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Biogeosciences Discussions

Interactive comment on "Microbiotic crusts on soil, rock and plants: neglected major players in the global cycles of carbon and nitrogen?" *by* W. Elbert et al.

Anonymous Referee #2

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This manuscript is a broad brush attempt at quantifying the carbon and nitrogen inputs of biological soil, rock, and plant crusts on global carbon and nitrogen cycles. As carbon and nitrogen fixation, and respiration rates, vary widely with various organisms, this is a difficult task. The authors have used median values, rather than averages, to gain more solid footing in their estimates, and also state that these estimates may be $\sim$2x off actual values. I would suggest that the error in the reported estimates is far higher than 2x, and that more accurate values can be obtained.

Values for C flux are more or less reliable. However, I would caution against using the median values here. The high values reported are for individual lichens, when in

almost all settings, cyanobacteria dominate biocrust cover. Thus, the values reported need to somehow be weighted rather than averaged.

The same can be said for biomass. For instance, *Collema tenax* or *cristatum* seldom represents more than 5-10% cover at a site, and is often much less in a given setting. *Squamarina* has generally far less than 1% cover. In contrast, cyanobacteria often represent 50% or more of absolute cover in a dryland setting. Thus, this somehow needs to be taken into account. Another issue is that cyanbacteria biomass can be hugely variable (as evidenced in Table 1), and thus this should also be taken into account in some broad-brushed way.

N fixation values are especially problematic. This is especially true for nitrogen fixation values, as they are most often estimated using acetylene reduction assays (ARA). Conversion of ARA values to actual N fixed can vary from 0.1 to 56, a huge range. Looking at Table A9, I would start by not using the 37 g m^2 a^1 reported by Belnap et al. 2001, and perhaps not even the 10 g m^2 a^1 reported by Veluci (2003) and Evans and Lange (2006) as they are far higher than other values in the table. I would also not use the 42.3 g m^2 a^1 reported by Sheridan 1991a, for the same reason. In addition, the authors need to discuss the problems with N values obtained by the ARA method.

One suggestion for estimating the values for C, biomass, and N: assume lichens represent 10% cover (a generous value) and cyanobacteria 50% cover. Delete the very high values obtained for individual lichen species and obtain the median values for those. Use the median value for cyanobacteria. Then weight these values by this "average" cover. I suspect the values obtained will be far lower than those currently reported, but more accurate.

May I also suggest not using "microbiotic" in the title? "Biological crusts" is more in vogue these days.

Interactive comment on Biogeosciences Discuss., 6, 6983, 2009.