

国総研セミナー  
人口と環境のダイナミクス



平成 14 年 1 月

国際協力事業団  
国際協力総合研修所

総研

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(写真：国際協力事業団)

国総研セミナー  
「人口と環境のダイナミクス」

1. 日時：平成 14 年 1 月 18 日(金)15：00～17：00
2. 場所：国際協力事業団 国際協力総合研修所 2階 国際会議場
3. 講師：Dr. Gayl Ness( ミシガン大学社会学部名誉教授 )
4. 議事
  - (1) 開会
  - (2) 講演者紹介 尾崎美千生 国際協力事業団 国際協力専門員
  - (3) 講演 ゲール・ネスミシガン大学社会学部名誉教授
  - (4) 質疑応答
  - (5) 閉会

5. 経緯

JICA では平成 13 年度より「第二次人口と開発分野別援助研究会」を開始いたしました。その中でミシガン大学社会学部のゲール・ネス (Dr. Gayl Ness) 名誉教授を招聘し、「人口と環境のダイナミクス」と題して講演をお願いいたしました。

ネス氏は1960年にカリフォルニア大学バークレー校で博士号を取得されました。その後、1964年から1997年まで33年にわたってミシガン大学で社会学、公衆衛生、人口・家族計画について教鞭をとられました。1988年には「人口と環境のダイナミクス」という名前の研修、研究プロジェクトを発足され、ミシガン大学の教授陣のみならず、米国内の他大学の研究者や外国の研究者も動員して学際的で総合的な研究を行われています。

今回のセミナーでは、アジアの5都市を例示しながら、人口と環境

の関係についてわかりやすく講演していただきました。

6. 講師略歴：1952 カリフォルニア大学バークレー校にて社会学士を取得
- 1953-1955 フランスの米軍にて勤務
- 1955-1956 フルブライト奨学生としてデンマークで農業経済と組合に関し研究
- 1957 カリフォルニア大学バークレー校にて社会学修士号を取得
- 1960 カリフォルニア大学バークレー校にて社会学博士号を取得
- 1964-1997 ミシガン大学で社会学、公衆衛生、人口・家族計画について教鞭
- 1988年 「人口と環境のダイナミクス」という研修、研究プロジェクトを発足

国際協力事業団 国総研セミナー  
「人口と環境のダイナミクス」  
ゲール・ネス博士  
ミシガン大学社会学部名誉教授

*IFIC Seminar, Japan International Cooperation Agency*  
**“Population-Environment Relationships”**  
*Dr. Gayl D. Ness*  
**Professor Emeritus, Department of Sociology,**  
**University of Michigan**

< 日時・開催場所 >

2002年1月18日(金)午後3:00～5:00  
国際協力事業団 国際協力総合研修所  
2階 国際会議場

< Date・Venue >

Friday, 18 January, 2002 3:00～5:00 PM  
International Conference Room,  
the 2nd floor, IFIC, JICA

～ プログラム・Program ～

3:00 開会

Opening

3:00-3:10 講演者紹介

Introduction of the Lecturer

尾崎美千生  
国際協力事業団  
国際協力総合研修所  
国際協力専門員

*Mr. Michio Ozaki*  
Senior Advisor,  
Institute for International Cooperation,  
Japan International Cooperation Agency

3:10-4:00 講演

Lecture

ゲール・ネス博士  
ミシガン大学社会学部  
名誉教授

*Dr. Gayl D. Ness*  
Professor Emeritus,  
Department of Sociology,  
University of Michigan

4:00-4:10 休憩

Break

4:10-5:00 質疑応答

Question and Answer

5:00 閉会

Closing

# セミナー概要

## <講演内容>

1. 人口と環境の関係には三つの基本原則があると考えている。第一は人口と環境の間には直接の関係はないということである。第二は人口と環境にはあらゆる形態の関係があるということである。第三は最も重要なことであるが、行動と結果は地域毎に対応させなければならないということである。この講演では、モデル化を行った三都市について言及する。第1にパキスタンのファイザラバードは貧しく、行政がうまく働いていない例である。第2にタイのコンケンはやや豊かで優れた行政を持つが、それでもいづらか問題を抱えている事例である。第3に神戸は非常に豊かで、高い生活の質を享受している事例として取り上げた。
2. 現在環境問題の一つになっている温暖化ガスの中には、二酸化炭素、メタンという2種類のガスがあるが本来はこれらのガスの存在により、太陽からの熱が宇宙に放射せず、地上に生命が生存できる。しかしながら、濃度は1750年頃と比較して現在では非常に増加している。これらのガスの増加の傾向は人口の増加の傾向と合っている。1000年前には地球の全人口は2億5000万人であり、現在のアメリカの総人口より少なかった。それが現在では地球の全人口は60億人を超えている。このため、人口増加が地球環境の変化を引き起こし、地球温暖化の原因であるように思われている。
3. 人口増加と関連づけることができるものの一つはエネルギー形態の技術革新である。古来馬など動物が移動手段として用いられてきた。16世紀に大航海時代を迎え、帆船が移動手段として用いられ始めた。その後化石燃料が使用されるようになり、人口は大幅に増加した。

4. 第一の原則は人口と環境には直接の影響はないことである。人口と環境の関係は非常に重要であり、その関係は非常に強力であるが、直接の関係はない。人口が環境に与える影響は社会組織や技術に仲介される。効果的組織を作り、効率的な技術を使えば、人口が環境に与える影響はかなり減少できる。
5. 第二の原則は人口と環境の関係には実例を挙げられるということである。ヒマラヤやアマゾンやアフリカにおける森林減少などのように人口増加が環境を悪化させる例は数多くある。また、タイの森林で出生率が減少したおかげで、希少種がいる国立公園に対する圧力が減少したというような人口の減少が、環境の質を高める例もある。ところが、シンガポールのように人口増加が環境の質を高める例や、ヨーロッパのアルプス地域のように人口が流出し、環境が悪化した例もある。
6. 第三の原則は人口と環境は地域に特有の問題であるということである。人口と環境の関係は、地理的気候、土地条件、住民の行動と保有している技術による。人口と環境のダイナミクスは人類の技術と社会組織によって決まる。そのため、市民と行政は人口増加に影響される環境の質を高める機会と責任を有する。
7. 5都市(ファイザラバード、コンケン、セブ、プサン、神戸)に対して、人口と環境の関係を示すモデルを作成したが、このモデルにおいて、環境は、水、大気、エネルギー、土地利用の4つの要素で表している。検討した3つの制度と事物は生産システムと経済、社会サービス、健康、教育、家族計画と輸送システムである。これらは都市の代謝を表すと思われるため、使用した。これらは実際に計測しているものである。すべての環境と人口の条件は生活の質にいくらかの影響を持つ。1970年から1995年までのデータを使ってモデ

ルを作成し、2025年までの25年の予測をした。

8. パキスタンのファイザラバードは、乾燥気候だが、インダス川が流れているため、水は豊富である。まだかなり貧しい都市で、トラックやバスや自転車の他に馬車のような動物による輸送が行われている。舗装されている道路もあれば、未舗装の道路もある。動物による輸送は優雅に見えるが、尿尿のため、健康的でない。自動車にも大気汚染のリスクはあるものの、動物輸送による感染症の多発よりはよい。モデルによる予測によれば、高位予測では、ファイザラバード近辺では農業の崩壊が起こることになる。中位予測では、現在と同じような状況が続くと考えられる。パキスタンの行政は必ずしも良い状態ではないため、人々は教育や健康で民間のサービスを受けているといわれている。人口が増加する一方、職業や学校がなければ、社会に受け皿が無く、不安定な社会になる。
  
9. タイのコンケンには、多くの河川が流れている。貧しい地域であったが、急速に発展しており、タイ東北部の中心になっている。道路は舗装されており、多くのピックアップトラックが走っている。行政のバイパス建設により、市街の渋滞は発生していない。大気物質( SPM( Suspended Particular Matter: 浮遊粒子状物質 )、窒素酸化物、オゾン )に関しては、降雨が多い夏期には、交通によって排出される汚染物質が洗い流されるため、濃度が低くなる。これは、環境が地域特性によって異なる例である。他方、タイは家族計画を成功させた国であり、既に出生率は人口置換水準以下になっている。そのため、よりよい教育や職が得られやすい。
  
10. 神戸は第二次世界大戦の廃墟から復活、発展した街である。神戸には二つの地理的優位性がある。海流により汚濁物が湾外に流れる。また北部に位置する山地から海側に吹く風により、大気汚染になり



にくい。神戸は、山を削って住宅地を造成し、その土でポートアイランドなどを造った。1900年頃には六甲山は禿げ山だったが、植林により今では豊かな木々がある。そのため土砂災害が減少し、清浄な水が得られる他に、二酸化炭素を吸収し、酸素を排出している。神戸の人口は第二次世界大戦後増加し、1960年に35,000台から45,000台だった車の数は現在では300,000台になっている。「ステラモデル」によれば、SPM や窒素酸化物や一酸化炭素の濃度は1970-1975年にはかなり高かった。技術向上により濃度は低下したが、現在の技術を所与とすると将来車両数が増加した場合、SPM 濃度は増加する。SPM が10 マイクログラム増加すると死亡率が1%増加する。もし、技術が向上せず、車両が増加すると、1995-2020年で10,000人死亡が増加する。他方、高齢化の問題もある。1970年には15歳未満が20%以上で、65歳以上が5～6%であったが1995年にはこれがほぼ同率であった。今後65歳以上の人口は増加すると思われる。

11. 教訓を要約すると、第一に豊かさはより環境を汚染するため、豊かな国は、貧しい国よりも環境を汚濁するといえる。しかし、豊かさは環境を保護もする。神戸はクリーン・テクノロジーを用い、環境を保全している。第二に出生率を低下させると、環境への圧力は低下する。第三に人口と環境のダイナミクスは地域特性によるため、地域レベルで考えなければならない。

### <質疑応答>

- Q. ネス先生は人口と環境は地域を特定して考えるべきとのことであるが、人類全体と地球という関係でもみななければならないのではないかと。その中で我々の生存はどうすれば可能なのかということを考えるべきではないか。
- A. 環境の劣化というのは二酸化炭素の排出による温暖化の問題や北極での重金属汚染などグローバルな問題であるが、対策としては口

ケーション・スペシフィックでなければならない。硫黄についてはアメリカで環境保護法が何十年か前に制定され、硫黄の排出量を向上で抑制するようになったが、土地の硫黄分が大幅に減少している。これは政府が民間企業に強制したからである。このようにロケーション・スペシフィックな形で問題に取り組まなければならない。

- Q . 日本では琵琶湖の石鹼運動や、ゴミの分別、生ゴミの堆肥化など女性が中心になって環境問題に取り組んでいるという現状があるが、人口と環境に女性のはいる要素があるのではないか。
- A . 女性は草の根レベルにおいて非常に重要な力を発揮するため、環境と人口の問題においては女性の役割は重要である。

## **Introduction of the Lecturer**

### **Mediator (Mr.Ozaki, Senior Adviser, Institute for International Cooperation, JICA)**

Good afternoon ladies and gentlemen. My name is Ozaki and I would like to act as the moderator for this seminar. I would like to thank you very much for taking the time despite your busy schedule and attend this seminar this afternoon. Professor Ness from the University of Michigan has been teaching for a very long time about population and environment. He is now a Professor Emeritus at the University of Michigan and we are very grateful that we have Prof. Ness with us, today. He has already given several lectures since he arrived at Tokyo and I don't know how many times he has already given lectures. He must be tired but I hope he will bear with us now and stay until the end as well. The profile of Prof. Ness and the presentation material are given as your handouts. In relation to the environment, "Rio past 10" is going to be held at the end of August this year in South Africa. It will commemorate the 10 year's anniversary since the earth summit held in Rio de Janeiro, 10 years ago. I'm sure that there are going to be discussions concerning population and the environment. So, prior to such international conference, I think it is a good opportunity for us to be able to listen to lecture by Prof. Ness on this topic.

