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Authors

Reid, JL
Holste, EK
Holl, KD
et al.

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Letter to the Editor

Does any bat box facilitate forest recovery? – Reply to Kelm

In a recent study (Reid et al., 2013) we reported that artificial bat roosts did not accelerate forest succession in abandoned tropical pastures in southern Costa Rica. Kelm (2013) criticized the study on the grounds that roost location, roost design, and data resolution were inappropriate, and he expressed concern that our study would dissuade researchers and practitioners from using artificial bat roosts for forest restoration in the future. We agree that further research on artificial roosts is warranted, but restoration practitioners should think twice before incorporating this method, which has not been demonstrated to facilitate forest regeneration in degraded farmlands.

A goal of our study was to test the hypothesis advanced by Kelm et al. (2008) that “Artificial roosts may act as nuclei for forest recovery in a similar fashion to isolated trees in abandoned pastures.” To do so, we installed artificial roosts in abandoned pastures and monitored them for bat visitation, seed dispersal, and seedling recruitment. Kelm (2013) critiqued this experimental design because roosts were placed in “very exposed conditions.” This concern is unfounded because abandoned pastures characteristically have high temperature and light levels, and these areas are precisely where seed rain limits regeneration. In retrospect it may seem obvious that bats would not prefer artificial roosts in hot, dry pastures, but this was a critical assumption of the bat-roosts-as-isolated-trees hypothesis (Kelm et al., 2008).

The roost design that we used was necessarily modified from the design used by Kelm et al. (2008) inside of forest fragments. Specifically, we needed to elevate our roosts above the height of pasture grasses (sometimes >2 m) so that bats would be able to locate the opening. We therefore made roosts smaller and lighter so that they could be installed on tall poles or trees. We also placed the opening on the bottom, rather than the side, so that seeds dispersed by roosting bats would fall into the pasture instead of the roost floor as in Kelm et al. (2008). Kelm (2013) noted that bats in our study rarely colonized roosts, and concluded that this difference negates our results. We disagree; bats did not frequently sleep inside of our roosts during the day, but >90% of roosts that we placed in forests were used by bats, typically for nocturnal feeding. Since a primary objective of the artificial roost strategy is to increase seed dispersal, we argue that nocturnal feeding is the more important behavior to encourage compared to diurnal sleeping.

We minimized disruption to bats using artificial roosts in our study by selecting passive monitoring techniques, such as infrared videography and searching for feces and masticated fruits. Based on these methods we inferred that bats had either visited a roost or not from one observation period to the next. The number of

times that we found evidence of bat visitation constituted the “bat detection” variable. Our passive measurement of bat detections significantly predicted seed rain beneath artificial roosts, and clearly showed that bats visited roosts in forests sooner and more frequently than roosts in abandoned pastures. While not as finely resolved as capture data, which might have deterred bats from visiting roosts, our method clearly demonstrated that bats were unwilling to use artificial roosts in recently abandoned pastures.

We strongly agree with Kelm that artificial roosts warrant further investigation and that nobody should generalize a conclusion from one study to all possible scenarios. Indeed we suggested a variety of future studies in our paper. We would particularly like to see research on alternative roost designs to attract a more diverse, less generalist bat community, along with sharing detailed plans of those designs, and more studies on the impacts of artificial roosts in forests on seed rain and seedling establishment in adjacent pastures.

Finally, we hope that Kelm is correct that our study will prevent land managers from assuming that artificial bat roosts are a cost-effective strategy for restoring tropical forests on abandoned pastures. Our study demonstrates that artificial bat roosts did not accelerate forest succession on abandoned pastures in premon-tane southern Costa Rica because bats rarely used roosts in abandoned pastures and because increased seed rain did not lead to increased seedling recruitment. These results underscore the general conclusion that succession in degraded pastures is limited by multiple factors, and restoration interventions that address only one of them are unlikely to achieve the objectives of restoration practitioners. The burden of proof still rests with researchers to demonstrate that artificial bat roosts enhance seedling recruitment, and hence forest recovery, in former agricultural lands.

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J. Leighton Reid
Department of Forest Ecosystems and Society,
321 Richardson Hall, Oregon State University,
Corvallis, OR 97331, USA
Tel.: +1 5417376557;
fax: +1 5417371393.
E-mail address: j.leighton.reid@gmail.com

Ellen K. Holste
*Department of Forestry, Ecology,
Evolutionary Biology,
and Behavior Program,
Michigan State University,
480 Wilson Road,
Room 126,
Natural Resources,
East Lansing,
MI 48824, USA*

Karen D. Holl
*Department of Environmental Studies,
University of California, Santa Cruz,
CA 95064, USA*
Rakan A. Zahawi
*Organization for Tropical Studies,
Apartado 73-8257, San Vito de Coto Brus,
Costa Rica*