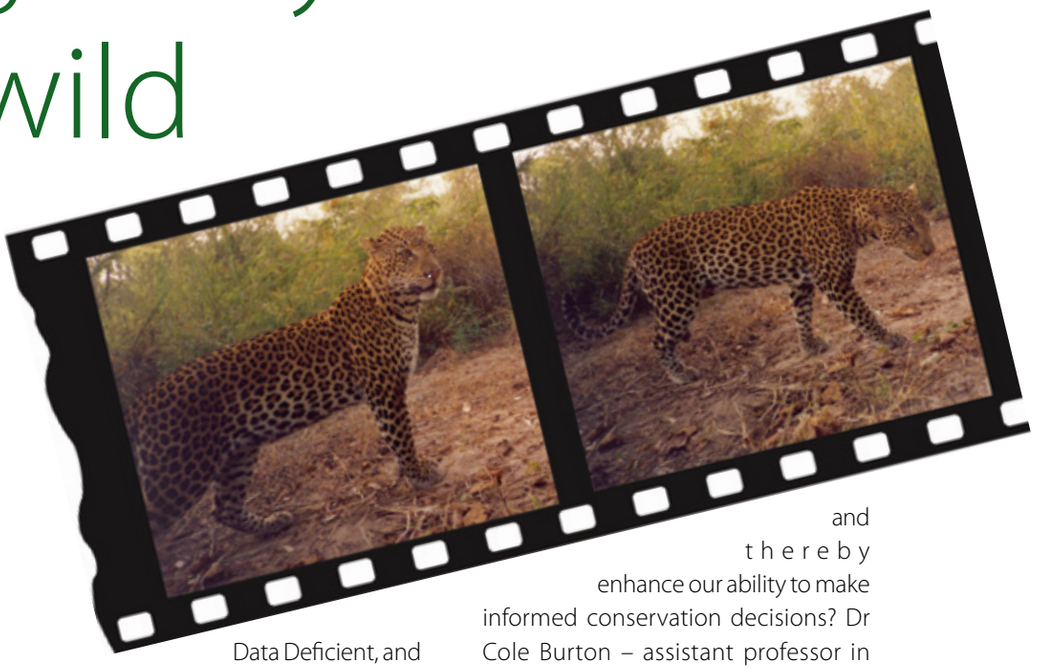
Keeping an eye on the wild



The challenge of conserving biodiversity on an increasingly human-dominated planet has been aptly described as a wicked problem – one that defies a simple technical solution. With humanity's ecological footprint expanding across local and global scales, finding a balance between economic development and ecosystem protection is proving difficult. People and nature are intertwined within complex socio-ecological systems, and "win-win" solutions – wherein economic growth and biodiversity conservation go hand-in-hand – are often hard to devise, and even harder to implement. In a complex arena of competing cultural values and substantial scientific uncertainty, navigating a path to sustainability requires transparent decision-making guided by reliable evidence. This evidence must not only reflect indicators of economic activity, many of which already have a large influence on public discourse (eg, GDP, S&P 500); it must also include measures of biodiversity status or ecological "health", which are much less well established. In other words, better biodiversity monitoring is needed to help us confront inevitable trade-offs between our economic aspirations and our commitments to protecting other species.

Many components of global biodiversity remain poorly known (tropical insects, for example), but even our most charismatic wildlife suffer from a lack of effective monitoring. The conservation and management of iconic large mammal species – from lions in Africa to grizzly bears in British Columbia – is often impeded by incomplete or inaccurate information. As wide-ranging, low-density, and wary animals, many mammals can be difficult to detect. The IUCN Red List classifies more than 15% of mammal species worldwide as Data Deficient, and the knowledge gap grows wider when we consider the status of particular populations within species. Even one of the leading attempts to track trends in vertebrate populations, the Living Planet Index, includes only a fraction of global species and populations. Furthermore, its population trends are derived from a patchwork of data sources of uncertain accuracy, and are rarely linked to management actions or drivers of change, meaning that lessons for decision-making are typically weak or absent. Consequently, while adaptive management remains an oft-stated goal in wildlife science, good examples of "learning by doing" remain elusive. Many policies thus rely on opinions more than evidence, leaving them vulnerable to criticism, particularly when they pertain to controversial issues (of which there are many in modern wildlife management). For example, a recently published review of efforts to manage conflict between people and predators was titled "Predator control should not be a shot in the dark", with the authors concluding that we lack sufficient evidence to gauge the effectiveness of controversial culling programs and guide the next management decisions.