I will not dwell on the detail career of Prof. Ness. But since 1988 he had started the Population and Environmental Dynamic in the University of Michigan that gathers not only the faculty of the University of Michigan but also the researchers of other Universities in the States and also foreign researchers, to take part in this inter-discipline comprehensive study. So I think he will share the result of the study today in part. In relation to activities in Japan, there is the so-called Asian Urban Information Center in Kobe. This center which has played a major role in environmental issues of cities in the world has been studying with participation

of Prof. Ness. So I think he will refer to the situation in Japan or the activities of the Asian Urban Information Center in Kobe, Khon Kaen in Thailand, Cebu City, Pusan, Kobe, and Faisalabad in Pakistan and major cities that have been taken up in this study. I'm sure he will talk about the result taken up by these 5 cities.

Personally I know that Dr. Ness is a lover of nature. I have once visited An Arbor, Michigan, where the University is located. I learned that he has a piece of land where he enjoys the Indian Teepee in the rural area in An Arbor. I have written "TP" in very large letters but it does not stand for Toilet Paper. It stands for Teepee. Teepee is an exercise by the American Indians, which they had made tents and enjoyed camp fires. I heard that Teepee is enjoyed by children as well as farmers, wood cutters and blacksmiths. He is a very kind person and I'm sure there are many people from various disciplines in the audience.

Anyway, I think that you can ask him a variety of questions, especially about the environment. It can be a basic question or a very technical, sophisticated question. So, we would like to hear Prof. Ness first, and after his presentation we will invite your question. Prof. Ness Please.

## **Lecture**

### **Prof. Ness (Professor Emeritus, Department of Sociology, University of Michigan)**

Thank you for that kind introduction. Yes, I am a lover of nature. Actually I will tell you all what I said last night. Ozaki san visited us and he displayed rather considerable skills as a woodsman. So we were at the Teepee and he went to cut down a tree and then cut up the tree for firewood. So I have said to people if you don't like Mr. Osaki as an advisor on Population, you can always get him to chop wood for your fireplace.

I am always very pleased to come back to Japan. I was here first in 1961 after I completed my doctorate. My wife and I and three children went to Malaysia for

4 years to study economic development. We stayed in the newest, a modern hotel called “Ginza Tokyu” in Tokyo. You have more modern, larger hotels since that time and that is rather interesting thing. It illustrates the points I am going to make sure. Japan’s population has almost doubled in the past 40 years and has gotten much larger. Yet, the condition of the environment has improved and that is a point I want to emphasize. It is also a great pleasure for me to have worked with the great city of Kobe, which I now consider my second hometown. In 1984 we began doing research projects together. In 1989, Kobe has had the urban information center, which has done studies on urban areas around the Asia. I am going to draw on one of those major studies in this discussion.

Let us get on to the discussion. We are starting with population environment relationships. I want you to draw attention to my e-mail address here at the “gaylness@umich.edu”. If you have questions or comments on any of this and would like to discuss these with me overtime, over the e-mail, I would be pleased to have your e-mail messages and respond to them.

Contents
Three Basic Principles.
1. No direct relationship
2. We can find examples of all forms
3. Actions and outcomes are location-specific
Modelling: a tool for examining population environment relationships.
Models are highly simplified views of reality
Models are also <i>constructed</i> to be precise ways of thinking about reality.
Examples of using these models in three cities.
Faisalabad, Pakistan: poor and badly governed;
Khon Kaen, Thailand: Better, but still with problems;
Kobe, Japan: High life quality.

Here is what we are going to look at today. I want to lay out 3 basic principles on Population Environmental Relationship. First, there is no direct relationship

between population and environment and that will surprise some of you. Second, we can find all forms of relationship. Third and most importantly, actions and outcomes must be location specific. I am going to talk about the process of modeling, which is what we did when we studied these 5 cities. Models are highly simplified version of reality. They are constructed to be precise ways of thinking about reality and then I am going to use these models and the studies that we did for 5 cities and give you examples of just 3 of them. Faisalabad in Pakistan is a poor city, and unfortunately badly governed. Khon Kaen in Thailand is a wealthier city with a much better government but still with some problems, and then Kobe in Japan is a very wealthy city and has a very high quality of life.

Let us start with the first observation and the first principle.

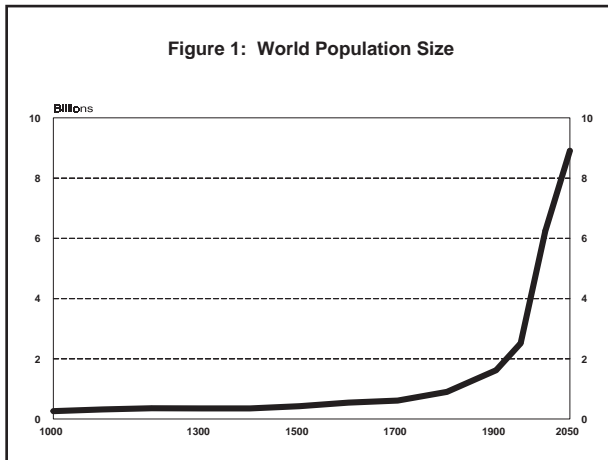


Figure 1 is a picture of population growth during last 1,000 years. The total population of the earth was 250 million people. The population of the U.S. is 281 million. So there are more people in the U.S. today than there were in the entire earth 1,000 years ago. Then we have a very long period of slow population growth and then a very rapid population growth only in the last 50 years but fairly rapid

in the last 250 to 300 years. That is a very common picture of the population over history. If you extended this back 200,000 years, it would not change very much. There was a long period of slow population growth and then very rapid increase in our time of our era. Now that makes it look like population growth has a large impact on the environment.

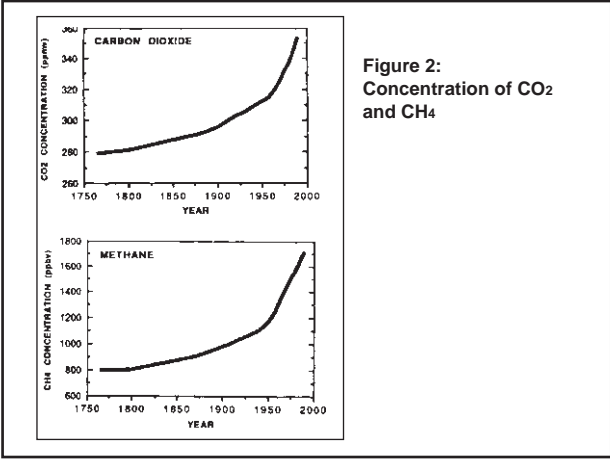
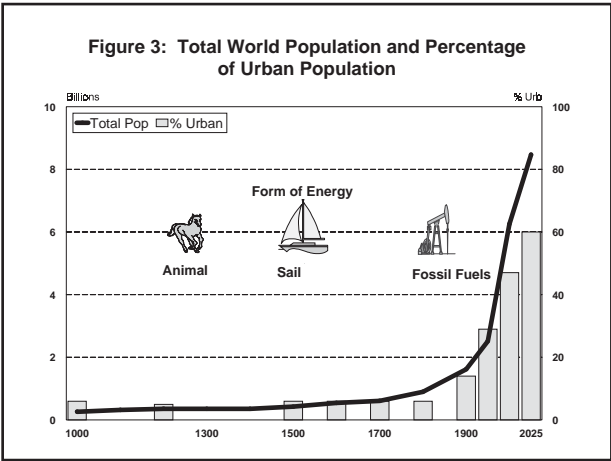


Figure 2:  
Concentration of CO<sub>2</sub>  
and CH<sub>4</sub>

In figure 2, there are 2 major trace gases. These are gases that are small proportion amounts in the atmosphere. One is carbon dioxide. We see that it was relatively low, 280 parts per million back in 1750, 250 years ago and it has gone up very rapidly. Methane is another one; these are parts per billion. The concentration of Methane was 800 parts per billion in 1760. They have gone up very rapidly to where they are today. Now both of these arrows exactly match the arrow of population for this period of rapid population growth. So that makes it look like population growth during global environmental change. If you are not familiar with these trace gases and what they do, they are responsible for the earth temperature. Sunlight comes down to the earth and heats the earth and radiates heat back out into space. If we had no atmosphere around the Earth, all that heat would be radiated back out. It won't be contained in the Earth and the Earth's

temperature will be 0 degrees Fahrenheit. Average temperature of the earth will be 0. All the oceans would become ice and there would be no life on Earth. But because we have the atmosphere here on earth, then these gases trap the heat from the earth. Carbon dioxide and methane and any other gases and water vapor as well bounce the heat back to the Earth. They give the Earth the overall average temperature of about 65 degrees Fahrenheit. Without the atmosphere we could not have life on Earth. It is this atmosphere that gives us the higher temperature and life on Earth. Since the rise of those trace gases exactly matches the rise of population, it looks like population growth is driving global environmental change and responsible for global warming which is certainly happening.

