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POPULATION-ENVIRONMENT DYNAMICS:

TEN CASE STUDIES

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PREFACE

This monograph, is a compendium of the individual works of eleven students enrolled in a cross-listed course NR 545 (EIH 575). The focus of this course, like prior years, is captured in its title ***Population-Environment Dynamics: Ten Case Studies***. The course began with an examination of alternative theoretical constructs useful in studying the interaction between human populations and the environment. Also, at the beginning of the course, each participant was asked to select a topic of inquiry and a geographical setting for their study. This selection then became their major focus for the entire semester.

Students participating in the course this fall had a delightful mixture of backgrounds and interests. Schools and colleges represented included the School of Natural Resources and Environment, School of Public Health, School of Business Administration, College of Engineering, College of Architecture and Urban Planning, and College of Literature Sciences and Arts. Participants included colleagues from the Continents of North America, Europe, Asia, and Africa.

A very important element in the seminar was the use of data sources which recently have become available in machine-readable form. These data sources permitted the students to quickly gain exposure in handling longitudinal datasets, especially those which were not amenable to modeling with linear functions. The most useful and user friendly dataset provided participants was The World Resources Institute Data System. Another tool used in the course was state-of-the-art PC-based Geographic Information Systems. The GIS package selected as most helpful, was ATLAS GIS version 3.03. The digital maps, used as separators of monograph chapters, help to unify monograph content as they depict, taken together, a spatial view of population-environment dynamics. Students also found maps of the Digital Chart of the World to be helpful, and a number found maps on the World Wide Web to be of considerable use. Dr. Sandra Lach Arlinghaus, adjunct professor in The School of Natural Resources and Environment co-taught the course, as she has in the five previous years in which it was offered.

The success of the course resulted largely from the enthusiasm of the participants. As in previous years, extra sessions were held near the end of the semester, which often extended beyond scheduled meeting times. Feedback from fellow participants was provided in these sessions. In addition, each student was asked to develop a brief synopsis of how their

study related to the other participants in the class. These thoughtful remarks are presented as the last chapter of this monograph. This monograph was published during the winter term in the academic year 1996-97, although the work was completed in December, 1996.

William D. Drake
University of Michigan
Ann Arbor, Michigan
February, 1997

POPULATION-ENVIRONMENT DYNAMICS: TOWARD BUILDING A THEORY

INTRODUCTION

This volume is a collection of separate but related studies focusing on the relationship between human populations and the environment. The effort consists of this introduction followed by seventeen chapters each written by a seminar participant which investigates a different aspect and geographic setting of the population-environment dynamic. A concluding chapter provides comments written by each participant relating their work to those of the others.

In this introduction we present a synopsis of the common framework, which we call a family of transitions. In addition to the common framework, this introductory chapter presents the abstracts for each ensuing chapter. Readers of the monograph reporting work from prior years should note that the material in the following section on a family of transitions is repeated here for background and therefore can be skipped.

1. A FAMILY OF TRANSITIONS

One way of viewing the complex dynamic relationships between population and the environment is to visualize them as a family of transitions. That is, not only is there a demographic and epidemiologic transition but also a deforestation, toxicity, agricultural, energy and urbanization transition as well as many others. In this chapter it is argued that for each transition there is a critical period when society is especially vulnerable. During that period, rates of change are high, societal adaptive capacity is limited, in part, due to this rapid change, and there is a greater likelihood that key relationships in the dynamic become severely imbalanced. The trajectory society takes through a transition varies, depending upon many factors operating at local and national levels. Transitions not only are occurring in many different sectors but also at different scales, both temporal and spatial. At times, a society experiences several transitions simultaneously, which can raise social vulnerability because of how they amplify each other.

1.1 TYPES OF TRANSITIONS

The Demographic Transition

Let us begin with a review of the ideas behind the widely accepted demographic transition. At the onset of this transition, births and deaths are both high and are in relative equilibrium with each other. Historically, births exceed deaths by small amounts so total population rises only very gradually. Occasionally, famine or an epidemic causes a

downturn in total population but in general, changes in rates are low. During the transition, however, death rates drop dramatically, usually due to a change in the health condition of the population. This change in health is caused by many, often interrelating factors. After some time lag, the birth rate begins to drop and generally declines until it is in approximate balance with the death rate again.

The Epidemiological Transition

The term epidemiologic transition was coined to describe the changing source of mortality and morbidity from infectious diseases occurring primarily in the younger age groups to degenerative diseases in older age groups. As with the demographic transition, there is considerable volatility during the transition. At the onset, infectious diseases begin their decline usually due to extensions of health care and sanitation by the national or local government. Single vector programs such as malaria control and immunization programs are often the first implemented because they are capable of ready extension and do not require as heavy a commitment to education and other sustained infrastructure - especially in rural areas. These single vector programs are then followed by broader-based health care which demand heavier investment in infrastructure. But an entirely successful move through this transition does not always happen. At times, other sectors in transition overpower the health care delivery system.

The Agricultural Transition

For several hundred years, worldwide agricultural production has been rising in relative harmony with population. Overall, increases in production have kept up with and even outpaced growth in population. The two factors that have been responsible for these increases are 1) extensions of land under cultivation and 2) improvements in productivity. At times changes have been dramatic. Formulating an agricultural transition reflects the condition that, in general, sources of increase in production shift from extending land to intensifying production on land already under cultivation.

The Forestry Transition

At the onset of the forestry transition generally a large percentage of a region is under forest cover. Rapid deforestation occurs during the transition and finally forest cover stabilizes at a lower level determined by many factors such as the local region's needs, the state of the local and national economy, climate and soil characteristics. In most settings this transition will end in a steady state equilibrium balancing growth and harvest. Again, how society handles the vulnerable transition period often determines in a profound way the quality of life for the region.

The Toxicity Transition

The toxicity transition can be considered a composite of many transitions: global atmospheric, local air pollution, surface water, ground water and solid waste to name a few. Again, there are at least two sets of factors operating in tandem. The transition begins with low levels of industrial or agricultural production and correspondingly low levels of toxins. As production and population increase, toxic byproducts increase to levels which eventually become unacceptable to the general public. This in turn, causes a public demand for pollution abatement. After an environmentally costly time lag, remediation steps are taken which helps to bring pollution under control.

The Urbanization Transition

The urbanization transition is driven by the dual forces of rural to urban migration and central city population growth. The early stages of the transition are characterized by rapid growth of urban population; however, in later stages, growth declines and may reverse. Rural to urban migration is a product of many forces - both "pull" and "push". In terms of the population-environment dynamic, the urbanization transition often acts as an amplifier as it interacts with other transitions.

The Fossil Fuel Transition

The fossil fuel transition is a special case of the energy transition. Historically, many energy transitions have already occurred in different regions and time periods. Significant transformations began in the sixteenth century brought about by sail and later, by steam power. Today, we are now in the most universal and perhaps critical energy transition: fossil fuels. Studying this transition is especially instructive because the record on different societies' passage through the vulnerable period is varied and appears to be heavily influenced by public policy.

1.2 GENERAL CHARACTERISTICS OF TRANSITIONS

Similarity of Trajectory Across Sectors

We have attempted to show in the seven example sectors discussed earlier that the notion of transitions apply across all sectors of investigation. Each class of transition, whether it be demographic, toxicity, forestry, agriculture, urbanization, energy or epidemiological have similar patterns. It is this perception that has caused us to posit the existence of a family of transitions possessing some common attributes useful in analysis. The first common attribute of all transitions is their trajectory. They all begin in reasonable stability, then move to the volatile transition period where change is rapid, and finally return again to relative balance. Analytically, these are clearly nonlinear systems but ones which have properties that lend themselves to well-understood

mathematical functions.

Applicability of Transitions Across Scales

The second attribute has to do with scale. One of the most interesting and at the same time vexing aspects of studying population-environment dynamics is that many phenomena manifest themselves at all levels of geographic and temporal scale. For example, data depict one demographic transition for an entire continent, a different one for a country within that continent and still other different transitions at the regional level. Local conditions may delay or advance the onset and or completion of the transition in relation to the larger body. Thus, moving through the demographic transition can take more or less time as the scale changes. This same variation seems to exist in all other population-environment transitions that have been investigated. True, national or regional-level determinants often set the stage for the local dynamic, but in the end it is these local conditions which determine the timing, magnitude and specific trajectory of the overall transition.

One can think of our world, seeming to be chaotic, but instead consisting of a multitude of well defined transitions in many sectors, each with its own local characteristic. Different transitions begin at different times and places, but ebb and flow in an overlapping way, sometimes reinforcing one another and at other times dampening their dynamic. As adjustment occurs, occasionally useful niches are created which are then exploited by stressed elements of the ecosystem. Unfortunately, at other times, different sectors interact with each other in a harmful way to broaden and extend the susceptible period.

Societal Vulnerability

During transitions there seems to be a special vulnerability borne by society. Ample evidence indicates that key relationships are most likely to become out of balance during the transition. A primary cause of this vulnerability is the rapidity of change during the high velocity portion of the transition. Adaptive capacity is impeded because there is little time for systems to adjust and often there are limited feedback mechanisms operating which otherwise could help this process. Another contribution to social vulnerability during a transition is the amplifying effects created by transitions occurring simultaneously in several sectors. Rapid rates of change in several sectors could more easily overpower the available infrastructure which leads us to the next source of vulnerability during transitions: capital availability.

Capital or investment capacity can either amplify or reduce societal vulnerability during a transition. If there are financial resources available to deal with the effects of rapid change, remediation is easier

to implement. Africa which is trying to deal with a difficult demographic transition has almost no capital available for its use and will therefore undergo great hardship. The Soviet Union and Eastern Europe are struggling to find financial resources to deal with their flawed toxicity transition. Another dimension of transitions which affects societal vulnerability is the degree of interconnectedness. How closely is the local village connected to the regional and national economy? How much does what happens in one location determine what happens in another? There is no question that interconnectedness is increasing worldwide. We also know that under some circumstances linkage creates dependencies which in turn, increase vulnerability. However, it can work in the opposite direction as well. These very same links to a larger domain can also act as a safety net. If there are connections, resources can be brought to the stressed area more easily to mitigate the local adversity. The final and perhaps most important dimension of transitions affecting vulnerability is feedback.

Analytic Properties of Transitions

We have seen that many characteristics of transitions are common across all sectors and geographic scales. The question then, is whether there are analytic techniques which might be useful in describing this family of transitions. If so, these techniques may be helpful in portraying transitions in a way that facilitates comparison and thereby increases our understanding. In this quest we are especially interested in techniques and functions which reduce complexity and at the same time provide a reasonably accurate portrayal of reality.

Functions which are candidates for consideration include exponential, exponential to the limit L, logistic, Gompertz, and the power function. Bounded functions which fit data more precisely but cannot be used for predictive purposes may also be helpful in uncovering patterns.

1.3 POLICY IMPLICATIONS OF TRANSITION THEORY

But what does it gain us to fit an exponential or logistic or for that matter any function to transition data? The answer lies in our ability to gain insights by relating different transitions to each other. First, consider the transitions within a given sector and at a given scale. We know there are transitions in a sector which some societies have already experienced while others have yet to endure. If the nature of these experiences can be captured in general form, it is more likely that knowledge can be transferred to other settings where a transition is first starting. Of course, each civilization or local culture has its own unique characteristics but any one emerging transition may be comparable to one or more of those which have occurred before because conditions are similar.

Second, there may be useful comparisons across different scales. We already surmise that a national-level transition, perhaps now in process, is actually comprised of a myriad of local transitions also in process or which have recently occurred. But there may be other locales in the region for which the transition has yet to happened. If similar patterns emerge because of similar local conditions, a useful prediction could be made about the nature of the passage through the transitions yet to appear. Third, there may be insights gained simply by the process of fitting a function to historical data. Different mathematical functions often have very specific underlying characteristics which can provide useful ideas. The next potential use of transition theory is to facilitate analysis across sectors. There is, of course, no good reason to expect the trajectory of, say, a forestry or agricultural transition to mimic an epidemiologic transition. However, for any society at a given time, there may be similarities in the rates of change across sectors. Developed economies have slower rates of change in their agriculture sector than developing economies when conditions are favorable. Rural based cultures may be expected to have urbanization transitions which are steeper than non-rural cultures. In short, it is worth testing to see if patterns can be empirically determined which would be helpful in predicting the shape of future transitions, given a stated level of intervention.

We have already mentioned the special societal vulnerability associated with several sectors being in rapid transition simultaneously. From a modeling perspective this simultaneity a very difficult condition to describe and analyze, which may be why less progress has been made in this area to date. However, being able to portray these multiple transitions with specific functions could be helpful. There is no question that each transition interacts with the other. And to the analyst this means that a reliable model must be structured as a set of simultaneous relationships. Describing transitions as functions facilitates this manipulation.

Another potential benefit of transition theory lies in the identification of lead indicators. If success is achieved in fitting transition data to an appropriate function, then for a given condition and point in time, the future trajectory can be predicted more accurately. Identifying lead indicators is facilitated because with an orderly function, only one, or at most, two parameters need to be determined to define the trajectory. This advantage is even more evident when several functions are considered simultaneously.

Finally and perhaps most importantly, transition theory may permit more informed public and private intervention. At one level we find ourselves believing that the trajectory of a transition is somehow fixed by an

immutable law of nature. But at another level we know that this is not the case. Public and private policy can make a difference as we have seen from some of the cases discussed in this book. Rates of change can be influenced by policy redirection and consequent resource allocation. To the extent that we can link historical rate differentials with historical policy implementation, a better determination can be made about which intervention mix works best in dealing with problems facing society today.

POPULATION-ENVIRONMENT DYNAMICS:

TEN CASE STUDIES

ABSTRACTS OF THE CASE STUDIES

Kazuhiro Arai

Evidence suggests that an agricultural transition currently is taking place in the United States. This transition consists of an increase in organic farm acreage as well as an increase in consumer demand for organic foods. The purpose of this paper is to chart this sharp rise in organic produce production and consumption in the United States. It seeks to link this transition with other transitions, including fertilizer, herbicide and pesticide use, as well as an epidemiological and toxicity transition. In addition, this paper intends to identify particular consumer attitudes affecting the organic agricultural transition, specifically increased concerns over pesticide use, overall health and environmental degradation. Using modeling and graphical methods the paper creates a comprehensive model for organic consumption behavior. From this analysis and model, policies and strategies to increase organic consumption are made.

Hideo Kuramitsu

It made me special aware of the urbanization in Egypt to attend the last United Nations Conference, "City Summit, Habitat II", held in Istanbul on June 1996, and to make a trip to Egypt for three weeks on August 1996. I saw a lot of urban problems in Cairo which were the same as what was discussed in Istanbul. These urban problems in Cairo made me feel like my own and think why a lot of people gather this large city and what kinds of urban problems will be brought about. In this paper, I made a population growth model, linked with GDP (Gross Domestic Product), by using STELLA II. I found some strong relationships between each distribution of GDP and its birth or death factor, resulting from the multiple regression. I am sure this model may be applicable for further studies of the population growth in the developing countries.

Clive Lipchin

The issue of water scarcity is an international environmental concern. Population growth coupled with consumptive patterns are increasing the pressure on global water resources essential for the continual survival of all of earth's living organisms. The Middle East region is becoming the focus for an impending water crisis that may very well escalate to open conflict amongst the nations of the region, forced to share common water

resources. This paper focuses on two such conflicts: disputes over the Tigris-Euphrates river system and disputes over the Jordan river valley and groundwater resources. Both of these disputes are common in the levels of mistrust amongst the riparian states and the attitudes of nationalistic ownership of water resources that are in fact politically independent. The political volatility and instability of the region, together with such disputes has led to increasing international concern. Resolving the conflicts will involve unprecedented long term international cooperation amongst the riparian states. Policies that will allow for trading agreements amongst the nations, where each can see the benefits of such action as overriding the costs is required. In addition, a scaling down of wasteful and inefficient agricultural and management practices, together with trading agreements must occur, in light of the characterization of the region as semi-arid to arid. Nationalistic pride and petty differences must give way to open cooperation for the good of the region and the planet as a whole.

Peter Murchie and Rebecca Spector

Evidence suggests that an agricultural transition currently is taking place in the United States. This transition consists of an increase in organic farm acreage as well as an increase in consumer demand for organic foods. The purpose of this paper is to chart this sharp rise in organic

produce production and consumption in the United States. It seeks to link this transition with other transitions, including fertilizer, herbicide and pesticide use, as well as an epidemiological and toxicity transition. In addition, this paper intends to identify particular consumer attitudes affecting the organic agricultural transition, specifically increased concerns over pesticide use, overall health and environmental degradation. Using modeling and graphical methods the paper creates a comprehensive model for organic consumption behavior. From this analysis and model, policies and strategies to increase organic consumption are made.

Tamana Nishiguchi

Burma, which lies on the western edge of mainland Southeast Asia, is one of the Least Developed Countries (LLDCs). Historically, its economy was dominated by agriculture, which provides employment for 60-70 percent of total labor force and accounts for the country's major export earnings. The history of agricultural development in Burma started in the mid 1970s when the authorities realized the important role of agriculture in the entire economy through the failure of industrialization in the 1960s. Some policies, which emphasized the introduction of new technology contributed to the progress of Burmese agriculture. However, other policies hindered it when the "Green

Revolution" reached the saturation point. To achieve sustainable growth of the economy, the development strategy should take into account the agricultural sector, in particular, and the rural area, in general.

Allain Rasolofoson

The purpose of this project is to analyze the phenomenon of deforestation in the case of Madagascar which desserves more attention than that of a simple national plague, considering the uniqueness of many species within the rich diversity of the country's natural ecosystems. It aims to attribute possible connections between this phenomenon and other past or present realities in the country. More precisely, it will emphasize on the complex dynamics of population and the environment by treating a family of transitions comprising:

political transition describing the implications of the successive regimes, through their policies and regulations, on the land uses.

social transition treating the most important changes which have influenced the land uses and the population's agricultural practices.

economic transition showing the relevant data through the national history, which affect the agriculture.

demographic transition indicating also an early stage of urban transition which affects the profile of the rural area.

The rest of the paper will be articulated according to the different political eras defined within the political transition. At the end, in the actual period of economic depression, an attempt is made to bring a possible solution through the mobilization of the private sector into a national program of "integrated patrimony management".

Julie Rodriguez

In the 1950's, Ecuador faced a growing population; a ballooning foreign debt; and a sagging economy. Ecuador's riches were composed primarily of its cultural and biological diversity. Since then, its gross national product skyrocketed. Oil development in Ecuador's Amazonian region is responsible for this transformation. Oil development also stimulated other changes. It opened the rainforest to logging and settlement. Land tenure laws encouraged the landless masses in Ecuador's cities to forge east to the "unproductive" rainforest region. Now Ecuador is challenged with striking a balance between providing for its population and protecting its environment. Ecuador can move toward this balance by increasing its reliance on market forces, reforming land tenure policies,

and by investing in infrastructure, education, and research. A continued reliance on oil is unavoidable, but oil developers can be made to adopt environmentally sound practices to reduce environmental and cultural costs.

Hitomi Sasaki

This paper illustrated the various kinds of human resource, environmental, social and economical problems caused by the urbanization transition in Thailand. In Thailand, there is no official definition of the urban areas, however, I discussed the transition to Bangkok Metropolitan Regions from other rural districts to make my ideas clear.

Why has Bangkok been expanded as such a huge primate city? The principal answer of this question was the centralization of direct foreign investments toward Thailand since 1986 in order to create economically, educationally and internationally well developed country. However, these investments actually aimed at creating the well developed city, Bangkok, not the country as a whole. This economical and political inconsistency caused the regional imbalances. A number of people in the rural areas where no suitable jobs to support their families or the educational institutes moved to Bangkok to compensate for their needs. And this excessive mobility of population to Bangkok caused environmental, social and economical problems both in Bangkok and in other rural areas.

There have been several trials by Thai government to reduce the regional imbalance and environmental problems in Bangkok. One of the most significant policies is the National Economical Social Development Plan. In its Seventh Plan (1992-96), Thai government have carried out the Metropolitan Regional Structural Plan to decentralize the urban population by extending the Eastern Seaboard Project and developing the new industry zone in Northern part of the metropolitan regions (Saraburi Industrial Complex).

These Thai governmental policies are needed to be considered in terms of how much succeed in the decentralization and reducing the environmental problems. However, Thailand have actually just realized that it should consider the balanced development in both urban and rural areas, so we should wait at least three years to criticize governmental policies or bring the new suggestions.

Julie Smith

Freshwater is a substance of paramount importance: it is pervasive in all biological and physical systems, and its use is inextricably intertwined with many of society's efforts to enhance economic and social well-being. In the arid East African Nile River Basin freshwater is scarce and widely shared by countries with enormous economic, military,

and political differences; over-exploitation, depletion, and deterioration of the Niles' waters are prevalent problems. The Nile River traverses nine international borders and the water it provides is unevenly distributed and used; thus the potential for conflict is great. The Nile basin countries share several common problems which could be mitigated through combined efforts. Instead of opposing each other, they could direct their attentions toward multinational agreements and policies, defining collective basinwide management strategies for mutual benefit. Effectively developing the Nile's waters will require a cooperative approach, treating the basin as one hydrologic unit and all riparian states as equal stakeholding partners.

Luejit Tinpanga

The population can be a positive or negative force to national development. In case of Vietnam, its large population and unequal distribution of population throughout the country has been one of many factors that impedes socio-economic development. The Vietnamese government has adopted population policy: family planning programs and population redistribution since the early 1960s in order to control population growth rate and reduce high population density in big cities and deltaic plains. The paper seeks to study how effective this policy is and how it has an impact on its population and socio-economic development.

Four sectors were elaborated: labor force and employment, agricultural production, urbanization, and forestry. At the end, policy suggestions are included.

CHAPTER ONE

KAZUHIRO ARAI

LABOR MIGRATION AND ITS INFLUENCE: THE CASE OF YEMEN

Introduction

Labor migration is one of the common phenomena in the Middle Eastern countries. People in this region migrate from one country to another, mainly for economic reasons. The destinations and the number of migrant laborers are mainly determined by the economic and political conditions of both sending and receiving countries. From the 1970's, substantial portion of Arab migrant laborers head to the Gulf States, especially to Saudi Arabia. The function and the impact of labor migration has been discussed by many scholars. It is said that labor migration functions as a safety valve of the economy in the sending countries of migrant laborers on the one hand. When a country cannot meet the need for jobs of its ever increasing population, labor migration could serve as one of the solutions for surplus labors. Besides, the remittances from the migrant workers may benefit the economy of the sending countries. On the other hand, some points out the dangerous aspects of the labor migration. Large scale of migration may cause the

shortage of labor force in the sending countries and thus hinders their internal development. Return migration is also a serious problem for the sending countries. The extensive scale of return migration inevitably results in the serious destruction of the economy of the sending countries.

The present paper discusses the transition of labor migration of Yemen from the 1970's until the beginning of the 1990's. Yemen is a typical country which depends on the migrant laborers and their remittances. The economy and the society of the country are closely related to the situation of labor migration. Both positive and negative impacts of the phenomenon are observed in these few decades. Through the discussion, the cause, the influence and the problem of Yemeni labor migration are examined, and a few suggestions for the future development of the country will be made.

The Outline of the Country

Yemen is located in the south east corner of the Arabian Peninsula. Because of its relatively humid climate and fertile land, this area is most densely populated in the arid Arabian Peninsula. People has been living there since ancient times. The country is usually divided into two regions. The west part of the country is called "Yemen Proper" or "Highland Yemen." This part consists of high mountain region including the capital city, San'a, and coastal region along the Red Sea. The mountain part is characterized by quite humid climate in summer,

sedentary population, and rain fed agriculture. In contrast, the eastern part of Yemen is rather dried. This part is usually called "Hadramawt." This region consists of inland Wadis, i.e. dry river beds in the desert, which runs parallel to southern coast of the Arabian Peninsula and of the coastal region of the Arabian Sea. The two regions differ in terms of social, cultural and historical background. This division roughly corresponds to that of former Yemen Arab Republic (YAR, or North Yemen) and People's Democratic Republic of Yemen (PDRY or South Yemen) respectively. These two countries were united in 1990 to found one unified nation, Yemen Republic.

The migration activities of the people of Yemen has history of more than one thousand years. Since the ancient times, people of Yemen have been migrating to various part of the world. From the thirteenth century, the people of Hadramawt, a region in South Yemen, began to migrate to the regions around the Indian Ocean, mainly for commercial reason. They played an important role in the Islamization of the region. From the end of the eighteenth century, large number of Hadramis headed to Southeast Asia. It is reported that in the end of the nineteenth century, more than 20,000 Arabs were living in today's Indonesia and Singapore, and more than 90% of them were from Hadramawt (Van den Verg, 1886). Until recently, the length of Yemeni, especially Hadrami emigrants were relatively long. Some of them became permanent residents at their destination, and it is not unusual that an migrant stayed there for more than twenty years until he finally went back to the home land. Recently,

however, most of the length of stay became relatively short. Most of the immigrants are manual labors and go back to their home land after several years. The destination of migration came to be the Gulf States.

Political Transition

Yemen has several political transitions in this century. For the study of labor migration in these few decades, four political transitions should be taken account. Before the unification in 1990, Yemen was divided into two nations. The North Yemen was ruled by Imams, the religious leaders of Islam, until 1962 while the South Yemen was under the British rule until 1968. In north Yemen, a revolution happened in 1962, and the new state, Yemen Arab Republic, was founded in that year. After a few years of political turmoil and the fight against pro-Imam groups, the nation came to be recognized by all of the neighboring countries. As for the South, they became independent in 1968 founding a Marxist country, People's Democratic Republic of Yemen.

These two Yemeni nations continued to exist until May 22, 1990, when they were unified to form one nation, Republic of Yemen. San'a was decided to be the political capital and Aden, former capital of South Yemen, to be the economic capital. Saudi Arabia was not pleased by this unification, because the emergence of this relatively strong country within the region could threaten the state security of neighboring countries. This distrust of Yemen would influence the situation of

Yemeni migrant workers in Saudi Arabia.

The unification of Yemen, however, was not complete at first. The people of former South Yemen felt that the whole country was ruled by the former North government. In 1994, a continuous conflicts between the ruling classes of former North and South Yemen within the new government resulted in a civil war. Some of the members of the former South government declared independence in Aden, the capital of former Peoples' Democratic Republic of Yemen. This war ended in the victory of former North government and Aden was conquered by its army. However, this sequence of events unveiled the dissatisfaction of the people of former South Yemen. Now the most important matter for the government is the consolidation of the country and the maintenance of the unification.

Sources for the Study

Obtaining reliable data on the labor migration of Yemen is really problematic, because we have only limited information. Considering the fact that many migrant laborers use public taxis to cross the borders between Yemen and Saudi Arabia, the main destination of Yemeni migrant workers, and that Yemenis sometimes do not need even passports to enter this neighboring country, it is almost impossible to know the precise number of Yemenis working in Saudi Arabia. Moreover, there is no census of labor migration covering the whole Middle Eastern countries. Given such restriction, one of the most reliable information on the labor migration is the amount of workers' remittances to their home countries.

Both IMF and the World Bank gives the information on workers' remittances in their publications. However, most of money earned in foreign countries is brought to Yemen by themselves. Therefore the data provided in the publications is just the tip of the iceberg. It can be said there is no quantitative data which represents the real situation of the labor migration of Yemen.

In addition to the limit of data, Yemen has a statistical problem as well. As I explained above, North and South Yemen were united in 1990 to form one nation. Therefore the statistical data of both Yemens which used to appear in separate places in the publications was also "united," that is, it was summed up, and the information on each region can no longer be found. As I state, both countries had different backgrounds in terms of society, history and culture. Thus the data of newly formed Yemen Republic may not indicate some of the transitions of a particular region.

Considering these facts, one has to depends on fragmented information for the study of labor migration of Yemen. Therefore the data used in this paper mostly comes from various studies done by individual scholars. Some of the studies give useful statistical information such as the reason for migration, the occupation of the migrant laborers in both foreign countries and their home country, and the use of accumulated money after returning to the home countries. Although the focus of those studies are limited to a certain region in Yemen, the information provided in the studies may reflect the reality of labor migration of Yemen to some

extent.

Current Trend of Labor Migration in the Middle East

Although the present paper focuses on the labor migration of Yemen, the phenomenon is commonly observed in most of the Middle Eastern countries. It is partially because they laid special emphasis on the move of the people in the history. It is better to move to various places than staying in the same place in one's lifetime. Throughout the region, substantial amount of people migrate to other countries for a certain period, mainly looking for better job opportunities. The typical pattern of labor migration is that people from poor countries head to richer countries, searching for jobs. The destinations of the emigrants are mainly industrialized countries such as Europe and the United States and oil producing countries such as the Gulf States and Libya. Some of them settle in the host countries. However, most of them are temporary residents. After several years, they go back to their home countries. This section examines the trend of labor migration in the Middle Eastern countries.

Overview of the Labor Migration

The trend of labor migration in the Middle East can be seen in the amount of workers' remittances in each countries. Table 1 shows the private unrequired transfers, i.e. workers' remittances, of the Middle Eastern countries from 1973 to 1993. The minus value means that the

amount of money sent from the country exceeds that sent to the country. It can be said that the countries whose amount of remittances is minus are receiving countries of migrant laborers. Figure 1 is the chart of the data in 1988. As we can see, there is a clear distinction between oil producing countries and the others. Saudi Arabia seems to offer the most job opportunities in the region. Egypt and Turkey send more workers to foreign countries than other countries. Two Yemens, YAR and PDRY are rather minor entries here. Since the population of each country is different, the workers' remittances per person should also be examined. Figure 2 shows the private unrequired transfers per capita in each countries in the same year. It can be said that each of the four Gulf States has equal importance in receiving labor migration according to population. Egypt and Turkey become rather minor countries in the region, and South Yemen (PDRY) appears as the third country receiving workers' remittances per capita. The situation of Israel and Jordan, occupying the first and second position in this chart, may be explained by the Palestinians living in both countries. Because of the conflict between Arab and Jewish people, Palestinian refugees had to find the way of sustenance in foreign countries, and the number of migrant workers is huge if compared to other countries. In addition to the remittances from Palestinians abroad, Israel's remittances might include the assistance from Jewish people living in other countries. In any case, it can be said that the amount of private unrequired transfers reflect the situation of each country to some extent.

Table 1. Private Unrequired Transfers, Selected Middle Eastern Countries, 1973-93.

Figure 1. Private Unrequired Transfers, Middle Eastern Countries, 1988. Bar chart.

Figure 2. Private Unrequired Transfers per capita, Middle Eastern Countries, 1988. Bar chart.

Number of Arab Migrant laborers in the Gulf States

There are some estimations of the number of migrant laborers in the Gulf States. Table 2 and Figure 3 show the number and the percentage of Arab migrant laborers in Saudi Arabia in early 1980's. As the chart says, Egypt sends the most migrant workers to Saudi Arabia. The sum of both Yemen is approximately 20% of total Arab migrant laborers working in Saudi Arabia, the second most number among the Arab countries. However, it is necessary to know that not all emigrants from those countries head to the Gulf States. Substantial portion of them go to Europe and other industrialized countries. Moreover, the Arab migrant laborers are minorities among the whole foreign workers in the Gulf States. Figure 4

shows the ratio of Arab migrant laborers to other foreign migrant workers in the Gulf States. In most of the country, the number of non-Arab foreign migrant laborers exceeds that of Arabs. Most of them come from Pakistan, India, Bangladesh, Philippines, and other Asia countries.

Table 2. Estimates of the Numbers of Arab Migrant Workers in Saudi Arabia and the Gulf States, Early 1980s.

Figure 3. Estimates of the numbers of Arab Migrant Labors in the Gulf States, early 1980s. Pie chart.

Figure 4. Estimates of Arab and Other Foreign Migrant Workers, ca. 1980. Bar chart.

Transition of Workers' Remittances

Transition of workers' remittances show the trend of labor migration in Yemen. Figure 5 and figure 6 are the amount of private unrequired transfers and worker's remittances of Yemen, provided by IMF and the World Bank, respectively. The entry of private unrequired transfer may contain

elements other than workers' remittances. However, both charts show similar trends. The workers' remittances was minor in both countries in the early 1970's. The amount, however, dramatically increase in North Yemen (YAR) through the decade and come to the peak in the late 1970's. After that time, the amount is gradually going down, though it continues to fluctuate. As for South Yemen (PDRY), the amount of workers' remittances is quite stable if compared to that of North Yemen. The amount of the remittances gradually increases through 1970's and culminates in the middle of the 1980's. After that time, it begins to fall toward the end of the decade.

Figure 5. Private Unrequired Transfers, Yemen 1973-92. Graph.

Figure 6. Workers' Remittances, Yemen, 1973-93. Graph.

The difference between the two countries can be explained by the situation of each country. For example, the government of South Yemen restricted the number of emigrant laborers from 1973, because of the shortage of labor force caused by extensive scale of migration. It may be true that the stability of the workers' remittances in the South reflects

the restriction of the migration by the government. The difference between the character of migrant workers from the North and the South might be one of the reasons for the difference of the transition of workers' remittances. It is said that the people of the South Yemen tend to get into business for themselves in the receiving countries while North Yemenis are employed by companies or working at construction sites. Therefore the economic situation of the workers from South Yemen is more stable in the receiving countries, and their number does not fluctuates, though it has not been proved by statistical data.

Economic Transition

One of the most important factors which decides the flow of labor migration is the economic conditions of the receiving countries. This is categorized as "pull" of migrant labors. The rise of oil price and subsequent construction boom began in the early 1970's in the Gulf States. Thus the labor market in the region expands, and many migrant laborers came to those oil producing states. Figure 7 shows the Saudi oil prices and workers' remittances of Yemen. The oil price begin to rise in the early 1970's and culminates in 1981. After that year, the price continues to fall toward the 1990's, with some fluctuation in the end of the 1980's. This trend roughly corresponds to that of the workers remittances of Yemeni migrant laborers.

Who are the migrant laborers?

Although migrant laborers have various background in terms of age, economic condition, and family condition, there are certain tendencies. Usually it is said that a typical migrant is "a single man who stay abroad two to five years (Stevenson, 1993)." However, although the majority of migrant laborers are living alone in their destination, substantial portion of them are accompanied by their families. For example, there is a report that about one-third of Yemeni migrant laborers in Saudi Arabia brought their families to live with them in 1990 (Stevenson, 1993). Another report says that about ninety per cent of male migrant workers left their wives in their home town (Colton, 1993).

Figure 7. Saudi Crude Oil Prices and Workers' Remittances of Yemen. Graph and bar chart.

Destination

Most of Yemeni migrant workers go to Saudi Arabia. The result of the interviews conducted in al-Hujariyya region in North Yemen is that 87.8% of the returnees used to work in Saudi Arabia. Those who worked in other Gulf States are 2.3% and those who worked in the rest of the countries were just 9.9% of whole returnees (Colton, 1993). There are several reasons for this trend. First one is the location of the country. Since former North Yemen bordered on Saudi Arabia, prospective migrant

workers can enter the country by public taxis. This is appealing to many people, as the families of the migrant laborers can save the cost of air ticket which is necessary if their destination is Europe or other Gulf States. Besides, Yemenis used to have a special status which allows them to enter the country without working permission (Stevenson, 1993). Another reason for going to Saudi Arabia is that most of prospective migrant workers have their relatives there. With the help of the relatives or acquaintances, one can easily find a job before leaving the country. Therefore most of the migrant workers found their jobs within one week from their arrival date. Supported by these merits, Saudi Arabia became almost exclusive destination of Yemeni workers.

Types of Job

The occupation of Yemeni workers in the Gulf States is mainly construction workers or unskilled laborers. Table 3 is the occupation of returnees in al-Hujariyya region in North Yemen.

Table 3. Occupations of Returnees

Al-Hujariyya Region, North Yemen, 1989.

Although this chart does not represent the whole trend of labor migration in Yemen, there can be seen certain tendencies which are commonly maintained. The largest portion of the people are engaged in agriculture,

while the percentage decreases to almost half after the migration. The percentage of farmers among the migrant workers is much less than that among general population. Another study, however, says that 52% of returnees from Saudi Arabia had been agricultural workers before migration (Stevenson, 1993) During the migration, the most popular occupation is construction workers and unskilled laborers. Other study also support this fact, showing that about 40% of migrant workers are employed as unskilled laborers (Serageldin, 1983). After returning to the home land, many of them start their own business such as running a small convenience shop or doing commerce. The returnees tend to work in the service sector after returning to their home.

Cause of the Migration

There are various reasons why people decide to migrate to foreign countries, and each migrant laborer has different reason. Those reasons, however, could be classified as two kinds of forces push and pull. For example, the shortage of labor forces and better wages in the Gulf States can be considered as "pull." On the other hand, surplus of labor force and low wage in the sending countries are considered as "push." The labor migration happens in the balance of these two factors.

Limits of Natural Environment

Historically, the limitation of land and water resource are major factors which cause the flow of migration. Yemen, especially the North,

has been the most densely populated region in the Arabian Peninsula. The land is quite fertile compared to other regions, and rain fed agriculture supported quite huge number of population. However, the amount of arable land is limited, and the country sometimes could not deal with the increase of population. The possible consequence of the demographic pressure is the shortage of food. The situation was more severe in the South. Therefore the community had to "expel" some of the members from its territory to maintain the standard of living, tradition and the social structure (Yajima, 1993). Waves of emigration were usually preceded by famines, floods, or other natural disasters.

Private Benefit

Some of the scholars emphasis the private reason for the labor migration. The difference between foreign and local income is also the main factor for the decision of migration. Usually, there is considerable gap of wages between the sending countries and the receiving countries of migrant laborers. In the personal level, what makes them decide to work in foreign countries is huge gap of wages (Richards, 1990).

Impact of Labor Migration

This labor migration influences many aspects of the life in their local community. First of all, the economy of both Yemen has been heavily depending on the remittances from the foreign countries. In the 1980's, the sum of workers' remittances was as much as 20% of gross domestic

product in the North and 50% in the South (Stevenson, 1993). It can be said that most of the households in Yemen rely on those migrant workers. Some scholars discuss the migration activities in the light of destruction of culture. A peasant, living in the rural part of the countries, return to home after several years of manual work in the Gulf States with television and tape deck. However, this kind of discussion does not enlighten the reality of the emigration.

Age Structure

Labor migration in the Middle East often affects the age structure of both sending and receiving countries of migrant workers. Figure 8, 9 and 10 shows the age structure of North and South Yemen and Saudi Arabia in the middle of 1980's. In North Yemen, male population in their twentieth through fortieth is much less than the female population of the same generation. There are several possible reasons for this kind of phenomenon. One of the most common explanation is the influence of war, though it is not the case here. The most plausible explanation is the result of extensive scale of labor migration, as migrant workers are usually men in their twentieth and thirtieth, and the majority of them go abroad alone. South Yemen has the same tendency of age structure, though the difference between male and female population is not as great as that of the North. On the other hand, Saudi Arabia, typical receiving country of foreign workers, has an opposite tendency of the age structure. The "surplus" of young male population cannot be explained by other than the

presence of a number of foreign migrant laborers.

Figure 8. Age Structure: YAR (North Yemen), 1985. Graph.

Figure 9. Age Structure: PDRY (South Yemen), 1985. Graph.

Figure 10. Age Structure: Saudi Arabia, 1985. Graph.

Decline of Agriculture

The labor migration has negative effect on the agricultural productivity in the sending countries. Figure 11 and 12 shows the relationship between workers' remittances and food production in both YAR (Yemen Arab Republic) and PDRY (People's Democratic Republic of Yemen). In both countries, the increase of remittances roughly corresponds to the decrease of food production, and the other way round. This does not necessarily mean that the increase of labor emigrant results in the less productivity of food. However, there seems to be direct relationship

between the two factors to some extent. First of all, agriculture in Yemen is still labor intensive industry. In the North Yemen, for example, I have not seen any tractors in the mountainous region. It is rather difficult to introduce tractors to terraced fields up to the mountain top. Secondly the difference of wage is more appealing to rural population than those living in cities. As a result, more peasants in rural area migrate to other countries for higher wage. Finally, most of the emigrants are in their twenties or thirties, who are the main workers in a field. The labor migration in Yemen used to be the result of the shortage of food production. However, the increase of emigrants result in less food production in the current situation.

Figure 11. Workers' Remittance and Food Production, Yemen Arab Republic (North)

Figure 12. Workers' Remittance and Food Production, Peoples' Democratic Republic of Yemen. (South)

As the number of labor migration increased, the type of agriculture also changed. Instead of absent male residents, women came to work in the field, though they could not sufficiently compensate the loss of men. Moreover, as we see above, nearly half of farmers abandon

agriculture after the return from foreign countries. The crop grown in the field has also changed. Instead of labor-intensive coffee and grain, qat trees increase. Qat is a mild stimulant which most of Yemeni men chew in the public settings. The growing of qat require little labor and produces much profit. As the result of labor migration to the Gulf States, agriculture came to be abandoned because it requires a hard work and produces relatively low profit (Birks, 1980). Even though the returnees go back to occupation in agriculture, they prefer qat as their main crop, and thus food production does not recover.

Development of the country

Labor migration also affects the development of local industry. The cities in the sending countries of migrant workers need manual labors for the factory. However, the potential workers, i.e. rural population, prefer to go to foreign countries. Especially the wages in foreign countries are more appealing to rural population than city dwellers, the potential manual laborers needed for the development of a country. Thus the sending countries of migrant laborers stay behind from the industrialization and modernization. In former South Yemen, labor migration caused the shortage of skilled workers and technocrats. Thus the country had to receive foreign workers from the East Africa to compensate the loss of labor force (Richard, 1986). The reason why former South Yemen restricted the number of migrant workers leaving the country is mainly this.

The remittances from the migrant laborers usually does not help the development of the country. That money generates a new demand for luxury things such as VCR, camera and car. However, most of those commodities are imported from foreign countries because domestic products do not meet the demand of quality, or even they do not exist at all. Thus only import section of the economy is benefited by workers' remittances (Wenner, 1988).

Return Migration

In 1990, Iraqi army suddenly crossed the border of Kuwait, occupying the whole country and claimed the rights over the occupied territory. Saudi Arabia opposed Iraq and decided to invite US military forces into its territory. While most of the Arab countries supported the decision of Saudi Arabia, Yemen took a neutral stance, refusing to support the introduction of US military forces to solve the problem. This decision of Yemeni government caused the unprecedented scale of return migration. The Saudi government decided to deprive the special status of Yemeni migrant laborers. As a result, nearly a million of Yemenis had to leave Saudi Arabia. There were also approximately 45,000 Yemenis returning from Kuwait and Iraq. These phenomena meant the increase in the population of Yemen by 8% (Stevenson, 1993). The unemployment rate rose from 15% to 30% (Feiler, 1993). The country also lost the remittances from those countries as well.

The large scale of return migration, however, did not began with

the Gulf Crisis. From the mid 1980's, return migration became one of the issues in the Middle Eastern countries (Richards, 1996). As the labor market shrank, migrant laborers, especially unskilled workers, were forced to return to their home countries. The reason for this transition is the fall of oil price and the completion of major construction programs in the Gulf States. Although Yemen lost a substantial amount of workers' remittances at the time of Gulf Crisis, the amount of remittances had fallen to about 400 millions of US$. Considering that nearly 1.6 billions of US$ were sent to Yemen in 1983, the loss of the Gulf Crisis cannot be overestimated.

Policy of Yemeni Government and the suggestion for the future

The Yemeni government has several projects for the development of the country. From the mid 1980's the government had already been aware of increasing return migration and its potential negative effects on the economy. The government also noticed the relationship between workers' remittances and the import of industrial products:

Most industrial products are imported. The trade balance has a chronic deficit, but it is held within manageable limits. Between 1980 and 1988 it ranged between Y.D. 152 million (1987) and Y.D. 274 million (1984). The service account had a surplus up to 1984. This surplus has been decreasing between 1981 and 1984. In 1985 it involved a deficit of Y.D. 10 million which grew to about Y.D. 35 million in 1988. However, the deficit of goods and services has been partly covered by unrequired

transfers, the most important of which are the remittances from Yemeni workers working abroad, especially in the Arab Gulf countries. . . The amounts have been decreasing since 1984, as a result of the contracting economic activities - especially oil exports and prices - in the host countries (UN 1990). Thus Yemeni government tries to increase export production to improve the balance of payments. The government is also trying to minimize the import of goods by restricting them to the level to meet the country's needs for foodstuffs, raw materials, fertilizers, machinery and spare parts. However, the latter does not seem to succeed, as I saw a lot of Sony, Panasonic and other electric appliances in San'a this summer.

Yemeni government also lists several objectives for the 1990's. Here, I show just some of them.

(a) Development of natural resources
(b) Development of physical production sectors such as Agriculture, Industry and Fisheries
(c) Encouragement of exports by all possible means
(d) Encouragement of tourism
(e) Improvement of human resources including education, health, and job training

Among these objectives, the government gives priority to the development of industry. This is the right choice because most of the industrial

products are imported from foreign countries. The development of industry also produces job opportunities which is strongly needed in the current situation. The development of natural resources also sounds feasible, as oil and natural gas have been found in the country recently. The growth of the production of these two materials will be one of the solutions for current problems of return migration. Since this project requires infrastructure, the construction of pipelines and other facilities produce additional job opportunities.

On the other hand, tourism is not recommended. It is true that the development of tourism leads to the increase of foreign currency into the country. However, it simultaneously causes the increase in imported goods, as the tourists usually spend their money for imported goods, with the exception of souvenirs. For example, they use luxury hotels run by foreign companies. The service in the hotels is kept same as that of developed countries. This means that they use foreign products needed for the guests. The bus they use may be made in Japan or Germany. Moreover, the dependence on the tourism often results in avoidance of alternative ways of development such as industrialization of the country. Finally, the tourism is as unstable as labor migration, as the number of tourists usually fluctuates and cannot be controlled by a government. Considering these facts, it can be said that the development of tourism has little contribution to the improvement of economic situation of Yemen, if not at all.

Since the objects listed above cannot be achieved overnight, the

restoration of the position of the returnees to the original place is also needed. There was a talk between Yemen and Saudi Arabia after the Gulf Crisis and the flow of return migration. Some of the migrant laborers were allowed to return to Saudi Arabia, though the number is quite small if compared to number of those forced to leave the country. Considering that Saudi Government wants to reduce the number of foreign workers, the complete return to the original situation cannot be expected. Here, again, the rapid growth of economy and development of physical production section, i.e. industry, agriculture and fisheries, are needed.

Political turmoil in the country is also a problem Currently the consolidation of the country and the maintenance of the unity are the most important objectives of the government of Yemen. Everyday there are TV programs which spreads a lot of propaganda about the need for the unification and the consolidation of the country. Currently, it is said that most of the people agree on the unification of the country, though they differ in the opinion about the current government. Large scale of development will come only after the consolidation of the country.

The next step for the future is the industrialization and the restoration of agriculture. The decline of these sectors are partially caused by the outflow of labor power. Therefore now may be the chance to establish the way of self development of the country. Without achieving these two goals, the country will continue to depend on imported products and remittances from the migrant workers, and thus its economy are continuously influenced by the policy of the receiving countries. There

are some feasible projects of the development. Among them, newly found oil is the most likely solution for the current economic problems. Although the oil production of Yemen is not yet high enough (less than one per cent of the world production), there is high possibility of the improvement of current situation.

The port of Aden is another source of revenue for the country. The port has been known as one of the best natural port in the area for a long time. The position of the port is quite convenient, near to the Bab al-Mandub, the strait which connects the Red Sea to the Arabian Sea. The port, however, has been almost abandoned since 1970's. Yemeni government is planning to renovate the facilities of the port and receive large ships. Since most of the ships using the Suez Canal stop at Hormuz, a port in the Persian Gulf, the renovation of Aden may attract those who want to shorten the route of voyage.

Conclusion

Labor Migration is one of the common features in the Middle Eastern Countries. There is a clear distinction between the sending countries and the receiving countries. Usually, the receiving countries are characterized by small population and rich natural resources, i.e. oil. On the other hand, the sending countries are usually poorer than the receiving countries and have quite huge population. Yemen is a typical sending country with more than fourteen millions of population. Most of Yemenis headed to its neighbor, Saudi Arabia. The remittances from the

migrant laborers have been changing the household, neighborhood, and state economy of the country. The trend of migration is vulnerable to the change of policies of the receiving countries. The boom of labor migration was accelerated in the early 1970's with the rise of oil price and the construction boom in the Gulf States.

There are two different opinions on the effect of labor migration. Some scholar maintain that the labor migration functions as a safety valve for the economy of the sending countries. The surplus labor force in the sending countries can be absorbed by the labor shortage of the receiving countries. Thus the sending countries can manage the ever increasing population. Those countries can also benefit from huge amount of remittances from the migrant laborers. However, other scholars claim that it has also the negative effect on both current economy and the industrialization of the sending countries. In these days the latter theory seems to be applied. With the decrease in job opportunities for migrant workers in the late 1980's the potential danger of the labor migration emerged.

The character of the migration activities in the Middle East has changed from the past, especially after the emergence of oil producing countries. These countries give huge amount of job opportunities and attract the people from the surrounding regions. Now, the reason for migration is "better wages" and higher social status, i.e. landowner, as well as the solution for economic stagnancy in the sending countries. The governments of the sending countries should control the overflow of

migrants. One of the solutions is the rise of wages in their home country. Especially the revision of the state policy to keep the prices of agricultural products relatively low.

The Gulf Crisis was one of the turning points of Yemeni labor migration. About one million Yemenis were forced to return to the home country, and Yemen suffered from economic stagnation. It is true that the return migration at that time was unprecedented scale. However, the Gulf Crisis was not the major reason for the trend of return migration. The migration to the Gulf States had already declined by the end of 1980's. This trend was the result of the decline of oil price and the completion of major construction programs.

Yemen is currently suffering from economic stagnation and serious unemployment, and the country is not yet politically stabilized. However, the possibility of development is high because of the presence of natural resources such as oil and gas, and the potential usage of the port of Aden. In my opinion, although the government encourages tourism, it should concentrate on the development projects based on its own industries for the time being.

Maps:

Map of region.

Private Unrequired Transfers, Middle Eastern Countries, 1988.

GNP per capita, Middle Eastern Countries, ca. 1990.

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Notes

See the attached map.

The number includes Hadrami descents born in Indonesia.

There are several conflicts over the borders between Saudi Arabia and Yemen.

International Financial Statistics Yearbook and IMF Country Tables (line 77afd: Private Unrequired Transfers). As for the World Bank, they provide the data for the study of labor migration in their World Table (Workers' Remittances). These two publications, however, give only insufficient information for certain countries. For example, they have no information on the United Arab Emirates, the country which seems to provide quite large opportunities to foreign workers. The data on Iraq and Iran also cannot be found. Therefore we can access the information on

less than half of the Persian Gulf countries.

The reason for this is that the banking system in Yemen is not yet fully established, and the people are suspicious of the system. Some accidents during the process of remittances are reported (Stevenson, 1993).

The result of an interview in al-Hujariyya region in North Yemen says that more than ninety per cent of workers left their wives in the hometown. Since the interview is conducted in 1989 among returnees, the data can be considered as the situation in the early and middle 1980's.

As Table 3 shows, however, the percentage of farmers among the migrant laborers is less than that among general population (Colton, 1993).

UN Disaster Relief Organization, US Committee for Refugees, US State Department, International Organization for Migration and the US Government Accounting Office cite one million as the number of return migration from Saudi Arabia to Yemen (Stevenson, 1993).

I saw the programs almost everyday during my trip to Yemen.

CHAPTER TWO
HIDEO KURAMITSU
URBANIZATION IN EGYPT

Introduction

Last summer, I worked at United Nations Headquarters, belonging to United Nations Center for Human Settlement, a Secretariat of the last UN Conference "City Summit, Habitat II", held in Istanbul last June, and went there to attend the conference as an assistant for UN staffs from the beginning, This opportunity made me realize what current urban problems were and what we should do in the future. After this internship, I made a trip to Egypt for three weeks, and I saw a lot of urban problems in Cairo, which were the same situation as what was discussed in Istanbul. Although I may have nothing to do with these problems in Cairo, I felt like my own and would like to carry researches into why a lot of people gather this large city and what kinds of urban problems will be brought about. That is the reason why I selected this topic in this course.

First of all, I will introduce what urbanization is, including future trend and current reality. Second, I will mention about the City Summit, Habitat II. After showing the objections and goal, I will add what I did there and what I thought regarding this conference. Third, I want to show you the itinerary of my Egypt trip, including some pictures. I will report from the current situation in Cairo to some tourist spots such as Luxor, Aswan and Alexandria, and show you what I saw and thought. Fourth, I will introduce about Egypt, Geography, Population Maps and Economy. After that, I will show some graphs as a demographic transition. Finally, I want to show my analysis by using STELLA II. Recent data can tell us the future trend of urbanism such as population growth; however, few people knows why these things happen. After promoting better understanding about this country, I try to examine available data in various fields as mush as possible, and will find possible relationships among them. These analysis will allow me to create the population dynamics model in Egypt by using STELLA II. This model will visibly show the relationship among the population growth and others, and bring about better understanding about the population dynamics in this country. I made a simple model taken into account population factors such as birth and death rate from the data of World Resource Institute, and linked it to GDP (Gross Domestic Products). It was very difficult to link them, because they cannot be represented by an equation.

For example, a fertility rate is supposed to be linked with Industrial output per capita; however, each graph never tells any relationships. Fortunately, I found a good relationship between them by multiple regression analysis. I could link between each distribution of GDP and population growth factors by a liner equation. This STELLA model tells us to what extent each distribution of GDP will effect on the population growth, which can be handled by the government. In conclusion, I will give some findings and possible further studies in the future, based on

the results from the STELLA model.

Urbanization

Urbanization is one of the critical global trends shaping the future, reshaping the physical and social environment, as it fuels economic growth and spurs environmental degradation. Cities can serve as centers of employment, growth and innovation; however, the rapid population growth in large cities in developing counties will go beyond its capacity. On the table below, I show some future trend and current reality in the world, which we are surely surprised at.

Table 1 : Future Trend and Current Reality

Future Trend

By 2025, world population is expected to reach 8.3 billion, a 50 % increase over the present. Africa's population is expected to double, Latin America's to grow nearly 50 %. and Asia's to grow 40 % during that period.

Current Reality

Fertility rate in most developing countries are declining, but must fall mush further if even the mid-range population growth projection (8.3 billion) is not to be exceeded.

Future Trend

By 2025, 2/3 of the world's people will live in cities.

Current Reality

Only one third of the world's population was urban 35 years ago. More than 150,000 people are being added to urban population in developing countries every day.

Future Trend

By 2015, the world will have 33 "megacities" with population over 8 million and more than 500 cities with population of 1 million or more.

Current Reality

Greater Tokyo already has 27 million people; Sao Paulo, Brazil, 16.4 million; and Bombay, India, 15 million.

Future Trend

In coming decades, most of the world's poor will be in urban, living under conditions that can be worse than those of rural poor.

Current Reality

Between 1970 and 1990, the number of urban poor in Latin America alone increased from 44 to 115 million.

Future Trend

By 2000, the physical size of cities in developing countries is expected to be double what it was in 1980, exerting phenomenal stress on local environment.

Current Reality

More than 40 % of all cities with a population of 500,000 or more are in tidal estuaries or on the open coast. Half of the world's coastlines and coastal ecosystems are already at risk from development.

Future Trend

By 2020, energy use will increase by 50 to 100 %. Emissions of greenhouse gases that contribute to the risk of climate change will increase by 45 to 90 %.

Current Reality

In the past 20 years, global energy use has grown nearly 50 %. The Intergovernmental Panel on Climate Change has concluded that greenhouse gas emissions have led to a "discernible human influence on global climate.

Future Trend

By 2010, the number of motor vehicles could grow to more than 800 million, exacerbating urban air pollution especially in rapidly industrializing countries.

Current Reality

In Bangkok, 300-400 more vehicles are added to traffic jams daily. In the United States, the number of miles driven in motor vehicles climbed 40 %, largely offsetting increases in vehicle efficiency.

Future Trend

World food production is expected to keep up with population growth, but

many people will still go hungry. By 2010, the number of African's which suffer from malnutrition is expected to increase 70 % to 300 million.

Current Reality

Nearly one billion people get most of their protein from fish. Overfishing has already depleted more than one-fourth of the world's marine fish stocks.

Future Trend

By 2050, as many as 2.4 billion people could live in countries facing water scarcity. This is nearly 1/5 of the world's projected population.

Current Reality

Withdrawals of fresh water from rivers and lakes have quadrupled in the last 50 years. In 1994, at least 220 million urban dwellers lacked steady access to safe drinking water. Fully 90 % of sewage in developing countries go untreated.

Source: World Resources 1996-97 Press Release

Habitat II
Goals and Objectives

As can be seen on the table 1, such urban problems were the main topics at the recent international conference, Habitat II, which was held in Istanbul last June. The overall objective of the Habitat II Conference is twofold: one is to increase the world's awareness of the deteriorating living environment, and the second is to awaken the planet to the potentials of human settlement as catalysts for social progress and economic growth -- and that can only happen if our cities, towns and villages are healthy, safe, just and sustainable. The fundamental goal is to prepare the international community for life on an urbanized earth.

What I did

I have worked as an intern in the United Nations Centre for Human Settlement (Habitat), New York Office, from May 22 to July 26 1996. I assisted with various tasks in the preparation of the Habitat II Conference which take place in Istanbul, Turkey. I attended the conference in Istanbul from 1 to 16 June, was to assist to the UN staff in the organization of special events including hospitality services and coordinated logistics for the Secretary-General's Advisory Group. Several opportunities to attend conferences were given to me, such as main conference, NGO Forum and other official conferences. A lot of current

urban problems were reported there, which made me realize what happened in urbanizing world.

What I thought

My main impression about the conference is that from now on our efforts to improve the living environment must be focused on urban areas. That is where most of the world's population will live and work, where most economic activity will take place, where the most pollution will be generated, and where most natural resources consumed. In Istanbul, I had an opportunity to know some keys to urban efficiency; such as decentralization, employment generation, environmental infrastructure, land regulations, municipal finance, and promoting good governance. These might be the ways to reduce the urbanization; however, first of all, I should understand why and how such movement of human population occurs and what kinds of relationship with the global environment exists.

