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BOOK REVIEW

Satellite remote sensing for biodiversity conservation: exemplary practices and lessons learned

A. K. Leidner, G. M. Buchanan (eds.), *Satellite Remote Sensing for Conservation Action: Case Studies from Aquatic and Terrestrial Ecosystems*. Cambridge University Press, Cambridge, UK. 2018, 372 pp.

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Biodiversity is the very basis of human existence and sustainable development on Earth. It not only provides us with the basic necessities such as air, food, and water, but also serves as fundamental building blocks for healthy ecosystems. However, biodiversity is facing unprecedented threats. According to the global biodiversity assessment released in May 2019 by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), the number of species that are now threatened with extinction is greater than ever before in history; these threatened species are becoming extinct at a faster rate; current global response to this biodiversity crisis is still insufficient; and transformative changes are critically needed (IPBES 2019).

One technologically transformative change may be the employment of satellite remote sensing for biodiversity conservation. Data collection is currently being carried out by more than 700 earth-observation satellites according to the Satellite Database of the Union of Concerned Scientists (2019), while data processing is continuously accelerated by both software and hardware development. This fact makes it effective and efficient to monitor the Earth's surface in a spatially and temporally exhaustive manner, making satellite remote sensing an amazing opportunity for biodiversity conservation. The problem now for conservation practitioners is how to exploit this opportunity, given that relatively few have an academic background or practical experience in remote sensing.

The book *Satellite Remote Sensing for Conservation Action: Case Studies from Aquatic and Terrestrial Ecosystems* is a bold effort to address this problem. The two editors, who wrote two out of the 10 chapters of the book, are among the pioneers and leading experts in remote sensing application in identifying conservation problems and solutions. The other chapters were contributed by 32 leading researchers in conservation remote sensing from Australia, Italy, Spain, UK, USA, and Niger.

Satellite Remote Sensing for Conservation Action can be divided into three parts, namely Chapters 1–2, 3–8, and 9–10. The first part presents a necessary and excellent background for readers from either the conservation or remote sensing disciplines. Chapter 1 provides a brief but comprehensive background on biodiversity conservation. It also explains why remote sensing is of interest and can be of use to conservation

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practitioners. Then, Chapter 2 follows up with some essential details of remote sensing, including its development history, basic concepts, and functional mechanisms. Because one major barrier to the application of remote sensing lies in data accessibility, Chapter 2 tries to summarize key remote sensing data products (including raw data and higher-level products) and web sources.

The second part contains six case-study chapters and is the highlight of *Satellite Remote Sensing for Conservation Action*. The six case studies cover both aquatic and terrestrial ecosystems from around the world. The first case study illustrates the role that satellite remote sensing has played in the conservation of East Asia's coastal wetlands, specifically the tidal flats in the Yellow Sea. A practical method was developed to achieve consistent time-series maps of the tidal flats, using the 30-m resolution, free Landsat remote sensing data archive. The second case study documents the quantification of the quality and loss of chimpanzee forest habitat in Africa. Satellite remote sensing data delivered at different levels of processing were used, such as Landsat ETM+ band 5 and Landsat-derived per cent canopy cover. The third case study demonstrates the usefulness of satellite remote sensing for fire monitoring in African protected areas. Two satellite remote sensing-based tools were developed for incorporating the monitoring information into fire management. The fourth case study proposes a satellite remote sensing-based solution for monitoring and assessing ecosystem functioning, such as the dynamics of primary productivity and water fluxes. The solution was successfully applied to the Doñana National Park of Spain. The fifth case study introduces a novel system in the Idaho Department of Fish and Game, a wildlife management agency, for predicting mule deer harvests at a regional scale. The prediction is performed in real time by using satellite remote sensing information on environmental and climate conditions. The last case study reports a near-real-time tool for predicting blue whale occurrence and densities based on satellite telemetry data for blue whales and some selected environmental variables such as sea surface temperature and height. All the selected environmental variables have ecological links to blue whales and were derived from satellite remote sensing images.

The third part (i.e., Chapters 9–10) provides some case study-independent and case study-dependent perspectives on satellite remote sensing for conservation action. Chapter 9 reviews the use of satellite remote sensing by conservation organizations, especially Conservation International, and discusses the recent challenges and future opportunities of conservation remote sensing. By contrast, Chapter 10 is a case study-dependent discussion. It summaries the six case studies of the book, highlighting their common themes, lessons learned, and implications for the future.

The distinctive feature of the book is the emphasis on exemplary practices and lessons learned. As can be seen from the book' structure, the six case studies form its core. In each case study, the authors present not only their conservation problem and scientific methods but also technological practices and lessons learned. The practices and lessons are often absent from scientific journal and conference papers, but they are significantly important in practically applying remote sensing for conservation action. The lessons can also be found in the last chapter, which were learned by the editors from the case studies. All these facts make the book complementary to scientific journal and conference papers.

The book demonstrates the great and still-increasing importance of remote sensing for biological conservation. Indeed, biodiversity can be better investigated by using remote sensing (Rocchini et al. 2018), and there are at least ten ways remote sensing can contribute to conservation (Rose et al. 2015). However, it should be pointed out that remote sensing is not limited to spaceborne, namely the satellite remote sensing illustrated in the book. Remote sensing can also be airborne or ground-based, such as Light Detection and Ranging (LiDAR). In some biodiversity conservation cases, airborne or ground-based remote sensing may be more applicable because the sensed data have a higher spatial resolution than that of satellite (i.e., spaceborne) remote sensing (e.g., Getzin et al. 2017). This resolution issue is also the reason why a chapter author of the book found it impossible to determine the local factors affecting ecosystem resilience using only satellite remote sensing observations (p. 182).

Overall, *Satellite Remote Sensing for Conservation Action* is a timely, instructive, and stimulating book on biodiversity conservation practices. The book is of great use to landscape ecologists in general and conservation practitioners in particular. The only (minor) criticism worth making is that in Chapter 2, the summary on key remote sensing data products is not that comprehensive and the software tools for data processing are not introduced for landscape ecologists. Nevertheless, the book is readable by both the conservationists who are unfamiliar with remote sensing and those have a remote sensing background but a limited understanding of biological conservation. If conservation remote sensing is to be included in the curriculum of conservation education, the book can be used as a course book or a reference.

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