Had you roamed the plains of Colorado during the last Ice Age, you would have encountered numerous large companions: mega mammoths 3 feet taller than any modern elephants, giant bison with 8-foot horn spans, huge lions 25 percent bigger than their African cousins, and gigantic ground sloths bigger than bears to mention just a few. Even two hundred years ago, your stroll across the plains would be a completely different experience from today: in 2011 you might drive through urban sprawl, or through fenced, thinly stocked ranches. In 1811, you would have negotiated your picnic spot with thousands of bison—and probably retreated.

The many large animals that became extinct with climatic change, retreated from what we call development, or were actively wiped out, are the most obvious difference in plains ecosystems before and after humans took them over. But numerous other organisms depend on large mammals, either indirectly by thriving in an environment that is formed by huge herds of grazers, or directly by feeding on the animals or their products. Dung beetles are among the latter.

A bison defecates at least once every two hours. Their feces are quite substantial, covering around a square foot of prairie. One bison covers around 10 square feet of prairie every day. Before their eradication, the bison population of North America was an estimated 30 to over 60 million animals, with single herds counting up to 125,000 or even a million head. Sixty million bison would have covered 7,855.5 square miles per year with their excrement. Although the United States was never at risk to be completely covered by dung—it would have taken the bison over 500–1,000 years—it is conceivable that such an enormous resource had provided for a substantial user community.

When food disappears from an area for a couple of years, many of the species relying on this food become extinct. In some areas where the bison was exterminated, cow pies might have served as a replacement food. In many areas, however, the formerly reliable and plentiful supply of bison dung was not sufficiently or quickly enough replaced by cattle droppings. Or perhaps cattle dung is not as yummy for dung beetles as bison poop. This is certainly true for modern cattle dung that is contaminated by helminthicides (medication against intestinal worms) and antibiotics.

Currently, the dung beetle fauna of the Great Plains is composed of a limited number of species, about 40 of them in the Colorado prairie, the more abundant species being invaders from Europe. Looking into a bison cookie rarely reveals buzzing life. If we compare our Plains with grasslands elsewhere in the world where large mammals are producing a lot of dung, we look pretty poor. African savannas are the most striking example. Large mammals have roamed African savannas for millions of years. Africa is dung beetle heaven, or, more scientifically speaking, the center of dung beetle diversity and abundance.
If a Cape buffalo defecates, the result is gone within a day or two. A portion of human feces, a very attractive resource for dung beetles, is gone within a couple of hours.

In central Kenya, we found 13,699 dung beetles in 1 kg. of elephant dung (counted by Frank’s wife Sylvia who is an ecologist and more persevering than her husband) whereas a kilogram of Colorado poop yields dung beetles in the hundreds or even less. Admittedly our winters are colder and our humidity is much lower than in Africa, two factors that insects do not appreciate, but 7,855.5 square miles of poop per year, or even half of it, was likely to have sustained a much richer dung fauna than we have today.

In grassland ecosystems with large mammals, be it cattle or bison, the dung fauna plays a vital role in maintaining soil quality. They break up the droppings and bring nutrient-rich dung into the soil where plant roots take them in. Dung beetles aerate the soil by their digging activity, and they disturb the dung patties enough that dung flies, often biting pests of large mammals, cannot develop in large numbers. Dung beetles also reduce the number of pathogenic worms in pastureland.

What happens if dung beetles are missing in a grassland ecosystem can be seen in Australia during the last century: Ranchers lost large areas of pastureland because it became sealed by cow dung. Biting flies emerged in the billions, creating a serious problem for both livestock and the rural human population. No Australian dung beetle was adapted to the unusual, soft, muddy type of poop that a domestic cow produces every other hour. In 1965, the Australian government started a twenty year-long project to introduce foreign dung beetles to Australia and succeeded in establishing 23 species from Africa and southern Europe, which largely resolved the sticky problem.

In our prairies, we still have dung beetles on the job. We do not have any problem close to the extreme situation in Australia last century. However, our current dung beetle fauna is poor and not efficient enough to break up a significant part of the dung produced in ranchlands. How could we increase the efficiency of our dung recyclers? One idea is that bison dung as an indigenous resource, uncontaminated by heavy medication, might serve as a reservoir for a regenerating dung beetle fauna. To find out whether bison dung can sustain a more efficient dung recycler fauna is a goal of a study of the Denver Museum of Nature & Science Entomology Program. This study involves monitoring the beetle fauna for a decade after bison were reintroduced in an area, finding out whether the fauna gets richer, more abundant, or changes species composition.

When the Plains Conservation Center decided to have a bison herd on the West Bijou Creek Site in fall 2007, we jumped on this opportunity. The following spring we began monitoring the dung beetle fauna once every month in summer. We collect ten relatively fresh, well populated bison cookies and bring them to our outdoor lab (Frank’s back yard) where the dung beetles get extracted from the dung by floating the dung in water. Beetles float; dung sinks to the ground—ideally. Although the extraction takes more than six times the collecting time, it is still the most efficient method to quantitatively record the dung beetle fauna.

Now you want to know what we found so far, right? Well, we found many thousands of beetles, and pinned, labeled, and partly identified them. Identification takes time, but can only be done with a microscope. Imagine hundreds of little blackish beetles covered by dung—identification in the field would be impossible. We are still working on the identifications of the first four years of our monitoring. The specimens are preserved in the research collection of the Denver Museum of Nature & Science, but a selection of specimens will be displayed at the Plains Conservation Center starting next year.

As with any scientific research project, preliminary work or information often results in new questions. Sometimes, just answering one question leads to many more. One question that came up a couple of years into the project was, “Who ate the mammoth, giant bison, American lion, and ground sloth droppings, and did they become extinct along with the large mammalian mega fauna, or are they with us still today?” Well, okay, that’s three questions. We haven’t even started on the answers to those questions, yet.

When we have the results about how the bison dung fauna developed over that time period, we will let you know in Prairie Perspectives Journal.
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