Trip to Egypt

After the internship at United Nations, I made a trip to Egypt for three weeks, visiting Cairo, Alexandria, Upper Egypt and Red Sea. Since various urban problems were discussed at the conference in Istanbul, this trip was not just sight seeing. I arrived at Cairo on the 5th of August. The current situation of Cairo is just terrible; such as a lot of people and auto-mobile, which bring about a lot of garages with sand in the streets, smog in the air and even River Nile is far from clean. The scene is surely different from the image which I had. Furthermore everything is written in Arabic and people who can speak English tend to tell a lie to travelers, so I think visitors cannot make a trip individually unless they speak Arabic. Next, I visited Alexandria, the second biggest city in Egypt, which is one of the cities faced on the Mediterranean Sea. I met a French gentleman there, and he said that Alexandria was the most beautiful in Mediterranean cities, even more than Nice or Monaco in France; however, now it becomes one of the worst cities with floating garbage in the sea. Then I headed for Aswan by a mini-bus, which took me about 15 hours to get there. I visited the Aswan High-Dam and found an interesting sign, saying "This is an Egyptian challenge against nature". In fact, this dam can control the water flow and brings about steady water supply without flood; however, it resulted in climate change around there. It used to have little rain before, but, because of the Lake Nasal, it sometimes has rain due to the vapor from the lake, causing environmental change. At Luxor, I pedaled a bicycle to visit King of Valley under hot weather. The direct sunshine brought more than 44 C(degree), and I almost died. Finally I went to Hurghada, Red Sea to go scuba-diving. Red Sea has one of the most beautiful coral reefs, which attracts all divers in the world. It is sure that a lot of world heritage still exist in Egypt, and a lot of foreign people want to see them once. However, it seems to me that a lot of people depend upon them too much. That is the reason why service per capita has been growing up recently. Frauds and crimes for visitors have increased, which makes the image of Egypt worse. Under such a current trend, nothing new will be produced. If the government thinks much of

service sector especially in travel, it should commit with a positive attitude, which create repeat visitors to Egypt.

EGYPT

Geography and History

Officially Arab Republic of Egypt, from 1958 to 1971 UNITED ARAB REPUBLIC, republic, Northeast Africa and Sinai Peninsula, Southwest Asia. It is bounded on the North by the Mediterranean Sea, on the East by Israel and the Red Sea, on the South by the Sudan, and on the West by Libya. The country has a maximum length from North to South of about 1085 km (about 675 mi.) and a maximum width, near the South border, of about 1255 km (about 780 mi). It has a total area of approximately 1,001,450 sq. km(approximately 386,660 sq. mi). The land of the Nile River, Egypt is the cradle of one of the world's greatest ancient civilizations and has a recorded history that dates from about 3200 BC. The descriptive material that follows is pertinent to modern Egypt. The History section covers Egypt from ancient times, including the Dynastic Period (3200 BC-343 BC), the Hellenistic Period (332 BC-30 BC), Roman and Byzantine Rule (30 BC-AD 638), the Caliphate and the Mamalukes (642-1517), Ottoman Domination (1082-1882), and British colonialism (1882-1952) as well as modern, independent Egypt (1952-).

Land and Resources.

Less than 10% of the land area of Egypt is settled or under cultivation. This territory consists of the valley and delta of the Nile and a number of desert oases. More than 90% of the country consists of desert areas, including the Libyan Desert in the West, a part of the Sahara, and the Arabian (or Eastern) Desert, which borders the Red Sea and the Gulf of Suez, in the East. The Libyan Desert (also known as the Western Desert) includes a vast sandy expanse called the Great Sand Sea. Located here are several depressions with elevations below sea level, including the Qattarah (Qattara) Depression, which has an area of about 18,100 sq. km (about 6990 sq. mi) and reaches a depth of 133m (436 ft) below sea level, the lowest point in Africa; also found here are the oases of Siwah, Kharijah, Bahriyah, Farafirah, and Dakhilah. Much of the Arabian Desert occupies a plateau that rises gradually East from the Nile Valley to elevations of about 610 m (about 2000 ft) in the East and is broken along the Red Sea coast by jagged peaks as high as about 2135 m (about 7000 ft) above sea level. In the extreme South, along the border with the Sudan, is the Nubian Desert, an extensive region of dunes and sandy plains. The Sinai Peninsula consists of sandy desert in the North and rugged mountains in the South, with summits looming more than 2135 m (more than 7000 ft) above the Red Sea, and including Jabal Katrinah (2642 m/8668 ft), the highest elevation in Egypt.

The Nile enters Egypt from Sudan and flows North for about 1545 km (about 960 mi) to the Mediterranean Sea. For its entire length from the South border to Cairo the Nile flows through a narrow valley lined by cliffs. At the Sudan border lies Lake Nasser, a huge reservoir formed by the Aswan High Dam (q.v.) . The lake is about 480 km (about 300 mi) long and is about 16 km (10 mi) across at its widest point.

Population Map in 1960.

Population Map in 1992.

Population Map in 2001.

Economy

During the presidency of Gamal Abdel Nasser, the economy of Egypt was radically socialized. Beginning in 1961, foreign trade, banking, insurance, and most wholesale and industrial establishments were nationalized. Those sectors which remained in private hands were placed under heavy regulatory restraints. Industry was expanded and production increased according to a five year plan. Inadequate foreign investment, a sluggish bureaucracy and the disastrous 1967 Arab-Israeli War subverted subsequent programmes until a process of economic reform was inaugurated by Abdel Nasser's successor, Anwar Sadat, in the aftermath of the October War of 1973. By reversing many of Abdel Nasser's policies and opening Egypt to foreign investment, Sadat began a gradual revival of the Egyptian economy which was significantly enhanced by remittances from Egyptian working in the surrounding oil producing countries. The very slow but sure relaxation of import, currency and trade restrictions stimulated Egypt's foreign exchange economy. Tourism, which had fallen off drastically during Abdel Nasser's time due to Egypt's anti-western stance and poor tourist infrastructure, was restarted with the privatization of many nationalized tourist facilities. Sadat's dramatic peace initiative and treaty with Israel transformed the western view of the Arab leader and his country and further enhanced the country internationally, although the gesture was motivated by more practical considerations: Egypt couldn't afford another war with Israel. Despite the many advances the country has witnessed under President Hosni Mubarak, Egypt continues to suffer from the vagaries of regional instability and its exploding population. Government leaders openly admit that population growth is undermining all efforts toward developing the country's economy. This situation is further aggravated by consumerism. Servicing a foreign debt over twice the size of the national budget is another negative factor. Under pressure from the IMF and World Bank, Egypt finally began to lift price controls, reduce subsidies and begin to relax restrictions on trade and investment. Tourism represents one of the most lucrative sectors of Egypt's economy but is highly vulnerable to internal violence and regional politics. The government remains hopeful that the oil and gas discoveries in the western desert will produce significant revenues.

Figure 1. Total Population. Graph.

According to the data from World Resource Institute, the total population in Egypt will grow up as can be seen on the figure 1. Although it looks like a linear curve, I got a better result using logistic model. Basically, logistic models represent that the curve will get close to the limit, so the growth of the total population in Egypt will be declining over time. By 2050, it is expected that the total population in Egypt will reach almost 12 million.

Figure 2. Urban and Rural Population.

Figure 3. Crude Birth and Death Rate.

The graph of Urban & rural population in Egypt shows urbanization clearly. According to the data, the urban population will be doubled in the next 30 years. This is one of the typical cases of urbanization in the developing countries. Crude birth rate will be still higher than death rate; however, the crude birth rate is expected to be declining over time. On the other hand, the death rate will be growing up again around the year of 2015. Since people are aging, such a trend can be expected in the future.

Population Growth Analysis
STELLA II

About 20 years ago, Dr. Dennis L. Meadows, a professor at MIT, represented the world model in his book, "The Limits To Grows". This model was built specifically to investigate five major trends of global concern; such as accelerating industrialization, rapid population growth, widespread malnutrition, depletion of nonrenewable resources, and a deteriorating environment. Since this model is a formal and mathematical model, it has two important advantages over mental models. First, every assumption is written in a precise form so that it is open to inspection and criticism by all. Second, after the assumptions have been scrutinized, discussed, and revised to agree with the best current knowledge, their implications for the behavior of the world system can be traced without error by a computer, no matter how complicated they become. Referring to the world model and using current available data, I will create the Egypt model by STELLA II.

Simple Modeling

First of all, I created a simple model, taking into account population factors only, such as birth and death rate. The generation was divided by three, and each growth pattern can be seen in the graph. As a result of this simple model, I could got a similar growth patterns as can be seen on the figure 1. However, the range is a little higher than the data from WRI. Other factors such as Industry, Agriculture and Natural Resource will effect on this growth pattern. Since some of these other factors would play a significant role to decrease the population growth such as birth control, I would like to put GDP (Gross Domestic Products) into the previous model.

Figure 4. STELLA II model 1 (population factors only)

Figure 5. Population growth by generation.

Link to GDP

Figure 6. Distribution of GDP (percent).

Figure 7. Each category per capita.

GDP is divided three outputs such as industry, service and agriculture. As can be seen, the service sector holds about 60 % of the total GDP. With the increase of service output, service per capita is also growing up in spite of the rapid population growth. Each output will have some relationship with population growth factors such as fertility and mortality. For example, if the industrial per capita increases and people obtain better life, the birth rate would be effected by that. The service per capita also have an influence to this, because people would have better education, which would bring about birth control.

Figure 8. Relationship between industry per capita and fertility rate.

Figure 9. Relationship between service per capita and fertility rate.

However, there is no equation to link between them. To what extent the increase industrial per capita effects on total fertility? How about service output? In order to solve this problem, I created graphs in the previous page, showing the relationship between each category of GDP and fertility rate. As can be seen, the fertility rate will be declining over time, while each output changing randomly. That means I cannot have the relationship, because the fertility rate is not determined my them. However, let me think like this. The difference of the fertility rate each year may be effected by the actual results of industry per capita or service one. So I summed it up year by year, and look into the relationship by using Multiple Regression.

Multiple Regression
Fertility Rate

Equation Number 1 Dependent Variable.. FERTIL

Block Number 1. Method: Stepwise Criteria PIN .9800 POUT .9900
SUMIND SUMSER SUMAGRI

Variable(s) Entered on Step Number
1.. SUMSER

Multiple R .99805
R Square .99610
Adjusted R Square .99592
Standard Error .03889

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	8.50350	8.50350
Residual	22	.03328	.00151

F = 5621.96550 Signif F = .0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
SUMSER	-3.41548E-04	4.5552E-06	-.998049	-74.980	.0000
(Constant)	5.506274	.012850		428.511	.0000

```
------------- Variables not in the Equation -------------

Variable             Beta In      Partial    Min Toler           T    Sig
T

SUMIND       -.126370   -.191485    .008950         -.894  .3814
SUMAGRI     -.145369   -.255322    .012025       -1.210  .2397


Variable(s) Entered on Step Number
   2..    SUMAGRI


Multiple R                .99818
R Square                  .99636
Adjusted R Square    .99601
Standard Error           .03849

Analysis of Variance
                    DF      Sum of Squares      Mean Square
Regression           2             8.50567          4.25283
Residual            21              .03111           .00148

F =    2871.05761       Signif F =  .0000

------------------ Variables in the Equation ------------------

Variable                B                SE B              Beta
T      Sig T

SUMSER      -2.92100E-04  4.1109E-05   -.853557    -7.106  .0000
SUMAGRI    -1.18900E-04  9.8253E-05   -.145369    -1.210  .2397
(Constant)      5.527124          .021414                    258.108
.0000

------------- Variables not in the Equation -------------

Variable          Beta In    Partial     Min Toler         T  Sig T

SUMIND       .023096  .021745    .003230      .097  .9235



Variable(s) Entered on Step Number
   3..    SUMIND

Multiple R                .99818
R Square                  .99636
Adjusted R Square    .99581
```

```
Standard Error          .03943

Analysis of Variance
                    DF      Sum of Squares      Mean Square
Regression           3             8.50568          2.83523
Residual            20              .03109           .00155

F =    1823.75924       Signif F =  .0000

------------------ Variables in the Equation ------------------

Variable             B                    SE B             Beta
T         Sig T

SUMIND       1.32982E-05   1.3671E-04    .023096       .097  .9235
SUMSER      -2.94550E-04  4.9072E-05   -.860716    -6.002  .0000
SUMAGRI    -1.31929E-04  1.6755E-04   -.161299     -.787   .4403
(Constant)      5.528470         .025937                     213.147
.0000

End Block Number   1   POUT =     .990 Limits reached.
```

In this multiple regression, independent variables; such SUMSER as sum of service per capita, were entered on step number, meaning that the most relative independent variable to the dependent variable of "fertility rate" was selected to be in the equation at first. As can be seen in the R square, the fertility rate is totally effected by service per capita (R Square = .99610). The other two variables could not give significant change in the R Square (R Square = .99636). This seems to mean that there is little link between the fertility rate and the industrial or food per capita. It is sure that this discovery will decisively effect on the model, and I can put an equation into it based on the result of the multiple regression as follows;

"Fertility rate" = .000013982 * SUM(industrial_per_capita) + (-.00029455) * SUM(service_per_ capita) + (-.000131929) * SUM(food_per_capita)

```
Mortality Rate
Equation Number 1    Dependent Variable..   MORTAL

Block Number  1.  Method:  Stepwise     Criteria   PIN  .9800   POUT
.9900
   SUMIND   SUMSER   SUMAGRI

Variable(s) Entered on Step Number
   1..    SUMAGRI

Multiple R               .99574
R Square                 .99150
Adjusted R Square    .99111
Standard Error          .28094
```

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	202.48991	202.48991
Residual	22	1.73634	.07892

F = 2565.61570 Signif F = .0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
SUMAGRI	-.003984	7.8645E-05	-.995740	-50.652	.0000
(Constant)	17.985729	.103648		173.527	.0000

---------- Variables not in the Equation ----------

Variable	Beta In	Partial	Min Toler	T	Sig T
SUMIND	.993537	.713548	.004385	4.667	.0001
SUMSER	.406696	.483664	.012025	2.532	.0194

Variable(s) Entered on Step Number
2.. SUMIND

Multiple R	.99791
R Square	.99583
Adjusted R Square	.99543
Standard Error	.20146

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	203.37397	101.68698
Residual	21	.85228	.04058

F = 2505.54368 Signif F = .0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
SUMIND	.002798	5.9949E-04	.993537	4.667	.0001
SUMAGRI	-.007949	8.5162E-04	-1.987096	-9.335	.0000
(Constant)	18.469929	.127621		144.724	.0000

```
------------- Variables not in the Equation -------------

Variable          Beta In     Partial     Min Toler         T  Sig T

SUMSER       .134039  .195267    .003230      .890  .3838


Variable(s) Entered on Step Number
   3..    SUMSER

Multiple R                .99799
R Square                  .99599
Adjusted R Square    .99538
Standard Error           .20246
```

Analysis of Variance

```
                    DF      Sum of Squares      Mean Square
Regression           3           203.40647         67.80216
Residual            20                .81978          .04099

F =    1654.14658       Signif F =  .0000

------------------ Variables in the Equation ------------------

Variable                  B                  SE B              Beta
T      Sig T

SUMIND           .002477          7.0200E-04     .879610     3.529   .0021
SUMSER         2.24357E-04    2.5197E-04     .134039       .890   .3838
SUMAGRI        -.008028         8.6035E-04  -2.006650    -9.331  .0000
(Constant)       18.501888           .133183                      138.920
.0000

End Block Number   1   POUT =     .990 Limits reached.
```

In comparison with the fertility rate, the most relative independent variable of SUMAGRI (food per capita) to the dependent variable of "mortality rate" was selected to be in the equation at first. As can be seen in the R square, the mortality rate is totally effected by food per capita (R Square = .99150). The other two variables could not give significant change in the R Square (R Square = .99599), either. This seems to mean that there is little link between the mortality rate and the industrial or service per capita. I can also put an equation into it based on the result of the multiple regression as follows;
"Mortality Rate" = .002477 * SUM(industrial_per_capita) + .000224357 * SUM(service_per_capita) + (-.008028) * SUM(food_per_capita)

Curvefit Analysis

Since the multiple regression is used a liner model, there might be another estimation such as logistic model in representing the

relationship. I found strong relationships between the fertility rate and the service per capita, and the mortality rate and the food per capita as I noted earlier. In these two cases, I compared the linear model with the logistic one below. The results tells us that each of the linear models has a slightly better R-Square than that of the logistic model. It means that I had better use a linear model in the multiple regression rather than a logistic one.

Curvefit fertility with service per capita

```
CURVEFIT /VARIABLES=fertil  WITH sumser

->   /CONSTANT
->   /MODEL=LINEAR LGSTIC
->   /PLOT FIT.

Independent:  SUMSER

Dependent  Mth   Rsq      d.f.       F             Sigf  bound      b0
b1

   FERTIL   LIN   .996     22     5621.97     .000             5.5063
-.0003
   FERTIL   LGS  .995     22     4021.98     .000       .        .1798
1.0001
```

Figure 10. Curvefit fertility with service per capita

```
CURVEFIT /VARIABLES=mortal  WITH sumagri
->   /CONSTANT
->   /MODEL=LINEAR LGSTIC
->   /PLOT FIT.

Independent:  SUMAGRI

  Dependent    Mth   Rsq    d.f.             F      Sigf   bound
b0      b1

   MORTAL   LIN   .991    22        2565.62  .000            17.9857
-.0040
   MORTAL   LGS  .989    22        1954.93  .000         .        .0537
1.0003
```

Figure 11. Curvefit mortality with food per capita.

```
        Gross_Domestic_Products(t) = Gross_Domestic_Products(t - dt) +
(capital_investment - capital_depreciation) * dt
        Initial Gross_Domestic_Products = 40000000000

        INFLOWS:
        capital_investment =
(agricultural_output*.3+industrial_output*.7+service_output*.5)*(investment_rate/
        100)+official_development_assistance

        OUTFLOWS:
        capital_depreciation =
Gross_Domestic_Products/average_lifetime_of_capital/100

        population_1__#0_to_14#(t) = population_1__#0_to_14#(t - dt) +
(births -       deaths_0_to_14 - maturation_1_to_2) * dt
        Initial population_1__#0_to_14# = 23924000
        INFLOWS:
        births = population_2__#15_to_64# * 0.48 * fertility_rate -
total_population
        * infant_mortality
OUTFLOWS:
        deaths_0_to_14 = population_1__#0_to_14#*mortality
        maturation_1_to_2 = population_1__#0_to_14#*(1-mortality)
```

Modeling linked with GDP

Figure 12. STELLA II model linked with GDP.

```
        population_2__#15_to_64#(t) = population_2__#15_to_64#(t - dt) +
(maturation_1_to_2 - maturation_2_to_3 - deaths_15_to_64) * dt
        Initial population_2__#15_to_64# = 36361000

        INFLOWS:
        maturation_1_to_2 = population_1__#0_to_14#*(1-mortality)

        OUTFLOWS:
        maturation_2_to_3 = population_2__#15_to_64#*(1-mortality)
        deaths_15_to_64 = population_2__#15_to_64#*mortality

        population_3__#65_and_over#(t) = population_3__#65_and_over#(t -
dt) +   (maturation_2_to_3 - deaths_65_and_over) * dt
        Initial population_3__#65_and_over# = 2646000

        INFLOWS:
```

```
        maturation_2_to_3 = population_2__#15_to_64#*(1-mortality)

        OUTFLOWS:
        deaths_65_and_over =
population_3__#65_and_over#*mortality/mortality

        agricultural_output = Gross_Domestic_Products *
agricultural_capital _output _ratio                                  /100
        birth_control = (.000013982*SUM(industrial_per_capita) -.00029455
*                           SUM(service_per_capita) - .000131929 *
SUM(food_per_capita)) * 5
        fertility_rate = perspective_birth_rate+birth_control
        food_per_capita = agricultural_output/total_population
        health_service = (.002477*SUM(industrial_per_capita) + .000224357
*                           SUM(service_per_capita) - .008028 *
SUM(food_per_capita)) * 5
        industrial_output =
Gross_Domestic_Products*industrial_capital_output_ratio/100
        industrial_per_capita = industrial_output/total_population
        mortality = (perspective_death_rate+health_service)/1000
        service_output =
Gross_Domestic_Products*service_capital_output_ratio/100
        service_per_capita = service_output/total_population
        total_death = deaths_0_to_14+deaths_15_to_64+deaths_65_and_over
        total_population = population_1__#0_to_14# +
population_2__#15_to_64#                          +
population_3__#65_and_over#

agricultural_capital_output_ratio = GRAPH(TIME)
(0.00, 17.0), (1.00, 16.5), (2.00, 16.0), (3.00, 15.0), (4.00, 12.0),
(5.00, 11.0), (6.00, 9.50), (7.00, 8.50), (8.00, 8.50), (9.00, 6.50),
(10.0, 7.50), (11.0, 9.50), (12.0, 10.0)
average_lifetime_of_capital = GRAPH(TIME*5)
(0.00, 30.0), (1.00, 28.5), (2.00, 28.0), (3.00, 27.5), (4.00, 26.5),
(5.00, 26.5), (6.00, 25.0), (7.00, 24.5), (8.00, 22.5), (9.00, 22.5),
(10.0, 22.0), (11.0, 21.0), (12.0, 20.0)
industrial_capital_output_ratio = GRAPH(TIME)
(0.00, 28.0), (1.00, 27.0), (2.00, 26.0), (3.00, 25.5), (4.00, 26.0),
(5.00, 26.0), (6.00, 27.5), (7.00, 30.5), (8.00, 33.5), (9.00, 36.5),
(10.0, 38.0), (11.0, 39.0), (12.0, 40.0)
infant_mortality = GRAPH(TIME)
(0.00, 0.054), (1.00, 0.043), (2.00, 0.035), (3.00, 0.03), (4.00, 0.025),
(5.00, 0.02), (6.00, 0.017), (7.00, 0.014), (8.00, 0.012), (9.00, 0.009),
(10.0, 0.008), (11.0, 0.008), (12.0, 0.007)
investment_rate = GRAPH(TIME*5)
(0.00, 1.00), (1.00, 1.85), (2.00, 2.35), (3.00, 2.75), (4.00, 3.05),
(5.00, 3.45), (6.00, 3.70), (7.00, 3.95), (8.00, 4.35), (9.00, 4.60),
(10.0, 4.75), (11.0, 4.75), (12.0, 5.00)
official_development_assistance = GRAPH(TIME*1000000)
(0.00, 2000), (1.00, 1950), (2.00, 1785), (3.00, 1695), (4.00, 1635),
```

```
(5.00, 1500), (6.00, 1365), (7.00, 1305), (8.00, 1185), (9.00, 1125),
(10.0, 1065), (11.0, 1035), (12.0, 1000)
perspective_birth_rate = GRAPH(TIME)
(0.00, 3.00), (1.00, 2.95), (2.00, 2.90), (3.00, 2.85), (4.00, 2.85),
(5.00, 2.80), (6.00, 2.75), (7.00, 2.70), (8.00, 2.65), (9.00, 2.65),
(10.0, 2.55), (11.0, 2.50), (12.0, 2.45)
perspective_death_rate = GRAPH(TIME)
(0.00, 8.00), (1.00, 7.20), (2.00, 6.80), (3.00, 6.65), (4.00, 6.20),
(5.00, 6.10), (6.00, 6.00), (7.00, 6.15), (8.00, 6.45), (9.00, 6.65),
(10.0, 7.20), (11.0, 7.50), (12.0, 8.00)
service_capital_output_ratio = GRAPH(TIME)
(0.00, 55.0), (1.00, 56.5), (2.00, 58.0), (3.00, 59.5), (4.00, 62.0),
(5.00, 63.0), (6.00, 63.0), (7.00, 61.0), (8.00, 58.0), (9.00, 57.0),
(10.0, 54.5), (11.0, 51.5), (12.0, 50.0)
```

Assumption

Each initial number; such as GDP and population is based on the data in 1995 from WRI. In capital investment, an inflow of GDP, it is on the assumption that each distribution of current GDP would effect on that of the next year by the following ratio; such as agriculture 30%, service 50% and industry 70%. Deaths of each generation is based on mortality, and the rest of them mature to the next generation. Birth control and health service, which effect on fertility and mortality rate, is the results from the multiple regression analysis. Some factors have (*5) at the end of equation, because 1 time on graphs equals 5 years. Each distribution of GDP capital output ratio makes up to 100%, and it is on the assumption of the prospective trend the government might think much of the industrial output in comparison with the service one over time. Average life time of capital would be improved 50% in the model. Other factors are overall based on the data of WRI, and added some reasonable assumptions.

Results (Graphs)

From the next page, some graphs are shown; such as Total Population, Fertility, Mortality and the distribution of GDP, which were brought about by running the STELLA II model. In comparison with the previous model, the total population became closer to the perspective of WRI, which means that the distribution of GDP would surely effect on the population growth, and the linear equations by the multiple regression analysis brought about a better connection between the distribution of GDP and the fertility or mortality rate in the model.

Figure 13. Total Population.

Figure 14. Distribution of GDP.

The total population would increase over time, which looks like a logistic growth. It would reached about 13 million in 60 years. Since WRI expects about 12 million in 2050, this result is very close to it. On the other hand, GDP would gradually grow up, and the distribution clearly reflects the assumptions which I gave. Each of these output effects on the fertility and mortality rate on the basis of the equations, resulted by the multiple regression.

Table 2. Input Data of Each Sum of Distribution of GDP per capita and Population Growth Factors.

Spreadsheet, first part.

Spreadsheet, second part.

Spreadsheet, third part.

Spreadsheet, fourth part.

Figure 15. Fertility Rate.

Figure 16. Mortality Rate.

The fertility rate would gradually be decreasing and reach around 2.10 children per women. According to the equation from the multiple regression, the sum of service per capita would strongly effect on it. Since service per capita would be still high for a while, the fertility rate would be surely influenced, and would be the same rate that WRI estimated. On the other hand, the mortality rate would be increasing in about 30 years. The sum of food per capita would have a significant role for the mortality rate in the equation of multiple regression results. Because of the low share of the agricultural output, the mortality rate

might not depend upon the linear equation.

Conclusion

In this research, I found very strong relationships between the sum of service per capita and the fertility rate, and the sum of food per capita and the mortality rate by multiple regression analysis. Each R Square is over .99, which means the dependent variable changes as the almost same as the independent variable does. By using these results, the new STELLA II model would reflect the population dynamics more realistically in comparison with the previous simple model. However, it is sure that a lot of factors; such as pollution, nonrenewable resources and agriculture, should be included into this model in order to make it more realistic. Furthermore, most of other students created maps and graphs among countries in the world. It is sure that such maps and graphs make us easily understood to what extent of the category in the country is situated in the world. I could include other neighbor countries into the STELLA model, too. Actually, such a relationship is surely important for the population dynamics, though the data might be difficult to obtain. I hope this research would provide further studies regarding the population dynamics and that this STELLA model would be endlessly improved by adding more factors.

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CHAPTER THREE
CLIVE LIPCHIN
WATER SCARCITY, INTERNATIONAL SECURITY AND RESOURCE DISPUTES-THE CASE OF THE TIGRIS-EUPHRATES AND JORDAN BASIN RIVER SYSTEM

Introduction

Fresh water is a fundamental resource, vital for an organism's survival. There is probably no other resource on earth as vital as water (except perhaps for air) for any extant species. Humans, like any other organism, must have access to water. Water is integral to all ecological and social activities. It is required for food and energy production, transportation, waste disposal, industrial development and public health. However, fresh water is unevenly and patchily distributed across the surface of the earth, with some regions having either ample supply or unlimited access whilst other regions suffer from unpredictable rainfall patterns and long periods of drought. As human populations grow and their activities continue to alter environmental patterns, the demand for fresh water will increase as the availability and quality of fresh water decreases. These conditions make it more likely for water related conflicts to occur between nation states that are forced to share a common water resource under the strain of locally increasing populations. In the semi arid and arid regions of the globe conflict over water seems a more and more likely prospect. Indeed, the next great war might be fought over water. The incompleteness of available data and uncertainties about the role that environmental degradation will have on the water supply and demand further complicate matters.

Where water is scarce, competition for limited supplies can lead nations to see access to water as a matter of national security (Gleik, 1993). As early as the mid-1980s, U.S. government intelligence services estimated that there were at least 10 places in the world where war could break out over dwindling shared water resources; the majority of these locations are in the Middle East (Starr, 1991). Jordan, Israel, Cyprus, Malta and the countries of the Arabian Peninsula are sliding into the perilous zone where all available fresh surface and ground water supplies will be fully utilized (Starr, 1991).

Across the globe many rivers, lakes and ground water aquifers are shared by two or more nations. This geographical fact has led to the geopolitical reality of disputes over shared waters where the situation in the Middle East (Nile, Jordan and Tigris-Euphrates) is just one such example. Other regions where water disputes have or are likely to arise are: the Indus, Ganges and Brahmaputra in southern Asia and the Colorado, Rio Grande and Parana in the Americas.

Some examples of water related disputes: a global view

The following examples were down loaded and adapted from the following web site: http://inter.mfa.gov.tr/GRUPF/water.

The Water Dispute on the Ganges River

The Ganges River originates in the People's Republic of China, passing through Nepal and India. It forms a boundary of 128 km between India and Bangladesh, then flows 112 km within Bangladesh taking the name Badhma, before joining the Jamuna-Brahmaputra. Afterwards it joins the Meghna River before the combined flows empty into the Bay of Bengal.

The allocation of the Ganges waters constitutes the most important aspect of the dispute between India and Bangladesh. Pakistan protested the construction of the Farakka Dam in 1951, when it was announced that India had planned to build it. Pakistan, at the same time, offered that the planning of the utilization of such shared water resources be made by a UN body and that the subject matter must be examined by the experts of both countries. These proposals were not accepted by India and the construction of the Farakka Dam started ten years later in 1961 and was completed in 1970. The matter of the allocation of the transboundary waters was negotiated between India and Pakistan until Bangladesh gained its independence in 1971.

In negotiations conducted after 1971, Bangladesh authorities stated that they would not favor any temporary arrangement in the allocation of the Ganges waters and have instead requested that there should be a permanent solution to the matter, which would include all of the shared water resources between the two countries. India and Bangladesh agreed in November 1977 that 63 % of the Ganges' waters be allocated to Bangladesh in the dry season. Indian officials have expressed that this agreement has been realized on the understanding that a channel should be constructed between the Brahmaputra and the Ganges Rivers which would lead to an increase in the flows of the Ganges. Indian officials have further emphasized that the riparian countries should utilize the waters in accordance with the principles of justice and equity, taking into account the population, land and needs of the countries.

India, moreover, has stated that if a country alleged that its interests were harmed due to a decline in the amount of water, it should be asked to prove this allegation. It further stressed that Bangladesh's opposition to the construction of the Farakka Dam is unfounded and that the construction of a dam is a natural right of any country. Indian authorities further argue that the water, gathered behind a dam, belongs to the country which constructed it and that no international rules have yet been established to resolve such a conflict. They also stress that efforts by the UN to codify the international rules applicable in such disputes are still far from sufficient. In conclusion, it may be said that India, regarding its conflict with Bangladesh, follows a policy in accordance with the principle of equitable utilization.

The Water Dispute Between the USA and Mexico

The dispute over the Rio Grande River flared up at the end of the 19th. century between the United States of America and Mexico. The office of the Secretary of State, which was responsible at that time for the Rio Grande dispute, asked the opinion of the Attorney General Judson Harmon on the problem.

Harmon was asked to comment in the light of international practices, relating to the diversions made by the USA, on the part of the Rio Grande River situated in its own territory. Harmon stated that the USA has a legal right on the part of the Rio Grande River that flows within its own territory (absolute sovereignty). By this he therefore indicated that international law does not hold for the USA on the sharing of the waters of the Rio Grande. Subsequently, these arguments regarding the transboundary waters have been named the Harmon Doctrine.

The USA, after adopting a more flexible approach in recent years, concluded its first agreement in 1906 with Mexico. A further agreement was signed in 1944, whereby the USA undertook the obligation of allocating certain amounts of water to Mexico from the Rio Grande, Colorado and Tijuana Rivers (Knowlton, 1968). This agreement brought an end to the disputes regarding the rivers between the USA and Mexico. The joint utilization of the Colorado, Tijuana and Rio Grande Rivers was therefore realized. Such an agreement guaranteed the rights of the upstream country but at the same time allocation of the waters was regarded as if there were no political boundary between the two countries.

Disputes between Mexico and Guatemala

The Usumacinte, Suchiate and Grijalva Rivers originate in Guatemala and flow into Mexican territory before emptying into the sea. Mexico has proposed that the waters of these rivers be shared between the two countries. It was only at the beginning of April 1990, that any response was received from the Guatemalan government.

Guatemala accepted to negotiate on the sharing of the rivers, just after Mexico started building a dam on the Suchiate River which has a minimum flow of 20 mcm/s (mcm=million cubic meters) in the dry season and a maximum flow of 200 mcm/s in the rainy season. According to the information available, an agreement has not yet been reached, although the negotiations are still continuing. It has been envisaged that the agreement, intended to be signed sometime in the near future, will be based on the principle of equitable, rational and optimum utilization.

Environmental resources as international security threats

As awareness for environmental problems increases so too does the realization that environmental resources can become an issue of international security. Where a resource occurs in limited supply and is locally or regionally important for a number of peoples or countries such a resource may become responsible for local instability. Such a situation can escalate into open regional conflict becoming a threat to the international community as a whole. Threats to security can include resource and environmental problems that reduce the quality of life and result in increased competition and tensions among sub national or national groups (Gleik, 1993). Recent experience suggests that conflicts are more likely to occur on the local and regional level and in developing countries where common property resources may be both more critical to survival and less easily replaced or supplemented (Lipshutz and Holdren, 1990). In addition, the economic, cultural and sociopolitical factors at

work in any given country or region will also play a large role in a region's overall stability and security.

Because water is essential to survival, many hold the position that access to clean and fresh water is every person's inalienable right. However, when translating this into a national context, all too often countries take this stand point to mean their inalienable right to water as opposed to other nations. Complicating this issue is the sometime frustrating geographical fact that water ignores political boundaries forcing countries that border, or contain a part of a river course within its borders, to share a water resource whether they like it or not. To date all across the world such riparian states are battling with this contentious issue. Perhaps no where else is this issue more volatile and liable to erupt into open hostile conflict as the region of the Middle East.

Not only is water vital to survival it also provides a source of economic and political strength. Under these conditions, ensuring access to water provides a justification for going to war, and therefore water supply systems can become a goal of military conquest (Falkenmark, 1986).

Gleik (1993) outlined the following characteristics that make water likely to be a source of strategic rivalry:

1) the degree of scarcity
2) the extent to which the water supply is shared by more than one region or state
3) the relative powers of the basin states
4) the ease of access to alternative fresh water sources.

The Middle East region with its many ideological, religious and geographical disputes is an ideal candidate to match Gleik's (1993) characteristics. However, disputes over the region's limited water supplies is not a modern phenomenon. During the seventh century BC, Ashurbanipal of Assyria (modern day Syria) seized control of water wells as part of his strategy of desert warfare against Arabia (Drower, 1954). In 689 BC Sennacherib of Assyria destroyed Babylon as retribution for the death of his son by purposefully destroying the water supply canals of the city (Drower, 1954).

The current water crisis plaguing the region can be traced back to the arbitrary political division of the region into competing states by the withdrawing of the post-World War I colonial powers (Hillel, 1994). The subsequent map of the region that arose disregarded the issue of water as forming possible natural political boundaries. With the exception of Lebanon, none of the states the colonial powers created was provided with independent water resources, and no mechanisms were put in place for coordination in the utilization of internationally shared water resources (Hillel, 1994). The Tigris-Euphrates basin was sectioned irregularly and placed in the domains of three competing states (Turkey, Syria and Iraq), while the Jordan river was divided up among four states (Israel, Jordan, the West Bank and Gaza and Syria) (Hillel, 1994).

One example should suffice to illustrate this crisis. In the 1950s Syria tried to stop Israel from building its National Water Carrier, an

aqueduct to provide water to the extremely arid areas of southern Israel, fighting broke out across the demilitarized zone, and when Syria tried to divert the head waters of the Jordan in the mid-1960s, Israel used force, including air strikes against the diversion facilities to prevent their construction and operation (Naff and Matson, 1984). It was these military actions that contributed to the outbreak of the 1967 war.

The disputes over water within the region are many and varied. This project will serve to concentrate on two of these disputes: the Tigris-Euphrates dispute among Turkey, Syria and Iraq and the Jordan river and ground water dispute between Israel, the West Bank and Occupied Territories, and the Hashemite Kingdom of Jordan. The levels of water scarcity existing in these countries is graphically represented in figure 1. An area comparison of the countries involved is contained in the map appendix.

Figure 1: A graphical visualization of the water scarcity existing in the region. Adapted from: Falkenmark, M and G. Lindh (1993). Water and Economic Development. In: Water In Crisis. Gleik, P. H. Oxford University Press, New York.

Demographic and freshwater conditions for the region.

Many factors contribute to the burgeoning water crisis in the region. As the populations of the countries continue to grow the demand for available fresh water is becoming perilously close to outstripping the demand and in Israel's case, this has already occurred in some instances. An exacerbating factor is the region's unpredictability in rainfall patterns. For most of the region the rainy season is short, 4-5 months. For Israel, Jordan and the Occupied Territories of the West Bank and Gaza rainfall is less than 2 inches per year and the region is characterized by dry cycles, 2-3 relatively rainy years followed by 2-3 years of drought (Fishelson, 1995).

With populations predicted to increase, the stress on the average sustainable yield for fresh water is going to increase and the amount of water per capita will therefore decrease (Figures 2, 3 and 4).

Figure 2: The current and expected population for the countries of the Middle East. Source: Fishelson, G. (1995). The value of freshwater in Israel, Jordan, the West Bank and Gaza. International Conference on the Peace Process and the Environment. Tel Aviv University, Tel Aviv, Israel.

Figure 3: Current and expected fresh water

according to the average sustainable yield (ASY). Source: Fishelson, G. (1995). The value of freshwater in Israel, Jordan, the West Bank and Gaza. International Conference on the Peace Process and the Environment. Tel Aviv University, Tel Aviv, Israel.

Figure 4: Current and expected water amount per capita. Source: Fishelson, G. (1995). The value of freshwater in Israel, Jordan, the West Bank and Gaza. International Conference on the Peace Process and the Environment. Tel Aviv University, Tel Aviv, Israel.

With more mouths to feed the allocation of fresh water becomes a pressing problem. More mouths means more food and so more water needs to be allocated to agricultural production. This issue is especially true for Turkey, Syria and Iraq who have all independently embarked on ambitious irrigation projects on the Tigris-Euphrates river system to increase their agricultural capacity. For the riparian states along the Jordan river water allocation has become a balancing act between agriculture and domestic use as more of the population becomes urbanized (Figure 5).

Figure 5: Fresh water withdrawal by sector for the countries of the Middle East and North Africa. Source: World Resources Institute. (1992-93). A Guide to the Global Environment, Oxford University, New York.

In order to allocate sufficient water for each country's required needs depends not only on the available internal water supply but also the amount of water flowing into and from the countries. The allocation of water can immediately lead to issues of conflict as upstream states, by controlling the flow of a river course, inadvertently disadvantage those downstream states dependent on the same flow. This is all to true for the Middle East where the Tigris-Euphrates head waters originate in Turkey but empty into the sea at the Persian Gulf in Iraq, flowing through Syria on its way to the sea. Egypt is entirely dependent on the Nile River for practically all of its water requirements but is at the sometime mercy of the upstream states of Sudan and Ethiopia that contain within their borders the head waters of the Nile, the Blue and White Nile. Israel, Jordan and the Territories (the West Bank, Gaza Strip and the Golan Heights) are in an even worse position. They possess few internal renewable water resources and are all dependent on one river system, the

Jordan which has its head waters originating outside of their territories in Lebanon and Syria. Figure 6 serves to illustrate this point.

Demographically, economically and agriculturally all the countries of the region are highly dependent on the water resources that they are forced to share. In these countries, where the majority of their land mass is arid, most of the population lives either on the coastal plains or along the river courses. These areas have therefore seen the largest economic and agricultural expansion. As most of these countries activities are centered around shared water courses, they are vulnerable to hostilities from their neighbors. Each vehemently insists on its "rightful" share of the available water resources, therefore raising the concern over international security. The maps in the map appendix show the population distributions, economic activity and land use practices of the countries of the region and of how they are centered along the river courses found in each country.

Figure 6: The origin of fresh water resources for the countries of the Middle East and North Africa. Source: World Resources Institute (1992). World Resources 1992-93. A Guide to the Global Environment, Oxford University Press, New York.

The dispute over the Tigris-Euphrates River System Hydrology of the Tigris-Euphrates

From source to sea the Euphrates is the longest river in the whole region of West Asia (Shultz, 1995). It traverses a distance of 2 700 kilometers, of which some 40 percent are in the modern state of Turkey, 25 percent in Syria, and 35 percent in Iraq. Its twin, the Tigris, has a total length of 1 900 kilometers, of which about 20 percent lie in Turkey, 78 percent in Iraq, and only 2 percent along the pointed northeastern corner of Syria known as the "Duck's Beak" (Hillel, 1994). (refer to the map of the Tigris-Euphrates River System in the map appendix for further detail).

A feature common to both rivers is the heavy concentration of suspended sediment (silt) that they carry at flood-time: as much as 3 million tons of eroded soil from the highlands in a single day (Hillel, 1994). Most of this material settles en route and is responsible for the great deposit of alluvium that fills the Mesopotamian Plain. The river beds are raised above the alluvial plain and thus facilitate the diversion of water for the purpose of irrigation, to which the region owes its prodigious agricultural productivity.

The mean natural flow of the Euphrates is about 30 billion cubic meters per year (BCM/y) at its entrance into Syria from Turkey, and 32 BCM/y on leaving Syria, after including the combined flows of two tributaries, the Balikh and the Khabur. The remaining 1000 kilometers of its course is in Iraq where it obtains no further increment of water such as tributaries

(refer to map appendix). The Tigris is a less circuitous river than the Euphrates, and it flows more directly toward Mesopotamia (Hillel, 1994). After skirting the northeastern corner of Syria, at its junction with the eastern Khabur, the Tigris enters Iraq. At this point its mean annual flow is between 20 and 23 BCM/y. In Iraq it collects an additional 25-29 BCM/y from its left-bank tributaries, for an average total of roughly 50 BCM/y (Hillel, 1994).

Current development on the Tigris-Euphrates

For Turkey, Syria and Iraq, dependence on the Tigris and Euphrates is high. The rainfall in the region can vary from 250-400 millimeters per annum and agriculture demands at least 400 mm per annum, hence the high levels of dependence on the rivers (Shultz, 1995). All three states are using water from the same sources, which may create a future situation of overuse, implying a scarcity of water. Clearly a situation of cooperation is needed to avert such a problem but all three states are going full steam ahead, independently pursuing their own water development schemes.

Probably the most ambitious of these projects is Turkey's South East Anatolia Project known by the Turkish acronym GAP (for Guneydogu Anadolu Projesi, in Turkish). The project aims at developing the regions bordering Syria and Iraq, encompassing the headwaters of the Tigris and Euphrates. The area is sparsely inhabited with a population of around 6 million, the majority being ethnic Kurds which claim the region as part of their national homeland. Turkey hopes by transforming this semi-arid region into the country's breadbasket it not only hopes to bring in and promote the development of agriculture and industry but to also offset the Kurdish majority by attracting Turks into the area and so diluting Kurdish nationalistic claims.

The Turkish government has promoted the GAP project as having great eventual benefits for all, but recently, over 250 000 people were displaced from their homes which were to be inundated by dams. A civil war broke out between the Turkish government and the Kurdish Workers Party (PKK) which has repeatedly claimed its opposition to GAP, regarding it as a Turkish theft of Kurdish waters (Hillel, 1994).

The GAP plan calls for the construction of 80 dams, 66 hydroelectric power stations with a total capacity of 7 700 megawatts, and 68 irrigation projects covering up to 2 million hectares. Among the principal dams are the Keban, the Karakaya and the Ataturk, which is the linchpin of the entire GAP complex (Hillel, 1994) (refer to the map in the appendix for a representation of the GAP complex).

Despite its great agricultural potential, Iraq has in the last decade become a net importer of grain to feed its population of 20 million (expected to reach 26 million by the year 2000). Iraq's main irrigated lands are the regions of lower Mesopotamia. However, this region is plagued by water logging and salinization and therefore an imperative need has arisen for a coordinated scheme of rehabilitation and sustainable water management, especially for the provision of regional drainage. (Hillel, 1994).

In 1953 Iraq began work on a regional canal to provide comprehensive drainage. This canal has been dubbed "The Third River" as it flows midway between the Tigris and Euphrates. Ironically enough, creation of the canal was created by American engineers to reclaim large tracts of land that had become barren through salinization. During the Gulf War, bombing caused great damage to Iraq's hydraulic works but it managed to complete the project in December of 1992 (Figure 7).

Figure 7: The "Third River", a recently completed drainage canal in southern Iraq (Source: Hillel, 1994)

The main canal is now 565 kilometers long and wide enough to allow 5000 ton barges carrying cargo from the Persian Gulf to Baghdad (Hillel, 1994). It was designed to drain 1.5 million hectares of land, allowing Iraq to increase its domestic food output significantly and thus help achieve its aims of economic dependence. However like Turkey's GAP project, Iraq's third river has caused the displacement of the indigenous Marsh Arabs and the canal has been criticized by the UN as an environmental crime, threatening to destroy an entire ecosystem. An ulterior motive to the draining of the region has been the possible exposure of oil deposits that are though to underlie the marshes, considered to be as great as those of Kuwait.

More than Turkey and Iraq, Syria is nearly entirely dependent on the flow of the Euphrates for the development of its economy (see map in appendix). Apart from the Euphrates, Syria has access to a few underground aquifers (Figure 8) from which, through the sinking of thousands of well, has already caused the overdrawing and salinization of the ground water.

In 1974 Syria began its greatest engineering feat, the damming of the Euphrates and the creation of Lake Assad (see map in appendix). The dam, built with Soviet engineering and financial aid was supposed to irrigate some 400 000 hectares, generate electricity and make the region prosperous (Hillel, 1994). In this project, as for the latter projects 70 000 indigenous Bedouin were displaced. However, so far the project has turned out to be a disappointment, the imported Soviet water generators proved to be faulty and the land originally designated for irrigation proved to be unsuitable due to the soil containing large amounts of gypsum (Hillel, 1994). Gypsum dissolves in water causing the soil to become lumpy and uneven making it difficult to distribute water over the soil surface.

Disputes over the Tigris-Euphrates River System

According to Shultz (1995) the real problems the three states are currently facing are the problems of management, apportionment and development planning, which has led to disagreements between them. This joint dependency on the river waters clearly indicates that the national security of all the states is linked. Turkey, Syria and Iraq may be considered to form a hydropolitical security complex. A hydrosecurity complex is defined as those states that are geographically part owners and

technically users of the rivers and as a consequence consider the rivers as a major security issue (Shultz, 1995).

Disputes over the Tigris-Euphrates waters consists of conflicts between upstream and downstream neighbors, but also between the state and ethno-religious groups, such as the Kurds of Turkey, the Marsh Arabs of Iraq and the Bedouin of Syria. Both Syria and Iraq are dependent on Turkey for the continual flow of the Euphrates. The intensification of the utilization of the Euphrates for Turkey's GAP project has caused sporadic decreases in the flow for both Syria and Iraq. Such a decrease in the flow is especially important for Syria, as unlike Iraq it cannot rely on the flow of the Tigris. The issues of an amicable apportionment of the river's flows could probably be easily met as there is enough water for all three states (Shultz, 1995). Surprisingly enough though, as yet no tripartate agreement has been signed by the three riparians on flow regulation, dams and sustainable water management. The writing is on the wall for an impending crisis but the parties seem to be to self involved in their own projects to notice.

According to a web site issued by the Turkish government, Turkey is not a country rich in water resources and that for per capita annual water availability Iraq is actually richer in water than Turkey and Syria is not far behind (http://inter.mfa.gov.tr/GRUPF/water). According to Table 1, issued from Turkey's Investigation and Planning Department of the General Directorate of the State Hydraulic Works serves to illustrate Turkey's point.

Country	cm/y/p
Canada, USA	10,000
Iraq	2,110
Turkey	1,830
Syria	1,420
Israel	300
Jordan	250
Occupied Territories	100

Table 1: Water quantities per capita in some water rich and Middle Easter countries for the year 1993. cm/y/p=cubic meters per year per capita.

Such data must be treated with caution however as most of the water feeding both rivers originates from within Turkey, with Iraq contributing around 20 percent and Syria less than 10 percent. It is also Turkey's official view (not mentioned on the web site) that the Tigris and Euphrates are its sovereign resources, to be exploited as Turkey sees fit (Hillel, 1994). To quote Suleiman Demirel, a Turkish official: "Water is

an upstream resource and downstream users cannot tell us how to use our resource."

Iraq claims long-standing historical rights to utilize the waters of the twin rivers, a viewpoint that is mentioned on the web site. Both Syria and Iraq suffered water deprivation during the filling of the Ataturk Dam when in early 1990, Turkey blocked the flow of the entire Euphrates for one month. According to Turkey, all the necessary steps were taken to prevent significant harm to the downstream riparians and it maintains that this practice is a necessary technicality when building a dam and that Syria was timely informed that the flow would be interrupted. However, no agreement was ever signed between Turkey and her neighbors on the construction of the dam and its possible consequences.

The issue in contention then is how to weigh historical rights against proportionate contributions to flow, taking into consideration the real needs of each country. These being, the availability of energy, the need for hydroelectricity, the feasibility of developing economic alternatives to irrigation based farming, the efficiency of water use and the size of each country's population. Thus far the levels of mistrust between the countries, and their self involved development projects, that disregards the concerns of their neighbors, makes any serious settled negotiation in the near future unlikely.

The Jordan River System

Hydrology of the Jordan river and the region's underground aquifers

The Jordan Basin is an elongated valley in the central Middle East. Draining some 18 300 square kilometers, it extends form Mount Hermon in the north to the Dead Sea in the south, and lies within the pre-June 1967 boundaries of Israel, Jordan, Lebanon and Syria (refer to map appendix for further detail). Its waters, which originate in rainfall and in rivers and streams of Lebanon, Syria and the Golan heights, drain the lands to the east and to the west of the Jordan Valley. Precipitation in the basin ranges from over 1000 mm/y in the north to less than 50 mm/y in the south, but averages less than 200 mm/y on both sides of the Jordan river (Inbar and Maos, 1984). Much of the basin is arid or semi-arid and requires irrigation water for agricultural development (Table 2). Table 2 also shows the many times the various sources of the river have changed political hands indicating the importance of the river for those states dependent on it.

River	Source	Political Control	Discharge(mcm/y)
Hasbani	Lebanon	Lebanon Israel post-82	138
Banias	Syria	Syria pre-67 Israel post-67	121
Dan	Israel	Israel	245
Upper Jordan	Israel	Israel	650

Lower Jordan	Israel	Israel/Jordan	1200
Yarmouk	Syria	Syria/Jordan/ Israel	450

Table 2: The principal surface waters of the Jordan basin and their political control (source: Lowi, 1993).

As can be seen the basin extends into four states, but about 80 percent of it is located within present-day Israel, Jordan and the West Bank (refer to map in appendix for further details). It is these lands that are most dependent on the waters, and since the beginning of the political conflict of the region, has been intertwined with a dispute over access to the water resources of the Jordan Basin:

"It appears equally clear that along with other outstanding issues of the Palestine dispute-compensation, repatriation, Jerusalem, boundaries-there is a fifth element, water, which must be considered as we approach a final settlement."-U.S. Department of State Position Paper, May 4, 1953.

Critical to the region's water supply is not only access to the water resources of the Jordan but also access to the underground water aquifers of the region. Such access is especially crucial for Israel as 60 percent of its total potential supplies of water are found in the country's two largest aquifers, the coastal plain aquifer and the mountain aquifer (see map in appendix for further details). An aquifer (literally, "water carrier") is a water-saturated geological stratum, occurring at some depth, that can accumulate and transmit water in sufficient amounts to serve as a water source for human use (Hillel, 1994).

The coastal aquifer underlies Israel's central and southern coastal plain, from Mount Carmel in the north to the Gaza Strip in the south. From north to south the aquifer covers an area of some 1 800 square kilometers, it derives its waters primarily from the seepage of excess rainfall and floodwaters generated by runoff from the mountains to the sea (see map in appendix for further details). The mean natural recharge estimate is about 300 MCM/y with a safe annual withdrawal rate of 240-300 MCM/y. The pumps withdrawing water from the coastal aquifer have actually been overdrawing this rate for some time now due to the heavy demand for irrigation. Israel grows citrus along the coastal plain. This overdrawing of water prevents a sufficient amount of water to pass through the system to flush out salts and other minerals and over time the water has become steadily more saline and brackish. The Gaza Strip is also dependent on this aquifer where it is estimated that 65 MCM/y is available. Rapid population growth however, has severely taxed the system causing the lowering of the water table and severe intrusion of sea water into the well. Consequently most of the local drinking water in Gaza exceeds the salinity level of 500 ppm, considered the upper threshold of safe drinking water and in some areas this has reached 1500 ppm, making the drinking of water next to intolerable (Hillel, 1994).

The mountain aquifer or Yarkon-Taninim aquifer extends beyond the Green Line (Israel's pre-1967 borders) into the mountainous regions of the West Bank (refer to map in appendix for further details).The aquifer extends about 150 kilometers from north to south. The aquifer's sustainable yield of fresh water is estimated to be about 300 MCM/y. It is tapped by over 300 wells, whose total annual pumpage averages 375 MCM. Like the coastal aquifer, the mountain aquifer is suffering from overpumping.

Figure 8 shows the available groundwater for the countries of the Middle East.

Figure 8: Available groundwater sources for the Arab region. Sources: Shahin, N. (1989). Review and assessment of water resources in the Arab region. Water International, 14 (4): 206-219.; Shelef, G. (1995). The coming era of intensive wastewater reuse in the Mediterranean Region. International Conference on the Peace Process and the Environment, Tel Aviv University, Tel Aviv, Israel.

The water and political tangle of the Jordan River Valley

Israel's water resources are unfavorably located in relation to its main areas of demand. Water is most plentiful in the north and north east, but the densest concentrations of populations, industry and irrigable land are in the center of the country and along the coastal plain (refer to maps in appendix for more detail). The critical point for contention amongst the Jordan River states is that the water resources, especially the groundwater resources, upon which Israel is dependent are predominantly located within occupied territory. For example, about 475 MCM, or 40 percent of Israel's sustainable annual supply of groundwater, and one-quarter of its total renewable fresh water supply, originate in occupied territory (Lowi, 1993).

Israel's attitude to the availability of water has always been one of national survival. Unrestricted access to water resources was perceived as a non-negotiable prerequisite for the survival of a Jewish national home (Lowi, 1993). The idea of water equal to national survival and aspirations have governed Israel's water policies, especially since the occupation of the West Bank and Gaza.

Israel's Arab riparian neighbors have also found it difficult to deal with the water issues of the region as they have been in opposition to the very fact of Israel's existence. They therefore refused to enter into negotiations with Israel on all matters, including water, as Israel was an affront to their ideas of a Pan-Arabian Middle East. Due to this lack of dialogue, no measures have yet been instituted to limit the overuse of the regions highly limited and sensitive water resources.

The area of the West Bank plays a significant role in this

scenario. Israel views it as a solution to its geographic vulnerability as it offers strategic depth and a defensible natural frontier, the Jordan River. More importantly, the West Bank provides Israel control over vital water supplies contained within the mountain aquifer. In the Arab-Israeli conflict therefore, water resources and national security are intimately linked.

Since the 1967 Six Day War the water resources of the Occupied Territories have become under Israeli economic control and the Arab population has been limited to access over the local water sources such as wells. This has caused many Arabs to abandon agriculture and join the increasing day labor force that works across the Green Line in Israel. Complicating this issue is the allocation of water to Israeli settlers in the West Bank which is subsidized by the state, unlike water allocated to the Arabs. According to recent statistics, West Bank Palestinians which make up more than 80 percent of the population were receiving only 16-17 percent of the water originating from their territory (Kolars, 1990).

There is no escape for an eventual agreement on sharing the resources of the Jordan River (crucial for Jordan) and the underground aquifers (crucial for Israel and any future Palestinian home land), current levels of mismanagement, coupled with increasing demand from growing populations and demographic shifts make a negotiated settlement crucial to avoid the predicted water shortages. The alternative war, unfortunately likely, can leave no true winners.

Some developmental plans to solve the region's water crisis

The recent International Conference on the Peace Process and the Environment held during the summer of 1995 at Tel Aviv University in Tel Aviv Israel was heralded as a truly international Middle East conference. To be included for the first time at a conference of this sort in Israel, were the Jordanian and Egyptian ambassadors to Israel and a representative of the Palestinian Authority in Gaza. Unfortunately, for undisclosed reasons, the Palestinian representative did not attend and so too did the then Prime Minister the late Yitzhak Rabin who in the end had prior engagements. The absence of such important figures from a conference of such importance for the region does not bode well for the future.

In Israel sheer necessity has led to new ways of dealing with the water crisis. Wastewater reuse schemes for agricultural irrigation is a scheme currently in operation (Shelef, 1995). According to Shelef (1995) Israel has devoted more effort to wastewater reuse than probably any other country in the form of investment, research and professional and scientific manpower. Figure 8 shows how groundwater utilization will decrease in the future due to the over-exploitation of this resource, while the source of surface water will remain relatively constant To make up the shortfall, reusable wastewater will by the year 2010 constitute one fifth of the total supply and about one third of all the demand of the agricultural sector (mainly used for irrigation) (Figure 9). Israel's heavy investment in wastewater as an alternative water resource is an admiral one but nowhere during this international conference was mention

made of sharing Israel's know-how with her neighbors. Jordan could substantially benefit from such knowledge as it has constantly been plagued by chronic water shortages since the breakdown of negotiations with Israel and Syria on the construction of the Maqarin dam on the Yarmouk river (Lowi, 1993).

Figure 9: Current and expected water resources for Israel. Source: Shelef, G. (1995). The coming era of intensive wastewater reuse in the Mediterranean region. International Conference on the Peace Process and the Environment, Tel Aviv University, Tel Aviv, Israel.

