What's That Buzzing Noise? Public Opinion on the Use of Drones for Conservation Science

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There is rapidly growing interest among scientists and practitioners in using unmanned aerial vehicles, or drones, to gather ecological data crucial for the effective conservation and management of natural resources. Public acceptance and support of drone use for conservation will play an important role in shaping the local-level regulatory landscape in the near future, either promoting or derailing the use of drones for this purpose. Here, we report the findings of the first public polling conducted on the use of drones for conservation efforts. We find moderate to strong public support for using drones for conservation among Americans but differing levels of support for other domestic uses. Demographic factors are not predictive of public support; rather, positive beliefs about science and egalitarian worldviews are associated with increasing support. The results highlight the importance of proactively engaging the public on this issue and avoiding antagonistic messages or cues that may activate ideologically driven opposition.

Keywords: attitudes towards science, conservation, polarization, public opinion, unmanned aerial vehicles

The management and conservation of natural resources frequently requires accurate images of terrestrial and aquatic habitats (Kennedy et al. 2009, Morgan et al. 2010). Mapping habitat patches, identifying corridors for animal movements, quantifying the colonization of invasive plant species, and other uses of aerial imagery are important tools for improving conservation and management practices (Lewis 2002, Zharikov et al. 2005). Traditional approaches to obtaining such imagery are costly and come with significant risks because of the need to hire manned aircraft (i.e., planes and helicopters). The use of stock or satellite imagery obtained for other purposes is an alternative option but comes with its own limitations (e.g., images are often dated or not taken at desirable heights, resolutions, or angles; reviewed in Morgan et al. 2010). Over the past 10 years, a number of innovative conservation scholars and managers have turned to a rapidly evolving technology, unmanned aerial vehicles (commonly referred to as drones), in an attempt to avoid or overcome many of these financial and practical challenges (Koh and Wich 2012). However, there is potential for public opposition toward drone use—because of concerns about privacy and safety—that might derail these conservation efforts. Here, we show that public support for drone use for conservation purposes is currently robust in the United States. However, there are also worrying signs that this support may become politically polarized if scientists and their partners are not careful in how they interact with the public moving forward. Such polarization and public antipathy could lead to regulatory and other efforts aimed at limiting or eliminating the use of drones for conservation purposes for political rather than scientific or safety reasons.

The case for drones

Using manned aircraft to obtain aerial imagery for science and management comes with a number of practical challenges, including proximity to airports, the possible disturbance of wildlife, the willingness and ability of pilots to fly needed paths, and risks to pilots and passengers. Drones hold multiple advantages over traditional methods for obtaining aerial imagery of wildlife and landscapes. First, they reduce many of the personal safety risks involved with the use of manned aircraft, because drone operators stay on the ground and are generally not injured if the drone should crash. Second, the vehicles themselves tend to be quite small, making them relatively easy to transport to field sites and launch from small clearings, even in remote locations. Third, although there is some concern about the noise produced by drones (DeGarmo 2004), in comparison with manned vehicles, drones produce much less noise, thereby

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reducing negative impacts on wildlife. Similarly, the use of drones significantly reduces air pollution (including carbon emissions) relative to the use of manned aircraft. Finally, the cost to researchers and practitioners (and therefore to their funders) of using drones can be orders of magnitude less than when using traditional technologies, vastly increasing the capacity of the scientific community to obtain crucially useful visual data.

Drones have been used to study numerous ecological systems and taxa, including rice paddies (Uto et al. 2013), rangelands (Rango et al. 2009), tropical forests (Paneque-Gálvez et al. 2014), small birds (Rodríguez et al. 2012), aquatic mammals (Martin et al. 2012), and coral reefs (Lewis 2002). Equipped with a wide diversity of cameras and other monitoring devices, drones have quickly become a powerful (and cost-effective) tool in ecologists' "toolkit" for obtaining high-quality, project-specific visual imagery (Allan et al. 2015), and interest in their use among conservation professionals and scientists only appears to be growing.

Public opposition as a potential roadblock

But the use of drones for wildlife monitoring and ecosystem assessment faces the potential significant roadblock of public opposition (Finn and Wright 2012, Sandbrook 2015). As with any new technology that involves possible (and likely) public scrutiny, there is a strong potential for public opposition to spread rapidly, effectively shutting down widespread adoption and acceptance (Nisbet 2014). In addition, local municipalities may put restrictions in place that supersede the federal-level regulations released in 2016 by the Federal Aviation Administration (FAA), the regulatory body primarily responsible for regulating US airspace. If scientists and conservationists want to continue using drones for wildlife monitoring and management, they will need to consult the public on their concerns, effectively communicate about the benefits and trade-offs of using drones for environmental conservation, and incorporate public input into the responsible use of the technology.

