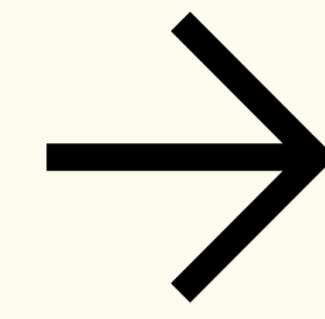


CAN A NEW CULTURE SAVE US FROM INVASIVE SPECIES?

Invasive species: Non-native species that cause significant negative changes to the environment they invade

The issue with invasive species

- Lack of natural predators can lead to **explosive** population growth
- Outcompete native species, which can lead to **biodiversity loss**
- Management efforts are often **ineffective** and cause substantial **economic cost**



How to deal with it?

- Develop a **new culture**, which adapts to new species and **integrates** them
- Change view of invasive species from **intrusion** to part of the “**new nature**”
- Instead of **eradicating** the species, try to **harvest** their goods



Photo: Norbert Nagel

COYPU

➤ *large semi-aquatic rodent*

Issues:

- High reproduction
- Reduces provided ecosystem services
- Agriculture and infrastructure damage
- Outcompetes native species

Solutions:

- Fur production – with governmental subsidies
- Medical purposes: Coypu bile to treat liver injuries

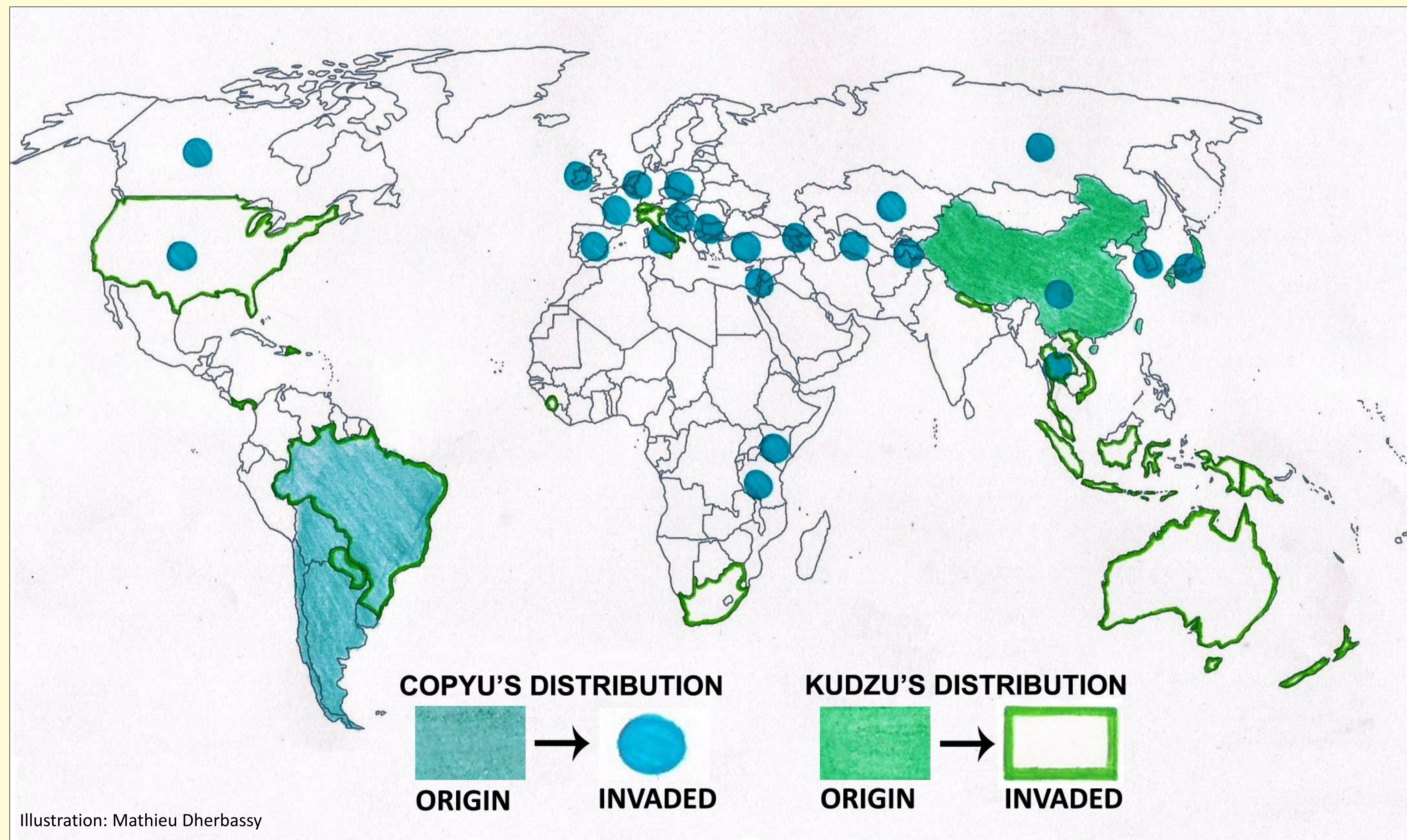


Illustration: Mathieu Dherbassy



Photo: Bruce Ackley & Alyssa Lambel

KUDZU

➤ *Climbing vine*

Issues:

