Earth Syst. Dynam. Discuss., 3, C308–C310, 2012
www.earth-syst-dynam-discuss.net/3/C308/2012/

Earth System Dynamics Discussions

Interactive comment on "Estimated impact of global population growth on future wilderness extent" *by* E. Dumont

T. Oliver

toliver@ceh.ac.uk

Received and published: 29 August 2012

Conflict of interest disclosure: I have a professional connection with the author, working in the same institution. However, I do not believe this has biased my judgement of the manuscript, as reflected in comments and reasoning below. I waive anonymity. Tom Oliver, Centre for Ecology and Hydrology, Wallingford, UK.

This study seeks to estimates future global extent of 'wilderness' area based on extrapolated trends in population growth rates, agricultural efficiency, loss of groundwater and non-agricultural land use change. The subject is clearly topical and important. There is a clear need to highlight the danger of continued rapid degradation of the (few remaining) more 'pristine' areas of the earth, especially with regards to the benefits that they can provide to humans. As expected, any study of this kind has to make a

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number of large assumptions. So the question is to what extent are these assumptions valid, and is uncertainty in their validity adequately conveyed? The data used are generally well cited, but I believe a number of assumptions are questionable. The author might resolve this through testing sensitivity to parameter estimates and/or presenting alternative scenarios. If this can be achieved satisfactorily, then the paper may make a useful contribution to the field.

Major points:

1. The authors assume that the recent halting of agricultural land expansion is only temporary (see plateau of total global agricultural area in Figure 2a), so they fit a linear regression to the long term trend, effectively ignoring the lack of positive trend since 1995. I think that this is a major assumption, and results should be tested for sensitivity to this assumption. Regressions are generally only extrapolated because we believe that the conditions leading to these relationships are set to continue. However, since 1995 the conditions have clearly changed in the socioeconomic system. The author states that the recent stop in agricultural expansion is likely to be temporary (Pg 439, line 25), and give some justification. However, what is the reasoning that the socioeconomic system will return to its exact previous state with the same rate of increase in agricultural area? Indeed, the new rate of change in agricultural area could be completely different. Therefore, I think the author needs to present scenarios with different rates of agricultural expansion, depending on potential agricultural efficiency.

2. The parameters for the 'managed non-agricultural land' per person are constants based on either a global estimate in 1995, or a single study in North America. However, there exists a clear global trend for increasing urbanisation (i.e. the huge growth in 'supercities' and migration out of rural areas), with consequently lower per capita demand for infrastructure. Therefore, alternative scenarios for the spatial pattern of population growth may be worthwhile.

3. The discussion is overall too slight and needs to critically assess assumptions made

ESDD
3, C308–C310, 2012

in the study.

Minor points:

1. 'Wilderness' is defined as unmanaged land or land unlikely to suffer major species extinctions, which may have high or low biodiversity (pg 435 line5). The authors state that wilderness is not absolutely essential for human survival (pg 434 line 9), but this disregards the very active research field of ecosystem services, which often shows that unmanaged land can be important for regulation of climate, water, pollination and pest control, to name but a few services. The author should really add these to the (limited) list of benefits described from Noss (1991).

2. In Equation 1, it is unclear why the term I(y) is not included in the term Apers(y). I(y) is defined as the increase in agricultural land due to unsustainable irrigation, although I think the authors do not mean to imply that this is a rate, but actually an absolute area of agricultural land required per year. Why is I(y) not simply incorporated into Apers(y), the agricultural land needed to support the average person in the world? As formulated, it appears that I(y) does not depend on population growth at all- equation 5 suggests that it is a function of agricultural area increasing at a linear rate from the year 2000. This contrasts with equation 1, where agricultural area scales with estimates of population size.

3. The source for world population growth between 1960 and 2009 used on pg 441, line 3 needs citing.

Interactive comment on Earth Syst. Dynam. Discuss., 3, 433, 2012.