Moreover, the many proposed and rapidly evolving domestic, nonmilitary uses of the technology—from search and rescue to package delivery—mean that there is potential for public antipathy toward any one of these proposed uses to hamper use in other domains, including by conservation scientists. Indeed, initial public polling conducted within the past few years suggests that some of these proposed uses of drones are quite unpopular with the majority of the general public (see recent polls in AIA 2013 and Murray 2013). Concerns over security and privacy appear to be particularly salient for many Americans (Finn and Wright 2012).

However, the public polling work that has been conducted to date also suggests that, in fact, the American public is, at least for now, differentiating among these diverse uses of drones for nonmilitary uses. For example, polling conducted in 2013 found strong public support for using drones in search-and-rescue missions but much weaker support for everyday and hobby-related uses (Eyerman et al. 2013). These initial findings suggest that it is important for advocates to clearly understand public support for their particular desired uses of drones, because public opinion could sway how rules are written over the coming months and years regarding the varied uses of drones for domestic purposes. Moreover, understanding the core drivers of support or opposition to particular uses may help advocates better protect and build public support for particular uses.

Public support for using drones for conservation

To date, despite the polling specific to both military and nonmilitary uses, no empirical work has specifically examined public attitudes about using drones for environmental-conservation purposes nor the factors that influence individuals' perceptions and preferences. We conducted a survey in January 2015 of American adults to examine support for drone use across a number of domains, including wildlife monitoring and protection.

Methods and materials

A nonprobability quota sample of 1904 adult Americans was conducted in January 2015 to explore public opinion on a variety of science and technology topics and issues, including the use of drones for nonmilitary, domestic purposes. The survey instrument was administered online by the company Qualtrics, which recruited online survey respondents from a voluntary, paid panel of adults. Through Qualtrics, we used a simple quota-sampling procedure to recruit a diverse sample of adults whose demographics resembled the adult population in the United States on the following factors: gender, age, educational attainment, percentage Hispanic, percentage African American, and percentage employed. Quota sampling matched the sample to current US census data on the selected demographic variables.

The participants were asked the following question pertaining to the use of drones: "Over the past few years, the use of unmanned aerial vehicles or 'drones' for nonmilitary purposes has been increasing rapidly. Please tell us how much you support or oppose the use of aerial drones in your own community for each of the following activities." This prompt was followed by the following eight proposed uses (presented in randomized order): use by scientists to monitor and protect animals in the wild; use by police to monitor civilians, including the tracking of suspected criminals and terrorists; use in search-and-rescue efforts following major emergencies such as hurricanes, floods, or terrorist attacks; use by farmers for crop dusting and other agricultural purposes; use by firefighters to combat forest fires; use by businesses to sell real estate or develop land; use by hobbyists and amateur photographers for recreation and enjoyment; and use by Amazon and other companies to deliver packages and goods. The participants indicated their support or opposition for each proposed use using the following scale: *strongly oppose*, *oppose*, *somewhat oppose*, *neither oppose nor support*, *somewhat support*, *support*, and *strongly support*.

