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To whom it may concern:

Letter in support of *Pinus pinea* project proposal: Dr Luis Fontes

The proposal to establish an irrigation and fertilization trial on *Pinus pinea* (Stone pine) in Portugal is timely and appropriate. The species is an important tree crop in the Iberian peninsula and, it appears, there has been little or no work on its physiology and little detailed work on the factors that affect seed yield. The proposed project will obtain detailed data from the irrigation and fertilization trial as well as utilising existing stands and permanent plot measurements to improve extant models of tree growth. The whole project is built around the objective of calibration and validation of a process-based model of growth and seed production by *P. Pinea*.

The project is conceptually and scientifically sound and should be supported. Intensively monitored and measured irrigation and fertilization trials have, in the last 25 years, led to great progress in understanding tree physiology, and modelling tree growth using process-based models. This type of experimentation usually subjects trees to a much wider range of growing conditions than would normally be expected under unmodified natural conditions. These result in a wide range of responses, which allow the relationships between environmental factors and tree growth and productivity to be clearly established. These relationships are essential for the development of process-based models. The use of this approach by Dr Fontes should lead to insights into the growth of *P. pinea* that would be very difficult to obtain any other way.

The modelling approach underlying the project provides a framework within which the measurements made will be analysed. A process-based model essentially constitutes a hypothesis – or series of hypotheses – about the way trees grow and the mechanisms controlling growth. Therefore the use of such a model ensures that the project as a whole is scientifically sound; the hypotheses involved are tested and parameterisation of the model – assuming the hypotheses are not invalidated – provides clear, quantitative statements about the growth of the trees. In the case of this project and model, there is particular interest in the partitioning of carbohydrates to the seeds, and the effect of growth conditions on that process.

The model to be used as the framework for the project (3-PG; Landsberg and Waring, 1997*) has been widely and successfully used and tested in relation to a large number of tree species. This is the first time it will be parameterized for a tree where the major economic yield is seed. The development of the model needed for this purpose will increase its value and flexibility.

I have worked with Dr Fontes on a previous project and am confident that he will carry out this project efficiently and effectively, and that it will make a significant

contribution to our understanding of tree physiology and our ability to model tree growth and the production of seeds.

With regard to my own background: I have 40 years of experience in tree physiology (see my books: 'Physiological ecology of forest production' (Acad. Press, 1986) and (with S.T. Gower) 'Applications of physiological ecology to forest production' (Acad. Press, 1997), have held senior research management positions and positions in universities. Details can be provided on request. A signed hard copy of this letter can also be provided if required.

I repeat my recommendation that this project should be supported.

Yours faithfully

(Dr) J J Landsberg

* Landsberg, J.J. and Waring, R.H. (1997) A generalised model of forest productivity using simplified concepts of radiation use efficiency, carbon balance and partitioning. *For. Ecol. and Managt.* 95, 209 - 228.