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# **The science behind the ban: the outstanding impact of ecotoxicological research on the regulation of neonicotinoids**

## **Abstract**

The restrictions and bans imposed on insecticides of the neonicotinoid group in Europe were legitimized by emerging knowledge about their impact on the health of bee populations. That such knowledge was articulated and acted upon in the regulatory space is puzzling, given the standard forms of regulatory science, and the ways in which scientific knowledge is used in this very space. This short article reviews research in social science about regulation and regulatory knowledge, to help understand how research on bee decline opened the possibility of wide regulatory restrictions on neonicotinoids.

## **Highlights**

- The regulation of pesticides generally operates on limited and standard regulatory science.
- The general restrictions on neonicotinoids adopted in the 2010s disprove this science-policy relationship.
- A diversity of scientists not normally involved in regulatory proceedings contributed.
- They coalesced with and helped critical policy actors gain influence in the regulatory space.

## Introduction

Neonicotinoids (neonics, hereafter) started to be introduced in agriculture at the beginning of the 1990s. In the span of thirty years, these substances shifted from one of the most widely diffused new class of pesticides and a proclaimed agrochemical innovation, to a target of public regulation. Indeed, in 2013 and 2016 respectively, the European Commission and the French government restricted the use of several substances pertaining to the chemical category of neonicotinoids at once. The European Union Regulation 485/2013 restricted the use of clothianidin, thiamethoxam and imidacloprid, while the French biodiversity law of 2016 banned these three substances, as well as acetamiprid and thiacloprid, effective in 2018<sup>1</sup>.

Rarely have *families* of substances been regulated as such. In the past, when several substances of the same family proved problematic, their withdrawal took place substance after substance over a long period of time. Such was the case of organochlorine pesticides (DDT, mirex, dieldrin, lindane...)[1- 4]. In the case of neonics, after a series of controversies surrounding various individual substances one after the other – imidacloprid first in the second half of the 1990s, followed by clothianidin or thiamotexam – the generic property of these substances started to justify regulatory action. The European Commission and French law-makers, respectively, have dealt with the “*fact*” that “*neonics affect the central nervous system of insects, leading to eventual paralysis and death.*”<sup>2</sup> or that they have a common “*mode of action*”. This biological and ecotoxicological property of neonics has justified blanket regulatory action.

What specifically interests me in this review is how knowledge claims constituting neonics as a hazardous class of substances, emerged and was acted upon in the space of pesticide regulation. The admission of research knowledge establishing the mode of action and its negative effects on bees was indeed as unlikely as the overall ban in which it resulted. The paper reviews the condition in which it took place, to advance our understanding of how research knowledge, as opposed to regulatory science, is encoded in the regulatory space — or not.

## Knowledge in the regulatory space

Regulation is a form of governance that takes place within the boundaries of a social space [5]. It is an iterative activity of law implementation taking place among interdependent actors [6-8]: those whose activity and practice are being regulated (in the case of pesticides, agrochemical firms that manufacture neonics, as well as the economic actors who sell pesticides, and those who use them); the network of regulatory bureaucracies that evaluate and license substances across Europe; as well as a number of “regulatory intermediaries” [9, 10] such as scientific experts (who review data about pesticides and their impacts on behalf of regulators) and technical committees who establish the standards against which pesticides are evaluated [11, 12].

Knowledge is a key tool of governance in this space. Actors of the regulatory space compete to articulate what may be called regulatory knowledge, or the ensemble of experiences, information, data, simulations – knowledge claims in general – that constitute something as an object of regulation [13, 14]. Nearly all of the actors of the regulatory space engage in the production or shaping of regulatory knowledge. Firms test substances, in laboratories and in

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<sup>1</sup> This ban has just been reversed: a law was recently passed to allow sugar beet growers to use neonicotinoids to treat the jaundice virus.