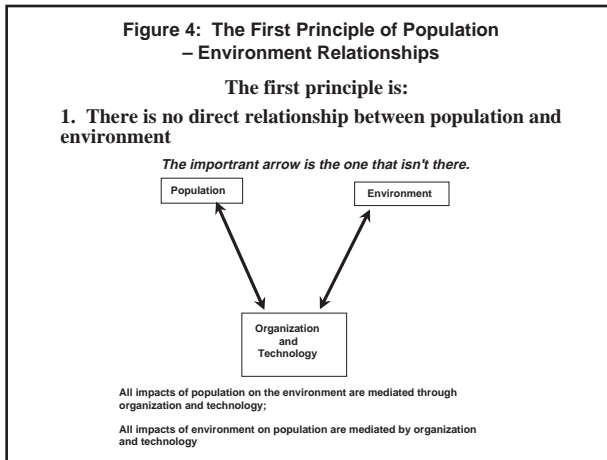


But if we look at figure 3, we can put together this population together with 2 other things. One is technological change in the form of energy. When population was growing very slowly, the main form of energy was animal energy. This was the kind of energy that we had to use to do everything. In the 16th century we developed sails. The Portuguese, Spaniards reached out across the Atlantic, across the Pacific, across Indian Ocean, and had the new world system. But still the population was growing very slowly. Actually we had a slight increase in



population in Asia and in Europe at this point. New crops like corns, beans, tomatoes, sweet potatoes were found in the Americas, and within 100 years they spread all around the world. That raised the carrying capacity and raised population growth here in the 16th century. Before that it was about 1/10 of 1 percent per year. After that in Asia and Europe it rose about 1/2 a percent per year. Just as parenthetical note the effect of that as increasing the diseases on the Americas was disastrous. The diseases from Europe and Asia had been traveling back and forth for 2,000 years. All of the microbes spread through these populations and populations developed some immunity to these microbes. They went to the Americas. Columbus went in 1492 and then many others who followed him brought the European disease to the Americas. It absolutely wiped out many of the population because those populations were vulnerable to this disease and had not developed immunities. So the impact of finding new crops, which was very good for Asia and Europe, was disastrous for the Americas. But it was not until we developed a new kind of energy form called fossil fuels, coal and oil in the 18th and 19th century and new types machines that we really increased population growth. Two things happened with these new fuels. Human productivity increased tremendously. So we can produce much more food and many more goods to support many more people. In addition, the cost of transportation went down incredibly so people could move into urban areas. That increased concentrations in urban areas and these little bars show you the percent of urban population. You notice that there have always been urban areas and some of them were quite large. Beijing was one of the large cities of the world with 1 million people and the largest up until about 1800. But with fossil fuels, a new boom of energy, we can bring more people to cities. Today we have almost 50% of the world's population living in cities. Over the next 25-30 years that will rise to 60%. So we might have the development of a new fossil fuel and technology, a new form of social organization and urban industrial society, move from rural agrarian societies to urban industrial societies. That is what is driving global environmental change

and so this is our first principle.



The relationship between population and the environment is a critical one. It is a very powerful one but there is no direct relationship. The important arrow is the one that is not here. Any impact the population has on the environment will be mediated by some parts of social organization and human technology. There is no direct relationship. There is a very large impact of the population on the environment. That is mediated by some forms of organization or technology all the time. Actually that is very good, very useful, because organization and technology are the things we have control over as human beings. We can make more efficient organizations, more efficient technologies so that the impact of population on the environment can be significantly reduced. If we make a bad social organization and inefficient technology, then the population and the environment will be very large. You will see many cases of that.

**Figure 5: The Second Principle of Population  
– Environment Relationships**

**2. We can find real life examples of all population-environment relationships**

		Environmental change	
		Enhancement	Degradation
Population Change	Growth	Singapore; Curitiba, Brazil	<b>Most Common Perception</b> Himalayan deforestation; Amazon forests; African forests, savannah, etc
	Decline	Thai Gibbon sanctuary;	Japanese and European Alpine rural exodus reduces biodiversity

The second principle is that we can find real life examples of all population environment relationships. I will produce a 4-fold table here in which we look at population change in 2 directions, population decline or population increase. We look at environment change in 2 ways and in 2 places. Environment can be enhanced or degraded. We can fill each of these cells with real life cases. This is the cell that is the most common misconception. We think that population growth degrades the environment. There are many places that it does, the Himalayan deforestation, deforestation in the Amazon, African forest and so on. In many places population growth is actually destroying the environment. We can also look at places where population decline has enhanced the environment. In Thailand the national parks that are sanctuary for the Gibbon, which is a somewhat endangered species, used to have people pressing on the boundaries of the park. Because the Thailand had a very good national family planning program, fertility has gone down rapidly to withdraw a lot of the pressure on those parks. There is considerable enhancement in the environment by population decline. We can also find places of population growth and environmental enhancement. Think of Singapore. I first went there in 1961. It was rather dirty with a great deal of infectious disease, even though it was quite advanced from all Southeast Asia

cities. There was a big deal of infectious disease and it was quite a dirty city. Forest was being cut down in Singapore. Today the Singapore population is not 1 million as it was in 1950-1960. It's 3 million and the environment has been enhanced considerably. Curitiba, Brazil is known as the greenest city on earth. It also has more than doubled its population in the last 30 or 40 years. But the environmental conditions have been greatly enhanced. I would say this is true about Japan as well. I'm going to show some pictures later on of mountains that in 1900 were totally deforested and today are very beautifully forested. Japan's forests are expanding and are growing as are the forests of the United States. That has come along with population growth. And also you find case in which population decline has contributed to environmental degradation. We've seen in the alpine areas of Europe in Switzerland. People are moving out of those Alpine areas. They used to live in Alpine places with fruit tree farms and that produced a rich Bio-diversity. As people move out, the fruit trees go, the farms go and all the Bio-diversity declines rather considerably. You will find the same things in some Japanese rural areas. People want to go out of these areas. We go from a rich bio-diversity with different crops being planted and different animals to fewer and fewer crops and reduction of animals. There is a kind of degradation in some places where environmental populations decline. So, we can find real cases of all relationships between population and environment.

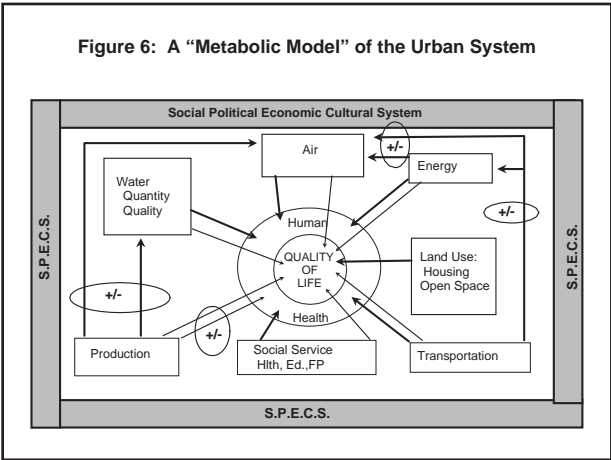
Third principle is that all population and environment is location specific. It depends on geographic climates and land conditions. It depends on what people are doing, how they are organized, what kind of technology they have. It is very location specific. All the results of population dynamics are determined by some specific forms of human technology and that of human social organization. That is good. This means people and their governments are basically responsible for the outcome of any specific population environmental relationship. So people and their governments have an opportunity and responsibility to enhance environments from population growth. I ask you to take this on faith for the

moment; I will try to give you some actual effects of such.

Now in order to look more closely, look at the population environment specifically. We have developed a model and a modeling process. Models are simplified forms of reality and there are basically 2 kinds of models. Using the model that we carry in our heads all the time, we have some understanding on how things work, and what things produce and what cause other things, what kind of conditions in cities cause more crime or less crime. We all have models like this. So when we think about this future, we think this is going to happen in the future because this is the way things are connected. Problems with those models are that there are plenty of assumptions, that we never test and that we never make visible. The other kind of model we have is the ones that we deliberately create. In this case, we are creating dynamic system models. The important thing about those models is that we specify what all these conditions are. We make visible what the assumptions about the course of the relationship are. So if there is any question, we can look at those, change them and discuss them. So those dynamic models deliberately constructed are highly specified, which make visible all of the underlining assumptions. In 1998 and 1999 we did a study of 5 cities. The results are in this block. This is modeling of 5 cities on population and dynamics. It was done under the Kobe group, Asian Urban Information Center of Kobe and our University of Michigan Population Environment Dynamics project. I cannot say more about Kobe, because it has been a while, it has done a very good job over the past 14 years now of surveying of Asian Urban Administration, asking them what the problems are and asking them how they are addressing their problems. Bring some of those administrators to Kobe for training where administration is doing more research.

In this particular study we look at 5 cities. We built a range of cities from the poorest to the most wealthy. One is Faisalabad in Pakistan. Another is Khon Kaen in Thailand. The third is Cebu city in the Philippines. The 4th is Pusan in South Korea, South Korea's major seaport. The 5th is Kobe in Japan. Now in

order to study a model of Population and Environment relationship, we have to answer some basic questions. What is the environment? How do we measure it? How do we get a handle on it? What is population? Don't we know more about that? About birth rates, death rates and migration rates, we know what are good and what cause that? But what technology and organization condition link population and environment?



One way to address these questions is to build a model. This is the model we built. First of all, by environment we mean 4 things, water, air, energy and land use. This is taken from a very excellent piece of work of demographer, Wolfgang Lutz. This was used in the study on population development and environment in the island state of the Marinas almost a decade ago. Here we have what the environment is. Each one of these is an element of the environment. This is a module and we can get quantifiable objective measures of these modules. We have water, water quantity, the amounts of water available and the quality of the water. Is it clean or is it dirty? The amount of air does not change but the quality of air changes with amount of pollution that is in it. We know that has an impact on population. The amount of energy that we have and the types of energy that

we have are very critical things. The character of land use is very important. For this particular study we focus on housing and open spaces. In other studies you want to look at agriculture or forest or all sorts of things but for this method of study we only look at these 2 things.

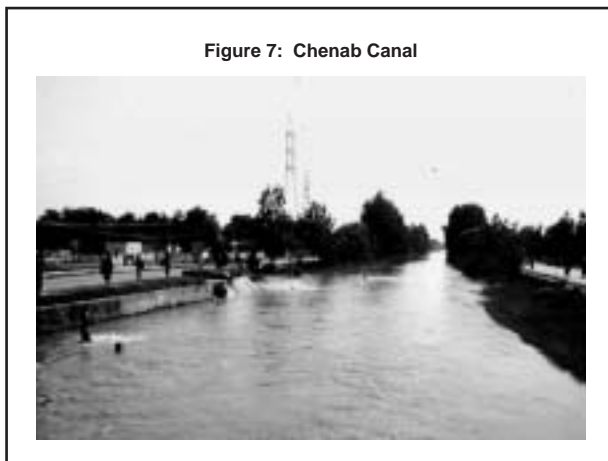
The 3 institutions and things that we look at are the production system or the economy, the social services, health, education, family planning and the transportation system. Why did we choose these? It's because of the urban administrators in many surveys that we had done with them. They told us that these critical things determined the impact on the quality of life and all impact on the environment in the urban areas. Then you see all of these arrows point to a central area, life. That takes to the metabolic character. We call this a metabolic model using the analogy of metabolism. Think of human metabolism. It's the process that gives you life. We inhale oxygen. It goes through the body and changes into carbon dioxide and we exhale carbon dioxide. That is the metabolic process. The outcome of this process is life. If we stop breathing, we die. If we continue to breathe, we live. So think of this metabolic process as producing quality of life. Think of it as a variant of a high quality life and low quality life. If our own human metabolism is working well, we are breathing, we are strong, we can move easily, we have a good appetite, we can think quickly, we have a high quality of life. If the metabolism process begins to break down because of disease or age or things, then we have a lower quality of life. You can say exactly the same thing about an urban system, a human system, rural area, nation or even for the Earth as a whole. So we call this a metabolic model. Now this inner circle is the quality of life, something we didn't know how to measure. There is a kind of subjective quality about it. What is important for you, people in Japan is what is quite not so important for people in the United States or Pakistan or any other country. What is important for people in Afghanistan is maybe not so important for people in Japan. At least at certain levels we are not certain how to measure this. Around that, there is an objective aspect of human quality of life that we call

