TAKATAKA: PERCPETIONS OF SOLID WASTE POLLUTION IN URBAN, NORTHEN TANZANIA

by

CHARLES JOSEPH ELFER

(Under the Direction of Carolyn Ehardt, Ph.D.)

ABSTRACT

The influences of occupation and formal education on local perceptions of environmental pollution were investigated in Moshi, Tanzania. The specific focus was on the effects of two variables, employment in the tourism industry and secondary-level education, on knowledge levels regarding the ecological, economic and health-related consequences of solid waste pollution. Analysis of mutually supporting qualitative and quantitative datasets demonstrated that educational attainment outweighs the impact of employment type on residents' awareness of solid waste pollution and the associated consequences. Regardless of whether employed in the tourism industry or not, residents with secondary education at or beyond the Form-Four level were more cognizant of and knowledgeable about pollution and its impact. Only among less educated residents of the city did employment in the tourism industry influence perceptions related to solid waste pollution.

[Anthropology, environmental education, solid waste pollution, urban ecology, Tanzania]

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CHARLES JOSEPH ELFER

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CHARLES JOSEPH ELFER

Major Professor:	Carolyn Ehardt
Committee:	Ervan Garrison Ted Gragson

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
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TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1: THE ANTHROPOLOGY OF POLLUTION

This research investigates the perceptions of environmental pollution held by residents in Moshi, Tanzania. By recording knowledge levels regarding the associated ecological, economic and health-related consequences, this research examines the influence of occupation and education on perceptions of solid waste pollution. These results compliment recent research on the anthropology of pollution by exploring perceptions of pollution in the context of environmental degradation and by evaluating the impact of tourism and formal education in an urban and developing region of the world.

Foundations of the Anthropology of Pollution

Theoretical approaches to the study of pollution and human perception have evolved significantly over the last half century. Scholars initially broached the subject from a purely symbolic and structural perspective, where perceptions of pollution and purity were analyzed for their roles in the establishment and maintenance of social order (e.g., Douglas 1966). This area of inquiry has more recently been expanded to consider physical pollution (e.g., solid waste pollution, water pollution), perceptual variability within and between societies, and the significance of human perception in the context of global environmental change. These developments in the study of pollution and its perception by humans are discussed below.

Although there was a modicum of interest in pollution as it pertained to ritual behavior before 1960, it is Douglas (1966) to whom initial developments in the *anthropology of pollution* must be attributed. Douglas' approach to pollution is based primarily upon the symbolic value of

non-physical pollution and its role in the maintenance of social structure. For Douglas, whose *Purity and Danger* (1966) is the earliest example of pollution theory in anthropology, perceptions of pollution in cultural systems function in two interrelated ways. In the first place, pollution can be incorporated in taboos that work to reinforce culturally agreed upon categories within a particular society. Douglas suggests that taboos surrounding pollution are often followed, even where they appear ridiculous or illogical, if individuals share the values that these taboos protect. She states that a second function of pollution is to minimize the "cognitive discomfort caused by ambiguity" (1966: xi). Pollution taboos minimize this discomfort by establishing boundaries around otherwise gray areas and by working to prevent the unveiling of contradictions that threaten social order.

Despite Douglas' (1966) contributions to our understanding of pollution and perception, her structuralist approach resulted in the omission of a number of other important issues. She was correct in presenting notions of pollution as a feature of all societies, as all peoples probably do distinguish between the pure and thus impure. Douglas did not adequately address, however, the intracultural variability that exists within societies regarding pollution. This omission was arguably the result of her insistence on demonstrating the significance of pollution in the maintenance of cultural categories. Her structuralist approach to pollution ideology is not without utility, but it is a theoretical approach that can be inflexible and limiting.

Douglas (1966) admits that she wrote *Purity and Danger* during a period in the social history of the United States when many were not particularly open to discussions validating social control and structure. It is in part for this reason that Douglas's work on pollution remained in relative obscurity throughout the next as the environmental movement accelerated. Douglas insists that there is no pollution outside of cultural systems and, as evidenced through

her discussion of taboo, it is clear that she viewed pollution as being entirely symbolic and relative, with no tangible consequences outside of the cultural systems it was intended to support. Whether it was the timing of *Purity and Danger's* introduction or its author's theoretical perspective, the value of pollution belief systems in the context of environmental degradation was not realized until much later.

Douglas' symbolism-based approach to pollution has continued to receive scholarly attention. Khan's (1994) research in the Caribbean, for example, has considered symbolic pollution in the context of food taboos (*juthaa*) and suggests that they are critical for the formation of identity and social hierarchy in diaspora communities in Trinidad. Through his research on the gold trade in Mt. Kare, Papua New Guinea, Clark (1993) has revealed the symbolic value of pollution as a factor contributing to the social change associated with that development. Namihira (1987) reviews the Japanese concept of *kegare* (symbolic pollution) and describes its connection to social discrimination historically and in the present. Together with Douglas, these examples characterize one dimension of the anthropology of pollution that is focused on symbolism and interested in the social significance of non-physical pollution.

Recent Contributions to the Anthropology of Pollution

Social scientists have recently adopted an alternative approach to the subject of pollution and while they have remained interested in perception and pollution ideology, they have begun to consider more thoroughly (1) the variability that exists in pollution ideologies and (2) the non-symbolic, tangible consequences of physical pollution.

Beliefs about pollution must ultimately be situated under the heading of value. In this way, it is not difficult to understand that pollution is a highly subjective concept and variable not only between cultures as noted by Douglas (1966), but within cultures as well. This intercultural

and intracultural variability has been demonstrated repeatedly and Thompson (1979), Alley (2002), Wex (2001), Strasser (1999) and Hawkins & Mueke (2003) each provide recent illustrations. Subsequently, having established this variability in pollution ideologies, scholars have taken on the additional task of accounting for those differences.

Thompson (1979) presents a wealth-based argument to explain the variability that exists in intracultural perceptions of pollution. Thompson's thesis is that wealth and class dictate the attachment and removal of value to items. He suggests that distinctions regarding the value of items are attributed by individuals to items according to the norms established by their membership within hierarchically ranked groups whose formation is based primarily upon wealth. While this work recognizes the variability that exists within cultures regarding beliefs about pollution and is a departure from earlier theories, his arguments do not exhaust the issue of wealth as a factor influencing perceptions of pollution (or *rubbish*, to use the author's terminology). Thompson adequately considers the role of wealth and class, but his analysis is a cursory one as he does not explore the other ways in which economic factors might influence perceptions of pollution. Additionally, although he considers issues of *filth* and *cleanliness*, Thompson fails to address the issue of environmental pollution in his theoretical framework.

Wex (2001) applied an expanded economic argument to perceptions of pollution. Working in Panajachel, Guatemala, the author examined the effects of the tourism industry on the production and management of environmental pollution in and around Lake Atitlan. While Wex does briefly explore the belief systems of pollution of indigenous residents in the area, her primary concern is to understand the perceptions of ex-patriots and visiting tourists to the region. Wex's research is useful in that it goes beyond other economic arguments to consider tourism specifically, rather than more nebulous categorizations of status that have preceded it.

Unfortunately, the author provides little more than anecdotal evidence to support her conclusions and lacks methodological rigor and transparency in her presentation. In terms of context, she only briefly considers the relationship between the tourism industry and the perceptions of indigenous residents, and in doing so she describes the entire population monolithically, neglecting the potential for intracultural variability.

Another important contribution to the anthropology of pollution comes from Alley's (2001) work on the subject of pollution ideologies, specifically the role of religion in shaping notions of pollution in a predominantly Hindu society. Alley contrasts the belief systems held by Hindu devotees and environmental conservationists regarding water quality to illustrate that a sacred and 'pure' river can simultaneously be heavily polluted. She demonstrates that perceptions about pollution can vary significantly within societies based upon the attributes of groups of residents with different backgrounds. Alley's suggestion that religion is a particularly influential force in shaping beliefs about pollution is not new; the effects of formalized religion have been considered on numerous occasions (Barr 2002; Guth et al. 1995; Campbell 1999; Young 1990). What her work omits are other potentially important influencing factors, such as education, employment or concerns about health, all of which might contribute to understanding the basis for intracultural variation in perceptions of and belief about environmental pollution.

Several studies have attempted to link different levels of formal education with some aspect of environmental awareness or environmentally positive behavior. Weigel (1977) focused on New England residents and his research supports the notion that better educated individuals tend to be more environmentally aware. In similar work, Sia *et al.* (1985) correlated tertiary-level education with support for American environmental organizations (i.e., Sierra Club) and found a positive correlation between the two. This is echoed in research by Schahn and Holzer (1990)

who examined the relationship between higher-level education and environmental activism in the United States, who found a small, but positive connection. Working in Alberta, Canada, Derksen and Gartrell (1993) attempted to link education with pro-environmental attitudes. The study revealed that the number of years of formal education that respondents possessed was positively correlated with their concern for the environment and with their tendency to recycle. In a Canadian study by Berger (1997), however, educational experience had only a minor influence on individual decisions to participate in paper recycling. Overall, these studies suggest at least some degree of correlation between environmentally positive attitudes and formal educational experience. In none of these examples, however, has environmental pollution been isolated and investigated as the central area of interest, although a possible exception is represented by those studies concerned with recycling. Another notable short-coming, at least from an anthropological standpoint, is the North American bias in each of these studies, as Canada and the United States are the sole areas to receive research attention.

Mwanthi *et al.* (1997) partially address the problem of Western bias through their review on education and pollution in Nairobi, Kenya. Over 650 respondents participated in the research and a significant relationship between level of education and knowledge regarding the health-related effects of urban pollution was identified. For example, the identification of cholera as a disease associated with poor sanitation was directly proportional to the respondent's level of education. Although these authors provide a non-Western example, their research is limited to consideration of health-related effects and does not fully address the relationship between formal education and other dimensions of pollution (e.g., ecological or economic effects).

Directions for the Anthropology of Pollution

Approaches to the anthropology of pollution have clearly shifted over time from a purely structural and symbolic perspective to one that is more concerned with the existence of perceptual variability. Scholars have come to appreciate more fully the utility of the anthropology of pollution in the context of global environmental change. Despite such shifts in focus, however, a number of issues remain unexplored.

