A compassionate conservation perspective on migrant species

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Based on the papers:
Ben-Ami 2018
Wallach et al 2018
Lundgren et al 2017

Compassionate Conservation strives to combine animal protection and conservation management for improved conservation outcomes

צופית על פרח לנטנה

(צילום: שלומית ליפשיץ)

בולבול על עץ שיטה כחלחלה

(צילום: שלומית ליפשיץ)

דרור ספרדי על טיונית

(צילום: שלומית ליפשיץ)

דרור ספרדי על שיטה כחלחלה

(צילום: שלומית ליפשיץ)

חוחית אוכלת טיונית חולות

(צילום: בני סטרשונסקי)

חוחית אוכלת כנפון צהוב

(צילום: בני סטרשונסקי)

ירקון סועד לנטנה

(צילום: ברוך אלרט)

כחליל אספסת על טיונית חולות

(צילום: שלומית ליפשיץ)

נמפית חורשף על טיונית חולות

(צילום: אריה פלדי)

לבנין תלתן על טיונית החולות

(צילום: אריה פלדי)

Background

- In the Anthropocene humans are the key driver of change in both magnitude and distribution of biodiversity

- Humans cause habitat loss

- Humans enable, accelerate and expand the mobility of species – migrant species

The need for management action

- Migrant species can have a dramatic impact on their new environment
  - Disruption of existing ecosystem balance
  - Adverse impacts on native species
  - Economic loss
  - Nuisance
  - Unforeseen consequences
- Current management is causing great harm to migrant species
  - At odds with emerging social norms
  - Creating conflict with the public
  - Hindering conservation efforts

➔ CC agrees, preventing the foothold of migrant species is likely to be desirable

The need for restraint

- However, removing established migrant species is unlikely …. We might be wrong (-:
  - Very difficult on islands
  - Nearly impossible on continents

- Ecological consequences?
  - How should we manage established migrant species?
  - How resilient (adaptive) are ecosystems?
  - Could the redistribution of species be an adaptive process?
  - What is the functional ecological role of established migrant species?

- **Does biotic migration create many "winners" and few "losers"? (not McGill et al., 2015)**

Figure 4. Immigrant species that are globally threatened or decreasing in their native ranges. Top panel from left to right: threatened species – common carp (*Cyprinus carpio*, Vulnerable), and Alexandrine parakeet (*Psittacula eupatria*, Near Threatened); and Least Concern (LC) but decreasing – golden carp (*Carassius carassius*), and Muscovy duck (*Cairina moschata*). Bottom panel from left to right, LC but decreasing: Indian silverbill (*Lonchura malabarica*), Nutria (*Myocastor coypus*), ruddy duck (*Oxyura jamaicensis*), and Sictus tree (*Tetraclinis articulata*). Photos: *Cyprinus* by Biopix, *Psittacula* by Sumatra Pramanick, *Carassius carassius* by Biopix, *Cairina* by Dario Sanches, *Lonchura* by Dibyendu Ash, *Myocastor* Petar Milošević, *Oxyura* Dick Daniels, *Tetraclinis* CS California via Wikimedia.

Figure 5. Emigrant species that are locally extinct in Israel. Top panel from left to right: Egyptian goose (*Alopochen aegyptiacus*), red deer (*Cervus elaphus*), soft bindweed (*Convolvulus pilosellifolius*), spreading bedstraw (*Galium humifusum*), and *Halopeplis amplexicaulis*. Bottom panel from left to right: dugong grass (*Halophila ovalis*), frogbit (*Hydrocharis morsus-ranae*), great yellowcress (*Rorippa amphibia*), slender clover (*Trifolium filiforme*), and water celery (*Vallisneria americana var. biwaensis*).
Images: *Alopochen* by Andreas Trepte CC BY-SA 2.5; *Cervus* by Charles Sharp CC BY-SA 4.0, *Convolvulus* by www.floraofqatar.com, *Galium* by Anatoly Lisitsyn, *Halopeplis* by Alon Solej CC BY-SA 3.0.

