Reviving extinct species has unclear consequences

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Should scientists be working to revive extinct species?

Jurassic Park makes it seem like a terrible idea. In the iconic 1993 film, dramatically advancing science without waiting to discuss ethics pretty clearly results in tragedy and disaster. "Your scientists were so preoccupied with whether or not they *could*, they didn't stop to think if they *should*," says Ian Malcolm in one of the movie's most memorable lines.

But the real world isn't quite like *Jurassic Park.* Today, research on the revival of extinct species includes healthy, open debates about ethics and potential consequences.

The debate is similar to the one presented in Jurassic Park: should we really be trying to bring back species that natural selection eliminated? Is it responsible? If not, what about species who went extinct thanks to human activity, like overhunting or deforestation? Maybe we *should* try to undo the damage we did.

It's likely that a consensus will never be reached on whether it's 'right' or 'wrong' to bring back extinct species. The best we can do is try to figure out what the practical consequences might be.

And there definitely will be consequences. Reinstating extinct creatures on even a modest scale could have big ecological effects. In an ecosystem, every species fills a particular niche, or role: they eat other species, they get eaten by other species, they interact with plants, rocks, and bodies of water. This is why, when a species goes extinct, it can have a disruptive rippling effect on the entire ecosystem.

The woolly mammoth is a popular example: During the last ice age, mammoths helped keep the grasslands alive by eating plant matter, traveling, and then excreting it, thus spreading grass seeds around. When the mammoths went extinct, the grasslands receded, and the loss of plant life encouraged the permafrost to melt more quickly, releasing greenhouse gases into the atmosphere. Many scientists argue that if we could reinstate a healthy mammoth population, the grasslands might return, slowing global warming.

The skeleton of a wooly mammoth in a German museum. (Lou.gruber via Wikimedia Commons)

However, some feel that we just don't know enough about the consequences to implement reinstatement right now. "De-extincted" species carry some concerns similar to those surrounding genetically modified organisms: unusual genes from de-extincted species may mix with the genes of extant (currently alive) species, with unpredictable effects.

On the big-picture side of things, we have far less data on historical ecosystems than on present ones, and there is a significant possibility that either scientists have an incomplete picture of an extinct species' niche, or that the ecosystem will have changed so much that the reinstated extinct species will no longer be able to fill their old niche.

"Forests have fragmented, forests have expanded and contracted," explains University of California ecologist Douglas McCauley. "A passenger pigeon that hits that forest again is going to be like a middle-aged guy who really wants to go back to high school and then he gets back there and he's like, 'Whoa I don't fit in anymore.'"

Last year, McCauley was the lead author of an article published last year in Scientific Ecology that suggested three criteria for choosing extinct species as candidates for what he calls "de-extinction": the species has to have a unique niche, filled by no other similar species; the species should have become extinct fairly recently; and the species should only be chosen if it's able to become abundant enough to make a difference in the ecosystem.

These criteria were developed to offer guidelines for making sure the reinstatement of an extinct species is ecologically meaningful, by ensuring that we understand the past and present ecological situations thoroughly before attempting any de-extincting action.

But a concerning complication of the de-extinction debate is that the potential consequences aren't all ecological.

"Honestly, the thing that scares me most is that the public absorbs the misimpression that extinction is no longer scary," says McCauley. "That the mindset becomes: Deforest, no biggie, we can reforest. If we drive something extinct, no biggie, we can 'de-extinct' it."

The fears McCauley voices, and the ethical debate they're a part of, aren't hypothetical. The technology needed to bring back extinct species is already here.

The last Pyrenean ibex – a sort of European wild goat – died in the year 2000, crushed under a tree. A few years later, a team of Spanish scientists impregnated goats with eggs filled with her genetic material. Six goats miscarried; one gave birth. The ibex clone that was born alive had severe lung defects, and lived for only ten minutes. But she was, for those ten minutes, alive.

If one extinct individual can be brought back, then an entire species can be reinstated. Advances in genetics – most notably the gene-editing technology known as CRISPR – mean that de-extincted species won't have to be clones, giving ecologists the hope of a stable gene pool. In a few years it might be totally feasible to bring back the woolly mammoth, or the passenger pigeon, or anything else we have a chance at getting DNA from. But it might be many years before we see herds of mammoths wandering around idyllic grasslands.

And the ethical debate is still ongoing, with scientists and ethicists working hard to design guidelines like McCauley's in the hopes that we don't take on monumental ecological projects before we're prepared to deal with the consequences. In other words, they're making sure that before we implement this power just because we *can*… we stop to think whether we *should*.