WHERE DO CAMELS BELONG?

THE STORY AND SCIENCE OF INVASIVE SPECIES

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INTRODUCTION

WHERE DO CAMELS BELONG?

Where do camels belong? Ask the question and you may instinctively think of the Middle East, picuring a one-humped dromedary, some sand and perhaps a pyramid or two in the background. Or if you know your camels and imagined a two-humped Bactrian, you might plump for India and central Asia. But things aren't quite so simple if we're talking about the entire camel family.

Camelids (the camel family) evolved in North America about 40 million years ago. *Titanotylopus*, the largest camel that has ever lived, stood 3.5 m high at the shoulder and ranged through Texas, Kansas, Nebraska and Arizona for around 10 million years. Other species evolved very long necks and probably browsed on trees and tall shrubs, rather as giraffes do today. Much, much later camels spread to South America, and to Asia via the Bering

Strait, which has been dry land at various times during the recent Pleistocene glaciations. Camels continued to inhabit North America until very recently, the last ones going extinct only about 8,000 years ago. Their modern Asian descendants are the dromedary of north Africa and south-west Asia and the Bactrian camel of central Asia. Their South American descendants are the closely related llamas, alpacas, guanacos and vicuñas (llamas are only camels without humps; all you need to do is look one in the eye for this to be pretty obvious).

Now you know all that, let me ask you again: where do camels belong? Is it:

(a) in the first place you think of when you hear the word 'camel', i.e. the Middle East.

(b) in North America, where they first evolved, lived for tens of millions of years, achieved their greatest diversity, and where they became extinct only recently.

(c) in South America, where they retain their greatest diversity.

Or, just to muddy the waters a bit more, is it:

(d) in Australia, where the world's only truly wild (as opposed to domesticated) dromedaries now occur.

Finally, if you felt able to give a confident answer, can you explain why?

If you think camels belong where they evolved, the question has only one answer: North America. If it means where they have been present for the longest time, the answer is the same. If it means where camels have been present during recent millennia, then the answer is Asia and South America. If camels belong wherever they can thrive without human assistance, then it must also include Australia. These are all perfectly reasonable interpretations of belonging.

And there is nothing particularly special about camels. Dispersal over huge distances is not at all unusual among land animals, and it is almost routine among birds. Horses are much the same as camels, and frogs, toads, shrews, deer, cats, weasels, otters, hares, skinks, chameleons and geckos are among the many other groups that now occur almost everywhere, and do so as a result of relatively recent dispersal – without human assistance – often starting out in Africa or south-east Asia. None of these species have an an obvious answer to the question about where they belong – whether they are natives or aliens – any more than camels. Indeed, once you adopt a view of the world that doesn't assume that there's something very special about where things happen to be right now (or in relatively recent history), asking where *anything* belongs tends not to have an obvious answer.

The Earth is home to just short of two million species of living organisms. At least, those are the ones we have recognised, described and named. There are certainly many more, maybe up to 10 million, possibly even more. Each of those species has a characteristic distribution on the Earth's land surface, or in its oceans, lakes and rivers. Some are common, some are rare, some have very wide ranges, others are confined to tiny areas such as single islands. But in every case, that distribution is in practice a single frame from a very long movie. Run the clock back only 10,000 years, less than a blink of an eye in geological time, and nearly all of those distributions would be different, in many cases very different. Go back only 10 million years, still a tiny fraction of the history of life on Earth, and any comparison with present-day distributions becomes impossible, since most of the species themselves would no longer be the same. Go back further still, and the Earth itself starts

to become unfamiliar, with some continents drifting further apart, others colliding.

Only rarely do we get a really good view of what a dynamic, unstable place the world and its inhabitants really is, but when we do it can be quite startling. Recently, Dutch researchers drilled down over half a kilometre to obtain sediment cores from the Bogotá basin in the tropical High Andes of Colombia. The pollen grains preserved in this sediment column tell us what the vegetation was like at every moment during the last two million years – and the researchers found something remarkable. This is what they concluded:

> *Present-day montane forest and páramo vegetation reflect a 'frozen moment' in a long and dynamic process of almost continuous reorganization of floristic elements. It indicates that on a Pleistocene timescale present-day plant associations are ephemeral. Most of the record reflects no-analogue vegetation associations.*

In other words the plants (and the vegetation they formed) that would have been familiar to a human observer at any moment during the last two million years would have seemed quite unfamiliar to anyone from any other point in time. Not only that, but (that final 'no-analogue' comment) none of the various kinds of vegetation that grew during that immense span of time has any close modern equivalent, and all would be unfamiliar to a present-day observer.

