



### **Benchmarking Applied to Forest Cockchafer Ecology to Ensure Regeneration in a Context of Forest Health Crises**

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**Context** — For several years the populations of forest cockchafer have been in the epidemic phase in large forest areas in Picardy and Alsace; they cause significant damage in regeneration and weaken adult trees. Faced with this massive damage affecting all production species, foresters have been destitute and have triggered a crisis since 2014 in Alsace and 2016 in Compiègne.

**Objectives** — The project aimed to capitalize on the knowledge, know-how and research for solutions implemented in France and in various European countries where forest areas are also confronted with swellings of cockchafer and associated damage. The objective was to isolate unsuccessful experiences, identify the technical options to be tested and their degree of maturity with regard to the work carried out by the various partners.

**Approach** — We conducted an audit with the various European research and forest management organizations to identify (i) those who have already been confronted with the problems of forest cockchafer swarms and (ii) the work they have been able to carry out in search of operational solutions for plantation or natural regeneration. We organized an exchange workshop with the European partners identified during the audit, in order to present the situations and work carried out, and collectively reflect on short-term operational solutions as well as research issues.

**Key results** —

- Besides France, the countries strongly affected by the swarms of forest cockchafer are Germany, Poland and Hungary, for decades; the impacted areas amount to tens of thousands of ha.
- The damage rates on infested plots are close to 100% (death of all young trees), in line with the infestation rates above the critical threshold of 2 larvae L3/ m<sup>2</sup>.

- Although chemical treatment solutions exist, they remain expensive, complex to implement and regulatory changes - which follow a general request from the public - tend to prohibit their use in most European countries.
- Solutions based on forest cover management and / or soil preparation have not shown their effectiveness.
- Experiments carried out in Poland confirm the strong appetite of the larvae for the roots of sessile and pedunculate oaks and of Beech, highlight molecules derived from agricultural plants (turnip, rapeseed, buckwheat) which would have a biocidal effect on young larvae (less than a year) and identify woody species unfavourable for adult reproduction.

**Main conclusions including key points of discussion** — The general biology of the cockchafer is well described but the elements of ecology remain incomplete, notably on its habitat. A precise and quantified knowledge of the determinants of the presence and abundance of populations is a prerequisite for the identification of environmental management strategies to limit these outbreaks. The issue of the interactions between the impacts of red and roe deer on the understorey and the proliferation of cockchafer remains unresolved.

To date, no technical solution is effective to eradicate the populations or limit their damage. Some results point to possibilities for biological control but are not yet mature enough to be deployed on a large scale. More generally, it is the monitoring and detection of chafer damage that is necessary in order to adapt forest management strategies to this biotic constraint by limiting unnecessary investments for natural or artificial regeneration, and by anticipating harvests of adult trees before depreciation of timber.

#### **Future perspectives** —

This work has enabled the NFB to consolidate the content of an aid guide to adaptive forest management in the context of the beetle outbreak. The exchanges made it possible to identify two areas of investigation. The first relies on the development of preventive and curative techniques based on the use of natural allelopathic compounds and biotechnologies (parasitology and virology). The second is based on the implementation of adaptive management strategies by foresters; this implies an acculturation of foresters at risk, the implementation of damage monitoring procedures and the adoption of more agile working methods.

#### **Valorisation** —

Organisation d'un workshop européen associant gestionnaires et chercheurs forestiers (du 2 au 4 octobre 2018). Programme fourni en annexe 1.

Cours J. (2019) Etude de la niche écologique du hanneton forestier (*Melolontha hippocastani* Fabr. 1801) dans les forêts des Vosges du Nord - Study of ecological niche of forest cockchafer (*Melolontha hippocastani* Fabr. 1801) in Northern Vosges forests. Rapport diplômant d'études AgroParisTech. 215p. + annexes.

Dossier spécial dans la revue technique « les Rendez-Vous Techniques de l'ONF » 4 articles restituant le contenu et les échanges du workshop (publication en cours d'édition, à paraître en 2020)

1. Nageleisen LM, Cours J. Biologie des hannetons: bilan des connaissances.
2. Touffait R., Roussel M., Donze B., Sukovata L., Delb H., Ulrich E. Situation des forêts européennes vis-à-vis du hanneton (*Melolontha spp.*) : les impacts sur les peuplements et les impasses en matière de gestion forestière.
3. Cours J., Touffait R. Ecologie de *Melolontha spp.*, bilan des connaissances.
4. Touffait R., Cours J., Boulanger V. Recommandations pratiques à destination des gestionnaires et perspectives de R&D.

Office national des forêts, 2019, « Stratégies de gestion adaptative des coupes et des travaux dans les forêts infestées par les hannetons », guide technique ref. 9200-18-GUI-SAM-076. 51p.