

Theoretical Analysis on People's Environmental Concerns in the Watershed

Yuejun ZHENG, Research Institute for Humanity and Nature

1. Roles of Environmental Concerns in Project 5-2

For analyzing an environmental change based on the Response-Prediction Model (RPM), a researcher is often asked to provide various scenarios linked with possible impacts considered by his professional knowledge. To enhance the information necessary to fix the concrete scenario, it is important to grasp people's concerns toward the environmental matters. This is because the data obtained from the environmental concern survey can make the process to make impacts simple in the RPM. Suppose the environmental matters, which people are interested in, become clear through the sample survey, it will become possible to select the impacts related to changing the most significant environmental elements.

This research aims to develop a multipurpose tool on account of watershed management, so we start from considering people's concerns toward a generalized environment site instead of a specific watershed. Construction of method on designing environmental concern survey, therefore, concentrated on a representative watershed. This approach will guarantee the future output from this research can be introduced to various types of watershed management theoretically, and provide a meaningful tool for extraction of environmental concerns.

2. Idea of Environmental Concerns Design

The most important purpose of environmental concern survey is to clear up people's attitudes toward different environmental sites in a watershed. Figure 1 shows the conceptual flowchart to decide what contents should be selected as the topics to describe the watershed environment.

To clarify the quality and feature of an environment definitely, a set of topics should be created in the same time. This research has decided to deal with values of an environment site as the concrete topics, and developed a group of keywords to describe each topic. For instance, we may use timber, fiber material, and food as the keywords to describe the direct utility of a forest that was considered as a topic. Moreover, according to the keystone of survey, it should be allowed to select a keyword or several keywords from one specific topic, or multiple keywords from various topics to make an item that must represent a complete unique concept. Finally, the content of a question should be developed to reflect this item truly. On the other hand, the concept flowchart also can be used to confirm the validation of each question in the phrases of data design, data collection and data analysis.

As for selection of topics in a watershed, a set of topics can be produced based on the following consideration. Referring to the land use / land cover (LULC) classification system

proposed by the IGBP (International Geosphere-Biosphere Programme), we have divided a watershed environment into the following sites: forest, grassland, cropland, water body, artificial and environment complex, and considered the people's environmental concerns to a specific watershed as a part of environmental consciousness. Table 1 demonstrates a topic-key matrix that can be used to explain possible concerns derived from a specific environment site and its values.

Values of each environment site are often classified into the use value and the non-use value. The use value is defined as the utility obtained from the utility of environment site, it can be divided into the direct use value and the indirect use value. For example, the former means the timber yield when a forest is considered as the environment site, and the latter refers to the recreation in the forest. Non-use value, however, does not have any relationship with utility of environment site, but people's satisfaction from their spirit behaviors, it includes the inherent value and the intrinsic value. Inherent value often comes from people's awe or admiration for nature instead of use, but intrinsic value means the nature itself has the value independent of people's intervention, and its meaning may not always be expressed clearly. For this reason, it is difficult to discuss intrinsic value in the environmental concern survey.

As a result, the concern survey concentrated on dealing with the use value and the non-use value, the human activity and environmental impact involved in the value of environment site were also considered as parts of the topics. In other words, after LULC and value, the human activity and environmental impact are considered as the third axis described in Table 1 using category "Others". Needless to say, it is also necessary to allocate keywords for this special axis. For designing the environmental concerns, we first divided a watershed into multiple topics, and thought up the keywords necessary for each topic, then constructed the item based on one keyword or more, and finally completed the question sentences that must match the concept of each item.

3. Selection of topics for concern survey

Through examining the status of LULC in Japan and the research purpose, the topics in the environmental concern survey have been decided by means of combination of the three environment sites including "forest", "cropland" and "water body", and their "direct use value", "indirect use value" and "inherent value" respectively. Questions related to the third axis were also brought in the questionnaire for data analysis. The main items in this survey were occupied by the concerns to values of forest, cropland and water body. For a forest, the questionnaire contains not only items concerning the direct use values such as "timber production" and "other forest products" and etc., but also items covering the indirect use values such as "recreation" and "water purification"

Besides, as the items of inherent value, the experiences in environment sites and detailed activities over there etc. were asked as the separate questions, including existence of environment sites, frequency of recreation activity, pro-environmental behavior, interests to global environmental issues, route to get environmental information and so on.