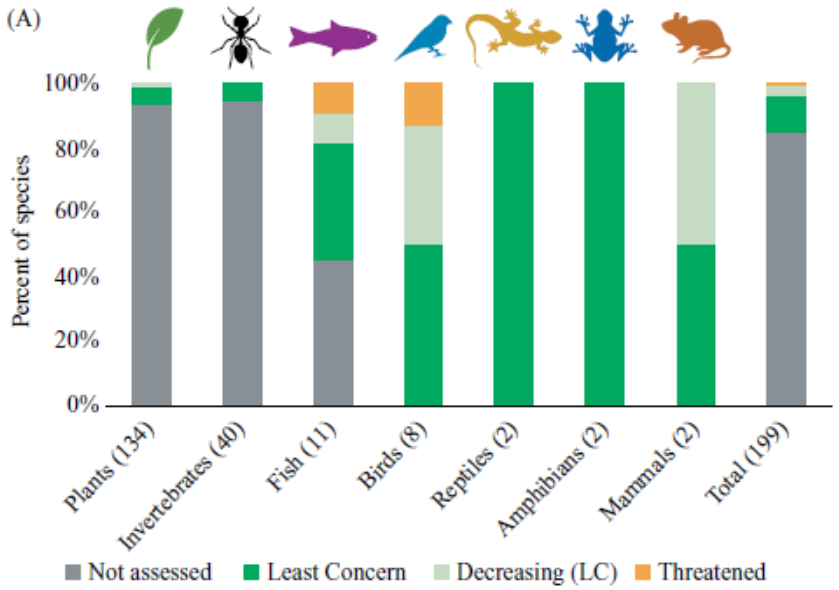
Table 1 Post-domestic ('feral') animals that originated in Israel and surrounding region, and have established wild populations in new **regions. The native ranges of most post-domestic species is not well defined, and their distinction as separate species to their pre-domestic** ancestors is also often not clear. Conservation statuses refer to their pre-domestic ancestors in their native ranges, as Least Concern (LC), Vulnerable (VU), Extinct in the Wild (EW), and Extinct (EX). Photos by Arian Wallach (wild cattle, goat, camel), Angus Emmott (wild cat), and Agriculture Victoria (wild boar).

Post-domestics	Species name	Pre-domestic ancestor	Wild populations established (bioregions)	Global conservation status	Israel conservation status
	*Bos taurus*	*B. primigenius*	Australian, Nearctic, Neotropical, Oceanian, Oriental, Palearctic, Panamanian	EX	EW/EX
	*Capra aegagrus hircus*	*C. a.*	Australian, Madagascan, Nearctic, Neotropical, Oceanian, Palearctic, Panamanian, Saharo-Arabian, Sino-Japanese	VU	EX
	*Camelus dromedarius*	*C. thomasi*	Australian	EX	EW/EX
	*Felis catus*	*F. silvestris*	Afrotropical, Australian, Madagascan, Nearctic, Neotropical, Oceanian, Palearctic, Panamanian, Saharo-Arabian, Sino-Japanese	LC	VU
	*Sus scrofa*	*S. s.*	Antarctica, Australian, Madagascan, Nearctic, Neotropical, Oceanian, Oriental, Palearctic, Panamanian	LC	LC

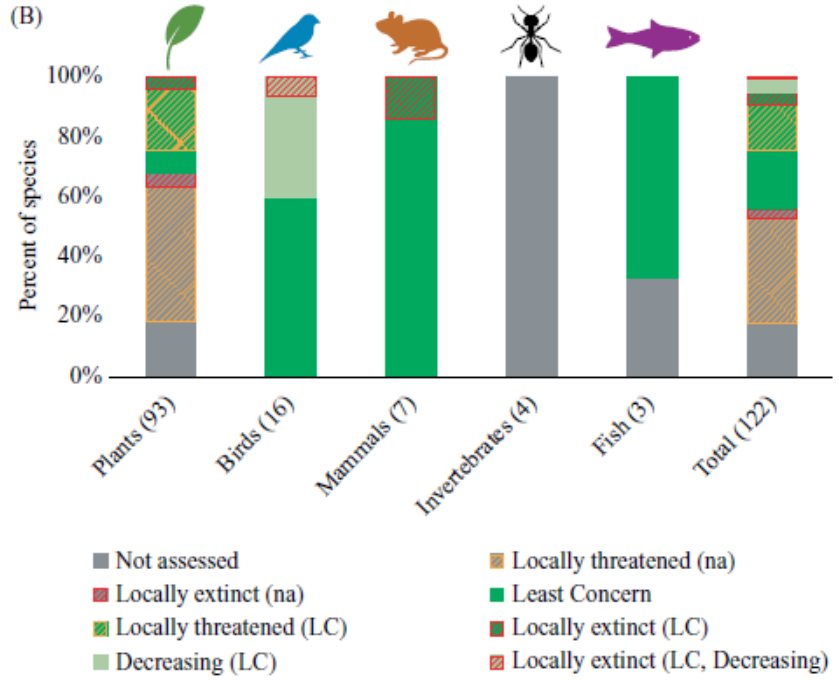
The simultaneous **decline of species in their native ranges**