One of the significant projects which have been considered to date has been the Intersea Canal (Segev, 1995). This project has the desire in mind for the cooperation and mutual benefit between Jordan and Israel since the signing of the peace treaty. The 400 meter difference in elevation between the Red Sea and the Dead Sea is considered to hold considerable potential for the generation of hydro-energy and the desalination of up to 800 MCM/y for Jordan, Israel and the Palestinians, with the energy required for desalination being obtained directly as a result from the differences in sea level (Hamberg, 1995). Three main routes for the canal have been proposed: the Red Sea-Dead Sea route (the Red-Dead project), the Mediterranean Sea-Dead Sea southern route (Med-Dead project) and the Mediterranean Sea-Dead Sea northern route (Figure 10). This ambitious project, although to be admired for its aims, will require massive construction of tunnels and pumping stations to connect the Mediterranean or Red Sea with the Dead Sea. Although this project has prospects for international cooperation, the environmental consequences could be far reaching. One would have to be naive to think that by linking two ecosystems long term environmental costs won't be incurred. In addition, the creation of underground canals could disrupt the natural flow of groundwater and provide havoc for wildlife by constructing artificial barriers. One needs to just look at the Aswan dam of Egypt and its long ranging effects along the Mediterranean coast line. Proponents of the project envisage the creation of tourist and recreation facilities (creation of lakes), aquaculture and generation of energy (Hamberg, 1995).

Figure 10: The "Med-Dead" and the "Red-Dead" canals of the proposed Intersea canal project (Source: Hillel, 1994).

Finally, an imaginative project put forward by a Canadian company is the transfer of as much as 250 MCM of water from Turkey to Israel in

enormous containers referred to as 'Medussa bags", that would be floated across the Mediterranean (Lowi, 1993).

Policy implications

For the riparian states of both river systems, the issues to be resolved are shared. As these countries become more developed their urban populations are increasing at a phenomenal rate, whereas their rural populations, are in most cases, remaining stable. This urbanization transition is going to up the demand for more water to be allocated for domestic consumption as opposed to agriculture. Indeed, in most instances, permanent cropland is shown to remain stable as the agricultural production indexes decreases. This is especially serious for Jordan. This alarming trend alludes to the current inefficiency and mismanagement of water use in agriculture. Interestingly, population growth rates are shown to actually decrease in the future but this will not help to alleviate the problem (Figures 21-22) as caution must be taken when interpreting these graphs. The data used is not age specific and does not take into account current trends such as fertility patterns. Also, in addition to population pressures, consumptive patterns must be factored in to any policy decision based solely on population trends. From the data at hand it does seem however, that it is the urban transition that is actually going to increase the immediate pressure on available water resources, as consumption per capita will increase even as agricultural production decreases. These trends are graphically represented in the following figures (Figures 11-20).

Figure 11: The agricultural transition for Israel (Source: World Resource Database Diskette, 1996).

Figure 12: The agricultural transition for Jordan (Source: World Resource Database Diskette, 1996).

Figure 13: The agricultural transition for Syria (Source: World Resource Database Diskette, 1996).

Figure 14: The agricultural transition for Iraq (Source: World Resource Database Diskette, 1996).

Figure 15: The agricultural transition for Turkey (Source: World Resource Database Diskette, 1996).

Figure 16: The urbanization transition for Israel (Source: World Resource Database Diskette, 1996).

Figure 17: The urbanization transition for Jordan (Source: World Resource Database Diskette, 1996).

Figure 18: The urbanization transition for Syria (Source: World Resource Database Diskette, 1996).

Figure 19: The urbanization transition for Iraq (Source: World Resource Database Diskette, 1996).

Figure 20: The urbanization transition for Turkey (Source: World Resource Database Diskette, 1996).

Figure 21: The mean rate of population growth for Israel, Jordan and Lebanon (Source: World Resource Database Diskette, 1996).

Figure 22: The mean rate of population growth for Iraq, Syria and Turkey (Source: World Resource Database Diskette, 1996).

The countries of the region need to come to the realization that the river basins, river systems and underground aquifers that they utilize are not sovereign units that can be independently exploited without incurring repercussions to neighboring countries equally dependent on the same unit. Rather, the utilization of such units should be irrespective of political boundaries. Such a policy has been advocated as optimal by planners, politicians, and jurists, and has been adopted as policy in multi-national agreements in several river basins, including the Mekong in 1957, Columbia in 1961 and Senegal in 1963 (Lepawsky, 1963).

The conflicts in the Middle East are probably unique in the world and are many faceted and complex. As the birthplace of modern western civilization and three of the world's largest religions, conflicts, whether political, racial or religious, have been a part of the system since civilization first began between the twin rivers of the

Tigris-Euphrates. The on-going conflicts taking place on today's political stage can be traced back to biblical times and beyond. In the face of such a historic record of conflict, solving the disputes over shared water resources automatically involves cultural and political connotations. Perhaps this is why, where in other parts of the world common property issues have been resolved, in the Middle East they have not.

The existence of modern independent states in the region has served to strengthen nationalistic ideals exacerbating common property issues that transcend their borders. The international community has been quick to realize the delicate power balance in the region and how precarious and volatile it can be. Therefore it is in their best interests to succor cooperation between the states.

Such a goal is obtainable. For example, Israel possesses few internal renewable resources but has high technological expertise. By exporting its expertise on such things as drip irrigation and wastewater management to countries like Jordan and Egypt it could import products from those countries that it cannot produce itself such as oil. A trade agreement where expertise is traded for goods and services is a possibility if both sides can perceive how the benefits would outweigh the costs. Such an agreement could be worked out among Turkey, Syria and Iraq along the lines of proportional flow of the Tigris-Euphrates for the needs of each country controlled by trade agreements between them. Elsewhere in this volume, the water crisis for the Nile River riparians parallels those of the riparians mentioned in this chapter (refer to the chapter by Julie Smith). For the states of Egypt, Sudan and Ethiopia an effective policy would be similar to the one proposed here, that of a regional trade agreement that involves not only water but the expertise to manage it effectively. Regional development programs have been considered by some as a regional stepping stone to regional peace. Projects that require on-going multilateral cooperation in the use of water resources are being advocated. Each country has something to offer its neighbor that its neighbor lacks and visa versa. The realization, that by sharing information, expertise and goods can help in transcending the political divide that currently exists. Only when each country can directly gauge the benefit to itself from cooperating with its neighbors can regional stability be attained.

Dynamic modeling as a tool for predicting the outcome of policy implications

A recent useful tool to understand the complexities of a system such as that of a shared water resource is the use of modeling programs. STELLA II is one such program that allows a particular situation to be augmented, elaborated and most importantly, allows us to run the situation in order to yield predictions based on inputs incorporated in the model (Hannon and Ruth, 1994). The model that follows is a theoretical model that takes into account the interactions of population growth, water resources, consumption and the need for a political settlement based on the above parameters.

Population, water in the system (total available water, rainfall and groundwater) are all stocks with arbitrarily chosen figures. Population is controlled by the number of births and deaths, which in turn depend on the birth and death rates (as the population increases, birth and death rates are said to decrease). Per capita consumption (consume per head) is dependent on how much water is available per capita and this in turn will effect the death rate of the population. The relationship is: as the amount of water available per capita increases then so to will the amount consumed per capita. Water in the system depends on how much comes in (water source) and how much goes out (water sink). The two main sources of water are rainfall and groundwater. The amount of water that is lost to the system depends on the amount consumed per capita (factors such as evapotranspiration were not considered). Finally, a political settlement is driven by how much water is consumed and by how much water is available. The assumed relationship was, as the amount of available water (water sink) increases the need for a political settlement, defined as multilateral negotiations decreases (Figure 23).

Figure 23: A theoretical model to describe the interactions between population growth, water consumption and the need for a political settlement.

The change in population growth, water sink and political settlement were run over a period of 160 years. From figure 24, the population grows exponentially but then levels off and stabilizes according to some environmental constraint. With a rise in population, there is a concomitant drop in the amount of water at the sink. As the population increases and the water decreases, the need for a political settlement on the allocation of water increases. At that point in time where the population begins to stabilize, the water in the sink is allowed to gradually recover and so the pressure for a political settlement decreases. Eventually, water in the sink and some form of settlement will stabilize and will be maintained as long as the population remains stable and water does not begin to decrease further. Such a settlement could be considered to be based on equitable shared resource policies and efficient management of the resource. The model serves to illustrate how a policy decision must be based on international agreements and on demographic and consumptive trends.

Figure 24: A graphical outcome of the above model for the parameters: population, water sink and political settlement.

Multilateral agreements can go a long way in resolving the political disputes. But in addition, the region needs to review its water management practices and be prepared to take bold steps for change. With the predicted rise in consumption, particularly in the domestic sector, the level of mismanagement and wasteful agricultural practices must be reviewed. This means that the countries must reconsider the size and importance of agriculture in their economies, revise the choice of crops grown, and phase out the production of water intensive crops such as cotton, tomatoes, lettuce, bananas and rice (Lowi, 1993). Such a radical shift will not be easy as cultural attitudes and consumptive patterns will need to be modified. However, if governments are bold enough to take these steps they may be in time to install them before the need for them reaches crisis levels. Instigating such patterns in an atmosphere of regional peace and development will only make the job easier. It should be plain to realize that resource security and political security are not mutually exclusive. One cannot exist without the other. The alternative may very well be increasing scarcity and war.

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APPENDIX: MAPS

CHAPTER FOUR
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ORGANIC PRODUCE CONSUMPTION IN THE UNITED STATES: INDICATIONS OF TRANSITIONS

Over recent years, the concept of sustainable agriculture as an alternative to conventional, commercialized agriculture has become a popular topic among some environmentalists and small sectors of the agricultural community. Definitions of sustainable agriculture vary, from the National Research Council's (1989) definition as "food or fiber production which employs ecological production strategies to reduce inputs and environmental damage while promoting profitable, efficient, long-term production," to the University of California at Santa Cruz's Agroecology Program's definition as "a system which is environmentally sound, economically viable, socially responsible, non-exploitative, and which serves as the foundation for future generations" (Allen, 1995). Both definitions promote agricultural systems that are responsive to the environment and human health, as well as reduce inputs, or consumption of industrialized products such as chemical pesticides and fertilizers.

According to William Drake (1993), one way to view the population-environment dynamic is to visualize relationships between these sectors as a family of transitions. This definition of transition describes a specific period of time which spans the shift from slow to rapid change in a particular sector (e.g. agriculture) and then usually a return again to relative stability. Although a typical agricultural transition includes a dramatic increase in productivity due to new grain varieties and heavy application of fertilizers and pesticides, Vernon Ruttan (1994) suggests that future gains in production will be through improvements in land productivity.

Organic agriculture employs farming methods that do not use industrialized pesticides, chemical fertilizers or herbicides. It therefore uses fewer inputs and reduces consumption on the production side. By definition, organic agriculture therefore appears to be a reasonable candidate for promoting sustainable agriculture, and a more sustainable economy. Since it also typically involves more biointensive production (as a result of intercropping and integrated pest management), it typically increases improvements in land productivity.

It appears that an agricultural transition currently is taking place in the United States. This transition consists of an increase in organic farm acreage as well as an increase in consumer demand for organic foods. This paper seeks to chart this sharp rise in organic produce production and consumption in the United States. Additionally, it seeks

to identify particular factors affecting this transition, specifically: increased environmental degradation; increased consumer concerns over pesticide use; and increased consumer concerns over environmental degradation.

Review of Data: Organics Market

Although organic food captures only a small share of the total food market in most industrialized countries-typically 2 percent or less-substantial growth in this market over the past five years indicates a more than fleeting interest in organic foods (Gardner, 1996). In the past, spurts in organic sales were primarily a result of passing concerns about food safety (Gardner, 1996; Sachs 1987). A review of current data on the organic foods market is significant for showing this substantial growth, and hence for displaying the move towards an agricultural transition.

Prevalence of Organic Farming

The U.S. Department of Agriculture (USDA) has historically neglected the organic agriculture industry, as it lacks a formal tracking system for organic farm production as well as for direct farmer to consumer sales (Mergentime, 1996). The USDA has, however, managed to informally track the increase in organic cropland acreage (see Chart 1.1), as well as the increase in organic farmers (see Chart 1.2).

Chart 1.1. U.S. Organic Cropland.

Chart 1.2. U.S. Organic Farmers

Both of these charts indicate an overwhelming increase in organic farming, as organic cropland acreage more than doubled from 1991 to 1994, and the number of organic farmers increased by 43 percent. It is significant that even with such a large increase in organic cropland acreage as well as in the number of organic farmers, organic agriculture still constitutes only 2 percent of total U.S. agricultural production, according to USDA estimates (Gardener, 1996). Due to the lack of a formal tracking system, however, this data is likely an under-representation of the actual prevalence of organic farming in the U.S.. This data likely does not include hundreds, if not thousands, of small-scale, organic farms throughout the country.

Organic Industry Sales

Recent evidence points to a sharp increase in organic product

sales over the last decade (Mergentime, 1995; Gardner, 1996). For example, organic industry sales have increased more than ten-fold since 1980, representing an exponential increase (Chart 1.3). Produce constitutes more than one-fourth of all organic sales at natural product stores (Chart 1.4), which in 1994 was the equivalent of $333 million. If this growth continues at such an exponential increase, it will result in the capture of a large percentage of the entire food market.

Chart 1.3. Organic Industry Sales.

Chart 1.4. Organic Sales by Sector.

Figure 1. Availability of Organic Produce.
Map.

According to a survey conducted by The Packer (1996), 54 percent said their supermarket sells organic produce. Additionally, 23 percent of the consumers polled had purchased organic produce within the last six months. This data can also be broken down regionally (Figure 1). It is significant to note that while 62 to 63 percent of respondents in the Western and North Eastern regions report availability of organic produce, only 45 and 50 percent of respondents in the Southern and North Central regions report such availability. This inequality in distribution may be explained for a number of reasons. The West grows the largest percentage of organic produce in the country, thus accounting for its highly reported availability in this region. There is also a large percentage of organic produce grown in the East. In addition, the East is heavily populated, thus making distribution of organic produce to markets in this region more efficient. Lower percentages of organic cropland in the South and North Central regions may explain the lower levels of availability in these regions.

Linkages to Other Transitions

Since organic agriculture employs farming methods that do not use petro-chemically derived fertilizers, herbicides or pesticides, an expected correlation to an increase in organic farming would be a decrease in overall chemically-derived fertilizer and pesticide use. Although the present level of organic agriculture in the U.S.-about 2 percent of total

agricultural production-is not large enough to result in significant changes in such use, transitions towards a decline in fertilizer, herbicide and pesticide use are currently underway. Such transitions may not be directly caused by the rise in organic agriculture, however the transitions are connected. In addition, as organic production continues to increase-perhaps reaching 10 to 20 percent of total agricultural production in the next decade-it will have a significant impact on these transitions. In a broader sense, the organic agricultural transition can also be linked with an epidemiological transition as well as a toxicity transition.

Fertilizer, Herbicide and Pesticide Use

As evidenced in Chart 1.5. (Brown, 1995 p. 41), fertilizer consumption in the United States has been decreasing since 1980.

Chart 1.5. Fertilizer Use in the US: 1950-1990.

Although use was up slightly in 1994, from 18.3 million tons in 1993 to 19.0 million tons in 1994, this level of fertilizer use is still one tenth below that during the early eighties (Brown, 1995). Such a decrease may be caused by various factors, such as an increase in cover and inter-cropping to replenish soil nutrients and a decrease in overall active farmland. As organic produce production continues to increase, this level of fertilizer use is likely to decline even more.

According to Zilberman (1991), herbicide use in the U.S. is also on the decrease. This steady decline since 1980 is due partly to a reduction in conventional farmed land and to an increase in herbicide cost. Once again, as organic production and acreage increase, ideally conventional practices and use of chemical herbicides will decrease.

Farmers in the U.S. currently use an estimated 700 million pounds of pesticides annually (Pimentel, 1993). The use of pesticides in the U.S. increased dramatically from 1945 to 1973-since 1973, however, this use has significantly declined (see Chart 1.6).

Chart 1.6. Pesticides Produced in the US.

This decline is linked with increasing evidence linking detrimental health and environmental effects from pesticide use and exposure; the

introduction of more potent materials; and the adoption of integrated pest management (IPM) (Zilberman, 1991). In particular, increasing evidence of detrimental health effects and increasing use of IPM are factors which will lead to increased organic production. These factors actually serve to feed the trend toward organic farming practices, which in turn lead to decreases in pesticide use.

Epidemiological Transition

This project also proposes that the organic produce consumption transition is both influenced and will influence a 'good' epidemiological transition (Drake, 1993). As you can see from diagram 1.1 (taken from Drake, 1995) a 'good' epidemiological transition will have a decline in the infectious disease rate and a corresponding increase in the degenerative disease rate (chronic diseases such as cancer). For a 'good' transition the overall disease rate must also be decreasing.

The second diagram (1.2) shows that mortality rates for infants is declining and for those that are older than fifty it is increasing. The importance of these trends- - rise in life expectancy and an increase in degenerative diseases- - is that they change societies focus to behaviors that reduce the risk from chronic diseases (cancer). Diet is an essential tool in combating chronic disease such as cancer. As society becomes more aware of the causes of cancer (pesticides, additives, etc.) the more they will be inclined to look for alternatives such as organics. As society buys more organics the more likely the epidemiological transition will be 'good', meaning an overall decrease in disease rate. Thus there is a reinforcing relationship between the organics and epidemiological transitions.

Diagram 1.1. Epidemiological Transition.

Diagram 1.2. Mortality Ratios.

Toxicological Transition

The toxicological transition is another transition that has an impact on and is impacted by the organics transition. Diagram 1.3 and 1.4 (from Drake, 1993) are representations of the toxicological transition. Diagram 1.3 shows the relationship between the percentage of the environment polluted and time. Diagram 1.4 is a representation of the number of toxins emitted per unit of production over time. In both cases after an initial increase there is a reduction in the increase until eventually a decline occurs. The assumption in this transition is that eventually the toxins we emit into the environment will cause severe

enough pollution problems that we will find ways to reduce emissions. The emission reductions will then reduce the percentage of the environment that is polluted. In the United States the increase in percentage of the environment that is polluted has declined (still increasing but not as sharply). It has been argued above that organics are a good candidate for sustainable agriculture, with reduced toxic emissions (see the pesticide and fertilizer transition shown above). Because of the 'low impact' nature of organics we propose that increasing the use of organic agriculture will lead the United States down the backslope of the toxicological transition (reduce the amount of toxins emitted and the overall pollution levels)

Diagram 1.3.

Diagram 1.4.

Review of Data: Consumer Attitudes

Since the organic agriculture and pesticide transitions are influenced by consumer attitudes and demand, it is important to relate these transitions with transitions in consumer attitudes. In other words, the transitions will be analyzed as existing within a family of transitions (Drake, 1993).

Since consumers generally drive the produce market, their attitudes towards foods, produce, and agricultural methods have the power to affect the agricultural transition in this country. The following, therefore, is a collection of existing data on consumer attitudes toward produce and agriculture.

Profile of the Organic Produce Consumer

While demand for organics can rise and fall based on waves of media attention, organic produce is steadily making its way into the mainstream (The Packer, 1996). A recent survey conducted by The Packer (1996) measured a number of factors concerning consumer attitudes about organic produce (see Chart 2.1). According to the survey, 24 percent of respondents purchased organic produce because they liked its appearance; 17 percent responded that organic produce looked fresher or riper; 16 percent purchased it because they perceived it to be healthier; and 12 percent purchased organic produce because it was produced without pesticides or fertilizers.

Chart 2.1. Reasons Why Consumers Purchased Organic Produce

These results are significant since these factors are by-products of organic production. Namely, (1) organic produce looks riper because it generally is: since organic produce tends to be distributed locally, it can remain in the fields until ripe (as opposed to most conventional produce which is shipped long distances and has to be ripened in the store rather than the field); (2) organic produce tends to be healthier than conventional produce since it does not use pesticides and since it tends to be more nutrient rich; and (3) organics are produced without chemical pesticides or fertilizers.

In addition, results from The Packer (1996) survey suggest that consumers are overwhelmingly satisfied with their organic produce purchases. As Figure 2 indicates, in every region in the U.S. but the South, 80 to 85 percent of consumers were extremely or very satisfied with their organic produce purchases. Such satisfaction will clearly lead to more consistent purchasing of organic produce, and hence a more steady, and increasing overall demand for such produce. It is also significant to note that most organic produce sold in the southern region of the U.S. is shipped from other regions, primarily the West. Such shipping and storage may result in produce that is bruised or cosmetically displeasing and that is less ripe or fresh. These factors may contribute to the lower level of satisfaction of organic consumers in the South.

Figure 2. Satisfaction with Organic Produce.

Consumer Attitudes Toward Pesticides

Public concern over pesticide residues in the environment was first highly publicized after the release of Rachel Carson's popular book Silent Spring in 1962. The emergence of consumer and environmental groups during this time had a direct impact on pesticide use, as they were largely responsible for the ban on the use of DDT in 1972. Since the 1960's, the public's exposure to pesticide issues through the media has greatly increased (Sachs et. al. 1987). Although consumer attitudes towards pesticide residues has waxed and waned, overall their concern has steadily increased (see Chart 2.2).

Chart 2.2. Consumer Pesticide Concerns.

Sachs' (1987) comparison of consumer concerns over pesticide use from 1965 - 1984 reveals an increase in consumer concern of the health of farmers,

wildlife, and humans from exposure to pesticides or pesticide residue. This concern may be intensifying as the number and accounts of chemicals in the environment increase, as do episodes of specific pesticide problems, such as local water contamination, breast milk contamination, and the banning of certain pesticides.

A 1994 study by Buzby and Skees also cites increasing consumer concern over pesticide residues on food. According to this survey, concern over pesticide residues on food ranks among the top three concerns over food safety (see Chart 2.3).

Chart 2.3. Top Food-Safety Concerns.

Age and Income

The Packer data also revealed some important relationships between age and income with organic consumption. Chart 2.4 indicates that for those that purchased organics in the last six months age was a determining factor. Younger people and middle aged 40-49, are more likely to purchase organics than other age groups. We have speculated that increased education and knowledge in the younger age group and an increased income for those age groups could be the cause (younger age group tends to not have families and more money to spend and 40-49 year olds are probably the wealthiest age group). Chart 2.5 represents both availability and the purchase of organics in the last six months by income level. There are two important trends found in this chart. First as income increases the availability of organics increases linearly. A second trend is that the middle income range shows a significantly decreased purchasing trend. This drop may have occurred because the middle income range may be made up of young families that have little flexibility in their budget for the 'luxury' of organics.

Chart 2.4. Purchased Organics in the last 6 months.

Chart 2.5. Purchasing and Availability by Income.

Trends in the data also show relationships between age and the reasons why people buy organics. Charts 2.6 shows that older age groups buy organics

because of nutrition. This corresponds to both the epidemiological transition talked about above (increased awareness and concern over degenerative diseases) and data that shows nutrition to be the number one food safety concern (Chart 2.3).

Chart 2.6. Consumers Who Purchased Organics Based on Nutrition by Income.

Modeling Behavior

One of the goals of this project is to develop a comprehensive model for green consumer behavior, and lay out a conceptual base for future research on green consumer behavior. Specifically we have used Stella modeling and GIS Mapping as representational tools to help better understand the determinants of consumption behavior.

As stated above, we have picked organic produce consumption as a behavior that is environmentally and human health 'friendly'. We have argued that organic agriculture is a likely candidate for sustainability in food production and beneficial to environmental and human health. Thus, understanding both the attitudes and profiles of consumers and how they relate to 'organic' behavior is an important tool in advancing sustainable organic agriculture.

Conceptual Model

To research and understand the factors that affect consumer behavior related to organic food products it is important to conceptualize the decision making process of the individual and model the determinants of behavior. Presently there is little academic literature on environmental consumer behavior, while there has been extensive attention paid to consumer behavior in disciplines such as, psychology, sociology, public health, and business (marketing).

To enhance our research in environmental consumption behavior we are attempting to conceptualize and model the determinants of behavior. A model for environmental consumption behavior can be created drawing from the disciplines mentioned above.

The ultimate success of programs and regulations that attempt to reduce or change consumption behavior is dependent upon the individuals willingness to undertake and/or maintain the required behaviors. Unfortunately, it is difficult to decrease mis-consumption when the pressures of society call for increased consumption environmentally 'unfriendly' products.

The determinants of behavior can be categorized into three areas; predisposition, ability; and need (Becker 1986). Each of these areas includes several sub-components that provide the theoretical and operational definitions of the model. Predisposition includes

socio-demographic characteristics, social structure variables (interaction and support), and beliefs. The predisposing variables are not directly responsible for the final consumption behavior but are determinants of variation in inclination towards a behavior (Becker 1986).

Ability, the second component of the model, are the conditions that hinder or allow the consumer to take on a behavior. Even though an individual may be predisposed to buy organic products, the individual must have the means and access. The two most important determinants of ability are price and distance from the product. Other sources of ability include individual and family resources, community resources (infrastructure, etc.), and the skills to use them.

When appropriate predisposing and ability conditions are present, the individuals perception of need becomes the deciding factor for behavioral change. The individual must perceive a need for the behavior in order to take it. A premise of this model is that the behavior of the individual is a function of the predisposing and enabling characteristics of the individual and the individuals perceived need for the behavior, such as changing to 'green' agricultural products. Knowledge and experience are important determinants of perceived need and efficacy of a behavior.

Stella Model

Attached to this paper is the Stella map for the model we have created. It was created to simulate a community or region and is designed to take aggregate data as inputs. Not all of the determinants listed above are present in the model but the major factors have been included. The model was also designed to incorporate the trends and relationships shown in The Packer data (discussed above).

Predisposition: As you can see from the map Social Interaction, Socio-Demographic, and Beliefs are present as predisposition determinants. Social Interaction is calculated by inputting values for an areas social networks and support. Sliding scale input tools in the model ranging on a scale of 1 to 5, with 1 being the lowest and 5 the highest, for both networking and support have been provided. We have assumed that the greater the networking and support the more likely the community will take on progressive behaviors such as organic produce consumption.

Socio-Demographic stock is determined from factors such as age, income, and education. These demographics can also be inputted using the sliders. A graphing interaction to approximate the relationships that we found in the Packer data to the converter's for age and income has been used. There was no data for education levels in the data but we have assumed that with greater income is greater education. Chart's 2.4 and 2.5 show the relationship of both age and income respectively to purchasing organic produce in the last six months. The graphs used in Stella follow this

trend with middle class and middle aged communities having a lower tendency to buy organic produce than the other groups.

Beliefs are determined from concerns about health and the environment and the experience and knowledge of the community (part of the perception of need section of the model). Again, sliding scales to allow variable inputs ranging between 1 and 5 have been used. By giving a value to these determinants it is possible to quantify predisposition.

Ability is calculated from measurements of the average distance to the product in the community in question and the price difference from organic to conventional agricultural products. It is assumed that the less the distance the greater the probability of taking on the behavior. It was also assumed that the less the price difference the more likely the 'organic' behavior will occur.

Perceived Need: Perceived need is determined in the model by quantifying experience and knowledge about organic production, health effects, and environmental effects related to agriculture. Again all of the perceived need variables are on a sliding 1 to 5 scale and can be inputted into the simulation. It was assumed that the greater the knowledge and experience the community has with organic agriculture production, health and environmental benefits the greater the likelihood that the community will take on the 'organic' behavior.

Beliefs (which in this model represents both predisposition and perceived need) and ability interact and lead to behavior. This behavior in turn creates an outcome (either reduced or no change in adverse health and environmental impacts. The impacts are then reintroduced to the model as experience and knowledge creating a feedback loop that allows the community to reinforce its 'organic' behavior.

Strategies/Policies for Change

Traditionally social programs have centered around two areas, information dissemination or transfer to a targeted group and economic policies. The information programs target the experience and knowledge sector of our model. The theory follows that if you can increase the knowledge of the group they will be more inclined to take on the wanted behavior. The economic policies target the ability sector of the model with the goal of increasing the capability of the consumers to take on the behavior, either by decreasing the cost of the product, increasing the resources of the consumer or making the product available. The model has been designed to allow variations in these sectors to enable the simulator to make a series of runs with changes in the variables.

The expected outcomes of the model are that knowledge programs will have a reduced effect on lower income, less educated communities as compared to wealthier, more highly educated communities. Conversely it is

expected that ability programs will have a greater impact in lower income, less educated communities than those programs would have in wealthier areas.

Outcomes

Attached to this paper is are the graphical results of model runs. Stella graph 1 are representations of the model run at the extremes. Graph 1 is a comparative graph for the behavior and environmental outcomes. As you can see the 'worst' case scenario has an increase in organic behavior that is much less than the 'best' case scenario. This is also true for environmental and health outcomes. The 'worst' case has a rise that is much less than the 'best' case.

Stella graphs 2 and 5 show the relationship between income, education, and age on organic behavior. These results are not as easily deciphered but a trend follows that contradicts that predicted above (that knowledge strategies work better in wealthier communities and ability programs work better in lower income communities). Graph 2 is represents lower sociodemographic communities with changes in experience and knowledge. Line 1 is 'lower income' with little knowledge and line 2 is 'lower income' with knowledge. Adding knowledge shows a marked increase in behavior change (not exactly what was predicted; that there would be little effect from knowledge for lower income communities). Graph 3 shows the relationship between experience and knowledge with 'wealthier' communities. Line 1 shows the relationship with little experience and knowledge and line 2 is with increased experience and knowledge. The results show that there is little impact from experience and knowledge increases for wealthier communities (again contradicting the predicted outcomes).

Graphs 4 and 5 show the relationships between ability and the sociodemographic sector and follow the outcomes predicted above. Graph 4 represents 'lower income' communities. As ability increases the corresponding increase in organic behavior is apparent. Graph 5, 'wealthier' communities, also has an increase in organic behavior with increased ability but it is not as drastic as the shift for 'lower income' communities.

Implications of Transitions

Consumer Attitudes and USDA Labeling Requirements

Although this recent trend toward organic produce still constitutes only a small segment of the U.S. agricultural industry, it is significant for a number of reasons. Primarily this trend displays a change in consumer attitudes towards organics-a change which does not appear fleeting. This growing awareness of food safety will undoubtedly lead to USDA standards for organic produce (currently under development) as well as standards for pesticide residue labeling on conventional produce (Frazao, 1992). Such federal regulations would establish a

standard allowing consumers to judge between organic and non-organic produce, to make assumptions about the benefits and drawbacks of each, and choose between the two types of produce. And with increasing publicity about the environmental and human health effects of pesticide use, it is likely that these consumers will choose organic if within a reasonable price. It appears, therefore, that USDA standards and labeling for produce are likely to have an even greater effect on the rise of organic produce production and consumption.

Environmental Effects

Although organic farm acreage is currently relatively small in the U.S. compared to total agriculture acreage, it still serves to reduce environmental degradation. As of 1994, well over one million acres of land were being used for organic agriculture, while conventional farm acreage decreased. Since the Environmental Protection Agency considers conventional agriculture the largest non-point source of water pollution in the country (Lustgarden, 1994), the transition toward organic agriculture is a welcomed one, even if seemingly small. Farming without the use of chemical pesticides and fertilizers can significantly reduce pesticide run-off and water pollution, the result being safer water for humans and wildlife. Additionally, it can result in decreased environmental and public health costs, which, according to Pimentel (1993), total about $8 billion every year in the U.S.. As previously stated, the organic produce transition has the potential to effect the overall toxicity transition.

Decline and Resurgence of the Family Farm

The family farm as an institution has been continuously eroding since the late 1970's. A transformation in American agriculture from small-scale, broad-cropped based farming to large-scale, industrial and monocultural farming occurred from the 1940's up until the 1970's (Strange, 1988). The reasons for this are many, but most are based on the theory that "bigger is better." This idea has been reflected in U.S. agricultural policy since the 1940's. Such policies have encouraged large-scale, monocultural farming practices through programs such as commodity price and income support subsidies, tax credits, research programs, and pesticide subsidies (National Research Council, 1989). Under these policies, farmers faced economic penalties for maintaining small scale, broad-based farms, and were therefore nearly forced to either get out of business or change to large-scale, commercialized production practices.

An increase in organic farming correlates with an increase in small family farms. For organic production practices favor small farms that grow a variety of crops. The 1996 Farm Bill also provides farmers with greater planting flexibility, allowing them to plant a variety of crops, and using organic practices if desired (Hosansky, 1996). Hopefully this policy with result in further conversions to organic and small-scale

methods.

Policy Recommendations

Under traditional agricultural policy in the U.S., farmers are not rewarded for practicing sustainable farming methods. In fact, agricultural policies serve to deter the emergence of such methods. Although the 1996 Farm Bill may serve to promote crop diversification, and hence alternative methods such as organic farming, the policy still does not reward those farmers who have been practicing sustainable methods for years.

The U.S. government needs to re-evaluate its agricultural support system, so that equal rewards and incentives are provided for farmers managing large as well as small tracts of land. The following are recommendations intended to guide agricultural policy makes toward promoting alternative agricultural practices such as organic farming, and hence promote agricultural sustainability. The policies are not intended to be comprehensive in scope, but rather address a few key areas where current policy is lacking.

USDA Management Information System

As mentioned, the USDA has historically neglected the organic agriculture industry, and currently lacks a formal tracking system for organic farm production and sales. State and national agencies therefore typically do not consider such small-scale and organic farms when agricultural policies are established.

Given increasing public awareness and concern over health issues, and in turn an increasing rise in the organic industry, it is time for the USDA to acknowledge this rise and get updated on these transitions. For starters, the USDA must implement a management information system (MIS) that will gather information on organic production and distribution. Information such as average farm size; specific production practices such as inter-cropping and folier feeding techniques; and distribution methods could be collected through surveys distributed through regional Sustainable Agriculture Working Groups (SAWG). Presently, SAWG networks are present in a number of regions in the country, and are typically in contact with most small-scale, family, and organic farms in their region. Such data could be used by the USDA as well as other sustainable agriculture organizations to more accurately represent current agricultural and consumption trends over time, which could then be compared with other trends and considered when state and national agricultural policies are established.

Institute Government Policy-Led Sustainable Agriculture Programs

As suggested by Buttel (1993), government policy led-sustainable agriculture is an approach to sustainability that seeks to implement public policies that give producers strong incentives to achieve sound environmental performance. Research in this area would consist of an

assessment of the social and ecological costs and benefits of various approaches to sustainable agriculture.

One example would be applying polluter-costs for environmental damage, such as water quality. Such a policy might be similar to existing environmental policies which require industries to pay polluter-costs for environmental degradation such as decreased air or water quality. Another example would be applying taxes (as opposed to subsidies) for extensive use of chemical pesticides. Research by Zilberman (1991) suggests that pesticide taxes would encourage farmers to become more selective in their chemical choices and switch to other options that would be more cost-effective.

A final example would be implementing subsidy programs which reward farmers for implementing organic and/or sustainable agriculture production methods. The implementation of such subsidy programs, however, would need to be based on specific data on such production methods, which currently the USDA lacks. Such programs would therefore need to be established with the aid of sustainable agricultural organizations across the country, such as the network of Sustainable Agriculture Working Groups, the Community Alliance with Family Farmers, and American Farmland Trust.

Protect Small-Scale and Family Farms

As mentioned, one consequence of traditional U.S. agricultural policy as been the decline of small-scale and family operated farms. Such policies have encouraged large-scale, monocultural farming practices and imposed economic penalties for maintaining small scale, broad-based farms.

The 1996 Farm Bill does include farmland conservation programs, such as the Environmental Quality Incentives Program (EQIP), which provide financial, technical, and educational support for farms practicing conservation methods. Historically, many small farms have participated in these voluntary programs, and have even come to depend on annual financial support for their participation in these programs (Thorpe, 1996). Proposed rules under EQIP-which are currently undergoing a public comment period-include provisions such as the establishment of "conservation priority areas" which would prioritize large tracts of lands for receiving EQIP support, and essentially make small farms ineligible for receiving EQIP funds. Sustainable agriculture and rural conservation organizations across the country are concerned over such proposed rules, and are currently taking efforts so that such rules will not be adopted in the final EQIP guidelines.

Such proposed rules clearly reflect that the USDA does not recognize the importance of maintaining small-scale farms for environmental, economic, or social reasons. Once again, if the agency collected and tracked information on such small-scale farms and their practices, it would be better equipped for implementing more accurate and progressive agricultural policies.

Develop Bioregional Communities to Localize Food Consumption

Moving toward more localized food distribution may be a way to further promote more equal distribution of food in the United States. Additionally, it can provide farmers with greater financial and social stability. Community-Supported Agriculture (CSA) programs are one way of localizing food consumption. CSA's are a form of mutual cooperation between farmers and consumers who come together in order to produce healthy food in a sustainable way (Donahue, 1994). In a typical CSA, community members purchase a share in the farm's operations at the start of each growing season. CSA members provide capital for the agricultural season, and receive fresh produce (produced locally) on a weekly basis. In addition to providing community members with fresh produce, the CSA strengthens the farm by providing farmers with guaranteed income, no matter how successful or disastrous the harvest. Programs such as the CSA promote crop diversification and often alternative agricultural practices. Additionally, such a program replaces the need for government subsidies through guaranteed income.

Presently, such efforts to promote such localized food distribution are small and regional in scope. Organizations such as the Community Alliance with Family Farmers in California (CAFF) are making tremendous efforts at promoting bioregional communities and supporting small-scale farms. Although they are recognized as a leader in promoting sustainable agriculture, the reality is that organizations such as CAFF are under-funded, under-staffed, and at times their efforts are thwarted by conventional and outdated agricultural policies. Agencies such as the USDA have the power to aid such organizations through funding mechanisms and grant programs.

Conclusion

The trend toward large-scale commercial farms, which was encouraged through traditional domestic agricultural policies, has deterred the growth of alternative agricultural practices in the United States. The result has been increased environmental degradation, increased health and safety concerns, unequal food distribution, a decline of the family farm, and decreased agricultural sustainability.

It appears that a move away from that trend in underway, as a transition toward organic agriculture becomes increasingly evident. Organic cropland acreage and number of organic farmers are up significantly, as is organic produce sales. Consumer attitudes also are steadily increasing in favor of foods produced without the use of chemical pesticides and fertilizers.

In order to maintain this transition, domestic agricultural policy must be re-directed to greater promote and reward organic agricultural practices and consumption . Until that time, the transition will be maintained by increasing consumer demand, and the vision of individual

farmers who believe in promoting sustainable agricultural practices.

STELLA MODELS AND GRAPHS

Stella Model Map.

Stella Model Inputs.

Stella Graph 1: 'worst' and 'best' case scenarios.

Stella Graph 2: 'low' sociodemographics and changes in knowledge/experience.

Stella Graph 3: 'wealthy' sociodemographics and changes in knowledge/experience.

Stella Graph 4: 'low income' and changes in ability.

Stella Graph 5: 'wealthy' and changes in ability.

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CHAPTER FIVE

TAMANA NISHIGUCHI

THE IMPACT OF POLICY ON AGRICULTURAL TRANSFORMATION IN BURMA
-APPROACH FROM AGRICULTURAL DEVELOPMENT-

Introduction

Burma is located on the western edge of mainland Southeast Asia. A surface area of about twenty six thousand square miles, makes it the largest country in that region. The population, estimated at about 43 million (1994/95), is composed of as many as 135 ethnic nationalities. From the southern Himalayas, the Ayeyarwady river runs through the country for 1350 miles, flowing into the vast Delta stretched 150 miles wide and 180 miles long. The Ayeyarwady Delta, the center of rice culture, shows us a significant view of the rice paddy.

One of the Least Developed Countries (LDC), Burma has recently showed political, social and economic change. Historically, the key sector in Burmese economy is agriculture, which provides employment for 60-70 percent of total labor force, and accounts for the country's major export earnings. The people, of whom about seventy-five percent live in rural areas, engage in subsistence agriculture. In 1988 when the military took power, economic policies shifted from centralization to market-oriented system. As a result, Burmese economy showed dynamic performance. However, the people in rural area tend to be bypassed by whatever economic progress has been attained. In order for Burma to become economically self-sustaining, the government's development strategy must take the rural area into consideration, particularly the agricultural sector. Without integrated rural development, industrialization in Burma either would be stultified or, if successful, create severe internal problems such as poverty, inequality, and unemployment. A focus on impact of policy on agricultural development will make clear to which extent Burmese agriculture has been developed, and how it has the potential to cause structural change for further national economic development. An understanding of these concepts will contribute to discovering an effective strategy for development in Burma.

My approach in this paper starts with an brief account of agricultural development and its transition. I will also discuss a desirable policy setting in each transition. With its characteristics, I will describe and analyze the feature of Burmese agriculture, leading to an examination of future development strategies.

Agricultural Development

Historical Perspective

Agriculture has been the main component of the economy in the Third World, which implicates that, for the vast majority of the world's poorest people living in rural areas, agriculture has been not only an economic activity for survival, but also a way of life. In spite of this fact, the role of agriculture in most country's economies was historically considered as passive and supportive. Empirical experience reveals that the growth spectrum of agricultural sector in general spans from 2 to 3 percent to 4 to 6 percent even in case of accelerating condition. In the short term, however, agricultural growth occasionally shows beyond that level in some areas, due to the sudden implementation of the modern technology on a broad scale. On the contrary, nonagricultural sectors demonstrate a high growth rate at the rate of 8 to 10 percent and higher. Therefore, under the promotion of economic development, governments in developing countries were inclined to give priority to the faster-growing nonagricultural sectors to a slower-growing agricultural sector. However, the changing view of agriculture has emerged since 1950. During the period called the economic-growth-and-modernization era of which has formulated 1950s and 1960s, many developing countries had launched a development strategy along the guidelines emphasized in rapid industrialization. Although the economy of many countries in the Third World demonstrated a respectable performance in the manufacturing and commerce sectors, it became obvious that rapid economic growth in some countries caused a country's socioeconomic structure to be deleterious and disastrous rather than improved. As a result, the disappointing experience through 1950s and 1960s forced many the governments to recognize the important role of agriculture in the early stage of development and, in addition, caused to a remarkable shift of the development strategy and policy-making. Taiwan and Thailand are two of the countries where the shift to an agricultural-oriented strategy since the early 1970s has resulted in the achievement of structural change favorable to pursuing further industrialization. This suggests that agricultural development is an important element in the early stages of economic development and a driving force leading to structural transformation.

Despite of the growth pattern of nonagricultural sectors, why does a set of strategies, which emphasize such industrialization at the expense of the agricultural sector, end up in failure, causing such serious problems as widespread poverty, inequity and unemployment? Moreover, why do the countries which promoted both sectors equally attain success? John W. Mellor (1995) offers us one of the answers; "Agriculture plays an important role in structural transformation because of its preeminent size, not its preeminent growth rate."

Figure 1. Output and Employment in Third World Agriculture, 1990.

FIGURE #2 shows that in the Third countries the portion of agricultural employment in the total labor force has, as a whole, doubled the output of agriculture as a percentage of the Gross Domestic Product (GDP). In spite of a much lower share of the output in the GDP, agriculture has been the major sector which absorbs in large numbers of the labor force in the developing countries. This indicates that the agricultural sector owns a large labor force of low productivity, comparing to other sectors such as manufacturing and commerce. In the early stages of development, dominance of agriculture is reflected the most in the land, labor and capital of one's developing countries. Therefore, the development of agriculture has great potential in terms of socio-economic structural change. In order to achieve further economic development, the government of the Third World countries need to comprehend the role of agriculture in their economic structure, while their development strategies should strive to create an appropriate policy for the transition stage between economic development and an agrarian system.

Transition of Agricultural Development and Policy Setting

The experience of some developing countries during 1970s and 1980s witnessed that agriculture played an important role and had a great potential to achieve structural change in the process of development. The agricultural transformation can be divided into four stages, requiring desirable policy setting for each stage. In the early stage of development, agricultural sector is composed of a high percentage (70-90 percent) of labor force, and creates a lower agricultural output which has no reflection of the proportion of labor input. The increase of labor productivity in agricultural sector, caused by external or internal factors, creates a significant surplus, because the rest of the economy is so small. In this stage, policy must be concerned with "getting agriculture moving," or creating a better environment in the agricultural sector. Thus, surplus needs to be allocated in public investment such as infrastructure, and in favorable price incentives for farmers to adopt new technologies. Agricultural surplus, which was created in the first stage, is absorbed directly or indirectly in both public and private sectors and mobilized for development of nonagricultural sectors in the second stage. The agricultural sector then becomes a key contributor to the overall growth process. But as the nonagricultural sector, in particular the industrial sector, develops, the disequilibrium between agriculture and industry comes to light. When this gap in labor productivity and measured income(not psychic incomes) between rural and urban sectors starts to narrow, agriculture takes a step to the third stage. Policy during the second stage should strive to link the agricultural sector with the

industrial sector, and to improve factor markets to mobilize the rural resources. Sufficient input and output in the agricultural sector will help to integrate rural markets, creating a linkage between rural and urban economy. As result, integration of rural and urban economy accelerates the process of extracting labor and capital from agricultural sector, and mobilizing them into industrial and service sectors with high productivity in the third stage. Due to the integration into macro economy, policy should consider the environment surrounding the agricultural sector, such as the fluctuation of macro prices, level of aggregate activity, and trade. Agriculture receives pressure to change the traditional management, and move into industrialized economies in the forth stage. Although agriculture has the small share of the labor force, it gains the influence on political issues. The countries which have attained success in the transition face to serious problems, such as resource allocation and competition in the world economy. Agricultural protection and its impact on the world economy become essential elements in the process of agricultural policy making.

Transition of Agrarian System

Agrarian systems tend to evolve from predominately subsistence and small-scale peasant farming, to more diversified and larger extended family farming, and finally to specialized and commercial farming, which dominates in total production. Although subsistence farming tends to dominate in developing countries and specialized farming does so in industrialized countries, these stages can be seen in every country at any point in time.

The purpose of subsistence farming is to produce outputs for family consumption and a few staple food crops for the local market to obtain necessities. Productivity of land and labor are at a low level, and capital investment has no expectation. In general, for peasants, land and labor are the principal factor and they use traditional methods and tools for cultivation, which is vulnerable to weather shifts. The laws and policies, such as taxation systems, place burdens on peasants and restrict incentives. The failure to collect sufficient outputs causes farmers to create outstanding debt from moneylenders, leading to a critical condition in their lives. Most subsistence-farming peasants in the Third World are confronted with difficulties due to technological limitations, rigid social institutions, and the lack of communication systems connecting rural to urban areas. It is obvious that the environment surrounding peasants is static and uncertain. Since the nature of subsistence agriculture is highly risky and uncertain, farmers in that level are reluctant to adopt new technologies and crop patterns, even though they promise to attain higher productivity. This is because the motivation of small-scale peasants is based on the maximization of their chance of survival and they tend to avoid risks which will endanger their lives. Moreover, environment surrounding peasants, for example, the

restrict land tenure condition, inadequate credit facilities, and immature local market, can be the major stumbling block in preventing the farmers from responding to proposed technical change. Without an effort to reduce risk and remove social and commercial impediment, there is little possibility for small-farmers to accept innovation which raises agricultural productivity and affects structural change in society. Peasants begin to act economically and rationally when given alternative opportunities and provided adequate insurance. The increase of productivity per worker under desirable social, commercial, and institutional condition causes to a shift from subsistence farming to mixed and diversified farming.

In mixed and diversified farming, new cash crops such as fruits, vegetable, coffee and tea take the place of staple crops. Along with diffusion of cash crops, simple labor-saving devices like small tractor can be introduced, freeing the labor force for other farming activities. In addition, the introduction of better seeds, fertilizers and irrigation help to increase the productivity of the land, creating a surplus to invest for improvements of agricultural input, while adequate supply enable farmers to use their land for cash crop cultivation. In this stage, a reasonable and reliable access to credit, fertilizer, water, the information network and marketing facilities become essential requirements.

Specialized and modern commercialized farming is the dominant form the agricultural sectors in advanced industrial countries. Its goal is to produce commercial profit, not take into provide food for family. Adopting the economic concepts which will be referred to costs, saving and investment, price fluctuations in market and proper resources utilization, the farming system is mobilized effectively with quantitative and qualitative significance. A particular cultivation method becomes the prominent feature of all specialized farms, in which capital-intensive labor-saving technology allows a single family to cultivate a large land. In some cases, it can be seen in both developing and industrialized countries that specializes farming operates similarly to large agribusiness multinational corporate enterprises.

Agricultural and Rural Development Strategy

In developing countries, we see that most people live in rural areas and engage in subsistence agriculture for survival. Despite the fact that these countries showed dynamic economic growth, such people were overlooked. Recent serious problems, such as widespread poverty, inequity and unemployment, has developed as a result of the severe imbalance between rural and urban areas caused by rapid industrialization. While the transformation of the agricultural function occurred in the economic development, the agrarian system also shows the morphological transition from subsistence farming to specialized and commercial

farming. As far as the traditional society in rural area is concerned, agriculture is no longer an economic activity, but a way of life, therefore, it is necessary for any government to recognize and to understand the structure of farm economy in terms of the process of agricultural modernization. Policy should involve not only meeting the demands for increased production, but also causing profound changes which affect the whole social, political, and institutional structure of rural society.

The major objective of agricultural and rural development should focus on the improvement of living standards in rural areas through increases in small-farm incomes, output, and productivity. To achieve these basic conditions, development strategy must comprise the essential and fundamental elements in terms of small-scale agricultural progress and rural integration. The main requirements is as follows:

Small-Scale Agricultural Progress

1. Application of technological change and innovation
2. Appropriate government economic policies
3. Creation of supportive social institutions

Rural Integration

4. Modernization of farm structure to meet demands of increasing food
5. Creation of effective supporting system
6. Social and physical change of the rural environment

There are two major sources of technological innovation, which enable farmers to increase their yield. However, new technology, in some aspects, possesses problematic elements. The introduction of labor-saving technology such as mechanization has drastic effects on the increase of output per worker. In reference to the land, most farmers in the developing countries own small plots of land without sufficient capital. Thus, this can not be suitable for the small-landholders. On the other hand, land-saving technology such as improved-seeds, irrigation and chemical fertilizers raises land productivity by improving quality. Theoretically, many economists agree that this has a positive effect on small scale agriculture because of it does not require a large capital input. To promote this measure, of course, adequate government policies and supportive social institutions will be needed. Otherwise, this will turn out to be a failure and cause the further impoverishment of the masses of rural peasants.

Green Revolution fortifies this proposition. Following the recognition of the role of agriculture in the world, the new

high-yielding varieties (HIV), called "miracle seed," of rice, wheat and corn have been introduced to many countries in the Third World, starting the early 1970s. Some countries achieved success, but the others did not. This is because this new HIV requires access to related resources such as irrigation, fertilizer, insecticides, credit, and agricultural extension services. Large landowners, with their disproportionate access to these resources and support services, have the opportunity to take advantage of HIVs over smallholders and eventually drive them out of market. The inevitable result is that an innovation with great potential for alleviating rural poverty and raising agricultural output can be antidevelopmental if government policies and social institutions militate against the active participation of the small farmers in the evolving agrarian structure. Pricing policies of agricultural commodities can be one of the critical areas for major improvements.

It is obvious that small-scale agricultural development with full benefits is critical to the role of government. In many parts of Asia and Latin America, land reform is essential through a joint effort of the government and all farmers. The most important determinant in the existing highly inequitable distribution of rural income and wealth originates from the unequal structure of land ownership. Although there are many forms, land reform as a whole entails a redistribution of the rights of ownership in favor of cultivators with limited or no land holdings. The transfer of acreage from the land owner to the people who actually work the land can be encouraged under the overall protection of government. In addition to social structural reforms, rural development needs substantial support of public sectors in the form of, for example, transportation, a communication network, research and education, leading to the development of small- and medium-scale industry and upgrading of consumption pattern for rural modernization.

Burmese Agriculture: Its Structure

Historically, the Burmese economy was supported by agriculture, which provides sixty to seventy percent of employment and occupies over one-third of the Gross Domestic Products (GDP).

Figure 2. Total Labor Force and Employment in Agricultural Sector, Burma.

FIGURE #2 shows Burma's total labor force and employment in the agricultural sector.

Obviously, the majority of the labor force is absorbed by the agricultural sector. However, the lack of significant change in employment of

agricultural sector implies that fluctuations in the economy (Asian Development Bank) have no effect on the mobilization of the agricultural labor force to nonagricultural sectors.

Figure 3. Output and Employment in Burma.

Unlike the other developing countries, Burma's agricultural employment from 1985 is in relatively close proportion to the agricultural output. The growth of GDP percentage of agricultural output reveals that the agricultural reforms of 1974 were successful. Moreover, this recent trend indicates that Burma appears to be in the higher level of labor productivity in the Third World. However, it should be noted that, in terms of the agricultural production index per capita, this presumption is not supported by the evidence.

Figure 4. Output and Employment in Thailand.

Thailand is a typical country in the Third World where the agricultural sector shares much less percentage in total than agricultural employment does in terms of the economic structure (Fig.4). By one set of criteria of "output and employment," Burma has done better than Thailand. However, when we evaluate Burma's growth according to the agricultural production index per capita in FIGURE #5, Burma's development has been at the same level as Thailand.

Figure 5. Agriculture: Production Index Per Capita, Burma and Thailand.

Map #1-3 (Shares of Major Sectors in GDP) give us a visible feature of the economic structure in the Southeast Asian region. According to this, Burma is referred to as one of the agricultural countries in the Southeast region because of a large portion of agricultural output in the GDP. Its history as an agricultural country dates back to the nineteenth century as a British colony. Its main rice field, Ayeyawady Delta, which contains about 3.5 million acres, experienced dramatic increased cultivation after the British arrived. Promotion of agriculture under British rule made Burma the "rice bowl" in Asia. This legacy has left paddy/rice as the main agricultural product

which has shared over seventy percent of the total agricultural output in Burma today.

Needless to say, the agricultural sector, because of its size, has played an important role in Burma. The rise and fall of this sector is a decisive factor in the performance of the national economy and the life of the majority of the populace. Since agriculture has affected the economy, government has attempted to have an impact on it through its policies.

Historical Perspective of Agricultural Development in Burma

The history of agricultural development in Burma has been similar to that of many other countries of the Third World. The military government, which established the "Burmese Way to Socialism" in 1962, gave priority to industrialization. The objectives of this new concept was self-reliance, nationalization and strict neutrality in line with 'socialism,' which was adopted for Burmese tradition and its natural features. Rapid nationalization and the neglect of the role of agriculture resulted in a disappointing growth in both the agricultural and the nonagricultural sectors, which caused stagnation in the whole economy. The lesson from this disappointing experience during 1960s turned the governments attention to the agricultural development. To overcome the stagnating economy, the government was forced to reform some of its economic policies, practice, and institutional structure with an emphasis on improving the agricultural sector. In 1971, the government carried out the "Twenty Year Plan," which was composed of the four terms of the Four Year Plan (FYP). In fact, it was launched from the Second FYP in 1974, which was adopted for the new policies under the 'modification' of Burmese Way to Socialism. A prominent landmark in this plan was the emphasis on exploitation and efficient utilization of natural resources such as agriculture, forestry and mining. In addition, the introduction of the Official Financial Aid (ODA) as well as other international inflows helped Burma pursue radical and further economic development. The authority's recognition of the importance of the agricultural role in the economy brought the highest priority to agriculture for economic development in the future. However, modification of the policies implied a slight change from strict nationalization toward liberalization, and the fundamental concepts remained unchanged; self-reliance, centralization, and regulation of domestic investment. During the Forth FYP, no measures were carried out in the agricultural sector, and economic growth started to wane in accordance with the decline of agricultural production. The global price-down in primary goods in the mid-1980s caused serious damage not only to agriculture, but also to the overall Burmese economy. In 1988, when the military took power through a coup, the economy in Burma was in a critical condition. The economic policies under the present administration, showed drastic change : the movement from inward-looking,

nationalized policy to outward-looking, market-oriented. In order to promote this radical policy, the State Law and Order Restoration Council (SLORC) has formulated the Short Term Plan (STP) (1992/93-1995/96), in which the first and the second year were designed as "Economic Years", the third year as "All Round Development Year" and the last year as "Visiting Myanmar Year." In the name of economic liberalization, the current agricultural sector is considered as one of the three leading economic growth sectors: the other two, being tourism, and natural gas and mining.

Land Policy

Land reform is an essential condition for agricultural development. In Burma, land distribution from large landowners to small farmers moved smoothly. This was because the state was the ultimate landlord and considered that farmers should have the right to work on the land as individuals. The Tenancy Law of 1965, which abolished the tenancy system , contributed to the accumulation of about five million acres, or a quarter of the total cultivated area. Although lands were prohibited from sale, purchase or mortgage, lands allocation had taken place in accordance with this law. But the land reform emphasized equity rather than productivity, which caused further land fragmentation.

TABLE #1 Size Distribution of Farms, 1985/86

Size of Holding (acres)	Farm Families ('000)	Farm Families (Percent)	Area ('000 acres)	Area %
Less than 5	2661	61.6	6078	25.11
5 to < 10	1058	24.49	7540	31.14
10 to < 20	491	11.38	6853	28.3
20 to < 50	107	2.47	3010	12.43
50 to < 100	2	0.04	129	0.53
100 and above	0.9	0.02	603	2.49
Total	4320	100	24213	100

Source: Mya Than, "Agricultural Policy Reforms and Agricultural Development," in MYANMAR DILEMMAS AND OPTIONS, Institute of Southeast Asian Studies, edited by Mya Than & Joseph L. H. Tan, 1990.

TABLE #1 shows that over fifty-six percent of lands was occupied by eighty-five percent of the families whose farm size are ten

acres or less, whereas 15.3 percent of lands belongs to about 2.5 percent of families whose farm size are over twenty acres. This indicates that the majority of farmers in Burma were small land holders and a more equitable land distribution had been attained compared with neighboring countries, as a result of the emphasis on equity. In addition, farmers were protected by the Farmers' Rights Production Law, which was introduced along with the land reform. The land reforms emphasized on equity and strengthened government control over farmers, causing a strong relationship between the government, the owner and the cultivators.

