Interactive comment on "Population Growth–Land Use/Land Cover Transformations–Water Quality Nexus in Upper Ganga River Basin" *by* Anoop Kumar Shukla et al.

Anonymous Referee #1

The paper sets out to investigate the relationships between land use/cover, population growth and water quality for a large river basin. Remotely sensed data is used in combination with population census and water quality measurements to analyse correlations between the data available. The authors have attempted to identify causal links between the patterns of change seen between 2001 and 2012. The datasets used are appropriate but there are some technical issues to be addressed as highlighted below. General observations are made with regard to the potential sources of pollutants which given the scale of investigation is probably appropriate although it would have been better if some clear cut examples could be presented that show how a specific change in land use/cover has changed the level of pollutants measured. The OIP clas-

sification is helpful in the categorisation of water quality at this scale of analysis and matches the scales of the available population and land cover/use data.

Specific comments: 1. Better clarity is required in the description of the remote sensing methodology. Section 3.2 starts by describing the validation points used for the accuracy assessment. The sampling design used to identify these points is not described here, this information appears much later in section 5.3 and is only described as a simple random survey. The sample design must be described in section 3.2 and the selection of the sampling methodology applied justified. In particular, the use of a simple random sample must be clearly justified as this approach potentially raises a number of issues not least the potential to have a poor spatial distribution of sample points. 2. How many of the validation points were ground truthed? What was the accuracy of the validation point interpretations? 3. How many GPS survey data points were used to train the MLC? How did you account for potential autocorrelation in the training data? 4. A comment is needed that assesses the impact of the scan line corrector failure on Landsat 7 imagery from 2003 onwards with regard to the 2012 image classifications. 5. What radiometric correction was applied to ensure consistency of reflectance values across the large number of images used in your classifications? 6. You refer to 'relative geometric correction'. What is this? What algorithm was used? 7. The districts you have selected for analysis should be included on the maps of LULC (Figure 4) to give the reader of the paper the spatial context for them 8. I would recommend the addition of district specific land use change maps to help support your discussion. At present it is impossible to visually relate the pattern of land use change to the water quality and population statistics because the scale of the mapping in figure 4 is too small. 9. In place of table 4, I would present a cross tabulation table of the 2001 and 2012 LULC classes. This will clearly show the reader what has changed to what and then the gross and net changes can be shown in figure 5.

Technical Comments: 1. Repetition is a problem in several places through the text. The worst example of this is presenting results back again in the conclusions. Go through

the paper carefully and remove the repetition. 2. The English needs to be corrected throughout the paper. Please find a native English speaker to go through the paper to correct for missing words, improve the phraseology used and correct the grammar. 3. Avoid the use of superlatives e.g. 'tremendous' and 'colossal changes'. These terms cannot be substantiated and so should not be used. 4. The long list of water quality indicators is excessive. Highlight only those that could be relevant to the data available for this study and those commonly used. 5. Avoid excessive precision e.g. 238,347.74 km2. At the scale you are working expressing to the nearest km2 is appropriate. 6. Figure 1 - The inset map should be inside the map frame, the water quality monitoring station location labels conflict with the basin boundary line - change the position of the labels so that this doesn't occur, remove the underscore characters from the legend text (this also applies to figure 4). 7. The population statisitcs on page 18 should be presented as a table with the PGR statistics given for each district. Figure 3 on page 19 is repetition of the data that will be presented in the tbale so remove figure 3. 8. The information on pH on page 30 can be regarded as a known fact and so doesn't need to be explained. 9. The discussion that follows the pH description needs to be written with reference to just the set of figures showing the OIP values plotted against the stations. The other figure is effectively repetition so remove the other figure.

C3