and

flourishing in their introduced habitats



immigrants



emigrants

Figure 3. Conservation status of Israel's immigrant (A) and emigrant (B) species, in each taxonomic group. Threat statuses follow the IUCN Red List, and local (Israel) statuses are included for emigrant species (B). Colors denote global threat statuses according to the IUCN Red List, and for emigrant species also local threat statuses according to Endangered Plants and Vertebrates in Israel Red Lists.

Israel's biodiversity in the Anthropocene

- **Israel's 199 immigrant species** are taxonomically diverse
  - Comprised of members of 85 families
    - ranging from Australian trees
    - American and African amphibians
    - Indian parakeets
    - Atlantic Ocean fishes.
  - Only 30 immigrants have conservation status assessments
    - of those 27% are threatened or decreasing in their assigned native ranges.

- **The 122 emigrants** are comprised of members of 64 families
  - Established around the world
  - Most emigrants (62%) are locally or globally threatened and decreasing
    - including 10 species that are extinct in Israel
    - 17% of Israel's threatened plants have emigrated.

- Human impacts are extensive:
  - Human population growth
  - Urbanization
  - Habitat loss

- However, plant and vertebrate richness has increased by about 104 species (after accounting for local extinctions).

➔ Suggests that migration is an important adaptation mechanism to anthropogenic changes (Lundgren et al., 2017).

