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Empowering rangers through technology and innovation

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Abstract

Protected areas are key to biodiversity conservation and ranger-based monitoring, and law enforcement is the cornerstone upon which effective protected areas are built. Frontline practitioners, however, are often asked to protect large swathes of land or sea with limited resources, support, infrastructure, capacity, and/or training. Technology, when applied effectively and appropriately, has the capacity to empower practitioners, revolutionize ranger operations, improve ranger safety, and enhance wildlife protection and conservation outcomes. To do so, technology must be recognized, from the frontlines through to key decisionmakers, as a force multiplier, but only when it is fit for purpose, accessible, cost-effective, and supportive of rangers' needs. In this paper we detail the general state of conservation technology and innovation within the ranger context and provide a series of detailed recommendations to help the Universal Ranger Support Alliance (URSA) meet the needs of rangers around the world, including: demystifying technology and clarifying what it can and cannot do, connecting the right technology with the right people and places, focusing technology development and investment on substantive improvements and support, broadening ranger familiarization with technology, building technology capacity in rangers, fostering greater community building and creating opportunities around technologies, engaging the technology sector to innovate and design technology to support rangers, and supporting technology as a complement to traditional knowledge and skills, rather than a replacement. These recommendations constitute an ambitious vision which cannot be delivered by URSA in isolation. Rather, we propose URSA leverages existing efforts to ensure rangers are supported around the world.

Review and synthesis

Protected areas are key to biodiversity conservation (Watson et al. 2014; Gray et al. 2016) and ranger-based monitoring and law enforcement is the cornerstone upon which effective protected areas are built (Marvin et al. 2016; Critchlow et al. 2017). Recent research also suggests that lands managed by Indigenous Peoples—which often include "rangers" appointed by and accountable to their local community (e.g., see Muntifering 2019)—may support even greater levels of biodiversity than formal protected areas (Schuster et al. 2019). Often, however, these frontline practitioners are asked to do the impossible: protect large swathes of land or sea with limited resources, support, infrastructure, capacity, and training (Leverington et al. 2010; Belecky et al. 2019; Coad et al. 2019). Technology and innovation have the capacity to revolutionize the way rangers operate and lead to significantly enhanced wildlife protection and conservation outcomes. When applied effectively, technology can empower practitioners by providing critical tools to augment and streamline data collection, optimize operational processes, enhance management decisionmaking, and, importantly, reduce risk to and improve the safety of those in the field.

As with the general challenges faced by rangers, the conditions enabling technology to be effective are often missing, and "technological solutionism" (Morozov 2013) is common across conservation—new "silver bullets" arising regularly that purport to be able to solve complex problems with innovative new techniques or tools. New technologies are also often presented in isolation, developed outside the context of conservation (Berger-Tal and Lahoz-Monfort 2018), have limited ability to deploy at scale, are resource-intensive, or are provided with limited support. In order for technology to have the impact on rangers seen in other sectors around the world, we need to ensure that it is recognized, from the frontlines through to key decisionmakers, as a force multiplier. This can occur only if it is fit for purpose, accessible, cost-effective, and supportive of rangers' needs.

Berger-Tal and Lahoz-Monfort (2018) detail two eras in conservation science with respect to technology, with the first underpinned by practitioners' wariness towards technology in general, and the second characterized by "a widely accepting, albeit opportunistic and mostly centralized approach." The authors go on to argue that it is time for a new era in conservation and its relationship with technology, defined by leadership and innovation driven by frontline practitioners. The Universal Ranger Support Alliance (URSA)[1]—a group of international conservation organizations that have come together to address the issues and obstacles faced by rangers around the world—has the unique capacity to leverage its partners and the global ranger community to drive this new era of conservation technology. There are already several organizations and initiatives in the vanguard of this effort driving bottom-up innovation and developing technologies and communities of practice to not just meet the needs of the frontline conservationists, but to do so at scale. These organizations (e.g., the SMART (Spatial Monitoring and Reporting Tool) Partnership,[2] Cybertracker,[3] WILDLABS,[4] Open Acoustic Devices,[5] FieldKit,[6] Arribada,[7] Open Data Kit,[8] Global Forest Watch,[9] Global Fishing Watch,[10] and more) can offer key lessons and provide a foundation from which URSA can build its strategy to support the technology needs of rangers globally.

