

Don't throw the baby out with the bathwater – ban of glyphosate use depends on context

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Recently, Science journal published a letter entitled “Support Austria’s glyphosate ban” (Peng et al. 2020) where the authors argue that the usage of glyphosate should cease. They propose that other weed-killing alternatives such as root exudates, crop rotation or mulch be used instead. We agree that risks associated with using this herbicide on a large scale exist, but on a small scale, such as in invasive plants control, glyphosate has an important role and is not easy to replace. Therefore, the context and scale need to be taken into account when applying such bans.

Many aggressively resprouting invasive trees and shrubs, e.g. *Robinia pseudoacacia* (black locust), *Ailanthus altissima* (tree of heaven), or *Acacia* (acacias) can only be effectively eradicated by combining mechanical and herbicide treatments (Dufour-Dror 2013; Krumm and Vítková 2016). Local conditions also limit the use of some methods. Recommended mechanical girdling without herbicide treatment and leaving standing trees to avoid the root resprouting (Vítková et al. 2017) is not suitable for public forests where falling branches may cause serious injuries (Sádlo et al. 2017).

For many herbaceous plants, e.g. *Heracleum mantegazzianum* (giant hogweed), *Fallopia* sp. (knotweeds; syn. *Reynoutria*) or *Rumex alpinus* (monk’s rhubarb), the sensible application of herbicides is an effective method of control, because mechanical removal is not feasible (e.g. Bímová et al. 2001; Csiszár and Korda 2017). Such need for herbicide combination with mechanical methods is reported from many regions

and for many species (e.g. Burn et al. 2003; Nielsen et al. 2007; Csiszár and Korda 2017). A European-wide example is that of knotweeds (*Fallopia* sp.) where mechanical methods include regular cutting with removal of aboveground biomass. Unfortunately, this approach does not lead to eradication; it only lowers the impact and needs to be repeated each year. An alternative option is to dig out the rhizomes which is resource- and labour-demanding if done properly. Both these methods are associated with the need to remove and transport the biomass which can lead to further spread. Spraying with herbicides thus offers much more efficient control of the invaded sites (Jones et al. 2018). In large infestations, the foliar spraying of herbicides is recommended in the first season, followed by spot application or injection to stems or rhizomes. Of course, if foliar spraying is the only option for invasive species management, then selective herbicides should be used as a first option as they allow for faster regeneration of the surrounding vegetation, hence reducing the reinvasion.

The situation is different for annual plant species, such as *Impatiens glandulifera* (Himalayan balsam), where the use of herbicides is not needed as the plants can be destroyed mechanically by pulling due to their weak root system. Such an approach allows for the eradication of large infestations effectively, rapidly and without any side effects to co-occurring biota (Saegesser et al. 2016).

We agree that to minimize the side effects on biodiversity and human well-being, large-scale spraying using a huge amount of herbicides in agriculture needs to be dramatically reduced. However, spot application and other direct methods used for invasive plants control (e. g. hack-and-fill, drill-and-fill, cut-stump) must remain as an option because other effective control methods are currently unavailable.

Herbicides other than glyphosate are very similar in their rate of degradation in soil, mobility and potential abilities to contaminate e.g. water; their effects on nature are comparable and some of them, which might replace glyphosate in the future, have a much less favourable ecotoxicological profile (Burn et al. 2003). It also needs to be considered that a complete ban on glyphosate or similar herbicides might lead to the resignation of some stakeholders regarding the control of invasive species. Thus we call for a balanced approach to the use of herbicides, taking into account the context of an environmental problem in question. Agriculture, as the largest user of herbicides, and nature conservation have different goals that require different methods to achieve. It is necessary to distinguish between application of herbicides for economic reasons such as in large-scale agriculture, and for nature conservation purposes including the control of invasive species representing one of the major threats to biodiversity as identified by many managers (Pyšek et al. 2013).

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