Environmental pollution is a global problem, yet for a variety of political, economic, and sociocultural reasons it is a problem that has become particularly acute in developing nations. For this reason, there is currently a need for social scientists concerned with human perception and pollution to accelerate research in less developed regions of the world. A greater understanding of the range of factors influencing belief systems of pollution in developing nations, and specifically in urbanizing regions, may help to clarify the challenges surrounding pollution control in these areas. Such an understanding can guide the creation, implementation and monitoring of strategies designed to address pollution related issues.

Tourism is often presented as a strategy to promote conservation and sustainable development through the protection of vulnerable habitat and economic stimulation. It is also possible for tourism to pose potentially devastating ecological consequences and this is particularly true in the area of environmental pollution, a dimension where the anthropology of pollution becomes particularly relevant. As noted, there is presently no adequate understanding of the influence that economics has on perceptions of pollution, specifically where tourism is concerned. What is needed is an expanded analysis that provides a more precise illustration of this relationship. The potential impact of tourism should be broadened into an economic variable in order to evaluate the effects of this industry on human perceptions of pollution in the developing world. That is, for individuals whose economic base lies in the tourism business, are

there discernable impacts of this involvement on their perceptions and beliefs about environmental pollution?

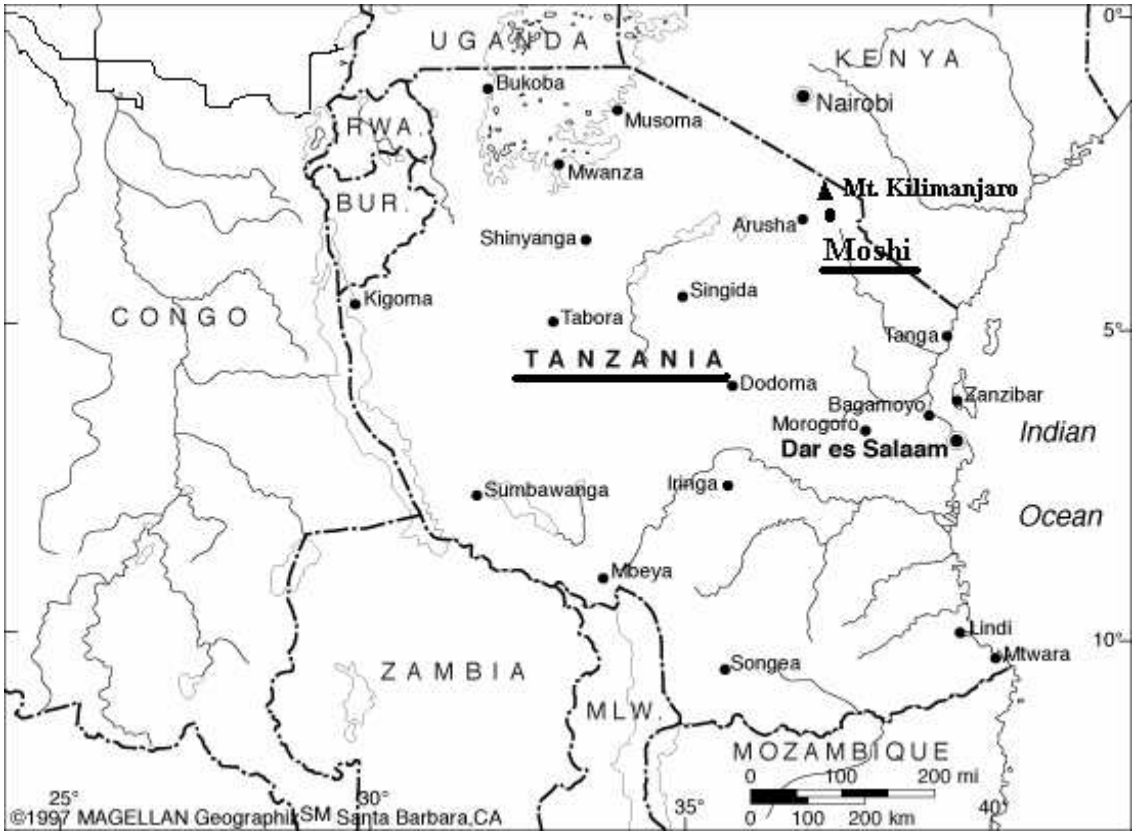
Formal education is another factor that has been identified as having utility in promoting conservation and sustainable development. As reviewed above, formal educational attainment has been investigated as a factor influencing general environmental attitudes, but little attention has been paid to environmental pollution, specifically. Scholars have considered related issues such as recycling, yet these studies are exclusively Western and the effects of formal education on perceptions of environmental pollution in non-Western, developing nations have not been thoroughly explored. This is a sizeable deficiency in the literature, as the structure and content of formal educational systems vary significantly, suggesting that the relationship between perception and formal educational attainment may be equally dissimilar.

This project seeks to expand our knowledge in the evolving area of the anthropology of pollution, and to address the noted deficiencies in the research to date. It explores two variables, *employment in the tourism industry* and *formal education attainment*, among residents of Moshi, Tanzania, as they influence perceptions of environmental pollution and, specifically, solid waste. The conclusions reached through this research contribute not only to the anthropology of pollution, but also should find application in informing practitioners currently working to address solid waste management issues.

CHAPTER 2: RESEARCH SITE AND OBJECTIVES

Moshi, Tanzania

The research site, Moshi, Tanzania, is an intermediate-sized, urban center with approximately 150,000 residents (2002 Population and Housing Census), and is situated in the north-central portion of The United Republic of Tanzania, in close proximity to Mt. Meru and Mt. Kilimanjaro (Figure 1).



(Figure 1: The United Republic of Tanzania) (Available:http://infoweb2.newsbank.com)

This rapidly urbanizing settlement is one of several intermediate-sized municipalities (50,000 to 1,000,000, residents as defined by Brockerhoff & Brennan 1998) throughout the

region which serve as hubs for ecologically-based tourism not only in Tanzania, but in neighboring Kenya and Rwanda, as well. Centers such as Moshi are bases of operations for both mainland and coastal tourism, the former oriented around activities such as mountaineering, game drives, and hunting, the latter utilizing East Africa's rich coastal diversity and beaches.

Not unlike other urban centers in the region, Moshi has experienced relatively rapid population expansion in recent decades at an annual rate consistently above 2% (2002 Population and Housing Census). This growth has been accompanied by a variety of social, health-related and economic changes. As evidenced through regional news reports (e.g., Arusha Times 2004), solid waste management, in particular, has gained attention among residents and urban planners in the Moshi-Arusha region of northern Tanzania. Moshi has not yet experienced a crisis in solid waste management akin to that of larger Tanzanian cities, such as Mwanza or Dar es Salaam (Achankeng 2003; Harsch 2001). Nonetheless, an interview with the city council's public health engineer reveals that the problem is growing rapidly and that services are currently collecting sixty-percent of the estimated 200 tons of waste produced daily (Viane, personal communication, May 26, 2004). These factors make Moshi an especially appropriate site to examine tourism as a factor underlying resident perceptions of pollution. Likewise, as an urban center, Moshi is characterized by a variety of educational backgrounds, providing an opportunity to evaluate the potential influence of educational attainment on resident notions of pollution.

Although the general concern was environmental pollution, the project focused specifically on *solid waste pollution* in the urban setting. Solid waste refers to all solid waste products such as glass, plastics, metals and leftover food matter, and can be classified as either degradable or non-degradable. There are numerous sources for such wastes, including domestic, industrial and medical as example classes.

Objectives and Hypotheses

The fundamental goal of this project was to gain an understanding of the influence that *occupation* and *education* exert on local perceptions of environmental pollution among residents in Moshi, Tanzania. Perceptions of environmental pollution were evaluated through an assessment of knowledge levels regarding the ecological, economic, and health-related consequences associated with pollution. The occupation aspect of the project was concerned primarily with individuals employed within the tourism sector and hypothesized that this area of employment would promote a higher level of knowledge about pollution and its potential effects. Similarly, education as an influence was examined by linking residents' knowledge of pollution with their educational attainment, contrasting responses of individuals representing the primary and secondary levels of education.

Objective One: Employment in Tourism Industry

Objective One derives from the assumption that an economically viable tourism industry depends upon a healthy and aesthetically pleasing environment and that both the final destinations of visiting tourists and the urban centers from which they stage such excursions must maintain certain standards of cleanliness. Mpandazoe's (2000) research on East African coastal tourism supports this assumption in demonstrating that the aversion held by tourists to pollutants associated with disease and illness, particularly solid, human and animal wastes, is directly linked to the economic success of the industry in the coastal region. For this project, the perceived relationship between economic success in the tourism sector and the physical and aesthetic health of surrounding environments is addressed. This is accomplished by examining perceptions held by tour and non-tour employees through an assessment of the knowledge about pollution that these two distinct groups of residents possess.

The economy of Moshi is heavily dependent upon the tourism sector, the bulk of which is oriented around natural areas (e.g., Mt. Kilimanjaro, the Serengeti, Olduvai Gorge). As such, tourism in Moshi is ecological in nature and there is a direct relationship between the health of natural systems and the economic well-being of those employed in the tourism sector. This includes not only the tour operators themselves, but the drivers, guides and other personnel whom they employ. A vested economic interest in the tourism industry should motivate individuals to concern themselves with the presence of certain forms of environmental pollution given the perceived link between a quality environment and a healthy flow of visitors to the region. The perceptions of environmental pollution that tour employees hold, therefore, also should be reflected in the knowledge they possess about the ecological, economic, and health-related consequences of solid waste. The following hypotheses directed the evaluation of this relationship.

H_1: *Local residents whose occupations are associated directly with the tourism industry recognize the most types of environmental pollution and perceive a greater number and variety of associated ecological consequences than do residents participating in other economic sectors.*

H_2: *Local residents whose occupations are associated directly with the tourism industry perceive environmental pollution as a detriment to economic well-being to a greater extent than do residents participating in other sectors.*

H_3: *Local residents whose occupations are associated directly with the tourism industry perceive environmental pollution as a detriment to human health to a greater extent than do residents participating in other sectors.*

Objective Two: Formal Education

Objective Two was to evaluate the influence that formal education exerts on Moshi residents' perceptions of solid waste pollution and their knowledge of the associated consequences. The level of education that individuals possess, secondary and post-secondary in particular, should play a significant role in shaping perceptions of pollution given the nature of educational policy in East Africa. With few exceptions, it is only at the secondary level and in institutions of higher education in East Africa that courses and programs of study concerning development and environmental issues are available (Taylor 1998). An education beyond the primary level is inaccessible to many (Lassibille 2000), however, and a large proportion of the population consequently lacks access to formal instruction on environmental issues.

