

Novel resources and species conservation: Risks and opportunities

In brief

Humans have altered the natural world to such an extent that species and habitats that have previously not interacted are now mixing. One consequence of this is the potential use by species of novel resources that these altered ecosystems now provide. Novel resources may be defined as new resources created as the result of human influence on the environment, which were not part of the traditional resources available to a species in a particular region.

We explored cases of novel resource use, concluding that novel resources

may both provide opportunities and incur costs for the species that use them. Novel resources can affect species on many levels, including behaviour, health, population dynamics, species distributions, and community interactions. The broader ecological consequences of novel resource use by species are still largely unknown.

Given the degree of anthropogenic change, the uptake and potential reliance on novel resources by species are likely to increase. Predicting whether and how species

will use and adapt to novel resources is challenging, as responses are species-specific. Several threatened species have already been identified as using novel resources, such as the spectacled flying-fox (*Pteropus conspicillatus*) which is feeding on fruit from the non-native wild tobacco bush (*Solanum mauritianum*). By being aware of the diverse ways that species use and respond to novel resources, managers may be able to incorporate this information into future conservation plans.

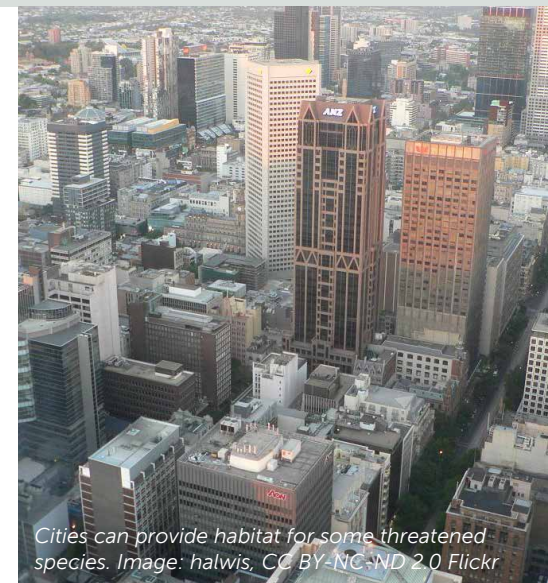
Background

Human activities have led to the creation of highly altered landscapes that have been termed “novel ecosystems”. Novel ecosystems are part of the human environment, including cities, farms and timber plantations, and they often feature numerous non-native species and manmade structures. The creation of novel ecosystems has led to the mixing of species and habitats that have previously not interacted. These altered environments may offer novel resources for the benefit or detriment of existing and introduced species.

Novel resources may be defined as resources used recently by a species, where those resources are known not to be part of that

species’ traditional, native “portfolio” of resources used in a particular region, with the emergence and availability of those resources likely to be the result of human influence on the environment.

We consider any time after 1950 to be recent. This is a potential start date for the Anthropocene, a time period during which the influence on climate and the environment of human socioeconomic-driven activity is becoming dominant. Some types of novel resources are thus also known as anthropogenic resources, and include human garbage, bird-feeders and buildings. We need to better understand how species exploit and are



Cities can provide habitat for some threatened species. Image: halwis, CC BY-NC-ND 2.0 Flickr

influenced by novel resources, especially when threatened species become reliant on novel resources for population maintenance.



Grey-headed flying foxes in a Melbourne park.
Image: cskk, CC BY-NC-ND 2.0 Flickr

Aims

We wanted to explore how species use and respond to novel resources. We also sought to understand the impacts of novel resources, and the implications for managing threatened species that use such resources.

What we did

We explored cases of novel resource use by species in the scientific literature.

We researched the possible positive and negative impacts of novel resources on threatened species, and how to manage threatened species that are using novel resources.



Key findings

The current literature showed that a vast array of species use novel resources such as buildings, human food and waste and non-native species to meet a range of needs. Novel resource use varies depending on the availability of both traditional and novel resources, and species can switch between resource types. As ecosystem novelty increases, so too does the potential for the presence of novel resources. Use of novel resources is more likely in highly modified or novel ecosystems such as cities or farms.

Not all species will use a novel resource, and the ability of a species to adapt or change its behaviour will influence whether and how a species uses novel resources. Novel resources that are similar to traditional resources do not necessarily require new skills or behavioural learning.

Several wildlife species use human-built structures, often analogous to traditional resources, as novel breeding and roosting sites. For example, the peregrine falcon (*Falco peregrinus*) uses tall buildings in cities for breeding and roosting.

The response of a species to a novel resource depends on whether the novel resource is replacing a traditional resource or provides an alternative, additional resource option. In some circumstances, the availability of a novel resource may lead to expansion of a species' range or population. Altered environmental conditions, such as increased temperatures in cities due to the combination of climate change and urban heat island effects, may provide novel resources.

RIGHT: The peregrine falcon sometimes uses tall buildings for breeding and roosting.
Image: slagheap from Canada, CC BY 2.0 Wikimedia Commons

One example is higher temperatures coupled with reductions in frost events are contributing to threatened grey-headed flying-foxes (*Pteropus poliocephalus*) establishing permanent camps in Melbourne – a location outside their historical habitat range.

Novel resource use can affect species' health, population density, distributions and community-level species interactions. A species may use a novel resource as an occasional tasty treat, or it could be dependent upon it for survival. Novel resource use can also impact species by promoting new species interactions. For example, in the tropical rainforests of northern Australia the threatened spectacled flying-fox (*Pteropus conspicillatus*) forages on the fruit of the non-native wild tobacco bush (*Solanum mauritianum*). This bush grows lower to the ground than traditional food sources, increasing their exposure to a ground-dwelling paralysis tick (*Ixodes holocyclus*), leading to occasional paralysis and mortality of flying-foxes.