4. Survey Conduction and Extraction of Environmental Concerns

Sample survey on environmental concerns was carried out in a national-wide from October to November, 2005, and the 1,800 samples were drawn from Japanese citizens between 20 to 79 years old. The survey mode is face to face interview, the valid number of completed samples is 886, and the completed rate is 49.2%. The respondents over 50 years old occupied approximately 60% of all the completed samples, but the proportion of young people is relatively low.

Tentative results calculated from the survey data have revealed that the most respondents express high concerns to the water quality purification, environment conservation, habitat and carbon sequestration in forest, production of grains, vegetables and fruits in cropland, and life water and self-purification in water body.

5. Pattern Analysis

It is essential to extract matters of concern for each environment site, and to identify the characters of environmental concerns and the influence factors through analyzing the survey data. In this section, we applied correspondence analysis, a statistical method for qualitative data, to the survey data for verifying the connection between the environmental concerns and the respondents' attributes.

5.1 Consideration of Correspondence Analysis

For pattern analysis of qualitative data, correspondence analysis is an efficient statistical approach, which is a technique to explore the similarity of qualitative data, without any objective variables. The purpose of correspondence analysis is to identify the connection between the individuals and response categories by quantifying them together.

When an individual and a category were given by the qualitative type of data, individuals which respond to the same category have high similarity. Inversely, the categories responded by the same individual hold close similarity. Suppose we classify the respondents' preferences to goods and make a classification on individuals together, and then we will be able to find the characters of preference. Table 2 shows the response pattern obtained from the 7 respondents who responded to the 5 categories. A, B, C, D and E can represent the multiple choices from one question, or binary choices from the item-category type of questions. The choices

responded by an individual is recorded by 1, otherwise 0. For example, individual 1, 2 and 3 responded to category A, and all individuals except individual 2 responded to E.

Correspondence analysis is a technique that aims to get similar individuals and categories together simultaneously, through rearranging all “1” on the left-up and right-down diagonal in the matrix as close as possible. Concretely, categories assembled in the left side are chosen by many individuals, similar to one another, but categories located in the right side are just responded by few individuals, are distant relations. Similarly, individuals in the top have closer relations one another, comparing with ones located in the bottom. In this way, individuals and categories with a high similarity, are gotten together and classified based on response pattern. Although this is a simply approximate situation introducing only one dimension, it is possible to extend this principle to more than two dimensions simply. If we express correspondence analysis as a statistical description, it means to explore the maximum correlation of two variables corresponding to the weighs given to the individual and the category, respectively. In fact, this problem can be explained as the calculation of the minimum of total sum of distances corresponding to individuals and categories in a space shown in Figure 2.

5.2 Result of Pattern Analysis

Correspondence analysis was applied to survey data on environmental concerns to “forest”, “cropland” and “water body” with the response choices ‘very interested’, ‘somewhat interested’, ‘not interested so much’ and ‘not interested at all’. The plot of analysis result, shown in Figure 3, illustrates that four categories distributed in two dimension space in a “U” shape, based on the scores given to the first axis and the second one, respectively, locations of category 1, 2 and 3 are near one another. This implies the environmental concerns to “forest”, “cropland” and “water body” have close relation, with a mutual influence.

Regardless of both direct use value and indirect use value, the cluster that has high concern to “forest”, “cropland” and “water body” and others were divided clearly. This means a phenomenon in which people have strong concerns to all values if they show a strong concern to value. Inversely, it is also true. As for respondents’ attributes, the middle-aged men have stronger concern, but the old people with low education do not have concern to any value much more.

Table 1 Topic-keyword Matrix Based on Land use/Land Cover and Values

Value	Land cover/Land use					Environment complex
	Forest	Grassland	Cropland	Water body	Artificial	
Direct value	Timber	Food/feed Fiber material Fertilizer Biomass	Food/feed Fiber material Biomass	Water resource Aquatic	Infrastructure Production Dwelling	Agro-forest Paddy
	Water and soil Environment Recreation Species protection	Soil protection Air Recreation Wild habitat	Soil protection Rural Bird habitat	Hydroelectricity Assimilation of toxic Recreation Hydrobiological	Power plant Disaster Landscape	Public Park
	Nature/recovery Biological resource Land conversion	Livestock Inherent Land	Livestock Breeding Land	Water resource Aquatic	Conversion History/culture Heritage	Population
Inherent value	History/culture Original nature Mystique	History/culture Original Mystique	History/culture Mystique Love of	Water culture Mystique	Mystique Cultural	
	Forest ecosystem Carbon Soil formation	Grassland Element Grassland soil	Agricultural Element Cropland soil	Aquatic ecosystem Watershed ecosystem Water purification	Man-made	Life basis
Human activity	Management Paper recycle Employment Pollinosis	Management Degradation Culture Agrichemical Fertilizer	Management Use of Agrichemical Irrigation Fertilizer Water disaster	Management activity Beyond water use Water quality Drought/flood Water pollution Eutrophication	Local culture Alienation Waste Waste Groundwater	Norm/custom Law/institution Value Ethic Nature thought Attitude
	Environmental impact					