Here we detail the general state of conservation technology in the ranger context and provide a series of recommendations to help meet the technology needs of rangers around the world. Given the broad range of technologies available to practitioners and the pace with which they are continuously updated, released, or deprecated (i.e., made obsolete), these recommendations do not focus on specific technologies. Rather, we propose actions and areas that URSA should explore, evaluate, and prioritize to build capacity and adoption of technology in the field and that more effectively supports ranger work.

We recognize that these recommendations constitute an ambitious vision that cannot be delivered by URSA in isolation. Many of the issues identified below are not limited to rangers: they

Zambian ranger using telemetry | © MANA MEADOWS

are common across conservation technology (e.g., WILDLABS 2018), and many groups are already investing significant effort to address them. Where possible, URSA should support delivery on these recommendations by leveraging existing efforts and influencing their focus to ensure the ranger perspective is represented.

Recommendations

1. Demystifying technology and clarifying what it can and cannot do

Widespread access to technology is not assured around the world (Pew Research Center 2015, 2019; 'Utoikamanu 2018), so basic understanding of technology may be limited in some contexts. This lack of familiarity with technology can lead to misconceptions and confusion. In setting the context for technology, URSA should emphasize that *people* implement *processes* efficiently using *technology*, and that these things matter in that order: building capacity in people is the highest priority, then establishing and institutionalizing processes, and then implementing the appropriate technology.

Recommended actions:

- Establish a common understanding of what "technology" is and is not, and what it means for the ranger profession (and those who manage rangers and/or protected areas). We should advocate that:
  - Technology is software and/or hardware (either singly or as a suite) that can provide efficiencies or benefits that would not otherwise be possible.
  - Technology is just a tool, and like all tools, it is ineffective if not appropriate for the specific situation or if used inappropriately.
  - Technology is additive or complementary to ranger work.
  - Technology should be friendly to use and facilitate processes of ranger work.

- Technology is not a replacement for rangers or their traditional field skills, nor is it a replacement for adequate resourcing elsewhere. Prioritizing technology over meeting basic ranger needs will undermine attempts to implement technology and limit ranger effectiveness. Funding agencies, governments, and protected area authorities should not invest in development of technology or its implementation at the expense of the basic necessities of ranger work (e.g., uniforms, boots, basic communication and navigation technologies; Belecky et al. 2019) or ensuring adequate staffing. The enabling conditions for technology to be successful (e.g., basic training of rangers in technology, appropriate infrastructure, defined standard operating procedures, etc.) must also be in place.
- Promote the understanding that for technology to be effectively used at sites, rangers and management staff need to be trained (both initially and on an ongoing basis) and supported with frameworks that promote adoption and continued use (see point 5), as well as adherence to best practices.
    - Ongoing training is particularly critical, as well as the need for "training of trainers" to ensure knowledge of the use of technologies is retained in the event of staff changeovers or redeployment.
- Promote understanding among developers about suitable user interface (UI) and user experience (UX) design, as well as field conditions that need to be considered.
- Encourage research that expands knowledge of how rangers adopt (or resist) technology (e.g., Sintov et al. 2019). Also encourage better communication between researchers and rangers to ensure research development meets the needs on the frontline (see also point 6).

2. Connecting the right technology with the right people and places

With the range of options available, it can be complicated for conservation practitioners to choose what will best meet their needs, or whether adopting technology to solve a problem is the right approach in the first place. Instituting wholesale changes to operations or existing technology can require substantial effort and resources. It should be clear that the benefits of such changes, and associated near- and long-term costs, make sense in terms of the overall benefit to operational effectiveness.