Non-native plant species are now satisfying essential habitat requirements for some threatened species. For example, the Endangered southern brown bandicoot (*Isoodon obesulus*) has been found to use European blackberry bushes (*Rubus fruticosus*) for shelter and food. Bandicoots have even been found in higher abundance in blackberry patches compared to nearby remnant native habitat.



Maritime pine.
Image: S. Rae, CC BY 2.0 Flickr



Implications

Understanding how threatened species use and respond to novel resources is important, as such reliance generally arises from recent human actions. If a species becomes reliant on a novel resource, the risk is that changes in the human actions which initially provided or facilitated the resource may subsequently remove it. Some species can even become so highly dependent on a novel resource that they lose their ability to switch back to their traditional resource.

Novel resources can have negative impacts on the species using them. Some species find novel resource just as attractive, if not more so, than traditional resources, even though using the resource is detrimental to the health of the species.

When threatened species become reliant on a novel resource from

an invasive plant or animal, this can make managing the invasive species complicated and controversial. If existing management practices or policies target the removal of the novel resource, they may need to be reconsidered. Conversely, if a novel resource has detrimental effects on a species, or on the broader ecological community, management strategies may require direct human intervention to remove the novel resource, ideally replacing it with a traditional resource.

If a novel resource benefits a species by replacing a traditional resource lost due to human impacts, this could improve the negative effects of lost native resources. By using a replacement novel resource, a threatened species may possibly reduce the rate of its decline, such as with Carnaby's black-cockatoo

(see case study). The deliberate addition of novel resources can also be an important management tool for some threatened species. For example, nest boxes are often used as a means to entice tree cavity-dependent fauna, such as the squirrel glider (*Petaurus norfolcensis*), to remain in or return to altered landscapes.

Species' use of novel resources adds a further layer of complexity to conservation and management decisions. It is yet unclear how effective novel resources are for achieving desired conservation outcomes for threatened species. Conservation practitioners need to consider the opportunities and risks provided by novel resources in the management of threatened species, particularly in highly altered environments.

Case study

Black-cockatoos and non-native plants

We reviewed recent literature on the conservation and management implications of the Endangered Carnaby's black-cockatoo (*Zanda [Calyptorhynchus] latirostris*) using a novel resource. In Perth, Western Australia, Carnaby's black-cockatoo forages on seeds from non-native maritime pine (*Pinus pinaster*). Populations of this cockatoo have been foraging and roosting in a pine plantation near Perth for around 75 years. The pine trees may partially compensate for losses of the cockatoo's native habitat, *Banksia* woodlands, which were cleared to establish the pine plantations and housing developments. The cockatoos are now considered to be reliant on the pine as a food resource, but they still use

traditional food resources including *Banksia* seeds found in remnant native woodland.

The pine plantations are being harvested commercially. At the same time, expanding urbanisation around Perth is causing ongoing removal of the native *Banksia* woodlands. As a result of these activities, the population of Carnaby's black-cockatoo in the Perth region is projected to decline by 34–56% by 2050.

One of current conservation mitigation strategy involves replanting pine trees specifically for Carnaby's cockatoo, as replanting with pines is considered more cost-effective than replanting *Banksia* woodlands. The pine cones also provide more calorific value than the cones of native *Banksia*.

However, few other conservation values are associated with replanting



pine plantations, such as whether they provide habitat and resources to other species that occur in *Banksia* woodlands. This management decision also assumes that pine cone seeds provide equivalent nutritional requirements to Carnaby's cockatoos and that consumption of pine cone seeds has no detrimental effects to the birds' long-term survival. Such knowledge is currently lacking but urgently needed if managers are to better understand the impacts of this threatened species using a novel resource.

Case study

City-dwelling native insects and non-native plants

We used an existing dataset to explore how insects in urban Melbourne were interacting with native and novel (non-native) food and habitat resources. The data described the interactions between 107 plant species (50 native, 57 non-native) and 558 insect species (539 native, 19 non-native) within 15 greenspaces in Melbourne. We divided the native insect species into 13 categories based on their ancestry and functional role. These groups were:

- herbivorous beetles
- predacious beetles
- herbivorous heteropterans
- herbivorous leafhoppers
- herbivorous plant hoppers
- herbivorous jumping plant lice
- pollinating bees
- pollinating flies
- predacious heteropteran bugs
- predacious wasps
- predacious ants

A native blue banded bee (*Ameigilla* spp.) feeding on flowers in a garden in Perth.
Image: Jean and Fred CC BY 2.0 Flickr



- parasitic wasps
- detritivorous flies.

We then summarised the frequency with which these groups interacted with native and non-native plants in the urban greenspaces. This analysis showed that all the insect groups frequently used non-native plant species for food and/or shelter in urban Melbourne.

Many native insects forage on, or shelter in, a variety of plant species, commonly relying on a mix of traditional and novel resources to fulfill their resource requirements. This highlights how insect communities are adapting, and potentially co-evolving, to use the spectrum of novel resources provided by non-native plant species in urban environments.

Cited material

Leonie E. Valentine, Christina E. Ramalho, Luis Mata, Michael D. Craig, Patricia L. Kennedy, and Richard J. Hobbs (2020) Novel resources: Opportunities for and risks to species conservation. *Frontiers in Ecology and the Environment*, 18 (10) 558–566. doi:10.1002/fee.2255

Further Information

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