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Identifying suitable thinning areas in pure stands of Scots and maritime pine through Sentinel-2 and LiDAR

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INTRODUCTION & AIM

The Scots pine (*Pinus sylvestris Linneo*) and maritime pine (*Pinus pinaster Aiton*) forests in Soria, Spain, are vital to the local economy. Thinning for regeneration is crucial for both silviculture and wildfire prevention but incurs costs for forest owners. High-precision technologies like LiDAR and satellite imagery offer an opportunity to automate the identification of areas suitable for thinning, reducing these costs.

Figure 1. Thinning area of maritime pine.

Can LiDAR and satellite imagery technologies be used to identify suitable thinning areas in pure stands of Scots and maritime pine in Soria (Spain)?

METHOD

Thinning conditions were defined as pure stands of Scots or maritime pines where at least 80% of trees range between 0 to 5 meters' height or between 5 to 9 meters' height with a density above 1000 trees/hectare. Given this, 21 plots of Scots pine and 64 of maritime pine with this conditions were selected from National Forest Inventory (2019) for being used as training points. Sentinel-2 (2021) and LiDAR (2009) variables were used as independent variables to create an automatic classification model using the random forest algorithm. Finally, the model was applied on the area of the Spanish Forest Map (2020-2021) established as monospecific stands of Scots pine and maritime pine (Fig.2).

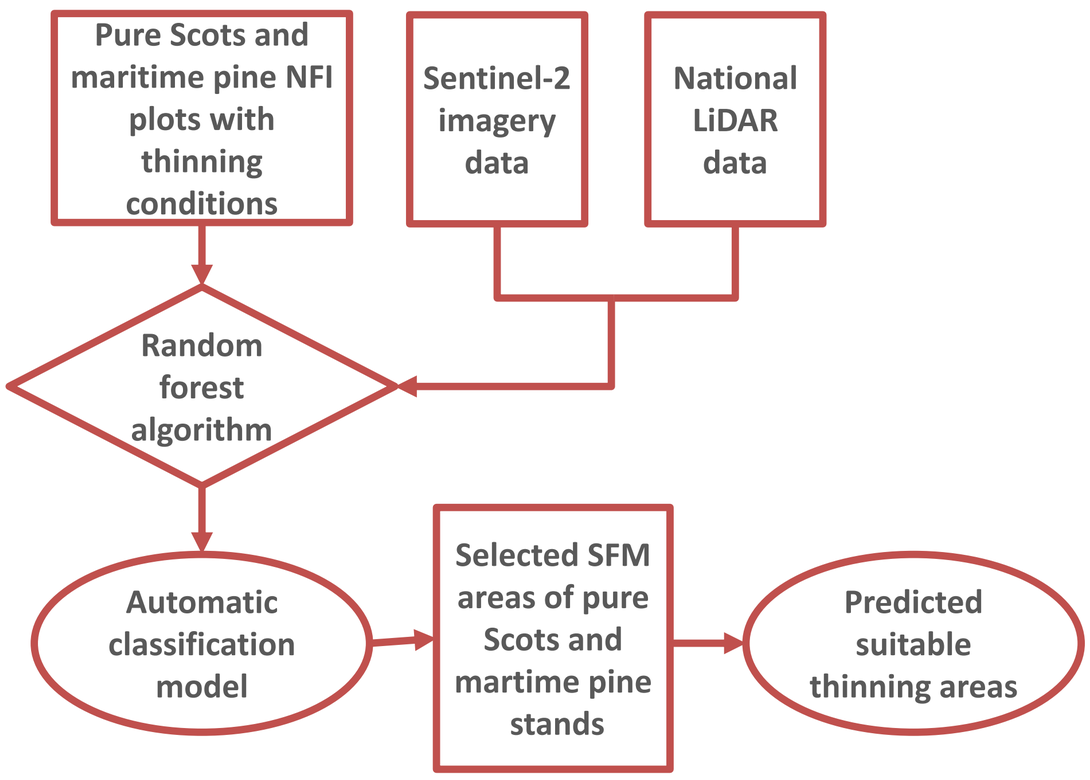

Figure 2. Workflow of the applied methodology.

RESULTS & DISCUSSION

An updated map of the areas suitable for thinning in the province of Soria was obtained (Fig.3 and 4). The confusion matrix of the predictive model showed a producer's and user's accuracy of 62% and 76% respectively for the Scots pine (Fig.5) and of 66% and 75% respectively for the maritime pine (Fig.6).

Figure 3. Example of a thinning area predicted for Scots pine.

Figure 4. Example of a thinning area predicted for maritime pine.

		Prediction		Producer's accuracy
		Thinning	Non-thinning	
Real	Thinning	13	8	0.62
	Non-thinning	4	522	
	User's accuracy	0.76		

Figure 5. Confusion matrix of the predictive model for Scots pine.

		Prediction		Producer's accuracy
		Thinning	Non-thinning	
Real	Thinning	42	22	0.66
	Non-thinning	14	403	
	User's accuracy	0.75		

Figure 6. Confusion matrix of the predictive model for maritime pine.

CONCLUSION

This map can be considered as a tool to help locate thinning areas and could assist companies in planning fieldwork. However, its accuracy needs improvement, likely through using a larger training data, as random forest algorithm tends to perform better with more data.

FUTURE WORK / REFERENCES

Further work is needed to improve the model's reliability, particularly in terms of Producer's accuracy, to reduce the number of areas incorrectly predicted as thinning when they are actually non-thinning.