Resurrection Ecology

The other day, my colleague Mary Ann Pels suggested that I read *Mammoth: The Resurrection of an Ice Age Giant* by Richard Stone, the European news editor of *Science*. Needless to say, I found it fascinating. Stone provides a real-life account of scientists and others involved in daring and somewhat bizarre attempts to find and recover woolly mammoths (*Mammuthus primigenius*), thousands of which remain entombed in the permafrost of northern Siberia. More fantastic than those activities, however, are the plans of two Japanese geneticists who hope to take sperm from these dead animals, and resurrect them through either *in vitro* fertilization or cloning.

I was immediately attracted to Stone's use of the word "resurrection" because it is one of the many "re-" words that are closely related to restoration. Moreover, the resurrection of extinct species as well as the cloning of living, endangered species have several ethical and practical implications for ecological restorationists. As I read along, I found myself asking these questions: Should we be like the Japanese geneticists and try to resurrect dead mammoths or other extinct beings? Or like the indigenous Dolgans of northern Siberia who respect and deify the spirits of these creatures, and leave well enough alone? Or like the scientists who have exhumed mammoths in order to learn how they lived and why they died? Or like the scientists who want to use their knowledge of genetics to increase populations of living, but endangered, species? So many questions.

Etymologically, "resurrect" is derived from the Latin word *resurgere* (*re-*, again + *surgere*, to rise), while the Latin derivation of "restore" is *restaurare* (*re-*, again + *staurare*, to make strong). As with so many words, these two have subtle, nuanced differences. From my perspective, "resurrect" describes activities that bring back the dead, while "restore" focuses on healing the living. Of course, taking this binary approach to their meanings is the easier ethical path—one that at least some bioethicists would contend fails to comprehend or account for the dramatic increases in our knowledge of genetics that have made the distinction between living and dead increasingly less clear. Nonetheless, I think it gives us a point of departure for looking into this issue.

With the genie out of the bottle in terms of cloning, it really depends on how we decide to use this technology. After reading Stone's book, it appears that resurrecting a woolly mammoth will not happen any time soon, if at all. I don't think the world will be the worse off for the failure. In this aspect, I agree with the Dolgans. As much as I love history and things historic, I have no vision of bringing back dead animals from another geologic era. Like the Dolgans, I see the worth in respecting the life force, and not necessarily the life form, as the most important expression of vitality. Moreover, we must always be careful not to be caught up

in our own romantic notions of the past, especially if they cause us to create or resurrect charismatic creatures to fulfill our present-day desires or appease our sense of guilt.

On the other hand, I find the idea of cloning endangered species or even species that have become extinct in recent time somewhat more appealing, if only because we might be able to care for those beings by returning them to their former or restored habitats. Since the cloning of Dolly the sheep in 1997, geneticists have made several strides toward cloning endangered species. In January 2000, for instance, scientists used the interspecies embryo transfer technique to implant a cow from Iowa with a cloned embryo of a guar, a species of wild ox native to southeast Asia. The guar calf was born but died shortly thereafter. A year later, using a similar technique, a team of scientists led by Paqualino Loi of the University of Teramo in Italy, created a clone of the European mouflon (*Ovis musimon*), an endangered wild sheep that once lived on the islands of Sardinia, Corsica, and Cyprus. Since then other similar efforts have produced clones of an African wildcat, an Indian desert cat, and the bongo antelope (*Tragelaphus euryceros*). Giant pandas (*Ailuropoda melanoleuca*) and cheetahs (*Acinonyx jubatus*) are now being considered as possible candidates for cloning.

Scientists are also attempting to clone species that have recently become extinct (this is what I mean about the now fuzzy boundary between "dead" and "living"). For example, researchers in Spain and the United States are working to clone a bucardo (*Capra pyrenaica pyrenaica*), an extinct mountain goat that once ranged across the Pyrenees Mountains. In this case, geneticists are working with live cells taken from the last bucardo, which perished in 2000. Similar efforts with living cells from extinct animals are taking place in Australia with the Tasmanian tiger (*Thylacinus cynocephalus*), and in New Zealand with the huia bird.

Where does all this work fit into the agenda of ecological restorationists? Obviously, if cloning of rare and endangered animals ever becomes commonplace restorationists will be called upon to provide suitable habitats for their long-term well-being. Will we be ready both practically and ethically to accept the challenge? Practically, I think we will be more capable than we are now to restore habitat for endangered species. Moreover, these situations may bring restoration closer to its allied field of conservation biology. Ethically, I suspect the entire conservation community will have to do some soul-searching; it will have to answer the question: Does cloning have a role to play in conservation or will it only serve to make humans more complacent about protecting other beings and their place on this planet? The answer to this question will certainly tell us something about our selves, our faith in technology, and our level of hubris.

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