CONSERVATION INTERVENTIONS HELP SPECIES ADAPT TO CLIMATE CHANGE: A SUMMARY FOR POLICY MAKERS

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INTRODUCTION

Current climate change trends threaten many species with extinction. A good understanding of the potential for conservation interventions to enable species to adapt to climate change is required to respond to this risk. We reviewed published literature that tested the effectiveness of conservation interventions under different climatic threats to underpin conservation interventions under climate change.

BOX 1 *Anjerbjörn et al. (2013) studied a population of arctic fox* Vulpes lagopus*, which was close to extinction in 2000. Declines were attributed to changes in lemming (a favoured prey group) cycles and colonisation by red fox* Vulpes vulpes *(a competitor and predator) in the arctic fox's range due to a warming climate. The authors tested the effects of two interventions: supplementary feeding and red fox control. Both successfully worked to increase the abundance of arctic fox and the authors concluded that these actions can be used to help the arctic fox adapt to climate change.*

Erik F. Brandsborg

OVERVIEW OF STUDIES

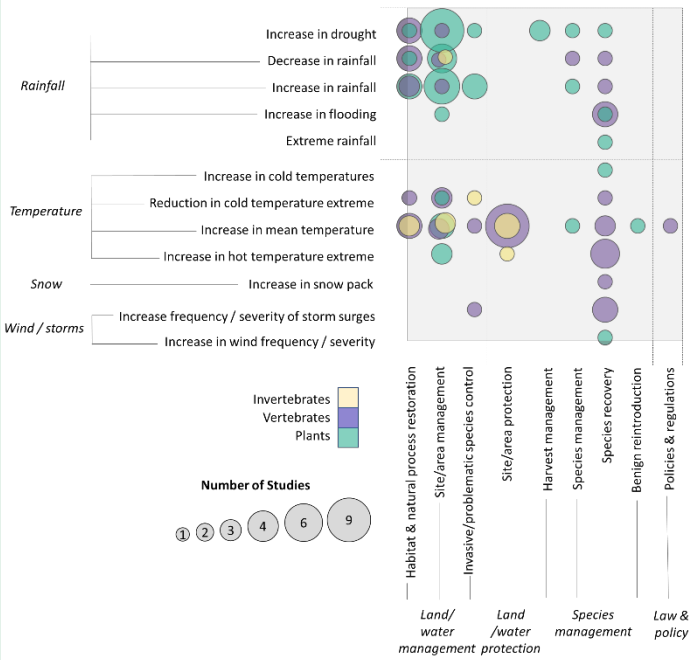

Fig. 1 Number of studies that measured the effectiveness of the different conservation interventions in relation to various climatic variables.

We extracted 443 lines of data from 77 studies. Most studies were located in Europe and North America (82%), and in grassland (27%), forest (25%) or wetland habitats (20%).

Responses to a range of climatic threats were assessed (Fig. 1), although no studies considered responses to changes in humidity, fire, water flow or sea-level rise. Over half (60%) of studies considered land/water management, 27% species management, 12% land/water protection and one law and policy. No studies tested interventions related to education and awareness, livelihood, economic and other incentives or external capacity building interventions (Fig. 1).

Studies on **invertebrates** were largely focused on land/water management and protection to help species adapt to changing temperatures. Studies on **vertebrates** tested a range of interventions, largely on species recovery for a range of climate variables, and also land/water management & protection for changes in rainfall and temperature. **Plants** were largely studied in the context of rainfall and on land/water management (Fig. 1).

Albert Herring

BOX 2 *The sex ratio of leatherback sea turtles* Dermochelys coriacea *is determined by temperatures during incubation, and increasing temperatures are expected to reduce the proportion of males produced, and thus limit population growth. Patino-Martinez et al. (2012) experimentally shaded clutches to reduce nest temperatures. They found that more males were produced in shaded clutches than those that were not, concluding that shading can be a useful action in years of high temperatures.*

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LITERATURE REVIEW

Successful **land/water management** interventions include habitat & natural process restoration (e.g. sowing native plants, increasing tree cover, connectivity of habitats, pond creation), site management (e.g. grazing reduction, adding mulch to soils) & invasive or problematic species control (e.g. box 1).

