_{tj} \times d_{bj})$ | $m^3$ |
| [c] Wet branches volume (if cubing) | $V_{cBw} = \Sigma_i\, v_{pj}$ | $m^3$ |
| [c] Wet branches biomass | $B_{Bw}$ | kg |
| [l] Wet branches sample volume | $v_{Bw}$ | $m^3$ |
| [l] Wet branches sample biomass | $m_{Bw}$ | kg |
| [l] Dry branches sample biomass | $m_{Bd}$ | kg |
| [c] Infradensity of branches wood | $ID_B = m_{Bd}/v_{Bw}$ | kg $m^{-3}$ |
| [c] Water content of branches wood | $WC_B = (m_{Bw} - m_{Bd})/m_{Bw}$ | % |
| [c] Dry branches biomass (if cubing) | $B_{cBa} = V_{cBw} \times ID_B$ | kg |
| [c] Dry branches biomass (if weighing) | $B_{wBa} = B_{wBw} \times (1 - WC_B)$ | kg |

## 6 Acknowledgements

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