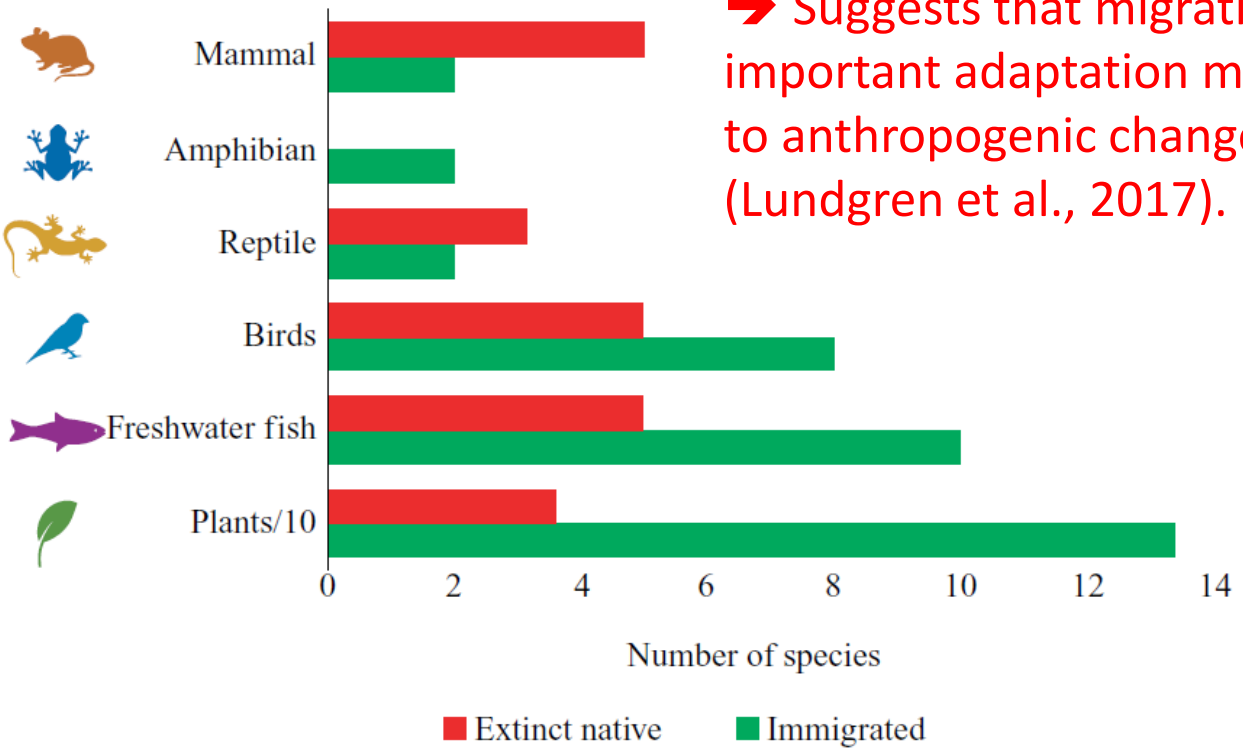


Figure 6. Number of plant and vertebrate species lost by extinction (red), and gained by immigration (green), in each taxonomic group in Israel since the late 19th century. Plant numbers were divided by 10 for scale.

Large (100 kg) herbivorous (megafauna)

- Contribute to the functioning of ecological systems (Ripple et al. 2015).
  - consume fibrous vegetation, which can benefit smaller herbivores, reduce fire risk, accelerate rates of nutrient cycling by orders of magnitude
  - shift plant community structure by facilitating coexistence between different plant functional types.
  - cause physical disturbance and disperse large seeds and nutrients great distances.

- Loss of this functionality at the end of the Pleistocene had dramatic effects:

    (Gill et al. 2009, Ripple and Van Valkenburgh 2010, Smith et al. 2015, Bakker et al. 2016a, Doughty et al. 2016a, b,c, Malhi et al. 2016)
  - on plant community structure
  - fire regimes,
  - nutrient and mineral cycling across landscapes,
  - and community assembly

- Modern (Anthropocene) declines have led to:
  - similar consequences for terrestrial ecosystems and community dynamics (Ripple et al. 2015)
  - broad international calls for immediate action to conserve the world's remaining mammalian megafauna (Ripple et al. 2016, 2017).

Much remains unknown about the ecology of introduced herbivores, but evidence suggests that these populations are rewilding modern ecosystems.

