Bg2014-176 Responses to referee comments and author responses.

During the interactive discussion of the paper, two RC were received:

RC from John Birks, 18. Jun 2013 (RC C2638), which we responded to on 03 Jul 2014 (AC 3204).

RC from Anonymous Ref. #3, 03 Jul 2014 (RC C3224), which we responded to on 11 Jul 2014 (AC C3415).

We have made changes to the manuscript and corrections to the text pointed out by the two referees. The most significant and relevant ones are listed below, see further details in our Acs if necessary.

In our minds the manuscript is now ready for publication in BG. We have received a note from the handling editor, Tim New, stating that sufficent changes and corrections have been made.

With best regards,

Borgþór Magnússon
August 29, 2014.

Authors comments to remarks from J. Birks and main changes made to manuscript

p. 6 -7: Nomenclature:

We have now included a reference for the plant nomenclature (Kristinsson 2008) and made several corrections of latin plant names throughout the paper, including figures and tables. (see page 7, line 2)

A reference is also included for the bird names (British Ornithologists' Union (BOU). 2013.). (see page 6, line 13)

p. 7 line 15: Details on selection of the location of permanent plots:

We have made an addition to the decription as follows: „The location of the plots was chosen subjectively with respect to substrate type and influence of seagulls on vegetation development on the island. *The first plots were set out in the center of the developing gull colony, on bare and sandy lava. Following that plots were also established under comparable substrate conditions on other parts of the island, in areas where there were signs of plant colonization. Plots were not established in areas where no colonization had occurred at the time, e.g. on the solid palagonite ridges* (Magnússon et al. .....)."

Is all the variation given in Table 1? In our mind the table covers the main variation of substrate types on Surtsey where the p.p. were set down. Plots have not yet been established on the solid palagonite ridges as they have remained barren and without vascular plants. With further erosion of the island and increasing impact of the seabirds on it´s higher part plots will also be established on the palagonite substrate.

In Table 1 we have added information in the table text on the plots from Elliðaey and Heimaey as they have thick, developed soil on top of the volcanic substrate. „*The plots on Elliðaey and Heimaey have thick (> 1 m), developed soils on top of substrate.* "

(See T1 on page36)

p. 9 line 3: Lowest inercept value of 1 cm:

We have changed the description to make it better understandable, the new version is: *„Additional species within the plots not intercepted by the lines were also recorded and given an intercept value of 1 cm, equal to 0.02% cover."*

p. 17 line 4-5: Length of DCA axes, and DCA versus CCA.

In the paragraph on the DCA results we have now included information on eigenvalues and total gradient length of the first two axes, thus*: „DCA separated plots with dense grasslands, regardless of location, from poorly developed and barren Surtsey plots on the first axis (eigenvalue 0.791, gradient final length 6.172) . Main separation along the second axis (eigenvalue 0.453, gradient final length 4.077) was between sandy and lava plots on Surtsey (Fig. 8)."*

In the text with Fig. 8 we have added: „, *axes units are multiplied by 100"*

Our choice of using DCA rather than CCA is due to that important external variables are not quite comparable between the islands or can not with accuracy be put on the same scale, e.g. the nutrient impact of the seabirds. On Surtsey we have the gulls and a count of their nests by each plot, but on Elliðaey we have puffins and an estimation of their nest density. However, how to put these into numbers of e.g. N-input is difficult and we did not attempt that for the present analysis. Therefore we decided to use DCA to compare vegetation similarities between the islands and successional trends.

p. 23 line 3: Why do the sites from the old islands give a meaningful comparison?

Here we have added a short text to explain this further:

„Although the grassland sites sampled on Heimaey and Elliðaey in 2013 are small and do not represent all the different conditions and plant communities of the islands (Friðriksson and Johnsen,1967; Friðriksson et al., 1972), they do provide a meaningful comparison *and connection between the primary and mature stages in plant succession on these bird impacted volcanic islands. The response of the different plant species to nutrient enrichment and early dominance of grasses in the bird colony on Surtsey is also of particular interest."*

Response to the technical corrections:

We have made the corrections and further that we found, changed the use of commas and hyphens in accordance with the comments made. In the final editing by the BG we assume that rules of either British or American spelling will be followed and necessary corrections made.

Authors comments to remarks from AN #3 and main changes made to manuscrpit

p. 3-4: Introduction

We have worked further on the introduction and tried to improve it as suggested.

The first and second paragraphs have been united, in the following way: page 3: line 4 – 15. ..... „The lava flows around Mt. Hekla in the south of Iceland have provided excellent opportunities for chronosequence studies of plant colonization and community development (Bjarnason, 1991; Cutler et al., 2008; Cutler, 2010), comparable to studies around active volcanoes in temperate and tropical regions. The 1963 submarine eruption and birth of Surtsey island off the south coast of Iceland was, however, a surprise.“ .....

At the end of the third paragraph we have added the following: page 4, line 14: „On Surtsey it has been possible, for the first time, to follow the initial steps of colonization and primary succession of these subarctic volcanic islands. As outlined by Svavarsdóttir and Walker (2009), the detailed studies carried out on Surtsey are of particular value due to their long-term data, detailed demographic data, information on species interactions and responses to nutrient inputs, opportunities to test of island biogeography concepts, and more.“

At the end of the introducion we have added the following on the objectives: page 5: line 1: „The general objectives of our studies are to follow plant colonization and ecosystem development on the island under different nutrient loads from seabirds and compare to the biotas and ecosystems of the several thousand years older neighbouring islands.“

p. 8: Methods. Study in permanent plots

Permanent plots on older islands and extension of study. We decribe further how the plots were selected and why in the following way: page 8, line 5-9:

„The aim was to investigate old grassland communities of the islands under different nutrient inputs from seabirds as these grasslands are indicative of the future development on Surtsey. Two accessible islands and areas with limited human disturbance were selected. The number of plots was determined by the available time and manpower and considered as an absolute minimum for a comparison to the Surtsey plots. “

p. 17: Results. Section 3.3.

Ordination results and our choice of DCA rahter than CCA. We also got an earlier and a very similar comment from John Birks on this which we have responded to, see comments on interactive discussion.

Page 17, line 3-6: In the paragraph on the DCA results we have now included information on eigenvalues and total gradient length of the first two axes, thus*: „DCA separated plots with dense grasslands, regardless of location, from poorly developed and barren Surtsey plots on the first axis (eigenvalue 0.791, gradient final length 6.172) . Main separation along the second axis (eigenvalue 0.453, gradient final length 4.077) was between sandy and lava plots on Surtsey (Fig. 8).“*

Our choice of using DCA rather than CCA is due to that important external variables are not quite comparable between the islands or can not with accuracy be put on the same scale, e.g. the nutrient impact of the seabirds. On Surtsey we have the gulls and a count of their nests by each plot, but on Elliðaey we have puffins and an estimation of their nest density. However, how to put these into numbers of e.g. N-input is difficult and we did not attempt that in the present analysis. Therefore we decided to use DCA to compare vegetation similarities between the islands and successional trends.

Also the ordination analysis is not a central part of the paper or analysis and we use the DCA to show the general relationships and trends but do not attempt to go into further details. Had we been dealing with the Surtsey plots alone, CCA would certainly have been a more appropriate method to follow.

Response to the technical corrections:

We have made the corrections and changes suggested, taken out references and added missing ones, changes have been made to Fig. 3 (page 41) to indicate the different periods (see attahced PDF-file of manuscript).