Credit Policy

Credit is an advanced purchase which enables farmers to access agricultural inputs in advance. In the beginning of the Second FYP (1974-77), the government made more credit available to farmers. Although credit had been existed even during the previous government, about 85-90 percent of government agricultural loan was spent for the paddy crops. On the other hand, industrial crops, such as jute, sugar-cane and tobacco, were supported by lower interest rates. However, the farmers tended to depend on more expensive private sources of credit to meet their demand than official credit, whose lending rate covered only about eleven percent of the total cost of cultivation in 1972/73. These reasons sprang from the government purchasing system, where farmers, who took credit from the government, were obliged to sell their crops to it. In addition, credit distribution on a per acre basis allowed larger land holders to enjoy the benefits of this system. The objective is not the elimination of the private money lender, but administrative control over farmers. Therefore, the credit system, like the land reform, emphasized equity rather than productivity and efficiency.

Marketing Policy

The features of Burmese agriculture under the Burmese Way to Socialism accounted for the government procurement of rice and control over major exported agricultural products. The procurement system, though it had existed since 1946, aimed at providing stable prices for producers and consumers, obtaining sufficient capital to employ for the development plan, and stabilizing the economy. These tasks were assumed by the Union of Burma Agricultural and Marketing Board (UBAMB), which bought rice and "controlled" products at fixed price set by government directly from farmers, distributing them along both producers and consumers with lower prices, and exporting them with value added. Although the objectives of this system was to restrain the inflation to low rates, the government control in domestic markets coincided with the spreading of the black market, which was responsive to the actual demand.

Along with the Second FYP (1974-77) the authorities modified the previous procurement system to the compulsory delivery system, which took into account land size, land productivity, and family

size. This system was "actually a form of progressive taxation which favored the small farmers with poor performance." However, rice, as usual, emptied into the black market. Large farmers in particular tended to sell their products in the free market, whose price was higher than government price. This flow was because of the widened price gap between the official and free markets. Therefore, farmers responded to this price gap which is shown in FIGURE #4. Since 1974, the government had raised the official price twice to adjust by the widened price gap. This pragmatic price adjustment contributed to, to some extent, increasing the amount of procurement rice along with exaltation of incentives among farmers. Although the government continued to maintain the adjustment prices, the price in the free market far exceeded the official price. As a result, the amount of procurement started declining after 1978.

Figure 6(4). Prices of Paddy/Rice.

In 1987, the government inaugurated the most radical reforms: the liberalization of agricultural trade. According to this announcement, once restricted agricultural products, rice, maize and seven varieties of beans and pulses, were allowed to be handled by the privately. After a short time, people enjoyed free trade, and demonetization was carried out. This was aimed at absorbing the black money to prevent the dominance of non Burmese People, most of whom were engaged in the commercial sectors. However, the government efforts resulted in economic chaos rather than economic recovery. SLORC, which took power through the political upheavals in 1988, replaced it with the former centralized procurement systems.

In spite of the shift to the marketing liberalization in the national economic policy, farmers have remained obliged to deliver at controlled prices a certain pertain proportion of output in return for inputs. Since delivery of paddy still has been based on land acreage rather than production, without respect to the number of crops of paddy sown per year, its burden has fallen on farmers who have relatively low-yielding land unfavorable for new multiple cropping. Although official paddy price rises yearly, the authorities require additional quotas. The failure to deliver tends to cause farmers to loose their access to the land.

Agricultural Reform -Green Revolution-

The highlight of agricultural history in Burma could be a consequence of the introduction of High-Yield Varieties of paddy rice (HYV) through the "Green Revolution." The introduction of new technology, which started in 1974, had gained more momentum under "Whole Township

Special Production Programme," spreading throughout countries, especially, Lower Burma. Since HYVs required more fertilizer, the government promoted the utilization of this new technology combined with fertilizer. FIGURE #5 gives the amount of 8466 thousand tons of paddy production in 1974, and 34.19 baskets paddy yield per acre. By 1982 in FIGURE #6 and #7 show that over 10000 thousand acres, half of the paddy land was covered, while four times of fertilizers were consumed, compared to in 1974 Along with these trends, paddy production per yield increased twice as much as before 1974, causing rise of total production to 13923 thousand tons.

The increase of paddy production during the period between the mid-1970s and the early 1980s resulted from neither little or no extension of cropped area, nor introduction of agricultural machines, but did resulted in yield increase. Added to these new technologies, good weather, more available credit and incentive, which led to the rising price of official procurement, contributed to the increase of productivity per yield and consequent total paddy product.

Figure 7(5). Paddy Production and Paddy Yield in Burma.

Figure 8(6). Paddy Production and HYV Area during 1974-85.

Figure 9(7). Paddy Production and Fertilizer Consumption.

Burmese Agriculture: Position

Through the "Green Revolution," Burmese agriculture made a great progress. The introduction of land-saving technology was suitable, as long as concerned the feature of Burmese agriculture: land fragmentation, low land-man ratio, and scarce capital. The policy reforms, which gave the higher priority over agricultural sector during this period, seemed to bring benefits to farmers through rising productivity. however, despite of increase of gross income, high inflation, which caused by dual economy, had no effect on their real income. This was in favor of large-land holders. Even in 1993, most farmers used simple implements such as plows, harrows, and spades. TABLE #2 suggested that the Burmese agriculture have not given away to subsistence level.

TABLE # 2 Agricultural Equipment,1993

		Thousand Numbers
Implements	Plows	2674
	Harrows	2792
	Spades	3600
Machinery	Seed Drills	84
	Rotary Harrows	409
	Water Pump	46
	Tractors	11
Vehicles	Carts	1659

Source: Central Statistical Organization, STATISTICAL YEARBOOK 1993, Yangon, Myanmar, 1993.

The growth of agricultural sector, however, had slowed down when the effects of Green Revolution reached the 'saturation point.' This is largely because of the inappropriate allocation of surplus springing up from the agricultural sector, and the policies emphasizing on 'equity' rather than 'efficiency.' Thus, surplus coming from the agricultural sector was allocated to neither sufficient infrastructure, nor favorable price incentives. The progress of Burmese agriculture had no link to the next stage of transformation of agricultural development as well as to the agrarian system, keeping it to a subsistence level.

Agricultural Potential and Strategy Suggestion through the Recent Policy

The recent agricultural strategy under the ruling military junta, the SLORC, aims at the comprehensive progress of productive sectors including agriculture, livestock and fisheries. As for the agricultural sector, its feature can be described as the encouragement of production through small-scale irrigation and new multiple cropping.

Multiple Cropping

Rapid diffusion of multiple cropping, in particular, contributed to recovery of the agricultural output during 1991-1995. This seemed to result from the great efforts of the government, which extensively publicized nationwide instructions to farmers of when and what to cultivate on paddy land through all the state media organs. In addition, government formed 7000 "agricultural supervisors," and placed

them throughout countryside mainly to communicate these instructions for reliable compliance in the process of the paddy procurement. The application of multiple-cropping brought about, to some extent, success, owing to farmers' voluntary response in some regions. The salinity problem, high flood risk and seasonal pest problem are major concerns in Delta region (Ayeyarwady Delta and coastal area), which occupies fifty percent of country's cultivated area. Flooding in this region which is caused by constant heavy rain during the monsoon season, in particularly, destroyed ten to fifteen percent of cultivated area in the Delta region. Flood protection will be badly needed.

Irrigation

On the other hand, this multiple-cropping technology required expansion of irrigation systems. Historically, irrigation had played a fairly limited role in Burma's agricultural development. As a whole, due to the need of capital input, the scarce budget of the government seemed unmanageable for the need. In spite of the large land possession of mainland Southeast Asia, only 12.69 percent of the total area of 67.6 million hectares is under cultivation in 1994. TABLE #3 reveals that Burma has a vast room available to cultivate.

TABLE #3 Land Use, 1994

Type of Land	Hectare (Thousands)	Percentage
Net Sown Acreage	8587	12.69
Current Fallow	1489	2.2
Cultivable Waste	8191	12.11
Reserved Forest	10260	15.16
Other Forests	22130	32.71
Others	17001	25.13
Total	67658	100

Source: Ministry of National Planning & Economic Development, Economic Development of Myanmar, Government of the Union of Myanmar, 1995

As for both the Dry zone region in the center of Burma and the Hill region along the boarder, paddy, as well as other crops which is share about forty percent of the total agricultural products, are available only in the area where the irrigation is provided, or conditions

are relatively favorable. It is necessary that irrigation development which based on the construction of dams and diversion water, pump irrigation of both surface and ground, and the establishment of village-level irrigation schemes. Recently, under government pressure, total irrigated areas have increased from 2.5 to 4.1 million acres, and irrigated paddy cultivation from 2.1 to 4.3 million acres during 1989/90-1994/95. This is because the state irrigation construction projects were accomplished by a large number of people with little or no compensation in the name of "people's contributions." Thus, without a large amount of capital input, irrigation had and has been undertaken. Since Burma has a vast potential of land resources, land expansion will lead Burma to the next stage.

Small-Scale Machinery and Diversified Farming

Considering different land conditions, the diversified farming and the shift to producing cash crops, will be desirable in the Dry zone and the Hill region, where its soil does not retain moisture long enough. On the other hand, the Delta region, although this is true for other regions as well, will be need the introduction of small-scale machinery. As we noted above, Burmese agriculture still mainly depends on simple devices whereas agricultural machinery is insufficient. However, the numbers of tractors and harvesters in 1961 was three times greater in 1974, and has grown further to five times greater. FIGURE #8 provides visually the demonstration of its rapid growth.

Figure 10(8). Tractor and Harvester in Use, Burma.

The recent trends of tractors and harvesters basically demonstrates upward growth. It is largely because the utilization of both machines is under the promotion by the present government through encouragement of private sector suppliers. Even though, agricultural mechanization in Burma continued to lag behind in Asian countries and North and Central America, as provided in FIGUREs #9 and #10.

Figure 11(9). Tractor in Use, Burma, Asia, North and Central America

Owing to land fragmentation and the different condition of the region in Burma, it will be more efficient in Burmese agriculture to introduce diversified farming to suitable areas and to encourage small-scale labor-saving technologies with knowledge of management.

However, recent strategy without proper guidelines possesses a room to discuss the utilization of human resources and the impact on the environment.

Other Recommendation

As long as government procurement exists in marketing policy, there will be little hope to expect efficiency and productivity. Furthermore, it is obvious that the link between the agricultural input supplies and the delivery of output in return has had an adverse effect on farming efficiency. The government needs to relinquish its monopoly in respect to actual demand. The legalization of border trade has strengthened price incentives in agriculture and will call forth a strong supply response. It is important to offer opportunities opened up for export demand.

Achievement of the structural change for further development in the agricultural sector must follow rural development. Infrastructure, particularly transportation, which had been mostly intact since World War II, is critical to Burma. Toward "Myanmar Visiting Year of 1997," the ruling military junta devotes itself to invest in the tourism infrastructure. Although transportation is under renovation or construction by numerous uncompensated workers, its objective is convenience for tourists, having little relation to the rural areas. Future strategy must have a direct impact on the integration of the rural development.

Burma has suffered from a lack of priority for rural development in national policies and donor-country assistance. There will be many constraints and obstacles that still have to be eliminated. However, without such efforts, sustainable growth can not be expected in the future.

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MAPS

Map. Industrial Sector in GDP. Southeast Asian Region, 1993.

Map. Service Sector in GDP. Southeast Asian

Region, 1993.

Map. Agricultural Sector in GDP. Southeast Asian Region, 1993.

CHAPTER SIX
Allain J. Rasolofoson
DEFORESTATION: THE CASE OF MADAGASCAR

INTRODUCTION: The Problem of Deforestation

The destruction and degradation of forests is now recognized as one of the greatest environmental threats - and tragedies - of all time, and the continuing loss of the world's forests has become a global emergency. Both temperate and tropical forests are an integral part of the life support systems of the planet, performing different ecological and social functions essential for the continuation of life as we know it on Earth. These forests contribute in regulating the climate at both the regional and global level, provide a habitat for the majority of species, provide a homeland for million of forest peoples, maintain and conserve the soils, also regulate hydrological cycles and ensure water supplies.

In many temperate regions, an important part of the broad-leaved forests have been depleted since the dawn of agriculture. Continental Europe was still 90% forested during Roman times; today, the loss is estimated at around 80% to almost 100% in many countries, and as a whole Western Europe forest cover is down as to about 30%. On an other hand, in North America, only an estimated 7% of what existed when the first European settlers arrived can be nowadays retrieved; the figure was already at 12.5% by the 1930s. And still, most of temperate forests in Europe and North America are "managed" ones: we have 65% of closed forests in the US, and 58% in Europe. Few virgin forests also remain outside Canada, Alaska, and the former USSR, and in many instances even these are under threat. Historically, agricultural and urban development has been the prime cause of forest destruction in temperate areas. Today, what remains is being lost to logging, acid rain, and other pollution-related diseases - a syndrome generically known as "Waldsterben" or "Forest Death" -.

Worldwide, all tropical countries have experienced a massive increase in the rate of deforestation since the Second World War. Many countries which are now virtually stripped of their forests were once heavily forested. By the end of the 1980s, the UN Food and Agriculture Organization (FAO) performed an assessment and then estimated that, for the period 1980-1985, some 58 million hectares (0.58 million km2) of "productive closed broad-leaved forests" were cleared, along with 13 million hectares (0.13 million km2) of "commercially unproductive forests", making a total of 71 million hectares (0.71 million km2) of loss. These figures translate into an annual rate of 11.6 million hectares for "productive broad-leaved forests" alone. At such rate, all the world's

primary lowland forests will have been destroyed by the end of the century, except in inaccessible sites and in a few biological reserves.

In 1987, satellite pictures for a study by the National Institute for Research in the Amazon (INPA) indicated that 204 000 km2 of Brazilian Amazon were burned, of which 48 000 km2 were proper rainforest and the rest being savannah or previously cleared forest. The INPA gave an estimate for the brazilian Amazon according to which some 10% of the total area had already been cleared. However, the World Bank puts the figure at 12%. In one way or the another, the rate of destruction is always alarming, allowing this unique world's specimen less than 30 years to be completely lost. This tragedy will happen even faster if we consider the possibility that regional climatic change may disrupt the evapotranspiration mechanisms, accelerating die-back of the remaining forests (WRM, 1990).

The major factors that have led to rainforest destruction have not been systematically and adequately pointed. The common prejudice tends to assume that forests are being destroyed by poor people who burn them for agriculture or who use the trees for firewood. More recently, environmental groups and scientists have drawn the attention on many other possible causes. These include commercial logging, large road construction, dam and mining projects, conversion of forests into cattle ranches and plantations, transmigration and colonization schemes. Thus, "modernization" and commercial interests are also involved in the expansion of the tragedy on the global scale.

Nethertheless, in the case of Madagascar, the phenomenon has a much more complex origin which can be traced back in the country's early History. And because of coexisting circumstances, the plague has been carried over unto the modern era, challenging successive authorities and governments.

THE CASE OF MADAGASCAR

Background

Madagascar is an island nation in the Indian Ocean, located about 400 km (250 mi) across the Mozambique Channel to the southeastern coast of Africa. Because of its location and unique settlement history, Madagascar has remained fairly isolated from nearby East Africa. Approximately the same size as Texas, Madagascar is the fourth-largest island in the world, including its five small off-shore island dependencies. The Malagasy people consider their country as a continental expanse rather than as a maritime spot surrounded by ocean.

Madagascar's dominant topographic feature is a high upland region in the center of the island called the central plateau. Its average elevation is about 1,400 m (4,500 ft), but it is characterized by hills, deep gorges, and volcanic outcroppings that hinder transportation. The highest point, Mount Maromokotro, rises to 2,876 m (9,436 ft) in the

northern part of the country. Between the plateau and the Indian Ocean, to the east, a plain about 50 km (30 mi) wide occurs. In the sparsely populated west, a 160 km-wide (100 mi) region of hills descends from the plateau to the Mozambique Channel. Madagascar's major rivers, the Betsiboka, Tsiribihina, and Mangoky, descend from the plateau to the west coast, creating fertile and intensively cultivated valleys.

The east and southeast experience the greatest rainfall, with trade winds bringing about 3,710 mm (146 in) of precipitation annually. The climate of the central plateau is modified by the elevation; it is the coolest part of the country with an average annual temperature of 18oC (65oF) at Antananarivo. The plateau receives about 1,360 mm (53 in) of rain annually. The west and southwestern areas are the driest regions, with only about 350 mm (14 in) of rain at Tul
ar. However, rainfall is irregular and unpredictable throughout the country, and severe cyclones usually strike about twice a year.

Deforestation: Extent of the Phenomenon

Madagascar is classified among the most deforested nations of the globe and is reported for having lost 73% of its original forest; the actual total forest extent of about 160,000 km2 covers only 28% of the territory (WRD, 1996). However, the trees growing on a quarter of that wooded area are so dispersed or so stunted that they can no longer be said to represent genuine forests. The nickname, The Red Island, has been given because the predominating lateritic soil is uncovered and revealed to the sight in many regions of the country after a progressive deforestation.

Figure1 indicates the distribution of forest extent as for the year 1990, and Figure2 shows the rates of change varying from 0.6% to 1% per year according to the type of forest.

Figure 1. Distribution of Forest Extent (1990)

Dry and moist forests represent a major proportion of the natural habitat, to which we also add savannah and grass, and to a much lesser extent wetlands and mangrove. Such diversified natural habitat is home for an inimitable and worldwide recognized biological diversity. The tropical forests of the coastal zone and the lowland valleys produce the most valuable and useful trees, such as ebony, rosewood(palissandre), the raffia palm, and mangroves, as well as wild rubber vines. The valuable species become less fewer and less accessible on the mountainous regions of the high plateau which today are almost bare of trees.

Figure 2. Annual Change of Forest Extent (%)

The loss in forest extent, which is by itself an environmental threat, is accompanied by an irremediable and tragic loss in biological diversity that could cost Madagascar its fame for being a natural museum for the entire planet. In fact, only 1 out of 20 species identified in the spiny desert of the Malagasy south can be found anywhere else on earth. 80% of the flora, more than half of the birds, and 95% of Madagascar's reptiles survived only on this land. Many species had already expired - the monster-bird aepyornis, pygmy hippos, giant lemurs, and others -, wiped out by climatic change or by humankind (Mittermeier, 1988). Actually, Madagascar is listed by the International Union for the Conservation of Nature as one of the few areas for priority action in terms of genetic resource preservation (WRM, 1990).

THROUGH A FAMILY OF TRANSITIONS

POLITICAL TRANSITION

Madagascar knew different forms of political regimes throughout its history, which might have played a significant role in the local population's worldview (among all, the relation with the "land" and its uses). These different political regimes may as well have their own impact on the deforestation process by introducing technological and/or policy changes in the land exploitation. Distinct landmarks can be considered: (I) the Pre-colonial period , until 1896; (ii) the Colonial period , from 1896 to 1960; (iii) the Io Republique, from 1960 to 1972; (iv) the IIo Republique, from 1975 to 1992; (v) the IIIo Republique, since 1992.

On an other hand, this section also aims to set the historical background necessary to understand the actual socio-economic situation.

The Pre-Colonial Period:

The different regions of Madagascar were previously covered by a mosaic of small kingdoms. In addition to hunting and gathering, the original population cleared land for cultivation of yam, taro, and arrowroot, by practicing the slash-and-burn agriculture locally called tavy. Inundated rice (paddy) and banana cultivation came later, brought by other flows of immigrants from the far-eastern countries.

By the 17th century, a monarch issued from the Afro-Indonesian "Merina" of the central plateau started an unification of the country under one central leadership. His conquests came along with a surge of population and a corresponding expansion of rice fields. Increased agricultural production was one of the King's major goals. Public labor was used for the building of roads, bridges, and dikes (Thompson & Adloff, 1965). Tavy technology spread throughout Madagascar, aggravating the deforestation that already at that time marked the central plateau, and threatening the east and west regions. On areas that were burned over and then abandoned after several years of producing crops, a secondary forest called savoka had grown up. Since now, cattle are still pastured on the

periodically burnt prairies of lean grass. For all practical purposes, land was owned by those who cultivated it and forests were held to be communal property.

The 18th and the 19th centuries in Madagascar were characterized by different attempts to build a state, by an ascent of different political units in the island, and by growing contact with the European dominated international system (Covell, 1987). The foreign parties, mostly British and French, looked for influences over the country. New technology was introduced with the ambitions of the settlers to launch various industrial plantations, which would change further more the island's natural profile. Madagascar was then playing a role in the international slaves trade and also shipped beef, rice, corn, and even salt for the survival of neighbor islands.

The latter half of the 19th century saw the development of more intense interactions within the island, when the Merina Empire tried to extend its boundaries and when the other groups either resisted or were absorbed. Also, the first Franco-Malagasy war broke in 1883 principally because of conflicts over lands property. It ended with important Malagasy concessions in 1885. In 1896, after another war of conquest, the French abolished the Merina monarchy and declared a protectorate. The reigning Queen was exiled, and a formal law of annexation added Madagascar to France's African colonies.

The Colonial Period:

Soon after the conquest, effective protection of Madagascar's forests was conducted by the French rulers by creating a Forestry Service and by training local people to staff it. At the same time, however, they indirectly promoted the devastation of wooded land by granting to French settlers and to companies many concessions containing some of the most valuable tree species for exploitation. Moreover, lands were appropriated by settlers for the production of cash crops. Large, medium and small-scale plantations were created but were mostly profitable for large commercial companies and foreign settlers.

The supposedly French's civilizing mission was not entirely justified since the Malagasy monarchy had been, after all, recognized internationally and had conducted its diplomatic concourse with dignity (Allen, 1995). But, Madagascar was then removed from international intercourse and could maintain only the connections established under French authority.

Internally, this period was punctuated by patriotic revolts and a relative anarchy. The local population's mobilization under any strategy for rural development set up by the colonial rulers was never entirely gained. Peasant resistance to the colonial system took many forms, overt or not. The role of inertia as passive resistance, the role of maintaining newly illegal practices such as cattle-raiding and hills-slope culture, and the retreat into indigenous cultural values all had an element of

resistance to them (Feeley-Harnick, 1984). To involve an unwilling population, forced labor was instituted in 1897 and retained until 1946.

The First Republic:

After the previous period of unsuccessful revolts, Madagascar knew a peaceful access to independence in June, 1960. However, the First Republic is also a neo-colonial regime in which the power was just turned to a selected elite prepared by the departing colonial power. Continued dependence on France in economic affairs and external policy were traded for the rewards of local political office (Covell, 1987).

The agricultural policy was as well deficient. Production, both of rice and of cash crops, stagnated. The same forms of coercion and exhortation were employed to produce coffee, vanilla, cloves, or cotton for the national economy, and taxes for the state. Nethertheless, an attempt was made to contain the threatening natural erosion by implementing a program of reforestation. A new Forestry Code was drafted, which would penalize more severely than before those practicing tavy. But once more, the expected success did not take place due to a missing adhesion of the population to the established program.

The Second Republic:

The events that led to the birth of the Second Republic were a mixture of regime collapse, popular uprising involving different groups and social classes, and military coup. Both foreign and domestic policy options were established after the state structure and ideological principles were synthesized.

Democratic Madagascar was to adopt central planning, indoctrination of the institutions for the progressist movement, and external alignment with anticapitalist countries. But this was without considering two main obstacles: the need for external capital and the profound Malagasy distrust of the central state authority. The real economic battle is once more taken over by fruitless ideological slogans. Precisely, the Department of Agriculture had been held responsible for virtually systematic disincentives to rural production (Allen, 1995). Rural aspirations beyond subsistence were not even considered by a self-serving corps of untrained local administrators. Such situation provoked an abandonment of the already overexploited piece of land to progressive degradation.

On the international level, Madagascar is showing a clear will to remedy the tragedy. In early 1990, in developing countries, Madagascar was among the first respondents to the World Bank's call for action to preserve the environment (Ravel, 1989). A public association was created to manage 50 protected areas. Besides, a tourist program implemented by the UNESCO and incorporated into a five-year plan includes the selection of 50 other "discovery" sites and 3 coastal resorts.

The Third Republic:

Under a new constitution adopted in August 1992, Madagascar is converted from a socialist to a liberal democratic state with guarantees for free enterprise and private property, as well as the security of foreign investment and protection of the environment. The "decentralized administrations" are allowed part of the power and have also to designate the two-thirds of participants at the Senate. The constitution also gives them participation in ensuring local security and administration, environmental protection, social welfare, and the overall development of their respective territories. They will have taxing powers (Allen, 1995).

SOCIAL TRANSITION

Nationwide, each one of the different "historical eras" gives birth to a typical form of society, characterized by different value(s). It seems to be possible to assess, for each period, a predominant culture and form of education which affect somehow the social behavior. The changes in the population settlements also affect the land uses, as well as their management.

The Pre-Independence Period:

The settlement of the primitive population in Madagascar still remains enigmatic. Tribal distinctions are inevitable between peoples of different origins and from multiple crossbreedings. Nowhere in Madagascar does there exist a pure racial type, and even the broad classification of the coastal peoples as Negroid and of the inhabitants of the high plateau as Asian is misleading. This pre-independence period can be characterized by a mobility of most of the tribes, which is responsible to a large extent for their social and economical evolution. A theoretical model is proposed, according to which the earliest migrants were first wandering along the coastal lands before reaching the central plateau, where they soon started cutting down the existing forest to grow rice (Thompson & Adloff, 1965). After subsequent wars, and by the 14th century, the different groups crystallized into tribes and formed kingdoms. But the population continued to be mobile, depending on the outcomes of internal war. Later, with the expansion of the Merina (central plateau tribe) kingdom, colonization of "empty" lands were encouraged. The wrong agricultural practice of tavy was also spreading.

During the middle of late 19th century, a number of French-speaking settlers came to Madagascar, where they installed themselves as planters or traders. These settlers, mostly from the Mascarene Islands, in turn cleared the wooded areas to develop export crops (vanilla, cloves, coffee, pepper) and a money economy which further stimulated Malagasy migrations. In fact, with the institution of forced labor and the payment of taxes in money, the local population was compelled either to grow cash crops or to earn wages as laborers out of their regions in colonial concessions. But also, some other people migrated in some remote places in order to escape from these institutional

obligations.

Such mobility as a way of living had induced both advantages and disadvantages for the country. On the credit side, we can cite the development of many previously neglected or uninhabited regions, the lifestyle improvement of tribes previously isolated from outside world, and the help for famine areas to solve an overpopulation. On the debit side, the consequences are deeper. Internal migration had displaced the traditional attachment to the land, which in turn had undermined subsequent official programs for rural development because of lack of involvement from the population. In fact, those who were staying to plant their own lots earned obviously less than those who migrated. For the local peasant, it seemed to be out of reach to experiment bigger area than that he was used to. The great majority of the local population still practiced an agriculture of subsistence, without benefiting from any new technology introduced by the settlers. In the worst case, there was an abandonment of any agricultural activity in favor of non-lasting pecuniary trades, leaving the land and exposing it to natural erosion.

The Post-Independence Period:

The most significant changes result from the development of education. The first educational system was installed by the British missionaries during the pre-colonial period; they developed the written form of the native language, using the Latin alphabet, and introduced the printing press. The linguistic unity was then reinforced. But, despite many advantages, efforts were concentrated only on privileged classes - royal Court and upper-class children -. During the colonial period, education was mostly used to train the assistants for the Administration and to maintain a different status between rulers and population.

Figure 3 shows the percentage in gross primary school enrolllment between 1960 and 1993.

Figure 3. Gross Primary School Enrollment (%)

As can be seen, although the access to education was promoted at the independence, the difference between gender in 1960 was still noticeable. This difference is essentially due to the inherited conception. Males are more likely to occupy an administrative position to replace the colonizer, while females are viewed to help in the agriculture of subsistence or into domestic work. Education is associated to a source of wealth and prestige, fitting more to a "head of the family", whereas manual work is socially demeaning and financially unrewarding.

The educational policy during the 2nd Republic(after 1975) has shifted to promote democratization. An appreciable increase of the primary

school enrollment can be observed in both sexes. On an other hand, adult literacy is promoted to vehicle easily ideological messages. Figure 4 shows the development of adult literacy starting with an average of 50% for both sexes in 1970 to 80% in 1990.

Figure 4. Adult Literacy (%).

Such relative improvement in education level has both advantages and disadvantages. It has primarily facilitated the vulgarizing of public health services, thus allowing a rise of the life standings. Nethertheless, it has also induced for both parents and children an attraction towards the urban areas, where most of the time they survive hardly, rather swelling the proportion of urban proletariat. This results into a decrease in available agricultural labor, and into a disinterest in any farming-related activities.

ECONOMIC TRANSITION

This section does not intend to present a detailed analysis of the national economy for each considered period. Instead, only those facts and situations relating to or influencing the deforestation will be emphasized.

The Pre-Independence Period:

Madagascar's economy was damaged by the French impositions requested after the conquest, and by the inability to pay for its imports during the world depression of the 1870s. But it had structural weaknesses as well. Roads construction were neglected for fear of facilitating foreign invasion. Maritime industry, coast guard, or merchant marine never developed.

During the Colonial Period, French economic policy was mostly profitable for the two groups promoting the colonization of the island: the large commercial companies and prospective creole settlers from Mascarene Islands. This period was characterized by a shift to a money economy. The profits then came mostly from trade rather than production. The economic was all but monopolized by French wholesale traders and navigation companies, whereas retail commerce was taken over by Asians alien.

The Post-Independence Period:

Since 1960, the national leaders have then been trying to lay the bases for a genuinely malagasy economy without destroying the existing economic structure or abruptly ending Madagascar's financial and commercial dependence on France. Following the examples of newly independent countries throughout Africa, the Malagasy state initiated infrastructure development, civic service to replace the forced labor

system, rural animation, and limited import substitution. However, Madagascar's economy has always been relying on agriculture but opportunities for sustained economical growth still remain limited, since the country is poorly linked by roads or other communications and poorly served by its institutions of education, health, and law enforcement. Agriculture itself is dominated by rice which is the main food crop and which, with cattle, is the only agricultural product traded within the island. The other important agricultural products are all export crops (coffee, vanilla, sugar, cloves). Figure 5 indicates the distribution of the Gross Domestic Product per sector for the period between 1970 and 1993: (Data source: WRD, 1996)

Figure 5. Distribution of GDP per Sector (in %).

As shown by the figure, an increase in the allocation for agriculture can be registered after the fall of the 1st Republic, in 1974. Such governmental decision is reflected in the increase of irrigated and arable lands, as well as that of permanent cropland. However, the effects of such changes do not reach the rural population composed mostly of small farmers and a large gap can still be noticed between modern and subsistence economics. About 1.5 million widely scattered farms occupy some 80% of the active population but create only 43% of the country's wealth. Most of these farms are smallholds, 2 ha in average size, with limited adaptability. The following figure 6 shows the variation of GNP per Capita for the period between 1970 and 1993:

Figure 6. GNP per Capita (current US$).

The graph indicates that a peak was reached in 1980 before the GNP per capita began to decrease until the early 1990s. An erroneous economical strategy applied during the 2nd Republic could also have contributed to this unexpected situation. In fact, considering direct foreign investment as a threat to independence, the country started borrowing to implement many "investments without constraint". This already costly capital in turn allowed an expanding bureaucracy to launch and manage large but ultimately failing parastatal projects. Agricultural output was neglected in favor of capital-intensive agro-industrial projects that did not produce and social programs that did not improve life standing. By the early 1980s, an overvalued currency depressed exports dramatically, and the external debt had soared to crisis level

(Allen 1995).

The 3rd Republic thus inherited a condition of political uncertainty, administrative inefficiency, and export stagnation that continue to hinder new investments and commercial transactions.

DEMOGRAPHIC TRANSITION

Speculations are made to trace the original population of Madagascar as early as AD 400 and no later than AD 900. Of course, the most important changes can only be noticed for the recent history, due to the lack of valuable data. However, the considerable change in population density is one of the principal factor of deforestation as considered later within this section. Figure 7 shows the trends in crude birth and death rates for each period of five years starting from 1950 to 2050:

Figure 7. Curde Birth and Death Rates.

A sudden increase of the population was registered from the late 1940s. As revealed by this figure, such phenomenon can be ascribed more to a decline in death rate rather than to a rise in birthrate. It was due to a relative rise in local living standards but also, primarily, to the larger funds allocated to the public health service. An epidemiological transition occurred. Endemic diseases such as Malaria which had been devastating in effect was then mitigated. Family planning, vulgarized during the 2nd Republic, is probably the main cause of the drop in birth rate from the year 1985.

The steady increase of the population has indirectly imposed a burden on the country's natural environment. As cited by an analyst, "The system of environmental exploitation typical of Malagasy societies... engendered a vicious cycle of self-destruction of the ecosystem. In fact, the poorer the soil, the rarer the vegetation will be; this entails weaker protection against erosion from water run-off.... The peasants, choosing to live on the productive surfaces which decrease permanently and fail to insure the subsistence of a growing population, thus tend to leave the rural area to join the urban proletariat." (Ramahatra, 1989).

The Pre-Independence Period:

The possible origins of the Malagasy population are still greatly debated among scholars, whether Asian or African sources are the most important. The answer seems to favor a synthesis of the two. For a millennium, Madagascar has been a demographic melting pot in the Indian Ocean, with the interpenetrating of migrant people from Southeast and South Asia, East Africans, and subsequently Arabs and Europeans. Nowadays, physical and linguistic evidence verify both the Indonesian and African origins of the Malagasy population.

Attempts were made to estimate Madagascar's population. In 1900, the first census based on the number of taxpayers gave a figure of 2.5 million. During the last decade of the Colonial era, from 1950 to 1960, the island's population increased at the rate of 2.3% per year and the total attaining 5.3 million at the end of this period. Figure 8 shows the trends of the total population, along with the distribution into rural vs urban areas, for the period starting in 1950 to the year 2025.

Figure 8. Total Population Distribution (x 1000).

As shown by Figure 8, the great majority of the population has always occupied the rural country where they lived as farmers and herders in scattered villages situated mostly in the fertile, well-watered lowlands and valleys. Towns were either administrative centers or markets.

The Post-Independence Period:

We can notice an early stage of urban transition, starting from the 1980s Not revealed by this graph however, the growth has not been spread evenly throughout the country; some areas are still uninhabited, whereas some regions are overpopulated to the extent that their inhabitants are reduced to very low living standards. On the island as a whole, 60% of the population are concentrated in 20% of the total area. The existence of the uninhabited areas, along with the migratory habits of the Malagasy tribes, has favored the practice of shifting agriculture. Herders as well as farmers burn over vast areas of woodlands and grasslands every year to fertilize the soil. After a few seasons, the soil is exhausted and they move on to other regions, where the same process is repeated. The resulting destruction of trees and vegetation cover has led to widespread erosion.

CONCLUSION & PROPOSITIONS

In the case of Madagascar, the phenomenon of deforestation does not follow the classical process in which modernization is incriminated with all its backslides. In fact, since the early times in the country's history, the practice of tavy technology - the local form of slash-and-burn agriculture - has always been worsening the plague. Fires are set systematically to a million hectares of land each year in order to provide pasture for cattle, ashen topsoil for rice, charcoal for urban kitchens, wastelands for hunters and poachers, and scorched fields of protest for angry peasants. Also, among the wrong practices are sharecropping and the system of land tenure. Demographic density has forced an extension of farming to marginally fertile land. On the other hand, the less mobile groups prefer to grow rice perilously on familiar

mountaintops rather than move to distant valleys. Thus, in addition to risk of erosion, these pressures have reduced the time allotted to the soil to naturally regenerate (Jolly, 1980).

Different attempts were made to at least mitigate this real tragedy. Recently, by the end of the 2nd Republic, environmental protection started to be institutionalized. First, however, the permanent problem inherited by the successive governments after the independence has rather been deeply psychological. The Malagasy farmers have most of the time been reticent to accept new technology or other innovative techniques. Such attitude results from the passive resistance inherited from the colonial period, and appears as an intuitive defense against any regulation which is always felt as oppressive. Any directive emanating from the government is viewed as a privation of freedom, or as a tool for "minority rulers" to take advantage of the population. The officials are always considered to disregard the real interests. How then to adopt a policy which will gain the population's adhesion ? Second, a search for identity can be noticed, which is expressed in the different forms of resistance, overt or not. The national identity has for a long time been blocked at a stage prior to its full expression, and the public opinion was manipulated by the colonization towards a self-rejection. Third, any social and individual initiative have been inhibited by a permanent frustration.

The remedy to this particular situation was not and will not be found in the implementation of any kind of regulations. In fact, different policies had been "tried" since the pre-colonial period until recently in the agreement signed concurrently with the World Bank and The World Wild Fund. But, the adopted solutions should imply the needed social involvement through a complete adhesion, as well as a strong social education and information of the local population. In this very perspective, my proposition consists of involving the private sector into a national program of "integrated patrimony management", run with foreign investments and comprising the safeguard of natural environment, local arts and crafts, and cultural legacy. Foreign investments are fundamental, due to the weakness of the national economy and its inability to sustain any large and extended program. The private sector will bring the necessary rigor and discipline. Practically, a private and apolitical association will be legalized to conduct the project. Membership will be accepted by paying an adequately small annual fee and a massive participation will be encouraged by providing incentives such as the following for instance: reduced entrance fees to the managed parks and monuments, or to cultural festivities; reduced fees for organized trips; returned funds to the involved local communities to finance local projects of health and sanitation. Regulations reinforced within the freely enrolled members of such private association are more easily accepted. The government will only have the limited role of "ray aman-dreny"(local term

for natural parents) perceived as advisers and providers rather than directing body. Corruption will be more easily contained than through the regular and heavy bureaucracy inherited from the colonial system. Furthermore, to explore rationally the great diversity of natural and human resources of the country, Madagascar will be divided into three zones - North, Center, and South - about the same size and different from any actual administrative boundaries. Each zone will develop three departments respectively in charge of the natural environment, arts and crafts, and culture. The regional department will in turn have to report to a centralized organ responsible for any foreign relations and coordinating the different activities at the national level.

For more efficient management, the project will be installed progressively according to the following steps: organization and staffing, down to the regional level; assessment and inventory of each regional "patrimony"; communication, sensitizing, and information of the population; initiation and recruiting of membership; development of the entire project. It is expected, through the management of cultural patrimony, to reinforce the national unification under a linguistic unity, to re-establish the lost identity resulting from the colonization, to build the sense of unity which is needed to reach any subsequent common goal formulated into a national program. Also, the promotion of the artistic patrimony will help to rebuilt the self-esteem, or the self-confidence of the population in its values and own efforts, and to give the population the meaning of a rewarding work which will develop its initiatives. Finally, these two other departments will support that in charge of the natural environment in sensitizing the population about the particularity of the country's natural diversity, in conserving the remaining forest ecosystems, in promoting agroforestry and reforestation.

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MAPS

Map. Extent of Global Total Forest, 1990.

Map. Global Total Forest--Deforestation, 1990.

CHAPTER SEVEN
JULIE C. RODRIGUEZ
ENVIRONMENTAL TRANSITION IN ECUADOR:
DEALING WITH THE GROWING PAINS

"It takes a special kind of arrogance for a citizen of as rich and oil-greedy a country as the United States to decide that an impoverished nation like Ecuador should not use its principal natural resource[--oil]." Jan Reid, Texas Monthly, November 1995.

Introduction

Ecuador, like many developing countries, faces the challenge of providing for its people while preserving its precious natural resources to the greatest extent possible. At the same time, outsiders tug at the tiny country from every direction-environmentalists, creditors, multinational oil companies-everyone wants a piece. For better or for worse, development of Ecuador moves forward. This paper analyzes the environmental transitions that are occurring in the wake of Ecuador's development. The primary factors addressed are oil exploration, agricultural development, and deforestation in the Ecuadorian Amazon.

Throughout this paper the reader will note some common themes seen in other chapters of this monograph. For example, many of the countries discussed in these chapters are driven to provide for growing populations under the strict constraints of limited resources such as water and arable land. Ecuador and other countries discussed in this monograph, such as Vietnam and Thailand, struggle to alleviate the population pressure in urban centers by redistributing the populations to less populated areas. Several of the countries also redistribute their populations to assert sovereignty or political control over a region; this can be seen in Ecuador as well as in the Israel and Iraq. (See, e.g., Lipchin Chapter). Such redistribution efforts often foster more problems because the transplantations lack adequate planning, investment in infrastructure, investment in education, and protection for the environment. Thus, a broad view of the countries discussed in this monograph reveals some common opportunities and challenges. Ecuador illustrates many of these.

Setting

Although Ecuador is not a large country, roughly the size of Colorado, it is more geographically and biologically rich than most countries in the world, large or small. Much of this richness is probably

attributable to its location on the northwestern side of the South American continent where it straddles the equator and borders the Pacific Ocean. (See Map 1). This location produces a tropical climate along the coast that becomes cooler as one moves inland. Its biological richness also reflects its diverse topography. In the west, coastal plains shape the horizon. The Andes form a sharp boundary to this region, running parallel north-south through the middle of the country. Several active volcanoes checker this region. The east is dominated by the jewel of South America, the Amazon rain forest, which is drained by the scenic Napo River and other Amazon tributaries. (Reid, 1995). Ecuador's topography divides the country into three distinct regions: the Costa (coastal plains), the Sierra (inter-Andean central highlands), and the Oriente (flat to rolling eastern tropical rain forest). (CIA, 1995). (See Map 2).

Aside from the Amazon, Ecuador also claims another biological gem -- the Galapagos Islands. Off the north-eastern coast of South America, these islands contain an oasis of biodiversity, including giant sea turtles and blue-footed boobies. Like the Amazon, the Galapagos are threatened by human encroachment. However, the primary threat to the Galapagos is over-enthusiastic tourism. This presents a serious problem that could compose an entire paper on its own. The challenges facing the Galapagos are beyond the scope of this paper.

The Ecuadorians

Composed of Indians (25%), Mestizo (mixed European and Indian ancestry -- 55%), Spanish (10%) and African (10%), Ecuador has a rich ethnic component as well. (Lonely Planet, 1996). Its population currently lingers around 11.5 million with an estimated growth rate of 2.4%. (Lonely Planet, 1996). Ecuador's mean population growth has continued to decrease in the last few decades, as have the mean growth rates of neighboring Brazil, Colombia, and Peru. (See Figure 2). Reflecting this transition, Ecuador's population is relatively young with 36% of the population below the age of fifteen. (See Figure 1). Consequently, although fertility is moderate (currently between 2 and 3), the population is still expected to double by the year 2030 (Pichon, 1992), because of the demographic transition that is expected as the population comes of age. Thus, much needs to be done at these earlier stages to provide for the expanding population of the future.

Map of Ecuador showing rivers.

Increasing exploitation of Ecuador's precious natural resources, such as the Amazon Rain forest, is largely a result of rural transition and urban population density rather than excessive overall population

growth. Ecuadorians are moving eastward to the Oriente region to settle. (See Table 1). The rural population in the Oriente increased 37% in less than ten years. The primary causes of this migration are increased access due to road building for oil exploration and favorable land tenure practices because of the government's inability and unwillingness to police the forest area. (See Land Clearing discussion below). Thus, three transitions in the Oriente region are closely intertwined: the energy transition, that is the move to oil development and use that began in the 1970's; the forestry transition as forests were cleared for the oil development and rural farming; and the ultimate agricultural transition.

Map of South America.

Figure 1. Age Structure of Population. Pie chart.

Figure 2. Mean Population Growth Rate.

TABLE 1
Trends in Ecuador's Rural Population, By Region

Province	1974	1982	Relative Change (%)
Sierra	1,943,769	2,078,767	6.9
Costa	1,708,855	1,719,671	0.6
Oriente	150,492	206,246	37.0

Source: Instituto Nacional de Estadistica y Censos (INEC), Encuesta Nacional de Fecundiad (Quidto: INEC, 1982) cited in Douglas Southgate and Morris Whitaker. "Promoting Resource Degradation in Latin America: Tropical Deforestation, Soil Erosion, and Coastal Ecosystem Disturbance in Ecuador", Economic Development and Cultural Change, July 1992, p.796.

Economy

Ecuador enjoys one of the most stable republics in Latin America. (Reid, 1995). However, this free government is held captive by an economy saddled with high levels of foreign debt and very low national income levels. Ecuador is a relatively poor country. GDP per capita income hovers around $1,000, ranking it 71st in the world for per capita GNP. (Lonely Planet, 1996). (See Map 3). The bulk of its GNP is derived from oil production and banana exports. (See Figure 3). The discovery of oil reserves in the eastern portion of Ecuador has resulted in a steady and steep increase in GNP. (See Figure 4). Growth rates in the Ecuadorian economy are largely a function of the prices of its primary exports, oil and bananas. (CIA, 1995). When these products are doing well, Ecuador's economy follows. Consequently, its heavy reliance on a limited number of products has made it vulnerable to international shocks and economic slow downs in other countries. (MIEB, 1994).

Foreign Debt/Debt Service

Ecuador's foreign debt has steadily increased over the last two decades, brimming at over $14 billion in 1995. (See Figure 5 and Table 2). A large portion of this was a result of overly optimistic expectations of oil revenues. The government borrowed from other countries to fund Ecuador's oil development activities and social programs but was unable to repay the debts when oil prices dropped substantially. (MIEB, 1994). "Under newly renegotiated international debt agreements, the country must achieve 5 percent-a-year growth over the next 20 years or face default." (Goering, 1996). Without oil development, Ecuador has no chance of meeting the demands of its foreign creditors.

Map. GNP per Capita by Country.

Figure 3. Estimated Exports, 1994.

Figure 4. GNP per Capita.

Figure 5. Ecuador's Total External Debt (Stocks).

Figure 6. Rainforest Distribution in South America.

TABLE 2
Ecuador's External Debt in 1995

Type of Debt	Millions of U.S. Dollars
Total External Debt	14,366
Long-Term Debt	12,172
Short-Term Debt	2,015
Total Debt Service	1,234
Interest Payments	750

Source: "Executive Summary", Statistics and Quantitative Analysis, Ecuador: Basic Socio-Economic Data, http://iadb6000.iadb.org/~http/ecuador/ecbsed.html, 1996.

Inflation

Compounding its financial troubles further, Ecuador historically experienced high rates of inflation, at times reaching as high as 55%. However, a series of economic reforms helped decrease this considerably in 1994 to 25%. (CIA, 1995). This was primarily due to former President Sixto Duran-Ballen's policies that, inter alia, cut subsidies, balanced the budget, and raised fuel prices and utility rates. (CIA, 1995). These reforms helped stabilize Ecuador's shaky economy.

II. The Ecuadorian Amazon

Ecological characteristics, biodiversity

While merely the size of Colorado, Ecuador packs a powerful punch of biodiversity. It houses more plant and bird species than all of North America. (Conniff, 1991; 39-40). Ecuador is one of the richest in South America in terms of flora species (including a large number of endemic species). "The country perhaps features as many as 20,000 plant species, compared with an estimated 20,000 for all of Central America including southern Mexico, and 25,000-30,000 for all of Brazilian Amazonia." (Myers, 1980; 141). The region remains largely unstudied so biologists can only guess what lurks in Ecuador's misty forests. Unfortunately, huge amounts of forest have already been lost. The western half of the

country, where the bulk of the human population resides, has lost 95% of its forests in the last two decades. (Conniff, 1991; 40). The bulk of the islands of forest that remain are perched atop coastal ridgelines that are more difficult to access. (Conniff, 1991).

In the eastern third of the country Ecuador's Amazonian rainforest is a hotspot for biodiversity. It contains only about two percent of South America's rain forest, (See Figure 6), but contains a disproportionate amount of the region's biological diversity. The region is very wet with little variation in rainfall as a result it is composed of predominantly upland moist forest (mostly evergreen rain forest from tree-like on the eastern side of the Andes to the lowland plains). (Myers, 1980; 141). The lush region is threatened with destruction. Estimates of deforestation in Ecuador vary. An estimated two percent of Ecuador's existing rain forest is lost annually. (Pichon, 1992; 664). Consequently, Ecuador has experienced the highest rate of deforestation of all the Amazon countries. (Pichon, 1992). "All estimates indicate a significant deforestation that could lead to a total depletion of closed forests by the year 2030." (Pichon, 1992; 667 citing Hicks, Daly, Davis, & Lourdes, 1990).

Land Clearing and the Link to Oil Exploration and Land Tenure Laws

Historically the rain forest and its indigenous people were protected from disturbance by a lack of access. The bulk of forest land is owned by the state as forest patrimony or as part of a public park or reserve. However, the government failed to take control of these lands because the government lacked the resources to police the area and the forest resources were not seen as valuable enough to warrant development. (Southgate and Whitaker, 1992; 790). Instead, the undisturbed land was classified as "unproductive" under the Land Colonization Laws passed in the 1960's and, therefore, up for grabs by new settlers. (Myers, 1980; 142). The purpose of these laws was threefold. First, the Amazon was perceived as an "area with almost infinite space and resources, mak[ing] it an excellent 'escape valve' for socioeconomic imbalances and population pressures in other regions, offering a 'land without people' to 'people without land' . . . ." (Pichon, 1992; 666). Ecuador's growing population was applying increasing pressure to Ecuador's urban centers (See Map 5; Figure 7); and, as urban populations became more dense, the numbers of urban poor continued to increase as well. The government could solve the problem of urban population pressure and the poor at the same time by sending them east. One caveat, however, was that there were no efforts to help establish the colonists in the east. Although the policies stated that settlement would only occur if adequate infrastructure was created, in most cases this did not occur, and any infrastructure that was created was to support multinationals working in the area. (Pichon, 1992). Second, the agricultural production that would result from this new settlement would, hopefully, create a surplus that could help support the

growing population. Third, the new settlers would help create a "live border". For many years Ecuador and Peru have been in conflict over the border. Ecuador is particularly sensitive to further encroachments on its territory because it has lost "more than 70% of its original territory to Colombia, Brazil, and Peru" since 1830. (Pichon, 1992; 666). Populating the unoccupied land with Ecuadorians was viewed as a prime national security move to keep out Peruvians. Thus, under the land tenure laws a commons was created, but for several years no one took advantage of it because gaining access was so difficult.

The discovery of oil in the Oriente region, which encompasses the Ecuadorian Amazon, stole the forest's protection. Oil companies had the capital to build the extensive road systems necessary to exploit the forest. This also allowed outsiders to free-ride on the new road system and penetrate the rain forest borders. Settlement ballooned thereafter, particularly near petroleum zones which grew at a rate of 8% annually between 1974-82 compared to the national average of 2.5%. The entire Amazon region is estimated to have a growth rate of 5% annually; naturally, the bulk of this growth is derived from immigration. (Pichon, 1992; 667). (See Table 1).

Map. Percent of Population Living in Urban Areas, by Country.

Settlement occurred spontaneously as individuals and groups migrated east from the densely populated west in search of a better life. Settlers were primarily subsistence peasants looking to make a living on the pristine lands; under the land colonization laws, settlers could eventually gain title to land that they cleared and maintained. (Myers, 1980; 142). A large number of these settlers engaged in agriculture such as cattle ranching and farming.

Figure 7. Ecuadorian Population Living in Urban Areas.

Ecuadorian land tenure laws further contribute to deforestation because land claims remain insecure until the complex requirements to create title are fulfilled. (Southgate & Whitaker, 1992). Adjudication of claims takes years because of the country's antiquated record-keeping system. Until title is established, claimants are vulnerable to other settlers establishing conflicting claims. As long as title is insecure, settlers do not bother to invest in soil conservation measures or other

land improvements; indeed some measures such as land fallowing put the farmer at risk of having another come along and claim the idle land. Additionally, they clear more land around the perimeter of their farmed areas to discourage other settlers from laying conflicting claims. Both of these factors do not bode well for Ecuador's forests. Thus, land clearing under this regime occurs for two reasons: first, it establishes ownership; and, second, land must be cleared to make up for loss of productivity -- rain forest soils are frequently exploited without care so their productivity decreases rapidly. (Rudel, 1995; 187).

Logging

Logging the tropical forests is uneconomic. Profits from non-wood forest products exceed those from timber extraction. (Southgate & Whitaker, 1992). For example, rare mahogany trees are harvested and sold for a mere $3 a tree for plywood. (Conniff, 1991; 44). Logging prices are depressed primarily because of governmental regulations. In 1982 a ban was imposed on logging concessions. Consequently, timber may only be obtained through agricultural settlers that are far less efficient loggers. Settlers agree to sell their trees to lumber companies in exchange for a price and infrastructure support, such as construction of roads and schools. (Gonzalez, M., 1995a). When the lumber companies contract to cut down the settlers' trees they will destroy large amounts of trees in pursuit of the "three or four commercially-viable trees" on each hectare. (Gonzalez, M., 1995a). The heavy machinery used to extract the trees is the main culprit of forest destruction. It destroys the many trees that just happened to be in the path of the commercially viable trees and crushes the fragile soil below. The settlers' logging is also subsidized by low gasoline (subsidized) prices because the gas is needed to power their chain saws. But, the biggest reason for low timber prices is the prohibition on log exports. From an environmentalist perspective, such a ban sounds like a good idea; no chopping down of the forest to ship it off to the developed countries to make paper plates. However, the result is essentially the same with a lot less profit. The trees have such a low cash value that they are not preserved at all and no reforestation occurs. A tree in Ecuador valued at $2-$4 each would be valued in markets such as Italy at $15 each. (Southgate & Whitaker, 1992; 797). There is not much of an incentive to grow trees at the Ecuadorian rate. Additionally, forestry research is weak so production returns are low, (Southgate & Whitaker, 1992), and the government subsidizes conversion of forests to pasture. (Pichon, 1992).

III. Oil Production

The discovery of oil in Ecuador in the late 1960's/early 1970's transformed the country. (See Figures 4 and 8). Almost instantly, petroleum became the predominant source of energy, and the country

experienced explosive economic growth. (Pichon, 1992). Although the amount of oil reserves in Ecuador, 2 billion barrels, is small in comparison to others (e.g., Venezuela has 63 billion and Mexico has 50 billion), the country was so poor that such an influx of revenue from oil sales had the potential to overhaul the Ecuadorian economy. (Reid, 1995). As a result, the Ecuadorian government became captured by petroleum interests. Oil was seen as a quick fix to the problems that had been plaguing the country for decades. "Petroleum development offers immediate, predictable benefits for which the most influential social groups are clamoring." (Pichon, 1992; 672). Thus, many other interests, such as the protection of natural areas (including those that were officially protected), were rolled over in favor of oil development. Indeed, under the Law of Mineral Resources and Hydrocarbons, prospecting regions in protected areas and other government land are ceded to oil companies. (Pichon, 1992). No amelioration of environmental damage is required, and even if it was, there is no enforcement of such environmental measures.

Oil development does seem to have had substantial positive effects on the economy. For example, after the oil boom began, average incomes increased 500% since the 1960's. (MIEB, 1994). In addition, oil now makes up 60% of the government's budget, which does not make the government too keen on reducing oil development. The government sees oil development as necessary in light of the need to support its economy and pay off external debt. But, others are pressuring it to preserve the forests first. The Environment Unit Chief of Ecuador's oil branch of the government (Petroecuador), Manuel Navarro, stated it plainly: "All of a sudden we have pressures from organizations from Europe, from the States, claiming the Amazonian jungle has to be untouched, the same way they're demanding we pay off the debt; they're still getting cheap export goods. I think it's a little unfair the pressure we have from different sides. They say, 'Don't use this, don't touch this,' but do we have an alternative?" (MIEB, 1994 (citing National Public Radio, "Vanishing Homeland: Ecuador, Amazon and Oil," Morning Edition, January 13, 1992)). Hence, the conflict pervades national policy.

Figure 8. Total Commercial Fuel Production.

Enter U.S. Multinational Oil Companies

Multinational oil corporations immediately took notice and began infiltrating Ecuador's natural areas in search of more oil. The Ecuadorian government receives hefty benefits from the presence of the multinationals through royalties based on production levels and taxes. (MIEB, 1994). In addition, after the multinationals' contracts are up the

operations are taken over by Petroecuador. Low and behold, a mutually symbiotic relationship was formed between the U.S. multinationals and the Ecuadorian government.

Multinational and Petroecuador oil production activities have resulted in extensive pollution as a result of dumping untreated toxic wastes into unlined waste pits and water sources. For example, the waters that are brought up from the oil wells that have naturally high chemical content are typically re-injected into the wells in the United States to prevent contamination of the water supply and other ill effects. However, in Ecuador oil companies frequently pump the contaminated water directly into nearby rivers and streams. Thus, local people are poisoned by water pollution and wildlife and plant life are also put at risk. A 498 km pipeline was built by Texaco in the early 1970's that connected the Oriente to the refining and processing stations in the capitol, Quito, and then on to the port city of Esmeraldas. (MIEB, 1994). (See Map 2). The pipeline is the main source of oil transport and a major source of environmental damage. Leaks from the pipeline have resulted in a larger quantity of spilled oil (10 million gallons) than was spilled from the Exxon Valdez. (MIEB, 1994).

While multinational oil companies have taken much away from the Amazonian region, little has been invested in the region itself. The bulk of revenues generated are "capitalized outside the Amazon region." (Pichon, 1992; 668). Thus, oil production does little for the livelihood of most Ecuadorians in the region who rely primarily on the agricultural sector.

Current Situation

Since the oil boom, Ecuadorians have become increasingly reliant on petroleum domestically. Government subsidization of oil prices contributed to this greatly. As a result, "[e]xperts predict, that, if new fields are not developed, Ecuador will have no oil exports by the end of the century." (MIEB, 1994). Nonetheless, established oil reserves and oil exports are increasing. (See Figure 9). Ecuador's oil exports for September 1996 were at 7.21 million barrels of crude oil, up from 6.27 million at the same time last year. (Reuters, 1996b). To facilitate this increase, Ecuador has sold oil concessions for an additional 1.6 million hectares. (Ward, 1994). The primary motivator for this sale was the push to reduce the ballooning foreign debt.

Recently, Indigenous groups and environmentalists from Ecuador and abroad have been successful in pushing those developing oil in sensitive areas such as the Amazon to implement sound environmental practices. For example, Occidental, a multinational oil company that is preparing to drill in Ecuador has planned several environmental steps including "cutting seismic trails by hand for the smallest disturbance to 'surface vegetation' and having a width no greater than 1.5 meters; keeping road construction to a minimum by supporting seismic shooting by helicopter;

clustering drilling of production wells, should development go that far; re-injecting all effluents; having central facilities for separating and pumping crude at new fields, rather than having each field with an individual unit; and planting new trees to replace those cut in all operations." (Schneider, 1996). In addition, oil companies such as Maxus, are establishing security measures to keep out colonizing settlers to maintain the integrity of the indigenous populations in the regions. (Reid, 1995). It is unclear whether the government will continue these measures when the companies leave the region when their contracts are up and Petroecuador takes over.

