

***Interactive comment on “Ecosystem respiration, vegetation development and soil nitrogen in relation to breeding density of seagulls on a pristine volcanic island, Surtsey, Iceland” by B. D. Sigurdsson and B. Magnusson***

**Anonymous Referee #1**

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The two authors present a study from an interesting place. They chose ecosystem respiration (RE) as a measure of biological activity and discuss this in terms of ecosystem succession as driven by seagull colonisation via N input to the system. The Authors found highly significant differences in ecosystem structure, soil substrate and RE between colonised (C1) and non-colonised (C0) plots. The spatial design of the study is well appropriate to cover statistical relationships between different plots. The style of the manuscript is brief and the language is correct and easy to understand.

There is one essential problem with the study. Respiration is known to vary across

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diurnal, seasonal and interannual time scales due to its sensitivity to the physical and chemical environment. The methods chapter tells that each of the 21 plots has been measured 4 times resulting in 84 respiration measurements during day time. The description of the measurements does not note at which time of the day every single measurement has been taken and how the authors corrected for the effect of the diurnal RE variation on their results and conclusions. It neither describes which time period a single measurement represents. Normally a respiration measurement takes only a few minutes. The investigation sheds thus only a spotlight on a very short episode of a highly variable time series and quantitative estimates should be interpreted with great care, which the Authors do not apply. The manuscript mentions, e.g., a large temperature difference between C1 and C0 plots ( $T_{C0} \gg T_{C1}$ ), which they explain with shading by vegetation. It is not discussed, that(how) these differences depend on time both of the day and within season. It could well be vice versa (during evening, night or in autumn).

This limitation makes the study more a qualitative than a quantitative one. Looking at differences in structural ecosystem traits, as also described in earlier publications, one could well have expected that a well developed ecosystem with plants and soil organic matter (SOM) would respire more than a barren sand soil. The Authors compare RE rates with N concentration in SOM. Before discussing the comparably high RE(N) correlation (Fig 3) one needs to show that the criteria for such regression are fulfilled, as two very different data sets are analysed in one regression. To investigate this, one needs to do the same analysis for each of the two data sets, C1 and C0, and investigate the distribution(s) of the residuals. Apart from this I would find it more appropriate to compare at least also area related RE with area related N and C stocks. It is not only the quality of a substrate but also the amount of substrate that matters for respiration.

Given the presented RE / N relationship the Authors tend to see N as the most important driver for vegetation cover and ecosystem function. Although very likely from everything what ecological textbooks tell, I wonder how this statement is related to the

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study. Wouldn't one need to investigate all other possible drivers, e.g., phosphate and show that they are less important for ecosystem development than N?

Due to the scarce data basis (too short investigation period to end up with substantial, general conclusions) and in parts poor and descriptive analysis I do not recommend publishing this manuscript.

Does the paper address relevant scientific questions within the scope of BG? Yes

Does the paper present novel concepts, ideas, tools, or data? No, no, no, yes

Are substantial conclusions reached? Yes, but not supported by the novel data from the study

Are the scientific methods and assumptions valid and clearly outlined? Yes apart from the temporal aspects of the study.

Are the results sufficient to support the interpretations and conclusions? No

Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Apart from the temporal setup yes.

Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes. I wonder whether the Authors do not compare their findings with Mangússen's previous study (1992)

Does the title clearly reflect the contents of the paper? No the scope of the manuscript is only on respiration and not on vegetation development

Does the abstract provide a concise and complete summary? Yes

Is the overall presentation well structured and clear? yes, very much so!

Is the language fluent and precise? Yes, very easy to read

Are mathematical formulae, symbols, abbreviations, and units correctly defined and  
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used? Yes, apart from using names instead of symbols in formulas (Cover= ...)

Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? As mentioned above

Are the number and quality of references appropriate? Yes

Is the amount and quality of supplementary material appropriate? No supplementary material

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