In Tanzania, primary education consists of *Madarasa (Classes)* One through Seven, while secondary education contains *Vidato (Forms)* One through Six. Federal law requires that all Tanzanian citizens attend school through *Darasa la Saba (Class-Seven)*, from which the title *standard seven* originates. Educators at the primary level do not currently address development and environmental matters to a great extent and students only review issues of solid waste pollution in lessons more or less equivalent to home economics (Vare 1998). It is not until secondary school, particularly in the higher-level Forms (Form-Four and onwards), that students confront environmental issues in detail (Osaki 1998). Exposure to environmental education should have an observable effect on a resident's perceptions of solid waste pollution and those individuals with experience at or beyond the Form-Four level should possess a more developed knowledge of the consequences associated with pollution than do those residents with a *standard seven* education.

Post-secondary education is still relatively limited in Tanzania, and this necessarily limits questions regarding education to residents who have attained a secondary level education. The

following hypotheses were created to determine the extent to which educational attainment affects the knowledge that Moshi residents posses regarding the ecological, economic and health-related consequences associated with solid waste pollution.

H_4: *Local residents who have secondary educational experience at or beyond the Form-Four level recognize the most types of environmental pollution and perceive a greater number and variety of associated ecological consequences than do residents who do not have educational experience above the Class-Seven level.*

H_5: *Local residents who have secondary educational experience at or beyond the Form-Four level perceive environmental pollution as a detriment to economic well-being to a greater extent than do residents who do not have educational experience beyond the Class-Seven level.*

H_6: *Local residents who have secondary educational experience at or beyond the Form-Four level perceive environmental pollution as a detriment to human health to a greater extent than do residents who do not have educational experience beyond the Class-Seven level.*

CHAPTER 3: METHODS AND ANALYSIS

Data collection for the project began in mid-May of 2004 and concluded in early August of the same year. Systematic qualitative and quantitative data collection took place during May and June and was supplemented by further informal ethnography in July. Upon arrival in Moshi, a research assistant was employed to provide assistance in translation and local expertise. All interviews were conducted in English and/or Kiswahili and the choice of language was in all cases left to the collaborating informant. Likewise, the project provided instructions and utilized questionnaires (described below) in both Kiswahili and English. All interview transcriptions were performed by the research assistant, a native speaker of Kiswahili, in collaboration with the researcher.

Two character attributes, *occupation* and *formal educational attainment*, combined to create four classes of respondents (Figure 2). These attribute classes were: Tour employees with Form-Four education (T-F4), Tour employees with Class-Seven education (T-C7), Non-Tour employees with Form-Four education (NT-F4), and Non-Tour employees with Class-Seven education (NT-C7).

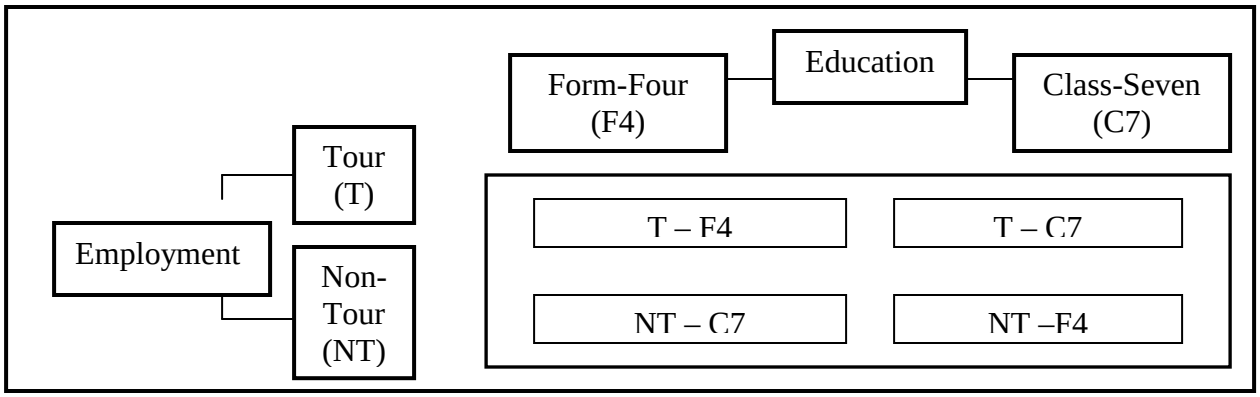


Figure 2: Attribute Classes by Education and Employment Type

Phase One: Semi-Structured Interviews and Free-Listing

Sixty-four respondents were consulted through two data collection phases and a variety of data collection techniques were incorporated. In phase one, semi-structured interviews were conducted among thirty-two Moshi residents, with eight respondents interviewed from each of the four attribute classes noted above. Tour employees were sampled from four separate tour establishments within Moshi. Through initial interviewees, the backgrounds of other tour employees within each establishment were revealed. With this information, individuals with the appropriate educational experience were approached such that sixteen highly educated (Form-Four) and sixteen less educated (Class-Seven) respondents participated in the two phases combined (8 T-F4 and 8 T-C7 in each phase). In Moshi, it is generally the case that financial, retail, and mid- to high-level government positions are occupied solely by highly educated individuals. This structured selection of respondents outside the tourism sector such that highly-educated, non-tour participants were recruited based upon the location of banks, mid- to high-end retail stores, and government offices. Non-tour, less educated respondents were recruited around bus stops and in outdoor markets. These are areas of low-profit vending and retail, common sources of employment for less-educated residents in urban areas in Tanzania. All participants agreed to cooperate on their own accord and only after the project was explained in an understandable style and language (IRB approval obtained April 2004, #2004-10733-0)

Aside from demographic information, each interview included a series of questions concerning definitions, consequences and evaluations of solid waste pollution in Moshi. Interviews were recorded and transferred to digital WAV files for security and transcription. Average interview length was between thirty-five minutes and one hour and thirty minutes. The transcribed interviews were coded by topic and common themes were noted.

In addition to open-ended, topical questioning, respondents participated in two free-listing exercises during each interview. Free-listing is an efficient tool for testing for perceptual variability within a particular cultural domain and its effectiveness is well established in the social and cognitive sciences (Gatewood 1983; Trotter 1981; Berlin & Romney 1964). Furthermore, Henley (1969) suggests that the number of items in respondents' lists reflects their expertise about a particular domain. By comparing the average lists lengths of individuals across attribute classes, therefore, differing levels of expertise regarding solid waste pollution were assessed.

The first free-listing exercise requested resident definitions of *takataka* (the closest available term in Kiswahili for solid waste pollution) and participants then were asked to list all of the items that came to mind in reference to this term. Responses were analyzed using the free-listing features in Borgatti's (1992) ANTHROPAC 4.9 software package. The *average list lengths* of the four attribute classes were contrasted in order to evaluate hypotheses $\mathbf{H_1}$ and $\mathbf{H_4}$, which predicted variation in the number of items that Moshi residents consider to be pollutants by attribute class. Analysis of variation in average list length across attribute classes utilized a two-factor analysis of variance (ANOVA, $p < .05$; SPSS 12.0, 2003), with education and employment type as factors.

The second free-listing exercise requested that respondents list all of the *magongwa* (illnesses) that they associated with solid waste pollution. The average list lengths of each attribute class were compared in order to determine the relationship(s) between occupation or education and residents' knowledge of the health-related consequences associated with solid waste pollution (hypotheses $\mathbf{H_3}$ and $\mathbf{H_6}$, respectively). ANTHROPAC 4.9 and SPSS 12.0 were

used to generate average list lengths and to analyze the significance of variation (ANOVA, $p < .05$) across attribute classes that results from education and employment type.

Phase Two: Likert-Scales, Sentence Completions

The second phase of the project involved formal questionnaires which were completed by thirty-two new respondents. Sampling procedures (i.e., recruitment locations) were consistent with those described above. Each questionnaire was printed in Kiswahili with English subtext, was divided into three sections and contained seventy-one questions (Appendix A).

In section one of the questionnaire, respondents provided basic background information regarding their residence, educational attainment and employment. Section two consisted of Likert-type questions (Likert 1932). Likert-Scales were incorporated to elicit responses regarding the perceived economic consequences associated with solid waste pollution, a multidimensional relationship not readily quantifiable, but made operational through this method. The Likert-Scales were structured to determine the extent to which each attribute class *agreed* or *disagreed* with the notion that there is a link between economic factors (e.g., the tourism industry, costs of waste management) and solid waste pollution. A five-item scale was utilized, where a Likert-Value (LV) of (5) corresponded to a strong agreement (*Ninakubali hasa*) with the idea that the economy and solid waste pollution are linked. Elicited responses were coded into a two-by-two matrix as prescribed by ANTHROPAC 4.9 and analyzed through the software's Likert function. The program generated an aggregate LV between (1) and (5) for each of the attribute classes. These were then used to evaluate the influence exerted by occupation and education on the knowledge possessed by Moshi residents regarding the potential economic consequences of solid waste pollution (hypotheses $\mathbf{H_2}$ and $\mathbf{H_5}$).

The final section of the questionnaire included ten questions designed as *sentence frames*. Sankoff (1971), Boster and Johnson (1989) and Garro (1986) each demonstrate the utility of

sentence frames, alternatively referred to as *sentence completions*, as a collection technique compatible with *cultural consensus analysis*. Following Boster (1986) and Romney *et al.* (1986), data collected through sentence completions were subjected to a consensus analysis to estimate the level of agreement within each of the attribute classes. Consensus theory states that agreement corresponds directly with culturally correct knowledge about a particular domain (Bernard 2002). All questions in section three were oriented around the ecological and health-related aspects of solid waste pollution and a consensus analysis was performed to estimate knowledge levels about each of these domains. Sentence frame responses were formatted for ANTHROPAC 4.9 and analyzed using the program's consensus analysis function. A *consensus value* (CV) ranging between (0.0) and (1.0) was generated for each of the attribute classes, as was a standard deviation value. A higher CV corresponds to greater within-group agreement regarding information about a particular domain. These data were used to evaluate the effect(s) of occupation and education on the knowledge levels that Moshi residents possess regarding the ecological (hypotheses $\mathbf{H_1}$ and $\mathbf{H_4}$) and health-related (hypotheses $\mathbf{H_3}$ and $\mathbf{H_6}$) aspects of solid waste pollution.