Figure 9. Crude Oil Reserves in Ecuador.

Figure 10. Arable and Permanent Cropland.

In addition, the government has made some efforts to ameliorate environmental damage caused by oil production. For example, companies exploring for oil must now pay a $100,000 tax to cover environmental clean ups, (MIEB, 1994), in addition to conducting environmental impact studies prior to drilling and seismic tests. (Goering, 1996). The government has also developed environmental operating guidelines for these companies. For example, recently the government announced that a new oil field franchise in the Amazon would be required to build facilities to safely process contaminated water and to bury the 165 kilometer pipeline that would be required to transport the oil out of the pristine region. (American Political Network, 1996). The regulations increase operating costs substantially, discouraging some companies from becoming involved. It remains to be seen whether the government will vigorously enforce environmental regulations, but its past record makes it seem doubtful. If enforcement does occur, it is likely to be linked to a company's failure to share its proceeds with the Ecuadorian government, i.e., Petroecuador; Ecuador has banned Maxus from operating in one area of the Amazon because it failed to share its revenues with Petroecuador. (Reuters, 1996a).

One of the risks that Ecuador faces when it demands a high level of environmental protection from multinationals is that of driving away potentially good companies because of the high costs and political pressures (externally and internally applied). For example, Conoco, a multinational oil company with an excellent environmental record relative to others in the industry, withdrew its plans to develop oil in Ecuador's Amazon because of strong environmentalist opposition, potentially low economic returns, and high environmental protection costs. (Haines,

1996). Shortly after the contract was awarded to a multinational with a spottier environmental record -- Maxus. Maxus has promised to enact environmental protection measures. Time will reveal the extent of their commitment.

IV. Agriculture

Although more land has continued to be cleared for agriculture in Ecuador, productivity has not significantly increased because of the inefficiency of current farming methods. As a result, the agricultural transition has stalled. Net gains from land clearing seem to be slim. The causes for this stagnation are discussed below.

Agriculture has declined in importance as an export commodity because it has been replaced largely by oil exports that are far more profitable. In 1970 food exports comprised 94% of exports. By 1985 food exports plummeted to only 28%. Nonetheless, in the 1990's food exports are rebounding and have reached 50%. (Gonzalez, G., 1996). Agriculture makes up a substantial portion of Ecuador's land uses and it has increased substantially in the last few decades. (See Figure 11 and Table 3). Deforestation is the main cause of this increase in agricultural land. However, arable cropland and permanent cropland have been increasing at a more moderate pace recently. (See Figure 10).

TABLE 3
Agricultural Land Use Trends in Ecuador (Hectares)

	1965-67	1984-85	Change
Tropical crop land*	1,205,000	1,360,000	+155,000
Pasture:			
Sierra	899,000	1,917,000	+1,018,000
Costa	516,000	2,005,000	+1,489,000
Oriente	226,000	484,000	+259,000

Source: M. Whitaker and J. Alzamora, "Production Agriculture: Nature and Characteristics," in Agriculture and Economic Survival: The Role of Agriculture in Ecuador's Economic Development, ed. M. Whitaker and D. Colyer (Boulder, Colo. Westview, 1990).
* Defined as the area planted to bananas, cacao, cassava, castor oil, coffee, cotton, fruits, hard corn, manila hemp, oil palm, plantains, rice, soybeans, and sugar cane.

Undervaluation of agricultural inputs causes further damage to the environment because farmers have no incentives to conserve land, water, forests, and wildlife. (Southgate & Whitaker, 1992). Under pricing inputs such as pesticide can lead to excess application and pollution of the environment as the chemicals run off. Former President Duran-Ballen's economic reforms may reduce this waste because the reforms ended a large number of subsidies. Land will continue to be undervalued as long as the free access and title-for-clearing policies continue. With cheap land, there is no incentive to invest in agricultural research to improve farming productivity on the fragile lands; thus, more land is deforested as the cleared land becomes less productive. (Southgate & Whitaker, 1992).

Agricultural development in the Oriente is unlikely to raise the status of most poor settlers because of the way that the land tenure laws are designed. Even if a peasant is able to clear an area of forest and begin farming or ranching, obtaining title to the land is difficult. To obtain permanent title the peasant must pay for the land based on a price scale established by the government that is based on the land's location and characteristics. (Pichon, 1992; 670). The price is amortized over a 25 year period but this is of little help since most settlers barely break even in their agricultural production. (Pichon, 1992). Little is left over to pay on the amortized amount. In addition, the settlers cannot obtain their title until the amount is paid in full; so they cannot even sell the property and retain the value of their investment. All is lost if they fail to complete the payments. Without proper title, the settlers cannot obtain credit either. Thus, the system is not favorable to poor settlers and may even widen the gap in wealth distribution between the rich and poor. (Pichon, 1992).

Figure 11. Land Use; pie chart in landscape orientation.

Ecuador's current approach to agriculture, land tenure and oil exploration spells trouble for a growing population. Ecuador's population is expected to double by 2020-30, reaching approximately 20 million people. (Pichon, 1992). Without sustainable development and a reduction of the current deforestation rates, Ecuador will not be able to provide for such a large population. Agricultural production cannot expand to support this demand unless more research is done to develop more efficient practices. In addition, deforestation must slow because the forest soil is being destroyed. Farming without fallowing the land leads to eventual

infertility. Deforestation in unsuitable areas, i.e., those with unstable soils and steep slopes, causes heavy erosion that further undermines agricultural production. (Pichon, 1992).

Much of the land that is being cleared has limited fertility, high erodibility, and/or poor drainage making it unsuitable for agricultural production. Chopping down the rain forest to convert it to agricultural land has further ramifications than loss of wildlife. It also results in increasing carbon-dioxide and other greenhouse gases. Cattle production exacerbates the problem by contributing to increased methane levels. (Southgate & Whitaker, 1992). Forest clearing also leads to erosion and pollution of the water supply because of sedimentation and runoff. This is an inefficient result. Clearly, Ecuador has a need for productive agricultural land. The best result would require limited land clearing in the areas most suitable for agriculture combined with proper soil conservation measures. Then productivity would remain high and more of the country's natural resources would be preserved.

V. The Indigenous People of the Ecuadorian Amazon

As with the Homesteading laws in the United States, the Ecuadorian land tenure and colonization laws paid little attention to the notion that there were already indigenous people living in the region that should have a claim to the land themselves. The "unoccupied" lands were considered property of the state. "According to the terms of [the land tenure laws], 'unoccupied' lands are those that (a) as part of the nation's territory have no other owner; (b) have been returned to the State due to any legal cause; or (c) have been uncultivated for more than 10 years." (Pichon, 1992; 669 (citing Hicks et al, 1990)). This last element strongly encouraged intense land clearing and discouraged fallowing of land to preserve the soil. Consequently, when settlers arrived and land tenure was based on land clearing, many indigenous people began to clear as well in an effort to protect their rights to the land. In addition, like the reservations established in the United States for Native Americans, the Ecuadorian government threw the indigenous people a few crumbs under the Law of Amazon Colonization, providing for the selection of certain areas to be set aside for the use of indigenous people. (Pichon, 1992). It is doubtful that the government enforced the boundaries of such reserves.

Fortunately, Ecuador's native people have become a strong force in Ecuador. Although they come from a variety of cultures, the indigenous groups have organized into a powerful coalition, known as the CONFENIAE, that has become a force to be reckoned with. The coalition is aided by the support of non-governmental organizations (NGOs) from the community development and environmental conservation arenas. In 1992, the coalition succeeded in obtaining land rights to more than three million acres. The Indians were able to accomplish this through a variety of measures. First they threatened to boycott the presidential elections if their demands

were not met. Also, they staged an "uprising" in which "[t]hey paralyzed the country by blocking the main highways, cut[]off food supplies to the capital, and [took] over private land." (Farah, 1992). This evoked fear in non-Indians living in the region that the Indians were demanding title to and aroused dismay in the military who feared that felt it would endanger national security to leave such a large block of land near the Peru-Ecuador border unsettled. The government soothed these fears by requiring that current non-Indian settlers in the area be allowed to stay and by requiring that the military continue to have unrestricted access. (Farah, 1992). In the land grant, the government stipulated that title was granted to the groups and not individuals and that the land could not be sold. (Farah, 1992). Another important caveat: the government retains title to subterranean products, i.e., oil and has access to explore for oil on the land ceded to the Indians in consultation with the affected communities to minimize environmental damage. (Farah, 1992).

The Quicha and the Shuar were the main indigenous groups responsible for the land rights reform. (MIEB, 1994). The smaller groups in the northern Amazon have lost a very large percentage of their populations since the introduction of westerners and oil companies to the region. (See Table 4). Pollution and introduced disease has lead to the death of many Indians. (MIEB, 1994). The most vulnerable groups are those that rely extensively on forest resources. Logging and oil spills have drastically reduced such resources.

Indigenous groups have also been successful in bargaining with oil companies planning to operate in their territories. For example, Arco negotiated with the Indians to build a pipeline through their communities in exchange for payment for socio-environmental damage, development of job training programs, and creation of a fund for environmental and cultural restoration. (Gonzalez, M., 1996b.). Essentially, Ecuador's indigenous people are some of the best organized and politically powerful in the world. They have representation in government and real clout. Currently, the indigenous groups hold eight seats out of eighty-two seats in Parliament. (Gonzalez, M., 1996b.). Partly as a result of support from this contingent a law was passed recently that would increase protection of biodiversity. (Gonzalez, M., 1996b.). Thus, their political force promises to make a real difference in the protection of Ecuador's natural resources.

TABLE 4
Indigenous People of the Oriente

Native Group	Population

Oriente Region		
	Quicha	40,000
	Shuar	35,000
	Achuar	2,000
The northern Amazon		
	Cofan	350-400
	Siona-Secoya	400-500
	Huaoroni	850-900

Source: Management Institute for Environment and Business (MIEB), Beckenstein, Alan R., Frederick J. Long, Matthew B. Arnold and Thomas N. Gladwin (eds.). "Rain forest Negotiation Exercise", Stakeholder Negotiations: Exercises in Sustainable Development, 1995.

The Indians have also successfully flexed their muscles in the United States oil and legal communities. In Maria Aguinda v. Texaco, poor Ecuadorian indigenous groups filed suit against Texaco in U.S. District Court to seek civil damages for Texaco's alleged pollution of the rain forest and subsequent poisoning of the local indigenous population. Unlike many similar cases against multinationals, the Aguinda case survived the initial stages of litigation. Usually, these cases are thrown out for improper forum. Texaco sought dismissal not on the grounds that it did not do what was alleged, but on the grounds that it obeyed the laws of the country during its operations. (Millman, 1996). Of course these laws resulted in operations that were far less environmentally friendly than its U.S. operating practices. Texaco also argued that its foreign subsidiary created the mess (in compliance with Ecuadorian operating standards), not the parent, so the case should continue in Ecuador not the U.S. The foreign subsidiary is far less solvent than its U.S. parent. Texaco also argues that Ecuador's national oil firm, Petroecuador, owned 60% of the project while Texaco was involved and has been operating since. (Millman, 1996). Texaco asserts that the government monitored all of its operations and decisions, and it asserts that it cannot be shown that the pollution existing now was caused by Texaco's presence 10 years ago and not Petroecuador's operations there in the meantime. Thus far, it appears that Ecuador is supporting Texaco's position. If Texaco should lose, Ecuadorian officials fear that other multinational oil companies developing oil in the region will pull out. (Goering, 1996). Most in the government find this to be more frightening than cleaning up Texaco's mess. It is unlikely that the Aguinda case will actually go to trial. The legal hurdles are considerable. Nonetheless, the case may force multinational oil companies to raise their

environmental standards for operation in Ecuador even when local enforcement is weak.

VI. Management and Protection

Reforms in Ecuador must be carried out carefully. Too often, well-meaning policy makers and NGO's push for broad sweeping changes that wind up having a severe impact on the most vulnerable members of society, those without a safety net, the rural and urban poor. The poor should not be an afterthought. Reforms should focus on reducing the need for the poor to clear land.

The first step is land tenure policy reform. The current system discourages improvement of cleared land and encourages excessive clearing. Reform would make titles secure faster to encourage investment in the land; clearing of land should not be required to obtain title. However, such title-granting must be limited to a certain extent to retain much of the forest in its pristine state. The trick will be finding the proper balance where citizens can make a living and where the forests are protected to the maximum extent.

The second step is investment in agricultural research and informing poor settlers of effective land management techniques. Greater efficiency will reduce the need to clear more land while also increasing productivity levels to provide for a growing population. (Southgate & Whitaker, 1992; Pichon, 1992). NGO's can assist in this effort by bringing in techniques developed in other rain forest countries and teaching the techniques to local farmers. Research should also focus on identifying crops appropriate for Ecuador's soil, climate, topography and population. NGO's, such as the United Nations, can assist in this endeavor as well.

The third step in striking a balance between environmental protection and providing for the people of Ecuador should be greater reliance on market forces, i.e., no more subsidies and price controls. (Southgate & Whitaker, 1992). These undermine resource conservation because people have no incentive to produce efficiently or conserve resources. For example, elimination of agricultural product subsidies would reduce waste of items such as pesticides and fertilizer. However, these reforms must be combined with educational programs to teach farmers how to use the products more efficiently. Otherwise, removal of the agricultural subsidies could have a terrible impact on subsistence farmers. Petroleum subsidies should be the primary target for elimination. The subsidies should be phased out slowly to reduce the impact on the poor and to allow technological adjustments. Reducing domestic reliance on petroleum will prolong the economic benefit of oil exports, where profits tend to be higher. Former President Duran-Ballen moved Ecuador in the direction of the market. This trend should continue provided there are adequate efforts to preserve resources.

The focus for forest policy reforms should be identification of high priority regions, i.e., areas with especially high levels of biodiversity and indigenous populations that rely on their natural resources. No doubt all of the Amazon should be protected, but at this stage that does not seem feasible because of economic pressures and the demands of a growing population. Thus, careful planning can allow for more efficient land uses that maximize the number of areas that are protected by increasing the productivity of those that are not. For example, if agricultural techniques improve such that land cultivation is sustainable, the need to clear more land will subside. NGO's can play a key role in this planning process, but they must act quickly. NGO's can help develop the priority list that incorporates several key factors: biodiversity levels, indigenous populations, soil stability, accessibility, and oil development potential.

The next step is greater investment in forest research and management. Better silvicultural methods could lead to increased reforestation and less damaging tree-removal methods. If settlers learn to manage their forests for selected logging and long term sustainability of its biodiversity, the need to clear indiscriminately will decrease. This research should be combined with careful forest planning so that the areas that are of lower priority for preservation purposes and that have a higher value for agricultural purposes become the focus of forestry efforts, leaving the remainder in tact for less consumptive forest practices and biological protection.

NGOs and governmental environmental organizations must keep a sharp eye on loggers entering the Amazon region to harvest. Improved logging technology is a real threat to South America's forests. For example, Chinese logging companies recently purchased large tracts of rain forest land and built state-of-the-art processing plants for high level wood production in Brazil's Amazon. (NPR, 1996). This new technology allows faster destruction of the forests, leaving them no time to regenerate. Logging rates will continue to rise in an effort to keep the factories at full capacity. Like Ecuador, Brazil has good environmental laws in place but they have only meager enforcement. Probably the most effective way to keep these international loggers in check is through media exposure to inform the public of their misadventures. Although the Amazon is no longer being written about on the cover of TIME like it was in the 1980's, it may still be able to attract public attention and, hopefully, some public outrage. NGOs can mobilize the international community to put pressure on the governments to control the logging rates. However, external funding will be needed to improve enforcement of logging laws to have any real impact.

"Nonconsumptive" uses of the rain forests present a potential avenue for economic expansion while preserving the forests. These uses include the harvesting of plants for pharmaceutical research, harvesting

of forest products such as nuts for sale to general public, and the opening of the forest to ecotourism. However, thus far, these nonconsumptive uses have not been that effective. For example, in the first case the pharmaceutical harvesting has lead to very little revenue for the rain forest country itself. In most cases the pharmaceutical companies pay a small price for the plants; the plants are then taken to a developed country where they are cloned into a new miracle drug that makes millions of dollars for the pharmaceutical company. Ecuador and other rain forest countries need to establish more beneficial contracts with these companies, requiring the companies to hand over a good portion of their royalties from successful products. In the second case, the forest product market has not been too successful because such harvesting is uneconomic in comparison to the broad scale production that occurs outside of the forest. This was the case for rubber production. Finally, in the third case of ecotourism there is real potential for economic development. However, ecotourism projects have often had ill effects on indigenous populations and the environment because they have not been sensitive to either. Ecotourism in the Amazon must be monitored closely to ensure that tourist capacity does not rise to the level where it destroys the natural areas that the tourists come to see. Ecotours should be well planned so that they avoid more sensitive areas and avoid exploitation of indigenous populations.

At the international level, Ecuador's large foreign debt must be dealt with to reduce the pressure on the government to develop its natural resources without regard to long term impacts. Debt-for-nature swaps are one possibility, but definitely not a sufficient solution. Through debt-for-nature swaps, environmental groups buy up Ecuador's foreign debt at a discounted rate and then forgive the debt in exchange for the establishment of nature preserves in Ecuador. It is a good idea, but has limitations. First, the swaps have been known to cause inflation because of increased domestic spending. (U.S. News & World Report, 1989). Second, the preserves will not make a difference if the government does not effectively curb destruction within it. As long as there are large numbers of poor people, they will continue to clear the land, preserve or no preserve. However, reducing the foreign debt would, hopefully, minimize the incentive for the government to develop oil in pristine regions to pay on the debts.

Laws to protect natural resources will continue to fail until the need for the poor to clear land is reduced. No one would choose to save a tree if it meant her family would starve. The problems of the poor must be addressed before environmental protection will succeed.

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CHAPTER EIGHT
HITOMI SASAKI
URBANIZATION TRANSITION AND ITS IMPACT IN THAILAND

Introduction

Thailand is one of the few countries in the Third World where economic and social development has been accompanied by a power shift toward democracy. Modern changes in Thai society which began in the late 19th century have been accelerated since early 1960s when economic and social development was consciously singled out as the most important goal of the country. The direct foreign investment since 1986 has also had effect on expanding the GNP and GDP in manufacturing or industry sectors. Although these economic and social development has succeeded, it is true that the development strategy have contributed to broaden the regional imbalance. In a word, Thailand has failed to narrow the widening gap between the rural and urban income.

Rural-urban gaps are most obvious when comparison is made between the predominantly rural Northeast region and Bangkok, the capital and mega-city of Thailand. The bigger the gap, the more people come to urban areas, especially to Bangkok. The problems caused by urbanization transition are varied. It causes not only environmental problems such as air and water pollution, traffic congestion or the urban poor but also the serious social problems in both rural and urban areas.

This paper seeks to illustrate the various kinds of human resource, environmental, social and economical problems caused by the urbanization transition from rural to urban area. I will also deal with Thai governmental strategy which tries to decrease the regional imbalance. The analysis is developed with the data from World Resource 1996-97 Database Diskette, Atlas GIS and National Migration Survey Thailand 1995. This paper is closed by suggesting that an essential plan for decreasing the regional imbalance exists in rising the public attention and in encouraging the regional, governmental and non governmental organizations.

Land and Climate

Thailand occupies the territory of the Indo-Chinese peninsula of Southeast Asia which lies between longitude 97
E and 106
E; its southern and northern limits are latitude 5
N and 21
N, respectively. The length from north to south is 1,684 kilometers and its greatest width is about 780 kilometers. The coastlines command roughly 2,875 kilometers of the Gulf of Thailand and about 740 kilometers on the Indian Ocean. Listed clockwise, countries bordering Thailand are Lao People's Democratic Republic (Laos) and Democratic Kampchea (Cambodia) on the north and the east, Malaysia on the south, and the Socialist Republic of the Union of Burma (Myanmar or Burma) on the northwest and the

north.

The country is divided into four geographic regions: the central region which includes the capital city of Bangkok, the northern region, the northeastern region and the southern region. The central region is relatively more prosperous and densely populated than others, whereas the northeastern region is the largest land-locked area but the least economically developed. The total land area of Thailand is about 513,115 square kilometers. Administratively, the country is divided into 72 provinces, 784 districts, 7,003 tambons and around 63,110 village. Bangkok Metropolitan Region if the capital and also the principal port of Thailand. (Ministry of Public Health Thailand, 1991)

Thailand is a tropical country, with rather high temperature and humidity. The climate of most of the country is dominated by monsoons. In most areas, there are three seasons: rainy (June to October), cool (November to February) and hot (March to May). Rainfall varies, but is generally heaviest in the southern portion of the country. (Shin, 1996)

Population

The rapid economic expansion over the past two decades in Thailand was accompanied by an equally rapid population increase. As shown in Figure 2, during the period of 1965-1990, the Thai population nearly doubled, growing at an average annual rate of 2.8 per cent, from about 26 million to about 51 million. However, the annual rate of population growth has declined from 3.5 per cent during the period of 1961-1966 to about 1.8 per cent in 1984. (Population Policy Background Paper, 1986) It is obvious that the population growth in urban areas is greater than that of rural areas in Figure 3 and the difference is the biggest in 1995. When looking at Figure 1, the rural population growth rate has been declining since 1965 and in 2005, t will be below zero. This is a critical indication that the urbanization in Thailand is the serious social phenomenon.

The 1990 census shows that Thailand's population is 54.5 million with a growth of approximately 1.4 per cent annually. This trend in population growth indicates that the country is growing more urbanized and is experiencing and increase in the population of working age and old age adults and a decrease in the dependency ratio.

Figure 1. Urban and Rural Population Growth Rates.

Figure 2. Population Growth in Thailand.

Figure 3. Growth of Total Urban and Rural

Population.

Figure 4. Industrialized Country, Thailand.
Inequalities in the Distribution of Gross Regional Domestic Product, per capita by region, 1978-88.

Map. GDP in Agriculture in Mainland of SEA 1990.

Map. GDP in Industry in Mainland of SEA 1990.

As shown in Map of GDP in Agriculture and in Industry in Mainland of Southeast Asia, 1990, Thailand is obviously not an agricultural country any more. Since 1986, Thailand has experienced economic growth, which has transformed the country from an agricultural into industrial economy. In 1986, agriculture, fisheries and forestry products accounted for 41 per cent of the total value of exports and manufactured products accounted for 55 per cent. In 1991, manufactured goods formed 75 per cent of all exports, and basic agricultural, fishery and forestry products accounted 21 per cent. Over the past years, the GDP has risen by an average of over 11 per cent per year in absolute terms. (Far Eastern Economic Review, 1992) However, Figure 4 tells us that this industrialization has been occurring only in Bangkok and its surrounded areas. An important indication o this figure is the very slow increase in productivity of agricultural labor. This can be compared to the fact that the Bangkok Metropolitan Region accounted 77 per cent, and the BMR plus the Central Region for 89 per cent of the nation's value added in manufacturing in 1987. This uneven pattern indicates that the combination of industrial boom brought by direct foreign investments since 1986 and faltering agriculture has led unmistakably to widening income disparities, with the largest decline in income shares affecting the poorest 20 per cent of the population.

Definition of Urban Areas

In Thailand, there is no official definition of the urban population. "A municipal area" has long been formally used to demote a non rural area by the Ministry of Interior. This has long been reported

as equivalent to an urban in all censuses.

The municipal area (or Mas) are established for administrative purposes under the Municipal Act of 1953. There are three classes of municipalities: nakhon (city); muang (town); and tambon (small town). An area which has a total of 50,000 or more inhabitants, with a population density of not less than 3,000 inhabitants per square kilometer, can achieve the status of nakhon municipality. The muang municipality requires a minimum of 10,000 inhabitants and the same population density as a nakhon municipality. But a place which is the seat of the provincial administration, regardless of whether it has a population size or density larger than the minimum requires for muang municipality, is required by law to be a muang municipality. The status of tambon municipality has no specific numerical criteria. It is established wherever it is considered appropriate through official decrees prepared by the Ministry of Interior. (Kritaya, 1983)

In addition to these municipalities, there are urban sanitary district, rural sanitary district and village. Sanitary districts (SDs) are usually treated as rural, though many sanitary districts have archived the urban characteristics to qualify as municipality.

Figure 5: Urban Hierarchy in Thailand

METROPOLIS
(Only Bangkok has been designated as a metropolis since 1972)

NAKHON MUNICIPALITY
(Places with population of at least 50,000 and
population density of at least 3,000 per square kilometer)

MUANG MUNICIPALITY
(Places with population of at least 10,000 and
population density of at least 3,000 per square kilometer)

TAMBON MUNICIPALITY
(No specific numerical criterion)

URBAN SANITARY DISTRICT
(SDs with population more than 5,000)

RURAL SANITARY DISTRICT
(SDs with population not more than 5,000)

VILLAGE

*Urban and rural SDs are terms used by the National Statistical Office in

the 1980 census report.

Bangkok has been termed a primate city, which heads a single city in a country in which is found a disproportionately large of concentration of the administrative, economic, educational, service activities and wealth of the country along with large of the total urbanized population. Even though there are other urban areas other than Bangkok as mentioned above, I would like to discuss the urbanization transition to Bangkok Metropolitan Region from other areas to make my ideas clear.

Characteristics of Urbanization in Thailand

Manufacturing

There is no doubt that, beginning of the mid-1980's, Thailand entered a new era of economic development that highly depends on direct foreign investments and worldwide markets for manufactured exports. Exports of textiles, electric goods and other labor intensive manufactured goods accelerated from 1986 onwards and have been the major factor propelling national economic growth. Much of the push for export oriented industrialization has come from rapid structural changes in the economies into labor intensive production in ASEAN countries.

During the three years from 1987 to 1989, Thailand was the primary recipient of direct foreign investment among the four 'next generation' manufacturing exports of Asia (the ASEAN 4 of Thailand, the Philippines, Malaysia and Indonesia). With approximately three-quarters of this investment coming from Japan and Asia NICs, the $17 billion in direct investment during those years is significant not only as it reflects the high level of investment and rate of increase but also for what it says the new position of the Thai economy as a host for labor intensive export industries being shed from the higher income economies of Asia.

The very rapid growth of manufactured exports following from direct foreign investments in Thailand has been accompanied by substantial increase in employment in manufacturing and related service sectors. As many as 500,000 jobs may have been directly associated with the growth of manufactured exports between 1985 and 1989. With the entire labor force growing by 3.8 million workers over this period, these figures imply that exports directly absorbed the equivalent of somewhat between 11 and 17 per cent of the additions to the Thai labor force.

Needless to say, these direct foreign investments based industrialization have contributed to the concentration of urban population. Thailand has been long known for its high spatial concentration of urban population, urban-based manufacturing and industrial activities and urban amenities.

Part of the explanation for this is geographical. Few other cities in Asia so solidly occupy the center of gravity of the national economy and its link with the outside world. The only significant challenge to Bangkok is Eastern Seaboard, which in fact is part of the

emerging Bangkok mega-urban region. I will discuss Eastern Seaboard Project in later section.

A second important contributing source of urban concentration has been the very narrow increase in productivity of agricultural labor. This can be set against the fact that Bangkok Metropolitan Region accounted 77 per cent, and this region plus the Central Region for 89 per cent, of the nation's value added on manufacturing in 1987. (McGee and Robinson, 1995)

Tourism and Vietnam War

The continuing expansion of tourism over the decade fueled substantial growth in the services in Bangkok's economy, despite the lack of direct coordination-ordination by government, giving rise to further growth in the entertainment and hotel districts of Silom-Suriwong and Ploenchit. The number of hotel rooms in Bangkok increased from 2,041 in 1964 to 8,763 in 1970, giving rise to claims that there were too many hotels in the city.

U.S. military aid to Thailand grew as the conflict in Indo-China escalated, reaching peak levels in 1962-1967. The presence of United States military personnel, both permanent and those on Rest and Recreation leave, provided and added boost to Bangkok's services sector, particularly the accommodation and entertainment sector. Bangkok's red light district of Patpong areas is a product of this period. Originally as extension of the Silom business districts, this through-way between Silom and Sathorn became a lucrative investment for the family of Udom Patpong during the Vietnam War years. The New Petchaburi Road extension was a district of clubs and bars relying on the custom of American Servicemen. It is worth nothing that overseas tourism was booming during the Vietnam War years, with tourists outnumbering R & R servicemen by 10 to 1 in 1970, although servicemen probably had a lot more disposable income during their stays in Bangkok. But R & R visits dropped drastically in 1972 with U.S. disengagement from Vietnam, while overseas tourism registered a 28 per cent increase. Nevertheless, the R & R program had provided much of the infrastructure for the investing tourism; and another legacy of the war period: ex-servicemen were among the groups investing in the bars and clubs the multiplied in the later 1970s and early 1980s in Patpong, Sukhumvit and Pattaya.

This expansion of service sectors in Bangkok have also contributed to the growth of urban population, especially the number of the women and children who would like to get heir jobs in the entertainment industry.

The Middle Class and Education

While Bangkok was becoming a center for western consumer spending with a retailing and entertainment industry expanding according to cosmopolitan tastes, the growing city was also the center of consumption for burgeoning Thai middle-class. The education expansion program of the later 1950s, boosted by overseas scholarship schemes, had produced an educated and well paid processional strum. By virtue of the historical concentration of administration and business in Bangkok compounded by ten years of urban biases development, three quarters of Thailand's university graduates resisted in the metropolis. In 1970, the level of concentration

of this group was higher than it had been 20 years earlier.

The establishment of new universities in Bangkok added to the process of attraction which drew students from the provinces to Bangkok. This served to concentrate consumption power in the metropolis. The growing disparities in per capita income between the Bangkok Metropolitan Regions and the other regions of Thailand was clear enough indication of this trend. Between 1960 and 1970 per capita income in the Bangkok Metropolitan Region grew at a rate higher than Thailand's average, with income for the metropolis 11,234 Bhat in 1970 compared with 3,849 for Thailand as a whole. (Marc, 1993)

Among studies of rural-urban migration in developed countries, the most generally accepted behavioral assumption is that movements is motivated by the search for a better material standard of living, and therefore results from inequalities of material welfare between rural and urban areas. Generally greater inequalities cause greater volumes of migration. (Theodore, Peerasit, Paul and Sawaeng, 1983)

Reasons for Migration and Data

Figure 6: Reasons for Migration by Type and Stream of Migration and Gender

	Place of Current Residence					
	Bangkok		MAs		Rural	
	Single Move	Repeat Move	Single Move	Repeat Move	Single Move	Repeat Move
Reason for Migration from Last Place of Residence						
Male						
Work	50	69	48	53	51	58
Family	22	9	28	28	37	29
Education	10	3	6	4	1	3
Problem	17	18	13	11	11	8
Other	0	0	4	5	1	3
Total	99	99	99	101	101	101
Female						
Work	40	39	52	42	26	48
Family	34	40	28	40	58	40
Education	5	4	4	2	3	1
Problem	21	16	15	14	11	11
Other	0	0	1	2	1	0
Total	100	99	100	100	99	100

Reason for Migration to Current Place of Residence

Male						
Work	35	55	33	44	16	17
Family	60	44	54	55	83	81
Education	5	1	6	1	1	2
Problem	0	0	2	0	1	0
Other	0	0	4	0	0	0
Total	100	100	99	100	101	100
Female						
Work	36	43	37	29	14	17
Family	64	56	61	60	86	82
Education	1	1	1	7	1	1
Problem	0	0	0	2	0	0
Other	0	0	1	2	0	0
Total	101	100	100	100	101	100

As shown in Figure 6, reasons for moving from the first place of residents varied both by gender and by the region of destination. In Bangkok, males are more likely to seem that they have repeat movers and single movers. Both repeat and single movers have a high percentage of a problem with their previous residence. Women are more likely than men to move for family reasons. Female migrants to Bangkok moves almost equally for family or for work reasons. In municipal areas, single movers are nearly twice as likely to move for work reasons than for family reasons. The opposite trend is observed for female single movers in rural areas: 26 per cent of work reasons while 58 per cent for family reasons.

In regards to their current residence, the majority of both men and women move for family reasons in nearly all locations. Slightly more than Bangkok move for work reasons compared to family reasons. This indicates that even though economic factors are the main reasons for migrating to a particular location, familial networks remain important. While rural networks are particularly likely to chose their location based on family reasons, there is little difference by gender for moving to the current destination.

Impact on Environmental Conditions

Air Pollution

Air pollution is presently most serious, to the point of being critical, for people living in Bangkok. Over the past few years, the air quality has been rated "dangerous" throughout much of the time, with the annual average air quality index nearing 300 - the maximum acceptable rate being 100.

Figure 7: The Number of Motor Vehicles in Bangkok 1990-94

Type of Car	1990	1991	1992	1993	1994
Sedan	899,161	918,595	987,999	1,091,836	1,214,927
Van/Pick Up	268,598	156,136	217,336	272,190	323,902
Taxi/ServiceCar	31,643	32,247	37,081	55,053	64,869
Motorcycle	728,679	887,289	1,006,302	1,105,084	1,233,503
Tractor	9,955	11,993	12,792	13,265	13,860
Farm Vehicle			33	69	69
Others	4,676	2,658	2,792	2,956	3,293
Total	1,942,712	2,008,918	2,264,335	2,540,453	2,854,423

The major air pollution sources in Thailand are transportation, fuel combustion from stationary sources, industrial processes and solid wastes. Large quantities for toxic gases and particulate matter are discharged into air by motor-vehicles and factories. (Figure 7) The number of the cars in Bangkok has been keeping increasing. Six air pollutant measured to indicate air quality: carbon monoxide, ozone, sulfur dioxide, suspended particulate, nitrogen dioxide and lead. Reports from the National Environmental Board shows that Bangkok, Samut Prakan, Chiang Mai, Chonburi, Khon Kaen and Hat Yai, have polluted with smoke churned out by hundred of industries and the lead-contaminated exhaust fumes emitted from over one million cars and some 660,000 motorcycles caught in the endless lines of congested traffic. As bad as the situation is at present, the prospects for the future are that it will get even worse. While dust causes irritations and allergies, carbon monoxide can build up to harmful level and cause headaches, impairment of mortal function, impairment of fetal development and death in the case of very high concentrations. (Suntree, 1993)

Traffic Congestion

Traffic congestion is one of the most obvious problems of the Bangkok Metropolitan Regions. Many areas in the metropolis are "super-blocked" where real estate is booming. Patches of empty land can be found in between major developments because of speculation. Also, the existing transit system is inadequate, forcing people to use private cars, thereby increasing traffic congestion and the demand for road use. Culturally, Thai people like to show off their wealthy so that having a private car can be an explicit indication of their being affluent. A few hours of congestion and traffic jams each day and loose concern for safe fuel consumption can cause air pollution as mentioned in last chapter.

Public bus service is very poor and control in granting licenses to an incensing number of private vehicles in going worsen the problem of traffic jams. The rate of increase of vehicles in the metropolis is estimated at about 5.7 per cent annually and if allowed to continue, by the next decade, the number of vehicles will be doubled.

Although a number of subdivisions in the suburbs have built their own road networks, there is no integrated master plan to guide and link one subdivision to next. The result is a patchwork of fragmented and disconnected roads that could otherwise serve as diversion roads. At present, a number of gigantic projects have been identified in order to cope with the problem, especially expressway and a mass rapid transit system such as monorail and subways. However, these mega projects could be used if there are not enough secondary and feeder road networks to link them. It is believed that land acquisitions are the main constraint.

Construction of the mass rapid transit system has been delayed, leaving only the inadequate bus service of the Bangkok Mass Transit Authority to meet transportation on the metropolis. At the same time, ongoing road repairs and construction works at many significant points in the city have caused heavy traffic jams. On bad days, traffic jams have been known to stand still hours.

Water Pollution

Water pollution is another product of Bangkok's growth, and here private industry and households are equally blamed. Traditionally, Bangkok has been a city with a pot of crisscrossing canals (klong), and its residents have relied on canals and rivers for bathing, traveling, drinking and waste disposal. Before industrialization, water pollutants went through the usual process of purification by bacteria interacting with dissolved oxygen which broke down these wastes into works, because the tremendous quantities of waste discharged into the water is greater than the available oxygen can cope with. Further more, some types of industrial waste sets off a biological process which accelerates the depletion of oxygen. (Tawanchai, 1987)

For the majority of the residents are not served by a piped-sewerage system, sanitary facilities range from septic to nothing at all, especially in the slums in Bangkok. Needless to say, these slums are composed of the migrants from other municipal districts, sanitary districts or villages. Human waste is disposed of mainly through septic tanks and cesspools, and the effluents are discharged into storm water drains or klong. Inefficient drainage, together with periodic flooding and a high water table makes water pollution a health hazard. It has been estimated that about 50 per cent of the city's 2,500 tones of garbage finds its way into klong daily. (Sham, 1993)

Slums

One result of an inadequate supply of decent housing in Bangkok is the presence of slums which in the Thai context means a settlements of low-income people occupying sub-standard housing or merely house-like structures with no security of tenure, and with virtually no access to public services.

According to the Bangkok Metropolitan Administration, there were 433 slums in Bangkok in 1982 (Bangkok Metropolitan Administration, 1983) with about 1,2 million people living there. A survey of 108 slums areas by National Housing Authority reveals that the size of slums varied from 42 to 2,000 families, with the average slum housing 247 families.

(Paiboon) Slums occupied by workers, street vendors, unskilled labors, lower level of government officials and others. The average family income in slums is 3,000 Baht per month, well below the average monthly income of Bangkok households which was 4,231 Baht per month in 1982.

The majority of the slums, 59 per cent, are found on privately owned land, while 37 per cent are on government owned land and the remaining four per cent are owned by the slum dwellers. Slums developed mainly as a result of the rural poor migrants to Bangkok in search for jobs. Without enough income or marketable skills, often having several dependent, people were unable to afford rental housing and were forced to set up crude houses on vacant land without the owner's permission. Although landowners often charge rent for profit while waiting to develop their land, the government usually does not charge rent and throw out the poor. In both cases, there are virtually no public services such as piped water or sewerage as mentioned in the section of water pollution, since the slums are not viewed as permanent housing. Rather it is assumed that slum residents will eventually the relocated elsewhere. Some slums have been established for over ten years.

One feature that add further misery to Bangkok slum is their location near marshy areas of the flood-prone city. Only 22 per cent of the slums are located on dry land. (Paiboon) Much slum housing has had to be built on sites over polluted and stagnant waters, filled with mosquitoes and germs. An example of such slums is on the territory of the government-run Port of Bangkok in the Klong Toey area.

Another feature id the "moving Slum". Settlements of construction workers, living in temporary shacks around a building site until the project is completed, move with their families to wherever the their construction company has a project. There are no figures on the total size of this type of slums, but given the building boom in Bangkok since the 1960s, it would be considerable.

Impact on Social Condition

Socially, migration can have a great effect on both rural and urban areas. In many developing countries it has been suggested that rural migrants are drawn from two extreme types: person s sufficiently interested and motivated to migrate in search of education or wider opportunities in urban centers and persons who are driven by the poverty of the village and are attracted by the opportunities in the city. In Thailand, a number of studies of migration show consistent findings on educational selectivity among out-migrants. Those who move out, although not highly educated, generally have higher average education than non-migrants. This selectivity has a negative effect on the village of origin. The better educated out-migrants take with them the investments made in education. Moreover, rural social and economic conditions may shut those migrants out once they leave in that many of them cannot or do not return to the village due to the lack of employment suitable to their education and ability.

Another aspects of rural out-migrants which is seen as having a

negative impact is a disruption of kinship or clan ties. Increased rates of movement of young people from villages to towns are viewed as a sign of breakdown of family and village society. Rural out-migrants may lead to the reduction of kinship dominance over person's behavior but it is also argued that the extent of the impact on family and kin in the place of origin depends on the type, permanence and distance of migration as well as the ties retained by a migrant with the family left behind in the village.

On the positive side, migrants who return to their villages may stimulate the process of change, functioning as agents for the diffusion of the ideas and technologies. Successful rural migrant returning from urban areas are often equipped with new ideas and skills gained during their stay in the city which they can share with those who remained behind.

It is not only the sending areas that are effected by migration. Mass movements of population from rural areas affect the social structure in the urban receiving areas, too. Migrants who moved to a city with a different cultural background and behavioral norms can create tensions or social confronts between migrants and urban native or among migrants themselves. While staying in Thailand in past summer, I met a news article mentioned that a guy from Northeast region working in Bangkok was arrested of eating a black dog, which is culturally admitted behavior in Northeast region in Thailand. This kind of collective violence and conflict in the cities can result from a lack of the public information centers or supportive institutions for migrants. There are problems of assimilation and integration as migrants, especially recent movers, are less prone to join with new neighbors or other formal association in the places of destination.

Impact of Economical Condition

In general, migration from rural to urban areas is seen to be beneficial to both urban and rural economic development. At the micro-level, however, individuals and families migrating to Bangkok face competition for jobs from those already resident there. Poverty and slum residents in urban areas are associated with the problems of unemployment, underemployment at very low wages with unfavorable working conditions that the newcomers face.

Migration represents a transfer of both labor supply and human capital. Lost primarily are persons 15 to 29 years of age, generally considered the prime years of productivity in rural areas. The absence of migrants in the prime years of economic productivity tends to increase the dependency ratio for those remaining in the areas of out-migration, especially in areas where the fertility level remains unchanged. This demographic effect of out-migration can have economic consequences. In the worst case, it may lead to changes in the economic structure of the community. Where labor shortage is not too serious, rural families can adapt to the situation. The adaptation may be that the women and children who are left behind take on more responsibility for agricultural work, use

remittances receives from migrants to hire extra labor for farm work or switch to less labor intensive crops. Where the absence of male manpower is too great or hired labor is unavailable or too expensive, the result may be a reduction of agricultural production or even leaving the land uncultivated. If these situations remain unsolved in the long term, they would not only have a strong impact on the economic situation but also would alter social conditions in the community through the disruption of family stricture changing the role of women, etc. (Bahssorn and Penporn, 1987)

Policy of Thai Government and Its Implementation

National Economic Social Development Plan

Thai government have tried a variety of policies intended to achieve more equitable distribution through influencing population movement. Policies or measurements have been initiated or adopted to discourage migration or to direct the flows of movement away from large cities. I will discuss the National Economic Social Development Plan, which, I think, one of the significant policies of Thai government.

The National Economic Social Development Plan (NESDP) was established to draw up five-year development plans in economics, education, society and administration in 1961. In the Forth (1977-81) and the Fifth (!982-86) Plans, it sought to control the growth of Bangkok and achieve better balance between rural and urban development. The principal means to accomplish this was to direct investments to a select number of growth poles and lower-order rural centers in each of the major regions. However, during this period, polarization in the Bangkok Metropolitan Regions continued and rural-urban inequalities remained high.

The Fifth Plan was critical of past policy and planning efforts, because it empathized that the major development issue was how to slow down Bangkok's population growth and lessen its economic dominance. To overcome those deficiencies, it outlined a comprehensive strategy for Bangkok's development in the form of a "Structural Plan for the Development of the Bangkok Metropolis and Vicinity Towns". The basic aim was to decentralize economic activity and thereby diffuse growth from the capital city to the five surrounding towns of Samut Prakan, Pathum Thani, Nonthabuti, Nakhon Pathom and Samut Sakhon, located in the five adjoining changwats (prefectures) of the same names.

The plan proposed that these outlying areas be developed as planned communities with a high degree of self-sufficiency, thereby ensuring that residents would not need to commute Bangkok for employment or lower-level of services but only periodically for special cultural or entertainment facilities. It also intended that agricultural land in and around the five towns would be preserved and in order to prevent the urbanized parts of Bangkok from spreading farther, a green belt would be designated around the current boundary of the city. Thus, Fifth Plan, through the 'Structural Plan', continued to advocate multi-nucleared or polycentric metropolitan regional development of Bangkok.

Another key spatial component of the Fifth Plan was the decision

to develop the Eastern Seaboard into a major location for the basic industries.

Although many opportunities to link rural and urban development on a regional scale remained relatively unexpected, the Sixth Plan (1987-91) adopted a much more clearly urban oriented view of development, which reversed the previous position on limiting the growth of Bangkok Metropolitan regions. According to the summery of the Sixth plan, controlling the growth of the Bangkok metropolis remained an important national goal. However, despite of the very clear statement of the objective to control Bangkok's growth, a considerable amount of investment in large-scale infrastructure projects was still being planned for a capital city. This means that instead of trying slowing down of the growth of Bangkok Metropolitan Regions, policies were directed towards improving urban management through privatization. The extended Bangkok Metropolitan Regions still represents the most important economic and employment base in the country itself.

The regional policies of the Sixth plan have been substantially carried over into the current Seventh Plan (1992-96), except that the new plan does not formally recognize the extended Bangkok Metropolitan Regions as a geographical entity for the government investment. The focus remains on regional growth centers, and investments are to be coordinated through the Ministry of Interior form central to provincial and municipal levels. Local levels of government are to be strengthened to enhance planning and implementation.

The Eastern Seaboard Project

This is one of the development projects to accelerate the provincial development with decentralization. These regions include three prefectures which are facing to the Gulf of Thailand and aim to develop the oil chemistry utilizing natural gas and its associated industries. They are far from Bangkok enough to establish the individual economy and society and close enough to keep the communication with Bangkok.

The infrastructures which Thai government developed included two industrial areas. The one focuses on a light industry with no pollution, the other oil and heavy industry. In addition, irrigation pipeline, new town housing, telecommunications were established. Thai government expects that there will be new job opportunities for about 13,000 people and also these regions will substitute for Bangkok Metropolitan Regions. There is a expressway between Northeastern region and the Eastern Seaboard, which must contribute to the development of Northeastern region and decentralization of population to Bangkok from this region.

As part of the metropolitan region, the Eastern Seaboard will serve as the country's major industrial base and a new gateway to industrial growth. The seaboard is seen as a countermagnet, providing alternative investment locations to reduce congestion in the Bangkok metropolis and its vicinity towns. It is considered that the seaboard will be served with a regionally integrated transportation network of a high standard, which would link the metropolis with the inner parts of the country. m Communication networks and the new deep-sea port in the Eastern

Seaboard development will increase international contacts for the metropolitan regions.

To accomplish these development schemes, it is necessary to speed up expansion of major infrastructure in the seaboard, especially roads, rail and communication systems connecting the major ports of to industrial estates at Leam Chanbang and Map-Ta-Phut. All the major urban centers of the seaboard must be well equipped with standard social services and infrastructure, community environmental improvement programs and upgraded administrative bodies. The seaboard must be connected to the rest of the nation via new transportation and communication networks, and an improved international communication network will be needed to maximize its role as a new economic zone. The success of the Eastern Seaboard Project is attribute to the multi program of Thai government and private sectors.

Metropolitan Regional Structural Plan

National Economic Social Development Seventh Plan recommends studying how to target the metropolitan region for development by using the Bangkok Metropolitan Regional Structural Plan to provide the region with a proper plan of orderly growth. The Bangkok Metropolitan Region Structural Plan emphasizes growth to the northern and southeastern parts of the metropolis in order to link Bangkok with the Saraburi Industrial Complex and the Eastern Seaboard. The clear direction offered for regional growth in the plan will assist the alignment of major infrastructure investments rather than allowing growth to sprawl in every conceivable direction.

This plan formulates measures to relieve congestion in the metropolis through construction of satellite cities and new towns, controls on building construction of city core, and prevention of housing sprawl along the main highways. The following strategies are laid out in the plan:

-Empty and unused lands in the suburban areas will be used efficiently by providing access roads to link them with existing main roads.

-Promotion zones will be established, with proper controls on high-rise buildings, especially in areas directly served by rapid mass transit. The high standard of services that these areas need could be met by requiring relevant private entrepreneurs to participate in investment projects to solve traffic problems, water supply and waste water treatment and other environmental issues. In fact, a master plan for waste water treatment and a garbage disposal system has been jointly undertaken by the Bangkok Metropolitan Administration and a number of private firms and could eventually serve the entire metropolitan areas.

-Urban communications will be improved and rehabilitated, provision of more recreation areas will be encouraged, and historically and culturally significant areas will be conserved. This last point applies particularly

to Rattanakosin Island, where it would also benefit tourism. (McGee and Robinson, 1995)

In this Metropolitan Regional Structural Plan, the northern part of the metropolitan region is especially considered as the industrial zone for the Upper Central region, the center for industrial activities relocated from Bangkok metropolis (Saraburi Industrial Complex). The regional network of roads and rail will directly link the industrial zone with the seaboard for transporting export commodities without having to go through Bangkok. This direct network is important not only because it will save time but also because it could help reduce congestion in Bangkok as mentioned above.

This industrial zone can be divided into three areas: (1) Saraburi as the main urban center and economic base of the Upper Central Region in trade, transportation and support services (Saraburi Industrial Complex); (2) Kaeng Koi as the center for cement and construction industry and other industries relocated from Bangkok and its vicinity towns; and (3) The Rua/The Luang as an agree-processing center for exports. (McGee and Robinson, 1995) To make the zone function effectively and attract industrial relocation and new factories, it is important to provide incentives beyond the speedy provision of necessary infrastructure services. The creation of export promotion zones is an example. (See Map of Metropolitan Regional Structural Plan)

Suggestions

Success in stimulating regional development through a focus on four or five regional cities, Eastern Seaboard or Bangkok Metropolitan Regional Structural Plan has had only limited success over the past few years. Whether investments were too modest or institutional frameworks too centralized is a matter of debate, but more substantial limitations exist within concept itself.

For the most part, even the largest provincial cities are too small in comparison to Bangkok. A Chiang Mai study shows, for example, that investing in municipal services and infrastructure in this city have a marginal impact as a whole. The country site cannot provide what is needed in a modern industrializing economy and also there is no effort has been made to develop new business to use what is available in rural areas of the region. Policies are needed to consider the urban-centered approach toward rural regional development.

In regards to traffic congestion in Bangkok, the public transportation system should be developed to reduce congestion in densely populated areas. Current Bangkok Governor, Phichit, has been trying hard to construct the new expressways, sky monorails and also begun to construct the subways. It is not until the completion of these constructions that we can debate the new suitable policies toward the traffic problems in Bangkok. However, it is true that the traffic

congestion in Bangkok is worsen and worsen everyday, partly because of this construction of new transport systems. I suggest that Bangkok Metropolitan Administration should bring public attention to share the car in the morning and evening at the time of the worst traffic condition, speed up the constructions, and implement the water transport systems and bus services.

In regards to the slum problems, this is directly connected urban poor problems. Most of the urban poor from other districts in search for jobs are struggling for put themselves in the urban framework such as better life, giving education to their children and so on. One Japanese NGO called SVO (Sotoshu Volunteer Organization) has been working in the Klong Toey Slum, biggest slim in Bangkok, to help especially children there. They are providing school education, medication, sanitary facilities and parental education. Their activities are well known to not only the Japanese but also people in Bangkok.

Bangkok Metropolitan Administration should recognize that the urban poor represent potential labor power and this labor power should be encouraged by providing training in new skills and promoting small scale enterprise and self employment development skills in order to upgrade its production capability. In order to accomplish this suggestion, Administration should recommend a policy to enact specific legislation to protect the housing rights of the urban poor in the slums.

Conclusion

The population problem has the effect on social and economical development in every country. The imbalance between Bangkok Metropolitan Regions and other municipal areas or villages is one of the most significant inequalities in the world. Managing the future of Thailand itself has a number of policy dimensions.

The policies in the Seventh Plan and Metropolitan Regional Structural Plan aim to enhance the positive functions of the metropolitan regions to create a center that can provide opportunities for higher incomes and better services and living standards. However, we cannot ignore the importance of the encouragement of the other municipal areas such as Chiang Mai in North, Khon Kaen in Northeast and Songkhla/Hat Yai in South. More specific regional plans for those areas are needed in order to decentralize the population. These plans should focus on providing the job opportunities with better incomes, the good educational institutes so that the young do not have to go to Bangkok and bringing the infrastructures to catch up with the growth of Bangkok.

From this perspectives, policies to manage the Bangkok Metropolitan Regions and to encourage the growth of other districts will require two aspects; first, how to continue attracting and keeping mobile investments: and, second, how to translate them into suitable development that closes gaps between urban and rural areas in terms of economics, infrastructures, services an environment.

Thailand, in fact, has a unique opportunity to provide a new model for urban and rural development that is likely to Southeast Asia. This

opportunity drives, in part, from the capacity of the Thai economy to develop along both urban-industrial and rural-agricultural lines of economic growth. Thailand still has a rich and diversified agricultural base, which is expected to contribute to substantially to economic growth in rural areas in the future. Agri-industry now accounts for more than half of the industrial GDP for the nation, and the economies of the most regions outside of Bangkok depend on agriculture as the basic economical sector. A national strategy of economic growth with the imbalance and the poverty reduction should take advantage of these various opportunities to raise the incomes of rural people where they live and to reduce the extent of urbanization transition. It is also necessary to enhance the power of administrative, political and private organizations in rural areas in Thailand.

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CHAPTER NINE

JULIE M. SMITH

NINE NATIONS, ONE NILE

"Scarcity and misuse of freshwater pose a serious and growing threat to sustainable development and protection of the environment. Human health and welfare, food security, industrial development and the ecosystems on which they depend are all at risk, unless water and land resources are managed in a more ecologically appropriate manner than they have been in the past. The problems are far from speculative in nature - they are here, and they affect humanity now."
Dublin Statement, January, 1992

Introduction

Water Scarcity

"Scarcity is an odd word for something that covers almost three-quarters of the surface of the globe." This sentence is, of course, referring to water. Globally, water is plentiful: the total volume of water on Earth is estimated to be one billion, three hundred sixty million cubic kilometers. Unfortunately, 97% of the water on our planet is saltwater which, without desalination, is not readily available for human use: the global supply of usable fresh water only amounts to about 1% of the total water supply. (See Table 1.)

Although water is not a globally tradable commodity, it is shared by humans throughout the world. It is continuously used and reused as it travels through the hydrologic cycle and its volume is constant -- neither increasing nor diminishing. Freshwater is a fundamentally important resource because it is essential for survival, because its use underlies all agricultural and industrial processes, and because it cannot be substituted for technologically. Freshwater, as fate would have it, is not evenly distributed throughout the world: it is often available at the wrong time, place, or quality. Thus, when discussing water scarcity the issues at hand are both the quantity and the quality of freshwater resources available to a particular region. (See Figure 1.)

Table 1: Water in the Hydrosphere

Water Source	Global Volume (1,000's km3)	% of Total Global Supply	% of Total Global Fresh	Avail. for human use?	% water Avail. for human use.*
Salt Water					
Oceans	1,370,000	97.61		No	
Saline Lakes	104	0.008		No	
Fresh Water					
Frozen					
Polar Ice Glaciers	29,000	2.08	80.0	No	
Unfrozen					
Groundwater	4,000	0.29	19.7	Yes	99
Freshwater Lakes	125	0.009	0.2	Yes	1
Soil & Subsoil Moisture	67	0.005	0.04	No	0.2
Rivers, Streams	1.2	0.00009	0.02	Yes	0.1
Atmospheric Water Vapor	14	0.0009	0.02	No	0.1

* Fresh and unfrozen water.

Figure 1. Annual Internal Renewable Water Resources per Continent--Percents and Cubic Kilometers.

In many lands water scarcity poses a threat to both health and wealth. Hydrologists designate water stressed countries as those with annual supplies of 1,000 - 2,000 m3/person. When the figure drops below 1,000 m3, nations are considered water scarce. Chronic water shortages affect 40% of the world's population, spread across 80 nations; current estimates show the demand for water increasing at 2.3% annually, or doubling every 21 years, thus deepening the need. Water shortages are worst in poor countries: 26 countries today fall into the water scarce category and face severe constraints on food production, economic development, and human and environmental welfare from a lack of usable fresh water. The conservation of water and the regulation of rivers for

irrigation and generation of hydroelectric power are matters of great social and economic importance in the world today, particularly in arid countries.

International River Basins

"An international river is one whose water course traverses, or whose catchment basin lies in, the territories of two or more sovereign states." More than 200 separate river basins in the world are shared by two or more countries. These international rivers constitute a significant portion of the world's freshwater resources and are great assets to the nations that share them.

Since a basin is interconnected through the flow of a river's waters, the use of waters in one part of the basin may affect the use in another part. Incentives for cooperative management do not exist when an upstream country uses an international river to the detriment of a downstream country that has no reciprocal power over the upstream country: the management of water is further complicated by the tendency to treat water as a commodity rather than as a finite natural resource. Consequently, shared river resources often suffer greater environmental abuse and are not as productively used as comparable national water resources. The uneven distribution of positive and negative physical impacts stemming from differing demands among the basin countries for water resources frustrate cooperative action to manage and develop the river for mutual benefit. East Africa, specifically the Nile River region, is an area that exemplifies these concepts.

The Nile River Basin

In East Africa and the Middle East freshwater is scarce and widely shared by countries with enormous economic, military, and political differences; over-exploitation, depletion, and deterioration of freshwater in rivers, lakes, and groundwater aquifers are prevalent problems. Most of the known conventional water resources have already been developed or will soon be fully exploited in most of the region's countries and, by the end of this century, six Nile riparians will exceed the hydrologic measure of water scarcity. The water resources in this arid area are unevenly distributed and used, and every major river in the region crosses international borders, thus making the potential for conflict over water great. (See Maps 1 and 2 in appendix.)

Figure 2. Nile River Watershed Area by State.

The Nile River Basin, along with all the water it carries, traverses the territories of nine separate nations: Burundi, Egypt, Ethiopia, Kenya, Rwanda, the Sudan, Tanzania, Uganda, and Zaire. (See

Figure 2.) Although these countries share one of the greatest rivers in the world, many inequities over this common resource exist and are especially difficult to redress. The Nile presents a classic riparian problem: a river does not recognize boundaries between states - it flows continuously. The water flowing from the source is the same water that leaves the mouth of the river and enters the ocean. (See Figure 3.) The ways in which it is diverted, collected, used, and returned to the stream determines the quality and quantity of water each successive downstream nation will receive. Conflicts over Nile River water provide examples of unresolved international water issues in a shared basin.