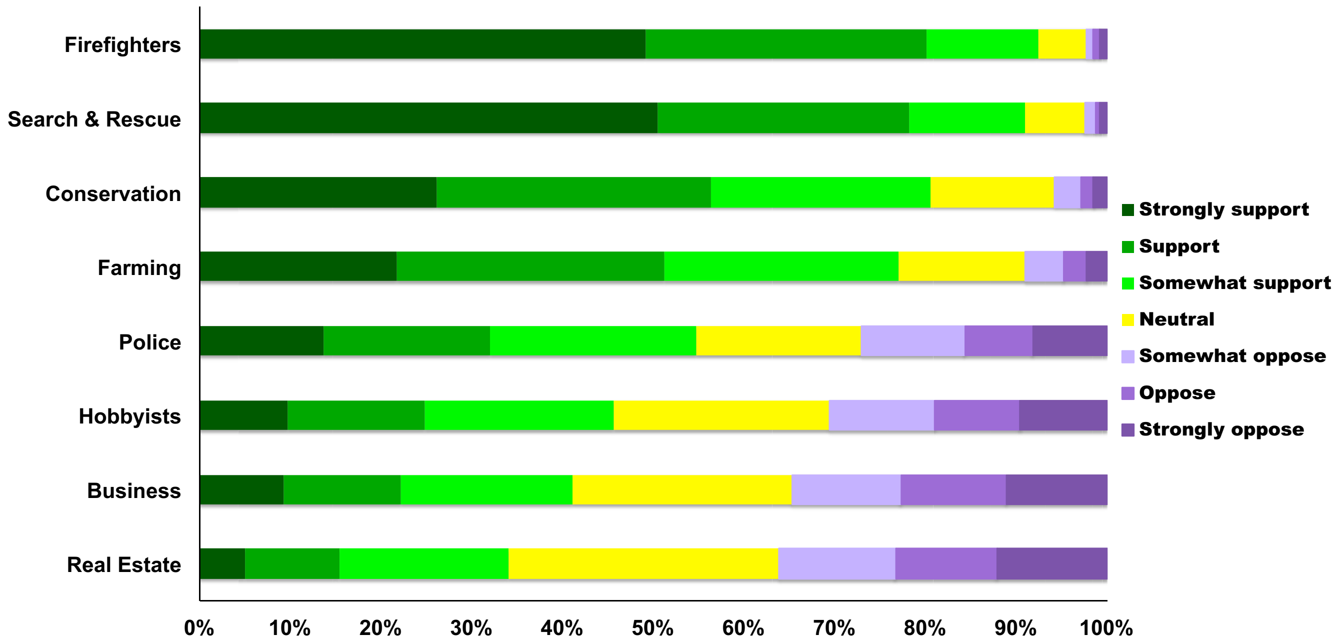

Figure 1. Support for eight possible domestic, nonmilitary uses of drones examined. Using drones for conservation purposes was somewhat to strongly supported by the vast majority of the sample.

Data were also collected on the participants' political worldviews, ideologies, and demographics using standard measures. The data were inspected and cleaned at collection and analyzed using standard descriptive and inferential techniques, including ordinary least-squares multiple regression. The research was approved by the Northeastern University IRB, no. 14-11-17. Informed consent was obtained from all the subjects. Additional details regarding the sample, data-collection process, and measures can be obtained by contacting the corresponding author.

Results

We found that the participants were largely supportive of drone use for environmental protection, with 81% of the sample indicating moderate to strong support. In line with earlier public polling, we also found that support for domestic drone use differs widely as a function of proposed use (figure 1).

What predicts support of drone use for environmental monitoring and protection? By far, the strongest predictor was individuals' general optimism about science and technology (Nisbet and Markowitz 2014), which uniquely explained 15% of the observed variance in support for drone use in our sample ($B = .424$, $p < .001$) after controlling for demographic and ideological variables. Demographic variables, including age, gender, and education, were unrelated to support in bivariate analyses, although gender emerged as a significant predictor after controlling for other variables ($B = .067$, $p = .001$), with men reporting greater support than women. However, we also found that support for the use of drones for conservation was weakly but significantly associated with liberal political ideology ($B = .047$, $p = .067$) and egalitarian worldviews ($B = .106$, $p < .001$), suggesting that the use of drones for conservation efforts may already be showing signs of political polarization. Table 1 presents the full results of the regression modeling for interested readers.

Conclusions

Although environmental scientists and practitioners may currently enjoy fairly widespread public support for conservation-related uses of drones, our results suggest that the picture may not be entirely rosy. The relationship between political worldviews and support for drone use that we observed poses a potentially significant risk to the widespread and continued acceptance of scientists and practitioners using drones in the field and should not be ignored moving forward. Scientists and their partners will need to be careful to avoid antagonistic messages or cues that easily activate ideological or worldview opposition (Kahan 2010), or else they run the risk of further contributing to potentially paralyzing polarization on this topic.

Researchers and others interested in using drones for conservation science and management should continue to develop, employ, and self-enforce the use of best practices within their community in order to maintain public support and avoid possible conflict moving forward. This will include ongoing consultation and collaboration with local- and state-level stakeholder groups to codevelop responsible regulations and practices. Additional research is clearly needed to examine more closely the specific applications and conditions under which the public supports the use

Table 1. The results of a full simple regression analysis for variables predicting support for drone use for conservation purposes.

Predictor	*b*	SE	*p*	B	95% Confidence Intervals of *b*	
					LCI	UCI
Gender	**.175**	**.054**	**.001**	**.067**	**.070**	**.280**
Education	–.017	.020	.394	–.019	–.057	.022
Age	<.001	.002	.949	–.001	–.004	.003
Ideology	**.040**	**.022**	**.067**	**.047**	**.003**	**.082**
Egalitarianism	**.100**	**.025**	**<.001**	**.106**	**.050**	**.150**
Individualism	.032	.028	.245	.027	–.022	.086
Optimism	**.570**	**.030**	**<.001**	**.424**	**.510**	**.629**
Pessimism	–.024	.026	.356	–.021	–.074	.027

Note: Adjusted model R^2 = .229. Significant predictors are in bold.

of drones for conservation science, the factors that influence those judgments and preferences (including ones not explored here, e.g., geographic location), and possible strategies for anticipating and responding to public concerns.

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