RJournal 2021-112 Response To Reviewers

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1 Reviewer Two

Thank you for investing your time to review this manuscript. I appreciated your suggestion to contextualize the present work within the larger body of research in movement ecology and mathematical ecology. I have now added a paragraph to the introduction, which I feel adds the required context. For more information on specific changes, see my responses to your comments below.

General Comment

> In movement ecology contexts, these days, a strong focus is often on the utility of
> stochastic process modelling and its extensions, including non-stational ones (for ex-
> ample, Lenzi et. al., 2018). It would be nice, if you could comment on this regard,
> contrasting how your implemented method is useful or if there is any theoretical limita-
> tion that needs to be careful in field applications, which will be very much appreciated
> by readers. Although it may not be the focus of this manuscript or the journal, I feel
> that the current stand is missing such a link to the existing methodology that has been
> used in the relevant field. It is not necessary to be a long description, but providing
> some flavour and connection to somewhat movement ecologists are familiar with will
> help to increase the popularity of your package.

This is good suggestion. In addition to citing the suggested work, I have looked at the CRAN task view called Handling and Analyzing Spatio-Temporal Data and the CRAN task view on Differential Equations. I have added several references from R packages listed on these pages to articles that pertain to spatial ecology and landscape ecology. These can now be found in the second paragraph of the introduction. In addition, in the first sentence of the third paragraph of the introduction, I attempt to more clearly describe the difference between model-based approaches such as the one referenced by the reviewer and the approach used in *ICvectorfields*.

Minor Comments

> **Introduction, the 2nd Paragraph L4** "and in in" → "and in".

Thank you for catching this. I have removed the redundant word.

> **Digital image correlation** I believe that, in general, $\mathbb{Z} = \{..., -2, -1, 0, 1, 2, ...\}$.
> You probably meant for the indices $i, j \in \mathbb{N} = \{1, 2, ...\}$?

You are right: I originally intended to write the positive integers, but in this context it makes a lot more sense to refer to the natural numbers. The suggested notation is much better. I have changed the notation in the manuscript to reflect this improved notation suggested by the reviewer.

> **Overall** please remove unnecessary indents after the equations.

The indentations after equations have been removed.

2 Reviewer Four

Thank you for investing your time to review this manuscript. I appreciated your positive assessment of the work and your suggestion to clarify the objective of the manuscript and to add relevant information regarding the larch budmoth case study. I have now added details on the origins of the larch budmoth dataset that should give the reader a better understanding of the figures in this study.

General Comments

> The article "Quantifying Population Movement Using a Novel Implementation of Dig-
> ital Image Correlation in the ICvectorfields package" brings a relevant topic of interest
> to quantitative ecologists and statisticians working with landscape ecology. The author
> demonstrates the use of functions of the ICvectorfields package to produce vector fields
> and quantify velocities in systems with population movement (specifically DIC-Digital
> Image Correlation algorithms and extensions). The demonstration of this approach
> based on data provided by Bjornstad (2020) is useful for readers who wish to apply
> this package to landscape ecology.

> Regarding the structure, the paper is well written and the computational and mathe-
> matical background necessary for understanding the approach is well described. The
> author did a good job of demonstrating the use of this approach and comparing the
> results with Bjornstad et al. (2002), but I missed a more detailed description on
> this case study (importance, background, biological characteristics, conclusion, etc).
> I know that is not the main purpose of this article, but a more detailed description of
> the larch budmoth data would help readers (especially those from biological areas) to
> follow the example.

I thank the reviewer for their positive assessment of this work. I agree that a better understanding of the larch budmoth data would benefit the reader. Therefore, I have added more details regarding the larch budmoth data as well as references that describe the larch budmoth system. For more details, see the response to your final suggestion in the next section.

> The author should check and fix the problems in the CRAN repository. Additionally,
> minor corrections are required and indicated in the attached PDF file.

I have repaired the issues that caused the *ICvectorfields* package to be dropped from CRAN. It is back up and has been consistently on the repository ever since it was first dropped. My appologies for the discontinuity; continuous up-keep is necessary because the packages on which *ICvectorfields* relies are regularly changing. Thanks for your additional detailed comments. I have attempted to address these in the section that follows.

Minor Comments

> Throughout the article, you try to show that your work is the first to use this approach
> in landscape ecology. Are you presenting a general tool to be used in a wide variety
> of disciplines or demonstrating its use in landscape ecology?

This is a good question. Digital image correlation is already widely used outside of theoretical and landscape ecology. Therefore, I agree with the reviewer that the final sentence of the abstract may be too broad. I have reigned it in. The final sentence of the abstract now reads: "These methods and functions are likely to produce novel insights in theoretical and landscape ecology because they facilitate visualization and comparison of theoretical and observed data in complex and heterogeneous environments."

> It sounds like a personal view without scientific foundation. I suggest to remove these
> sentences or develop them better.

You are right: The sentences highlighted by the reviewer were an expression of personal experience and would require references to published literature to corroborate this view. Rather than develop the idea further in the sentence highlighted by the reviewer, I have taken the reviewer's advice and removed the sentences in which I describe my experience with oversimplified mathematical models. The manuscript does not lose any critical arguments because the inadequacy of overly simple mathematical models in complex environments is explored with references to literature in the third paragraph of the Introduction section.

> "in" is repeated twice

Thank you for catching this. I have removed the redundant word.

> I know this is not the main purpose of this article but I missed a more detailed
> explanation on the case study.

Thank you for for this suggestion. Under the section called "Demonstration with larch budmoth data" I have now included a description of the origins of the data as well as some brief notes on larch budmoth biology.