# DO *PINUS RADIATA* PLANTATIONS ACT AS CARBON SINKS AT THE PLOT SCALE IN THE BASQUE COUNTRY?

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## OBJECTIVES

- FOREST PLANTATIONS MAY HAVE CONTRASTING BEHAVIOURS IN RELATION TO O.C ACCUMULATION DEPENDING ON:
  - INITIAL SOIL O.C. CONTENT
  - SOIL TYPE
  - CLIMATIC CONDITIONS
  - HARVEST INTENSITY
  - PLANTATION MANAGEMENT
- DIFFERENT SYTEMS OF PINUS RADIATA PLANTATION MANAGEMENT IN THE BASQUE COUNTRY MAY HAVE DIFFERENT EFFECTS ON O.C. STOCKS

## INTRODUCTION

- PROVIDE VALUES FOR O.C. STOCKS IN THE VARIOUS COMPARTMENTS OF *PINUS RADIATA* PLANTATIONS IN THE BASQUE COUNTRY
- MODEL LONG-TERM EVOLUTION OF O.C. STOCKS IN SOILS


## MATERIALS AND METHODS

- DATA FROM 23 PLANTATIONS OF VARIOUS AGES AND SITE QUALITIES IN THE LEA-ARTIBAI REGION (BIZKAIA):
  - TREE DENSITY, HEIGHT, AND DIAMETER IN A 200 $m^2$ PLOT
  - ESTIMATES OF TREE BIOMASS FOLLOWING MADGWICK (1985) AND BEETS & POLLOCK (1987)
  - FOUR 0.15 $m^2$ QUADRATS PER PLOT TO SAMPLE BIOMASS OF UNDERGROWTH AND MASS OF ORGANIC SOIL HORIZONS
  - SOIL PIT EXCAVATED TO GEOLOGICAL MATERIAL OR A MAXIMUM DEPTH OF 125 cm TO OBTAIN:
    - UNDISTURBED SAMPLES FOR BULK DENSITY OF SOIL HORIZONS
    - DISTURBED SAMPLES FOR ORGANIC CARBON ANALYSIS
- MODELLING THE LONG-TERM EVOLUTION OF SOIL O.C. CONTENT IN PLANTATIONS WITH THE SCUAF MODEL BASED ON:
  - NPP DATA OBTAINED WITH THE MODEL OF RAISON & MYERS (1992)
  - PREVIOUS WORK IN THE REGION (OLARIETA et al., 2006, 2007)

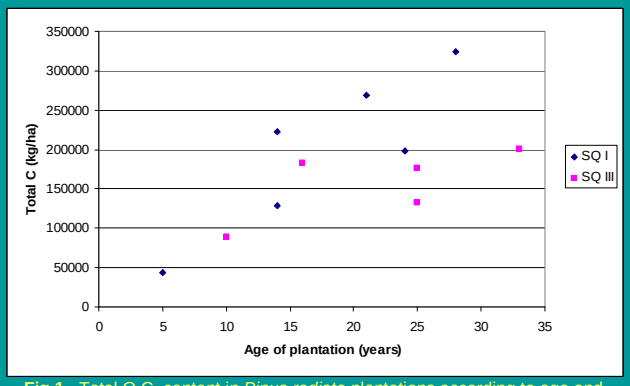


**Fig 1.** Total O.C. content in *Pinus radiata* plantations according to age and site quality
(SQI: high productivity; SQIII: low productivity)

## RESULTS AND DISCUSSION

- TOTAL O.C. CONTENT: 44-324 $Mg.ha^{-1}$
- CONTENT INCREASES WITH PLANTATION AGE AND IS SMALLER IN SITES OF POORER QUALITY (Fig. 1)
- DISTRIBUTION OF TOTAL O.C. IN COMPARTMENTS (Fig. 2):
  - TREES ABOVE-GROUND: 2-54%
  - UNDERGROWTH: <4%
  - SOIL ORGANIC HORIZONS: 2-23%
  - SOIL MINERAL HORIZONS: 41-87%
- MINERAL SOIL HORIZONS BELOW 23 cm-DEPTH ACCUMULATE:
  - 17-58% OF TOTAL O.C. IN SOILS
  - 14-48% OF TOTAL O.C. IN PLANTATIONS
- O.C. CONTENT BELOW 25 cm- DEPTH IS SPECIALLY IMPORTANT IN
  - FLUVISOLS (P.3/5)
  - ANDISOLS (P.9/1)
- IN 33 YEAR-ROTATIONS WITH PRESENT HARVEST INTENSITY THERE IS:
  - A NET ACCUMULATION OF 8-10 Mg $C.ha^{-1}$ IF MANAGED BY SLASH-BURN
  - A NET LOSS OF 15-40% OF THE O.C. STOCK WITH MECHANICAL SITE PREPARATION

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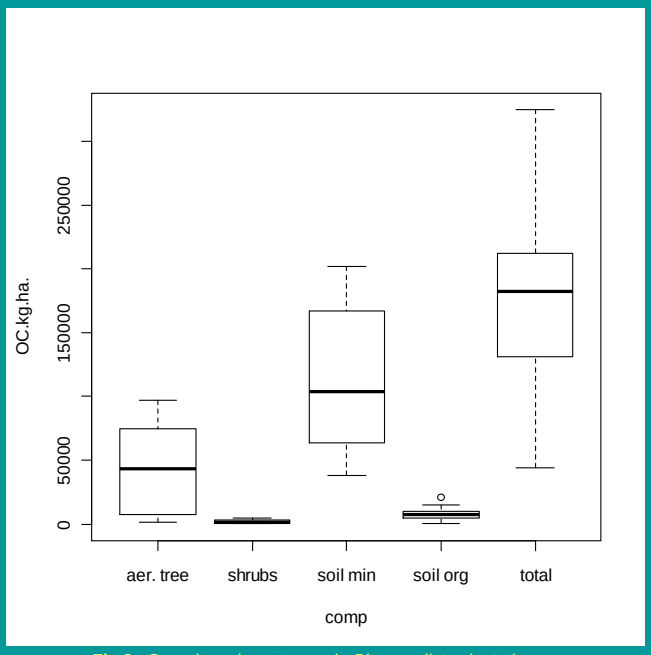


**Fig 2.** Organic carbon storage in *Pinus radiata* plantations
(aer. tree: tree above-ground; soil min: mineral soil; soil org: soil organic horizons; total: total OC in the plantation including roots)

## CONCLUSIONS

- MINERAL SOIL HORIZONS CONTAIN THE BIGGEST O.C. STOCK IN PINUS RADIATA PLANTATIONS IN THE BASQUE COUNTRY, WITH SIGNIFICANT AMOUNTS OCCURRING AT SOIL DEPTHS BELOW 25 cm
- PLANTATIONS MANAGED WITH MECHANICAL SITE PREPARATION TECHNIQUES SUFFER A NET LOSS OF 15-40% OF THEIR O.C. STOCK THROUGHOUT A ROTATION