Susan M. Haig is a supervisory wildlife ecologist with the U.S. Geological Survey Forest and Rangeland Ecosystem Science Center, Corvallis, OR; a professor of wildlife ecology at Oregon State University, Corvallis, OR; and president of the American Ornithologists' Union, Washington, DC. E-mail: susan_haig@usgs.gov.

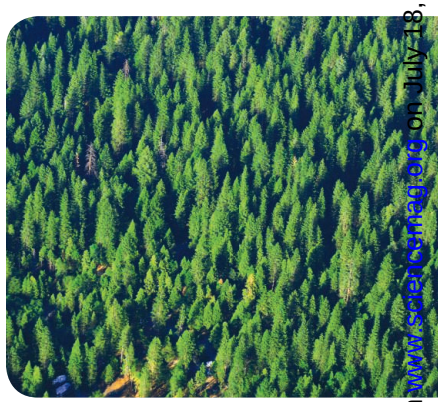
Thomas E. Martin is a senior scientist with the U.S. Geological Survey Montana Cooperative Wildlife Research Unit, Missoula, MT; and a professor at the University of Montana, Missoula, MT. E-mail: tmartin@usgs.gov.

Charles van Riper III is a senior scientist and supervisory research ecologist with the U.S. Geological Survey at the University of Arizona, Tucson, AZ. E-mail: charles_van_riper@usgs.gov.

T. Douglas Beard Jr. is the chief of the U.S. Geological Survey National Climate Change and Wildlife Science Center, Reston, VA; and president of the World Council of Fisheries Societies, Bethesda, MD. E-mail: dbeard@usgs.gov.

Pathways for Conservation

NEXT WEEK, CONSERVATION SCIENTISTS WILL GATHER AT THE INTERNATIONAL CONGRESS FOR Conservation Biology (ICCB) in Baltimore, Maryland, to grapple with the challenges of preserving our natural world in the face of a growing and increasingly consumptive human population. The natural world provides countless services, such as clean water, protection from flooding, and carbon sequestration, while offering opportunities for new medicines, foods, and energy production. Yet these valuable services and opportunities are disappearing along with the species and natural areas that supply them. The needs of a growing human population must be met while conserving the planet's natural systems. Accomplishing both will depend on making clearer connections between scientific results regarding issues such as biodiversity loss and the critical decisions that must be made about conditions that underlie change, such as greenhouse gas emissions and freshwater availability. The good news is that today's conservation scientists are developing innovative tools and strategies.



New technical concepts include applying electronic circuit theory to better understand how environmental features influence the genetic structure of multiple species in a particular landscape. This landscape genetics approach has provided guidance for decisions about timber management in the disappearing mature forests of the U.S. Pacific Northwest. Advances in automated wireless sensors, deployed by the thousands, will reduce the need for labor-intensive manual sampling of water, soil, air, vegetation, and wildlife, providing an unprecedented opportunity to track the effects of climate change. Likewise, identifying animal responses to environmental change throughout their life cycle will benefit from the use of unmanned aircraft. This effort will be greatly enhanced when a global animal tracking system operated from the International Space Station (called ICARUS) is launched and then expanded with the use of cell phone technology to monitor animal migratory connectivity. Even de-extinction technologies may be considered in future efforts.

Successful strategies for maximizing biodiversity while supporting human needs depend on understanding how species differ in their resilience and adaptability to broad environmental change. Those with little plasticity or genetic variance are at highest risk because of changing conditions; these include corals, amphibians, and island birds. Climate change may lead to completely new species assemblages, and conservation decision-makers must understand species responses so that responsible actions can be implemented. Another challenge is identifying the responses of invasive species, because they can so easily adapt to changing conditions and negatively alter biodiversity. This can be seen in the largely ineffective efforts to thwart loss of biodiversity in the U.S. Great Lakes as a result of a nonnative zebra mussel or in the loss of native plant diversity caused by invasive spotted knapweed.

Most importantly, conservation scientists must redouble efforts to communicate their research to the public, agencies, and policy-makers in ways that are easily understood and implemented. This approach is currently playing out in the California State Legislature as conservation scientists convey the negative effects of lead ammunition on wildlife and humans. A statewide ban on lead would also substantially boost recovery of the California condor and other scavenging birds and mammals. Overall, conservation decisions must be made by considering the fair-value impact on the ecosystem as well as the human need for the resource. If appropriately valued, nature and society should both benefit. The ICCB conference will continue this discussion to identify and address the most important of these challenges for preserving our natural world.

— Susan M. Haig, Thomas E. Martin, Charles van Riper III, T. Douglas Beard Jr.

10.1126/science.1242710