the human health system. Around here we have whole series of simple objective measure. We have death rates, crude death rates, infant mortality rates, child mortality rates and mortality by specific disease. These are objective indicators of the quality of life. We have birth rate and a series of rate that stands for not mortality but sickness from various diseases. These are things that we can actually measure, and those are the things that we do measure. You notice all these environment and population conditions have some impact in the quality of life. In some cases these are marked positive and negative. The production system can have a positive effect on quality of water, if we have an efficient irrigation system, a very efficient re-cycling system for water. If we have a very good system of controlling toxic conditions in the water, then we will have a high quality of water. On the other hand if we have ineffective water use and irrigation system and pump a lot of toxic thing into the water, the impact on the quantity and quality of the water will be negative. We are saying what determines these things to be negative or positive relationship. This thing is around the edge. We call this social political cultural economic system of the politics, the economics, the government of the city. That determines a lot of relationships between all of these parts of the models. Now with this model we had team in these 5 cities that consists of local social scientists working with urban administrators. They were modeling these cities over the period of 1970 to 2020. That means that they had 25 years, 1970-1995 over which to look over actual relationship between population growth, transportation, air quality, production and water quality. All of these relationships for 25 years can be used to build a model of all of these connective linkages. Then we would project 25 years to the future. In each case we made specific assumptions on how things might hold. Those assumptions could be exploited and they can be examined, challenged and changed. I believe this produced some interesting observations.

Let me begin with Faisalabad, Pakistan. It lies here on the northeastern side of Pakistan. There is the border between India and Pakistan. Here is India. Here is



Pakistan, the border with Afghanistan. Pakistan is a very arid territory. 2-3 inches of rain falls a year and that is coming in July or August. At the same time it is an extremely watered area. This is the great Indus River coming from the snow of the high Himalayas and running into this great plain bowling into the Arabian Sea. That water is what really brings life over that last couple of hundred years first to the British colonial and then to the independent Pakistan government. They did a great deal making dams, irrigation canals and moving that water to the land and allowing that land to be very productive. The question is if it is sustainable or not.



Here is the Chenab canal that is bringing the water into Faisalabad, right into aquifers, a saver area, filling the land up with water allowing it a very productive in agriculture.

**Figure 8: Traffic of Faisalabad**



It is still a relative poor city. It is a big center of cotton textiles but you see the traffic is a mix bag. You see some trucks, buses, bicycles and then animal traffic, quite a few camel carts, horse carts moving through the town. Some of the streets are paved but some of the streets are unpaved.

**Figure 9: Animal Transport**



There is something about animal traffic that is quite exotic looks at times, but it is not very healthy. Consider what Tokyo would be like today. Look back in

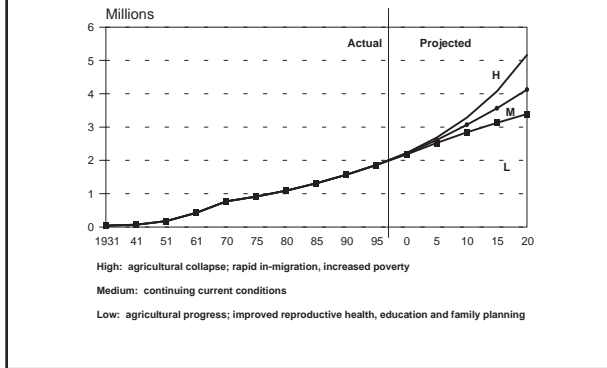
Tokyo in 1900, just 100 years ago. What was the transportation like in Tokyo? Probably it was by foot or by horse. Think what Tokyo would look like today if we had the same ratio of horses to population. If you had that many horses to 14 million people, the entire Tokyo Bay would be tons and tons of horse manure everywhere. It would be swamped by it. With horse manure comes flies. Flies are giving us infectious diseases. So animal transport can be a very dirty form of transport. It is interesting to see, to remember when we got automobiles with internal combustion engines. They were first heralded clean form of transportation. Automobiles don't leave horse manure around, automobiles don't give flies and automobiles don't give us infectious diseases. It is only later that this exhaust could be deadly itself. Gasoline exhaust itself partially with lead in the gasoline could be toxic. We really saw this as a real clean form of transportation.

**Figure 10: Extensive Female Seclusion**



Here Faisalabad a fairly substantial animal transportation is detrimental to human health. It is also a city with an extreme secluded female population. Here is a man on a bicycle with his wife or his sister but completely covered. Women don't go out in the market place.

**Figure 11: Faisalabad Population: Past and Projections**



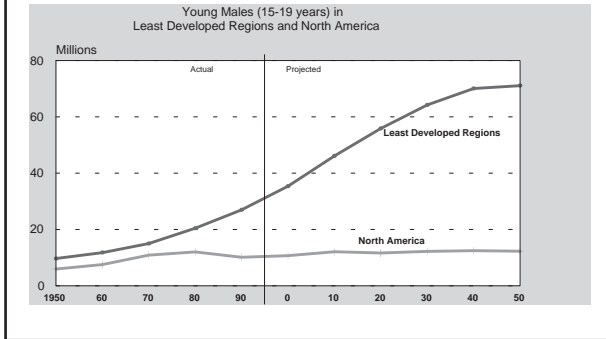
We modeled the population and we had a past history to look at. It grew in 1930. It was up to 2 million. And then we made some projections on how it is going to grow. Those are projections on what we think might be critical population environment relationship. We make 3, a high, a medium and a low projection. The high projections assume that there will be an agricultural collapse around Faisalabad. This is not unusual in irrigated agriculture in an arid climate. This is a very arid climate that during 10 months out of a year there is no rain and heavy sunlight. The water from the canals seeps down to nourish the agriculture. But because of the low humidity and high heat, many of the water evaporate and they leave behind salt. Over the years quantity of the salt in the soil builds up to the point agriculture is no longer possible. Many irrigated societies with arid climates have collapsed. We had one in southwest of the United States from the 9th to the 14th century, which collapsed soil, probably because of the high salinity. If that happens, I think it is likely that agriculture collapse happens. We are going to have rapid migrations of the people around the city and an increase of the city and an increase in poverty so the high scenario is a rather frightening one for Faisalabad. The medium scenario is that they will continue to be about the same as they are now. With relatively ineffective government for things like waste

management, water management, schools, health services, it is not a very effective government. But we think other things are possible. We could have more agriculture progress. You can improve crops and the land, treating the land to reduce salinity. It might be possible, certainly possible but I don't know how probable that the Pakistani government would be more effective in health education and family planning. Here is an area where foreign assistance can help a great deal. Pakistani government is not very effective. If this happens, then we are likely to see a reduction in fertility, population growth and an increase in the quality of life. It is possible. There has been in this area both population and environment stress. First of all, irrigated agriculture was a marvelous thing in the 1900's and most of the last century. It opened up new land and lots of people came into those new lands and produced many goods. But they also encourage high fertility. It was agricultural situation that encouraged high fertility. So family had 3-4-5-6-10-12 children. When you have so many children and the father dies, the land has to be divided among them. That gives us fragmentation and it undermines agricultural productivity. So we have 2 things. I am looking that an increase in the soil in fragmentation from high human fertility is pushing people of the land into the cities. In addition we have a population growth that sustains the stress in the environment. The sewage and waste management is very weak and the sewage system is being repaired now. But in the couple of months in the summer July, August, if you have a few days of heavy rain, the entire city is awash with raw sewage with human sewage and it is a terrible and an unhealthy place. The urban health and education system are very weak. Unfortunately the Pakistan government is currently unable to provide services to its population. So the most part of people have given up depending on government. Private services of all kinds are growing rapidly in education and in health. More seriously, there is an age problem when a population is growing rapidly. Its overall age is declining, because more and more young people are coming into that system. One critical character of those young people is the age 15-19. This is a group who is very

energetic but they are very volatile. Their numbers will certainly grow today. There are about 8 million of these young men in Pakistan. In the next 20 years there will certainly be 12 million. The question is where they will get education and jobs. If there are no jobs or school for the most, then what will they do? We know what they are doing now. They are going into Madros or religious schools teaching them to kill others. President Musharraf, if you have been reading the newspaper, is making a concerted effort now to turn away from violent religion to make it an Islamic welfare state. We can all wish him a great deal. We can all potentially provide him some orchestra from the outside that population growth in the young people produces a tremendous instability between Pakistan and India. That is a very serious thing.

Let's say little bit more about these young males. Why are they important? As I said they are a highly volatile population with great energy but they don't have much experience. Lots of testosterone hormones are pumping the body away but they have no experience. So they tend to feel immortal. Nothing can hurt them. Infantry sergeants love them because they are "Gung Ho" over everything. They can be mobilized to do wonderful things. We find some of the most heroic acts the most ultraistic among these young people, but they are also the cannon fodder of demagoguery. If you watch any of the Hutu-Tutsi riot and genocide in central Africa, it was young males with mandates that hack others to death, hack women and children to death. You see in the race riots in the United States, young males smashing the window and burning the cars. Young males are very volatile situation. In some cases, think about Kenya today. Daniel Arap Moi, very corrupt president is sending those young boys miles away as cannon fodder to destabilize oppositions to stay in power. Young males can be very dangerous.

**Figure 12: Population of Young Males (15-19 Years) in Least Developed Regions and North America**



I have just made a comparison with young males going into the least developed region. That is about 50 countries that include most of sub-Sahara Africa and places like parts of Afghanistan, Bangladesh, Pakistan, the least developed countries of the world. Already the populations of these young males are about 30 million. In North America that is the United States and Canada, it is leveling off at about 11 million. It is not going to grow. Here it is going to grow to 70 million before it level off. Where are they going to go? Where are they going to get education, get jobs, prospect for a future? They are many. Many of them are very destabilizing here. Of course we know how to deal with that. We know that if we promote good family planning progress, the fertility will decline very quickly and this will solve the problem. That is in the future.