Recommended actions:

- Building on the recent Global Ranger Survey (Belecky et al. 2019), conduct another to develop guidance and prioritize technology development to meet ranger needs.
    - Or, alternatively, leverage existing surveys on conservation technology (e.g., the annual SMART user survey or WILDLABS annual survey) and encourage increased ranger participation. Ranger responses could then be sectioned out to inform guidance and development.
    - This survey should include an examination of existing curricula for technology training, with the goal of including necessary basic skills, as well as regionally specific technology needs at the right levels (see point 5).
- Develop global guidelines for rangers or sites that are considering adopting technology, emphasizing these points:
    - Implementing technology well requires being highly selective, especially given limited budgets and having to justify expenditures to donors and governments.
    - Selecting the right technologies will mean making strategic choices, weighing costs (both initial and long term) against returns and outcomes, continually evaluating decisions as technologies change, and staying focused on achieving specific goals. Sites should be guided to pursue technology that meets these needs in the simplest, most effective, and most sustainable manner possible.
- This "tech readiness" guidance should specifically emphasize the following considerations:
    - Before anything else, are the basic necessities of ranger work being met, such

that the implementation of the technology does not detract from them?
    - What are your goals and objectives? Why is technology the best way to achieve these? Does the technology meet a clear and specific need?
    - What is the objective or necessary outcome, and can the specific technology achieve or help you achieve it?
    - What are the most failure-prone aspects of the ranger work at your site? Will the technology fall victim to this too? Can the technology be customized to overcome this?
    - Is the technology robust and stable (i.e., not experimental) for use in real-world scenarios?
    - Is the technology adaptable to and usable within your local conditions (e.g., mobile network coverage, etc.)?
    - Will the technology be supported— or even exist—in five years' time?
    - Will the technology align and integrate with other technologies and practices at the site, especially those that are working well? Does it duplicate them?
    - Is the technology cost-effective to implement relative to other approaches (being sure to consider long-term maintenance and technical support in addition to initial start-up costs)? The cost of any technology will be easier to justify if it increases efficiency elsewhere.
    - What are the time costs for implementing the technology, both initially (i.e., getting up and running technically, training staff) and long term (i.e., continued (re)training, maintenance, and troubleshooting)?
    - Is there a long-term commitment to implement the technology and adapt to its use, throughout the organization's structure (e.g., from rangers through to managers)?
    - Who purchases technology for you—is it management, an external non-governmental organization (NGO), private individuals, or someone else? Are long-term costs and sustainability of funding from the "buyer" factored into your decision to opt for a technology?
    - Is there a framework for feeding back performance reviews and experiences to the organization?
    - Who will host and store the data associated with the technology? Who will maintain the technology? Do they have the capacity to do these tasks over the long term?
    - Is staffing stable, especially for positions key to the management of the technology (i.e., is staff turnover high, and will that lead to continual capacity losses necessitating consistent re-trainings)? How will technology be maintained if there is staff turnover?
- Establish working groups and communities of practice around specific technologies (e.g., camera trapping) to provide "getting started" guidance on different technologies and their applications for to ranger work, as well as other professional advice.

3. Focusing technology development and investment on substantive improvements and support to rangers

Recommended actions:

- Prioritize adoption and expansion of technologies that meet the essential functions of ranger work, such as:
    - Expanding communications networks at sites and ensuring ranger access to and capacity for navigation and communications devices that are appropriate for the local context (Belecky et al. 2019)
    - Expanding access to basic technologies, such as computers and GPS-enabled smartphones
    - Expanding access to and capacity for technology related to monitoring of biodiversity values, threats, and responses (e.g., SMART, CyberTracker, camera traps, etc.)
    - To the extent possible, increasing access to and stability of internet connectivity at the lowest cost possible.
- Evaluate existing partnerships, technologies,

and ranger needs (e.g., see point 2 above on ranger surveys) to identify which technologies have a high potential to improve and benefit ranger work, as well as where URSA has the most potential to exert influence. Where these overlap, URSA should push for these specific developments (e.g., listing the top ten things rangers need from a given technology).