CHAPTER 4: RESULTS

Throughout both phases of the project, it was consistently the more educated respondents who demonstrated the greatest level of knowledge concerning solid waste pollution and associated consequences. Regardless of occupation, respondents with educational experience at the Form-Four level demonstrated a greater awareness of the ecological, economic and health-related consequences. In contrast, employment in the tourism industry had a relatively small and often inconsistent effect on the knowledge that residents possessed regarding solid waste pollution. One notable exception to this trend pertains to the attribute class containing tour employees who were educated to the level of Class-Seven. These individuals did not possess a significantly greater knowledge of either the ecological or health-related effects of solid waste pollution, although they were more likely than their non-tour counterparts to perceive a link to potential economic consequences. Of the two variables examined, educational attainment was by far the most influential variable in determining residents' knowledge of solid waste pollution and the associated consequences. Detailed results for each of the objectives are presented below.

Objective One: Employment in the Tourism Industry

As a group, tour employees did not demonstrate a more extensive knowledge of the consequences associated with solid waste pollution. In the first free-listing exercise (types of solid waste), tour employees produced only slightly longer lists than non-tour employees, with average list lengths of 7.4 items and 6.65 items, respectively (Appendix B; Figure 3). The difference in these values, however, was not statistically significant ($F = .424$; $p = .520$; Table 1).

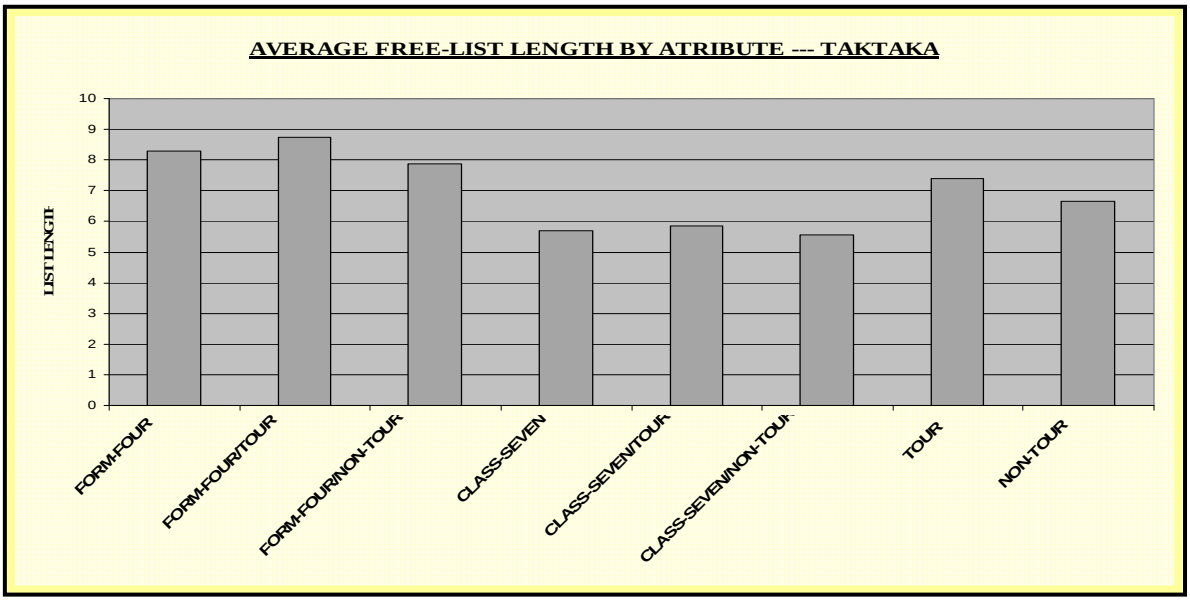


Figure 3: Average Free-List Length by Attribute Class- Takataka (Types of Pollution)

In the second free-listing exercise (*associated illnesses*), tour employees produced shorter lists than their counterparts and associated fewer illnesses with solid waste pollution than non-tour employees (Figure 4; F= 4.22; p= .050; Table 2; Appendix C).

Table 1: ANOVA Results for Takataka Free-Listing Exercise (Types of Pollution)
[(a) R Squared = .244; Adjusted R Squared = .163; O represents Employment Type; E represents Education Level; and O*E represents the interaction of both variables]

Analysis of Variance: Takataka

Source	Sum of Squares (III)	df	Mean Square	F	p value
Corrected Model	58.546(a)	3	19.515	3.011	**.047**
Intercept	1559.845	1	1559.845	240.698	**.000**
O	2.747	1	2.747	.424	**.520**
E	53.908	1	53.908	8.319	**.007**
O * E	.652	1	.652	.101	**.753**
Error	181.454	28	6.481		
Total	1808.000	32			
Corrected Total	240.000	31			

Table 2: ANOVA Results for Magonjwa Free-Listing Exercise (Illness)
[(a) R Squared = .670; Adjusted R Squared = .633; O represents Employment Type; E represents Education Level; and O*E represents the interaction of both variables]

Analysis of Variance - Magonjwa

Source	Sum of Squares (III)	df	Mean Square	F	p value
Corrected Model	61.729(a)	3	20.576	18.237	**.000**
Intercept	459.665	1	459.665	407.394	**.000**
O	4.768	1	4.768	4.226	**.050**
E	51.786	1	51.786	45.897	**.000**
O * E	3.372	1	3.372	2.988	**.095**
Error	30.464	27	1.128		
Total	549.000	31			
Corrected Total	92.194	30			

Tour and non-tour employees were each neutral regarding the relationship between the economy and solid waste pollution. The responses of both groups produced a LV of (3), corresponding to *Sijui* (Don't Know) on the five-point scale (Figure 5).

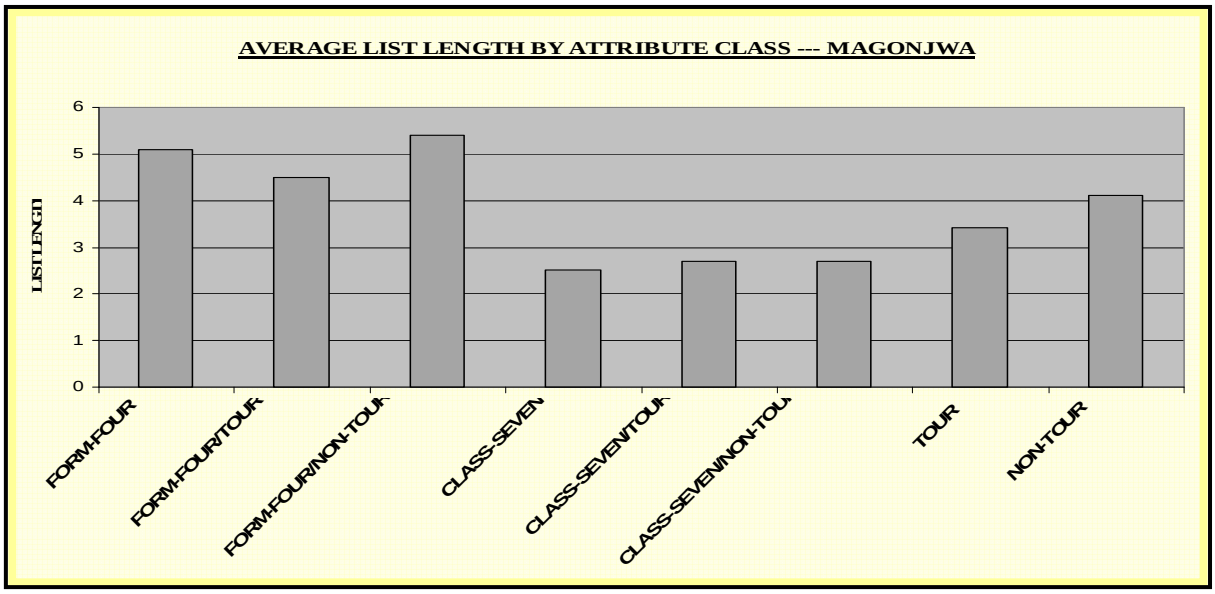


Figure 4: Average Free-List Length by Attribute Class-Magonjwa (Illnesses)

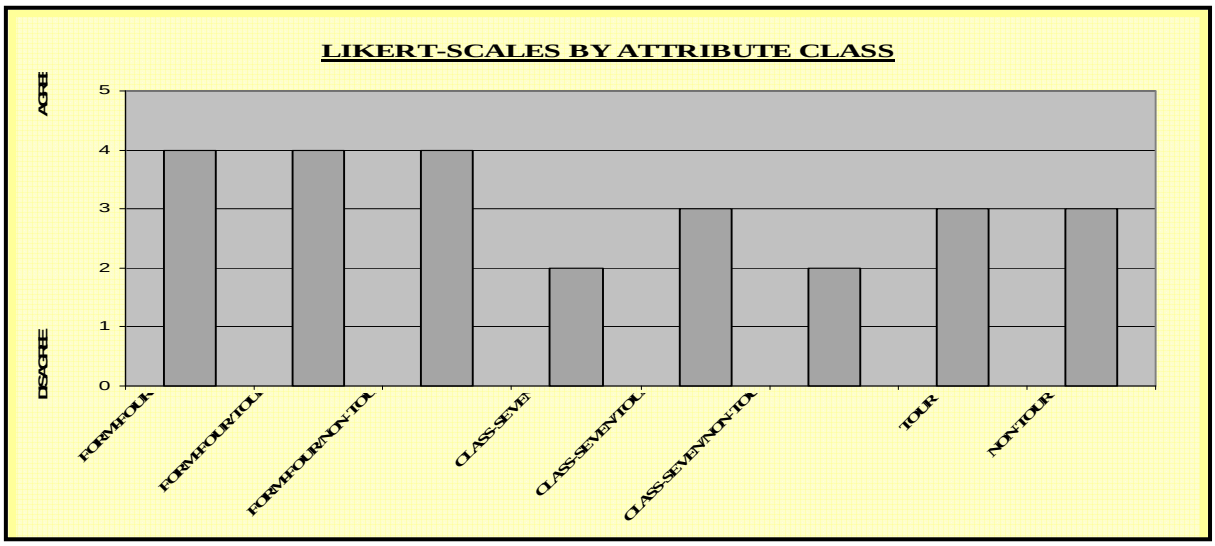
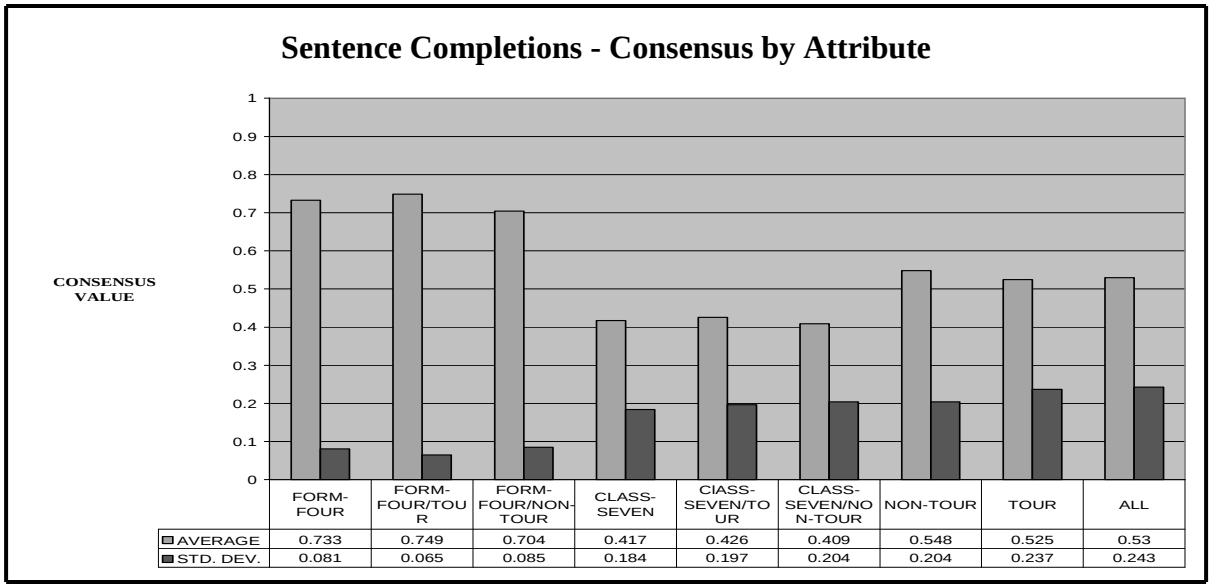


