Reexamination of Nitrogen Loading in Inbanuma Basin

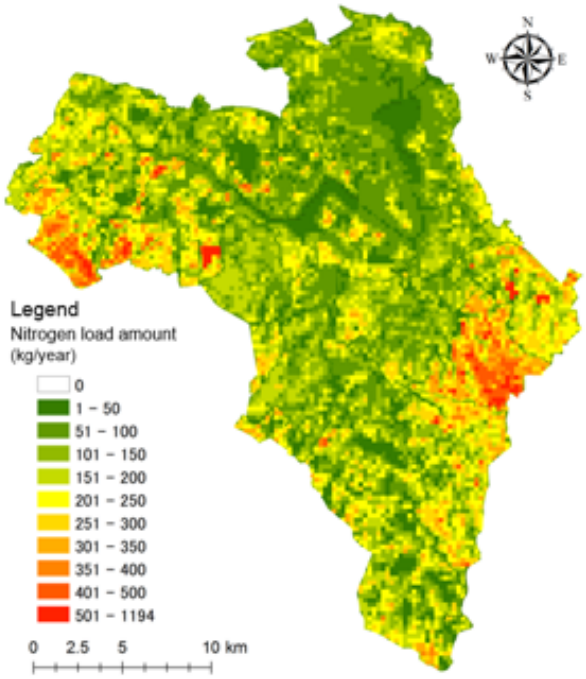
*Masaki Horie[1], Akira Hama[2], Yoko Fujimura[3], Akihiko Kondoh[4]

1. Faculty of Science, Chiba University, 2. Graduate School of Science, Chiba University・JSPS Research Fellow, 3. Former Chiba Prefectural Environmental Research Center, 4. Center for Environmental Remote Sensing, Chiba University

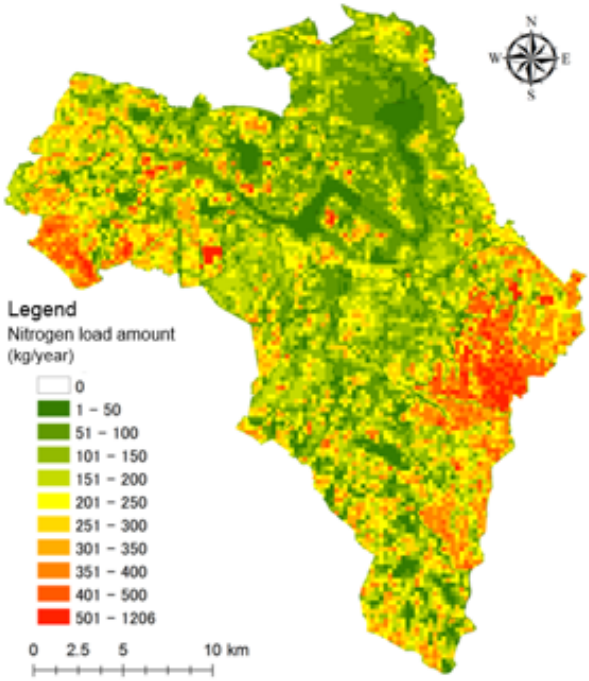
1.Introduction
Nitrogen circulation is mentioned as one of the most serious environmental factors due to global nitrogen excess and nitrogen saturation. In Japan, we are planning to improve the water quality by establishing Lake Water Quality Conservation Plan against the eutrophication problem of closed watershed. Inbanuma Lake in Chiba Prefecture is one of the designated lakes, and the generated pollutant load amount using the unit loads is calculated in the Lake Water Quality Conservation Plan. However, since it uses the same unit loads for the past 30 years, it is considered necessary to reevaluate, and new values were proposed for some items in Fujimura (2015). Therefore, in this study, I prepared two nitrogen load amount distribution maps of the Inbanuma basin from the unit loads of the Lake Water Quality Conservation Plan and Fujimura (2015) unit loads, and compared the load amounts of the two distribution maps and studied the unit loads.
2.Research method
First, the nitrogen load amount was calculated for each section divided by the administrative circle and catchment area for each incoming river. Nitrogen load amount was calculated by multiplying the unit loads by the 2010 statistical data provided by the Water Quality Conservation Division of the Environmental Department, Chiba Prefecture. The load amount can be classified into living load from residential land, animal husbandry load from livestock, natural loads which are surface source pollution loads such as forest and upland field, and work site load from workplaces. Next, in the 2007 land use map created by the Inbanuma Basin Water Circulation Revitalization Council, I set the living load amount in the residential land, the livestock load amount in the field, the work site load amount in the urban area, and the natural load amounts were allocated for each land classification such as forest and upland field. Finally, nitrogen load amount distribution maps were created by dividing into 250 m mesh. In order to investigate the adequacy of the load amount in two distribution maps, I set catchment areas with the water quality measurement points of the total nitrogen concentration as the outlet, and compared the nitrogen load amount in the catchment areas with the measured nitrogen outflow at the outlets. Nitrogen outflow was calculated from the total nitrogen concentration measured by the Water Quality Conservation Division of the Environmental Department, Chiba Prefecture and the flow rate measured by the Inbanuma Basin Water Circulation Revitalization Conference.
3.Result and Discussion
Since a good linear relationship was shown between the nitrogen load amount and the nitrogen outflow in each catchment area in the Inbanuma basin, it was shown that the nitrogen load amount in the catchment area increases the nitrogen outflow of the river. When the unit loads of the Lake Water Quality Conservation Plan was used, the slope of the regression line was 1.40, and the nitrogen outflow greatly exceeded the nitrogen load amount, so there is a possibility that the nitrogen load amount is largely underestimated. On the other hand, when using the proposed unit loads of Fujimura (2015), the slope was 1.09, and the nitrogen load amount was approximately proportional to the nitrogen outflow. However, there is a possibility of underestimating the nitrogen load amount obtained in the proposed unit loads, since in the actual outflow process, nitrogen is considered to be decreased by the denitrification process, and it is unlikely that the nitrogen outflow exceeds the nitrogen load amount. In addition, the nitrogen outflow used in this study was calculated from the observed value at the time of flat water, and

