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O55

Impacts of global change on freshwater plant species

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Pervasive introductions of exotic plant species have resulted in naturalized species becoming a major component of floras of many countries. It is likely that many naturalized species will benefit from ongoing global climatic and environmental change and become problematic invaders. Freshwater systems are generally thought to be particularly vulnerable to exotic plant invasion, due to increased nutrient input from anthropogenic sources, but less is known on CO_2 effects or the interaction of nutrients and additional CO_2. Using published and herbarium records, we first conducted a descriptive analysis of the naturalized freshwater plant species in Australia. We found there are 63 naturalized exotic freshwater plant species comprising 13 nationally invasive and 14 that are invasive in at least one state or territory. The greatest numbers are in New South Wales (87%), Queensland (71%) and Victoria (63%) with the main introduction pathway being aquarium trade. We then used an experimental glasshouse mesocosm approach to compare responses of selected native and exotic freshwater plant species to additional nutrients and elevated CO_2. In the first experiment, we compared trait responses of two native species (*Azolla filiculoides* and *Vallisneria spiralis*) and the exotic *Salvinia molesta* at ambient and elevated CO_2 concentrations. Elevated CO_2 resulted in increased biomass production and reduced specific leaf area (SLA) in the native *A. filiculoides*, while the other two species were unaffected. In a second experiment we investigated the effects of elevated CO_2 and nutrients on competition between *Azolla filiculoides* and *Salvinia molesta*. Additional nutrients and elevated CO_2 enhanced the relative growth rates (RGR) of both species, however there was no effect of competition on the RGR of either species. We conclude that exotic species are an important component of Australia's freshwater systems and that eutrophication is more important than elevated CO_2 in facilitating some exotic plant species in these ecosystems.

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The European pine marten's role in reversing native red squirrel replacement by invasive grey squirrels: differential predation and landscape of fear

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1. Invasive species pose a serious ecological threat to the survival of native species and the functioning of entire ecosystems. In parts of Europe the increase of eastern grey squirrel (*Sciurus carolinensis*) populations has led to regional extinctions of the native red squirrel (*Sciurus vulgaris).* However, recent research suggests a negative, spatial correlation between an expanding population of European pine marten (*Martes martes)* and grey squirrels, reversing species replacement in squirrels as well as providing biological control of an invasive species. The mechanism whereby these effects occur is unclear but may entail differential predation rates and/or differences in response to the presence of a novel predator.

2. We investigated the occurrence of both squirrel species in scats of pine marten, and conducted an experimental investigation using camera traps to investigate behavioural responses of both squirrel species to chemical cues of pine martens at feeding points.

3. Grey squirrels occurred proportionally more frequently in the diet of pine martens than red squirrels, and could not be attributed to differences in the relative abundance of red and grey squirrels across the study area.

4. Red squirrels demonstrated a landscape of fear in response to pine marten scent at feeding stations. Grey squirrels did not demonstrate any such behavioural response to pine marten scent. This suggests that a landscape of fear is an adaptive behavioural response leading to reduced predation rates but is not yet evident in grey squirrels. The timing of pine marten predation on squirrels suggests that pine martens prey on juvenile grey squirrels. This could lead to reduced recruitment, population decline and reversal of red squirrel, grey squirrel species replacement.

5. This provides a plausible mechanism whereby interspecific differences in predation rate based on presence/absence of a landscape of fear, influences species interactions involving invasive alien species.

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The harmonic radar to track the invasive hornet *Vespa velutina*: a tool to improve the Early Warning and Rapid Response System for the species

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The yellow-legged hornet *Vespa velutina* is an invasive alien species in Europe that preys honeybees and native insect species, thus producing serious impacts on beekeeping and biodiversity. Because of the issues posed by this hornet, Europe is considering *V. velutina* as an invasive species of union concern (Reg. EU 1143/2014), and member states should act to prevent, contain and limit its spread.

Many researchers are working on this topic, trying to develop innovative control methods. Currently, control strategies in Europe are based on hornet trapping and nest destruction. One of the main problems of the latter method is nest detection: despite of their great sizes, colonies remains hidden by leafs until late autumn or winter, when new queens have already spread into the surrounding environment.

To improve the efficiency of Early Warning and Rapid Response Systems (EWRRS) based on nest detection and destruction, the LIFE STOPVESPA project has developed a harmonic radar prototype able to track the hornets when flying back to their nests, to detect nests position before the reproductive period of the species. Advanced processing techniques allows to suppress clutter and improve target detection. The radar is capable to cover 360° in the horizontal plane and a large field of view in the vertical plane (20°). It allows following the tracks of the hornets tagged with a vertical 12.3 mm wire antenna and a diode (overall weight of 19.3 mg) in complex morphological environments, with a detection range up to 470 m.

This system has been used in Italy in autumn 2017, and allowed the detection of three nests that were immediately destroyed. In 2018, the harmonic radar will be used for the control of *V. velutina* diffusion in Italy, in particular in new invasion outbreaks to improve the efficiency of the EWRRS for the species.