Figure 5: Likert-Scale Results by Attribute Class

Finally, tour employees (CV= .525; SD= .237) had only slightly smaller consensus values in the sentence completion exercise than non-tour employees (CV= .548; SD= .204), and the within class variation was large for both employment categories (Figure 6). Furthermore, neither of these groups had consensus values substantially greater than that of the entire sample of respondents (CV= .530; SD= .243).



	FORM-FOUR	FORM-FOUR/TOUR	FORM-FOUR/NON-TOUR	CLASS-SEVEN	CIASS-SEVEN/TOUR	CLASS-SEVEN/NON-TOUR	NON-TOUR	TOUR	ALL
AVERAGE	0.733	0.749	0.704	0.417	0.426	0.409	0.548	0.525	0.53
STD. DEV.	0.081	0.065	0.085	0.184	0.197	0.204	0.204	0.237	0.243

Figure 6: Results for Consensus Analysis - Sentence Completions

Objective Two: Educational Attainment

Level of education was strongly correlated with the knowledge that individuals possessed about solid waste pollution and the associated ecological, economic and health-related consequences. In the first free listing exercise, respondents with a Form-Four education identified a significantly larger number of pollutants than Class-Seven graduates (Figure 3). In fact, eight of the ten longest lists from thirty-two participants were produced by Form-Four graduates, while seven of the ten shortest lists were produced by Class-Seven graduates (Appendix B). Whereas residents with secondary-level experience identified 8.31 items on average, Class-Seven respondents averaged 5.69 items per list ($F= 8.319$; $p= .007$; Table 1).

Residents with educational experience at the secondary level exhibited significantly greater knowledge of the illnesses associated with solid waste pollution (Figure 4). In addition, Class-Seven respondents listed 2.5 items per list on average, while Form-Four respondents averaged 5.1 items per list ($F= 45.897$; $p= .000$; Table 2). The ten longest lists provided by the pool of thirty-two residents were produced by Form-Four graduates, while eight of the ten shortest lists were produced by Class-Seven graduates (Appendix C).

Likert-Scales indicated that Moshi residents with educational experience at the Form-Four level or beyond were more aware of a relationship between the economy and solid waste pollution (Figure 5). Form-Form graduates produced an average LV of (4), which corresponds to *agree* on a five- point scale. These individuals were in agreement with the notion that solid waste pollution can have economic consequences. Class-Seven respondents did not perceive this link as a group and produced a LV of (2), corresponding to *disagree* on the five-point scale. Finally, sentence completions revealed that the consensus values of Form-Four graduates ($CV= .733$; $SD= .081$) were much greater than their Class-Seven counterparts ($CV= .417$; $SD= .184$; Figure 6).

Interactive Effects: Results by Attribute Class

Those individuals employed in the tourism industry and educated at the Form-Four level listed the greatest number of pollutants in the first free-listing exercise (Figure 3). These results, however, were not significantly different (mean = 8.75; F= .101; p= .753; Table 1) from non-tour employees with the same level of education (mean = 7.88). In the second free listing exercise (associated illnesses), the results were reversed and non-tour employees with secondary-level experience listed more illnesses than tour employees at the same educational level (mean = 5.4; Figure 4), although again the difference was non-significant (F= 2.99; p=.095; Table 2). For tour and non-tour employees educated at the Class-Seven level, results were comparable and there was no significant difference in average list lengths produced through the two free-listing exercises. As indicated above, both groups of Class-Seven respondents produced fewer items per list than their Form-Four counterparts. These free-listing results, therefore, suggested that occupation did not have a significant influence on knowledge levels regarding the ecological and health consequences of solid waste pollution.

Tour and non-tour employees with educational experience at the Form-Four level perceived a relationship between the economy and the presence of solid waste pollution. LV's for each of these groups averaged (4), corresponding to *agree* on the five-point scale (Figure IV). This result contrasts to tour employees with Class-Seven experience who were neutral on the subject, with an average LV of (3) (corresponds to *Don't Know* on five-point scale). Non-tour employees with Class-Seven experience *disagreed* (LV = 2) with the notion that economic consequences result from solid waste pollution.

Finally, sentence completions revealed that tour and non-tour employees with Form-Four experience produced higher consensus values than tour and non-tour employees with Class-Seven experience (Figure V). While the responses of tour and non-tour employees at the Form-

Four level were the same on more than 70% of the questions, tour and non-tour employees at the Class-Seven level agreed on questions only 40% of the time. Tour employees with Form-Four experience had consensus values only slightly higher than their non-tour counterparts, as did tour and non-tour employees educated at the Class-Seven level.

CHAPTER 5: DISCUSSION

A number of conclusions are warranted by the results of this research. Throughout both phases of the project, highly educated respondents consistently demonstrated the greatest level of knowledge concerning solid waste pollution and its associated consequences. As predicted in Objective Two (**H_4, H_5,** and **H_6**), respondents with educational experience at the Form-Four level demonstrated a greater awareness of the ecological, economic and health-related consequences of solid waste pollution. In contrast, the predictions of Objective One (**H_1, H_2,** and **H_3**, regarding occupation and the ecological, economic, health-related consequences of solid waste pollution, respectively) were not supported and employment in the tourism industry had a relatively small and inconsistent effect on the knowledge that residents possessed regarding solid waste pollution. One notable exception regarding occupation, however, pertains to the attribute class containing tour employees who had been educated to the level of Class-Seven. These individuals did not possess a significantly greater knowledge of either the ecological or health-related effects of solid waste pollution, although they were more likely than their non-tour counterparts to perceive a relationship between the economy and solid waste. This suggests that while education is clearly the strongest indicator of knowledge, occupation can have an impact in certain contexts and where multiple variables are considered.

It is not surprising that educational attainment proved to have the greatest influence on knowledge levels regarding solid waste pollution among Moshi residents. As previously described, formal education in Tanzania is divided into primary and secondary levels, the former containing Classes One through Seven, the latter containing Forms One through Six. Enrollment

percentages vary from region to region, but the Tanzanian government only mandates (and ensures) a primary-level education. It is not until students reach the secondary-level, and particularly the higher level Forms, that they are exposed to environment-related, development issues (O-Saki 1998; Taylor 1998), of which solid waste pollution is one example. A large proportion of the student-aged population, therefore, is never formally introduced to environment-related issues. This research represents one consequence of the current educational system in Tanzania, and demonstrates the power of formal education to influence environment-related knowledge in urban settings such as Moshi.

A secondary-level education corresponds with a deeper knowledge regarding the ecological consequences of solid waste pollution, yet nearly all respondents expressed some level of knowledge in this area. That few respondents lacked at least a baseline level of knowledge is likely the result of life experience. With regard to health-related consequences, there was again a baseline level of knowledge maintained by all respondents. In addition to life experience, public health programs may have contributed to this result. In the past, Moshi has had disease outbreaks stemming from pollution and these have prompted local health organizations to adopt educational outreach programs (Viane, personal communication, May 26, 2004).

Perhaps the most interesting result of this research pertains to Class-Seven (less educated) respondents employed in the tourism industry. This class of respondents was more likely to recognize a link between the economy and the presence of solid waste pollution than their non-tour Class-Seven counterparts, although they did not have significantly greater knowledge of the ecological or health-related consequences. These Class-Seven respondents involved in tourism apparently perceive a connection between the industry's success, their own economic well-being,

and cleanliness. Many of the Class-Seven respondents interviewed were Kiswahili speakers and not fluent in English or other non-African languages. In contrast to more educated, English-speaking employees who serve as waiters, drivers and guides, the majority of Class-Seven tourism employees serve as porters and servers and hold positions where contact with visiting tourists is limited. It is unlikely, therefore, that these Class-Seven respondents are influenced directly by visiting tourists, although non-verbal observations could play a role. It is more likely that tour employees are receiving instruction from individuals holding management and higher-level positions within the firms. The process by which Class-Seven tour employees are developing their notions about the economy and pollution is open for further investigation, but it is evident that some aspect of their involvement in the industry does influence their perceptions regarding solid waste pollution, particularly where the economy is concerned.

Contributions to the Anthropology of Pollution

This research stands as a significant contribution to the anthropology of pollution as the data presented identify formal education as a significant variable which influences perceptions of pollution. Alley's (2001) work on the Ganga River in India addressed the influence of religion on beliefs about water quality, and Thompson (1979) has presented an economic, class-based argument to understand perceptions of *rubbish*. Elsewhere, scholars have considered the role of gender as an influencing factor (Muller 1998). In none of these examples, however, has adequate attention been paid to the role of formal education.

