Light-weight mechanical tools for site preparation in planted or naturally regenerated forest stands

(1) INRA SCIENCE & IMPACT (2) AgroParisTech (3) Office National des Forêts (4) FCBA INSTITUT TECHNOLOGIQUE (5) Société Forestière Groupe Caisse des Dépôts (6) ARAA Association pour la Relance Agronomique en Alsace

C. Collet [1,2], **L. Wehrlen** [1,2], **F. Duez** [1,2], **M. Dassot** [1,2], **G. Gibaud** [3], **J. Piat** [3], **C. Richter** [3], **Q. Girard** [3], **E. Ulrich** [3], **J.Y. Fraysse** [4], **A. Berthelot** [4], **C. Sédilot-Gasmi** [5], **R. Koller** [6], **M. Bakker** [1], **L. Augusto** [1]

For more information : ***collet@nancy.inra.fr***

Mechanical Site Preparation

Aim of MSP: Improve soil conditions and control vegetation

Alternative MSP methods based on light-weight machinery have been developped to enhance forest regeneration while limiting environmental impacts.

A range of tools adapted to different soil and vegetation constraints is presently available.

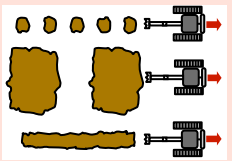
Reduced environmental impact obtained by:

- **Low machine weight :** 2.5 to 6 tons
- Machine mounted on **rubber tracks**
- **Localised treatment patterns :**

Individual patches (1m² to 3m²) :

Large patches (2x2m² to 10x10m²) :

Strips (2 to 4m wide) :

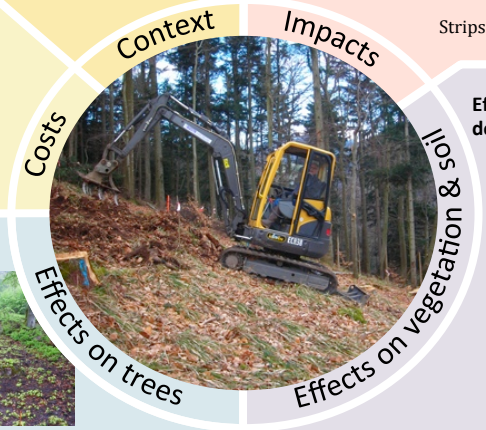


Indicative cost (in France in 2014)

Implementation cost for MFSS or DS:

Individual patches: 0.80 to 1.10 €/patch
Large patches (5x5m²): 6.50 to 10 €/patch
Strips: 0.85 to 1.55 €/ linear metre

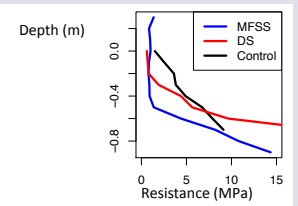
No additional cost due to cleaning operations for at least 2 to 4 years.



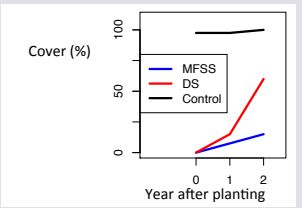
Effects in a waterlogged and compacted soil dominated by bracken – grass mixtures

(*Pteridium aquilinum* and *Molinia caerulea*)

Resistance to root penetration is reduced by site preparation (1 year after treatment) :



Global vegetation cover is reduced 2 to 4 years after treatment:

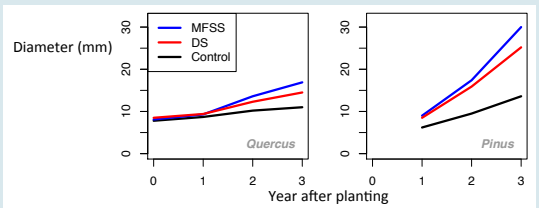


Natural regeneration

Seedling density is increased: 12, 12 and 2 seedlings per m² in DS, H and Control respectively, one year after treatment in low-mountain mixed stands.

Plantation

Seedling growth is enhanced: 3 years after planting, diameter is higher in DS (+86 and +37%) and MFSS (+121 and +44%) than in Control in *Pinus nigra* and *Quercus petraea*, respectively, in a bracken-dominated dry site.



Name	Tool	Site constraints	Work performed	Site preparation
Multifunction sub-soiler (MFSS) Sous soleur multifonction®		• Compacted soil • Waterlogged or dry soil	• Decompacts soil down to 60 cm • Creates a 20-cm-high mound • Removes vegetation	
Deep scarifier (DS) Scarificateur réversible®		• Vegetation with deep roots (e.g. *Pteridium aquilinum*)	• Extracts root systems and vegetation • Fractures soil down to 60 cm	
Herb scalper (HS) Razherb®		• Dense grass cover (e.g. *Molinia caerulea*)	• Removes the top 5cm soil layer • Removes above ground vegetation	
Hoe (H) Pioche-Herse®		• Small statured vegetation (e.g. *Vaccinium myrtillus*)	• Hoes soil down to 25 cm • Removes vegetation