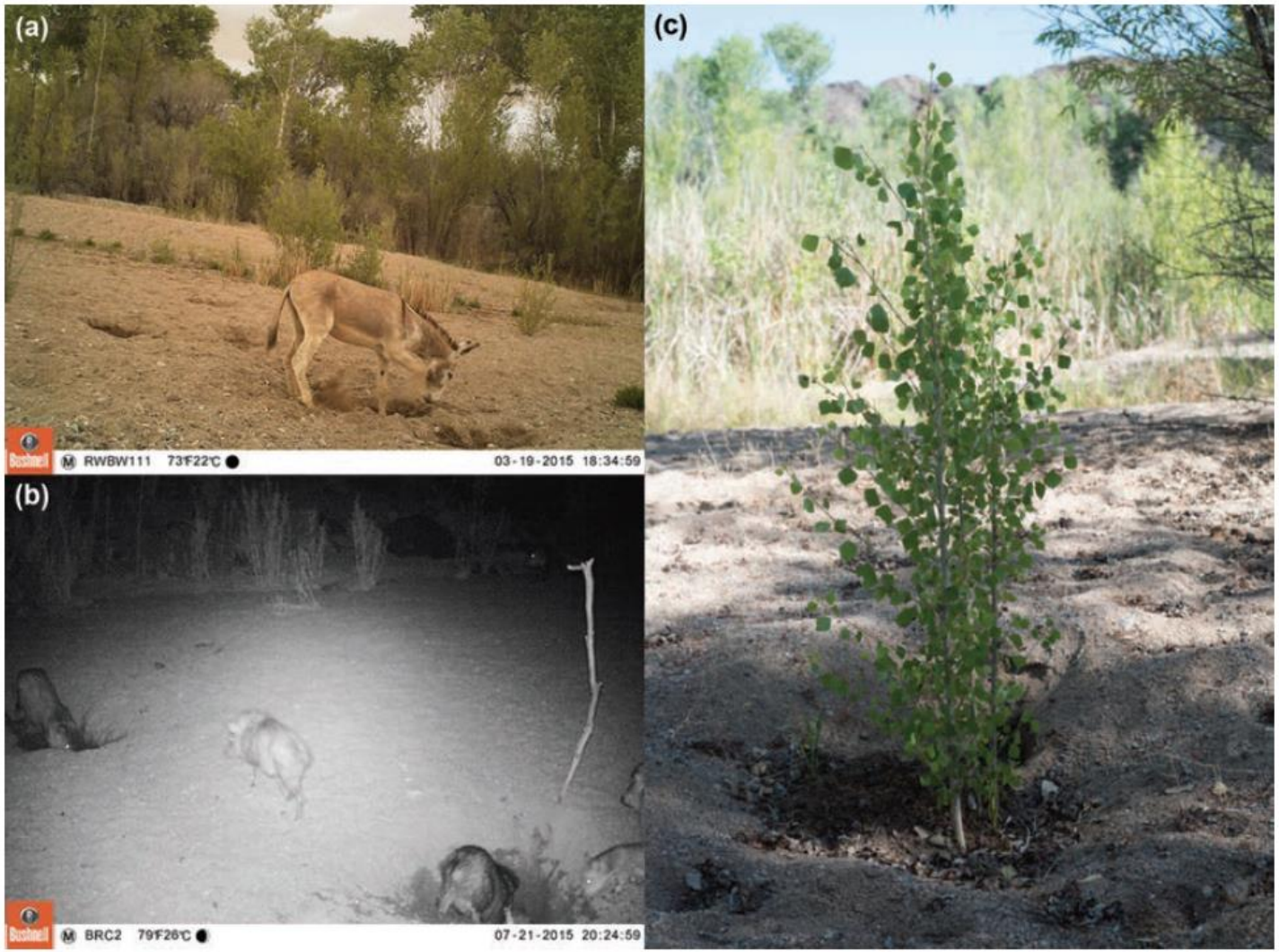


Figure 6. Wild donkeys *Equus asinus* increase surface water availability in the Sonoran Desert. (a) Wild donkey digging well to water table ('burro well'), (b) troop of javelina *Pecari tajacu* bathing and drinking in burro wells, and (c) several-year-old Fremont's cottonwood *Populus fremontii* growing in an abandoned burro well on a high channel bar.

- Of 76 megafauna species, 22 (~29%) have introduced populations; of these eleven (50%) are threatened or extinct in their native ranges.

