WildFood

PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

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WP2: PILOT PROJECTS FACT SHEETS (4/8)

Quantifying pinecone production, using sensors and drones

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Location: Girona, Catalonia, Spain

Context:

The edible pine nut of the stone pine (*Pinus pinea* L.) constitutes, due to its high nutritional value, excellent flavor and connection to the Mediterranean diet, one of the most emblematic WFP's of the Mediterranean forests, with an important impact on the world market (Calama et al., 2020). However, cone production is highly variable between trees and years, making it difficult to predict annual production and consequently to organize the pinecones harvesting, from which the pine nuts will be obtained. In this sense, it is very common that forest owners (private or public) do not know the production of their forests or plantations and are not able to organize the correct collection of cones in time and space, with proper harvesting techniques, avoiding collection outside the harvest season or pinecones robberies.

Currently, pinecone production is quantified visually before the collection startwith a subjective estimate of pinecones number in a selection of trees within the forest and, after that, the mean tree production is extrapolated to an estimation of the full productivity of the forest. Visual evaluation of cone production is complex, both in plantations and in forest stands, where in addition mobility and observation conditions are complicated. In this context, the use of cone production models with remote sensing has incalculable potential. Studies on cone production's estimations in stone pine stands with sensors are scarce (Schneider et al., 2020). Thus, it is necessary to examine innovative techniques and to implement new experiences to analyse the capabilities and drawbacks of using remote sensing techniques to evaluate cone production in stone pine stands at tree level.

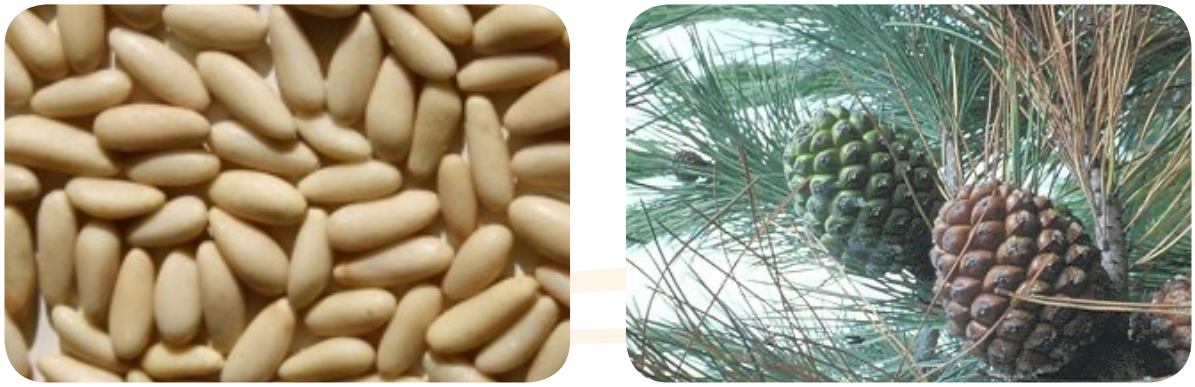

Figure 1. Edible pine nuts and pinecones from stone pine (*Pinus pinea* L.).

Objective:

The objective is to evaluate pine cone production in sufficient time to organize the correct collection of cones in time and space, thus increasing the efficiency of a key phase of the pinecones harvesting as it is the evaluation of annual production.

In order to increase the efficiency and objectivity of pine cone production, one possible option for improvement is the use of remote sensors to estimate pine productivity for a sufficient number of trees in a systematic way for the same extrapolation or even to partially count the pinecones directly and estimate productivity for every tree in a whole forest. To achieve this objective, the development and evaluation of the methodology by using remote sensors will be carried out on pilot plots.

Therefore, the overall objective is to establish and provide new technologies and protocols for directly quantifying pinecone production, using drones and multispectral sensors, to develop more efficient and precise evaluation of pine cones than the current visual pinecone estimation.

Expected Results:

New technologies and protocols for more efficient and precise evaluation of annual pinecone production, using drones and multispectral sensors.

The correct estimation of pinecone production, both, at tree and stand level, is crucial in pine nut value chain. On the one hand, pine forests owners (private or public) can know the potential value of the annual harvesting, which allows them to negotiate the conditions for the sale of the pine cones or the subcontracting of the collection . On the other hand, harvesting companies can know more precisely the total production and proximately value of a specific forest area and to plan the most profitable harvesting method (estimate needs for mobilizing machinery and human resources for a campaign). Also, processing companies will be able to plan the processing, commercialization and marketing campaigns with less uncertainty.

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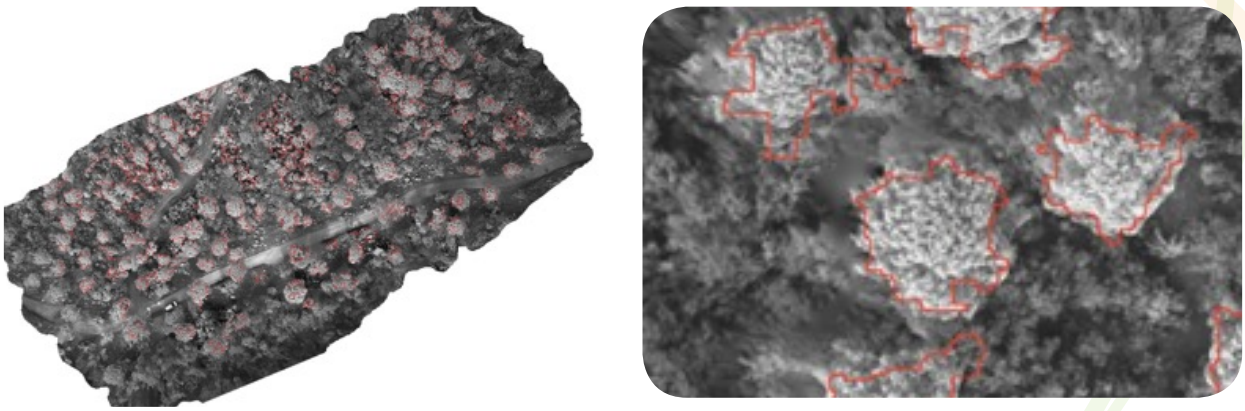

Figure 2. Edible pine nuts and pinecones from stone pine (*Pinus pinea* L.).

Figure 3. Example of automatic segmentation of *Pinus pinea* pinecones.

References:

Calama, R., Gordo, J., Montero, G., Pique, M., García-Nieto, O., Pastor, A., Herrero, J., Pardos, M., Mutke, S., 2020. Capitulo 5. El piñón mediterráneo. Los productos forestales no madereros en España: del monte a la industria, Monografías INIA: Serie Forestal Nº 31, Publisher: INIA, pp.131-181

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