4. Building technology competence and capacity in rangers

For technology to be used appropriately and effectively, rangers and other frontline practitioners, as well as decisionmakers above them, need the capacity to interact with technology confidently. This begins with ready access to, and familiarity with, basic technology to support ranger work, including computers, office productivity software, and the internet. However, access to technology is often approached as ticking a box—e.g., a computer has been delivered to the site and configured, but no training provided for its use. Despite the existence of competence standards (i.e., the Global Register of Competencies for Protected Area Practitioners; Appleton 2016), there are substantial inadequacies in the level of basic training in all subject areas for new rangers globally, as well as a lack of regular continuing education for rangers (Belecky et al. 2019). Particularly in the technology space, appropriate training and support will benefit adoption and effective use of technology (Sintov et al. 2019), as well as improve ranger job satisfaction and engagement (Moreto et al. 2016). URSA should encourage the conservation community (NGOs, governments, funders, etc.) to expand and enhance rangers' access to technology and basic computer/device proficiency, as such skills are increasingly essential to their work and effective protected area management in general.

Rangers in the Philippines | JAMES SLADE / GWC

Recommended actions:

- Promote an approach to and culture of technology use that transforms ranger work, similar to how the use of office productivity software (e.g., Microsoft Office[11]) has become routine.
    - Technology should be viewed as "a part of the trade" rather than a "shiny object" that is implemented opportunistically or forced on rangers by an external organization or superiors. This means it should be factored into ranger training curricula (see point 5).
    - Local conservation technology clubs that have developed digital literacy classes (e.g., Arribada Club[12]) could be utilized here, or their model replicated, to target education for rangers to use mobile apps and devices and other technology tools.
    - Technical capacity should be emphasized as a key skill in modern ranger work, and should be included in communications about professionalization and professional development
- Encourage and embrace alternative methods and technologies for building ranger capacity, such as communities of practice (e.g., see below point), online learning, exchanges, etc.
- Encourage the development of competencies for the application of specific technologies (e.g., SMART) to ranger work and advocate for

their inclusion in ranger training programs.
- Research the range of available opportunities and training related to technologies through existing sources (e.g., NGOs, IGOs or private companies) and encourage providers to fill the gaps (e.g., see point 6).
    - URSA should also consider developing, offering and driving opportunities for training to fill identified gaps.
- Provide an accreditation service for technology trainings and qualifications.
- Explore offering technology awards, grants, and/or support for rangers, to include funding, training and/or professional mentoring.
    - The technology sector could be engaged as leaders and/or providers of these awards (e.g. akin to Whitley Awards[13]) (e.g., see point 6).

5. Fostering greater community building and creating opportunities around technologies

Building a strong and supportive culture and community of practice around ranger work and technology can engage rangers, allow them to make connections despite being spread out in remote locations around the world, and provide a forum for knowledge exchange. A more engaged ranger community is more likely to result in desirable learning outcomes (Carini et al. 2006) and technology adoption (Sintov et al. 2019).

This effort needs to be twofold—technical and social—although the lines between the two are likely to blend. Existing platforms such as WILDLABS are an excellent resource for those seeking information on technologies and have the potential to accommodate much greater engagement from practitioners around the world. Numerous social platforms (e.g., Facebook, LinkedIn, WhatsApp) could be leveraged to provide a social media community for rangers, each with specific pros and cons around such topics as professionalism and privacy. For example, rangers may want to keep their work and private-life social accounts separate. A professional social network dedicated to rangers could facilitate networking and serve as the foundation of the more technical community of practice described above.

For many rangers, reliable internet access is a problem (Pew Research Center 2015, 2019; 'Utoikamanu 2018). While URSA may have limited ability to influence this, connectivity and smartphone usage are growing rapidly around the world (Pew Research Center 2019).

