Effect of topsoil removal and plant material transfer on vegetation development in created Mediterranean meso-xeric grasslands

Question
Can plant material transfer combined with topsoil removal be an efficient method of restoring Mediterranean meso-xeric grassland plant communities? Does increasing topsoil removal depth increase the success of plant material transfer establishment?

Location
The Camargue, Rhône delta, France.

Methods
A small-scale restoration experiment involving Mediterranean meso-xeric grasslands was conducted in a former rice field area. During 3 yr, plant species richness and composition were compared on permanent plots subject to the following four treatments: 5 cm topsoil removal, 20 cm topsoil removal, 5 cm topsoil removal with plant material transfer, and 20 cm topsoil removal with plant material transfer. Additionally, the seed bank at 0- to 5-cm deep, at 5- to 20-cm deep and at 20- to 40-cm deep were studied in order to evaluate the effect of topsoil removal.

Results
After 4 mo, species richness, number of target species and similarity to the reference Mediterranean meso-xeric grassland significantly increased with plant material transfer relative to the no transfer treatment (topsoil removal without transfer). However, we found no significant difference in plant species number between the two depths of topsoil removal. This can be explained by the absence of any variation in soil seed bank between 5 cm and 20 cm. The species richness and number of target species decreased significantly in transfer treatment between the first and the second monitoring. Despite this general decrease in the first year, the plant material transfer treatment showed significantly more target species than the no transfer treatment and a higher similarity to the Mediterranean meso-xeric grassland.

Conclusion
In order to restore a Mediterranean meso-xeric grassland plant community, plant material transfer combined with topsoil removal appears to be a relevant method. Removing 5 cm of topsoil eliminates half of the density of the undesired seed bank in a former rice field. However, the ability of target species to establish and persist in restored vegetation communities will require good management. Conditions with low competition in early stages of succession seem to be essential for transferred species to persist, and appropriately timed grazing and adequate stocking rates will be needed to limit the negative effects of competition.

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