- High growth speed: 26 centimeters per day
- Develops a large-scale monoculture
- Smothers the development of the native species.

Solutions:

- Medicinal and culinary uses
- Food for grazing animals
- Erosion control



SCAN ME



Does it work?

- **New cultures** have potential to **reduce the damage** caused by invasive species
- **Combine** conventional and novel **approaches** to maximize impact
- Method and success strongly **depends** on **species** and existing cultural and **social norms**

15 LIFE ON LAND



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Can a new culture save us from invasive species?

Abstract

Invasive species can cause significant ecological and economic harm and are a globally occurring phenomenon. Reversing the spread of an invasive species is very costly and, in many cases, even impossible. In the EU alone the financial costs caused by invasive species are estimated to be above 12 billion EUR per year and this even excludes other issues like biodiversity loss. Therefore, another way of dealing with invasive species is suggested: Instead of its eradication, a novel culture could try to adapt to and integrate the novel species to reduce its disruptive effect and to even make positive use of it. The problems caused by invasive species and possible solutions through novel cultures are presented in this paper and illustrated by the examples of the kudzu plant and the coypu mammal. We show that there is potential for this new approach, although its limits suggest that invasive species will remain a pressing issue.

Introduction

Before the advent of humans, many of the world's ecosystems were kept in relative isolation by natural barriers such as mountains and oceans. The minor introductions of non-native species done by early humans stand in stark contrast to those caused by the global movement of humans by modern transportation (Lowe et al., 2000). Although a majority of these introductions do not cause significant damage to environments, some species spread and cause substantial changes. If no natural predators control their population growth, they could modify entire ecosystems and outcompete native species. Those native species extinctions contribute to biodiversity-loss over time. Invasive species represent one of the most important causes of change in nature today. Their rapid spread and growth make them hard or impossible to control, even with extensive use of mechanical, chemical and biological tools for removal (Bhagwat, 2019).

Mainly because they dominate new environments and replace native species, there are huge costs associated with invasive species. In the EU the annual costs are estimated to 12 billion euros. The prevention, control and eradication efforts are primary drivers of the economic costs (Bhagwat, 2018). Seeing as such efforts are very costly, and often ineffective, it has been suggested that a more pragmatic approach should be pursued. In this view non-native species are seen as part of the novel nature of today. Bhagwat (2018) argues that invasive species are here to stay, and we must learn to live with them. In many cases the transfer of species by humans has caused irreversible changes which has created new ecosystems without a past analogue. Viewing these as resources that can be put to use can both save costs and mitigate the problem.

Two main approaches can be distinguished. First, bottom-up approach. It allows the communities to locally adapt to the changing environment from within and then influencing the higher scale powers. Second, top-down approach. Actions are planned at a governmental level to adapt a society (Thornton, 2019).

In this text we look at the prime example of the lantana plant (*Lantana camara*) and the opportunities of two invasive species in Europe, the coypu (*Myocastor coypus*) which have been dealt in the past with through a top-down approach, and the kudzu vine (*Pueraria lobata*) which was dealt in the past with a bottom-up approach. By looking at these two species, we try to analyse whether a more pragmatic approach is possible in Europe today. Are Europeans capable of creating novel culture and adjusting to novel nature?

New nature - new culture

Lantana - India's new gold?

The lantana (*Lantana camara*) invasion of the Male Mahadeshwara Hills in India is a prime example where a problem can be turned into profit. The lantana plant had detrimental effects on the environment, as it outcompeted native species and thereby decreased biodiversity and also ruined farmland. Local farmers found use of the so-called "useless plant" by for example burning them and fertilizing their soil with the ashes, or building fences from the branches. Many smart solutions were utilized to make use of the abundant plant and to reduce its further spread (Thornton et. al, 2019).

So why did this adaptation strategy work so well? The fact that the people living in lantana-affected areas had to deal with it themselves made the problem closer to home, which might have facilitated new culture to arise. The fact that one could also make profit by dealing with this problem plant was also a huge plus. Would this cultural change be possible in countries where the people do not have to deal with the problem directly in their day to day life? Is novel culture possible in Europe?

