Sabercats and Other Carnivores Kept the Ice Age World Green

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A Smilodon angles to get a better bite on a sloth at the La Brea Tar Pits and Museum. Photo by Brian Switek.

The huge herbivores of the Ice Age were ecosystem engineers. Wherever they went, mastodons, sloths, bison, and their ilk changed the landscape by eating, defecating, trampling, and otherwise going about their plant-mashing business. But they were not isolated agents. Following out the engineer analogy, the megaherbivores of times past had managers. These were the sabercats, hyenas, wolves, and other predators past.

Many Pleistocene carnivores certainly look menacing enough. The long fangs of Smilodon have made it a staple of museum halls as well as schlock horror, and the thought of staring down a giant hyena is enough to send a shiver down my spine. So given that some prehistoric predators had such impressive weapons it's not surprising that we've often imagined them setting into mammoths and other Ice Age giants. Bigger prey requires bigger cutlery, right?

Well, not quite. Many of the most iconic Ice Age herbivores were simply too big to kill. It's the same reason why lions don't chase after adult elephants. Clawing into a pachyderm is a high-risk scenario, even considering the fleshy reward, and fossil evidence has suggested the same pattern held in the

Pleistocene. Smilodon didn't take on adult mammoths and Megatherium, for example, but often targeted camels and bison instead. Large size was a refuge was most Pleistocene giants. But their offspring were a different story.

In a new study surveying the effects of large carnivores stalking the Ice Age landscape, University of California, Los Angeles paleontologist Blaire Van Valkenburgh and colleagues found that the young of many large Pleistocene herbivores would have been right in the sweet spot for hungry carnivores.

Part of the analysis involved sizing up the predators themselves. For starters, Van Valkenburgh and coauthors point out, not only were many extinct Pleistocene carnivores significantly larger than the predators that survived them, but each "carnivore guild" in the sample included a greater number of species in the past than comparable ecosystems today.

Even just looking at the felids, the researchers write, "nearly all Pleistocene predator guilds found outside of Australia included at least one and often two species of large sabertooth cat." This pattern is directly related to the number of big herbivores there were to eat. Even in modern ecosystems, Van Valkenburgh and colleagues point out, the likelihood that three or more large carnivores might be present steadily increases. In addition to the herbivores creating more open habitat that give predators the opportunity to hide along the forested margins, there's simply more meat to carve up.

Much of that flesh came in the form of juvenile giants. Even though we tend to think of adult specimens embodying any given fossil species, all prehistoric animals had to grow up. And just as with modern species – like the 74 juvenile elephants taken by lions over a four year period in Botswana – the little ones are vulnerable. Juveniles would have been even more at risk in the Ice Age, when apex predators were larger and there were far more of them.

Baby mastodon – like this one at the La Brea Tar Pits and Museum – would have been vulnerable until they reached about six years of age. Photo by Brian Switek.

Drawing from data on prey selection by modern carnivores, Van Valkenburgh and colleagues applied the same ecological arithmetic to the fossil record. While a solitary extant lion probably can't capture even a two-year-old baby elephant, the paleontologists found, a lone Smilodon, Homotherium, cave lion, or other large cat would have been capable of hunting a baby mammoth or mastodon in the two-to-four-year-old range. (A sabercat den full of baby mastodon bones in Texas supports this contention.) The chances of the Pleistocene predators only got better if they formed a pride, and social strategy was a boon to packs of wolves and clans of hyenas, too.

So while none of the Ice Age carnivores could have taken on an adult mammoth or mastodon, all of them – especially if they were social predators – were capable of tearing into the young. The big proboscideans would have been vulnerable until they were about six years old, which is a long time to have to be looking out for hungry eyes peering through the brush.

This is how the landscape was shaped by the subtle paw of the carnivores. Many paleontologists previously thought that Ice Age herbivores were too big to fail. That they existed at "saturation levels" because their size made them immune. But now Van Valkenburgh and coauthors have made a solid case that carnivores greatly influenced herbivore populations by preying on the young. This was violent, and even sad, but all a part of the constant ecological shuffle. Unchecked by carnivores, large herbivores can proliferate to destructive levels until they start eating themselves out of house and home. Smilodon, dire wolves, and other beasts of prey actually defended the plants – vegetation has no greater friend than a predator. That's how large carnivores have been keeping the world green for millions of years , and I hope that our species can yield them the space to keep doing so.

Reference:

Van Valkenburgh, B., Hayward, M., Ripple, W., Meloro, C., V. Roth. 2015. The impact of large terrestrial carnivores on Pleistocene ecosystems. PNAS. doi: 10.1073/pnas.1502554112