Project Focus

Water is pervasive in all biological and physical systems, and its use is inextricably intertwined with many of society's efforts to enhance economic and social well-being. Water is a substance of paramount ecological, economic and social importance. Interrelationships inherent in water use should encourage integrated basinwide management strategies. Nile basin countries, instead of opposing each other, could direct their attentions toward multinational agreements and policies, defining collective basinwide management strategies. Developing the Nile's water resources for common benefit will require a cooperative approach treating the Nile Basin as one hydrologic unit and all riparian states as equal stakeholding partners.

Figure 3. The Nile River.

Issues In an International River Basin

The Nile region boasts a unique situation with regard to economics and development. The pattern of water demand and use in the Nile basin contrasts sharply with the pattern of supply: the upper valley states, in particular Ethiopia, are best placed geographically, but the lower valley states, especially Egypt, have the vital resource interest and can exercise decisive military and economic power. The paradox is that the countries contributing the most water are using the least, but the countries using the most are those that have the power.

The utilization level of Nile waters by the co-basin states varies with their respective socio-economic development: Egypt, the most developed nation in the basin, uses 55.5 km3 of water each year and projects demands of 65.5 km3. The Sudan, the most rapidly developing basin nation, consumes about 13 km3 per year with a projected use of 30 km3 expected as agricultural irrigation expands. Egypt and the Sudan account for over 90% of the water drawn from the Nile. However, there are seven other basin states and their demand for water will inevitably grow. (See Figure 4.) The upper riparian states, Tanzania, Uganda,

Rwanda, Kenya, Burundi, and Zaire, utilize 0.05 km3 collectively; Ethiopia utilizes only 0.6 km3. This is ironic because combined, these states contribute 72 km3 of water per year, or about 86 percent of the Nile's flow.

Figure 4. Water Situations for Selected Nile Basin States.

Political boundaries present real obstacles to efficient water use and are often more difficult to overcome than physical ones. Much of the strain surrounding water in the Nile basin stems from a zero-sum game perception: one nation's gain is another nation's loss. As long as nations remain locked in such thinking, the tension and distrust among them will persist. A country faced with the prospect for a cooperative endeavor has three broad options: (1) to seek international agreement with neighboring states for joint management or development; (2) to develop a national plan that will maximize the country's net benefits from the same resources irrespective of other basin countries' actions; or (3) to retain the status quo and do nothing. The determination of the most favorable option is based upon the assumption that for each party the net benefits desired from international agreement must be greater than those associated with the national option, which in turn must be greater than the status quo alternative. All nine basin states could equitably share, utilize, and manage natural resources to the benefit and welfare of the basin's population, but optimum development will require treating the drainage basin as a unit and breaking through the barriers.

"The tendency of political analysts has been to make alarmist predictions based on extrapolations of competing demands for water in the face of dwindling supplies while ignoring the great potential for managing and moderating those demands internally." The task calls for a fundamental change in perception and attitude. Water must be recognized as a valuable and vulnerable resource. It must no longer be taken for granted as an inexhaustible free good: this leads to perceptions of water scarcity. Scarcity is, to some extent, a relative concept. The Nile states, although not water rich, do have a fairly substantial freshwater resource available for their use. Unfortunately, the pattern of water allocation, along with policies that discourage (or at least do not encourage) efficient utilization lead to a perception that water is more scarce than in actuality. Nile water is currently mismanaged and heavily misused which exacerbates regional water problems. Management, therefore, must be addressed by all the basin states to maximize available water resources, since options for developing new supplies are severely limited.

A management model has to be a combination of efficient allocation

principles for locally competing demands and rules for fair regional sharing between up and downstream users. Integrated water management can be contemplated on at least three levels: basinwide, regional, and local. Great opportunities exist for better use of water before it is eventually lost through discharge to the sea or evaporation: most involve improved management practices at all levels. The Nile is a geographical unit -- projects for its full development must also form a unity, the parts of which must work together.

Before discussing the shared problems and management opportunities available to the parties involved, it is important to understand the region's hydrology, or where the Nile water comes from in the first place.

Nile River Hydrology

The Nile is one of the great natural wonders of the world: it is the longest river, flowing south to north 6,825 kilometers (km) over 35 degrees of latitude. The Nile's catchment basin covers approximately one-tenth of the African continent, with an area of 3,007,000 square kilometers. (km2) (See Map 3 in appendix.) The Nile basin, because of its size and variety of climates and topographies, constitutes one of the most complex of all major river basins. For the vastness of the Nile basin, however, the river's annual discharge is relatively small. The annual flow of the Nile is about 84 billion cubic meters (bcm). The Nile is distinguished from other great rivers of the world since half of its course flows through country with no effective rainfall. Throughout the northern reaches of the Nile human civilizations have been dependent upon the river for their very survival: without the river, Egyptian civilization would not exist. (See Maps 4 and 5 in appendix.)

The Nile has two major tributaries, the White Nile and the Blue Nile. These two principal headwaters are very different from each other: they arise in contrasting climatic and physiographical areas and are characterized by disparate hydrological regimes. (See Figure 5.) The White Nile flows out of the tropical rainbelt of Central Africa with relatively little interseasonal variation. Its principal source is Lake Victoria, the second largest freshwater lake in the world after Lake Superior. Nearly one-third of Victoria's entire inflow is derived from the 60,000 km2 Kagera River catchment. Most of Rwanda and Burundi lie in this basin, while 33 percent and 10 percent of the catchment area fall within Tanzania and Uganda, respectively. Lake Victoria straddles the equator and lies 5,611 km from the mouth of the river.

Figure 5. Cross Sections of the Two Major Nile Tributaries from their Sources to the Mediterranean Sea.

From this lake issues the Victoria Nile, which passes through Lakes Kyoga and Albert. From Lake Albert to Nimule on the Uganda-Sudan border, the river is known as the Albert Nile. After plunging through the Fola rapids and into the Sudan, the river becomes the Behr el-Jebel (meaning mountain sea) and travels over a 168 km distance to reach Juba, the capital of southern Sudan. At this point the river has 4,787 km to travel before reaching the Mediterranean Sea.

A great deal of the Behr el-Jebel's waters, however, never reach the sea. North of Juba the river reaches the bottom of its upstream drainage basin. Its slope flattens dramatically: water spills out over its banks and spreads out in all directions, forming a giant papyrus swamp called the Sudd (the barrier). The total area of the great swamps of the upper Nile can never be measured with precision since their size varies with the season, governed by the fluctuations in outfall from the equatorial lakes. But the size has been estimated to range from 16,931 km2 to 30,600 km2 during the rainy season, and the permanent swamp area is about 6,000 km2. As the river moves through the Sudd it loses about one-half of its total discharge - approximately 14 bcm - through evaporation, but maintains sufficient velocity to cut a slow meandering 600 km course until it reaches Lake No. There it is joined by other tributaries: the Behr el-Ghazal, which receives its water from Zaire, and the Behr el-Arab and Lo Rivers of western Sudan. Known then as the White Nile, the river jogs east, picks up the flow of the Sobat River that rises in the Ethiopian Highlands, and turns to Malakal, 3,832 km from the river's mouth. From this point to Khartoum (the convergence point of the White and the Blue Nile Rivers), a distance of 807 km, the White Nile receives no additional water.

The Blue Nile flows from the highlands of Ethiopia and is strongly seasonal, subject to the annual monsoons streaming in from the Indian Ocean. The principal source of the Blue Nile is Lake Tana, but over its course, it picks up the flow of two seasonal tributaries, the Dinder and the Rahad. The Blue Nile flows approximately 2,500 km from its headwaters to Khartoum.

Flowing downstream from Khartoum is the main Nile itself. Except for the seasonal discharge of the Atbara River that enters 320 km north of Khartoum, the Nile receives no perennial sources of water over the rest of its 3,000 km journey to the sea. This is the longest stretch of river in the world for which this can be said, and is all the more notable considering the flow is through the eastern reaches of the largest desert in the world, the Sahara.

All waters of the Nile are derived from rainfall upon the Ethiopian plateau and upon the hinterlands of the Equatorial lakes. As one moves downstream from these regions annual precipitation declines in volume and increases in variability. While rainfall at the headwaters of both Niles is abundant it is by no means consistent. The seasonal

rainfall fluctuations in the Blue Nile headwater region of Ethiopia are much more marked than those prevailing at the source of the White Nile. During the summer months (the flood season) the Blue Nile predominates, accounting for some 90 percent of the united river's flow, an average of 10 bcm per month. During the winter and spring months (the dry season), however, the Blue Nile delivers no more than 0.5 bcm per month, so it is the White Nile that sustains the flow with its delivery of about 2 bcm per month. (See Figure 6, also see Maps 6 and 7 in appendix.) In sum, approximately 86 percent of the Nile's flow originates in Ethiopia: the Blue Nile contributes 73 percent and the Atbara 13 percent. The other 14 percent is contributed by the White Nile.

The united Nile's annual delivery to Aswan generally ranges from 80 bcm to 90 bcm. However, depending on the vagaries of the monsoonal weather over Ethiopia, the variation can be much greater. This is the heart of the matter: the total volume of water available in any given year is subject to substantial hydrologic variability. Precipitation over the Nile basin, and consequently Nile discharge, has fluctuated both historically and prehistorically.

Figure 6. Relative Contributions of the White Nile, Blue Nile, and Atbara Tributaries to the Main Nile River.

Substantial variations in Nile precipitation have occurred on long (>1,000 year) and short (<10 year) timescales. In the past, these variant factors have been exclusively natural in origin, but the progressive human impact on the global environment over recent centuries has now led to the possibility of anthropogenic forcing of Nile Basin precipitation. In other words, natural processes are affected by human practices. The magnitude of historical fluctuations in Nile discharge experienced both in this century and in previous millennia is unlikely to be lessened in the future. Regional land-cover changes, agricultural and urban development, population explosion, and increased global greenhouse gas concentrations may well increase the amplitude of such fluctuations to main Nile discharge. Any future management plan of the Nile must consider these factors.

Basinwide Management

The most broad approach to integrated water management addresses the interrelationships between water and social and economic development. At this basinwide management level, interest lies in overarching policies and practices that can benefit all riparian countries within the basin. The concern is to determine the extent to which water is both an opportunity for and a barrier against development, and to ensure that water is managed

and used such that social and economic growth may be sustained over the long term.

The multiplicity of nations represents both the single most powerful obstacle to basinwide development planning as well as the most compelling argument favoring such an approach. Almost all countries in the Nile basin face a number of environmental problems, such as deforestation, soil erosion, and sedimentation, as well as social and political problems, such as lack of appropriate institutions, financial resources, and trained manpower for environmental protection and management. These problems, coupled with poverty and high population growth, pose serious threats to the water resource and hence the life support system of the basin's environment. It is therefore important that all Nile basin states pool their efforts to protect the environment and avert disasters such as drought, famine, desertification, and floods.

Optimal development of the basin's water resources depends on agreement and cooperation between individual countries that share several common difficulties. Among them are population growth, insufficient agricultural production, and evaporative losses. These all directly impact the available water supply for all basin countries. An integrated approach to resolving these issues is most logical given the fact that all countries have a stake in the outcome. In addition, since these dilemmas transcend international boundaries, any action taken by one nation will almost assuredly impact other nations in the region. Prior to a discussion of the benefits and constraints associated with a basinwide management approach, the major problems driving the need for such an approach must first be addressed.

Population

Not surprisingly, as population grows and demand increases, so does the pressure on freshwater supplies and the capacity for conflicts. "In many countries in the Nile basin population growth, often at about 3 per cent per annum, is on a collision course with water resources." Population growth is the most fundamental constraint aggravating the water shortage in the Nile basin. Increased populations affect the demand for water in several ways. A larger population will need more water for human consumption, for livestock, and for industrial and commercial activities. Population growth increases the demand for food, and hence for irrigation and agricultural development. In water scarce countries, population size and consumption patterns will determine quality of life. As a consequence, the Nile riparians' freshwater needs to support health, quality of life, and socioeconomic development are rapidly increasing.

Until recent years the use of Nile water has gradually increased, keeping pace with the increase in population. The nine Nile basin states

are, however, faced with the prospect of continuing population increases, but with only limited further water available. The population increase in these regions with already high levels of water scarcity may be expected to generate water crises as increased numbers of humans will impact both water quantity and quality. The populations of Egypt, the Sudan, and Ethiopia have grown steadily since 1960. Egypt's population alone grows by another million people every nine months. By the year 2025, Ethiopia is forecast to have a population of approximately 122 million, 20 percent higher than that of Egypt. Along with the Nile countries themselves, pressure is added by the fact that the Horn of Africa harbors one of the world's largest refugee populations. In total, the population of co-basin states is expected to reach 812 million from the present 246 million by the year 2040.

Close relationships exist between water resources, population health and land use. (See Graphs 1, 2, and 3.) A growing population needs not only water, but also biomass to provide food, fodder, fuelwood, and timber: the demographic element of food supply will continue to undermine the attempts of all governments to meet food demands. Water scarcity may constrain land-use options through the risk of crop failures and water supply problems caused by growing populations and industrial sectors. In addition, headwater resources of the Nile have not been extensively developed - the main development has taken place in the semi-arid and arid zones of the basin - where water is most lacking. In view of Egypt's population growth and arid climate, Lake Nasser (the storage reservoir created by the Aswan High Dam) by itself cannot provide Egypt with the total hydrological and agricultural security that was the original rationale for the High Dam. Population increases will also require Ethiopia and the Sudan to

Graph 1. Egyptian Agricultural Production and Population.

Graph 2. Ethiopian Agricultural Production and Population.

Graph 3. Sudanese Agricultural Production and Population.

expand food production dramatically, but there are few avenues open to Ethiopia for such expansion, and the Sudan will require greater amounts of irrigation water - amounts that do not exist. Given the current co-basin's population growth, the question to be asked is whether they will be able to maintain a reasonable degree of food self sufficiency or whether they will become dependent on food imports.

Among the basin states, seven are least developed countries with per capita annual income ranging from 120 to 310 US dollars. The relationship between population growth and poverty is important - if the growth of the economy is not sufficient to absorb and remunerate rapidly expanding labor forces, poverty will not be reduced. The Nile basin countries have a very low financial base and are internationally indebted. Rapid population growth combined with international debt begs the question of whether meaningful economic development is possible. Reducing population growth would be the single most beneficial development in terms of addressing problems of feeding populations and enabling the formulation of sustainable and economic water use policies. Controlling population growth would also reduce political tensions over water availability. It is urgent that a conceptual framework be developed linking population, including its sociocultural systems, with the various functions of water in the landscape, elaborating the connection between environment and development. Increases in populations and demand for higher standards of living dictate that natural resources be developed to the maximum benefit of humankind.

Agriculture/Irrigation

Even more than population pressure, yet directly linked, agriculture lies behind most of the region's water problems. Given the present composition of their overall economies, the major determinant of the water balance remains the agricultural sector. The Nile has provided the basis of agricultural development in Egypt and the Sudan since the start of agriculture about 7,000 years ago, and for political reasons, most East African nations have adopted policies of self-sufficiency when dealing with food supplies. In the Nile basin agriculture accounts for at least 80% of all water consumption. (See Maps 8, 9, and 10 in appendix.) Whereas a few liters of water per day are a basic minimum for human survival, at least a ton per day is required to produce the food needed for a reasonable diet for just one person. Ideally, all of the water used for agriculture should be passed through a crop on its way into the atmosphere or to sea, and much of it actually is. However, that does not necessarily mean that it is used most efficiently.

There is little doubt that the most dramatic improvements in the use of water can be made in the agricultural sector. To begin with, certain current water use practices should be discouraged. Among these are the irrigated production of water-guzzling crops in arid regions that can readily be imported from water-rich regions; and the continued

reliance on inefficient irrigation methods that tend to waterlog and salinize the soil. For example, in Egypt, the growing of rice and sugar cane, which both require a great deal of water, is questionable. In the hot climate, the return on agricultural yield per unit of water evaporated is poor and thus inefficient. Also, the most prevalent method of irrigation in the region is still the surface flooding of basins or furrows, a process that has, at best, a 50 percent efficiency. This irrigation technique involves the needless percolation or runoff of half or more of the water delivered. As viable alternatives, sprinkler irrigation can be operated at an efficiency of 70 percent or more, while drip irrigation can attain an efficiency as high as 90 percent if competently managed.

Agriculture has a significant impact on water - it influences not only the quality of water passing on to downstream parts of the river basin, but flow as well. Land use also involves waste handling and the output of chemicals to the atmosphere, the land, and the water bodies, polluting the water circulating in the system. Proper management, therefore, demands that land and water management be integrated. As a result, the basin nations need to cooperate with each other in their respective agricultural planning. A partial solution could lie in the distribution of different crops to areas of the basin where they would be most bountiful. For example, water intensive or long season crops could be grown in the upper basin while crops requiring less water and growing time could be produced in the lower basin. Agricultural trades between the states could then ensue.

Egypt

With the lowest per capita arable land base in Africa, and with a rapidly increasing population, sustainability of agriculture in Egypt has now become a critical issue. In Egypt, the major resource constraint to sustainable agricultural development is water, not land. Less than 4% of the country's land area is cultivated at present. Egyptian agroclimatic conditions are particularly suitable for irrigated agriculture and the technology already exists for substantial increases in crop yields. It has been estimated that the yield in most crops could be increased by one-third or more. The High Dam at Aswan has assured two crops per year, but there exists every possibility that by using shorter term crop varieties, a third crop could be introduced - judicious crop selection could help achieve greater yields without use of additional water. The scope for agricultural improvement is enormous and the return on investment is high. Egypt has significant quantities of irrigation drainage water that could be reused, and increased efficiency of water utilization could free up even more water for alternative uses, in Egypt and elsewhere.

the Sudan

In the 1970s, the Sudan was widely perceived to be a potential breadbasket capable of alleviating the growing food deficit in the Middle East. Unfortunately, these high expectations have not yet been realized, apparently owing to poor management. The potential is still there, however. Within the Sudan there is still much highly fertile and easily irrigable land, given adequate river control. Plans for irrigation in the Sudan are concerned with the rehabilitation and modernization of existing agronomic designs, intensification of cropping, and the development of new irrigation schemes.

Ethiopia

At present Ethiopia cultivates 90 thousand hectares of irrigated land, compared to Egypt's 3.2 million hectares, most of which is located in its eastern parts. In all only 4 percent of the potentially irrigable land has been developed. The implication that Ethiopia might utilize water to irrigate even half of its 3.7 million irrigable hectares is very significant to downstream users. The fact that it has an estimated average of 112 km3 of water available for use annually means that Ethiopia has the possibility to command sufficient water to irrigate a much greater area than currently irrigated in Egypt and the Sudan combined.

The basic problem facing Egypt, Ethiopia, and the Sudan is thus a familiar one: there is not enough Nile water available to complete all of the irrigation schemes on the drawing boards of these three riparian nations. (See Table 2.) Adding to this already tense situation is the possibility that Tanzania, Uganda, and Kenya will bring another 1/2 million acres under irrigation by the year 2000. If this occurs, these upstream states will certainly pull greater amounts of water from their Nile resources, thus reducing further the amount available to downstream nations. (See Graph 4.) As time progresses, the need for water to keep pace with the expansion of irrigated agriculture will have to compete with water needs for other purposes. Water requirements for the domestic sector will continue to increase because of increasing population. Industrial water demands will also increase significantly; thus the amount of water available for agriculture will decline, forcing the agricultural sector to do more with less. This therefore requires an efficient high input agriculture making intensive and effective use of land and human resources.

Table 2: Projected Water Balance Sheet - Year 2000

Supply (as calculated at Aswan)

Mean discharge assumed in Nile Waters Agreement	84.0 km3
Actual increase in century mean	4.1 km3
Benefit of Jonglei Phase I	3.8 km3
Total	91.9 km3

Demand (as calculated at Aswan)

Egyptian	68.9 km3
Sudanese	32.0 km3
Ethiopian	2.0 km3
Total	102.9 km3

Graph 4. Projected Irrigated Areas.

Evaporation

The heavy evaporation and general dryness of the climate in Egypt and most of the Sudan have severe implications. (See Figure 7.) For example, substantial water losses from the surface of Lake Nasser occur, which, estimated at about 10 x 109 m3 per year, eliminate approximately 10% of the reservoir's net storage volume. In southern Sudan, enormous amounts of water, estimated to total at least 20 bcm, are lost in the Sudd swamps each year.

As if those facts are not alarming enough, evaporation losses are likely to increase over the next century. Although these may be partially compensated for by the increased precipitation yield over the White Nile catchment, the need for completion of water preservation projects and other planned water conservation methods is implied. Measures to reduce evaporative losses have been under consideration for many years; however, substantial political, social, and environmental problems are associated with most of the proposals and have thus far blocked most efforts.

Opportunities exist that could substantially reduce evaporative losses in the Nile basin. Storing more of the rivers' waters in Ethiopian highland reservoirs, where evaporation is much lower than in Egypt's Lake Nasser, could result in more water for all downstream countries. Shifting the major storage from Lake Nasser to reservoirs located in Ethiopia would reduce water losses not only because the climate in Ethiopia is less evaporative than the desert climate of Egypt, but also because the topography of the Blue Nile gorge in Ethiopia allows for a more favorable volume-to-surface ratio. The proposed upstream reservoirs would also regulate the water flow to the possible benefit of both upstream and

downstream users.

Other opportunities for cooperation exist in the Sudan. The reservoir behind the Jebel Aulia Dam on the White Nile, 40 km south of Khartoum, has annual evaporation losses of about 2.8 bcm. Elimination of this reservoir would substantially reduce these losses. Works upstream in the Southern Sudan could substantially increase the total water available by draining the marshes of the Sudd. The potential yield from Sudd projects could provide an additional 14 km3 per annum. Finally, over 200 possible water storage combinations exist in the upper riparian states, which would significantly reduce water losses from evaporation. However, implementing any one of them will require accord and cooperation between all basin countries.

All Nile countries, in the long term, would benefit by working together to reduce evaporative losses on a basinwide scale.

Figure 7. Evaporation's Effect on Water Supplies.

Constraints to Basinwide Planning

Nile Waters Agreements

The quest for basinwide management was actually begun by the British, who held sway over the greater part of the Nile basin until the middle of the twentieth century. Their idea was to develop the entire basin in an integrated fashion, through a series of dams controlling the outflow from the equatorial lakes feeding both tributaries and a canal for the White Nile to bypass the Sudd. Prospects for the comprehensive integrated development of the Nile basin dimmed when British colonialism ended and the newly independent basin nations began to assert their distinct national interests. From 1898 until the late 1940's attention on the waters of the Nile focused almost entirely on the irrigation needs of Egypt and the Sudan. The possible future requirements of Ethiopia and the other basin nations were ignored. The countries at the headwaters of the Nile, with substantial annual rainfall, were not thought of as areas where irrigation might be needed, despite the unpredictability and uneven distribution of rainfall in some parts and a high level of aridity in others.

The most recent, and most famous, accord was the Nile Waters Agreement of 1959. The agreement assumed the following availability and proposed allocations (in km3):

Average Annual Nile Flow	84
Reservoir Losses Due to Evaporation and Seepage	(10)
Net Water Availability per Annum	74
Allotment to the Sudan	18.5
Allotment to Egypt	55.5
Total Water Usage per Annum	74

No other potentially interested party or state was consulted about the final agreement between Egypt and the Sudan which was announced in Cairo and Khartoum on November 4, 1959. The upstream states' reaction was that the downstream states had simply divided the recognized average flow of the Nile between themselves, leaving nothing for any other countries. This is exactly what happened, and the inequity continues to the present day. Although the Sudan has yet to utilize its full share of water, Egypt already uses its full allotment plus the surplus that the Sudan does not use, thus fully exploiting all available water resources. Ethiopia and other nations have over the last 40 years stressed their rightful entitlement to the use of Nile water. Since they were not included in the 1959 Agreement between Egypt and the Sudan, they therefore do not feel bound by the treaty in any way and contend that they have a right to exploit natural water resources within their borders. The current situation is characterized by distrust, disagreement, adversarial actions, and threats. It is completely unproductive and unfair.

In addition to the 1959 Agreement, six other major agreements regarding the utilization of the Nile waters have been signed in modern history: none of them included more than three states. It is obvious that such a fractured approach will not serve to promote the interests of all nations. It will be necessary to develop a basinwide management strategy for the future and to renegotiate a new Nile Waters Agreement that includes all nine riparians. Despite the long-term necessity of negotiating a new agreement, there are numerous barriers to such an accord that must be addressed. These include, among others, factors such as perpetual political and economic instability, lack of skilled manpower, and a shortage of financial resources.

Control

The concern for sovereignty is a major obstacle in the way of integrated international river development. Confidence must be felt between neighbors before they are willing to commit treasured natural resources to interdependent development and management. "Even where states are willing to cooperate for mutual benefit, each generally desires to preserve as much control as possible over territories and resources within its own boundaries."

Because Egypt and the Sudan are the most dependent on the Nile

waters for survival, they are extremely concerned with securing their water supplies. It has been stated that, "the national security of Egypt, which is based on the water of the Nile, is in the hands of other African countries." This makes Egypt especially wary of development schemes proposed by upstream riparians. Two possible ways of assuring Egypt and the Sudan of their water supplies would be for all the countries to develop and agree upon specific operating rules for upstream reservoirs and agree to abide by general principles for water sharing.

Not one of the riparian states to the south of Egypt has implemented any water schemes that could threaten Egypt or the Sudan's water resources - Egypt's Aswan High Dam is the only scheme with far reaching consequences for a neighboring country. One reason for this is that the other Nile countries are extremely poor and none of them, with the exception of the Sudan, have been able to get assistance from donor nations or lending institutions for any major water projects. A more important reason, however, is political: all nine riparian states have been ravaged by civil war or engaged in interstate warfare, which is thwarting development.

Equitable Use

For a development strategy to be sustainable, it must consider the achievement of a reasonable and equitably distributed level of economic well-being among basin states. Basinwide cooperation should be founded on principles of equitable apportionment of the drainage basin waters in such a manner as to both meet the needs of co-riparian states and minimize disadvantages to them. The term "equitable" does not necessarily imply equal division between the nations involved. Rather, its application to specific cases must be flexible, taking into account a wide range of factors.

What constitutes reasonable and equitable is the crux of all water-sharing agreements and is open to widely different interpretations. Population size, geography, climate, historical use, and availability of other water sources are among the many factors that could be taken into account in determining equitable allocations among basin countries, but a clear formula for doing so does not exist. Definitions of equitable utilization must be negotiated and applied to any future Nile water agreements.

International Law

Unfortunately, there are no well-established international laws on river basins that could help lead the Nile states to a cooperative understanding. As previously stated, the current situation is such that Egypt and the Sudan, who do not contribute to the water resources, are the main users while the rights of the other seven riparians have been denied. The first step in international law development must be the promulgation of a set of principles on which to base a legal code. For shared river

basins, the question is which nation should be given priority: whether the one upstream or its neighbor downstream; the nation whose territory contributes most to the resource or the one that occupies the greater proportion of the watershed; the nation with the greater need or the one with the greater population; the nation that has used the resource longest or the one with fewer alternative sources. In the absence of an agreed set of principles, it is typically the nation with the greater power or the stronger international alliances whose interests predominate. This is what occurs in the Nile region. Almost all the nations lack hydrological data, capital, modern technology, and support from international organizations and donor countries. Egypt is the only riparian possessing advanced technology, river basin information, and adequate financial backing by developed countries and international organizations. International laws would help promote a basinwide perspective for river resource development, and would bolster support for the less developed basin nations.

Advancement Toward Basinwide Management

New Agreements

Even though the above constraints to basinwide river management exist, several compelling reasons for such development necessitate the renegotiation of a Nile Waters Agreement in the near future. The most important are the demographic and agricultural trends in Nile Basin states. A new agreement should focus on opportunities for expanding the usable yield of the Nile River and encourage interdependencies among basin countries, the general objective being the maintenance and enhancement of the overall social and economic development of all people in the basin. Cooperation based on clearly identified objectives will accrue benefits to all nine countries. Some of the possible components of a new agreement that would lead to collective improvements are discussed below.

Water Markets

It could be possible for the Nile states, especially Egypt, the Sudan, and Ethiopia, to buy and sell water rights from one another. The establishment of a mechanism for basinwide buying and selling of water would be one of the most significant innovations that could be introduced in a new water agreement. A regional water market would have numerous benefits. Foremost among these would be the ability of a market to allocate water to areas where it will have the highest returns, thus promoting regional economic development. Second, it would encourage sustainable agricultural policies and judicious crop selections, since overuse of a nation's water allotment would mean having to pay for water. Third, if a new treaty guaranteed that a certain proportion of each country's share of Nile water would be available to be traded, it would probably be easier to reach agreement on the allocation of the long-term Nile yield among Egypt, the Sudan, and Ethiopia. Fourth, markets could be

used to assist with rationing during times of water shortage.

Trading

A basinwide development plan should take into account the natural occurrence and location of the resource and the potential for development and use of the Nile waters in each country. Development in one nation should aim to maximize the benefits for as many other riparian states as possible. For example, hydroelectric power in Uganda and Ethiopia could benefit several other riparians, while increased agricultural production in Egypt and the Sudan could do the same.

Ethiopia's potential for hydropower development is enormous. A proposition of far-reaching potential importance to the future of Nile water supplies would be the construction of a series of dams in Ethiopia. It is argued that Egypt's development is constrained more by lack of power than lack of water. Thus, a mutually beneficial arrangement would appear to be possible with respect to water and power, whereby Egypt would agree to a greater water allocation for Ethiopia and to the construction of Blue Nile Reservoirs on the condition that a certain percentage of the electricity generated would be sold to Egypt at a specified price. Because of Egypt's growing demands for electricity, the Blue Nile Reservoirs may be more valuable for their hydroelectric power generation than for water regulation and storage. Reservoirs would also control Blue Nile floods, which could be particularly beneficial to the Sudan. Added upstream storage would facilitate expansion of the Sudan's gravity-fed irrigated areas, which in turn would mean greater crop production. It could be possible to negotiate a trade arrangement whereby Ethiopia trades electricity to Egypt and the Sudan in return for agricultural and/or industrial products.

Although it may seem odd in light of the current trend toward a world economy, the nine states of the Nile basin, though connected by the river are not moved to relate intensely with each other. The dominant trading partners of all nine nations for both exports and imports are the industrialized economies of Europe, North America, and the Far East. The basin states do not have a history of trading amongst themselves. Establishing trade relationships through a basinwide agreement would be a novel approach that could provide unrealized gains within the region.

Nile Basin Commission

Among the basin countries, there must be at least a latent willingness to work for a cooperative agreement and accept its obligations: this is crucial for states to be able to address joint problems. In terms of willingness to cooperate the most encouraging sign is the existing proposal for a new basinwide commission to include all nine member states. Egypt and the Sudan have submitted a draft proposal to the Nile riparian states for the establishment of a Nile Basin Commission. The Commission, to be composed of one representative from

each country, would assist the riparian states in cooperating to draft rational plans for the conservation, allocation, and development of the water resources of the entire Nile basin. Because it bestows a spirit of cooperation, advances mutual interests, and settles issues through discussion and negotiation, this framework is gaining acceptance within the basin states.

A New Nile Waters Agreement

In order to negotiate a new agreement among all basin states, several things must occur: the first is that other riparians must be able to make credible commitments to Egypt with respect to future shared development. Second, the upstream riparians have very few people with the necessary hydrological expertise or knowledge of the history of Nile water management efforts to participate effectively in negotiations; they must train or hire educated people to help with this. Third, in all of the riparian countries, Nile water issues are being handled primarily by diplomats - scientists must begin to play a greater role. Last, any new policies or potential agreements must be shared with and agreed to by all states.

There are four types of favorable conditions that can exist among shared river basin countries: (1) the countries have the same technical perception of problems within the basin; (2) the countries share similar values and tastes for goods and services such as environmental quality or river basin development; (3) the countries use the same technologies for production activities; and (4) between countries there exists an extensive network of transnational and transgovernmental contacts. Unfortunately, the Nile basin states currently have none of these commonalties. A new compact should address these issues through mechanisms for bringing all sovereign states into equal membership of a community to equitably utilize land and water resources and to protect the physical, biological, and social environment. Along with the above suggestions, other general recommendations for the nations include: preparing national water plans, designing and conducting adequate water studies on the river basin, introducing improved storage/augmentation projects, and developing the most efficient uses for water. Each country's right to use the Nile waters within their territory should be recognized, as long as it does not cause appreciable harm to other riparian users.

Much can be done to promote efficient use of water and to augment water supplies. Integrated river basin development should be perceived as a set of anthropogenic activities which takes place in an interlinked and complex ecosystem. The Nile basin is one such system which represents a very large and highly valued hydrological unit. It is only when a meaningful, comprehensive, and integrated strategy and plan of action is developed and implemented that the problems of the Nile nations can be tackled effectively. It should be stressed that the basin's environment should be seen as one ecological entity and that its sustainability

requires concerted action by all basin states.

Regional and Local Management Strategies

The value of the Nile's water varies among the nine basin nations with respect to their uses for irrigation, hydro-electric power, navigation, water-based recreation, and industrial and municipal purposes. Ideally, Nile water should be divided in such a way that the allocation of a quantum supply to one individual nation can improve the well-being of that country without decreasing the well-being of the other eight nations. Basinwide management strategies are best suited to address these issues and can provide the greatest number of benefits to the most people. However, they cannot work alone: they must be supported by management strategies at lower levels - regional and local. Together these three levels provide a comprehensive approach to planning and development.

Regional Management

Integrated water management implies that while water is, by itself, a system, it is also a component of and actor in larger systems. In that respect, the interactions between water, land, and the environment must be addressed, recognizing that changes in any one may have consequences for the others. This is a regional management perspective. Interests here focus on issues such as erosion control, pollution control, wetlands preservation, agricultural drainage, and recreational water use. Currently in the Nile basin, the countries with the greatest potential to impact water scarcity at the regional level are Egypt and the Sudan. Before constructing the Aswan High Dam, groundwater was used as a supplement to irrigation in the winter, but since that time this practice has fallen into decline. This is unfortunate because Egypt's available groundwater storage is estimated to be around 400 km3 - considerably larger than that of Lake Nasser (130 km3) and unlike the lake, aquifers are recharged through irrigation and are not subject to evaporative losses. Groundwater resources in the Sudan are also available for development. Although small, they are, nevertheless, resources and are estimated to have a potential yield of 2 km3 per year. Since Egypt and the Sudan are the major users of water in the basin, it is reasonable that they should put forth an effort to utilize all the water resources within their own borders in efforts to reduce the amounts they take from other upstream countries who will themselves need more water in the future.

Local Management

The local level of integrated water management accepts that water comprises an ecological system formed by a number of interdependent components. Each element may influence other components and, therefore, needs to be managed with regard to its interrelationships. Local water development and allocation is not only a quantitative problem: with intensified water use, pollution becomes rampant. At this level of integration, management attention is directed toward joint consideration

of such aspects as water supply and demand, wastewater treatment and disposal, and water quantity and quality.

Controlling demand, rather than supply, at the local level will prove cost-effective and sustaining for all Nile basin states. The demand for water by a society is not a preordained, unquestionable quantity that must be satisfied at all costs simply because it exists or is claimed, yet the prevailing supply orientation treats demand as a "given" that must be satisfied by ever-greater supply. What is needed is a more balanced approach that regards demand as a variable quantity to be controlled, and recognizes conservation, efficient use, and protection of quality as primary goals of rational water resource management.

Nile states wishing to resolve ongoing water disputes must go beyond bickering over competitive allocation of existing supplies for traditional uses and instead concentrate on longer-term programs. Such schemes should be aimed at augmenting supplies, avoiding waste, improving utilization efficiency, and capturing wastewater for treatment and reuse. Implementing conservation measures, on any scale, tends to be far less expensive than the construction of capital-intensive projects such as desalination plants and dams. Industries and households could recycle and reuse water for many purposes, thus reducing the need to increase supply. At present there is much latitude for improving the way Nile water is used on a local level, and doing so seems the most immediate, practical, and economical approach to tackling the water shortage. In other words, think basinwide - act locally.

Cooperative Policy Formulation

Redistributive politics is a term used to describe the reallocation of wealth and income or goods and services, or control over resources between or within nations. For purposes of an international rivers discussion, redistributive politics is more widely defined to also include those controversies in which one group must give up something directly to another group. This would include reallocation of river water rights and the redistribution of authority between nations. Establishing or changing the allocation of water rights for a major international river such as the Nile is a substantial political undertaking on any level. Hydrologic, economic, and foreign policy considerations influence the Nile nations' policies toward cooperation on their international watercourse. Improving international relations will help form basinwide management policies, but the success of such policies in the international arena depends greatly on conditions that exist within the basin countries.

To effectively co-manage a water resource, policies geared toward cooperative efforts must be developed at all management levels. Policies for cooperative river basin management may be advanced from any number of different sources, including interest groups, parliamentary committees,

political leaders, and/or government departments. One possible way to begin this process would be to divide responsibility between the different levels. The local and regional levels could have day to day responsibility over the resource in question, while the basinwide management group would have the authority to oversee all activities and to initiate international negotiations when necessary. Opening lines of communication and sharing information between and among the nine Nile riparians would be the first step toward forming cooperative policy-making coalitions.

A nonpolicy approach toward integrated basinwide management is based on economics. It may be possible to apply market mechanisms as a means of achieving better allocations of water. With this approach, each unit of water could be demanded and used where it would give the highest value in return. In addition, the cost of supplying the water demanded could ideally be reduced if its development and distribution are taken care of by actors in the market, as compared to arrangements made by a political or administrative system. From a resource perspective, a demand-management approach is promising, since it tends to reduce overconsumption, thus making relatively more water available for all of the Nile nations.

The question of how to begin the implementation of any of the water management strategies discussed is extremely difficult. The need for cooperative effort is clear, but the force to propel their achievement has not yet been strong enough to overcome the many obstacles inherent in such processes. Before cooperative efforts can benefit any of the Nile nations, new policies and agreements for water allocation and use must be reached. Unfortunately, the constraints involved are of such magnitude that it will likely require a serious threat to the livelihood of more than one riparian before serious efforts are initiated. It is, however, most encouraging that common problems are being identified and acknowledged, and possible joint working groups are being considered between nations who have historically been linked only by a common water source. The Nile states are far from reaching the point where they act cooperatively for mutual benefit, but strides are being made toward that end.

Conclusions

Increasingly and inevitably, water has been and will continue to be a complex, emotional issue in the water-scarce East African Nile River basin. The current water situation could provide motivation for both violent conflict and cooperative effort. In considering prospects for the future, one must remember that the Nile basin is a unique and single geographical, hydrological unit. All people living in the basin,

regardless of their great ethnic, cultural, religious, and political differences, depend on the same river, and hence on one another's use of it. There is no single solution to the Nile Basin's water problems and ultimately a combination of efforts and innovative ideas must be applied to a new accord. A neoteric respect for water must replace present utilitarian views which are founded on mechanical, disconnected views: a new professionalism must be introduced whereby water is properly acknowledged as a finite, vulnerable, and multifunctional resource. To keep pace with population growth and provide a higher standard of living, the Nile states must utilize all available land, water, and related resources intensively, efficiently, and sustainably.

Decisions made by each country regarding investments in water resource development, new irrigation schemes, and industrial projects will have consequences far into the future when available water resources will be in much greater demand. Sharing expertise, opening access to hydrologic data and exploring joint water conservation and supply projects offer some of the best opportunities for reducing the risk of future tensions over water in the Nile basin. Efficient management of the basin as a whole will require international coordination and integration based on the equitable sharing of the invaluable resources of water and energy contained in this unique river. Ultimately, all countries in the Nile basin stand to gain from cooperation in the development and sustainable utilization of the river's water supply.

"Where nature conspired to provide common resources, there can be no ultimate independence, only mutual dependence."

Appendix - Maps

Map 1 - Annual Internal Renewable Water Resources in the Nile Basin. This map illustrates the amount of water that flows annually through each Nile riparian, including rivers, rain, and groundwater. Amounts include flows from other countries and do not necessarily represent water that is directly available for use. (Source: World Resources Database, File WA22101.)

Map 2 - Nile Basin States Total Annual Water Withdrawals
This map depicts the pattern of freshwater use in the Nile basin in cubic kilometers per year. (Source: World Resources Database, File WA22106.)

Map 3 - The Nile River Catchment Basin
This map shows the outline of the Nile River Watershed area which represents ten percent of the entire African continent. (Source: Abate, p. 228.)

Map 4 - The Nile River in the Sudan and Ethiopia
A closer look at the White Nile (flowing north toward Khartoum from the lacustrine states on the left), the Blue Nile (flowing north toward Khartoum from Lake Tana on the right), and the Atbara (meeting the main Nile north of Khartoum). (Source: Digital Chart of The World.)

Map 5 - The Nile in Egypt
A closer view of the Nile river as it flows through Egypt. The High Dam at Aswan is represented (red triangle at Aswan) and Lake Nasser (the reservoir created by the dam) is shown. Note the locations of all major Egyptian cities along the river, and the fact that no water is introduced to the Nile in Egyptian territory. (Source: Digital Chart of the World.)

Map 6 - Intermittent Water in the Nile River Basin
During the wet season flooding occurs all along the main Nile and its tributaries. During this time the Blue Nile contributes approximately ninety percent of the united Nile's flow. (Source: Digital Chart of the World.)

Map 7 - Permanent Water in the Nile River Basin
During the dry season the floods recede and the desert returns. During

the dry months the White Nile sustains the flow of the main Nile river. (Source: Digital Chart of the World.)

Map 8 - Annual Water Withdrawals for Agriculture
The yearly water withdrawals for agriculture are linked to the annual crop production of the Nile states. Note that the areas which are most agriculturally intensive are also generally the most arid area of the Nile basin. (Source: World Resources Database, File WA22109.)

Map 9 - Annual Water Withdrawals for Domestic Use
This map illustrates the yearly amounts of water used for domestic purposes in the Nile states. (Source: World Resources Database, File WA22109.)

Map 10 - Annual Water Withdrawals for Industrial Use
This map depicts the yearly amounts of water used for industrial purposes in the Nile states. (Source: World Resources Database, File WA22109.)

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Three sublevels beyond the three main management levels have also been described: (1) the normative level, where decisions are made regarding what ought to be done (this level identifies current and potential issues that may require attention); (2) the strategic level, where decisions are made regarding what can be done (this level considers the broadest possible range of variables which may be significant for coordinated management of water and associated land and environmental resources - it provides the most comprehensive view); and (3) the operational level, where decisions are made regarding what will be done (direct attention is given to a smaller number of variables that are believed to account for a substantial portion of management problems - this provides insight on a local/regional scale). Integration can and should occur at all of these levels. Source: Bruce Mitchell, "Integrated Water Management," Bruce Mitchell (ed.), Integrated Water Management: International Experiences and Perspectives, (London: Belhaven Press, 1990), pp. 2-4.

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1 billion cubic meters (bcm) = 1 cubic kilometer (km3)

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CHAPTER ELEVEN
LUEJIT TINPANGA
POPULATION POLICY AND SOCIO-ECONOMIC DEVELOPMENT IN VIETNAM

Introduction

Just as population is crucial to each country, so is population policy. It means the future of the nation. A country with a high population and limited area has to consider seriously the ramification of their population policies. Vietnam has faced this situation for decades. Vietnam has adopted two policies: 1) family planning programs, 2) population redistribution to the New Economic Zones (NEZs). With these strategies, the government has set goals to decrease the population growth rate and distribute the population out of urban areas. After three decades, these policies are still in use.

My purpose of this study is to find out how population policy has impacted: 1) population growth and distribution and 2) socio-economic development. I will address the effectiveness of population policy and how these policies can be improved. I will begin this paper with an introduction to Vietnam's geographic, natural resources, economic and demographic characteristics to explain Vietnamese policy makers instituted programs of population control. Then I will evaluate Vietnam's population policy, including the results of each specific population plan. Apart from the national goal of population control, the goal of socio-economic development will also be elaborated. Four categories of socio-economic development will be discussed: 1) labor force and employment, 2) agricultural production, 3) urbanization, and 4) forestry. I will demonstrate how these policies of socio-economic development are relevant to population control in Vietnam. I will use Thailand as a country of comparison in this paper. Thailand has been successful in population control through family planning and land settlements. It has also enjoyed economic growth in the last two decades. With slight difference in development level, Thailand's experience will be helpful in studying Vietnam. Eventually, policy suggestions will be added for Vietnam's future socio-economic development.

Vietnam's background

Geography and natural resources

Geographically, Vietnam is located on the eastern edge of the Indochinese Peninsula. The total area is approximately 331,700 sq. km. Its "S" shape stretches 3,000 km. from the northern border with China south to the South China Sea. The coastal terrain on the east side causes Vietnam to have monsoon rains every year and some years Vietnam suffers from flooding and typhoons. In regard to its terrain, the north and the

south are level plains. Two major rivers--Red River in the north and Mekhong River in the south--have created alluvial deltaic plains. Hills and mountainous areas, which cover almost 75% of the country are located in a narrow strip in the central part and in the north.

Vietnam is blessed with many natural resources: petroleum, coal, iron, tin, bauxite, copper, and forests. The land in the Red River Delta and the Mekhong River Delta are the most fertile in the country and suitable for farming. The south central coast are also large deltaic alluvial plains but arable land has eroded. Hills and mountainous areas which include the Northern midland and North Central coast have poor in nutrient soils. The Central highlands has reddish brown soil as forest were destroyed. The large part of this area is unsuitable for cultivated.

Economy

Generally, Vietnam's economy is not in good condition. Compared to China and Thailand, Vietnam's average of GDP per capita in terms of purchasing power parity in 1991 was US$ 1,100 whereas China has US$ 1,190 and Thailand has US$ 3,986 (Thrift, 1986). Vietnam's per capita income in 1987 was only US$ 198 (Thrift, 1986). Although the government has adopted tight financial measures, inflation rate was 60% in 1991.

Vietnam's economy is dominated by agriculture (fig. 1). Although the percentage of GDP distribution of the agriculture sector is declining, agricultural labor force is the largest part of total labor force and Vietnam's leading major export products are rice and agricultural products. Rice is the major crop of Vietnam. During World War II and the Vietnam War, Vietnam was unable to compete with other countries but in 1996 Vietnam improved its rice production capacity to be the fourth largest rice exporter of the world. Services sector used to be ignored by the government. After the Fifth Five Year Plan was employed during 1991-1995, services sector has increased its proportion in GDP distribution and surpassed agricultural and industrial sectors apparently in 1993. Industrial sector has been promoted by the government since 1976. Industrial sector's growth rate did not increase dramatically because lack of infrastructure. The government has promoted heavy industry but it could not provide sufficient facilities and infrastructure for it. Vietnam's industry also suffered from was devastation. However, It is likely that percentage of industrial sector in GDP distribution will rise up as well as services sector whereas agricultural sector will go down.

Figure 1. GDP distribution in three sectors from 1990-1993 (%).

Vietnam's economy has been influenced by 3 major factors: wars, natural disasters, and foreign aid. Wars has interrupted Vietnam's agricultural and industrial production. During the Vietnam War, Vietnam's factories were severely damaged. Approximately 1.8 million has. of forest were destroyed. Natural disasters have been a major threat to the country, especially to agriculture, owing to the country's geographic location. During 1978-1979, agricultural farmland was damaged as a result of natural disaster causing sharp decrease in agricultural production. The last and very important factor is foreign aid. After the independence of the country in 1954, North Vietnam was supported by China, Soviet Union, the Eastern Europe . South Vietnam was supported by the US and capitalist countries. Most of foreign aid was used in national defense rather than economic development. After 1975, Vietnam was chiefly funded by Soviet Union, the Eastern Europe. When Vietnam invaded into Cambodia in 1978, the country's economy was affected by the cessation of foreign aids from China, Japan, and some countries in Europe. After the collapse of the Soviet Union, Vietnam lost US$ 1 billion from the Soviet Union and other East European countries. At present, structure of foreign aid to Vietnam changed. Vietnam receives foreign aid from Japan, the World Bank, the Asian Development Bank(ADB) and UN organizations.

Population Situation

Vietnam has a large population: an important factor in national development. At present, Vietnam's population is approximately 74,545,000; the second largest in the Southeast Asia. Vietnamese people in average have a primary level of education. The literacy rates of adult females and males was 87% and 95% in 1990 respectively (WRD, 1995-95).

The population is not equally distributed throughout the country (See Map 1). Although the average population density was 225 people per sq.km. in 1995 (WRD, 1995-96), most of population resides in the deltaic plains. The population density in the Red River Delta was 468 people per sq.km. and in the Mekhong River Delta was 353 people per sq.km. (Jones, 1984). In some parts of the country, including mountainous ares in the north, the west, and the southwest of the country, population density was only 20-50 people per sq.km.; due to lack of good farmland and arable land. Moreover, the government has provided water control systems--irrigation and drainage--in the deltaic areas, especially near Hanoi. Likewise, the south of Vietnam was improved by American assistance before the reunification of the country in 1975. Hence, there is high motivation for people to move to the big cities such as, Hanoi, Ho Chi Minh City, Hai Phong, and Da Nang.

The high growth rate of population together with high population density have brought Vietnam problems. Food shortages has been a chronic problem in North Vietnam. North Vietnam has suffered from this dilemma since the colonial period. The French rulers had to bring rice from the

south in order to feed the Northerners. The first time that the Vietnamese government became aware of food shortage was after World War II. An estimated 2 million people died of starvation. After the reunification of the country, many Northerners believed that the reunification would help alleviate food shortages in the north because of larger area in the South and higher rice production. On the contrary, the southern part was not ready to a food producer for the whole nation owing to was destruction. The government also had burden to provide job opportunities for 300,000 people in the south who used to work with military service. At the end of the Vietnam War, there were 21 million in the labor force and 8 million were unemployed. In 1988, Vietnam still had to import over 450,000 of rice(Thrift, 1986). Not until 1989 that Vietnam was able to produce over 21 million tons of food for domestic consumption, reserves and exports.

Map. Population Density.

Population Policy

In regard to the socialist ruling system, Vietnamese socialist government used centralized control, the government therefore is the most important mechanism for national development. In response to these problems, the Communist Committee decided to control the population and improve economic development. The Vietnamese government has adopted two population policies to deal with population problems: family planning programs and population redistribution to NEZ.

Family Planning

Family planning in Vietnam can be divided into two periods: the first period was before the reunification of the country in 1975, and the second family planning period was after the reunification. Prior to the reunification of the country in 1975, family planning programs had been conducted separately in the north and the south. In the early 1960s, North Vietnamese leaders were concerned about a rapid growth of population as an impediment to an economic development. In 1962 North Vietnam started a family planning program with the target to reduce population growth from 3.5% to 2.5% and 2% in a few years. Two -to- three children per family with 5 to 6 year-spacing was the encouraged family planning program standard. The Committee for the Protection of Mothers and Children was established to promote birth control. This policy was adopted widely in cities and the deltaic plain. The population in mountainous areas was not targeted rather the Vietnamese government encouraged population growth. The widespread contraceptive device was the intrauterine device (IUD). However, during 1965-1975 the government paid more attention to shifting economic and military sources to support the Vietnam War, and the family planning program was

inadequately promoted.

In regard to South Vietnam, there was a scarcity of available data concerning family planning. In 1971 South Vietnam prepared an annual report on birth control and proposed the program to the United Nations Secretary- General in 1973. The National Council on Population was established in 1973. There was no official policy on population and family planning in South Vietnam. However, the government has targeted to reduce population growth rate from 3% in 1973 to 2% in 1980. A new governmental decree called for a limitation of family allowances. These family allowances used to be allotted to each family for each new-born child, later the South Vietnamese government would only provide each family with allowances for only their first four children. This was applied to military families and civil servants' families. Giving this new decree, it is surprising that a law restricting birth control and banning a dissemination of contraceptives enacted by the French ruler in 1920 was still in use. Nevertheless, records show contraceptives were used in South Vietnam and promoted by the private voluntary agencies. In 1974, South Vietnam also attempted to seek the United States and the United Nations' assistance for a family planning program before it was annexed to North Vietnam in 1975.

The second period of family planning in Vietnam was after 1975. In the mid-1980s, the government encouraged people to limit the total number of children per family. To enhance this program, the government regulated financial and work penalties for couples who had more than two children (Banister, 1993). In 1990, the 2-child policy was changed from mandatory to voluntary. Overall, the family planning was operated on voluntary basis. The government attempted to persuade and educate couples about the benefits of family planning.

According to demographic indexes, a health survey in 1988 and national census in 1989,
it showed the government's failure to achieve their target goals in the family planning program. From 1979-1989, the average annual population growth was 2.1%. In 1995, population growth rate increased to 2.23%.

Overall, family planning programs in Vietnam have not been very successful. The fertility rate has decreased from 1970 to 1995 but did not achieve 2 children per woman as the government set a target (fig. 2). The mean rate of population growth has increased since the beginning of family planning programs in 1962 and it likely to rise up in the future. If population growth rate increases 2% a year as shown, there will be at least 14 million people more in Vietnam in 2005.

Figure 2. Mean rate of population growth and fertility rate from 1955-1996.

There are four primary reasons why Vietnam did not achieve its goals for population control. The first reason is that the government lacked adequate funds to fully support a family planning program, caused by a fluctuating economy since the World War II and the Indochinese wars. Intrauterine device was the only modern method that the government could afford. The funds for family planning before 1988 were supported chiefly by foreign assistance. The UNFPA provided 28 million dollars from 1977 to 1987 and the Vietnamese government started providing its own funding in 1988. The second reason is Vietnam had contradictory policies. At first, the government provided the enforcement of limitation of the child per family in 1988 but in 1989 the Vietnamese National Assembly issued the decree allowing the policy to be voluntary. Hence, both the citizens and Vietnamese bureaucracy were confused regarding these policies. The third reason is that Vietnam overestimated their target for population growth rate reduction, 3% to 1.7% within short period and incorrectly hypothesized that the Vietnam economy would improve enough to independently support these family planning policies. The last cause is a paucity of data. The first national census was held in 1979 and the second in 1989. Before 1979 census, all data, particularly demographic data, was unofficial and estimated. The data for South Vietnam before the reunfication is even more sparse. The insufficient data caused an uncertain projection and estimation of setting target of population growth. Moreover, in terms of birth control device use, the percentage of women using IUDs was above 50% but the population growth rate was still high. This is assumed that the birth control provided by the government did not meet demand of the users, and women interviewed by government officials regarding their birth control, gave affirmative answers in order to regardless of their personal practices (Banister, 1993)..

Population Redistribution

The Population Redistribution Policies can be divided into three phases. The first one was in 1961. The second phase was conducted in 1975 in the whole region of Vietnam. And the third phase was started in 1981 as a long term plan. The target is to mobilize the population to NEZs (See map 1). The government tried to promote industry all over the country but the NEZs were used mostly for agriculture. The purpose of these policies was to re-distribute the population to the slightly populous uplands, and create more urban areas apart from Hanoi, Ho Chi Minh City and Hai Phong. With this strategy, the government wanted to equalize: population density, employment, and income throughout the country. Moreover, the government also wanted to improve the uncultivated land in the highlands by moving people from the deltaic plains to use and teach their rice-production skills to local people in the NEZs.

Phase I

The first redistribution was conducted successfully under the First Five Year Plan (1961-1965) solely in the north of Vietnam. The target was to mobilize one million people from the Red River Delta to the upland areas: Bach Thai, Son La, and Lai Chau provinces. (Map 2) Thai Binh was the first province where the population was mobilized as it was the most populous province. According to the plan, 150,000 people should be moved in five-year period. During 1961-1963, 70,000 inhabitants of Thai Binh joined this program and during 1965-1966 it was concluded that 110,000 of Thai Binh's former residents moved to the NEZs. (Jones, 1982) This policy was conducted, similarly, in the densely populated deltaic provinces. The campaign gained more support by the fear of US bombing threats propagandized by the Vietnamese government. Approximately 500,000 people from major cities and minor urban areas moved to the northwestern provinces. (Jones, 1982) In one decade, 1961-1970, there were over one million people shifted to the new settlements.

This population mobilization was unsuccessful in terms of improving quality of life. First, there were natural calamities. Second, there was an inadequate planning. Lacking tools and funds, the settlers could not farm and faced an unpredictable future. Moreover, the ethnic minorities who lived in upland areas long before the coming of new settlers were not prepared to encounter the influx of newcomers. It was also found that the minority peoples were not respected by the people in the program. Food production, especially rice, did not increase though the settlers were moved to apply their skills in the upland areas.

Phase II

Before the reunification, it was assumed that 1.3 million soldiers and police were living in the south. The government tried to solved unemployment problem and also found that the southern area would be suitable location to continue population redistribution program. During 1976-1980, 1.5 million people were moved to the NEZs. People were moved from north to south, north to north, and south to south in 16 provinces. The government regulated more new economic zones shown in table 3. Virgin land was opened for 527,649 ha. in this period. Agricultural production was 436,480 or 82% of new land and 34.8% was used for growing rice.

Map. New Economic Zones.

	From	To	Number
North to South	Hanoi	Lam Dong	100,000
	Thai Binh	Kien Giang	100,000
		Song Be	120,000
		Gia Lai Cong Tum	10,000
	Hai Hung	Long An	150,000
	Ha Nam Ninh	Minh Hai	100,000
		Dong Nai	24,000
		Dac Lac	10,000
	Binh Tri Thien	Dac Lac	69,000
	Ha Son Binh	Lam Dong	19,500
		Tay Ninh	5,000
North to North	Hai Phong	Quang Ninh	15,000
	Ha Nam Ninh	Hoang Lien Son	35,000
	Ha Son Binh	Son La,Vinh Phu, Ha Tuyen and Bac Thai	35,000
	Thai Binh	Bac Thai	5,5000
		Lai Chau	10,000
South to South	Ho Chi Minh City	Dong Nai	170,000
		Song Be	100,000
		Tay Ninh	100,000
	Nghia Binh	Gia Lai Cong Tum	40,000
	Quang Nam	Dac Lac	45,000
		Total	1,263,000

Table 1 Population redistribution in phase II catagorized by north to south, north to north, and south to south. Most of population moved to the south and central highland, particularly, Dac Lac, Lam Dong, Gia Lai Cong Tum.
Source: Jones, 1982.

According to table 1, it is obvious that Southern region was a main target of the government in order to distribute population from the Northern deltaic plain and big cities. Thai Binh was the province among northern provinces where largest population were moved to new settlements. As for southern provinces, Ho Chi Minh City's 300,000 people were mobilized. This is explained that the southern provinces did not have severe population density as in the north except Ho Chi Minh City .