The studies reviewed above (Weigel, 1977; Sia et al., 1985; Schahn and Holzer, 1990; Berger, 1997) have all demonstrated that education is a factor contributing to environmentally positive attitudes. In each of these examples, however, researchers have focused exclusively on the United States or Canada while neglecting either the role of education in developing and non-

Western societies and/or the subject of *pollution* specifically. With its focus on Tanzania and solid waste pollution, this project clearly addresses existing deficiencies in the literature and confirms that education is equally significant in non-Western contexts.

This research also supports Barr's (2002) assertion that beliefs about pollution are multidimensional and are best evaluated through multiple data collection techniques. Education and occupation were both used as variables in Moshi and their influences were considered both singularly and in tandem through a series of mutually supporting qualitative and quantitative data collection techniques. The multivariable, multi-method approach adopted here proved to be valuable, especially in highlighting subtle relationships that would not have been revealed through more conventional methodologies which rely on a qualitative, single-variable approach. A more dynamic approach revealed, for example, the interactive effects that occupation and education can have on perceptions of solid waste pollution (specifically, the effects on perceptions of the economic consequences of solid waste pollution held by less educated tour employees).

Finally, in addition to education, the results of this project support the conclusion that tourism is an area that scholars concerned with pollution and perception must consider more rigorously. Wex's (2001) research in Panajachel, Guatemala, is useful in that it is oriented around the tourism industry, solid waste pollution and perception. Following Urry (1990) and his concept of the *tourist gaze*, Wex is interested primarily in the perceptions of visiting tourists and ex-patriots and how their notions of solid waste pollution influence the tourism industry in the region. What is absent in Wex's work, however, is a full consideration of how indigenous residents perceive solid waste pollution. Research in Moshi answers questions about the relationship between the tourism industry and resident notions of pollution, and as such, strongly

compliments and expands upon Wex's. The research confirms that perceptions about pollution can vary greatly within populations and that employment in the tourism industry can have an effect on residents' perceptions about solid waste pollution, particularly the associated economic consequences. Similarly, this research suggests that residents employed in the tourism industry are cognizant of the manner in which visitors perceive their surroundings and understand that their own economic well-being (the success of the tourism industry) is dependent upon the ecologically intact and aesthetically pleasing environments insisted upon by visitors. There are obvious geographic and culture disparities to consider, but combining research in Moshi with Wex's Guatemalan study provides at least initial insights that contribute to a fuller understanding of local and non-local perceptions of pollution in tourism-oriented areas.

Applications

In addition to its contributions to the anthropology of pollution, the results of this research may find direct application in several ways. Urban areas in Africa are in many cases approaching what can be described as a crisis in solid waste management. This is true not only in East African cities, but in a large number of other urban centers across the continent, as well. In many cases, municipalities are capable of managing only a fraction of the waste products produced. Moreover, the problem is exacerbated by still rising populations and changing consumer patterns (Achankeng 2003). What is needed are initiatives that are based both on a well-informed knowledge of the problem and locally-grounded contextualization.

A wealth of literature has been produced on the value of incorporating local perspectives into conservation initiatives (Barr 2002; Ehler *et al.* 1998; Mpandazoe 2000; Moningka 2000; Muthiga 2003; Obura et al. 2000) and doing so often determines the overall, long-term success of a project (White 1994). Interacting with stakeholders and accounting for local ideas about

development issues have been shown to produce positive results (Schmidheiny 1992; Logan 2004; Behara and Erasmus 1999; Bond 1998; Hulme and Taylor 2000). Participation is a prerequisite for success and this is particularly true in the case of solid waste management, where solutions could require residents to sort household wastes, recognize collection schedules and, in some instances, make financial contributions. Unfortunately, despite the interest in collaborating with stakeholders and the recognition that increased participation promotes success in conservation and sustainability, evidence of such inclusion is relatively shallow in the context of solid waste management in East Africa.

This research deals exclusively with perceptions of solid waste pollution and, as such, the conclusions reached have the potential to contribute to the formation and implementation of initiatives designed to address the specific urban pollution problems of the region. Compared to larger urban centers in the region, Moshi is relatively cleaner than other areas. Nonetheless, based upon formal conversations with upper-level municipal employees, the city is estimated to collect only sixty-percent of the approximate 200 tons of waste produced daily. One application of an expansion of this project would be provision of a reasonably accurate assessment of (1) residents' willingness to participate in certain programs (see Marchand (1998) for *willingness-to-pay* applications in solid waste management), and (2) residents' perceptions of the progress of the municipality with regard to waste collection. Likewise, by identifying the ways in which residents perceive solid waste pollution, this project identifies to whom the municipality should direct its attention for public education initiatives and other related programs.

This project also speaks to the quality and availability of formal education in Tanzania. As noted, it is not generally until secondary school that students are exposed to modules in environmental education. Given that access to secondary-level education is limited, a significant

proportion of the population is never formally introduced to such concepts, a conclusion that is supported by the results of this project. A longitudinal analysis of education in Tanzania (Lassibille's *et al.* 2000) reveals that while access to secondary education has increased through privatization efforts in recent decades, quality in those institutions is generally poor. Clearly, access to a comprehensive and quality education in Tanzania remains a problem.

If Tanzania intends to improve access to education, which would be congruent with statements in the Republic's *Vision of 2025* (1997), then at least two avenues for change currently exist. One option is to install policy changes such that curricula would be amended to address certain key issues (e.g., environmental education) at an earlier level. This requires a significant investment in resources and for this reason is a feature of very few national education policies across the continent (Vare 1998). Another option is to improve access to secondary education, a goal that has recently been sought after through privatization (Lassibille *et al.* 2000). Experiences in Moshi have provided support for the notion that education corresponds to a greater awareness of environmental issues such as solid waste pollution. Given the importance of education in influencing perceptions of environmental concerns demonstrated by this research, the arguments for finding a solution to improved access to and quality of education are further supported.

CHAPTER 6: CONCLUSIONS

Beyond the conclusions reached through this project, there are several additional research directions that deserve attention. In order to fully develop the multi-variable approach, a number of other variables should be examined. For example, based upon experiences in the field, it is clear that gender is an area that warrants investigation. In Moshi, and perhaps throughout much of East Africa, there is a clear division of labor by gender. This feature is particularly germane in the context of solid waste pollution, where it is primarily women who are responsible for collection and disposal. In other cases, the adolescents in the household take on this responsibility, also suggesting that the perceptions of youths should be investigated.

With respect to the project presented here, the research could have benefited from an expanded view of occupation and education. In regards to occupation, for example, it would be useful to consider the length of time that residents had been employed in the industry, a feature which may affect knowledge levels, particularly among less educated respondents. In terms of education, a more fine-grained analysis, rather than a single dichotomy of *primary* (Class-Seven) and *secondary* as the only two categories of formal education, might be warranted. Refocusing on the number of years of schooling, for example, would potentially reveal the effects of other Classes and Forms on residents' perceptions of pollution. In addition, attention should be paid to the influence of public versus private schooling. Similarly, while respondents may currently reside in Moshi, they may not have been educated in the Kilimanjaro or Arusha Districts. As the quality of education can vary significantly in public and private school settings and from region to region, it would be useful to record educational histories and to control for such discrepancies.

Finally, the project analyzed the responses from only 64 residents; to further ensure statistical validity, a larger and perhaps more structured sample should be employed in future research. There are approximately ten named subdivisions within the Moshi municipality and while these neighborhoods are somewhat heterogeneous in composition, residents have categorized each in terms of its perceived affluence or poverty. Respondents in this research were sampled from each of these municipal areas, but not in a systematic manner. In short, future research in Moshi should be more attentive to the various divisions within the municipality, such that variation within the broad categories of education and occupation can be taken into account in fully explaining their influence on perception.

Although the research presented here has limitations, the very specific intent was to evaluate the influence of employment in the tourism sector and level of education on local perceptions and knowledge about pollution. The results do support a novel and important conclusion - that educational attainment significantly outweighs the impact of occupation (at least in terms of tour and non-tour) on residents' notions of environmental pollution and the associated ecological, economic and health-related consequences. In affirming intracultural variation, this research also contributes to what Douglas (1966) has termed the anthropology of pollution, both theoretically and methodologically. In so far as the results can be generalized and applied, the research may stand as an additional contribution of ecological and environmental anthropology to addressing significant contemporary concerns.

REFERENCES:

Achankeng, E.

2003 *Globalization, urbanization and municipal solid waste management in Africa*. Conference Proceedings-Africa on a global stage, African Studies Association of Australasia and the Pacific.

Alley, K.

2002 *On the Banks of the Ganga: When Wastewater Meets A Scared River*. Ann Arbor: University of Michigan Press.

Arusha Times

2004 New 69.5 Million Dollar Dump Already Filled Up. *The Arusha Times*, June 26-July 2.

Barr, Stewart

2002 Household Waste in Social Perspective: Values, Attitude, Situation and Behavior. Burlington: Ashgate. Pp.193.

Behera, D.K. and Erasmus, P.

1999 Sustainable Development of Indigenous Populations: Challenges Ahead.' *South African Journal of Ethnology* 22(1), 1-12.

Berger, I.E.

1997 The Demographics of Recycling and the Structure of Environmental Behavior. *Environment and Behavior* 29(4):515-531.

Berlin, B. and Romney, A. K.

1964 Descriptive Semantics of Tzeltal Numeral Classifiers. *American Anthropologist* 66(3):79-98.

Bernard, R. H.

2002 *Research Methods in Anthropology: Qualitative and Quantitative Approaches*. New York: Alta Mira Press.

Bond, R.

1998 *Lessons for the Large Scale Application of Process Approaches from Sri Lanka, Gate Keeper Series 75.* International Institute for Environment and Development (IIED), London.

Borgatti, Stephen P.
1992 *ANTHROPAC 4.0*. Columbia: Analytic Technologies.

Boster, James
1986 Exchange of Varieties and Information between Aguaruna Manioc Cultivators. *American Anthropologist* 88(2):429-436.

Boster, J. and Johnson J.
1989 Form and Function: A Comparison of Expert and Novice Judgments of Similarity among Fish. *American Anthropologist* 91:866-89.

Brockerhoff, M. & Brennan, E.
1998 The Poverty of Cities in Developing Regions. *Population and Development Review*, 24(1):75-114.