Recommended actions:
- Enable the development of a global ranger social media community, either through an existing social platform or, potentially, one specific to the profession (e.g., the nascent Force for Nature[14] app).
    - If necessary, URSA should manage and support the infrastructure in order to help the community of practice reach its potential.
    - As most rangers will have limited capacity to engage in an "international language," communities will likely need to be built around common interests and languages, supported by careful research.
- Support the enhancement, expansion, and curation of existing platforms for technology exchange (e.g., WILDLABS) to more specifically engage the ranger community and to provide a non-intimidating entryway to those considering technology.
    - By doing so, URSA could provide an entryway to technology for thousands of rangers around the world, and generate a clearinghouse of data, resources, and contacts that will strengthen the ranger community's knowledge and experience.
- Promote and facilitate exchange programs to share knowledge and experience, as well as common values and standards.

6. Engaging the technology sector to innovate and design technology to support rangers

Technology companies and professionals, along with funders of technology development, may have limited understanding of the complexity of ranger work and the challenges associated with implementing technology in remote, demanding, and disconnected environments (Morozov 2013). This can lead to technology that appears appealing to decisionmakers but may be impractical in

the field or does not contribute to meeting key conservation objectives.

The advent of Berger-Tal and Lahoz-Monfort's (2018) "new era" in conservation, with its bottom-up leadership and innovation, is particularly necessary with respect to ranger work. URSA could facilitate bridge-building and greater collaboration between technology developers and rangers. Doing so can drive innovation specific to ranger work, leading to novel applications and technologies designed to meet rangers' needs (Marvin et al. 2016; Berger-Tal and Lahoz-Monfort 2018).

Recommended actions:

- Encourage NGOs and the technology sector to expand or develop new partnerships that factor in the goals of URSA and the Chitwan Declaration.[15]
- Lobby NGOs, funders, and governments to prioritize the expansion of access to technologies that meet the basic necessities of ranger work, such as communication networks and broadband access.
- Lobby the technology sector to prioritize innovation and development of technologies that meet the basic necessities of ranger work and that ensure access to low-cost technology.
- Lobby the technology sector to prioritize innovation based on the results of the URSA-led global ranger survey on technology needs (see point #1 above).
- Encourage the technology sector to build a robust, common data integration platform that will be provided and maintained free of charge to the conservation community.
    - New technologies should be compatible with the common platform to facilitate access. A focus on integrated development should allow for plug-and-play additions or expansions of technologies and for numerous technologies to all "play in the same sandbox."
- Encourage the technology sector to provide more specific technology awards, grants, and other support for rangers, to include one or more of the following: innovation, funding (seed, start-up, project, and continuing), trainings, professional mentoring (e.g., through the WILDLABS Tech Hub[16]).

7. Supporting technology as a complement to traditional knowledge and skills, rather than a replacement

In this globalized world, the use of technology is now possible in even some of the remotest locations. While this has its benefits, there is also concern that the relationship humans have with technology may be having an adverse impact on the connection we have to the natural environment. Some studies of adolescents have shown that an increase in the use of technology, namely screen-based systems, correlates with a decline in a connection to nature (Larson et al. 2018; Michaelson et al. 2020). As younger generations seemingly become further disconnected from nature, or rely on technology to support their interest in and knowledge of nature (Kahn et al. 2009), traditional skills and field knowledge that most rangers employ on a day-to-day basis may become increasingly diluted or lost. This disconnect from nature in younger generations is likely to have far-reaching consequences for conservation beyond technology use and adoption.

Recommended actions:

- Encourage the transmission of skills from late-career or retiring rangers to early-career rangers and those entering the profession.
- Ensure that technologies do not supersede the traditional field skills rangers require to be effective in their role.
- Actively promote skills and competencies in key general areas such as tracking, navigation, and wildlife behavior, and in localized knowledge of the environment, traditional skills and other aspects of culture, and history.
- Identify and support programs that encourage connections with nature and engagement with professional rangers among younger groups from which rangers have traditionally been drawn.

Endnotes

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2. www.smartconservationtools.org
3. www.cybertracker.org
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