Responses to Reviewers’ Comments:

Reviewer A:

“My recommendation to the authors includes writing a brief statement of how their Arkansas study of bumble bee decline and status can serve conservation planning at a local level. Are there any citable success stories or conservation plans that show the value of local assessments? The authors briefly point out this importance in their Introduction (i.e., “Conservation planning in the United States often occurs at a local (state, county or city) level delimited by political boundaries that are often independent of broad-scale habitats”), yet they do not discuss how their study may contribute to conservation planning in Arkansas. As local population trends are indeed an important factor to consider when proposing conservation or management plans, I recommend the authors to describe how the results of their study may influence local policies in their discussion.”

* Although we did not add any “citable success stories”, we have made our point about the misplaced attention on the state conservation status of *B. fervidus,* a species with no vouchered record of being collected in AR, more explicit within that species’ section.
* We have also added a line to the introduction highlighting that state conservation rankings often differ from range-wide ones and that our work can aid ARNC in state-wide assessments.
* We have also added a suggestion on using phenological data presented here to guide monitoring efforts.

“I think a short statement is warranted considering that contemporary abundances of *B. variablis* and *B. fraternus* reflect historic trends. If they are indeed simply “rare”, a short discussion of how rarity is an important factor in conservation status would be useful. Essentially, I think the 1st paragraph of the discussion need to be a bit clearer in contrasting between the trends being observed in Arkansas and the national trends of bumble bee decline.”

* In this paragraph, we have highlighted that these two species are considered declining by some assessments and added statements emphasizing the link between rarity, detectability and the assumptions commonly adopted in conservation assessments based on persistence that we feel puts our AR assessment into a clearer context.

Reviewer B:

The following are comments to the summary review provided. More detailed responses are included in response to each of the extensive comments from Reviewer B in the included Word file.

“However, there are some significant flaws in their conceptual framework, and I am concerned that their historic and modern datasets have not measured the same geographic areas with the same methods or intensities, making direct comparisons of relative abundance of questionable significance.”

* First and foremost, our sample area is the state of Arkansas. Counties should be considered as our sample units that we have used to assess changes in Arkansas between two time periods.
* Indeed, the two time periods were not equally sampled. There were far fewer records in the historic period as compared to the contemporary period. We believe that we have clearly stated this and illustrated it in Fig. 2.
* We are not comparing relative abundance but rather occurrence at the county-level. We have emphasized this point more explicitly to illustrate the difference between the two metrics of change over time. We hope that clarifies this important point better.

“The authors calculate historical relative abundance of each species by dividing number of counties for which a species was reported by total number of counties in which any of the species were reported. This approach makes the assumption that no collecting took place in all of the other Arkansas counties, which is probably not the case. Because of the spatial scale, the total number of counties and a relatively small total specimen sample (N = 285), I suspect these are not very accurate estimations of statewide relative abundance. Whether or not one accepts this criticism, it must be acknowledged that this is not a measure of relative abundance of insects in a museum collection.”

* This is not quite correct. We make no claims that we are calculating relative abundance. In fact, our proportion-of-occurrence method was adopted deliberately to avoid the pitfalls of relative-abundance methods that would allow spatial bias and uneven sampling to unduly skew the results in the case of our dataset.
* The total specimen pool was much larger (1,620 specimens), although far fewer specimens were available from the historical period (219). We have added this information.
* I’m not sure that there is an implicit assumption that “no collecting took place” in counties without represented specimens. In any work, sampling inevitably under-represents the true population, but by applying the same method (here, one that avoids abundance measures, but rather uses binary representation at the county-record level) to each time period, we hope to circumvent the systematic biases commonly accepted to be inherent in studies based on museum specimens (*e.g*., few specimens deposited during WWII, collections from near a university greatly outnumber collections from anywhere else, greater collecting efforts in contemporary times, etc.).

“By contrast, the contemporary period includes all bees (N = 92) collected 2010-2013 in citizen science and other efforts. These collections were made in a subset of Arkansas counties, but not the same set as the historic data came from.”

* This is incorrect. The N=92 refers to the number of county records, not the number of specimens. We have clarified this.
* Although we did not sample each and every county represented in the historical period, we did sample 20 of 39 previously sampled counties. Additionally, we sampled 16 counties that were not sampled in the historical period. Because we are looking at the state of Arkansas as a whole and using proportion-of-occurrence as our metric, we feel that comparing 39 sampled counties to 36 sampled counties is a fair comparison.

“Importantly, they did not resurvey counties where some of the rarities were taken in the past, especially Bombus fervidus and B. variabilis.”

* Three of the five counties reporting these species were resampled. *Bombus fervidus* was recorded in Boone, Columbia & Franklin counties. Boone and Franklin were both re-sampled in the contemporary period (N=156 & 24 bees, respectively). *Bombus variabilis* was historically collected in Desha (1), Franklin (1) and Washington (4) counties. We did not resample Desha in the contemporary period, but none of the 3 bees present in UAAM collected during the in-between period (1966-1999) were *B. variabilis.* In Washington county, none of the 563 *Bombus* collected from 1966-2013 were *B. variabilis.* Similarly, neither were any of the 30 Franklin county bees.

“Relative abundance is again calculated at the county level, and given the small sample size and incomplete county coverage, as a reader I am not convinced that this is an accurate representation of county-level relative abundance. I strongly believe that the authors need to address this issue. Based on what I can glean of the collections, the best approach would seem to be to calculate relative abundance in each time period from the individual bees, not the counties. They don’t need to follow the methods of their Chandler and McCoy (1965) as long as they have the specimens that informed that work. This would probably give a much better assessment of actual relative abundance than this county level assessment. If they choose not to do this, at a minimum, in the Methods section they must make a forceful and clear argument as to why their method gives a reasonable approximation of actual relative abundance for each species.”

* We have hopefully clarified that we are not calculating relative abundance, but rather the proportion of occurrence. Also, we have explicitly stated why we feel that this is a more reasonable way of addressing these data than relative abundance measures would be, given the small sample size and geographic unevenness of the historical dataset.

“One other general comment: while I understand that this work focused on an Arkansas collection of bees from that state, I think it is imperative that the authors look for additional Arkansas records of the threatened species in collections outside of the state. For example, there is an additional record of B. variabilis from the state depicted in the range map in of a recent field guide (Williams et al. 2014); given the extreme rarity of this species, the authors should figure out where this specimen resides and confirm its validity as an Arkansas record. And, ideally, they should have done a contemporary inventory in all of the counties where B. variabilis formerly occurred.”

* We have not contacted the authors (Williams, *et al*.) of *Bumble Bees of North America, An Identification Guide* to request access to their data records, but we have made efforts to assess Arkansas records from major data holders. We did not include the data in the paper, but we did examine Arkansas records available from GBIF. There were no records of this species in Arkansas in that repository (out of 698 *B. variabilis* records). In fact, Arkansas is not well-represented in GBIF at all (only 323 AR records out of 42628 for the 7 species in AR plus *B. fervidus*). For this reason, and for the fact that records are not as reliable as specimens, we did not pursue this further.
* Because the majority of *B. variabilis* records were historically from Washington County, we feel that our heavy re-sampling of this county (493 contemporary specimens vs. 104 historical ones) was a sufficient effort to rediscover the species there.