Now let's turn into Khon Kaen in Thailand. It lies in the center of northern Thailand. Thailand is a great center of Southeast Asia. Chou river makes this a very rich rice growing area. It runs through the Northeast high plateau, two, three, five hundred meters above sea level, sloping down into the great Mekong river. It is well watered by a number of rivers that run through. It has been a poor area. But it has been rapidly developing. Khon Kaen itself has a new effective university and the government has a lot of money. They are making it the heart of the

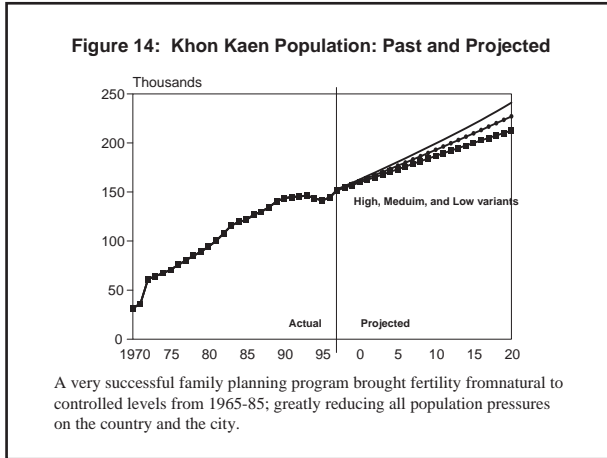
Northeast. Compared to Faisalabad, its transportation system is really quite good. You have instance of lively traffic, buses, trucks and cars. One of my friends in Thailand tells me that Thailand has the most pick up trucks than any other country in the world except the United States. They use this pick up truck as bus to pick up people in the rural area. Thailand is still extremely rural population, 30% of the people live in urban areas. A lot of the people live in the rural areas commuting into town. Roads are paved and there are no real traffic jams.

**Figure 13: The Road Map around Khon Kaen**

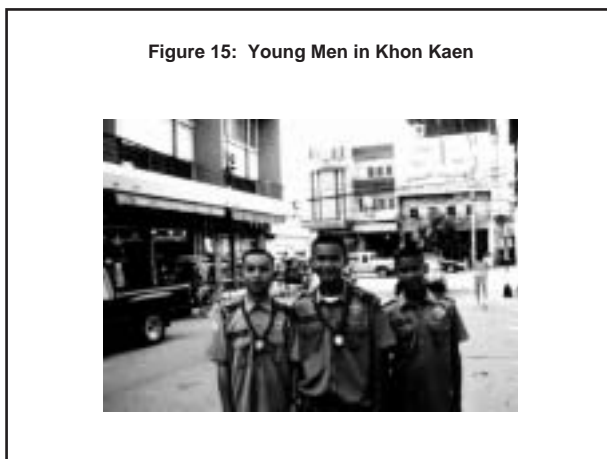


The reason for that is the government's transportation policy. These major roads lead from Bangkok via Nong Khai across the friendship bridge into Vientian. On all of these roads the government has built bypass roads around town. So the truck can bypass the town and they run from north to south, from east to west. There is another case in Vaduz Kein when you see the bypass road around the town. So you take the heavy trucks out of the town. It is a simple transportation policy the government has made that increases the quality of life to a better transportation system in the city.

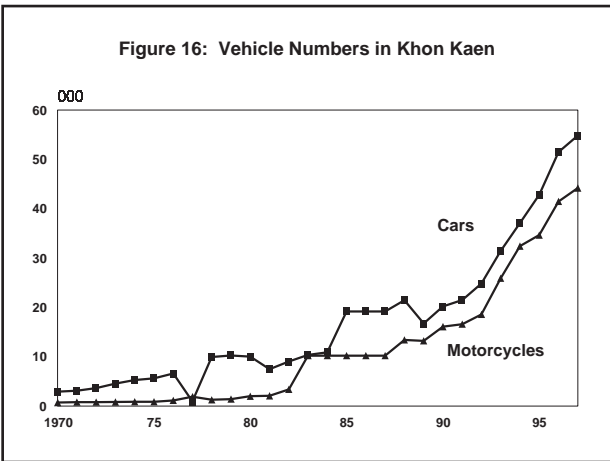




We have a model of the population growth of the city. In this graph between 1970-1972 they just redrew the administrative boundaries and made it larger. Thailand as you know has had an extremely successful family planning program. Fertility levels went from 6 or 7 children per family as late as 1965 down to today to just below replacement levels. That was a secret of a national family planning that got assistance from JICA, USAID, UNFPA and a lot of international organizations.

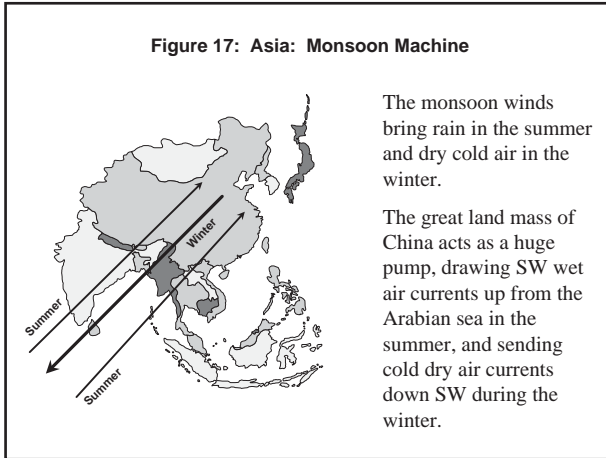


Here are the young men and their 2 things that stick out are, well I took this picture in Khon Kaen, they are dressed in scouts. They are mostly all in schools, in scouts. They have reasonable chances of jobs so they are not going to be a destabilizing part of the population. They are well controlled and developed because they are looking ahead. In addition to that, their numbers are declining. In 1985 there were 3.1 million in all of Thailand. Today there are 2.8 million and that will continue to decline in numbers. It is easier to provide a better education system for them, better jobs, better organizations for them.



Now as almost all cities the number of cars and motorcycles are climbing. This is not a model. This is actual data from the past. That raises the question. What does this do to air quality?

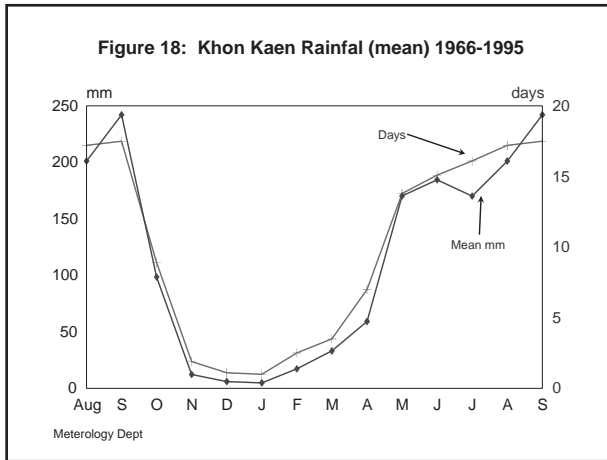
**Figure 17: Asia: Monsoon Machine**



The monsoon winds bring rain in the summer and dry cold air in the winter.

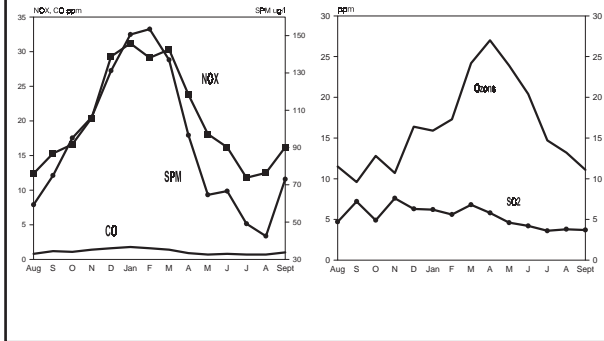
The great land mass of China acts as a huge pump, drawing SW wet air currents up from the Arabian sea in the summer, and sending cold dry air currents down SW during the winter.

Here we get back to the location specialty of population environment dynamics. It depends on what is going on in the local situation, on what is happening here. Of course there is the great monsoon. Here is the great Asian monsoon machine. It starts in China's great landmass. In the wintertime it cools down the air about that landmass and cools down and gets heavier and it settles down. It pushes air out across the landmass down south to the Indian Ocean and to the sea. It brings relatively cool and very dry wind across the Northeast of Thailand and parts of India and Southeast Asia as well. In the summertime when the air over this landmass heats up and air above it warms up and rises and pulls air in. It pulls a great bit of air from these very large area in the Arabian and Indian Oceans down in the south. They bring along with them a great deal of moisture that dampens the land here and gives us the monsoon season.



When that happens, look at what happens to the rainfall on a yearly process in Khon Kaen. In the summertime the line is the number of days when it rains per year. In the summertime August through September we got almost 20 days of rain in a month. We got almost 20 days of rain a month. It rains every day or almost every other day and the amount of the rainfall becomes as much as 250 milliliter when it stops. They start going in the other direction and the number of days of rain decline and the amount of rainfall during the winter when we are getting those big dry cold air mass coming from China. When spring comes, this big air masses starts to rise and pull the water of the Arabian and Indian Ocean and we get rain again.

Figure 19: Khon Kaen Air Quality: The Monsoon Impact



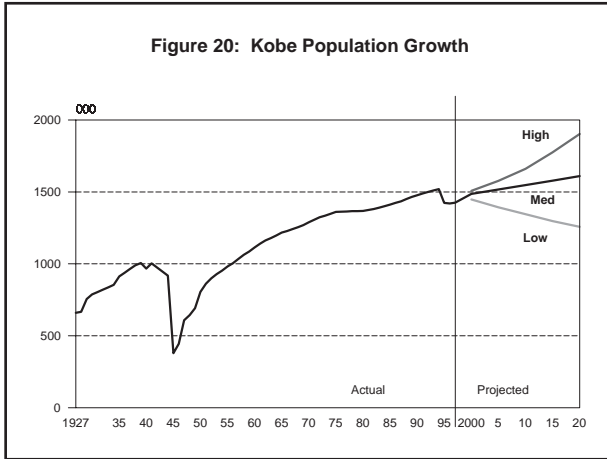
So here again is the location specificity. What happens to the air quality is very much a function on how much rain there is. Here you can see these 3 particular measures of air pollution, suspended particular matter, dust and dirty stuff that comes out of engines, nitrogen oxide and ozone. That is produced in part by transportation. As you can see in the summertime when the monsoon is on, the air is washed almost daily by the rainfall. This is very low. In the wintertime it goes up high and then comes back down again in each of these cases. So location specificity is an important principle. Now we don't know what if this is increasing all the time because they only have one year of measurement. We are trying to encourage them to take more measurements so we can see what is going to happen.

Finally let me look at 2 countries Pusan, South Korea and Kobe, Japan. I am only going to deal with Kobe. Both are modern well-developed cities that have emerged like something like phoenix, from the ashes. I was not here at the time but I have seen pictures, aerial photos of Tokyo and photos of Kobe in 1945. Bombed down, burnt out, absolutely flat and today Kobe is a wonderful, beautiful rich city. They rose from the ashes giving themselves a better quality of life as does Tokyo. They have a very high quality of life, good government, good services and all of the people. That is a good metabolic process to include a high quality of

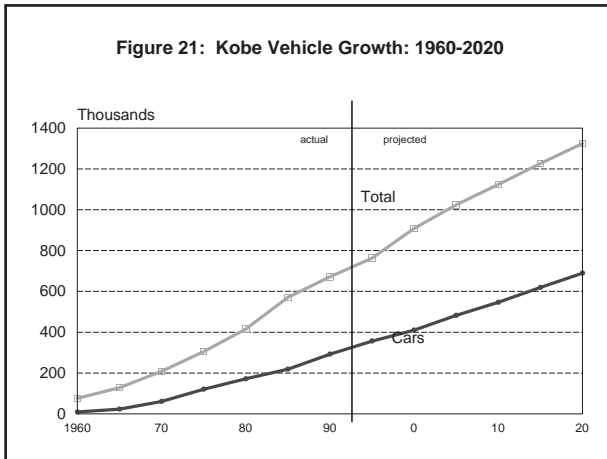
life. Can they sustain it? I am not sure. Let us look and see what happens.

