1. Introduction

Increased reactive nitrogen from human activities such as manufacturing nitrogen for synthetic fertilizer, industrial use, fossil fuel combustion, and by some (nitrogen-fixing) crops and trees in agroecosystems, have been giving significant impacts on global ecosystem (Millennium Ecosystem Assessment, 2005). The north-western Kanagawa, Tanzawa Mountains, receives elevated inputs of anthropogenic nitrogen largely from atmospheric deposition. Ecological results of elevated nitrogen inputs include troposphere ozone formation, ozone damage to plans, and the alteration of forest nitrogen cycles, acidification of surface waters and eutrophication in coastal waters (Driscoll, 2003). In fact, degradation of forest vegetation such as buna (fagaceous) and fir trees can be seen at various sites in Tanzawa Mountains. However, relationships between the effect of reactive nitrogen deposition from the atmosphere and the status of geology and forest are not clarified.

Our research group is analyzing and proposing appropriate monitoring points in Tanzawa Mountains, renowned for its nature's bounty and source of water for 8.5 million people. The purpose of this paper is to conduct
strategic selection of water sampling location of forested mountain head waters using GIS database and GPS technologies.

From the previous research results in the mountains, water qualities have significant variation among sampling points. However, the spatial distribution and how much geography, geology and vegetation influence water quality are not yet studied.

According to other previous studies, acquiring as many samples as possible is useful in evaluating the status of a forest. However, in vast Tanzawa Mountains with rough terrain and complicatedly combined geology, strategic site selection and analysis are required to understand the status of the mountains comprehensively.

By selecting catchments using digital elevation models (DEMs), and charactering the catchments by its properties such as elevation, slope, aspect, geology and vegetation, we could select water sampling points in a strategic way and make the fieldwork more efficiency. Additionally, properties of catchments could be useful for further factor analysis with the result of chemical analysis.

2. Outline of study field
Six river basins of the foot of Tanzawa Mountains are our study area (Fig. 1): Hayato River and Shiomizu River which flow to Miyagase Lake, Kurukura River, Nakagawa River, Oomatasawa, and Yozuku River, which flow to Tanzawa Lake. The total studied area was 21,000 ha. 95.7% of the area was covered by forest, 2.5% was waste land, and 1.6% was water surface (Digital National Land Information, 1997). Range of the elevation was 290 – 1,673 m (Average was 851m). Table 1 is the list of the properties of each river basin.

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<th>Properties of six river basins in Tanzawa Mountains</th>
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<td>Location 1</td>
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<td>Location 1</td>
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*Note: The tables are not fully transcribed due to limitations in the provided text.*
3. Methodologies

1. In order to analyze how much influences geography, geology and vegetation have on water quality, catchments of forested mountain head waters with the area of 30-70ha, were targeted for water sampling. Three raw GIS datasets were collected (Table 2) and analyzed to find the most appropriate sampling points for our purpose.

2. Catchments were delineated from DEMs in studied area using ArcGIS 9.1 and Spatial Analysis (川崎, 2006). Cell size was set to 12m. With a flow accumulation grid delineated from DEMs, streams were defined through flow accumulation value (1,500 cells). A threshold flow accumulation of 1,500 cells with a 12-meter cell size means that it takes a drainage area of \( 1,500 \times 12 \times 12 = 216,000 \) m\(^2\) or 21.6 ha to generate a stream. Then, a junction of a stream was set as a catchment outlet. As a result of catchment delineation, 139 catchments were selected as candidate sites in the area.

3. The properties of 139 catchments of forested mountain head waters such as elevation, slope, aspect, vegetation, and geology were calculated by GIS overlaid analysis.

4. Maps were created and distributed for team members (Fig. 2 and 3), and GPS units were arranged for field worker to collect data (Fig. 4).

4. Result

A general field survey by 6 teams with 25 members conducted to assess the current ecological condition of the mountains on July 14th, 2006. Soil and vegetation (bamboo grass and polygonum cuspidatum) near water sampling point were obtained as well. Finally, 59 water samples, 35 bamboo grass samples, 12 polygonum cuspidatum samples were obtained due to it was thundery rain during the day.

We verified there were actual streams and mountain runoffs at the point of catchment outlets delineated by GIS analysis; however water was not verified at just 3 locations. The relationships between catchment drainage...
areas, surface water flow, terrain properties, and amount of precipitation have to be considered as a further study.

5. Future research
Acquired data is being chemically analyzed for further analysis using GIS. By the end of this year, current ecological conditions of the mountains will be clarified, such as distribution of pH, Nitrogen and Phosphorous. And then, suitable ecological monitoring sites in western Kanagawa Prefecture will be proposed for local authority's decision-making of environmental policies.

Acknowledgements

References