Coypu - an invasive rodent of unusual size

Coypu is a large semi-aquatic rodent, native to southern South America (Carter and Leonard 2002) and has been introduced to all over Europe as well as North America, Africa and Asia (Carter, 2007) in the beginning of the 1900's (Pasko and Eich, 2005). It was mainly introduced for its fur (LeBlanc, 1994), but the fur market collapsed a few decades later. (Pasko and Eich, 2005). The coypus established outside its native range by intentional introductions, by escapes from farms and further range expansion (Carter and Leonard, 2002).

The coypu's high invasive abilities are due to (a) its high reproductive potential; (b) its local mobility; (c) its great shade tolerance; (d) its adaption ability to various environments; (e) its gregarious character; (f) ineffective predation. This made it possible for it to invade wide areas and to populate them with high numbers (CABI, 2008).

Coypu has numerous environmental impacts on the areas it inhabits. It modifies the hydrology of an area, the successional patterns, the provided ecosystem services and damages human agriculture and infrastructure, by its digging and feeding behaviour. Those habitat changes cause a reduction in the native biodiversity (Carter and Leonard 2002).

Limiting the spread of coypu by eradication, seems to be the general accepted approach in the scientific community (Carter and Leonard, 2002). Several eradication programs were successful (Evans 1970, Gosling 1989), but many more failed, as eradication is often unachievable after the species established in a certain ecosystem (Leuven et al., 2017). Is there a possibility to combine human interest and successful coypu limitation programs to a novel harmonic culture? A first possibility is to revive its original purpose: fur production. Farming coypus became unprofitable, when fur demand decreased and the fur prices nowadays are still very low (Jeremiah, 2018). With financial governmental support, a new market could be opened and coypu population limited. A second and more innovative approach is to use coypu for its medical interest. The study of Kong et al. (2019) shows that coypu bile has protective effects against thioacetamide-induced liver injuries in mice and so could be used for the treatment of liver injuries in humans.

Kudzu - the plant that ate the south

Kudzu is an aggressive climbing vine originating from Eastern Asia that has spread to the five inhabited continents. This plant is an example of an invasive species where innovative cultural answers can be employed to regulate its growth.

Its impressive growth speed of up to 26 centimetres per day is what makes it a problematic species. As such kudzu can spread itself at an impressive pace, developing a large-scale monoculture over a short amount of time. Its growth is detrimental to the native species. It smothers their development and thus represents a major change in the ecosystems it is introduced in (Global Invasive Species Database). According to Britton et al. (2002), in the US, the "losses vary with the potential use of the land in an uninfested state. Where productive forest land has been overtaken, lost productivity is estimated at about 120 USD per ha per year."

Despite these problematic features, kudzu has many other properties that, if put to good use, can serve diverse purposes. The people living in the kudzu's original habitat have utilized the medicinal and culinary benefits of the plant for generations (Van der Maesen, 1985). After its introduction in the US in 1976 during the Centennial exposition in Philadelphia as an ornamental plant (Miller and Boyd 1983), it became mainly used for erosion control in the states located in the South-East. Rhoden et al. (1991) in their paper showed the possibility to use kudzu as food for grazing animals, such as goats. In order to achieve control of this invasive species, cultural responses had to be employed together and not independently for one another to be efficient (EPPO, 2007).

Feasibility in Europe

On the basis of those case studies, it becomes clear that there is no common answer for all invasive species. Individual adapted limitation programs need to be taken for each species and region. It also becomes obvious that it is easier for some species, than for others, to find feasible alternatives, that are economically interesting and so might be self-sufficient in the long run. To determine how realistic these approaches are in developed countries, such as in Europe, more detailed analysis of the economic and political situation is needed. Important questions need to be answered: How can the invasive species limitation programs be attractive enough, but without causing the expansion of lucrative invasive species due to high demand? How do we prevent low cost imports of lucrative invasive species from regions with cheaper labour?

Conclusion

We need to find new pragmatic ways to deal with invasive species, since returning to an original preserved state without human disturbance has shown to be infeasible both ecologically and economically. A new narrative for these species being part of a novel nature can be derived to better manage them. Instead of the eradication of invasive species, a novel culture can propose ways for humans to live in a convivial way with them and try to harvest their goods and thereby reduce their disruptive impacts on native nature. In case of the coypu, its fur and its medical properties could be used, although the free market might need some governmental incentives. Besides medicinal and culinary advantages the Kudzu vine possesses advantages like preventing erosion and being used for animal feed. How far the concept of novel culture as a response to novel nature can work in general strongly depends on the specific species and the already existing cultural and social norms.

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