Just under half of studies on **land/water protection** found site protection to be a successful intervention, with the strongest evidence for birds and insects under increasing temperatures (e.g. box 3).

Successful **species management** interventions included elevation of nests to protect eggs from storms, shading of nests to protect turtle eggs from extreme temperatures (e.g box 2) and assisted migration of plant species when faced with increasing temperatures.

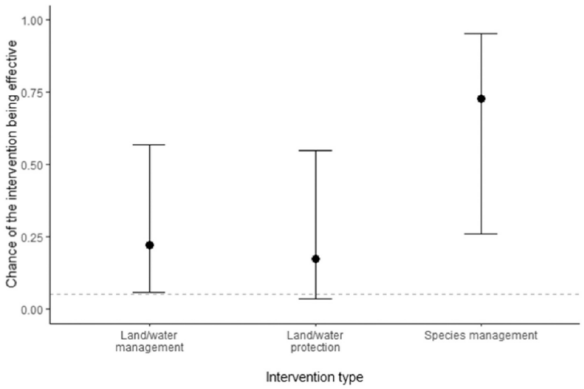


Fig. 2 The probability of an intervention being successfully used on species adapting to climate change (± 95 CI). The dotted line shows the baseline probability expected by chance.

Species management was more likely to be successful than land/water management or protection, but both species management and land/water management interventions were significantly more likely to be effective than expected by chance (73% & 22% chance of success, respectively), and land/water protection almost so (17%, Fig. 2). Climate variables had no effect on the probability of intervention success, suggesting that interventions can be successfully implemented for climate change regardless of the climate threat. Interventions also appeared to work consistently across habitats and taxa, suggesting these results can be generalised.

SUMMARY

- A wide range of studies support the contention that conservation interventions can enable species to adapt to climate change.
- Species management interventions are particularly effective for species-focussed conservation.
- Site protection and habitat management interventions are less likely to be effective for individual species, although by their very nature, may potentially benefit a larger number of species.
- The success of adaptation interventions did not vary with climatic threat, habitat or taxa, so our results can be generally applied.
- With sufficient resources, conservation organisations have the potential to help many species and populations to adapt to climate change.
- Projected impacts of climate change on species' extinction risk could be mitigated to some extent through effective 'conservation interventions.

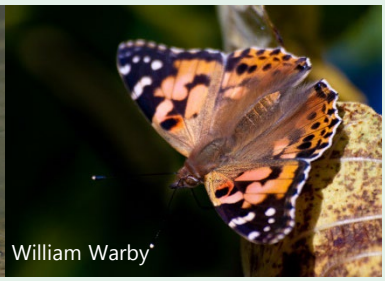
BOX 3

Warming temperatures are forcing some species to shift their ranges. A number of studies have assessed how protected areas (PAs) can support species in their newly-colonised ranges.

Gillingham et al. (2015) found that most of the butterfly and odonate species studied (61/99) were more abundant inside than outside PAs in newly-colonised areas of Britain.

Virkkala et al. (2014) studied bird species richness in Finland using Atlas data from 1974-1989 and 2006-2010. They found that species historically found in the south increased in northern areas during this time, and that species richness was higher inside PAs than outside.


Dick Daniels


William Warby*

Pavón-Jordán et al. (2015) found the wintering distribution of smew Mergellus albellus *shifted north-eastwards across Europe between 1990 and 2011. They found that population trends were more positive in PAs in northern areas than outside of PAs during this time.*

These studies provide strong support that PAs play an important role in conserving species as their ranges become more dynamic with a changing climate.

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Gillingham, P.K. et al. (2015a) High abundances of species in protected areas in parts of their geographic distributions colonized during a recent period of climatic change. Conservation Letters 8 (2): 97 – 106.
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Virkkala, R. et al. (2014) Protected areas alleviate climate change effects of northern bird species of conservation concern. Ecology and Evolution 4 (15): 2991 – 3003.

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