So how do we improve our monitoring of large mammals and other wildlife, and thereby enhance our ability to make informed conservation decisions? Dr Cole Burton – assistant professor in Forest Resources Management – and his colleagues believe the use of remote cameras holds considerable promise. These popular tools (also known as camera traps or trail cameras) are widely used by outdoor enthusiasts – such as hunters scouting for a big buck – but their use in ecological research has exploded in recent years. Early applications focused on photographing large, patterned carnivores, like tigers and leopards, whose unique coat patterns are used to track individuals and create data suited to traditional statistical techniques such as capture-recapture models. However, researchers soon sought to capitalize on the broad range of terrestrial mammal and bird species "captured" by camera traps, species that generally lack such individually identifying features. With more and more cameras deployed around the world, an expanding collection of animal "selfies" is quickly filling computer hard drives in the offices of university researchers, government biologists, conservation practitioners, and citizen scientists. This collection has spawned efforts to develop new systems for more effectively processing, analyzing, and synthesizing wildlife image data. Just as meteorologists developed a network of weather stations to improve understanding of global climate, Dr Burton

Wolf pack "captured" during surveys in northern Alberta

Rare photograph of a Syrian brown bear in the Caucasus mountains

and his collaborators believe that networks of remote cameras can improve monitoring of wildlife distribution and abundance across large spatial scales, ultimately addressing key ecological questions and informing conservation policies while helping connect people with nature.

Dr Burton's lab at UBC – the Wildlife Coexistence Lab, or WildCo – is using camera traps to study several wildlife species and management issues in western Canada and around the world. His early application of the method in West Africa shed light on the status of a threatened and poorly studied mammal community in Mole National Park, Ghana. This expansive woodland savannah park protects regionally important populations of large mammals such as leopard and elephant, but faces mounting pressure from illegal hunting and habitat degradation, which appear to have driven the local extirpation of the critically endangered West African lion. Recent research by Dr Burton and colleagues in the southern Caucasus region has combined camera trapping with non-invasive genetic surveys to reveal an unexpectedly large population of Syrian brown bears (a threatened relative of North America's grizzly bear) in an area undergoing new mining development. And WildCo members are currently using camera traps to assess the impacts of industrial development on wildlife communities in northern Alberta's boreal forests. Much management attention in this region has focused on the effects of oil and gas development on threatened populations of woodland caribou, with the footprints of energy extraction opening up caribou habitat to wolves and other predators. Energy companies are investing considerable money into trying to restore these areas – particularly linear disturbances such as seismic exploration lines – and thereby reduce predation pressure on caribou, but comparatively little has been invested in monitoring the effectiveness of this landscape management initiative. Dr Burton's team has deployed camera traps across restored and unrestored seismic lines to monitor the behavioural and population responses of caribou, their predators, and other members of the boreal wildlife community. By replicating the standardized photographic sampling over time and across spatial scales – from individual cameras to arrays within landscapes under different management treatments – the team hopes to guide efforts to conserve not only caribou, but also the many other species inhabiting these changing forests that fall outside the scope of single-species management priorities.

Ultimately, it is this integration of remote camera data across species, time and space that holds great promise for improving wildlife monitoring at large scales of management relevance. Coordinated camera experiments and networks for data synthesis are emerging through partnerships among researchers, practitioners, and citizens, including Dr Burton's new WildCAM initiative: Wildlife Cameras for Adaptive Management. While the wicked problem of biodiversity conservation will not be solved solely through better monitoring, there is hope that the rigorous collection, analysis and dissemination of reliable evidence on wildlife status can help us navigate the challenging road ahead.

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A camera "trap" in action