What all this tells us is that there is nothing special about the plants – or camels or anything else – we have now, nor about exactly where they happen to be, i.e. where they are currently 'native'. The only unusual thing about *now* is that we are here to see it. Which, of course, prompts another question. If we consider the Colombian example above, is there any sense in which any of the different kinds of vegetation that have existed

there are *better* – or worse – than what we have now? Does the long-vanished flora of, say, a million years ago have any more *right* to occupy the Bogotá basin than the vegetation that was around two million years ago, or than what is there today?

If we believe the answer to either or both of those questions is yes, then we need to answer another question: which vegetation do we prefer? If there is a hierarchy of rights and belonging, who or what is at the top? And why? And, most urgently of all, how can we reply to that question in such a way that the answer is given a good, shiny coat of scientific objectivity?

One answer is to observe that man is now by far the most important disperser of species around the globe, and to assert that human interference with species' distributions is an unnatural process – in effect that mankind is now no longer part of the natural world. Essentially that man is now bringing together species that, without our intervention, would have taken a very long time to meet, or might never have met. Yet if a study of the history of life on Earth teaches us anything, it's that 'never' should be used with extreme caution. The unique mammals of South America, evolving in isolation for 100 million years, must have thought they would never encounter their more advanced cousins from North America – until they did.

If we subscribe to this view of the world, we do not need to know *why* dispersal of species by humans is inherently unnatural. Nor do we need to know what event – whether the invention of agriculture, or the steam engine, or the lawnmower – caused *Homo sapiens* to be forever sundered from the rest of creation. It is enough to know that just before this event the Earth's species were briefly, and for the first, last and only time, not only where they ought to be, but also where they ought to remain. (Nor, apparently, is this invalidated in any way by the massive human modification of the majority of the Earth's surface, rendering much of it quite unsuitable

for the species that used to live there, nor by current and future anthropogenic climate change, which threatens even those few parts of the globe that remain relatively untouched by man.)

If we adopt this idea – and, bizarre though it seems, it has become a dominant and orthodox view – the 'frozen moment' when there was a place for everything, and everything knew its place, is set not quite now but at some point in the pre-human, pre-industrial past. Everything and anything that has happened since (which by definition would have turned out very differently without human intervention) is wrong in practice and in principle. And in such manner, belonging – or 'nativeness' – is elevated into one of the great conservation principles of our time, conferring indefinite rights of future occupancy and significant public funding on species judged to possess that nebulous quality, and zealous persecution of those species deemed not to belong.

This black-and-white view of the world – 'natives' good, 'aliens' bad – is justified by a focus on a relatively few species that cause undoubted economic or environmental harm when moved to new areas. But it ignores the vast majority that do no harm at all, or are positively useful – including practically all the crop plants and animals on which human civilisation depends. It is also based on multiple distortions in defining 'nativeness'. Adopting the frozen moment as one's perspective leads into the temptation to regard attractive, harmless (and especially rare) species as native; and, conversely, to consider species we don't like as alien. We rather too easily attach the pejorative epithet 'invasive' to 'alien', so that before you know it all aliens are 'invasive aliens'. And even if they're not obviously invasive (whatever that means), we suspect that one day they will be, or that we haven't looked hard enough for evidence of their delinquency.

Of course, native species often move around too, but such movements, whatever their impacts, are not considered 'invasions'. Indeed, even the movements of aliens that we've decided we like – such as, in Britain, the recent spread of little egrets into the south of England – are tagged as 'migrations'. The rest of the vocabulary of biological invasions is similarly elastic: once we agree that alien species are by definition harmful, their presence itself becomes one measure of 'harm', and because we 'know' that alien species cause economic damage we routinely inflate the cost of such damage by ignoring any possible beneficial impacts.

You might by this point be wondering whether I'm just paranoid. There surely isn't a global conspiracy to promote and maintain such a view of the world? Well, yes and no. There is no conspiracy, but a remarkable coalition has developed to promote this version of reality.

For biologists, alien species provide unparalleled opportunities to study dispersal, colonisation, competition and evolution in action. But funding for such pure research is limited, so there's an understandable tendency to loosen the purse strings by presenting aliens as some kind of existential threat to life. Not just species currently judged to be invasive either, but also those with the potential, however remote, to become invasive. Conservationists are, too often, happy to go along with this, because conservation is a value-laden activity, whose values are not always easy to pin down. 'Nativeness' appears to offer the prospect of unambiguous attributes that make something worth conserving; or, in the case of its absence, worth exterminating, or at least controlling. To question this approach is close to heresy. And the media are happy to buy into it. The language is easy to put across: the respect for natives and (especially) the fear of aliens.