Phase III

The third phase is a long term plan from 1985 to 2000. The target for the third plan was to mobilize 1,600, 000 people to the Mekhong Delta, the eastern areas and mountainous areas. In 1980, the government issued regulations for people moving to the NEZs, including training before redistribution and allowances for the basic living in new areas.

In conclusion, an estimated 6 million farmers have settled in the NEZs. 1.7 million hectares of virgin land was used in agricultural production. Thai Binh was the most successful in this program in terms of population decrease because 74,400 families were sent to new economic zones and enjoyed better living than in Thai Binh. The third phase was the most successful because the previous plans were ill-prepared and had inadequate supervision, causing many settlers to go back to their homeland. However, due to a small budget, 30% of people in this program are in poverty. Thus, in planning for redistribution from 1985 to 2000, the government emphasizes increased provision for technical planning, water control systems, rice field construction, infrastructure, schools, and medical stations.

Socio-economic impacts

Population policies in Vietnam are not successful in the overall decrease in the population growth rate and population density reduction. These inevitably affected socio-economic aspects of the country. I will discuss how these policies have affected labor force and employment, urbanization, agricultural production, and forestry.

Labor force and employment

Population policy has had an impact on the future labor force of Vietnam. First of all, population redistribution has increased the agricultural labor force because most of the jobs in the NEZs are related to agriculture. The agricultural labor force has increased from 15, 140, 000 people in 1980 to
19, 797,800 in 1986. (Statistical Public House, 1990) Moreover, the NEZs has created an estimated 8 million jobs not only in agriculture sector but also services sector during the past decades. However, the structure of labor force in Vietnam has not changed. Agricultural labor force still remains the large part of Vietnam's labor force.

According to the population growth rate, in the next 10 years, Vietnam's structure of population by age group will change. The country will be replete with young population (fig. 3).
Vietnam will have more labor force in the future which is good for economic development. However, the government has to be concern about unemployment in the future. Large population in 15-64 age group can suffer from unemployment if the country's economy cannot afford sufficient job in the future.

Figure 3. Population by age group.

Agricultural production

One of the objectives of population redistribution is to alleviate food shortages. To extend the cultivated land is one way to increase food production. In average, the production of major crops has increased. The cultivated land area has increased as well as food per capita. Although food per capita decreased to 239 kg/person in 1978 which is lower than World Health Organization (WHO) standard, 240 kg/person, an overall of food capita is above the WHO standard. It signifies that population redistribution program has helped increase productivity and alleviate food shortages problem of the country (fig. 4).

Agricultural production in the NEZS provinces increased in average. In the northern area, agricultural production increased more in average than in the southern area. It is because the northern part has been provided better water control systems and irrigation. The most successful province is Long An in which the production grew 63.4% from 433,300 tons in 1980 to 708,000 tons in 1986.

The industrial crops also increased during 1976-1984. During 1985-1990, the production of industrial crops fluctuated, some crops had higher yields while some had lower yields as a result of calamities. The higher production capacity of Vietnam has affected its export of agricultural products, especially in 1986, the amount of major crops increased sharply.

Figure 4. Food per capita in Vietnam.

The increasing volume of food production is partially caused by the population redistribution policy. It is interesting that agricultural production is increasing while food per capita does not highly increase. At the same time, Vietnam is the fourth largest rice exporter of the world and industrial crops also increased in the country's exportation.

Year	1980	1986	1988	1989
North				
Quang Ninh	79.0	125.1	129.6	139.7

Hoang Lien Son	222.1	248.8	267.8	281.9
Son La	147.3	150.9	164.7	168.9
Vinh Phu	286.5	385.9	416.9	432.9
Ha Tuyen	194.1	264.9	266.4	283.1
Bac Thai	161.0	228.0	217.7	249.9
Lai Chau	122.9	137.2	147.7	150.5
South				
Lam Dong	86.8	127.0	131.9	128.7
Kieng Giang	603.7	689.7	726.9	809.5
Song Be	91.2	166.1	158.9	146.8
Gia Lai Cong Tum	217.2	214.2	198.4	223.9
Long An	433.3	708.0	785.5	890.6
Minh Hai	688.7	671.2	707.4	829.4
Dong Nai	335.6	464.2	432.8	405.9
Dac Lac	144.7	202.6	232.2	244.2
Tay Ninh	242.7	239.3	249.9	239.5

Table 2 Production of food crops and food crops per capita by provinces in the NEZs
Source: Statistical Publishing House, 1991.

Urbanization

Urbanization accompanies modernization. The developed countries have passed through the urbanization transition whereas the developing countries still operate in different stages of urbanization. The Vietnamese government has attempted to decentralized development throughout the country. Population redistribution is one of the means to motivate people to create new urban areas besides Hanoi, Ho Chi Minh City, or Hai Phong, and reduce population in the big cities.

However, the urban population has increased each year since the end of World War II with annual average growth rate of 3.31%. The urban growth rate dropped during 1970-1980 as a result of the fear of the US bombing threats. Urban population is expected to increase in the next century. The unsuccessful creation of new urban centers is blamed on a lack of funds and inadequate infrastructure and facilities in the new settlements. The government emphasized increasing agricultural production and redistribution population, but did not develop sufficient infrastructures. The highly increasing urban growth rate is likely to occur in the future if the government cannot provide facilities and infrastructure in the NEZs. People who join population redistribution

policy may decide to go back to their former settlements instead.

Figure 5. Urban and Rural Growth Rates.

According to Drake, urbanization transition is created by two forces: rural to urban migration; and central city population growth. (Drake, 1994) Vietnam is in the early stage of this transition. The Vietnamese government is in a way to pass through the transition. The government has attempted to create new urban areas by using "pull" forces--jobs and allowances in mobilization--formed in the NEZs. The "push"--crowded community and unemployment--motivates people to move to different provinces. However, an increase of urban growth rate according to WRD's projection could be explained by the return of people to big cities or their homeland if new urban areas still lack of infrastructure and support from the government.

Forestry

According to MacAndrews, land settlement in Southeast Asia usually opens up and develops previously cultivated land. (MacAndrews, 1982) Likewise, during 1976-1979, 527,647 has. of virgin land in Vietnam was opened up and used in agricultural production for 436, 480 has. or 82% of the newly opened land. According to WRD, during 1981-1990, there was an annual -0.83% change in forest areas. In 1980, Vietnam had 10, 663, 000 has. of all forest and the extent decreased to 9,782, 000 in 1990. Although the new policies on land location and use are employed, it is effective in some areas. The yearly afforestation of 50, 000 to 100, 000 has. is inadequate in substituting 88, 100 has. of deforestation each year (WRD, 1995-96). Therefore, the NEZs partly has destroyed forests. An increasing population in newly settled areas causes higher consumption of fuelwood as the government does not provide sufficient infrastructure. According to figure 6, wood production has obviously increased, especially fuel wood and roundwood since 1961. Wood production is also expected to increase in near future.

Figure 6. Wood Production.

Comparison with Thailand

Overall, Vietnam's family planning programs and population redistribution are not totally successful. Thailand is one of many countries that have used both family planning and land resettlement policies. Thailand has been able to cope with high population growth. Its development level is not distant from Vietnam, including the size of

the country and population size. Thailand is a good case study in comparison with Vietnam in a discussion of population policy.

Thailand has also faced population problems. First, Thailand experienced rapid population growth since World War II. In 1958, the World Bank recommended the Thai government to control rapidly growing population which will obstruct a national economic growth. The government has employed family planning programs which has helped decrease the population growth rate from 3.2 in 1947 to 1.7 in the 1980s(Sternstein, 1976). The fertility rate also decreased from 6.62 in 1955 to 2.10 in 1995. (WRD, 1995-96) Secondly, Thailand adopted a land settlement policy in 1935 as a result of the government's regulation prohibiting trishaws in Bangkok. The government offered new settlements to trishaw drivers. After that, many programs were developed under various titles. From 1935 to 1980 at least 1.2 million people had been moved to the new settlements, opening up and developing previously uncultivated land. The objective was to raise the living standards of farmers and improve productivity.

Thailand's population policy has been successful in terms of population growth control. The government has put high priority for population control, including a significant allocation of funds. As for land resettlement, these have also been more successful than in Vietnam. It is explained that Vietnam's resettlement program is larger both in size of population and of newly settled areas. The common problems are inflexibility of policy and there is no long-range planning. Moreover, there was no careful planning, no initial site survey, no sufficient facilities and services. The staff was not well-trained for working in new settlements. However, Vietnam has been successful in creating new urban areas such as Haiphong, Da Nang, Da Lat and Nha Trang. In contrast, Bangkok still remains the most important and largest city of Thailand and center of the country.

Another problem that is more severe in Thailand than in Vietnam is deforestation. In the past, more than half of the country was forest. The forest extent of 18, 123, 000 has. in 1980 decreased to 13, 264, 000 has. in 1990 with -2.68% of annual change (WRD, 1995-96). Thailand consequently suffers more severe flooding every year. Thailand is able to cope with population growth and land resettlement is one of government's plan to conserve forests. However, the rate of deforestation is still increasing sharply since the 1960s until 1978 (fig. 7). It could be argued that Thailand passed through an "economic boom" which was fueled in part by a utilization of forests without adequate conservation. In regard to Vietnam, it has maintained family planning policies for more than 3 decades but could not control population growth. Although a rate of deforestation has not been as severe as in Thailand, Vietnam is currently going through economic boom as Thailand was. If Vietnam still cannot control population growth rate and population redistribution to new

land, it is possible that Vietnam is going to lose its valuable natural resources as higher increase of wood production previously presented. Afforestation should be seriously taken into consideration in environmental policy of Vietnam.

Figure 7. Forest and woodland in Thailand and Vietnam.

Policy suggestions and conclusion

According to the study of the population policy in Vietnam, the results are not completely satisfactory. However, population policy has begun many solutions for population problems. The government still maintains this policy. If the population keeps growing, I argue that family planning programs are important for Vietnam. Population redistribution policies should also be continued in order to reduce population density in some areas and equalize development throughout the country. These policies need adjustment to be more effective.

As for population policy, the Vietnamese government should focus on fund management. At present, it is known that Vietnam's economy has not in good condition. Foreign assistance is needed, and it is crucial that this fund is managed effectively. The second suggestion is cautious planning. In particular, the population redistribution program in the past was not successful because the people were sent to new settlements without sufficient support and planning from the government. The third suggestion is target setting. Both family planning programs and population redistribution target should be set by the real situation. It means that the government should take into consideration socio-economic factors, and the extent to which the government can support the programs. Previously, the government set too high of a target within a short period which was difficult to achieve if looking at the country's economy. The next suggestion is that infrastructure should be developed in new urban areas. At present, Vietnam still receives financial support from foreign sources, especially the World Bank, the Asian Development Bank, and Japan. Most of this aid is targeted for projects such as: rehabilitating highways, irrigation system, power development, water supply, port development, for present urban areas such as Hanoi, Ho Chi Minh City and Haiphong. Infrastructure development should be more focused on rural areas in the NEZs. This could help alleviate conflict between resident and new settlers. The ethnic minorities could change their attitude toward this population redistribution program and the settlers into positive way if facilities and infrastructure were created in their region. This also increase the likelihood for economic development in the NEZs. Apart from population policy implementation, a very important

policy to be included is forest conservation. Although the government has produced an outline of environmental policy but it has not been in use yet.

Population and socio-economic development are related to each other, in both positive and negative feedback cycles. Thus, to achieve national development goals, these two factors should be considered and implemented simultaneously. Vietnam is trying hard to go through this process. As for socio-economic development, Vietnam has better opportunities than other countries in the Indochinese region as an interesting spot for foreign investment. Foreign aid also helps support the country's socio-economic development. However, concerning population, it is an internal dilemma that Vietnam has to solve by itself.

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**POPULATION-ENVIRONMENT DYNAMICS:
TEN CASE STUDIES**

RELATIONSHIPS AMONG THE CHAPTERS

Kazuhiro Arai

What I have discussed in the paper is the history, the transition and the impact of the labor migration of Yemen. Yemen is a typical country whose economy depends on the remittances from workers living in foreign countries. This phenomenon has a close relationship with the issue of population and regional economy, as one of the reasons for the migration is demographic pressure and the lack of job opportunities. It is also related to the politics of the region. The large scale of labor migration and return migration may be caused by political transition to some extent. The return migration at the time of the Gulf Crisis is the typical example of how the politics influence the trend of labor migration. My discussion and suggestion is mainly in light of these factors.

Among the papers presented in the lecture, Kuramitsu's study is the most closely related to my topic. He examines the urbanization of the Middle East, and makes a model of the relationships between the percentage of each sector and population growth or urbanization. The result of the simulation is rather interesting: the number of the people in the service sector directly influences the fertility rate. According to the result, the increase of migrant laborers may cause the increase of fertility rate, as the workers returning from foreign countries tend to employ themselves in the service sector. This conclusion, however, must be evaluated very carefully because the result of Kuramitsu's study is probably the only one found in the world so far, and I did not study the direct relationship between the number of migrant laborers and that of people working in the service sector.

I did not suggest the model of the system of labor migration in my paper. I tried to make the model by using Stella. However, I finally gave up, because I could not find out the relationship among the factors which seem to be related to the transitions of labor migration. In other words, I could not explain those relationships by using equations. Some books show the model of labor migration, but without concrete data and thus without concrete relationships among the factors expressed by equations. The essence of the problem can be divided into two kinds. One is insufficient data. As I stated in the paper, the information on labor migration in the Middle East is very limited. Thus one cannot obtain the data enough to construct a model. However, this kind of problem is surmountable, if a large scale of census is conducted, and reliable data

is provided.

Another kind of problem is more problematic and seemingly insurmountable. As I stated in the paper, the trend of labor migration is influenced by the political situation of the region to large extent. First of all, the status of migrant workers depends on the policy of the receiving countries of the foreign workers. Although the receiving countries greatly depend on migrant laborers, these workers are not given any political power. Therefore the change of policy is made for the benefit of the receiving countries, though there are the negotiations between the sending countries and the receiving countries to some extent. Second, the political situation is still unstable in the Middle East. Nobody had predicted the Gulf Crisis in 1990 and the subsequent wave of return migration. This unpredictability is the essence of the problem of labor migration.

There are two opposing view on the function of the labor migration. One is that the migration functions as the safety valve for the economy of the sending countries of migrant workers. When those countries have surplus laborers, labor migration can relieve the problem of unemployment and economic stagnation. This is the case in former North Yemen, as the country somewhat encouraged the labor migration. This theory, however, can be applied to the countries which have enough laborers for development programs or industrialization. The other theory is that the labor migration hinders the development of the country. In former South Yemen, labor migration caused the shortage of workers needed for state development, and thus the country had to receive the foreign workers from the East African countries. As I discussed in the paper, the government of former South Yemen restricted the number of the migrant workers leaving the country from 1973. Even in North Yemen, the decline of agriculture caused by the shortage of labor force became one of the issues in the country. In my view, labor migration has negative effects on the sending countries in the long run. Because of the unpredictability of the transition, depending on the migrant workers makes the country's economy unstable, and vulnerable to the policy of the receiving countries.

Labor migration in the Middle East seems to be in the transition period now. Even if one excludes the influence of the Gulf Crisis, the boom of migration to the Gulf States was going to decline, and substantial number of workers had already returned to their home countries in the beginning of the 1990's. If the transition theory can be applied to this phenomenon, now is the middle of the transition from the state of heavy dependence on the remittances from the migrant workers to that of stable development and independent in terms of economy. Therefore now is the most dangerous and unstable period of the phenomenon. In the case of Yemen, the economy is in serious stagnation. The rate of inflation and unemployment is still high. These problems, according to the theory, will

be solved toward the completion of the development of the country. The economic condition may turn better in the future. However, it should not be the revival of the boom of labor migration. What is needed is the sustainable development of the country and the whole region.

Hideo Kuramitsu

Every student select a very interesting topic, and I learned a lot from each of them. First of all, I found that most of them focused on the country where they are from or are carrying researches in their major. That gives them do further researches in comparison with me, because they know how to get the information through various approaches. Of course, they are familiar with the geography as well as the history and the culture. It seems to me that they can answer questions persuasively in their presentation.

As for their researches, some of them used the economic transition by the distribution of Gross Domestic Product, which I also used in my research. Through their researches, I found that GDP per capita in developing countries has been decreased over time due to the population growth. This finding is the same as mine. One thing which I learned from them is that one of them used the political transition in order to know when rapid changes occurred in some categories such as the GDP trends and some agricultural factors. This transitional period gives us clear information why those things happened. Second, most of other students compare the categories among countries in the world. It is sure that such maps make us easily understood to what extent of the category in the country is situated in the world. Since I mainly focused on the relationship between the distribution of GDP and population factors in Egypt by using STELLA II, I can carry researches into further studies regarding my topic after the example of their maps comparing among the world.

Third, a couple of other students used STELLA II, modeling the situation which they are focusing on. Since I also made a model which makes it sure the relationship between the distribution of GDP per capita and population growth factors, their modeling interests me a lot. However, it seems to me that they met a difficult situation in making the model, because they have their own flows based on their assumptions. I also met a difficult situation in linking between the distribution of GDP per capita and population growth factors; however, I overcame this situation by using the results from multiple regression analysis. It seems that such a statistical analysis would be very useful to link different factors in modeling as well as to create some assumptions in the flow.

Finally, I feel a little regretful to focus on the effect of the GDP to the population growth due to time constraint. After the example of the researches by other students, my topic would go further, and their

approaches would bring about better relationships with other factors in the STELLA model. For example, relationships with other countries such as trade and migration can be or should be included into my model. I hope my research will be also useful for other students and will bring about better analysis regarding population growth in the near future.

Peter Murchie and Rebecca Spector

Many of the papers presented in this term's Population-Environment Dynamics course reflect transitions occurring across a number of sectors in countries across the world. The papers refer to transitions in demographics; political environments; economics; natural environments; agriculture; forestry; and others.

One unifying theme among many of the papers is that a lack of progressive policies intended to accurately respond to these transitions is evident in countries throughout the world. Our paper on organic produce consumption in the United States strongly suggests a lack of data, awareness, and hence effective agricultural policies at the national level. Such ignorance has resulted in the implementation of agricultural policies which discourage and dismantle small-scale and organic farming production and consumption.

Other papers also refer to similar deficiencies on the part of government and its ability to respond to population-environment transitions. For example, in Ecuador, the current transitions in deforestation are leading to unsuitable farming conditions; unsustainable rainforest practices; increased inefficiency and environmental degradation. This paper refers to the failure of the Ecuadorian government to provide an adequate infrastructure for these transitions. The result is that impacts on indigenous people and the environment are ignored. Other papers referring to rapid urbanization trends in Thailand, Egypt and Korea indicate extreme transitions, such as movements away from agriculture toward industry. These papers also reflect a lack of governmental recognition of the potential impacts of these transitions, as well as a lack of proper governmental research and support. Papers on the water crisis in the Middle East also refer to a lack of effective political support and policy intervention in dealing with these tremendous transitions.

As evidenced by all the papers presented in this course, there are a number of important transitions occurring across the world that are affecting people and the natural environment. A better understanding of these transitions will hopefully lead to appropriate policies that will result in smoother transitions that have minimal effects on populations and the environment.

Tamana Nishiguchi

Since the concern of my paper is the impact of policy

on the agricultural transformation in Burma, I will indicate the agriculture in relation with the population in Burma and Vietnam, which Luejit Tinpanga described. Policy-makers in the governments of both Burma and Vietnam had carried out inward-looking, seclusive national policies. Thus there will be some similarities.

Geographically, Burma possesses twice as large an area as Vietnam, (676,577 sq. km. in Burma against 331,700 sq. km. in Vietnam). However, as can be seen in FIGURE #1, the total population of Vietnam exceed twice over that of Burma. Despite of the two restrict population policies, the growth rate has still risen sharply upward. On the other hand, the growth rate of Burma demonstrates moderate growth without any population policies. Considering land area and the upward tendency of population, Vietnam has the potential to suffer from population pressure in the near future.

Total Population. Burma and Vietnam.

Source: World Resource Database

The economy of Vietnam, similar to Burma, is dominated by agriculture, which provide sixty-five percent of employment and shares about thirty percent of Gross Domestic Products. Unlike Burma, however, Vietnam has occasionally experienced severe food shortages, especially in the South, since World War II. Since 1961, the Vietnamese government has introduced Population Redistribution Policies, aiming at mobilizing the population by allocating people for the industrial sector and for the agricultural sector. This mobilization was one of the contributors to the alleviation of food shortages through the input of labor force into the agricultural sector. However, a set of these population redistribution policies also caused the natural disasters due to a lack of capital and inappropriate frameworks.

The similarities in the features of both governments seem to imply that a set of policies is inefficient. These polices resulted in worsening the existing serious problems rather than benefiting the populace. Although Burma and Vietnam have suffered from lack of donor country assistance and many inherited constraints, it is necessary to emphasize an 'efficient' allocation of human and natural resources to alleviate poverty.

Rasolofoson Allain J.

Population growth is evidently underlying several situations we can nowadays encounter on our planet. This point appears to be the main

link between the different projects which are presented in the class for Population-Environment Dynamics (NRE 545/EIH 575) during the Fall Semester 1996. In fact, many countries, mainly those in the Third World, are actually in their early demographic transition after having experienced an epidemiological transition sometimes during the last century.

In my own project about the Case of Deforestation in Madagascar, although it is worth to be considered, population growth is still a secondary element since the density is relatively low in several regions of the country. However, the same strong attraction towards the bigger cities we can observe in the modern society has just started an urban transition in the 1980s, desarticulating the economy traditionally based on agriculture. On this matter, when presenting the Urbanization in Egypt, Hideo Kuramitsu mentioned the International Conference on the Habitat whose goal has been to prepare the global community to an urbanized life when facing the resulting deteriorating living environment. The policy of Population Redistribution through the creation of New Economic Zones, as applied in Viet-Nam (Luejit Tinpanga), cannot be implemented in Madagascar because of the attachment of the Malagasy people to traditional values and kinship; the land on which a family has been living is most of the times an ancestral legacy that she cannot easily depart from. Moreover, a passive resistance against the governing authorities has been expressed through the History into reticence to new technology or other innovative techniques, hindering any modern improvement such as the Green Revolution which was introduced in Burma (Tamana Nishiguchi). Nethertheless, the southern Malagasy tribes have the propensity to migrate internally, driven by sporadic financial needs and always to come back their homelands after a period of absence. Such movement has the same motivation as the labor migration in South Yemen (Kazuhiro Arai).

The alarming deforestation of Madagascar has not followed a rational process as it might be found elsewhere. For instance, the Ecuadorian forests (Julie Rodriguez) are depleted mostly because of a need of space for modern structures such as fuel oil exploitation, urban areas, or other communication structures. In Viet-Nam, it results from the population pressure as well as from an internal economic policy which lessens agricultural activities in favor of industriali- zation. For Madagascar, it has a remote origin in the country's history and a relatively long process of social behavior change needs to be adjusted with a required rapid intervention.

Julie Rodriguez

It was amazing to see the commonalities among the various projects this semester. What seemed to be incredibly diverging topics in the beginning, boiled down to a few underlying themes and challenges. This illustrates the real value in studying other regions, cultures, environments to develop better strategies on the home front. The themes

that emerged from the projects, in relation to my study of Ecuador, all evolved around the challenge of providing for a growing population when financial resources and natural resources are limited.

In several countries discussed governments have attempted to redistribute their populations for a variety of purposes. Security was one purpose. For example, Lipchin discussed the attempts of Iraq and Israel to populate regions with particular ethnic groups to maintain political power. This is similar to Ecuador's attempt to populate the Amazon to keep Peruvians from infringing on Ecuador's border.

Pressure on urban centers was another reason for population redistribution. Tinpanga discussed the relocation of populations in Vietnam to reduce the pressure on urban centers and to encourage the poor to cultivate "unproductive" lands. Governments seem to ignore the impacts that this redistribution will have on the local indigenous populations and the environment. In addition, infrastructure is often inadequate or completely lacking. Sasaki pointed out the opposite problem in Thailand where populations were migrating from rural areas to the cities. Kuramitsu discussed a similar situation in Egypt's cities. Thus, the urban environment cannot support its new inhabitants because the infrastructure, such as sewer and sanitation facilities, is grossly inadequate.

Another challenge observed is inefficient use of resources. For example, Smith discussed the use of large amounts of water wasted farming regions of the desert in Egypt. This is partly due to resistance to change and failure to update to newer, more efficient methods and technologies. In Ecuador, similar challenges arose in the area of agriculture; improved farming methods would preserve the soil and perhaps much of the rainforest. Nisiguchi raised the issue of alienability of land in terms of land use efficiency. As in Ecuador, laws that make title difficult to obtain discourage investment in and preservation of land; consequently, land is used inefficiently. Murchie and Spector offered an attractive and realistic approach to agricultural reform that could help increase resource efficiency and help alleviate some of the difficulties being experienced in the countries of this monograph. Organic farming helps protect our health, our environment, and our resources.

Of course the projects also manifested appreciable differences among the regions studied. These differences do not mean that information cannot be transferred. It merely means that the information must be molded for situation at hand. Incidentally, the differences allow for more experimentation and creativity that can lead to better solutions in the long run. Overall, there is a need to address the population and its needs on a more holistic level that considers social, economic, and ecological impacts. In the past, reforms have frequently been too narrowly focused and too short-term oriented. Indeed, these are grand

plans, but sensible goals.

Hitomi Sasaki

By 2020, the ASEAN regional will have moved to become one of the largest and most prosperous of the Asian trading blocs. During much of the period after 1995, the growth of GDP for the original six members - Indonesia, Thailand, Malaysia, Singapore, Burunei Darussalam and the Philippines - have continued at between four and seven per cent per year. For three additional members - Laos, Cambodia and Vietnam - rates of GDP growth have been lower but will begin to accelerate in the period after 2010 to catch up to the original ASEAN six. As the region benefitted from the opening up of the world trading system, from a less-regulated global financial environment and particularly from the growth in Southeast Asian demand, the nine ASEAN countries will exhibit rapid growth and become a free trading bloc with a population of close to 690 million.

Therefore, it is favorable to consider the policy to sustain the development in Southeast Asia, which stimulates economies with narrowing the regional imbalance within each country. According to the Population Policy and Socio-Economic Development Plan in Vietnam by Leujit Tinpanga, Vietnam faces same problems as Thailand in terms of the centralization of population in urban areas. Even though the urban population growth rate in Vietnam have dropped during 1970-1980, the urban population has increased each year since the end of World War 2 with annual average growth rate of 3.31 per cent. If making comparison with Thailand's annual growth rate of 2.8 per cent, the population concentration is more serious problem in Vietnam than in Thailand. In her paper, there is no clear comment in regards to the problems caused by urbanization transition, however, it is obvious that Vietnam will follow the same step as that of Thailand if there is no effective policies in early stage.

Thailand has expanded its economies after bringing the direct foreign investments since 1986, which stimulated the urbanization transition to Bangkok. If Vietnam starts to receive such foreign aids especially targeting the industry and service sectors, the urban centralization will be inevitable. Vietnamese government may have succeeded in terms of family planning and population distribution, however, it is crucial to enhance the regional development plan/policy to encourage the development of rural areas. From this perspective, the government should refer to the National Economical Social Development Plan or Metropolitan Regional Structural Plan in Thailand to avoid the serious population concentration beforehand.

The ability of ASEAN may largely depend on the extent of the success of all the governments, working with the world business community and international aid in regards to not only to retain its current position as one of the world's fastest growing regional economies but also to continue improving the quality of life for its citizen. From this

point of view, both Thailand and Vietnam will be coping with urban problems while taking advantage of the positive features of urban regions. This will require new approaches, new policies and new administrative governmental arrangements.

Julie Smith

The Nile River Basin is one distinct geographical unit containing nine separate countries which share a common river resource and face several common difficulties. As I wrote my Nile project I focused on this region as a singular area that faced rather unique problems and needed narrowly directed solutions. But while I listened to the project presentations of other colleagues I began to see that the Nile region is not unique. Many economies and regions have limited resources and many other pressing priorities that restrain the development of wise resource practices. The similarities between different regions of the world and the problems they face are astounding.

Most projects examined the relationship between human society and the environment using concepts of transition theory. Transition theory states that a society moves through periods of rapid change followed by periods of relative stability; it provides one way of thinking about the complex dynamic that exists between populations and their environments. Societies may move through many separate but related transitions at one time. Although the regions studied for our projects spanned the globe, several commonalities exist among all, most of which are transitions.

The overriding similarity is population growth, or the demographic transition, which generally appeared to drive the other transitions. From the Nile region in East Africa to Ecuador to Southeast Asia rapidly increasing populations are putting pressure on natural resources. The demographics of many countries are rapidly changing as well. Shifts from rural to urban areas and from agriculture to industry are occurring around the globe: these changes represent urbanization and agricultural transitions. The agricultural transition is the next most prevalent commonality between the different studies. As population increases, the need to provide more food also grows. Many countries are facing agronomic problems which are worsened by inefficient practices and lack of proper technology, as is the case in the Nile Basin. Finally, the trend toward urbanization pushes many transitions, such as forestry, epidemiology, and energy, forward. As more people move into urban areas, population density increases, the need for goods and services increases, and in turn so does the pressure on resources like water and forests.

Some of the other common themes I recognized included: political instability and lack of appropriate governmental leadership to move countries out of negative situations and into more stable ones; lack of education and proper training to help many poverty stricken people improve their livelihoods; international debts caused by unsound economic policies

and practices and narrow views toward interactions with other countries or regions. The importance of global factors in the analyses of transitions was downplayed by administrations in many regions.

Most encouraging, however, was that many projects focused on policies and ideas which could help reverse or slow current and potential negative trends caused by many concurrent transitions. Looking beyond one's own borders for help in solving problems was a common theme. The international community and international policy will play an increasingly greater role for many nations as the push for a global economy increases. The challenge is to create policy that is effective in bringing about positive change, remembering that policies enacted in any one region impact other regions. Nations around the globe must begin to view themselves not as sovereign and distinct entities, but instead as parts of a whole, working together for mutual benefit. Many countries need to look and think beyond themselves when addressing social, political, and environmental problems. Because most nations have limited resources, pooling their assets and working toward cooperative agreements could help solve problems both within and transcending national boundaries. This is true for the Nile basin states and was also implied for many other regions in the projects.

Although many problems were identified in the studies presented, the problems are not insurmountable -- individuals and creative ideas can make a difference in our world. Our class represented a microcosm of the global community, just as the regions we studied do, and it was great to hear innovative ideas for mitigating problems found across the planet.

Luejit Tinpanga

My project is about population policy and socio-economic development in Vietnam. The context of my paper includes an overview of population situation in Vietnam which links to Vietnamese leaders' policy making. Apart from demographic impact, urbanization is a sector that I believe it has been affected by population growth and high population density. This part can be related to Sasaki's project which is a case study of urbanization transitions and its impact in Thailand. Sasaki's project illustrates Bangkok as a primate city, the only large city in Thailand as mentioned in section of Characteristics of Urbanization in Thailand. Tourism industry, the Vietnam War, and better education have brought people to seek their better condition of living and opportunities in Bangkok. In case of Vietnam, apart from Hanoi, Vietnam has Ho Chi Minh City as Southern center. However, majority of population resides in these cities together with high population growth rate cause socio-economic problems. Sasaki's project and mine show both Thai and Vietnamese governments' attempt to solve these problems and improve socio-economic conditions. The Thai government has adopted the National Economic Social Development Plans to guide the way to achieve

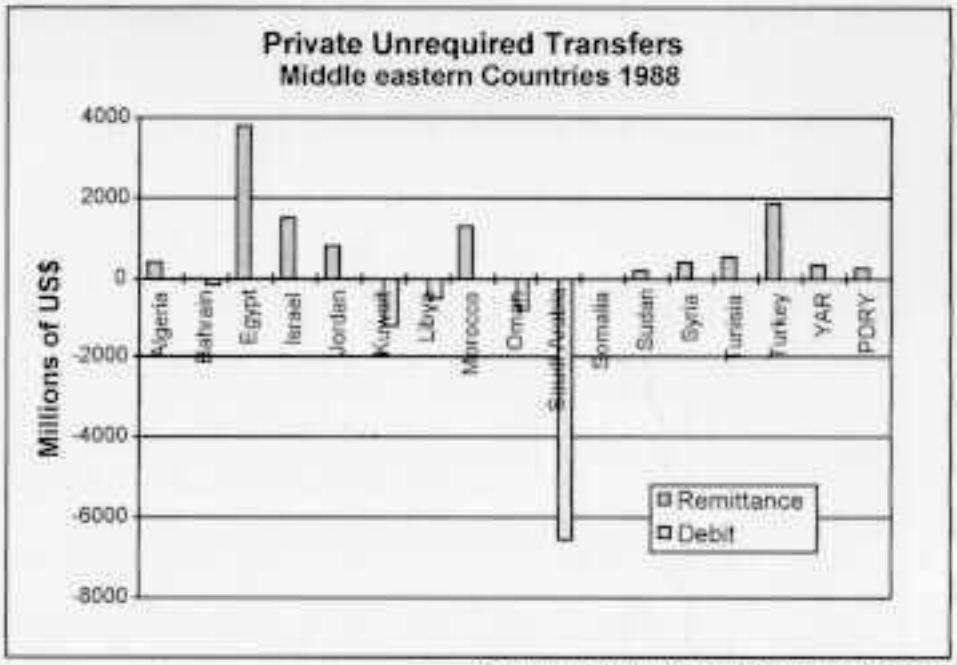
socio-economic development including population growth control. The Eastern Seaboard Project and Metropolitan Regional Structural Plan are also the Thai government's intention to distribute population to suburban regions and reduce population in Bangkok Metropolitan area. Similarly, the Vietnamese government has employed family planning programs in order to reduce population growth and population redistribution policy to reduce high population density in deltaic plains. This also implies the importance of the government in managing the country's population policy and socio-economic development direction no matter what ruling system that country has.

Table 1 Private Unrequired Transfers (millions of US$)
Selected Middle Eastern Countries, 1973-93

	1973	1974	1975	1976	1977	1978	1979
Bahrain	---	---	-76.4	-84.9	-101.1	-131.1	-93.5
Kuwait	---	---	-276.0	-315.0	-370.0	-433.0	-532.0
Libya	-273.0	-350.0	-260.0	-257.0	-858.0	-972.0	-859.0
Oman	---	-111.0	-208.0	-220.0	-222.0	-212.0	-249.0
Saudi Arabia	-391.0	-518.0	-554.0	-989.0	-1506.0	-2844.0	-3764.0
Algeria	337.0	319.0	355.0	386.0	278.0	295.0	313.0
Egypt	123.0	310.0	455.0	842.0	988.0	1824.0	2269.0
Jordan	55.4	82.0	172.0	401.8	420.8	468.0	509.0
Morocco	211.0	299.0	482.0	499.0	546.0	702.0	891.0
Sudan	6.3	4.9	1.5	36.8	37.0	66.1	115.7
Syria	37.0	44.0	52.0	53.0	93.0	636.0	901.0
Tunisia	91.0	106.0	131.0	128.0	152.0	204.0	271.0
Turkey	1234.0	1466.0	1398.0	1104.0	1068.0	1086.0	1799.0
YAR	---	135.5	270.2	675.9	987.1	910.1	936.8
PDRY	32.9	42.8	58.8	119.3	190.8	258.8	317.0
	1980	1981	1982	1983	1984	1985	1986
Bahrain	-93.4	-106.6	-117.6	-102.1	-125.5	-234.8	-264.6
Kuwait	-692.0	-689.0	-875.0	-865.0	-963.0	-1044.0	-1084.0
Libya	-1089.0	-1570.0	-1597.0	-2045.0	-1240.0	-859.0	-522.0
Oman	-362.0	-460.0	-556.0	-695.0	-819.0	-906.0	-846.0
Saudi Arabia	-4094.0	-5348.0	-5347.0	-5236.0	-5284.0	-5199.0	-4804.0
Algeria	277.0	304.0	347.0	237.0	186.0	367.0	765.0
Egypt	2791.0	2230.0	2481.0	3688.0	3981.0	3216.0	2515.0
Jordan	666.5	921.9	932.9	923.9	1028.1	846.2	984.4
Morocco	1004.0	988.0	840.0	888.0	847.0	965.0	1394.0
Sudan	209.0	322.7	107.1	245.8	276.8	248.6	89.3
Syria	774.0	436.0	411.0	387.0	321.0	350.0	323.0
Tunisia	301.0	331.0	361.0	346.0	304.0	259.0	354.0
Turkey	2153.0	2559.0	2189.0	1549.0	1885.0	1762.0	1703.0
YAR	1069.5	777.4	911.4	1084.3	995.5	763.2	527.4
PDRY	347.7	404.5	469.9	486.4	499.4	425.6	292.4
	1987	1988	1989	1990	1991	1992	1993
Bahrain	-243.6	-193.1	-198.9	-272.3	-303.5	-270.7	---
Kuwait	-1102.0	-1179.0	-1283.0	-770.0	-503.0	-870.0	---
Libya	-508.0	-497.0	-472.0	-446.0	---	---	---
Oman	-702.0	-762.0	-791.0	-817.0	-871.0	-1118.0	---
Saudi Arabia	-4935.0	-6510.0	-8542.0	-11236.0	-13746.0	-12700.0	---
Algeria	522.0	385.0	535.0	332.0	239.0	---	---
Egypt	3604.0	3770.0	3293.0	4284.0	4054.0	6104.0	---
Jordan	742.9	799.8	565.4	457.4	408.1	781.3	---
Morocco	1579.0	1303.0	1356.0	2012.0	2013.0	2179.0	---
Sudan	133.7	216.3	412.4	59.8	45.2	123.7	---
Syria	334.0	360.0	430.0	385.0	350.0	550.0	---
Tunisia	481.0	548.0	485.0	594.0	578.0	574.0	---
Turkey	2066.0	1827.0	3135.0	3349.0	2854.0	3147.0	3035.0
Yemen	1010.3	566.5	414.0	977.0	340.0	125.0	---

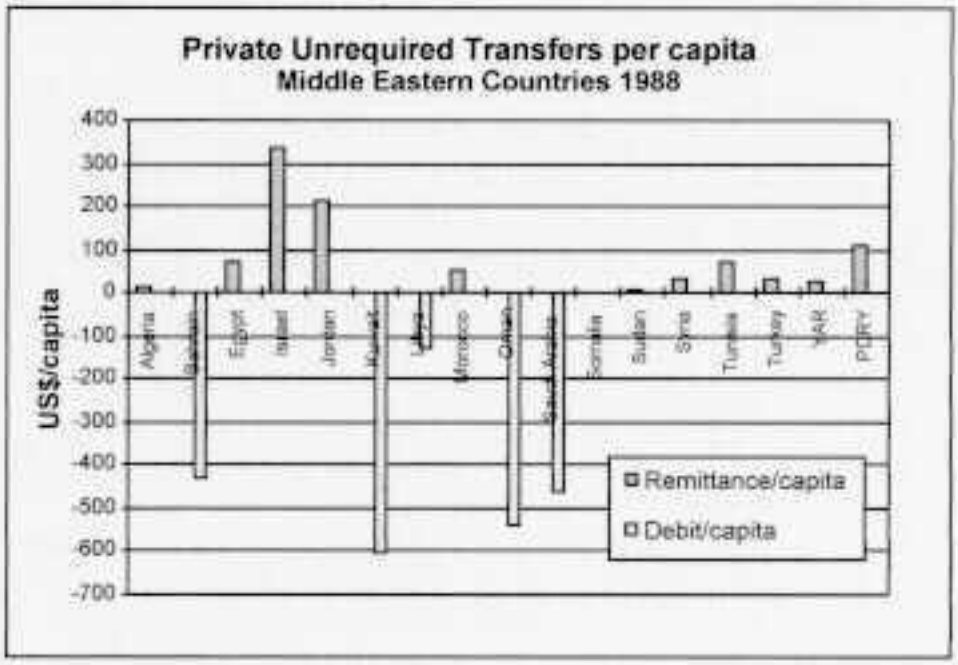
Sources: International Financial Statistics Yearbook (various years)

Figure 1



Source: International Financial Statistics Yearbook 1994

Figure 2

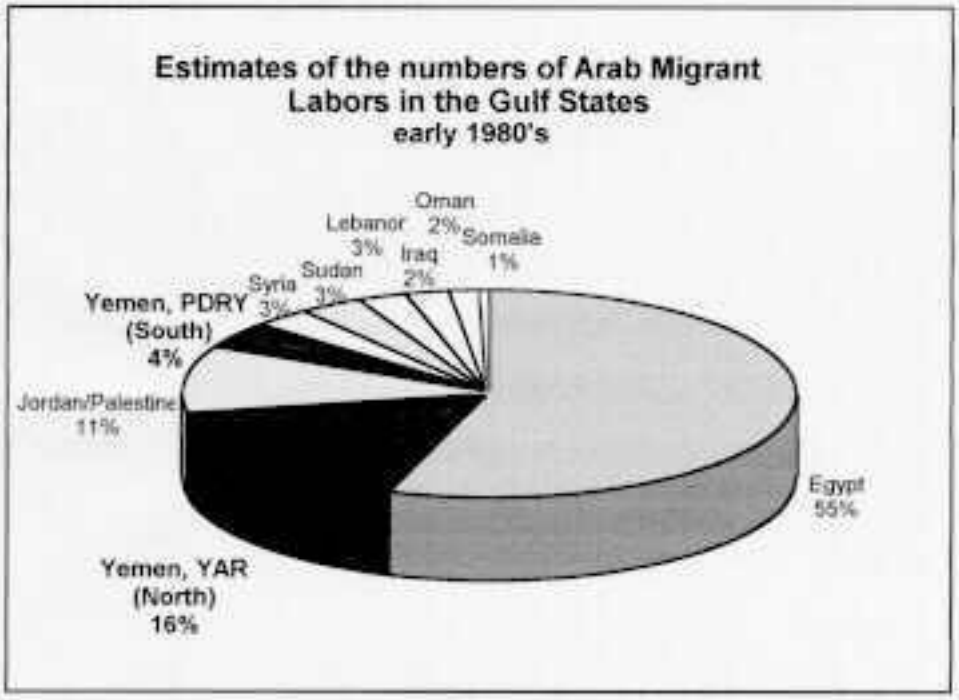


Source: International Financial Statistics Yearbook 1994

TABLE 2 Estimates of the Numbers of Arab Migrant Workers in Saudi Arabia and the Gulf States Early 1980's

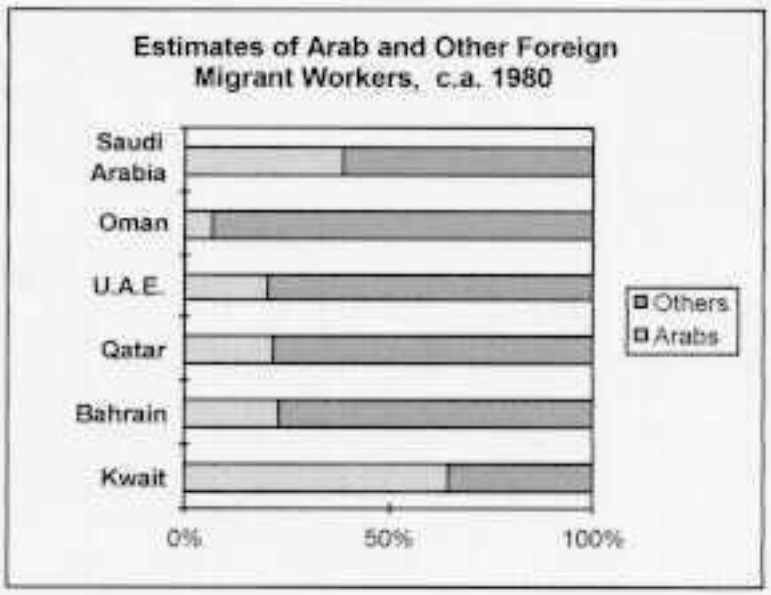
Country of Origin	At work in Saudi Arabia	Total in 6 Gulf States
Egypt	800,000	1,150,000
Yemen, YAR (North)	325,000	336,145
Jordan/Palestine	140,000	227,850
Yemen, PDRY (South)	65,000	83,845
Syria	24,600	67,150
Sudan	55,600	65,470
Lebanon	33,200	54,850
Iraq	3,250	44,760
Oman	10,000	33,450
Somalia	8,300	12,200
Tunisia/Morocco	500	920
Total	1,456,500	2,076,640

Figure 3



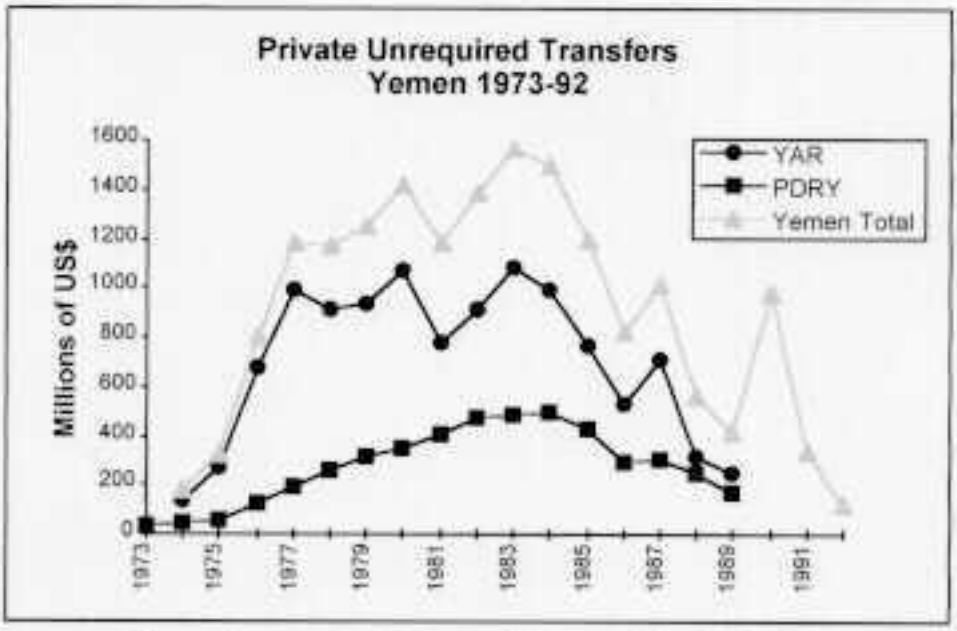
Source: Migrant Workers in the Gulf

Figure 4



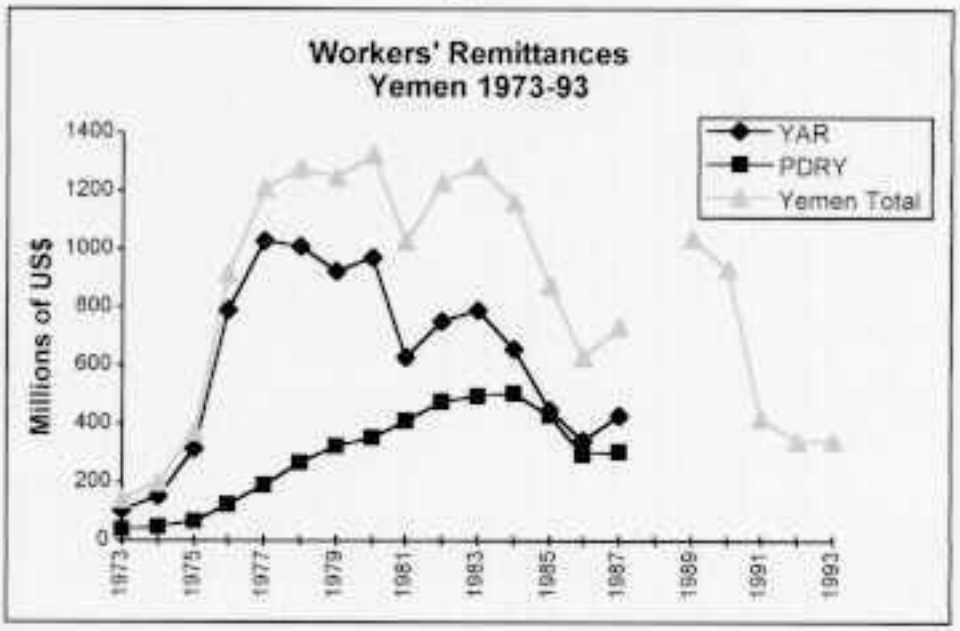
Source: Migrant Workers in the Gulf

Figure 5



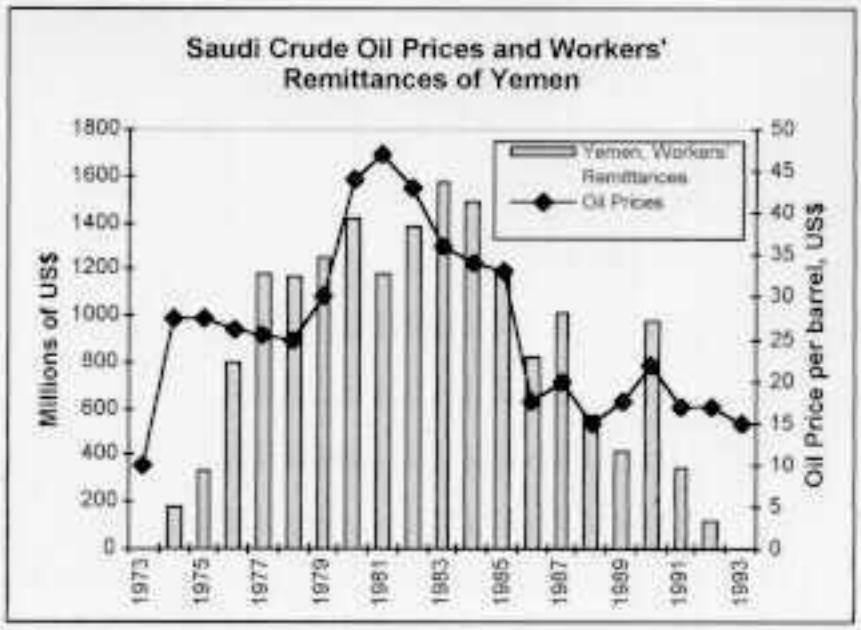
Source: International Financial Statistics Yearbook (various years), IMF

Figure 6



Source: World Table 1988-89, 1995, World Bank

Figure 7



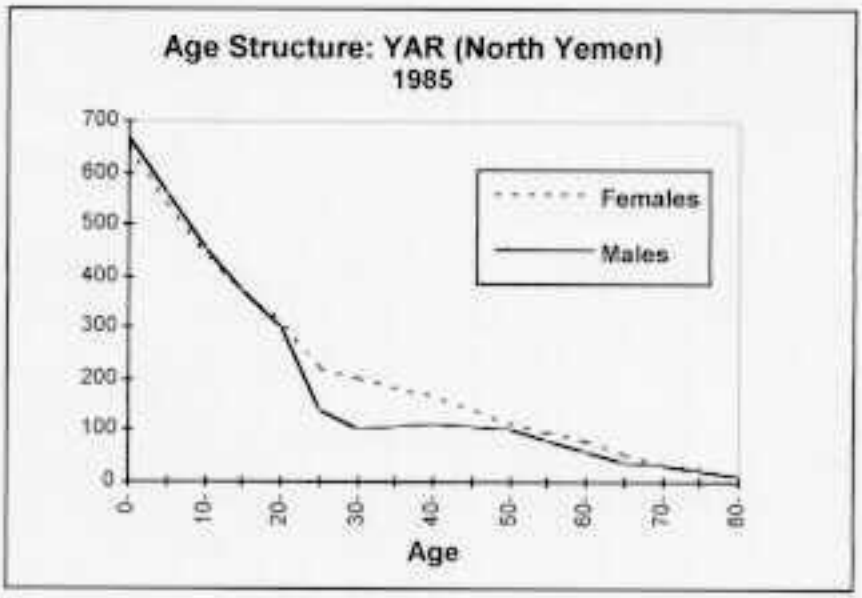
Source: OPEC Annual Statistical Bulletin 1993

TABLE 3 Occupations of Returnees
Al-Hujariyya Region, North Yemen, 1989

Occupations	Premigration	Migration period	Postmigration
Butchers	0.6	1.1	0.8
Carpenters	2.8	3.4	2.0
Clerical employees	6.5	13.6	7.4
Construction workers	13.6	22.7	11.3
Cooks	4.8	6.5	2.5
Drivers	7.6	6.2	3.7
Electricians	0.8	1.4	1.1
Farmers	20.4	0.0	10.2
Managers	0.6	1.4	0.3
Mechanics	1.1	2.3	1.4
Retired	0.0	0.0	7.6
Seamen	0.0	1.7	0.0
Self employed	3.1	2.8	18.1
Students	10.8	0.0	0.3
Tailors	1.7	4.5	2.0
Traders	7.4	9.9	5.1
Unskilled laborers	11.6	17.8	13.9
Unemployed	2.5	0.0	7.6
Visitors	0.0	0.0	1.0
Miscellaneous	4.0	4.7	3.7
Total	100.0	100.0	100.0

Sources: Homeward Bound: Yemeni Return Migration, Colton, 1989

Figure 8



Sources: World Population Growth and Aging

Figure 9

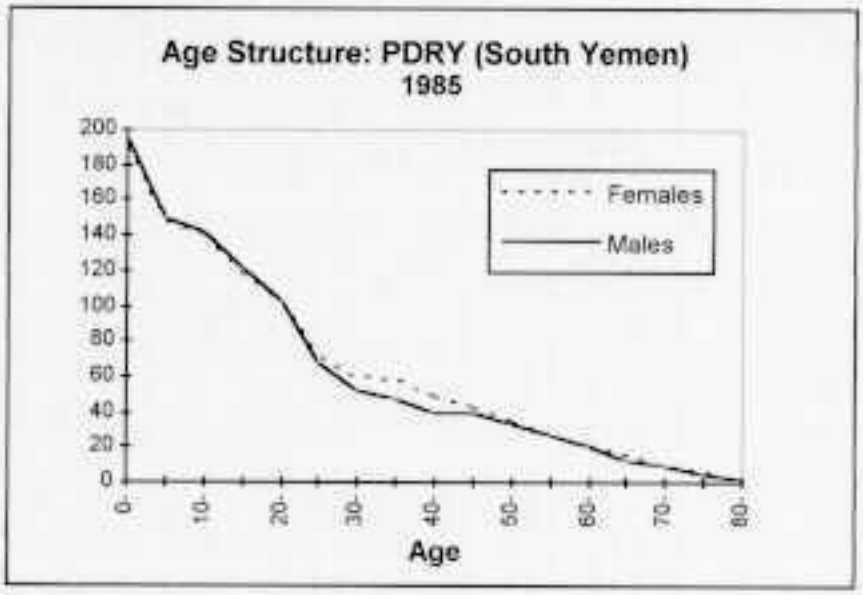
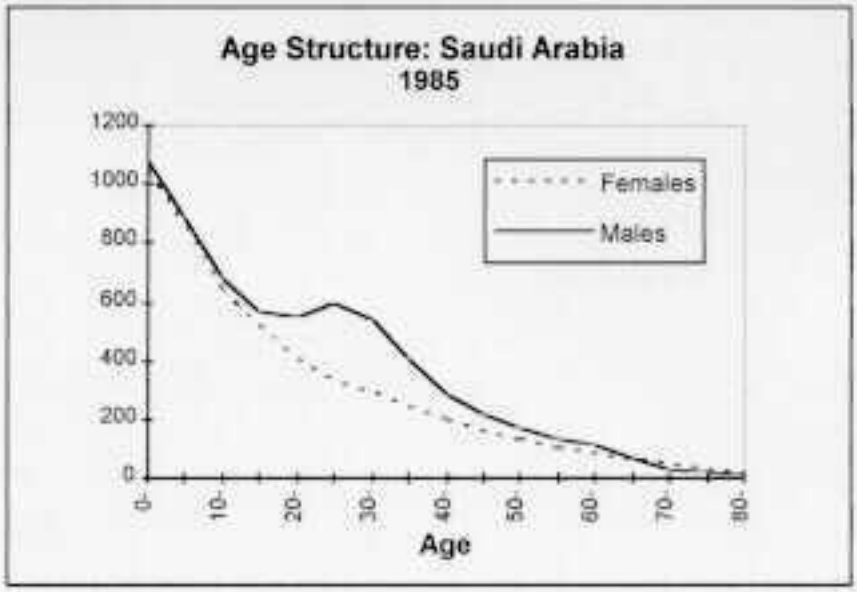