First, Kobe has 2 major geographic advantages. It lies here on the north part of Osaka Bay up against the Rokko mountains. One thing that happens is that Japanese current comes through and passed west central Japan. At this point, you know it merges with Taiwan and moves northward and a partial of the current goes to the Japan Sea but the major portion goes along Japan and up to the Aleutians Island to the United States. And then it moves at 2 to 4 knots per hour. Moving this way it pulls pollution from Osaka bay out into the ocean. That's a geographic condition. That is very favorable for Kobe. Another is the wind. Most of the winds come from the Northern mountains and flow out to the sea, so what little air pollution is. It generally goes out to the sea. The winds that come from the west blow it over to Osaka, so Osaka has Kobe's air pollution problem. The difficulty of area is that the Mountains hem Kobe and I will show you in a minute. It is a city 20km long by 4 km wide with no place to go. So they devised a scheme called the mountains to the sea project, absolutely remarkable engineering feat. Actually they chopped off the top of these mountains and made new towns up in the mountains. So that lots of the populations would move up to these new towns connected together by this very effective mass transit system. They took the fill and dropped it into the sea here, to make an island, Port Island, and then make another island. Here you can see better picture of this little shelf of land that is hemming Kobe in. They cut down and took the fill from these mountains and took them and lay them down into the sea and made Port Island and Rokko Island which are very, very effective for shipping and making Kobe a very efficient seaport. They are providing new housing, 20,000 apartments in both places and allowing population to move out into the mountains and out into the island, redistributing it and making much higher quality of life. That was an impact of government policy done for the land policy and for transportation. Here is another picture of Port Island and you can see Rokko Island Mountains that go up for 1000 meters. I will say just another point about this. In 1900 only a few years

after Kobe was established as an open port, these mountains were absolutely bare of trees. They were weathered limestone mountains. All the trees were cut down for wood for fire, wood for houses and so on. These were gleaming white, almost like they were snow covered. Of course when rains came, floods came down from the mountains, increasing erosion. It was a very bad situation. Then the government, not only the Kobe government but also the national government, turned its attention to these. This is part of the Seto Inland Sea National Park. Reforested marvelously, there are rich forests all over these lands. They provide not only a nice place for recreation, people walk into the mountains and have very nice times but also they provide 2 very fine important things for the environment conditions. One of the most important products of the forest is not the wood that a forest has. Most people think you cut from the trees, you got a good product from the forest. In fact the most important product of a forest is water. These forests are protecting from the rains. The rain seeps over the soil and then moves down into the sea. They clean water and one of my favorite sakes comes from Hanaguri water, which is produced in Kobe with the fine water that they have. The next thing is it gives oxygen into the city. Trees are like the lungs of a city. They take in carbon dioxide and give out oxygen and so they make the air cleaner for the city. Here is part 1 of the transportation system. The islands are connects to the city by an electric train system. That is very efficient.



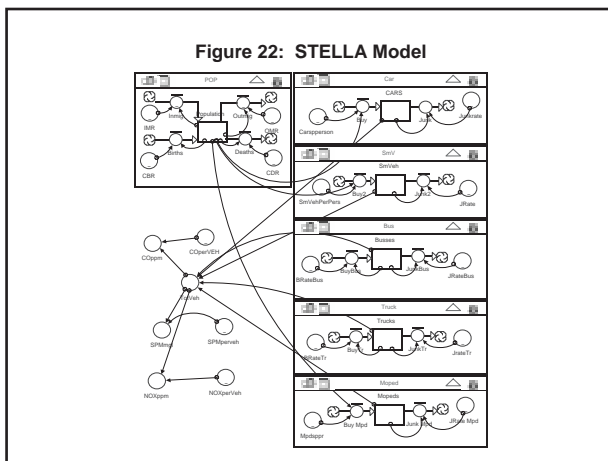
Here is the past history of population growth. You can see the effect of the world war II. There were I million people there in 1940 and it went down to 440 thousand and they comeback very quickly after the war. You can see the impact of the earthquake in 1995 and about 100,000 moved out of the city. We think it is going to grow very slowly in the future.



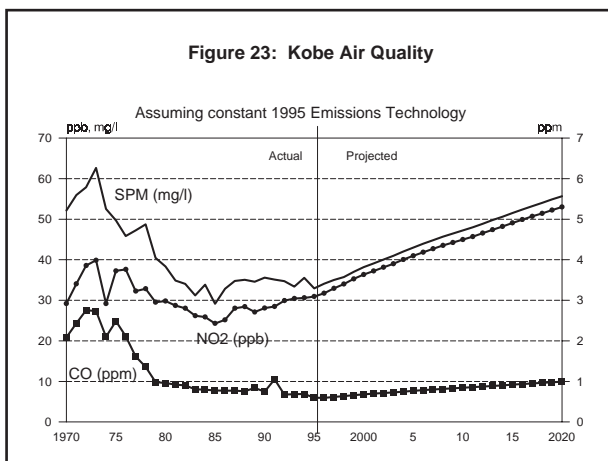
Automobiles will grow. Back in 1960 there were 35,000 to 45,000 in the city.



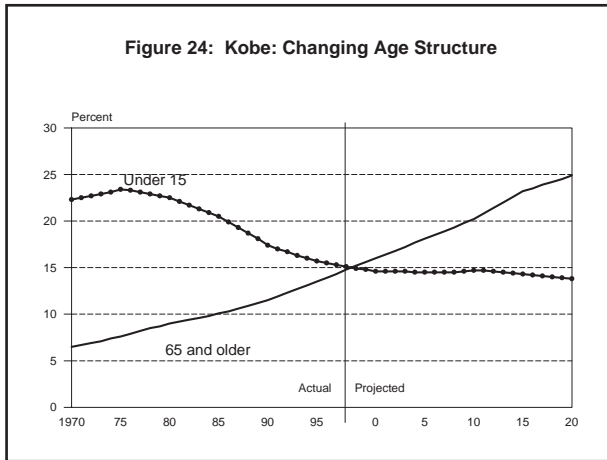
There are about 300,000 today. Using our model, we project that it will grow up to 700,000 in the next 20 years. What will that do to air quality?



This is the model we used. it's a computer program called "STELLA model" that connects population to total number of vehicles to air quality and gives us this result. This is a model of air quality that we can link to population, to transportation system.



Suspended particular matter, nitrogen oxide and carbon monoxide were relatively high in 1970-1975. It began to come down even though the number of cars was growing very rapidly. They came down because the technologies of emissions controls were increasing. We were getting cleaner and cleaner cars even though we were getting more and more. At this point we begin to look at the future. Here is a very important assumption we made. If we get this current projection, now the number of automobiles with the current emissions technology with no change in technology in automobiles emissions control, if that happens, then the suspended particular matter will rise. We know very clearly that the death rate increases when suspended particular matter rises. There are many studies that show there is a fixed relationship. For example 10 micrograms increase in suspended particular matter, we get a 1% increase in the death rate. Studies have shown this in many places. Therefore we can calculate that if the emissions technology does not change, the automobile increase, we will have 10,000 more death between 1995-2020, then we would have had. We have discussed this with urban administrators, urban engineers. They know this very well and they are saying the emissions technology is already changing and it will change a great deal. We already see now Toyota and Honda hybrid cars that produce very little emissions. We can firmly guess over the next 10-15 years. We will have a major transition of hydrogen fuel cells and we get "0" emissions. They are around in time. But it is important, as a model to be able to show urban administrators if something does not change, this is what will happen.



The more serious problem lies ahead. This is the change in age problem. Back in 1970 more than 20% of the population was under 15 and only 5 or 6% were over 65. When we did this study, they were equal. The older population will be growing in 20 years, you will be an older population. The younger population is declining and that is a problem in all of Japan not for Kobe only. It is also happening in Western Europe and a problem in the United States. In sometime in the future immigrants are going to have to come. There are not many signs of that. That ends the illustrations.

Let me summarize the lessons. First we know that wealth pollutes, wealthy countries pollute more than poor countries, but wealth also promises environmental protection. Kobe has sufficient wealth to produce very clean technology, and therefore Kobe is better to protect the environment. We found that slowing population growth has paid large dividends. That is very important because that is something we do know how to do. Japan has provided tremendous support in the last 30-40 years. Population progress from one of your private organizations JOICFP, one of the leading supporters of family planning, helped to reduce population growth. When you reduce fertility, a lot of the pressure on the environment is withdrawn. Population and Environment relationship is a major

output leading to a better quality of life. Wealth of course is the major determinate of quality of life. Something like political culture plays a role. These social, political, cultural and economic systems differ but they affect the capacity and society transforms wealth to welfare.

Finally all population environmental dynamics are location specific. If you want to do analysis or you want to intervene, it must be done at the local level. Thank you very much for your attention and interest.

## Questions and Answers

### Mediator

Thank you very much Dr. Ness thank you for your comprehensive and also very specific presentation. I am sure that many of you have questions you would like to ask. We would like to have a round of questions first and then perhaps Dr. Ness will answer this number of questions in one lot. Please do go around with questions.

### Q1

I think that I am very fortunate to have this opportunity to hear Dr. Ness's presentation today. Fortunately we had worked together on that "Stella" project. So I was able to understand the presentation quite well because of that short background. But there is a question that popped into my head while listening to your presentation. Now this population problem and the environmental problem that we are faced with, as you say, are both very difficult issues to resolve. However I think perhaps they are not related if we just think not being overly complicated, but also take in different prospective approach. One could see that in the 20th century the whole problem of population and environment really were treated as 2 separate issues. Here in Japan people treat population issues and environmental issues separately as well and they did not really think about the relation between the two. There has been the part of us here in Japan trying to correct these 2 things. However, theoretically speaking, even if there may not be any direct relationship, there is relationship by thinking in reality. When we look at the medieval period or ancient period, I wonder what sort of problems the world had. I wonder if they had any relationship between population and environment in the medieval period or ancient times. Considering the way people lived in ancient times and the lifestyles and the environment issues, you see that people do live within certain environments and depending on various environments. They decided

what to do, what sort of productive activities they were engaged in, whether they were starting agriculture or fishing or a life of collecting berries. So I think depending on the environment you changed your mode of life. We human being tried to maximize that ability to adapt to the environment and the characteristics of certain locations. That is the wisdom of humanity. We have to live by the carrying capacity of the area in which you are living on. I think what enable up our species are continued existence. When we look at the current, present population environment issue, the problem that we have with the environment is very much raised by the confrontation attitude or the relationship between people and the environment. I think that was not the case in the past. People lived within the environment whereas today people are confronting the environment. There seems to be a struggle between populations and the environment. Since in the past that was not the case, the relationship between people and the environment of today and ancient times are quite different. As Prof. Ness mentioned, I think the environment is location specific but at the same time the environmental problems we have today are global environmental phenomena. If that is the case, when you think about the relationship between environment and population, you have to look at it from the perspective of the entire human kind and the environment. It is an area specific but at the same time we need another perspective, which is the entire world and human beings, global environmental problems and human beings. Now the relationship between human kind and the environment should not be confrontational, adversarial relationship. That is not what we saw in the past as I said. Human beings adapted the environment in that kind of attitudes, which are perhaps what are needed now. I do agree it is area specific but at the same time we do have to think about the whole globe, the whole earth, the whole of humanity, how and what we should do in order to secure the survival and continuation of human kind. I don't think this has been pointed out very frequently, but it occurred to me while listening to your presentation.