<sup>2</sup> [https://ec.europa.eu/food/plant/pesticides/approval\\_active\\_substances/approval\\_renewal/neonicotinoids\\_en](https://ec.europa.eu/food/plant/pesticides/approval_active_substances/approval_renewal/neonicotinoids_en), consulted 19 October 2020.

fields, and share the result of their studies with the experts and regulators, so that the latter make an informed decision about the substance. They also try to intervene on what's coming out of research on substances, to promote certain claims, invisibilize others and hush up regulatory initiatives — as established by multiple publications looking at the strategic production of ignorance [15-20]. Regulatory bureaucracies often harbor laboratories that test, detect, monitor substances and their effects in various agronomic conditions. They may also contract with private laboratories to perform more studies. They do so to complement, and sometimes counter industrial knowledge, to arrive at a state of knowledge based on which they are comfortable making a decision. Finally, the scientists who review the applications in the name of regulators, work with the studies provided by the firms that request the marketing authorization or re-authorization. They may also introduce knowledge stemming from public research projects that they perform or know of, and that are relevant to the consideration of the substance being reviewed.

### **The limits of testing and of pesticide regulation**

Knowledge about the sub-lethal effects of pesticides on bees is not routinely produced in the pesticide regulatory space. Standard regulatory knowledge has three characteristics.

First, numerous studies in sociology and history of chemicals regulation show that knowledge in this space is predominantly about experimentally-captured, acute toxicity issues [21-25]. Indeed, this is what the space and its actors are geared to produce, and believe important to capture risks. Second, this regulatory knowledge is a combination of safety knowledge and of economic or use knowledge. Agronomic understandings of the efficacy and practical value of substances for various cultures matter a great deal, and are put in balance with knowledge of the hazards of the substance, to forge decisions. Third, standard regulatory knowledge of chemicals is substance-centered. Its object is the substance and its singular properties. The entire apparatus for producing regulatory knowledge is indeed reductive, centered on this object and its singularities [26] – a reflection of the substance-centric nature of the laws regulating these industries and of compromises struck for the regulation of innovation.

Acute risks, risk/benefit balancing, substance-centric thinking define what Dedieu calls the invisible cognitive architecture of the regulatory space [27]. This architecture has organizational origins: standardized knowledge helps select actors who can participate in decision-making (drawing a boundary around those who are literate in this knowledge, limiting supervision by principals or other audiences such as public interest groups), and make coordinated decision-making more routine. This architecture also has ideological origins (shared preference in this space for agrochemical innovation, leading to limited investigations of the risk), and political-economy causes as well: economic interests have the capacity to create a knowledge order, too [28].

All of this means that regulatory knowledge covering groups of substances and their joint impact on the environment and the overall fate of species, has little chance of being produced in a normally-configured regulatory space [29, 30]. Concretely speaking, tests are not required from manufacturers to prove or disprove the existence of chronic toxicity for insects, mammals or humans, or time-distant, indirect causal relationships between exposure to the pesticide and harm, while required regulatory tests are incapable of picking up these effects [31]. The scientists who review the dossier of data and studies advanced by manufacturers do not necessarily think it necessary to work on these hypotheses either. They may also have believed that asking the question was unnecessary, as these ecotoxicological problems would never balance out the massive agronomic benefits of using such products. In any case, all of

these actors produced knowledge on singular substances, and do not aim to compare and combine the noted effects of these substances.

### **Bee health and neonicotinoids: alternative regulatory knowledge**

The case of neonics contrasts with this description in two ways: the regulation of these substances is based on ecotoxicological knowledge of the properties of the class. What is more, this knowledge was acted upon by actors that are not normally involved in the regulatory space. In short, alternative regulatory knowledge emerged because actors producing and using ecotoxicological research knowledge — public researchers, beekeepers, NGOs, politicians advocating environmental action — coalesced to intervene in the regulatory space. The history of the regulation of neonics is in this respect outstanding. The regulatory space was reconfigured to include new actors, as other sources and forms of knowledge emerged to capture the global ecotoxicological effects of neonics. These processes mutually reinforced each other [32,33].