Table 2 Response Patterns to 5 Categories

Category	A	B	C	D	E
1	1	0	0	0	1
2	1	1	0	0	0
3	1	1	0	0	1
4	0	1	1	0	1
5	0	1	1	1	1
6	0	0	1	1	1
7	0	0	0	1	1

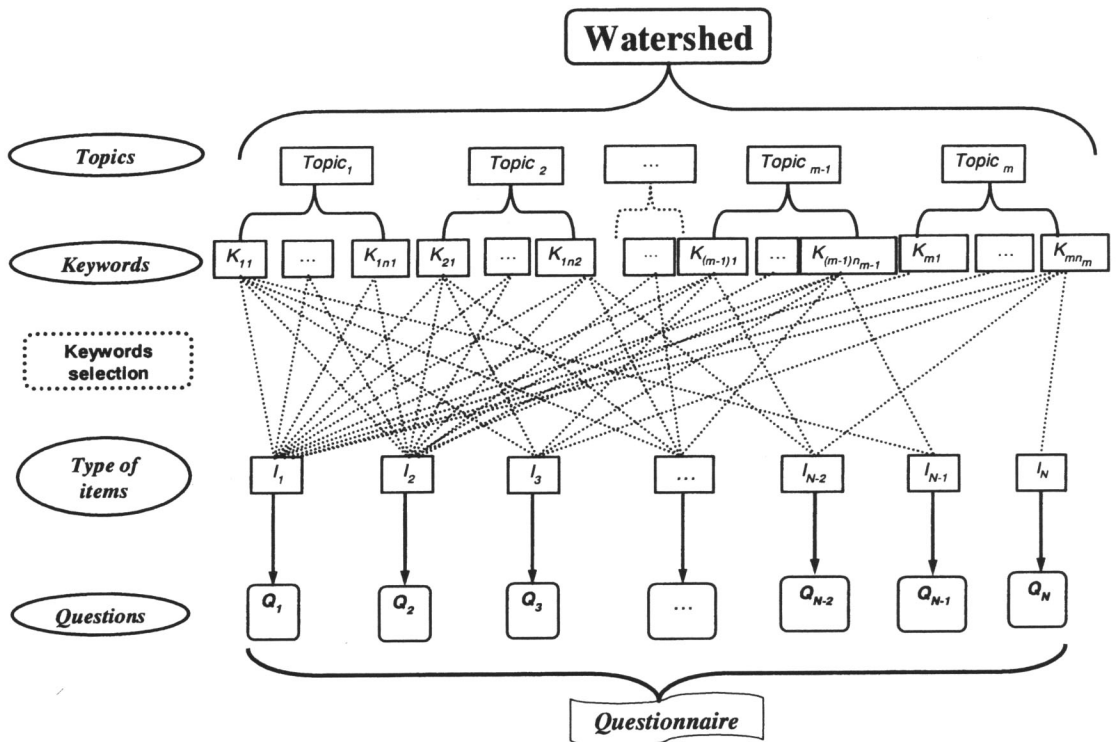


Figure 1 Conceptual Flowchart of Environmental Concerns extraction in watershed