## **Mediator**

Thank you very much for the question. It is a far-reaching question that was raised. Are there any other questions or related questions from anybody else? As you think about more questions and you may have more specific questions later on, but perhaps Dr. Ness could answer that question now.

## **Prof. Ness**

You gave me excellent comments and excellent questions.

Let me take the first one. You noted first of all that recently population people, environment people, who consider population and environment problems, have not considered the relationship between them. I think that is quite right. One of the problems that we have in development, the whole area of government, is the problem with specialization. On the one hand specialization is necessary. Think of the sciences and the specialization into astronomy, biology and then within biology, there are organism biology and microbiology. Currently there is more and more specialization because it helps build stronger theory and better technology for observation. Specialization is necessary. But on the other hand, that specialization puts blinders on us. We cannot see things on the other side. So what we need to do and something that we have been working on for the past many years are to build bridge between specializations. I think that it is quite true that many environmental organizations in the United States did not want to touch population. I have not an idea of what this means. In the U.S. population is a controversial issue. It sometimes means family planning and abortion. We have an extremely right wing and it opposed to family planning, abortion and all kinds of good things, and many of the environmental organizations did not want to touch population, because they would get pulled into this conflict and lose a lot of their popular support. At the same time it is absolutely obvious that people who are trying to protect the environment through National Parks and National Forest and protected areas do have to confront population problems, because

there is population pressing upon those national parks borders. They have had to do that over the past 10 years. There is a great increase in environmental people being concerned with population's issues. On the other hand Population people have one narrow group of demographers. They look at birth rates, death rates, immigration rates, number of people, rural/urban differences, age, sex differences and that is all. They have not wanted to deal with environment problems. Demography is a very powerful technology. It can do whole lots of things without talking to environmentalist but it cannot understand how population can affect that environment. Population can affect it less than it could. We have been trying to bring some specialists together and to talk to one another and to teach to one another what they know, how to get together. I think that is increasing successfully. There is more and more involvement in organizations that are talking population issues. More and more population folks are looking at environmental things. Here I must say 2 population organizations in particular have very interesting visions and are very effective. They are UNFPA and the office of population in USAID. Both of these offices have been very flexible to look at the relationship between population and other things. Both of them have prominence in women roles, population and development, population and environment, population and migration and a whole series of them. Unfortunately they have not kept in other agencies in USAID. The environment people do not care about population at all. They just do not want to deal with it. They have enough things to do for themselves. But the population offices have been supporting population and the environment. UNFPA supervise this excellent work by Wolfgang Lutz in 1994. It is the first major study of population environment dynamics. On excellent one, UNFPA reached out to other things. There is also something different about these 2 organizations compared to all those that surround them in USAID. USAID is a typical government organization, typically male dominated. Maybe 10-15% of the professionals at USAID are female, all the rest are male. In the United Nations it is even worse. United Nations is a major bastion of male chauvinism. Women



hold only 2% of the professional posts in the United Nations. But in UNFPA and in the population office of USAID women hold more than half. So these are 2 organizations that are very interesting. These flexibility and other visions to look at different issues also bring women into much more powerful positions.

You say that there may be some relations between population and the environment. There is. This is a problem I face often. My point is not that there is no relation between population and the environment. There is a great population impact on the environment. There is a great environmental impact on population but it is not direct. Some form of organization or technology mediates it all. When the technology changes then things do change. You mentioned the confrontation attitude that is something many people say. It has attested from Christianity and Protestantism, particularly out of Protestantism, which joins people to overcome the environment to turn the environment into something that is productive. I think that maybe there is something to do with that. At the same time if we go back to mid-evil period, people were not necessarily struggling to protect the environment. This is the time when they were cutting down all the forest in Europe to turn into agricultural land. Because population was growing and then we had this huge change in the agriculture scene. Starting in the world after 1492, after Columbus went to the New World, we began to pick up crops from the New World, brought them back to Europe and to Asia. That was a marvelous change on agriculture technology. It brought potatoes, beans, tomatoes, sweet potatoes, turkeys and a whole series of things that came from the Americas to Europe and to Asia. It raised the carrying capacity, because you have a new agricultural technology, which was really quite remarkable. Do we have a completely confrontational attitude today? I am not sure. I think one can still see that and still see many businesses that simply do not look at the impact they have on the environment. But I don't think that we have had in the past 200 years as many powerful groups, powerful organizations that were concerned with the environment protection as we have today. We have governments now that has environmental protection

acts. We didn't have that 100 years ago. Theodore Roosevelt actually started it 100 years ago. President Roosevelt started the National Park system and National Forrest system that were big pushes towards protecting the environment. But over the 30-40 years in the United States and throughout the world we have new powerful organizations that are trying to teach us that we have to balance our relation with the environment. We got developing guideline with development and population. I think that is something we can draw some conclusions. I tend to be optimistic about everything. The sky is not falling down. I know it is going to stand.

But I do think we should see this environment, a solid movement of people, grass roots, government, and non-government organizations. Organizations are pushing for a less confrontational attitude and a greater acceptance. I understand this local phenomenon. There was a question on location specificity and global effect. Absolutely the whole business of environment regulation is a global business. We pump a great deal of carbon dioxide out in the air in the United States. It does not just stay over the United State. It is part of the worldwide climate system and it is driving the temperature up. We are probably going to get some increase melting the ice caps in Antarctica. But certainly in the Arctic the ice sheets are melting and we could get an increase in the sea level. That probably will not affect Japan much because you are out of the sea but think of the Maldives. They are going to disappear and that comes from carbon dioxide emissions from the United States. You can see that some of my colleagues in the Arctic monitor pristine, absolutely pure kind of snows, except they include all kinds of heavy metals from industry in Europe. The lakes in Norway are turning into acid from sulfur emissions from the United States and England. So there is a global impact there. It's true. At the same time we are doing something about this. The action has to be location specific. Some 20-30 years ago, a series of environmental protection acts were passed to reduce the sulfur emission in a whole series of factories. We have at the University of Michigan a biological research station up

in the north of Michigan and we have had that for 100 years, measuring all kinds of things for a long time. Over the past 20 years, we can see an unbelievable decline in sulfur emissions and sulfur deposits on the land, in forested land in the North. That is because the government pushed the industry in the mid-west and Chicago. It was one way to reduce the emissions, so we pushed them on a location specific way to clean this up. That would have a large impact on the global system. Yes it is a global problem but I think we have to attack that global problem with very location specific kinds of activities. I think I covered the points. Thank you.

## Q2

Thank you very much Prof. Ness. I really enjoyed your presentation. This is going to serve as a policy model, speaking about the first principle. Now in Japan I have gone around the rural area in the country. There is the very close relationship between the roles of the women that I am fully aware of, as you know. The situations of the rural areas are changing on a daily basis and we support population issues very aggressively. For example, around lake Biwa in Shiga Prefecture 30 years ago women took part in the movement to produce soap from waste oil. And also in Minamata City right now, it is said that it has become “reborn” thanks to the efforts made by the women. So classification of waste into 23 kinds of waste has been carried out and they provide fertilizer from the waste. The so-called rainbow plan in Yamagata Prefecture won the Prime Minister Award. It had the participation of women. The garbage and the domestic waste were collected to produce fertilizer and this produced plants that were used as food for catering services. So I thought the countries especially with women playing a central role were tackling our environmental problems in a very aggressive manner. So that being the case, population and women have relationship. I believe one of the major sub-components of rehabilitating environment exists between population and environment. Prof. Ness, what do you think about this?

## **Prof. Ness**

Thank you. It is delightful to see you here. She was my student many years ago. I have not seen her for a long time. It is very good to have this issue of population and environment and women's role. It is very critical and what you have discussed here about women is a major force at the grass roots level, organizing and pushing for a cleaner area. Of course we need everybody to do this. In so many societies women have been pushed aside, sequestered not being listened to, paid less for everything. We all pay the price for that. I think of the great communist slogan, which was a slogan "women hold up half the sky". Unless we get to a point where we get greater gender equality, we are going to be poorer for them. Now gender equality is something that is gaining momentum and moving along. Remember it was not so long ago, I don't know when women got the right to vote here in Japan but it was in 1922 in the United States. It was not until the late 1970's in Switzerland before women got the right to vote. What is wrong with us? Why can't we see that women hold up half of the sky and that they must share with us all the power, all the authority and all the responsibilities? I don't know what it is in Asia but I know that in the western world. I think the religion coming out of the Middle East have decided anti-women bias. You think of Judaism, Christianity and Islam, if you look at the book of Genesis, the first book in the bible. Here is the Garden of Eden, God tells Adam and Eve you may eat all the fruit from all the trees but you may not eat the fruit from the tree of knowledge. Well the snake came along with an apple from the tree of knowledge to eat and she took a bite and gave it to Adam, God was furious and he threw them out of the Garden of Eden. What Adam said was "Why did you do this? It was woman's fault. Women made me do it." What kind of a religion is this that makes women responsible? And then if you look at when Moses is getting the laws from God, God tells Moses if a woman has a boy child, she is unclean for 7 days in certain ways and unclean for 30 days in other ways. If she has a female child, she is unclean for 2 weeks and for 2 months. What kind of religion do we

have? That puts women in that position and of course the most fundamentalist parts of most of any religion, Buddhism, Christianity and Islam. The anti-women sentiment is very profound. You saw when the Taliban took over Afghanistan. They kept women out of school and kept them covered and don't allow them to do anything. What kind of religions are these? Well we are struggling to be more liberal in all ways. I think we have made considerable advances, but we still have a lot to go. The kind of things that you are talking about demonstrate how important it is to be much more open to equilateral society to allow women to do the kind of organizing that they have been doing. They have done a tremendous job here in Japan and we just hope we will allow it to be done in other places. I think you are quite right in that point.

### **Mediator**

We have only 15 more minutes left. I have a question that I would like to ask but we can have 2 or 3 more questions from the floor.

