

What is a limit value?

Limit values as they appear in DELILA II have been estimated, using accumulated mass loss for litter, and give the stabilized fraction of the litter as well as the more readily decomposed fraction (see chapter 4 in Berg and Laskowski 2006; Berg and Ekbohm 1991; refs. below). As we have used limit values they are given as percent accumulated mass loss.

Limit values may be estimated using the equation

$$L_t = m(1 - e^{-ktm}) \quad \text{Eq. 1}$$

where L_t is the accumulated mass loss (in percent), t is time in days, k is the decomposition rate at the beginning of the decay, and m represents the asymptotic level that the accumulated mass loss will ultimately reach, often considerably less than 100%. The size of the stable fraction may be calculated as 100 - limit value.

Limit values may be estimated using values for accumulated mass loss (e.g. Eq 1) and remaining amount. Further, there are different functions that allow an estimation of limit values (see e.g. Currie et al. 2010).

Some publications presenting and applying the concept limit values

Berg, B., and Laskowski, R. 2006. Litter Decomposition: A guide to Carbon and Nutrient turnover. Advances in Ecological Research. Volume 38. Elsevier, San Diego. 448 pp. ISBN 0-12-013938-3.

Berg, B., De Marco, A., Davey, M., Emmett, B., Hobbie, S., Liu, C., McClaugherty, C., Norell, L., Johansson, M.-B., Rutigliano, F., Vesterdal, L., and Virzo De Santo, A., 2010. Limit values for foliar litter decomposition – pine forests. Biogeochemistry 100:57-73.

Davey, M., Berg, B., Emmett, B., and Rowland, P. 2007. Controls of foliar litter decomposition and implications for C sequestration in oak woodlands. Canadian Journal of Botany 85;16-24.

Akselsson, C., Berg, B., Meentemeyer, V., and Westling, O. 2005. Carbon sequestration rates in organic layers of boreal and temperate forest soils - Sweden as a case study. Global Ecology and Biogeography 14; 77-84.

Berg, B. and Dise, N. 2004. Calculating the long-term stable nitrogen sink in northern European forests? Acta Oecologica 26; 15 - 21.

Berg, B and Dise, N. 2004. Validating a new model for N sequestration in forest soil organic matter. *Water, Air and Soil Pollution. Focus 4*: 343-358.

Berg, B., Virzo De Santo, A., Rutigliano, F., and Ekbohm, G. 2003. Limit values for plant litter decomposing in two contrasting soils - influence of litter elemental composition. *Acta Oecologica 24*;295-302.

Berg, B., McClaugherty, C., Virzo De Santo, A. and Johnson, D. 2001. Humus buildup in boreal forests - effects of litter fall and its N concentration . *Canadian Journal of Forest Research 31*;988-998.

Berg, B. 2000. Litter decomposition and organic matter turnover in northern forest soils. Conference on "The Ecology and Management of Northern Forest Soils - An International Workshop" Prince George, BC, Canada. June 13-18th, 1998. *Forest Ecology and Management 133*; 13-22.

Couteaux, M.- M., McTiernan, K., Berg, B., Szuberla, D. and Dardennes, P. 1998. Chemical composition and carbon mineralisation potential of Scots pine needles at different stages of decomposition. *Soil Biology and Biochemistry 30*;583-595.

Berg, B., Ekbohm, G., Johansson, M.-B., McClaugherty, C., Rutigliano, F., and Virzo De Santo, A. 1996. Maximum decomposition limits of forest litter types; a synthesis. *Canadian Journal of Botany 74*:659-672.

Berg, B., McClaugherty, C., Virzo De Santo, A., Johansson, M.-B., and Ekbohm, G. 1995. Decomposition of forest litter and soil organic matter - a mechanism for soil organic matter buildup? *Scandinavian Journal of Forest Research. 10*:108-119.

Berg, B., and Ekbohm, G. 1993. Decomposing needle litter in Lodgepole pine (*Pinus contorta*) and Scots pine (*Pinus sylvestris*) monocultural systems. Is there a maximum mass loss? *Scandinavian Journal of Forest Research. 8*:457-465.

Berg, B., and Ekbohm, G. 1991. Litter mass-loss rates and decomposition patterns in some needle and leaf litter types. Long-term decomposition in a Scots pine forest VII. *Canadian Journal of Botany 69*:1449-1456.

Berg, B., and McClaugherty, C. 2008. Plant litter. Decomposition. Humus Formation. Carbon Sequestration. Springer Verlag, Heidelberg, Berlin. 338 pp. ISBN 978-3-540-74922-6.

Currie, W., Harmon, M., Burke, I., Hart, C., Parton, W., and Silver, W. 2010. Cross-biome transplants of plant litter show decomposition models extend to a broader climatic range but lose predictability at the decadal time scale. *Global Change Biology* 16(6):1744-1761.