

## ***Interactive comment on “The fate of seeds in the soil: a review of the influence of overland flow on seed removal and its consequences for the vegetation of arid and semiarid patchy ecosystems” by E. Bochet***

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Answer to Referee 2

First of all, I would like to thank you for your interest in the revision of my manuscript and for your helpful comments and suggestions that will serve to improve it. Hereafter, you will find a point-by-point reply to your comments that will be included in the next version of the manuscript.

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Specific comments

- Pag 590, Lines 25-28, and page 591, lines 7-11 I think that there is confusion here between seed dormancy and seed persistence in the soil. I recommend reading the paper by Thompson and Ooi 2010. To germinate or not germinate: more than just a question of dormancy. *Seed Science Research* 20:209-2011, for this discussion. Not all seeds that form a persistent seed bank are dormant. Dormancy is a property of the seed but persistence can be a property of the environment. A non-dormant seed that is buried might or might not germinate depending on its germination requirements (e.g. Light or darkness). If it does not germinate, it can be part of the persistent fraction, if it germinates at a sufficient depth, it can die because the seedling does not reach the soil surface. This also happens with dormant seeds when they release dormancy.

This section will be slightly modified in order to avoid possible confusions between seed dormancy and seed persistence. Hereafter, the changes included in the section between p.590, line 21 and p.591, line 11:

“First, they may germinate immediately if they have the chance to rest on a microsite with suitable conditions for germination and are non-dormant (i.e. physiologically active seeds). Second, seeds may be lost to death by post-dispersal predation (ants, rodents or birds) or decay due to pathogen attacks or senescence (Hulme, 1998). Third, seeds may rest at the initial point of deposition and remain on the soil surface for a short or long period, depending on the dormancy state of the seed and the occurrence of favourable conditions for germination. Seed dormancy has to be broken by the agents responsible for dormancy alleviation (time, temperature, moisture) before seeds can germinate in favourable environmental conditions (e.g. light, improved oxygen levels, . . .). Finally, seeds may be subjected to secondary dispersal processes and moved to new sites via horizontal or/and vertical seed movements. Concerning vertical movements, seeds may be incorporated from the soil surface into the soil in either a non-dormant or a dormant state and form the soil seed bank (Thompson et al., 1993). Seed entering into cracks at the soil surface, seed burial by small burrowing animals

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or by local accumulation of sediments may enhance vertical seed movements (Chambers and Mac Mahon, 1994; Chambers, 2000). Non-dormant seeds may germinate immediately once they have entered the soil in case of favourable environmental conditions for germination, and give rise to new seedlings if they are able to emerge above the soil surface. Dormant seeds may remain in the soil for long periods, waiting first for seed dormancy alleviation and then for the occurrence of favourable environmental conditions for germination”.

- May be you can develop a little bit more the aspects related with the fate of seeds when they are buried, which is other aspect of the problem, in the section 3.1. I suggest to read other related papers such as Traba et al 2004 Seed Science Research, and Rivera et al (2012) Ecological engineering.

I agree with you that little is said about the fate of seeds when they are buried. This is because the focus of the paper was initially put on the horizontal seed movements caused by runoff as stated at the end of section 2 (p.591, lines 18-20): “The following sections will focus on horizontal seed movements caused by runoff and their implications for the vegetation establishment and for the spatial organization and functioning of arid and semiarid patchy ecosystems”. However, after reading your comment, I think that the focus of the paper shouldn't be limited to horizontal seed movements caused by runoff, but should also include the burial of seeds after seed entrapment or seed recover by soil accumulation. Moreover, this inclusion will better adjust the content of the manuscript with the title, which proposes a review of “the influence of overland flow on seed removal and its consequences for the vegetation (. . .)”. As a consequence, the term “horizontal” will be deleted from the last sentence of section 2 (p.591, lines 18-20) and the following paragraphs will be included at the end of sections 3.1 and 3.2.2. in order to describe briefly the fate of seeds when they get buried in the soil: Section 3.1.”The general low rates of seed losses described in these studies may be due, in part, to the burial of seeds into the soil after being trapped or at the time they get covered by local accumulations of sediments transported by overland flow (Chambers et

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al., 1991)”. Section 3.2.2. “Finally, some seed traits enhance the incorporation of seeds into the soil column and decrease therefore the seed susceptibility to be removed by overland flow (Chambers et al., 1991). Small seed size and a lack of appendages are relevant morphological attributes for seed incorporation into the soil (Chambers et al., 1991), even though specialized appendages such as hygroscopic awns can facilitate seed burial (Peart and Clifford, 1987). However, if seeds are buried too deeply, especially small seeds, they can fail to act as functional seeds for the ecosystem (Traba et al., 2004)”.

Point-by-point reply to the minor comments

- Pg 586, Line 12, and pg 589, line 27: in your first goal, you do not put “..special attention to seed density. . .”, but “special attention to processes that affect seed density”.

It seems to me that you confused “seed density” with “seed destiny” when reading these sentences (same letters in a different order!), because I don't mention the word “density” in these sentences! Because I put special attention to seed destiny -as a synonym of seed fate- in the manuscript, I will not make any change to these sentences.

- pg 595, line 12 delete “slope or” it is a bit confusing and not necessary.

I agree it is confusing and not necessary and will therefore delete it from the sentence.

- pg 595, line 14: it is not clear what you want to say with “seed losses. . .decreased. . . with total transport length”.

I will replace “total transport length by “total slope length” to make it clearer to the reader.

- Figure 2 because of the small size of the figure, the different lines are indistinguishable.

From the Editorial Support Service I have been informed that the small size of the figure was rather a problem of the discussion paper format than of the submitted figure.

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However, in order to improve the identification of the lines, I will increase the length of the y-axis as regard the length of the x-axis and use different colors for the different lines as suggested by another referee.

- Fig 5 is very difficult to read. Also, I would delete part A of the graph. The label "Low competitive" or "High competitive" to refer to the plants in the steep slope of on the button flat areas is very controversial (Steep slope plants can be very competitive for water but plants on the flat area can be more competitive for light). I also think that this concept is not necessary for your discourse (you do not mention competitiveness in the entire text related to this figure).

I agree with you that the concept of "competitiveness" hasn't been mentioned throughout the entire manuscript and should be therefore removed from Figure 5A. Even more when the concept is controversial! I will delete the terms "Low competitive" and "High competitive" from the Figure 5A. However, this latter figure will not be removed, because I think it illustrates what happens to seeds at the slope scale, including important aspects of seed redistribution and seed losses slope that have been largely discussed in the manuscript. As for Figure 2, Figure 5 is difficult to read because of its small size in the discussion paper format. However, according to what I was said by the Editorial Support Service, its reading should be much improved in the typeset final revised paper. I will however make some small changes in the spatial distribution of the boxes and arrows to make the Figure more understandable.

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Interactive comment on SOIL Discuss., 1, 585, 2014.