Supplement

Areas of land cover and land cover change were derived from the site specific mapping results and represented as land cover change matrices for 1990–2000 and 2000–2010. These land cover change matrices were converted to area proportions relative to the total land area of the sample site without clouds. Cloudy areas within a sample site were considered as unbiased data loss, and were assumed to have the same proportions of land cover as the non-cloudy areas in the same site.

For the statistical estimation phase the sample sites were weighted in relation to their probability of selection. The sample frame, although systematic, does not have an equal probability of selection for each site due to the location of the confluence points. The circumference of the circle of latitude reduces in proportion to the cosine of the latitude; hence all sample units were given the weighting w_i, equal to 1 multiplied by the cosine of the latitude to account for the resulting higher spatial sampling frequency away from the equator. As the selected sample sites which contained a proportion of sea were considered as full sites (total of area proportions equal to 1), this compensated for those sample sites that contained a proportion of sea but were not selected as the centre of the site—the confluence point—was located in the sea. The proportions of land cover changes were then extrapolated to the study area using the Horvitz-Thompson Direct Expansion Estimator ([1]). The estimator for each land cover class transition is the mean proportion of that change per sample unit, given by equation:

$$\overline{y_c} = \frac{1}{m}\sum_{i=1}^{n} w_i * y_{ic}$$

where y_{ic} is the proportion of land cover change for a particular class transition '*c*' in the i-th sample unit. The weight of the sample unit is w_i and m is the sum of the sample weights. The total area of change for this class transition Z_c is obtained from:

$$Z_c = D * \overline{y_c}$$

where D is the total area of the study region.

Rather than the usual variance estimation of the mean for systematic sampling ([2]) we used a local estimation of the variance as follows:

$$s^2 = \frac{\sum_{j \neq j'} w_{jj'} * \delta_{jj'} * (y_j - y_{j'})^2}{2 \sum_{j \neq j'} w_{jj'} * \delta_{jj'}}$$

where the weight *wjj'*, is an average of the weights *wj* and *wj'* and *δjj'* is a decreasing function of the distance between *j* and *j'* (Note that if we choose *δjj'* = 1 *j* ≠ *j*' we obtain the usual variance estimator). For *wjj'* we used a value of 1 (as a simplification because all the weights *wj* are close to 1) and for *δjj'* we applied equation:

$$\delta_{jj'} = \frac{1}{d(j,j')} = \frac{1}{(dif_{(lat)})^4 + (dif_{(lat)})^4}$$

The standard error (s.e.) is then calculated as:

$$se = \frac{s}{\sqrt{n}}$$

where *n* is the total number of available sample sites (*i.e.*, not accounting for the missing sites even if they are replaced by a local average). The standard error represents the precision obtained with our sample scheme. The observations (source data sets) that are used to produce these results are derived from the satellite interpretations.

([1]) Särndal, C.E.; Swensson, B.; Wretman, J. *Model Assisted Survey Sampling*; Springer-Verlag:
New York, NY, USA, 1992.
([2]) Stehman, S.V.; Hansen, M.C.; Broich, M.; Potapov, P.V. Adapting a global stratified random sample for regional estimation of forest cover change derived from satellite imagery. *Remote Sens. Environ.* **2011**, *115*, 650–658.”