Airborne ecologists help balance delicate African ecosystem

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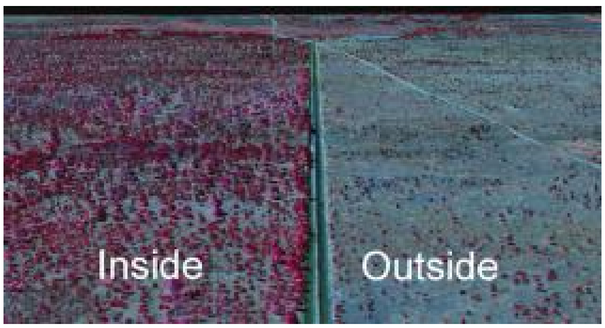

3-D images of African savanna vegetation in areas from which large herbivores have been excluded (left) and allowed access (right) give researchers a detailed picture of the ecological impact of the herbivores. The researchers can quantify not only the amount of vegetation change but also structural changes in the habitat. Image credit: Asner Lab, Carnegie Institution.

The African savanna is world famous for its wildlife, especially the iconic large herbivores such as elephants, zebras, and giraffes. But managing these ecosystems and balancing the interests of the large charismatic mammals with those of other species has been a perpetual challenge for park and game mangers. Now a new study published in the *Proceedings of the National Academy of Sciences* reports the successful test of new remote-sensing technology to monitor the impact of management decisions on the savannah ecosystem.

"These African savannas are extremely complex," said lead author

Gregory Asner of the Carnegie Institution's Department of Global Ecology. "On the ground they are notoriously hard to assess in terms what management decisions, such as controlling fire and large herbivore populations, are doing to the entire ecosystem."

The aircraft-based Carnegie Airborne Observatory (CAO) combines a laser-based 3-D mapping system with high-fidelity imaging spectrometers to create detailed 3-D maps of vegetation over large areas at high resolution (approximately 50 centimeters). For this study, the research team surveyed the vegetation of about 4,000 acres of savanna in Kruger National Park, South Africa. Included in the survey were areas of different soil types and experimental plots where all herbivores larger than a rabbit had been excluded for periods up to 41 years, allowing researchers to discern the effects of both soils and large herbivores on savanna vegetation.

Not surprisingly, the CAO survey found less plant growth and more bare ground in areas where large herbivores had been allowed to graze, compared to areas from which they had been excluded. But the 3-D mapping capability of the CAO revealed differences in the structural complexity of vegetation between herbivore and herbivore-free areas. This has implications for the types of other species these areas are likely to support. And by quickly and precisely quantifying the vegetation differences from the air, the CAO team demonstrated the potential of the new technology as a management tool.

"We are really creating a new way to do ecology," said co-author Shaun Levick. "What we're doing is collecting data for thousands of acres at extremely high 3-D resolution and getting clear answers for the first time as to what different management decisions do in the ecosystem."

Among the surprises in the study's results is that the impact of the large herbivores on vegetation cover is highest in areas where the soil had the highest concentration of nutrients, not areas with poor-quality soil. The researchers interpret this to mean that herbivores concentrate their feeding in areas of high-quality forage, so these areas suffer a disproportionate impact.

The team is preparing a similar study on the effects of fire on savanna vegetation in Kruger Park, according to Asner.

"There have been decades of excellent ground-based research on how different policies regarding fire and wildlife management play out," said Asner. "But the savanna ecosystem is spatially very complicated. With the CAO I think we're getting a picture of the large-scale impact of management decisions. That's what makes this series of studies unique."

Source: Carnegie Institution

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