Campbell, C.
1990 The Easternization of the West, In Wilson, B. and Creswell, J. (eds.), *New Religious Movements: Challenges and Responses*. London: Routledge. Pp. 35-48.

Clark, J.
1993 Gold, Sex and Pollution: Male Illness and Myth at Mt. Kare, Papua New Guinea. *American Ethnologist* 20(4):742-757.

Derksen, K. and Gartrell, J.
1993 The Social Context of Recycling. *American Sociological Review* (58):434-442).

Douglas, Mary
1966 *Purity and Danger*. London: Routledge, Pp. 244.

Garro, J.
1986 Intracultural Variation in Folk Medicinal Knowledge: A Comparison between Curers and Non-Curers. *American Anthropologist* 88:351-70.

Gatewood, J. B.
1983 Loose Talk: Linguistic Competence and Recognition Ability. *American Anthropologist* 85(2):378-387.

Guth, J. L., Green, J. C., Kellstedt, L. A. and Schmidt, C. E.
1995 Faith and Environment: Religious Beliefs and Attitudes on Environmental Policy. *American Journal of Political Science* 39(2):699-718.

Harsch, E.
2001 African cities under strain: Initiatives to improve housing, services, security and governance. *Africa Recovery* 15(1-2):30.

Hawkins, Gay & Mueke, Stephen
2003 *Culture and waste*. New York: Rowan & Littlefield.

Henley, N.M.
1969 A Psychological Study of the Semantics of Animal Terms. *Journal of Verbal Learning and Verbal Behavior* 8:176-184.

Hulme, D. and Taylor, R.
2000 Integrating Environmental, Economic and Social Appraisal: Differences in Approach for Industrial and Developing Countries. In N. Lee and Kirkpatrick (Eds.), *Integrated Appraisal and Sustainable Development in a Developing World* (pp. 65-80). Cheltenham: Edward Elgar.

Khan, A.
1994 "Juthaa" in Trinidad: Food, Pollution and Hierarchy in a Caribbean Diaspora Community. *American Ethnologist* 2(1):245-269.

Lassibille, G., Tan, J.P. & Sumra, S.
2000 Expansion of Private Secondary Education: Lessons from Recent Experience in Tanzania. *Comparative Education Review.* 44(1):1-28.

Likert, R.
1932 A Technique for the Measurement of Attitudes. *Archives of Psychology* 14(22).

Logan, I. B.
2004 Ideology and the Political Ecology of Resource Management: From Sustainable Development to Environmental Security in Africa. In Moseley, W. and Logan, B. (eds) *International Political Economics and Local Ecologies*. London: Ashgate Publishers.

Marchand, R.
1998 Marketing of Solid Waste Management Services in Tingloy, The Philippines: A Study of Affordability and Willing to Pay. *UWEP*, Working Document 9. Pp.139.

Moningka, L., Muller, M., Laroui, F.
2000 Community participation in solid waste management, factors favoring the sustainability of community participation: A literature review. Urban Waste Expertise Program. Avail: http://www.waste.nl/publ.htm.

Mpandazoe, Frederick M. T.
2000 *Overview of the Socioeconomic Opportunities Related to Sewage Management of the Coastal Urban Centres of the Eastern African Coast.* Prepared as part of the global programme of action for the protection of the marine environment from land-based activities. Pp. 39. The Netherlands: United Nations Environmental Programme.

Muller, Maria S.
1998 Gender and Waste. Urban Waste Expertise Program. Occasional Paper, pp.18.

Muthiga, Nyawira; Bigot, Lionel; Nilsson, Agneta
1998 *East Africa: Coral Reef Programs of Eastern Africa and the Western Indian Ocean.* ITMEMS Proceedings, 1998, pp. 114-143.

Mwanthi, M.W., Nyabola, E. & Tenambergen, E.
1997 Solid waste management in Nairobi City: Knowledge and attitudes. *Journal of Environmental Health* 60(5):1-23.

Namihira, E.
1987 Pollution in the Folk Belief System. *Current Anthropology* 28(4):565-574.

Obura, David O., Muthiga, Nyawira, A., & Watson, Maggie
2000 Kenya. *In Coral Reefs of the Indian Ocean: Their Ecology and Conservation*. D.O. Obura, ed. Pp. 199-230. New York, N.Y.: Oxford University Press.

O-Saki, K.M.
1998 *Environmental Educaiton.* Dar es Salaam: The Open University of Tanzania, pp. 104.

Romney, A.K., S.C. Weller and W.H. Batchelder
1986 Culture as Consensus: A Theory of Culture and Informant Accuracy. *American Anthropologist* 88:313-338.

Sankoff, G.
1971 Quantitative Analysis of Sharing and Variability in a Cognitive Model. *Ethnology* 10:389-408.

Schmidheiny, S.
1992 The Business of Sustainable Development. *Finance and Development*, December, 24-27.

Shahn, J. and Holzer, E.
1990 Studies of Individual Environmental Concern: The Role of Knowledge, Gender and Background Variables. *Environment and Behavior* 22(6):767-786.

Sia, A.P., Hunderford, H.R., and Tomera A.N.
1985 Selected Predictors of Environmental Behavior: An Analysis. *Journal of Environmental Education* 17:31-40.

Strasser, Susan
1999 *Waste and Want: A Social History of Trash*. New York: Metropolitan Books.

Taylor, Christopher
1998 Environmental Education in Primary Education: Status and Trends in Southern and Eastern Africa. *Environmental Education Research* 4(2):201-216.

Thompson, Michael
1979 *Rubbish theory.* Oxford: Oxford University Press.

United Republic of Tanzania
1997 *The Tanzanian Development Vision for 2025*. Avail:http: //www.tanzania .go.tz/ mvision.htm

2002 *Population and Housing Census*. Avail: http://www.tanzania.go.tz/census/.

Urry, John
1990 *The Tourist Gaze.*

Vare, Paul
1998 ECoSA: A Report on a Pan-African Environmental Education Survey. Environmental Ethics Research 4(1):1-20.

Weigel, R.H.
1977 Ideological and Demographic Correlates of Pro-ecology of Behavior. *Journal of Social Psychology* 103:39-47.

Wex, Anna
2002 *A Foreign Concern: Solid Waste Management in Panajachel*, North Carolina State University.

White, Alan T.; Hale, Lynn Zeitlin; Renard, Yves; Cortesi, Lafcadio, ed.
1994 *Collaborative and Community Based Management of Coral Reefs: Lessons from Experience*. Hartford: Kumarian Press.

Young, J.
1990 *Post Environmentalism*. London: Bellhaven.

APENDICES

A QUESTIONNAIRES

B FREE-LIST STATISTICS – TAKATAKA (TYPES OF POLLUTION)

C FREE-LIST STATISTICS – MAGONJWA (ILLNESSES)

D AVERAGE FREE-LIST LENGTH BY ATTRIBUTE CLASS

APPENDIX A: THREE-PART QUESTIONNAIRE

HUU SI MTIHANI. TUNAPENDA TU MAONI YAKO.
THIS IS *NOT* A TEST. WE ARE INTERESTED ONLY IN YOUR *OPINIONS.*

1) Mvulana/Male _____ Msichana/Female _____

2) Una miaka mengapi? How old are you? _____

3) Ulizaliwa wapi? Where were you born? _____

4) Umeishi katika mji wa Moshi miaka mengapi? How long have you lived in Moshi? _____

5) Unaishi katika mji wa Moshi wapi? In which area of Moshi do you live? _____

6) Umeshaishi katika mji mwingine zaidi ya Moshi? Where have you lived other than Moshi?

7) Je umeowa au umeolewa? Are you married?
Ndyio/Yes ____ Hapana/No ____

8) Una watoto wangapi? How many children do you have?

9) Bila kujihusisha wewe kunawatu wangapi wanaoishi katika familia yako? Not including yourself, the household in which you live is made up of how many individuals?
Men _____
Women_____
Children____

10) Kuna ndugu wangapi wanaoishi katika nyumba yako? How many relatives are in the household in which you live?
11) Nini kiwango chako cha elimu?What is your highest level of formal education?

a) darasa la saba/class 7
b) kidato cha nne/form 4
c) kitando cha sita/form 6
d) shule ya ufundi/technical school, elezea/explain_____
e) chuo kikuu/university, elezea/explain_____
f) nyingine/other _____

12) Kiwango cha juu cha elimu katika watu wanaoishi katika nyumba yako ni nini? What is the highest level of formal education in your household?
13) Kazi yako sasa hivi ni ipi? What is your current occupation?

14) Umefanya kazi hii kwa muda gain? How long have you held this position?
15) Una kazi nyingine zaidi ya hiyo uliotaja? Do you currently have more than one occupation?
Hapana/No____ Ndyio/Yes_____(Elezea/Explain)

16) Umewahi fanya kazi nyingine tofauti na ulizotaja hapo juu? Have you held other positions in the past?
Hapana/No____ Ndyio/Yes_____(Elezea/Explain)

17) Je kuna mtu zaidi ya wewe anayeleta kipato katika nyumba yako? Is there more than one income provider for the household in which you live?

18) Kiwango chako cha mapato kwa mwaka mzima hapa Tanzania kiasi gani?
What is your approximate yearly income in Tanzanian shillings?
a) chini ya/below 50,000
b) 50,000-60,000
c) 60,000-80,000
d) juu ya/above 80,000

19) Nini kiwango chako cha mapato kwa mwaka mzima katika nyumba yako?
What is your household's approximate yearly income in Tanzanian shillings?
a) chini ya/below 50,000
b) 50,000-60,000
c) 60,000-80,000
d) juu ya/above 80,000

20) Je nyumba yako inashugulikiwa na manispaa ya Moshi katika swala la usombaji takataka? Is your household part of the municipal waste management system?
Ndyio/Yes _____ Hapana/No _____

21) Kama nyumba yako inashuguli kiwa na manispaa je wanasomba takataka mara ngapi kwa wiki moja. If part of municipal system, how many times per week does the municipality collect trash?
(kila siku/everyday) (zaidi ya mara moja kwa wiki/more than once weekly) (mara moja kwa wiki/once weekly) (sijui/do not know)

22) Nani anahusika na kushuguki kia takataka katika nyumba yako?
Who in your household is responsible for dealing with waste materials?

23) Je mnazungusha takataka zenu? Elezea.
Do you recycle household waste products? Explain.