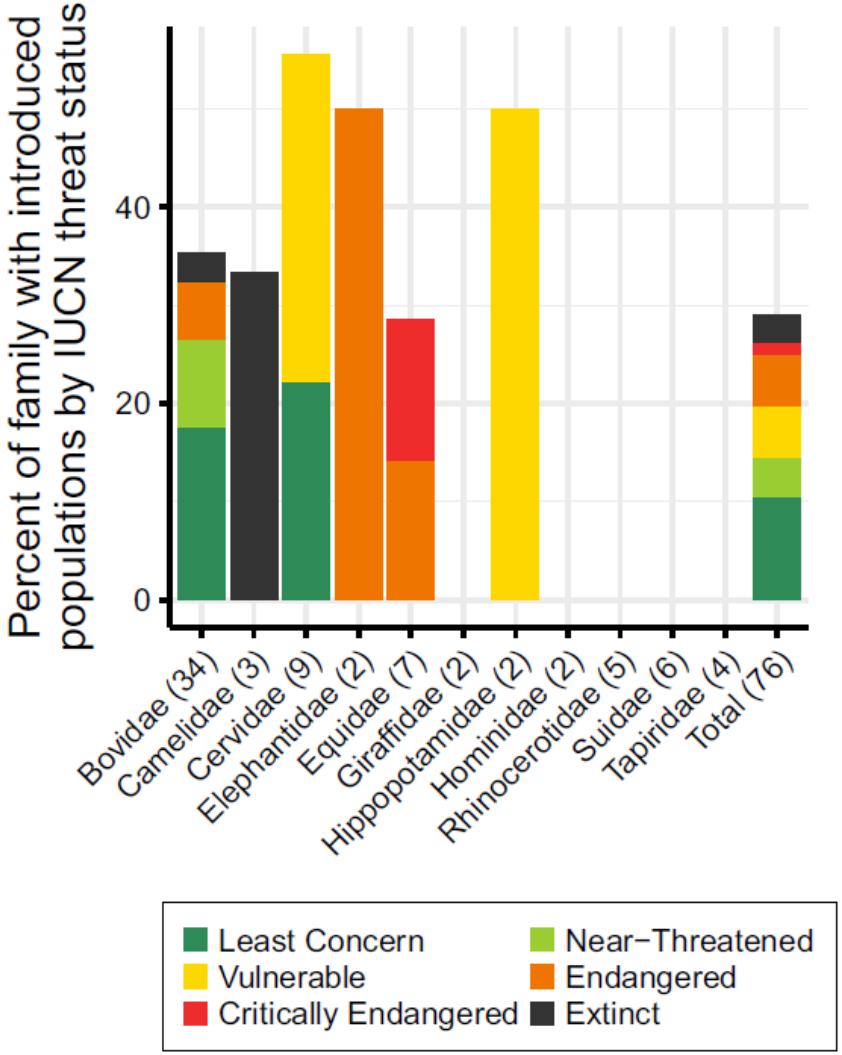


Figure 1. Threatened megafauna species are finding refuge outside their native ranges. Percentage of megafauna in each family with introduced populations, colored by IUCN threat categories in their native ranges. Number within parentheses indicates total number of megafauna within each family.

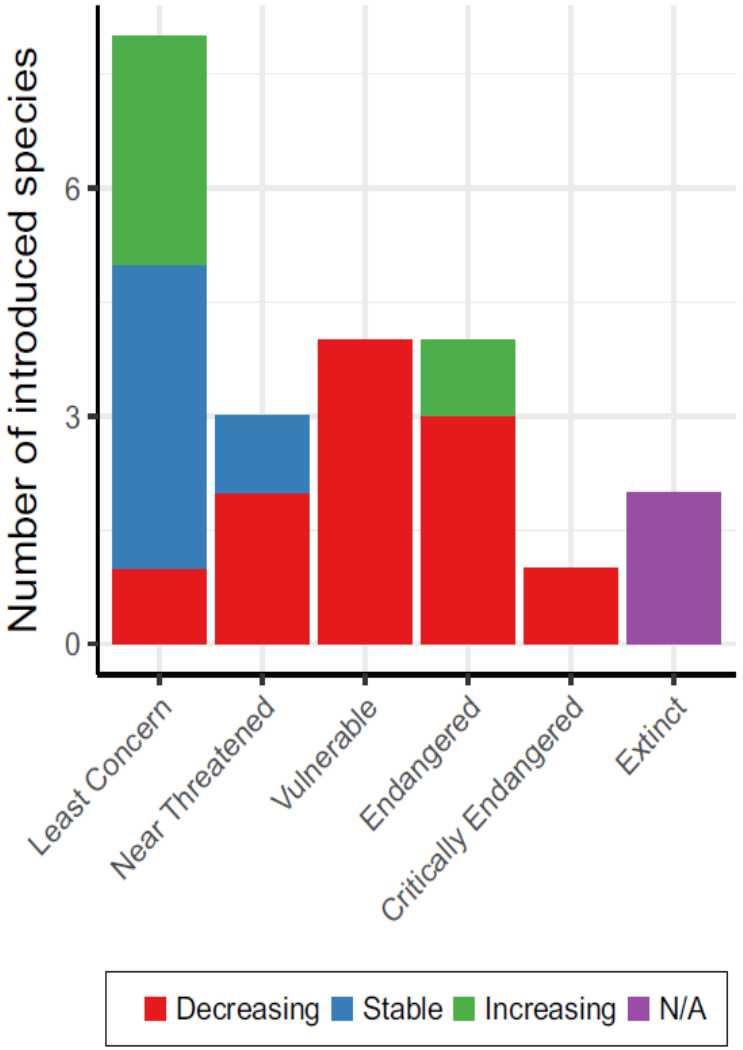


Figure 2. The number of introduced megafauna species by IUCN (2017) threat status and population trends in their native ranges. The majority (59%) of introduced megafauna are threatened or have declining populations in their native ranges.

The megafauna perspective

Table 1. Changes in megafauna species richness from the Pleistocene to the Anthropocene. In column 2, percent survived is the percent of megafauna to survive the late Pleistocene extinctions; in column 3, percent lost/gained is the percent change in Holocene species richness due to extinction/immigration during the Holocene; in column 4, percent replaced is the percent of all extinct megafauna richness (Pleistocene and Holocene) to be numerically replaced by introductions in the Anthropocene. * indicates natural immigration from Eurasia to North America during the early Holocene.