the nitrogen outflow caused by the first flash at rainfall was not considered. Therefore, there is a possibility that the value is underestimated not only in the unit loads of the Lake Water Quality Conservation Plan but also in the proposed unit loads.

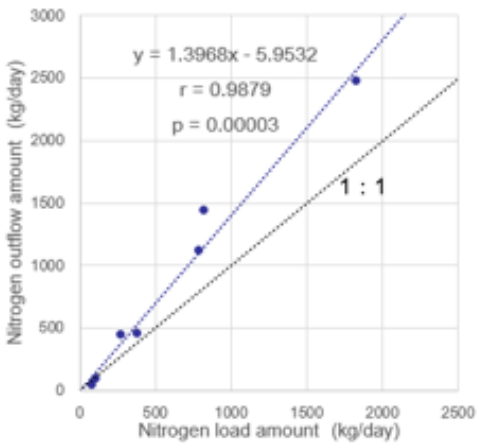
Keywords: nitrogen circulation, unit load, denitrification



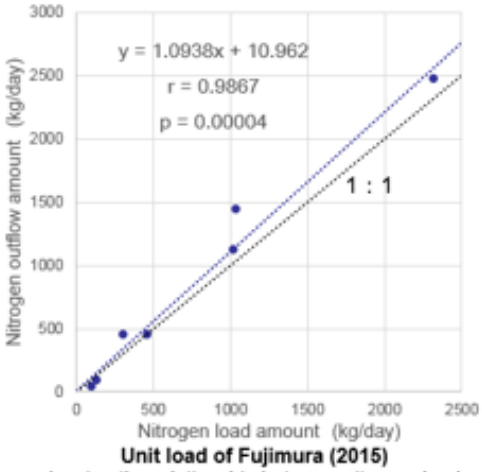
Nitrogen load amount distribution map
～Unit load of Lake Water Quality Conservation Plan～



Nitrogen load amount distribution map
～Unit load of Fujimura (2015)～



Unit load of Lake Water Quality Conservation Plan
Diagram showing the relationship between nitrogen load amount and nitrogen outflow amount



Unit load of Fujimura (2015)
Diagram showing the relationship between nitrogen load amount and nitrogen outflow amount