24) Je mnatanganisha takataka katika nyumba yako?
Do you separate household waste materials?

25) Zungushia sehemu ambazo umeshatembelea au kuishi. Circle the areas that you have visited or lived in.
Arusha Dar es Salaam Morongoro Zanzibar Dodoma Tanga Mwanza

26) Je umesafiri nje ya Tanazania. You have traveled outside of Tanzania.
Ndyio/Yes _____ Hapana/No _____

27) Taja sehemu ulizokuisha tembelea nje ya Tanzania. List any travels outside of Tanzania.

Soma maelezo na tafadhali zungushia sehemu ile unayoona inafanana na jibu lako. READ EACH STATEMENT BELOW AND CIRCLE THE ONE THAT MOST CLOSELY RESEMBLES YOUR OWN RESPONSE.

32) Mji wa Moshi hauna tatizo la takataka. Moshi does *not* have a problem with solid waste/trash.
(ninakubali hasa) (ninakubali) (sijui) (ninakataa) (ninakataa kabisa)
(Strongly Agree) (Agree) (Do Not Know) (Disagree) (Strongly Disagree)

33) Mji wa Moshi ni mji safi. Moshi is a clean city.
(ninakubali hasa) (ninakubali) (sijui) (ninakataa) (ninakataa kabisa)
(Strongly Agree) (Agree) (Do Not Know) (Disagree) (Strongly Disagree)

38) Ninaridhika jinsi manispaa ya Moshi inavyoshughuli kia takataka. You are satisfied with the municipality's handling of trash in Moshi town.
(ninakubali hasa) (ninakubali) (sijui) (ninakataa) (ninakataa kabisa)
(Strongly Agree) (Agree) (Do Not Know) (Disagree) (Strongly Disagree)

39) Ninaridhika jinsi manispaa ya Moshi inavyoshughuli kia takataka katika vitongoji vyake. You are satisfied with the municipality's handling of trash in the suburbs of Moshi town.
(ninakubali hasa) (ninakubali) (sijui) (ninakataa) (ninakataa kabisa)
(Strongly Agree) (Agree) (Do Not Know) (Disagree) (Strongly Disagree)

40) Manispaa ya mji wa Moshi ina wafanya kazi wakutosha kushuguli kia takataka. The municipality has enough workers to manage solid waste in Moshi.
(ninakubali hasa) (ninakubali) (sijui) (ninakataa) (ninakataa kabisa)
(Strongly Agree) (Agree) (Do Not Know) (Disagree) (Strongly Disagree)

41) Manispaa ya mji wa Moshi ina vifaa vya kutoshughuli kia takataka zake. The municipality has enough equipment to manage solid waste in Moshi.
(ninakubali hasa) (ninakubali) (sijui) (ninakataa) (ninakataa kabisa)
(Strongly Agree) (Agree) (Do Not Know) (Disagree) (Strongly Disagree)

42) Watalii wanauona mji wa Moshi kama mji safi. Tourists see Moshi as a clean city.
(ninakubali hasa) (ninakubali) (sijui) (ninakataa) (ninakataa kabisa)
(Strongly Agree) (Agree) (Do Not Know) (Disagree) (Strongly Disagree)

43) Watalii wanakuja katika mji wa Moshi kwa sababu ni mji safi. Tourists come to Moshi because it is a clean city.
(ninakubali hasa) (ninakubali) (sijui) (ninakataa) (ninakataa kabisa)
(Strongly Agree) (Agree) (Do Not Know) (Disagree) (Strongly Disagree)
44) Watalii wanarudi kutembelea mji wa Moshi kwa kuwa ni mji safi. Tourists return to Moshi because it is a clean city.
(ninakubali hasa) (ninakubali) (sijui) (ninakataa) (ninakataa kabisa)
(Strongly Agree) (Agree) (Do Not Know) (Disagree) (Strongly Disagree)

45) Takataka haziathiri uchumi wa mij wa Moshi. Solid waste pollution does *not* have an effect on Moshi's economy.
(ninakubali hasa) (ninakubali) (sijui) (ninakataa) (ninakataa kabisa)
(Strongly Agree) (Agree) (Do Not Know) (Disagree) (Strongly Disagree)

47) Watu hawajali kuweka sehemu za uma na baadhi ya mitaa katika hali ya usafi. People do not care about keeping public areas such as streets clean.
(ninakubali hasa) (ninakubali) (sijui) (ninakataa) (ninakataa kabisa)
(Strongly Agree) (Agree) (Do Not Know) (Disagree) (Strongly Disagree)

48) Wakazi wengi wa mji wa Moshi wanashughuli kia sehemu wanazoishi na pia sehemu wanazo miliki kuwa safi.The greatest concern of residents is their own compound/household/property.
(ninakubali hasa) (ninakubali) (sijui) (ninakataa) (ninakataa kabisa)
(Strongly Agree) (Agree) (Do Not Know) (Disagree) (Strongly Disagree)

SENTENCE COMPLETION: PROVIDE A SINGLE WORD OR PHRASE TO COMPLETE THE SENTENCE THAT HAS BEEN STARTED. KUKAMILISHA SENTENSI: TOA NENO MOJA AU KIFUNGU CHA MANENO KUKAMILISHA SENTENSI ZILIZO HAPO CHINI.

55) Sehemu safi katika mji wa Moshi na vitongoji ni _____/ The cleanest area of the Moshi and the surrounding area is _____.

56) Sehemu chafu za mji wa Moshi na vitongoji ni _____/ The dirtiest area of the Moshi and the surrounding area is _____.

57) Takataka zinazo kusanywa na manispaa ya Moshi hutupwa _____/ The trash that the municipality collects is taken to _____.

58) Takataka ni mbaya kwa sababu _____/ Solid waste pollution is bad because of _____.

59) Ugonjwa ambao unahusishwa na takataka ni _____/ The most common disease associated with solid waste pollution is _____.

60) Ugonjwa ambao hauhusishwi sana na takataka ni _____/ The least common disease associated with solid waste pollution is _____.

61) Ugonjwa ambao ni hatari sana na ambao unahusishwa na takataka ni _____/ The most dangerous disease associated with solid waste pollution is_____.
62) Aina ya takataka inayozuia mimea kumea ni _____/ A type of solid waste pollution that affects the ability for plants to grow is _____.

63) N'gombe na mbuzi wakila _____ wanapata magonjwa au kufa/ Cattle and goats can eat _____ and become very ill or die.

64) Aina ya takataka inayo leta matatizo mengi ni _____/ The most problematic type of solid waste is _____.

65) Manispaa inapata ruzuku kutoka _____ kushughuli kia tatizo la takataka katika mji wa Moshi/ The municipality receives funding from _____ to manage solid waste in Moshi.

66) Sehemu muhimu ya uchumi wa Moshi ni _____/ The most important part of Moshi's economy is_____.

67) Sehemu muhimu ya uchumi wa Tanzania ni _____/ The most important part of Tanzania's economy is _____.

70) Tatizo kubwa la mji wa Moshi ni _____/ The most serious problem in Moshi is _____.

71) Kitu kizuri kuliko vyote katika mji wa Moshi ni _____/ The best thing about Moshi is_____.

APPENDIX B: FREE LIST STATISTICS - TAKATAKA (TYPES OF POLLUTION)

RESPONDENT - (Attribute Class - #)*	LIST LENGTH
F4NT - 1	16
F4T - 1	14
F4T - 2	11
F4T - 3	10
F4T - 4	9
F4T - 5	9
F4NT - 2	9
F4T - 6	8
C7T - 1	8
C7NT - 1	7
F4NT - 3	7
F4NT - 4	7
F4NT - 5	7
C7T - 2	7
F4NT - 6	7
C7NT - 2	7
F4NT - 7	6
C7NT - 3	6
C7T - 3	6
C7T - 4	6
C7NT - 4	6
C7T - 5	6
C7NT - 5	5
C7NT - 6	5
F4T - 7	5
C7NT - 7	5
C7NT - 8	5
C7T - 6	4
C7T - 7	4
F4NT - 4	4
C7T - 8	4
F4T - 8	4

Average List-Length = 7

Total Number of Items = 221

F4 = Form-Four

C7 = Class-Seven

T = Tour

NT = Non-Tour

* In the respondent column, each respondent is labeled according to their attribute class (F4NT = Form-Four, Non-Tour) and assigned a number for their position in their respective attribute class (F4NT -1, the first Form-Four, Non-Tour respondent).

APPENDIX C: FREE-LIST STATISTICS - MAGONJWA (ILLNESSES)

RESPONDENT (Attribute Class- #)*	LIST LENGTH
F4NT4	8
F4NT8	7
F4NT6	6
F4NT7	6
F4T2	6
F4NT1	5
F4NT2	5
F4NT3	5
F4NT5	5
F4T1	5
F4T6	5
C7NT4	4
C7NT8	4
C7T1	4
C7T3	4
F4T3	4
F4T5	4
C7NT6	3
C7NT7	3
C7T2	3
F4T7	3
C7NT1	2
C7NT2	2
C7NT3	2
C7T4	2
C7T5	2
C7T6	2
C7T7	2
F4T4	2
C7NT5	1

Average List-Length = 3.8

Total Number of Items = 116

F4 = Form-Four

C7 = Class-Seven

T = Tour

NT = Non-Tour

* In the respondent column, each respondent is labeled according to their attribute class (F4NT = Form-Four, Non-Tour) and assigned a number for their position in their respective attribute class (F4NT -1, the first Form-Four, Non-Tour respondent).

APPENDIX D: AVERAGE FREE-LIST LENGTH BY ATTRIBUTE CLASS

TAKATAKA (TYPES OF POLLUTION)

ATTRIBUTE CLASS	AVERAGE LIST LENGTH
FORM-FOUR	8.31
FORM-FOUR/TOUR	8.75
FORM-FOUR/NON-TOUR	7.88
CLASS-SEVEN	5.69
CLASS-SEVEN/TOUR	5.85
CLASS-SEVEN/NON-TOUR	5.56
TOUR	7.4
NON-TOUR	6.65

MAGONJWA (ILLNESSES)

ATTRIBUTE CLASS	AVERAGE LIST LENGTH
FORM-FOUR	5.1
FORM-FOUR/TOUR	4.5
FORM-FOUR/NON-TOUR	5.4
CLASS-SEVEN	2.5
CLASS-SEVEN/TOUR	2.7
CLASS-SEVEN/NON-TOUR	2.7
TOUR	3.42
NON-TOUR	4.12