Continent	Pleistocene species richness	Holocene species richness (percent survived)	Holocene extinctions/immigration (percent lost/gained)	Anthropocene richness (percent replaced)
Africa	44	32 (73%)	–1 (–3%)	35 (31%)
Asia	61	36 (59%)	–2 (–6%)	38 (14%)
Australia	12	0 (0%)	N/A	8 (67%)
Europe	15	7 (47%)	–1 (–14%)	9 (33%)
North America	35	4 (11%)	+2 (+33%)*	14 (26%)
South America	44	5 (11%)	0 (0%)	12 (18%)

- The world's terrestrial megafauna (body mass >100 kg) are increasing regional megafauna richness to well above Holocene levels (Lundgren et al., 2017).
- Introductions have increased megafauna species richness by between 10% (Africa) and 100% (Australia).
- Furthermore, between 15% (Asia) and 67% (Australia) of extinct species richness, from the late Pleistocene to today, have been numerically replaced by introduced megafauna.

Where to with megafauna

- Unfortunately, little more is known about the ecological functions of megafauna outside their native ranges

- Future research:
  - the ecological functions of introduced megafauna,
  - under varying ecological contexts (e.g. predator control, landscape connectivity),
  - essential to understand the novel megafaunal communities of the Anthropocene.

➔ CC proposes that attitudes towards introduced megafauna should allow for broader research and management goals.

Compassionate Conservation and Migrant Species in Practice

פגיעה יכולה להיות מכוונת/לא-מכוונת וישירה/עקיפה

Fraser and MacRae 2011 - Four types of activities that affect animals- implications for animal welfare and animal ethics philosophy. Animal Welfare, 20:581-590.

מגדלי תקשורת
←פגע לא-ישיר בלתי מכוון

תפיסת דגים נלווה
←פגע ישיר בלתי מכוון

דריסה
←פגע ישיר בלתי מכוון

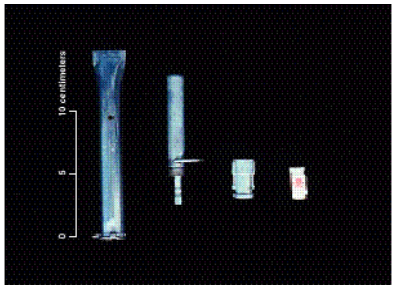
ממשק/דילול אוכלוסיות
←פגע ישיר מכוון

רְדִיפוּת
←פגע ישיר מכוון

דליפות נפט
←פגע לא-ישיר בלתי מכוון

שיטות קטלניות של ניהול - סטנדרטיות

Fumigation



Cyanide

Poison baits

Trapping

Aerial delivery

Shooting

Hunting

- Compassionate conservation is a field dedicated to developing and promoting practices that are consistent with four guiding principles (Draper, Ramp and Baker 2013):
  - *First, do no harm*
  - *Individuals matter*
  - *Valuing all wildlife*
  - *Peaceful coexistence*
- The principles of CC are largely in line with many of Israel's established norms
- Can strengthen conservation practices and ethical commitments to wildlife.

שימור טבע בחמלה מתרחש בישראל

- אוכלוסיית נוטרייה
  - סירוס זכרים
  - חיסון פוריות של זכרים
- זאב ותן
  - הפחתת משאבי מזון
- ממשק חקלאי
  - טורפים מקומיים מחליפים כמדבירים כימיים

END SLIDESHOW

Islands and Continents

- Across the world's **island ecosystems**, migration has doubled plant richness, tripled freshwater fish richness, and stabilized bird richness (Sax & Gaines 2003).
  - Migrants have increased vascular plant richness from about 2,100 to 4,100 species in New Zealand, and from about 1,200 to 2,300 species in Hawaii (Sax et al., 2002).
- **On continents**, regional richness of plants and fishes has increased by 20% (Sax & Gaines 2003).

There are a growing number of observations of rapid adaptations in novel ecosystems (Carroll 2011).

- The introduction of cane toads (Bufo marinus) to Australia
  - rapid behavioral and morphological adaptation to their toxins
  - enabling native predators to recover from initial declines (Phillips & Shine 2004).
- Balloon vine (*Cardiospermum grandiflorum*) introduced to Australia
  - was initially freed from consumers, but is now being predated on by the native Australian soapberry bug (*Leptocoris tagalicus*)
  - rapidly evolved the necessary longer mouthparts to consume its seeds (Carroll et al., 2005).
- Rapid evolution has also occurred in Hawaii's native birds
  - Adapting to the introduced avian malaria and its mosquito vectors
  - Some species have recolonized low-elevation disease-prone regions (Woodworth et al., 2005)