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EDITORIAL

Remote Sensing Training in Ecology and Conservation – challenges and potential

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The relevance of remote sensing (RS) for ecology and conservation has been recognized for decades (Kerr and Ostrovsky 2003; Turner et al. 2003) and RS is increasingly applied to a range of topics within these fields (Nagendra et al. 2013; Pettorelli et al. 2014; Rose et al. 2015). Although RS techniques are proven to be highly valuable for monitoring biodiversity (Pettorelli 2013; Horning et al. 2010), the routine use of new technologies and analytical tools could be improved (Bernd et al. 2017; Clark et al. 2017). Datasets such as hyperspectral or radar data, for example, come with their own complexities and require thorough training for their appropriate application.

In this special issue of *Remote Sensing for Ecology and Conservation*, we discuss the current status of training in RS, highlight the challenges for training and make suggestions for improvement. De Klerk and Buchanan (2017) provide an African perspective on RS training by examining the use of RS by African conservation agencies, RS training by African institutions and capacity development. The paper highlights the need to increase training opportunities in African academic institutions, with particular attention paid to data and software costs, Internet speeds and human capacity. Importantly, a number of academic conservation programmes now provide tailored RS teaching or use 'service modules' to provide RS skills to conservation professionals, which shows recognition of the importance of RS in conservation in Africa.

Palumbo et al. (2017) also highlight the key priorities and challenges for conservation professionals in relation to capacity development using the results of a survey, organized by the Conservation Remote Sensing Network. Specifically, the authors unveil the need for training in RS to focus on ecological questions, methods to analyse RS-derived products and how to derive indicators and relevant environmental variables (e.g. EBVs) from current RS products.

The relevance of open-source software for RS training is evident from the papers in this issue. Although existing and new datasets allow innovative and valuable RS research in ecology and conservation, access to methods in data analysis can be difficult. Yet, software and code for data analysis, statistics and mapping should be accessible free of charge to ensure it is used beyond the training exercise (Wegmann et al. 2016). Furthermore, there is a need for RS data to be provided in common formats and final processing levels. Any pre-processing procedures or data conversion can become an obstacle for the successful implementation of RS techniques. The RS community, moreover, needs to provide ecologically relevant datasets in adequate temporal and spatial scales. The importance of identifying such RS products has been acknowledged elsewhere and is in progress (Skidmore et al. 2015; Paganini et al. 2016; Pettorelli et al. 2016).

Collection of and access to data is becoming ever cheaper and easier but limited analytical expertise hinders their wider use. In that respect, Clark et al. (2017) describe problems associated with interdisciplinary research in RS and animal movement. The authors demonstrate how working at the interface between these two disciplines is challenging as there are no standard techniques for handling the complex spatial data, meaning that specific and in-depth training is indispensable. Clark et al. (2017) also explore the challenges organizers and attendees of training courses face, and provide a set of recommendations for prospective participants, course organizers and those making decisions on funding these courses or their attendance.

Remote sensing training should enable ecologists and conservationists to work with RS data and methods on a daily basis, being able to interpret existing datasets and develop new information. Bernd et al. (2017) describe the benefits of RS education, sharing crucial learning and gaps in current training for conservation and ecology. In order to successfully prepare students for their careers, the authors advocate that RS education needs to teach and apply state-of-the-art methods in interdisciplinary projects, especially with regard to policy making, linking research and practice and methodology and ecology, while fostering the development of soft skills.

Our community should aim to widen the availability and accessibility of RS training. Widespread

understanding of RS data, tools and applications can yield high rewards for conservation science and management, but their training is crucially needed. One particular challenge is that training is currently failing to reach ecology and conservation practitioners outside academia (Clark et al. 2017).

Identifying and removing barriers that hinder the implementation of RS tools is a priority, and the lack of training is one such barrier. Improved training is crucial if we are to bridge the gaps between disciplines, share our knowledge and realize the full potential of RS science for ecology and conservation.

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