### **Q3**

Thank you very much for your interesting presentation. Now you talked about population and the environment particularly focusing on urban areas. I have 2 questions, 2 points that I would like to rise now. In urban areas in Khon Kaen, around the cities you have slum areas. When the population concentrated in urban area, the areas surrounding the urban center were formulated. These slums have various problems having to do with bad sanitation and so forth. What was it like in the rural area? Which sort of things compelled people to move into the cities? Now also the topography and various environmental factors have a big impact, you said. But in major cities around the world, Bogota and Tehran are in the tail end. The air pollution is very bad there. According to your own experience in this region, in this plateau basin, what is the relationship between population and environment? You focused your attention on air, however, in the water source

area in Yemen, if the population continues to grow at the same pace, there will be no water available any more. So there is water scarce area. What is the relationship of population and environment like in these water scarce areas?

**Prof. Ness**

We focus on the urban areas for a variety of reasons; one is that urbanization is on the move. The industrialized countries are already highly urbanized. In Japan 90% live in urban area, in the United States 80% live in urban area, in all of Western Europe 80% live in urban area. Urbanization is growing very rapidly, in Asia and in Africa. In 1950 there were only 244 million urbanites in all of Asia. That was 244 million, twice the population of Japan today. It is less than the population of the United States today. In 1950, this was all of the people living in urban areas. It is going to grow up to 2.6 billion in the next few years. A tremendous change happened in urbanization here. This is happening in Africa, too. The urban area will be very important one for the working out of population dynamics. There is a very interesting thing I have used in other places. Maurice Strong who was the Chairmen of the United Nations Conference on Environment and Development in 1992 in Rio said, “The future of sustainability will be lost in the cities of the world”. That is why we are focusing on cities. We call the model that we have Urban System, but you can use this model in rural areas as well. You can apply this model to a rural agricultural district. You can apply it to a province or an ecological area or water short area. When you do that, maybe you should adjust these modules as I pointed out once before. When Wolfgang Lutz did the major study of the Marinas, they had all of these modules for water, air, land use, but they didn’t use the model for air because air pollution were not a problem for the Marinas. All the winds and pollution are blown out to sea. So they just left it out. Again we come back to location specificity. We should develop a model that is specific for the area. We are working on and we can do this in rural areas as well as urban areas. And then we would put other things. We are working on most

rural areas. We would certainly like to include agriculture in the land use part. We want to put other kinds of system here. We can do this. Of course, in many areas water is very critical. As we have seen in these parts, it is not a critical problem for Kobe. It is not a critical problem for Pusan. The quantity of water is not a problem for Pusan but the quality of water is a problem for Pusan. It is down river. It is at the mouth of up down river. It draws most of its water from that river. But up river from there is a major industrialization zone. Government is pushing industrialization and all the toxic effluents and all the toxic waste are being dumped into the river and they end up in Pusan. Pusan has to spend money to clean those up. Water quality is a very serious problem. In Khon Kaen it is not a very serious problem. In Faisalabad it is a very serious problem. They have got enough water but it is destroying the agriculture. In places like Yemen or a lot of Eastern Africa there are water-stressed areas. As population grows, they will become even more stressed. That is something we do know. Water is a very critical issue. It is very difficult to know what is going to happen in Israel and in Palestine. Over the next 20 years they will absolutely run out of water. Water is already very short there. Because of the political situation, the power of the Israel and the lack of power of the Palestinian, the Israelis taking most of the water available and leaving very little of it to the Palestinian. Some people argue that over the next 20 years the major conflicts will not be over oil not over land but over water. Think about the Nile River. That river in eastern Africa comes through the Sudan and the Ethiopia and down into Egypt. The struggle for control of water on the Nile will be very serious potential for high degree of violence. The Tigris and Euphrates rise in the eastern part of Turkey. Turkey is damming those rivers to provide more irrigation for itself. But there is a very serious down stream struggle. We are going to have to work out ways to resolve these sorts of problems. Bangladesh, Pakistan and India have recently done this. They have made some arrangements over some dams on the Ganges River. India wants to build but if they build them, they will destroy a lot of the wetlands in Bangladesh. So they are working together to

resolve that kind of problem. Water problems are going to be some series of future. We have to work out ways to resolve this problem. One of the things we can do in these areas will help reduce population. That will withdraw a lot of the pressure of population.

Another thing we must develop is a better technology for water use. In my country we are some of the most wasteful users of water. Irrigation systems that use too much water and are drying aquifers are very inefficient. If we would do what the Israelis do that is drip irrigation, we can use 1/10 of the water we are using now and increase tremendously our outlook. So we have got to work on better technology for using water, better technology for keeping the water clean, and then some social organization for managing the conflict that will inevitably rise over water. Thank you.

### **Mediator**

We are drawing close to the scheduled time to close the meeting. If you have further questions I hope you would make them brief.

### **Q4**

I am involved in advertising activities. I was going through the internet and I thought your presentation was very interesting and I am glad that I have taken part in this seminar.

As a result of the advancement of science and of technology, we have enjoyed various advantages. But at the same time there are stresses posed on the environment. My question concerns the environment, chemical waste, industrial waste as well as nuclear waste from the nuclear power generation, war and nuclear experiment. These are realized achievements. Then we have enjoyed the fruits from such achievements of science and technology but we have also suffered at the same time from the achievements. So what do you think mankind should do in the future with regards to technological achievement, that also have



shortcomings?

## **Q5**

I would like to ask the next question. I am a consultant for environmental development. Maybe this question is against your theory and logic.

Currently developing countries such as the Philippines do not offer high quality public services, which is accelerating the migration of the population out of the rural areas, which further deteriorates the environment of the cities. And the cities are turning into slums. So because there is the massive inflow of population that degrades the urban environment, I think the relationship between environment and population does exist. Though this is against your theory that there is only an indirect relationship, I think this increase of population is directly affecting the environment. So I would like to see your view on this specific aspect.

## **Q6**

You drew the conclusion that, when we study the relationship between population and the environment, we should take the best location. My question is why you came to this conclusion. I mean for example if we are from 4 different cities in different countries, we can get different conclusions. I wonder if the other person says the theory is practical or typical.

Another question is that we should study the relation between population and the environment, based on locations. But if we cannot divide three countries in terms of geography or in their location or their development levels, like the Tigris, for example, can we imagine that we can divide the countries or the cities into different types and get something in common? I wonder if something common to the environmental problem improves the environment.

## **Mediator**

The second person had challenged the first principle of Prof. Ness that there is

only an indirect relationship between population and the environment. Well Prof. Ness's answer of that question must be yes. There is an impact of population and the environment. Yes, there is an impact of environment on population but those are through technologies and organizations. So this is of great variety and there is no universal rule on how the population or the environment is important and I think that is how Prof. Ness makes the relationship. Am I right?

I would also like you to answer whether my understanding is correct or not. Now about Kobe, Kobe has various advantages. But what happens to the city, if you selected Tokyo or Osaka in Japan? These Faisalabad, Khon Kaen and also Kobe are the cities that you had presented today. Each development is in the order of their development. In Japan we had various problems like Minamata disease.

### **Prof. Ness**

Migration from rural areas to the urban areas is increasing the development of slums. What the government does for those migrants and how it manages them depend on the places. We can look at Kurativa in Brazil, which has had a very large migration of people into the rural areas. But you have to organize the cities very effectively planning with industries in one place, housing in another place, and excellent transportation between the 2, and you have managed to do a whole series of thing that made those slum areas a higher quality of life.

Here is one of the things they did, for example. They have slum areas. They got poor areas. They have small lanes moving through them and the garbage trucks to pick up the garbage cannot get into those. So the city agriculture products from the farmers in the city are put together in 10 pound bags and they help or make slums collect their own garbage and bring it to a transfer point, where it could be picked up. It would bring a bag of garbage, and it would get a bag of vegetables, a bag of fruits and vegetables from the outlining countryside. That reduced the cost of picking up the garbage so the city was able to pay for these

fruits and vegetables that went to the poor people. It increased the nutrition level of the poor people and cleaned up the slums. Now that was done because the government did it. That was matter of politics and the social organization so the impact of population on the environment was much mitigated because of the kind of organization they had.

Manila has no such capacity to do this. In fact Manila was a metro manila area and had a large metropolitan planning activities. The political organization was fairly effective. They went to decentralization of Corazon City, to Roja City, to all three separate cities. Decentralization evolved authority to them and no longer there is no central planning. Each one of these little cities does not have the capacity to manage immigrant and they are getting an impact increase of a very negative impact on the environment because the political system was lousy. So there was an impact but it depends on what kind of organization they are and what kind of technology you have.

About this issue on chemical waste and nuclear waste, there is an area where we need better technology. Well if you look at the technology you have developed for cleaning industrial waste effectively in Japan and the United States, we have developed such new technology, for filtering all kinds of things. And that technology employs many new people. It is a growing industry in both places. It is a good export industry. It came because government introduced some new environmental regulations to clean the air, to clean the water and to discharge its clean effluents, but those government regulations did not tell people how to do it. Only that you have to do is to reduce them. They grew a huge industry and a free market opportunity and that employ many people, and gives a good export industry. What we did is to make a better regulation and to enforce more implementation of these regulations enacted through this government protection activities.

Indonesia, for example, has very good laws on the books to protect the environment but they don't have the engineers or the capacity to implement those. So the industry simply tries to by-pass theme. We have good laws and good

implementations. Industry will develop new technologies for cleaning them and they must do that.

Another question is on the low quality of public services and migration from the rural to urban, degrading the environment again. You talked about location specificity. And on the problem of dividing up countries, there are some problems that are common. Yes, by all means, there is a problem with population growth and high fertility that produces illness for woman and children. No, high fertility is in some senses a epidemiological disease, because when you have high fertility, women have early and frequently and late pregnancy. And when that happens, the infant mortality rate goes up and maternal mortality rate goes up. So a common problem is the health problems of high fertility and we can deal with that. If we have a real good family planning programs that can make available to women and contraceptives technology that we have now, we have good population progress. That is a general problem, but you cannot use what Thailand did in the Philippines, you cannot use what Thailand did in Pakistan. In each one of those cases you have to develop an approach that is specific to the culture, to the politics, to economics of that sort of region. That is why you want to have a good family planning program. Though it might be very common, you cannot design it in New York. You have got to design it in the areas where it is actually going to work. The Indonesians will have to do it for themselves. The Philippines have to do it for themselves. To work out how that should be done, it is not a matter where we can get many common programs and common problems. But when we put them in a particular area we have to adapt so that people should not adopt a program from somewhere else, they should adapt from somewhere else, and that is the sense in which location specificity is a very important problem. I guess that is it. I want to thank you very much. This has been a very stimulating time, like your questions. I appreciate very much for your attention and interest. Thank you so much.

## **Mediator**

So ladies and gentlemen, thank you very much for coming here today and staying with us for the whole session and with this. We would like to close today's seminar. Thank you once again.