Traces of an alternative ecotoxicological, class-level knowledge can be detected in the work of regulatory agencies around 2010. In 2009, several national research institutes reported to the European Food Safety Authority (EFSA) that there was a need to “*improve the knowledge and understanding of factors that affect bee health*” [34]. By 2013, following the publication of three studies establishing the sublethal effects to bees of small doses of three neonics, in field-realistic conditions [35-37], a publication by the same EFSA showed that the state of the art had evolved [38]. A set of robust results was taking shape, to indeed demonstrate the systemic links between neonics and bee health. The role played by this public research was all the greater as EFSA and its experts had in the meantime established that regulatory tests and studies provided by firms were, by design, ignorant of health effects on bees [39]. Of course, uncertainties remained, and the comparability of the effects of various neonics had to be confirmed. But several decisive evolutions were apparent: the growing credibility of field-based methods as a way to discriminate between the weight of various factors on bee health; a consideration of neonics as a class, beyond a substance-by-substance effort; the joint effort of researchers in ecology, entomology, and biochemists, allowing to connect knowledge of insects and bees with knowledge of substances and their mode of action on the nervous systems of bees [40]; the consideration of an environmental trend towards biodiversity and insect population decline, in relation to the growing load of neonics in the environment [41].

Two factors explain that this public research became regulatory knowledge. First, it was brought to the attention of several expert agencies across Europe, and to EFSA directly. Public researchers did not shy away from contributing their knowledge to the bureaucracies involved, despite the difficulties associated with such commitment [42]. They directly contributed knowledge via reports or via membership in the working groups and panels of a variety of agencies, for instance the European Environment Agency [43]. They organized, for example through the “task force on systemic pesticides” [44], to engage with multiple agencies and institutions – a key factor to be successful in the regulatory space [11].

Second, emerging ecotoxicological knowledge about neonics built on the hypotheses and observations of actors that were long mobilized to demand action on successive substances, namely beekeeping associations. A decisive connection was tied between producers of ecotoxicological research knowledge and beekeepers, who took care of consulting and cooperating with public researchers to build up the necessary knowledge base and give credibility to their long-standing claims that insecticides harmed bees [45]. Beekeepers, in turn, were associated with alternative agricultural public interest groups (e.g. Confédération Paysanne), who gained an audience in European politics in those years, through members of

the European Parliament such as José Bové. The early 2010s also witness the mobilization of new actors, transparently basing their action on new research knowledge. Journalists specialized in scientific and environmental issues, stepped up their coverage and conveyed the results of these research efforts [46]. A series of specialized NGOs — e.g. Générations Futures, Pollinis — increased their mobilization, using their connections with researchers too.

As these gained access to politicians in power (such as socialist and green MPs in France between 2012 and 2017), facts about neonics and bee harm travelled to these actors, to enable and legitimize their call for broad regulatory intervention on these substances through the law. A lot of the above-mentioned research circulated, in this manner, in the public media arena, creating an altogether different knowledge environment that influenced the bureaucracies at the center of the regulatory space, by the mediation of political principals overseeing them.

## **Conclusion**

The singularity of the restrictions applied to neonics in France is that they were decided by actors who were not the usual, designated risk assessors or risk managers in the regulatory space. The incumbent bureaucracies, in this case, were placed at the center of a space that has been completely reconfigured by the rise of an advocacy coalition demanding the ban of neonics.

Research knowledge has not just circulated among the usual actors of the regulatory space. It has been produced in relation with this broader mobilization, which unfolded over time and took successive chemicals of the class of neonics as its object. The coordinated restrictions of all neonics is thus an inversion of the routine, closed functioning of the regulatory space, and of the production of a standard regulatory science that structurally disregards low-dose and chronic, sublethal problems. A fragile, and indeed reversible outcome of the knowledge politics that is at the heart of the regulation of environmental threats.

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## **Declaration of interest:**

None

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