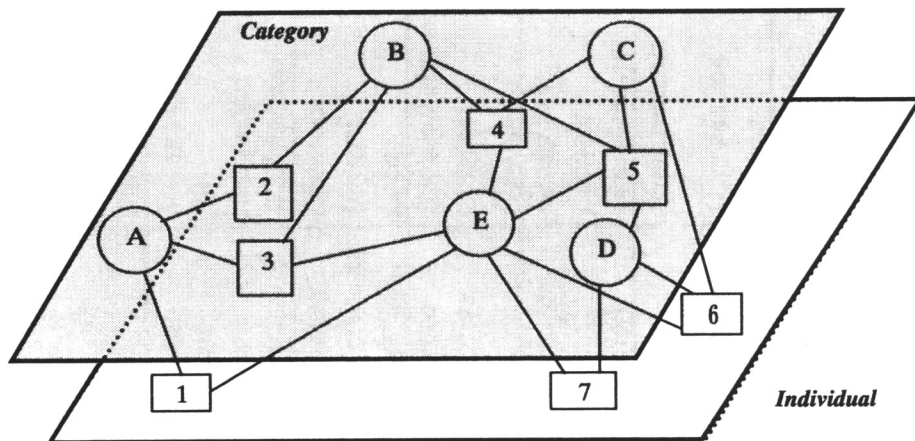


Figure 2 Correspondence Relations between Individuals and Categories

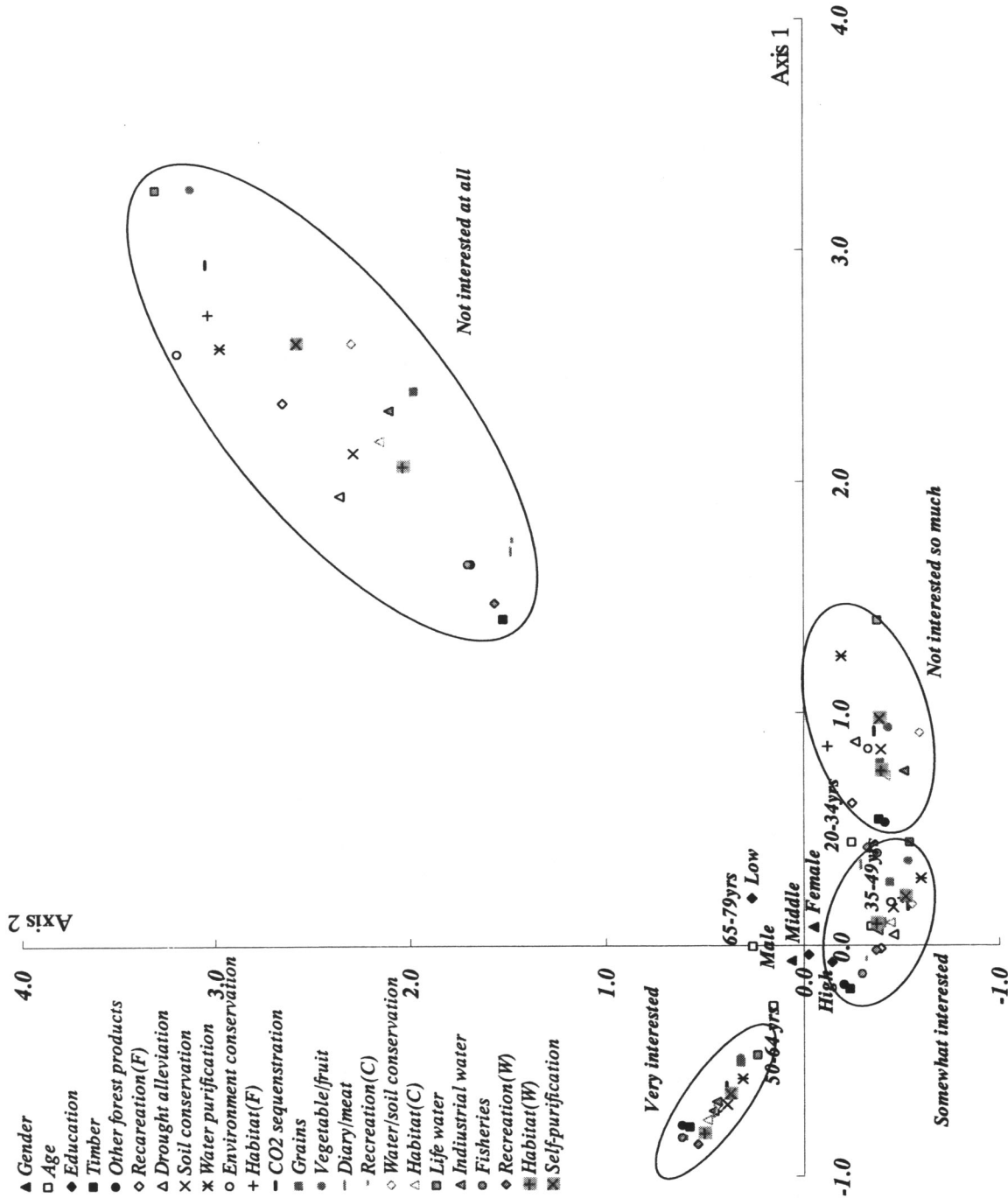


Figure 3 Spatial Configuration of Pattern Analysis on Environmental Concerns