Figure 10



Sources: World Population Growth and Aging

Figure 11

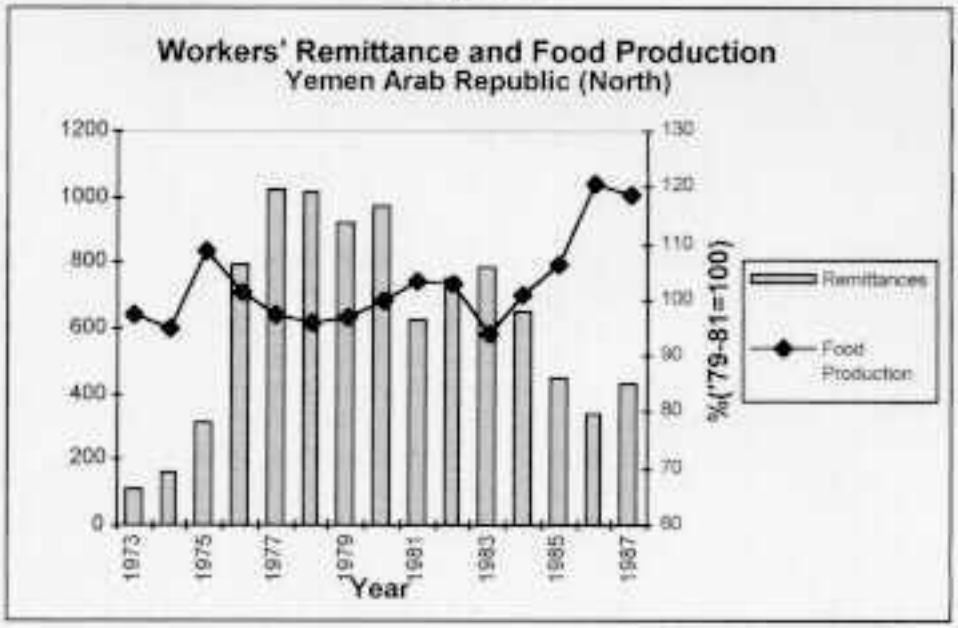
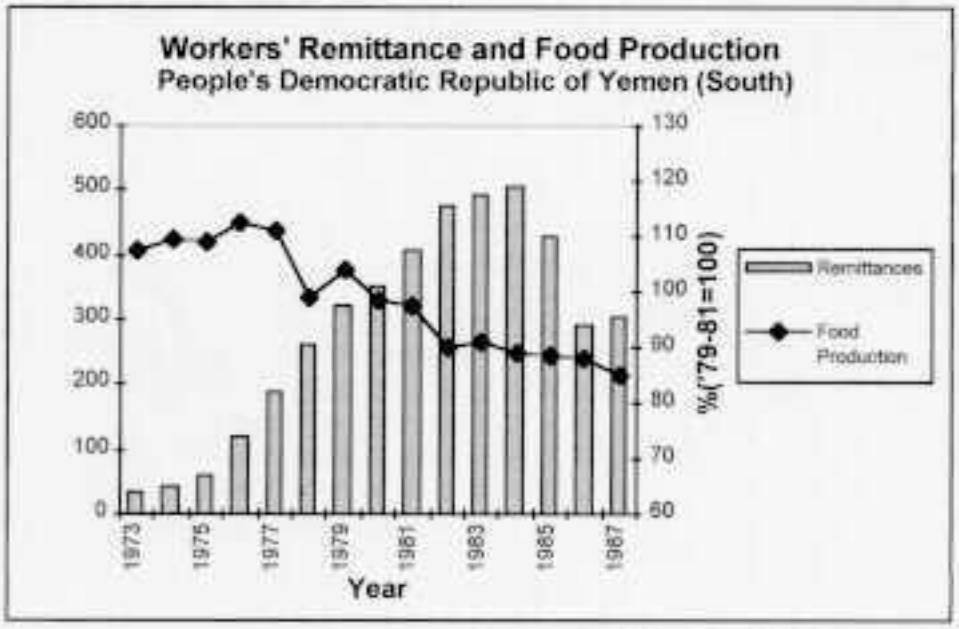
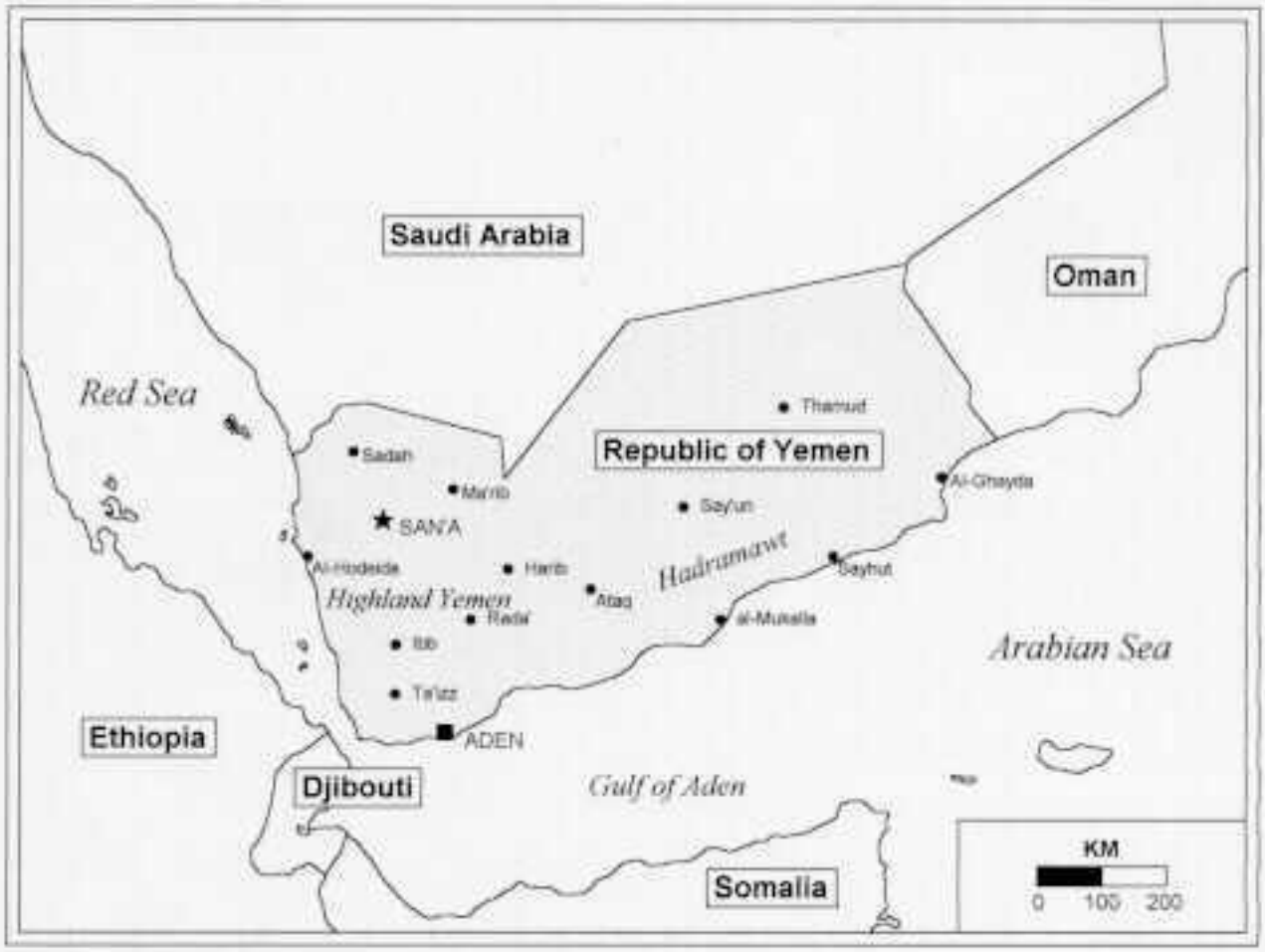


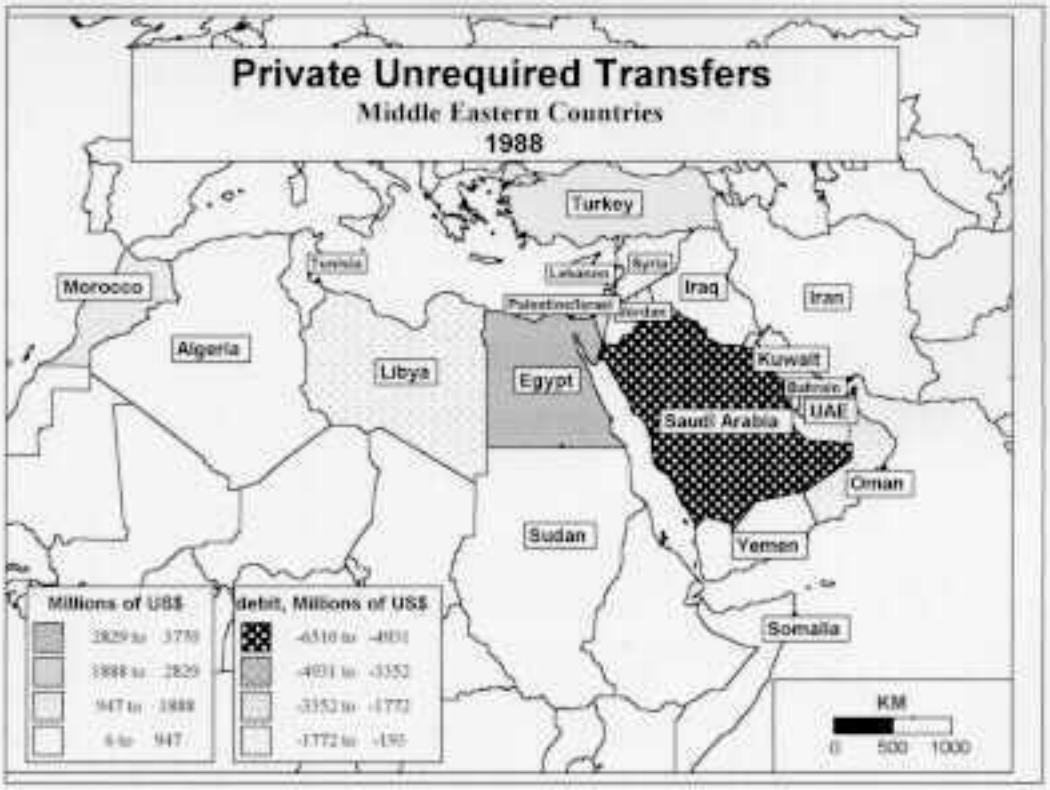
Figure 12

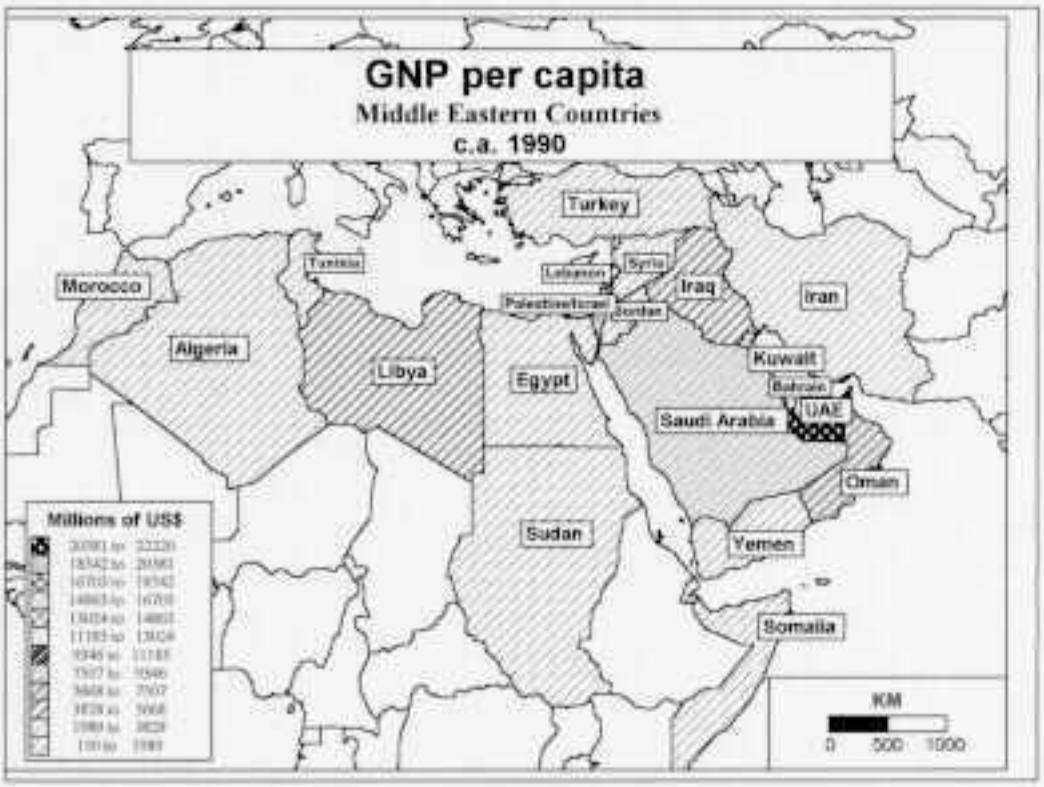


Source: World Table 1988-89, 1995, World Bank

Maps:


Saudi Arabia
Oman
Red Sea
Thamud
Republic of Yemen
Sadah
Marib
Al-Ghayda
Say'un
SANA
Al-Hodeida
Hamb
Hadramawt
Seyhut
Highland Yemen
Radd
Ataq
al-Mukalla
Ibb
Arabian Sea
Ta'izz
ADEN
Ethiopia
Djibouti
Gulf of Aden
Somalia
KM
0 100 200


Private Unrequired Transfers
Middle Eastern Countries
1988
Turkey
Tunisia
Lebanon
Syria
Iraq
Iran
Morocco
Palestine/Israel
Jordan
Algeria
Libya
Egypt
Kuwait
Bahrain
UAE
Saudi Arabia
Oman
Sudan
Yemen
Somalia
Millions of US$
debit, Millions of US$
KM
0 500 1000


GNP per capita
Middle Eastern Countries
c.a. 1990
Turkey
Tunisia
Lebanon
Syria
Iraq
Iran
Morocco
Palestine/Israel
Jordan
Algeria
Libya
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Kuwait
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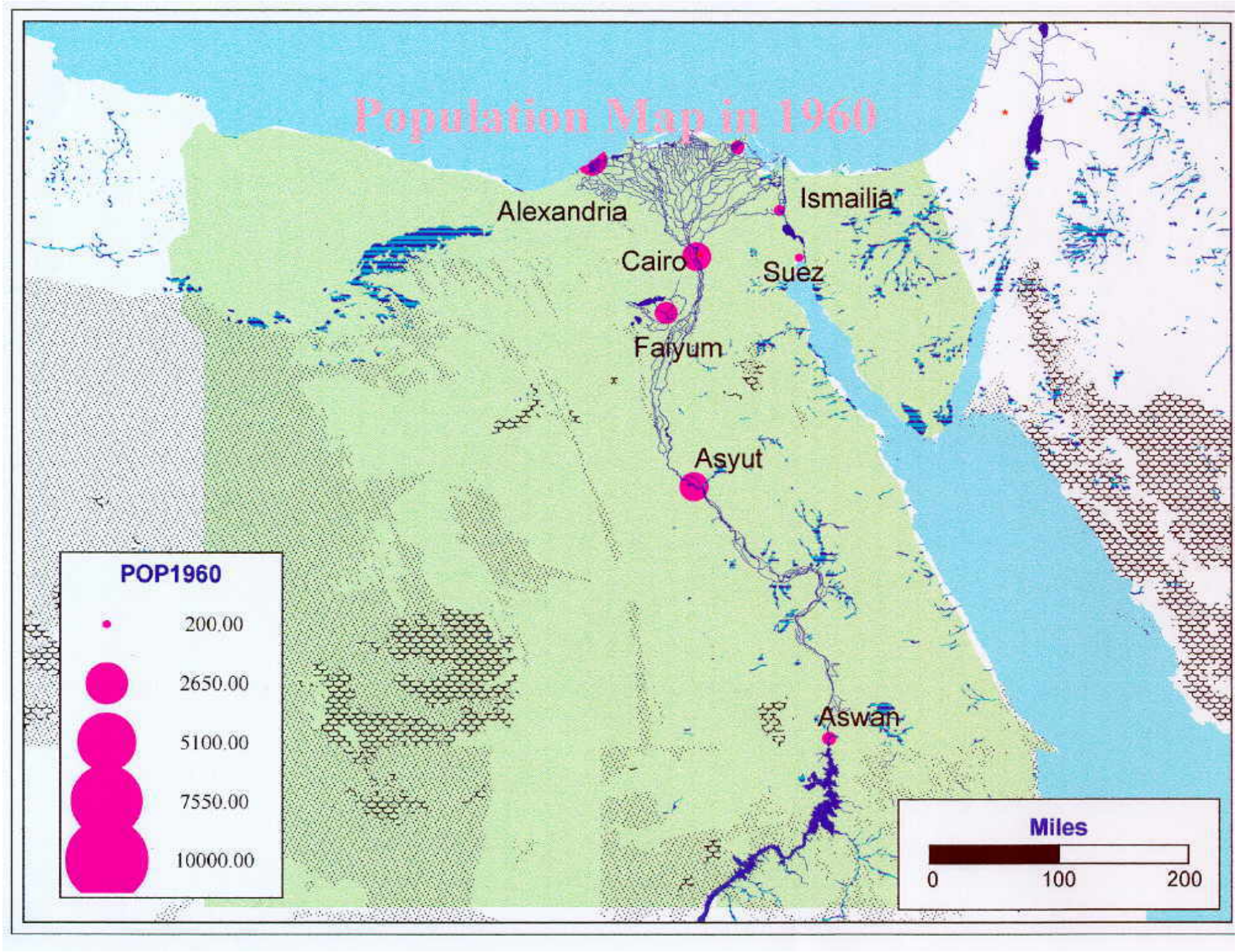
Sudan
Yemen
Somalia
Millions of US$
KM
0 500 1000


Population Map in 1960
Alexandria
Ismailia
Cairo
Suez
Faiyum
Asyut
Aswan
POP1960
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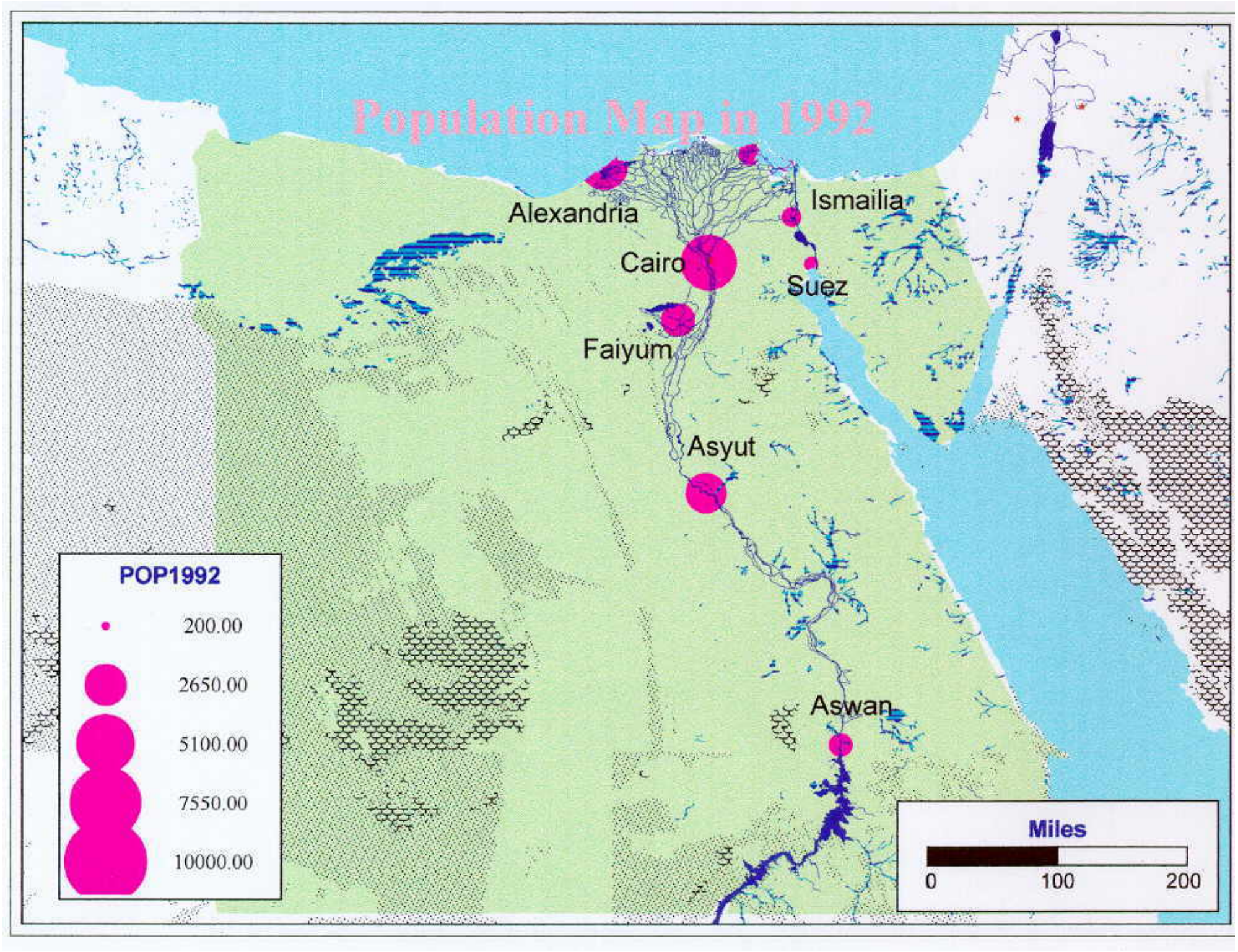
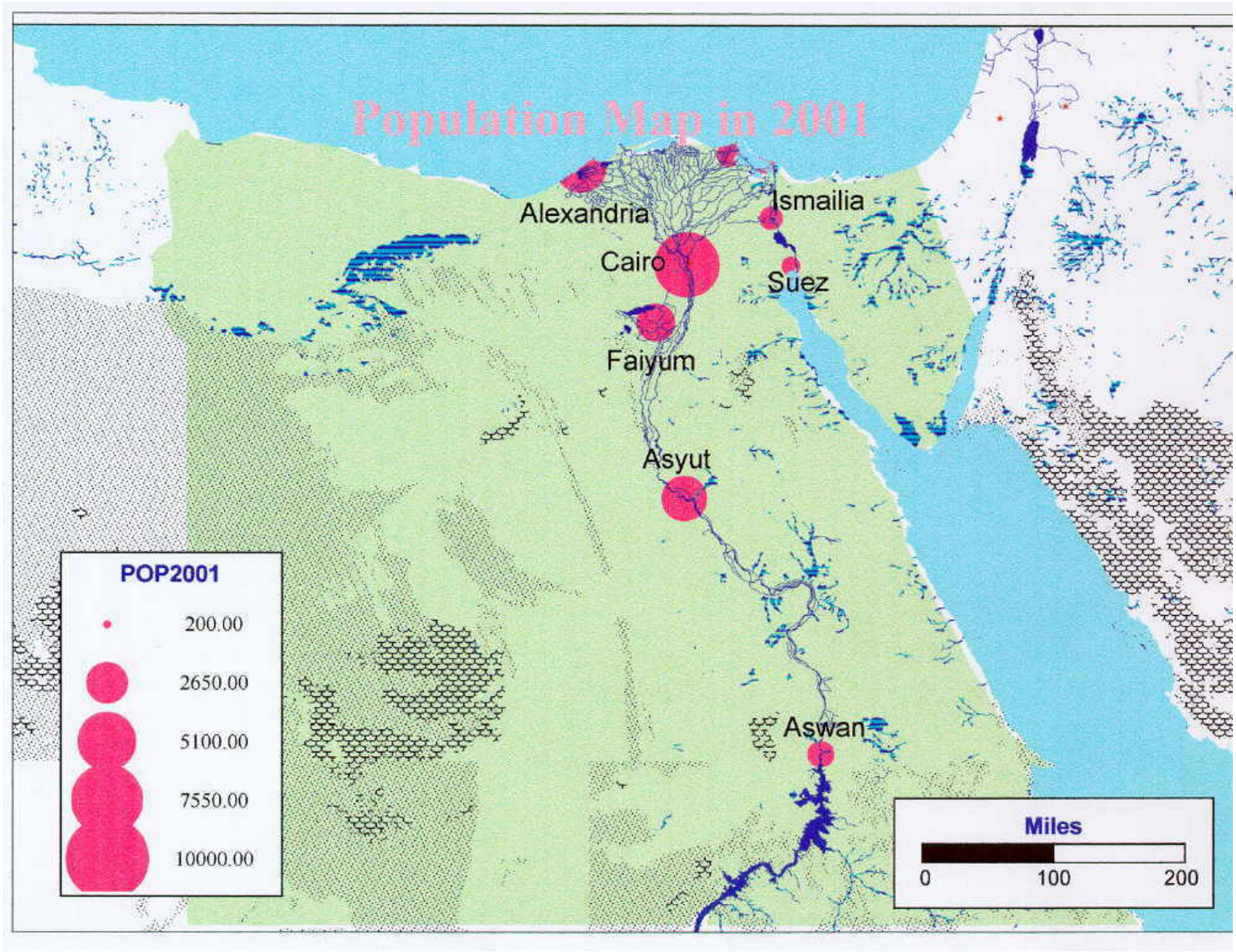
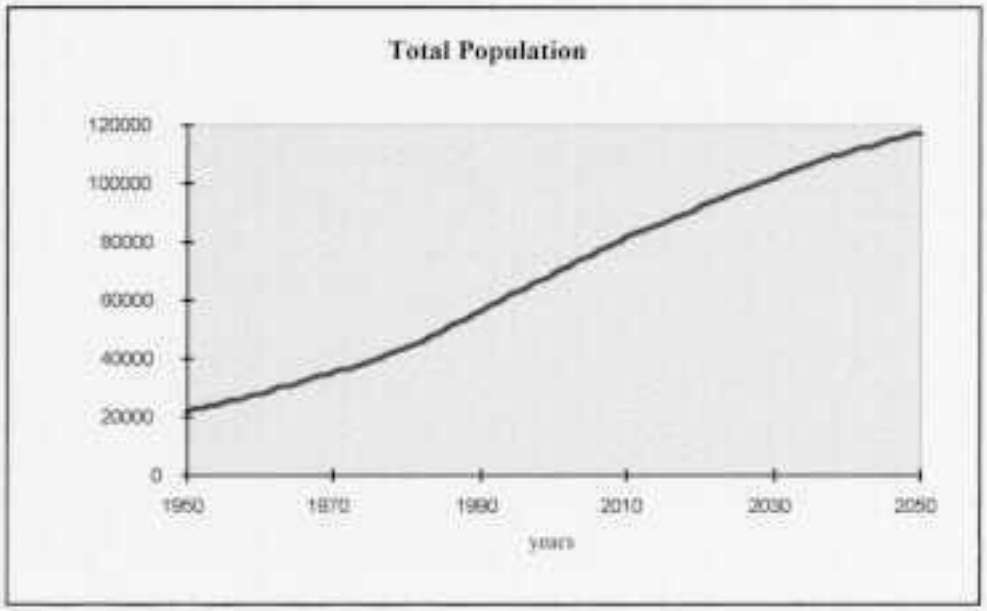
5100.00
7550.00
10000.00
Miles
0
100
200


Population Map in 1992
Alexandria
Ismailia
Cairo
Suez
Faiyum
Asyut
Aswan
POP1992
200.00
2650.00
5100.00
7550.00
10000.00
Miles
0
100
200


Population Map in 2001
Alexandria
Ismailia
Cairo
Suez
Faiyum
Asyut
Aswan
POP2001
200.00
2650.00
5100.00
7550.00
10000.00
Miles
0
100
200

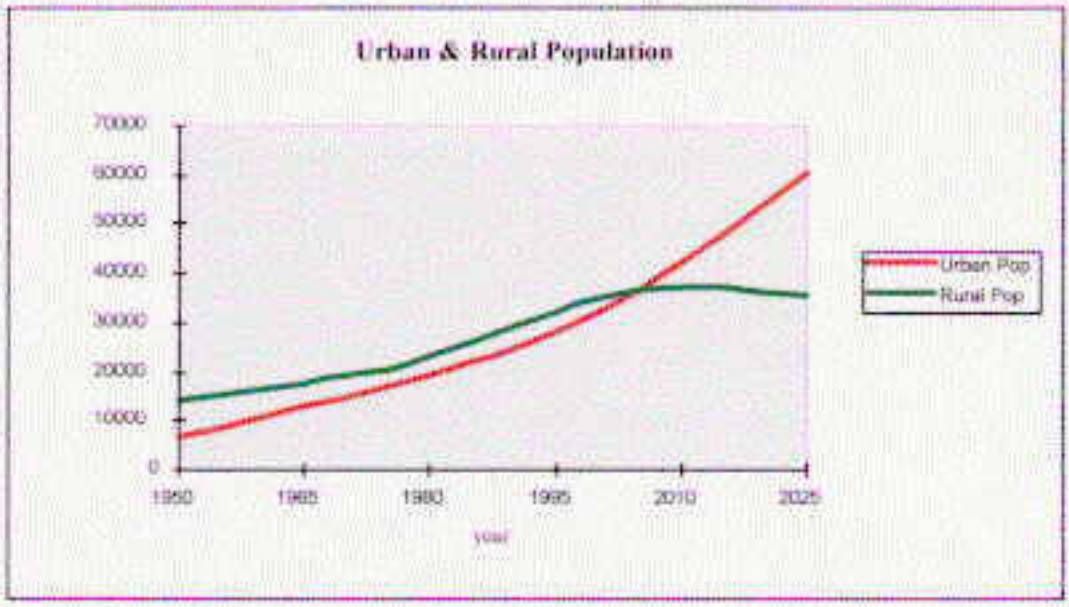
Demographic Transition

Figure 1: Total Population



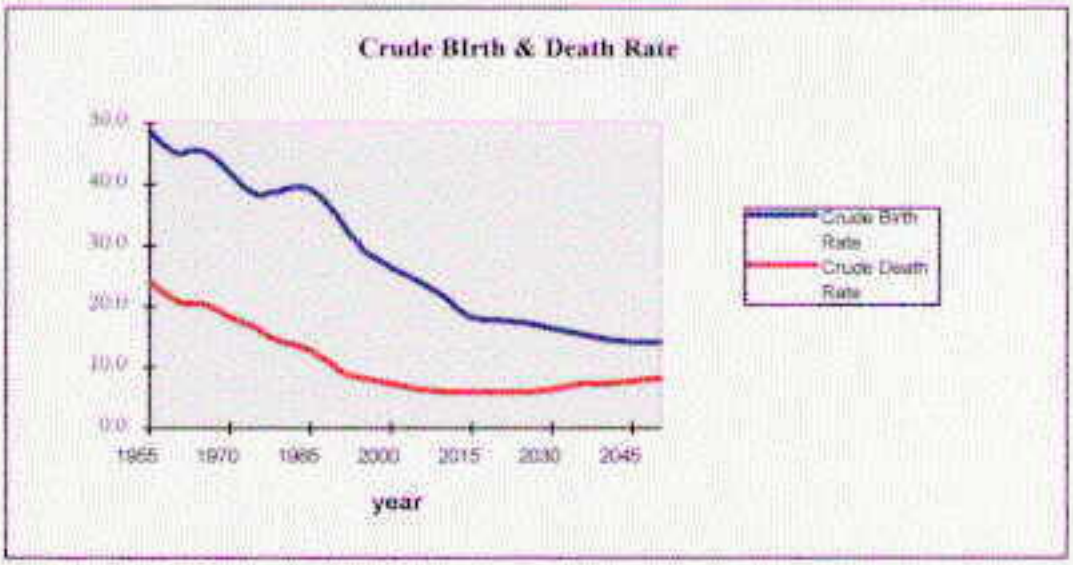
Source: WRI 1996

Figure 2: Urban & Rural Population



Source: WRI 1996

Figure 3: Crude Birth & Death Rate



Source: WRI 1996

Figure 4: STELLA II model 1 (population factors only)

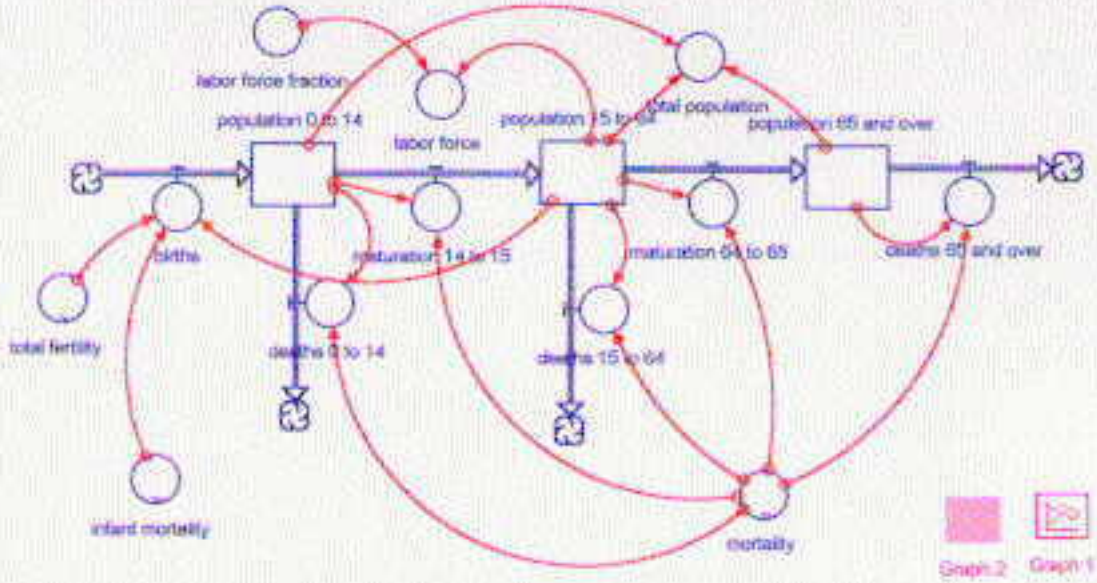
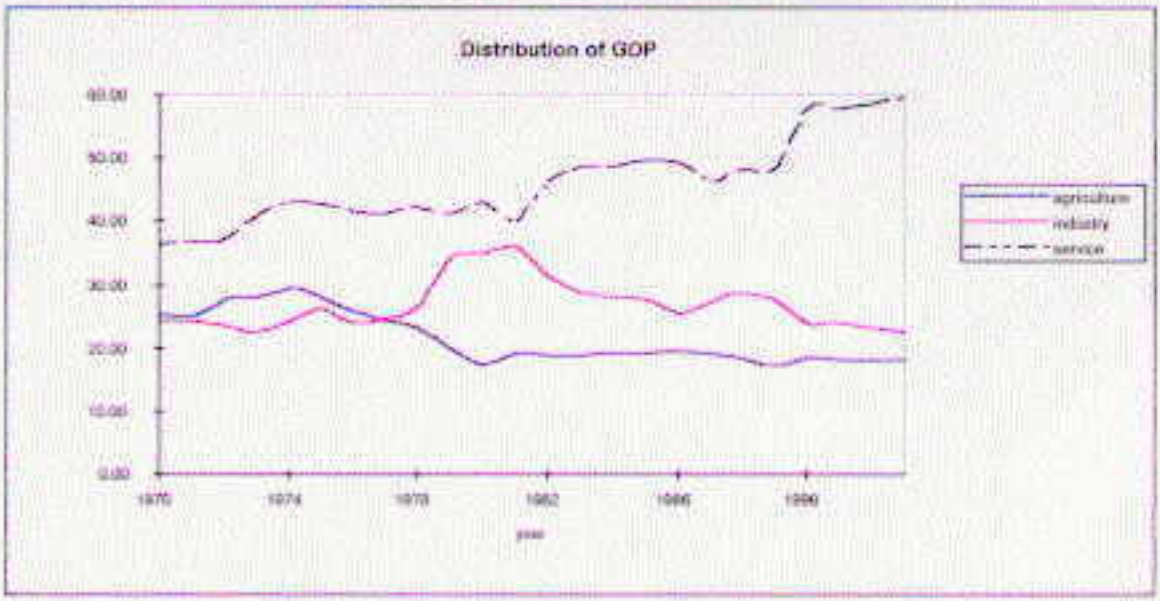


Figure 5: Population growth by each generation

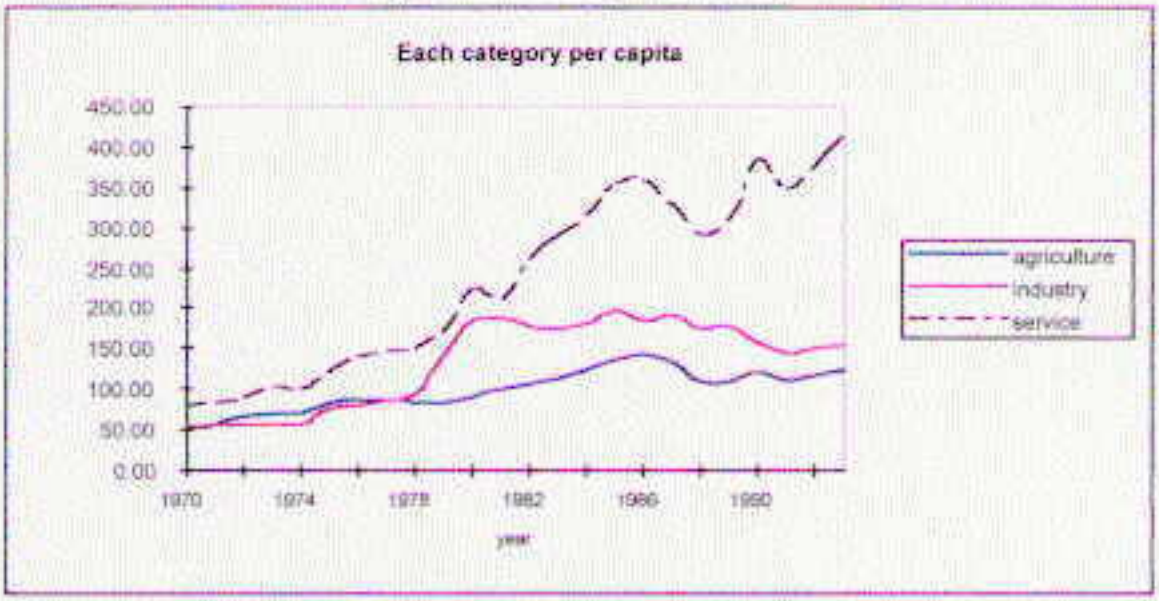
Link to GDP

Figure 6. Distribution of GDP (%)



Source: WRI 1996

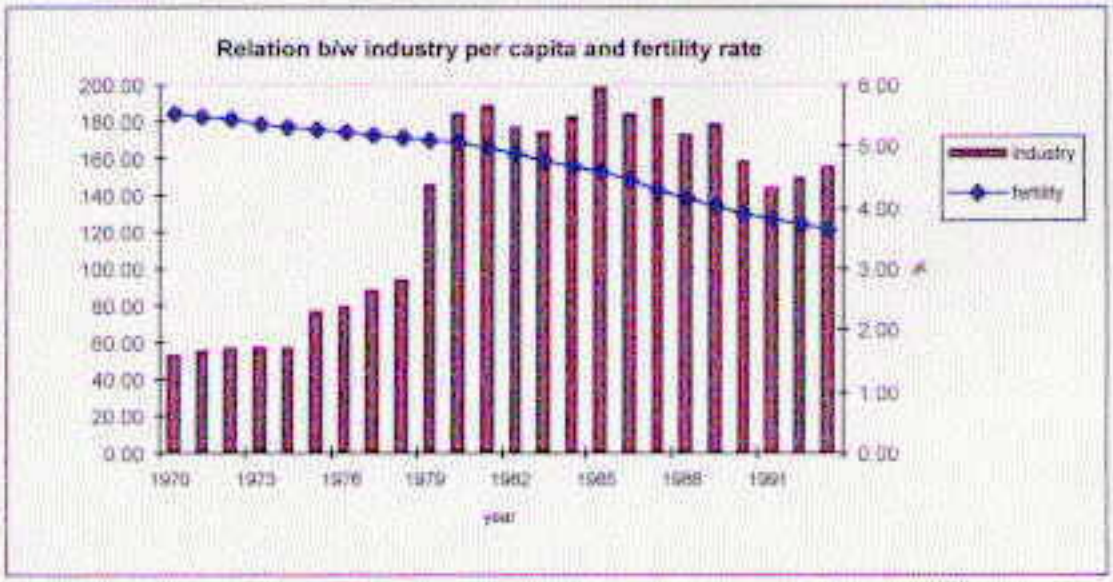
Figure 7. Each category per Capita



Source: WRI 1996

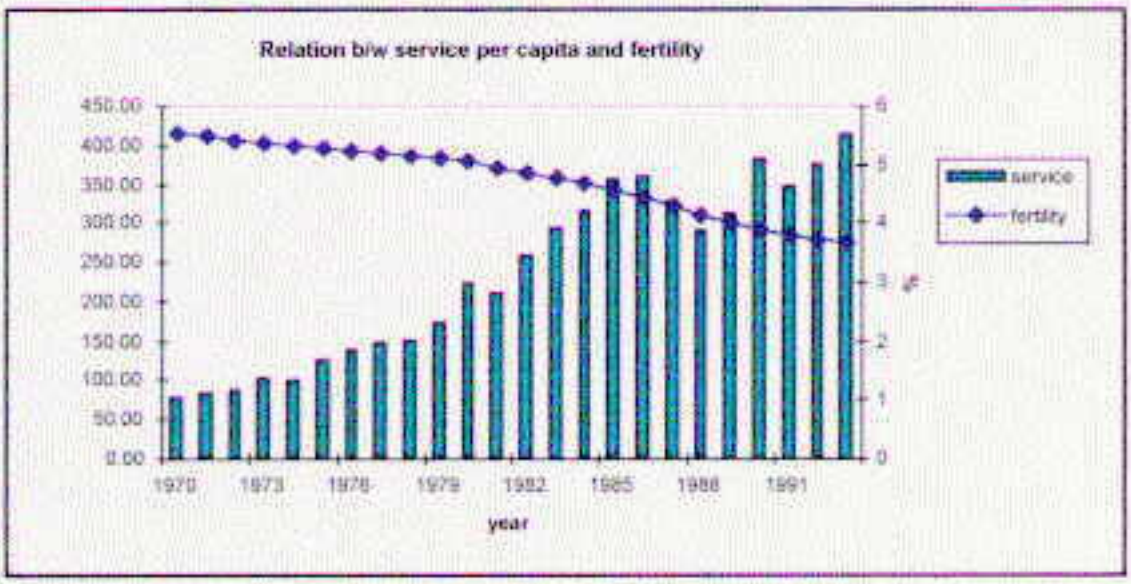
GDP is divided three categories such as industry, service and agriculture. As can be seen, the service

Figure 8: Relationship between industry per capita and fertility rate



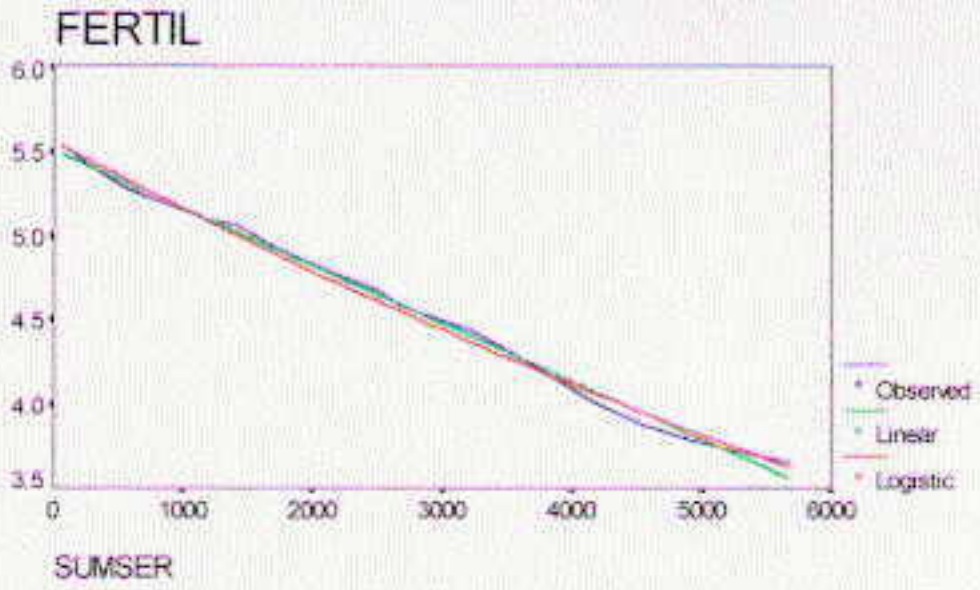
Source: WRI 1996

Figure 9: Relationship between service per capita and fertility rate



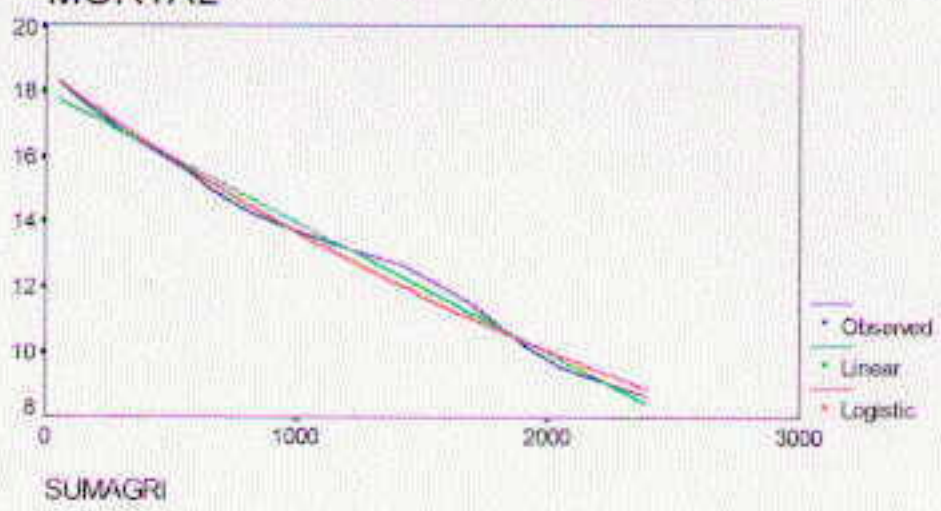
Source: WRI 1996

Figure 10: Curvefit fertility with service per capita



Curvefit fertility with service per capita

Figure 11: Curvefit mortality with food per capita



Each relationship among factors

Modeling linked with GDP

Figure 12. STELLA II model linked with GDP

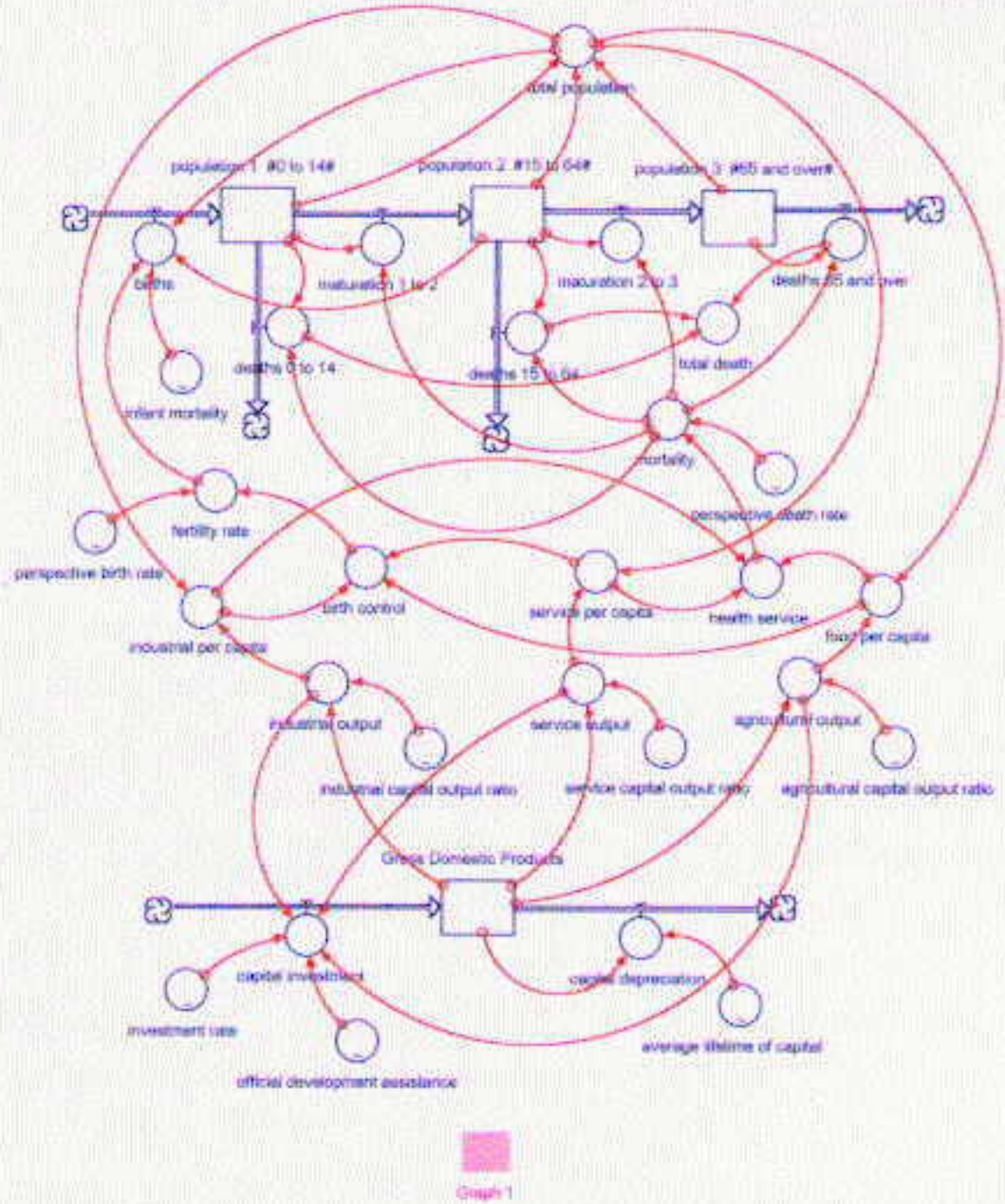


Figure 13. Total Population

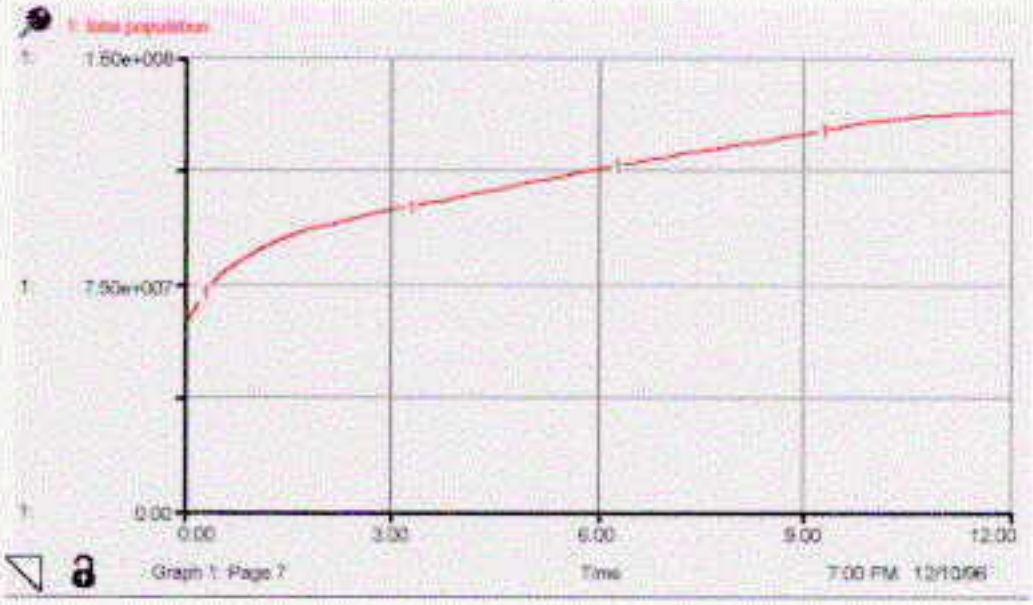


Figure 14. Distribution of GDP

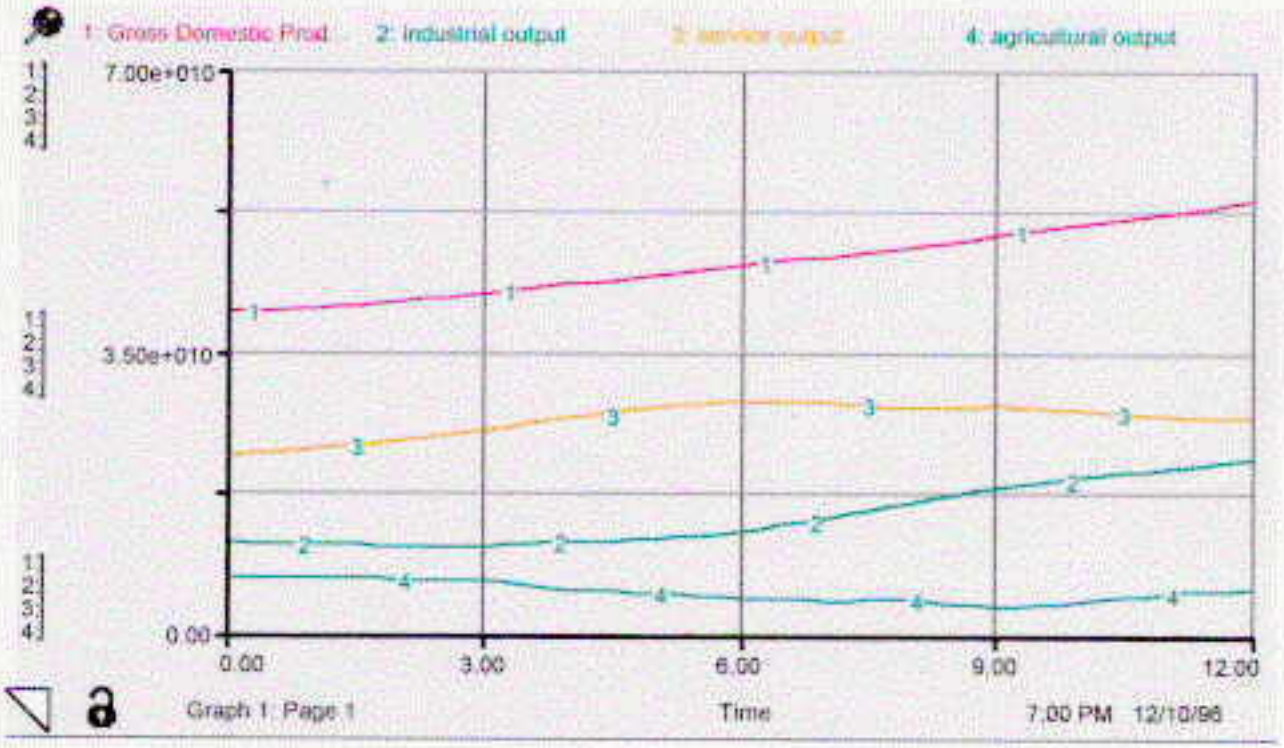


Table 2; Input Data of Each Sum of Distribution of GDP per capita and Population Growth Factors

	fertil	mortal	cbirth	sumser	sumind	sumagri
1	5.53	18.30	41.80	79.28	52.69	55.03
2	5.48	17.90	41.10	163.71	108.50	112.77
3	5.43	17.50	40.40	252.93	156.16	178.55
4	5.37	17.10	39.80	357.68	222.78	250.36
5	5.32	16.70	39.10	459.38	280.14	320.16
6	5.27	16.30	38.40	585.12	356.89	403.01
7	5.23	15.90	38.50	726.23	437.53	490.09
8	5.19	15.50	38.60	873.57	525.85	577.85
9	5.14	15.00	38.70	1024.47	619.73	660.93
10	5.10	14.60	38.80	1199.60	764.76	745.53
11	5.06	14.20	38.90	1424.15	948.54	836.80
12	4.96	13.90	38.90	1635.60	1137.70	937.54
13	4.87	13.60	39.00	1896.65	1314.21	1043.97
14	4.77	13.30	39.00	2190.39	1489.10	1158.49
15	4.68	13.00	39.10	2505.83	1671.41	1283.32
16	4.58	12.70	39.10	2682.60	1869.42	1421.90
17	4.44	12.10	38.20	3223.53	2054.12	1565.07
18	4.30	11.50	37.30	3553.27	2247.14	1700.34
19	4.16	10.80	36.50	3846.11	2420.41	1811.89
20	4.02	10.20	35.60	4159.24	2599.04	1924.14
21	3.88	9.60	34.70	4544.21	2767.25	2046.13
22	3.80	9.30	33.70	4894.35	2901.73	2155.75
23	3.73	9.00	32.60	5271.19	3051.25	2271.88
24	3.66	8.70	31.50	5687.85	3207.34	2396.53

Source: WRI 1996

	A	B	C	D	E	F	G	H
1	Sheet2							
2								
3	Distribution of GDP							
4	year	1970	1971	1972	1973	1974	1975	1976
5	agriculture	25.27	25.13	27.52	27.91	29.5	28.13	25.93
6	industry	24.2	24.28	23.71	22.39	24.25	26.06	24.01
7	service	36.41	36.74	37.33	40.71	42.98	42.7	41.71
8								
9	GDP, GDP per capita							
10	year	1970	1971	1972	1973	1974	1975	1976
11	GDP cpt.	218	230	239	257	237	294	336
12	GDP (mil)	76112	8266	8764	9617	9015	11438	13360.1
13								
14	each categories per capita							
15	year	1970	1971	1972	1973	1974	1975	1976
16	agriculture	55.03	57.74	65.78	71.81	69.8	82.85	87.08
17	industry	52.69	65.81	56.66	57.62	57.37	76.75	80.64
18	service	79.28	84.43	89.22	104.75	101.7	125.74	140.11
19	fertility	5.53	5.478	5.426	5.374	5.322	6.27	5.228
20								
21	year	1970	1971	1972	1973	1974	1975	19761
22	industry	52.68756	55.80884	56.66089	57.61789	57.36534	76.75261	80.63936
23	fertility	5.53	5.478	5.426	5.374	5.322	5.27	5.228
24								
25								
26	year	1970	1971	1972	1973	1974	1975	1976
27	service	79.2769	84.4329	89.2219	104.752	101.698	125.739	140.108
28	fertility	5.53	5.478	5.426	5.374	5.322	5.27	5.228
29	cru. birth	41.8	41.1	40.4	39.8	39.1	38.4	38.5
30	cru. death	18.3	17.9	17.5	17.1	16.7	16.3	15.9
31								
32	sumser	79.28	163.71	252.93	357.68	459.38	585.12	725.23
33	sumind	52.69	108.5	166.16	222.78	280.14	356.89	437.53
34	sumagri	55.03	112.77	178.55	250.36	320.16	403.01	490.09
35								
36								
37	fertility: Number of children per women							
38	crude death & birth: Per 1000 persons							

	I	J	K	L	M	N	O	P
1	Sheet 2							
2								
3	Distribution of GDP							
4	year	1977	1978	1979	1980	1981	1982	1983
5	agriculture	24.42	23.34	19.91	17.43	19.2	18.92	18.88
6	industry	24.58	26.37	34.14	35.09	3606	31.38	28.84
7	service	41.29	42.39	41.2	42.89	40.31	46.41	48.44
8								
9	GDP, GDP per capita							
10	year	1977	1978	1979	1980	1981	1982	1983
11	GDP cpt	359	356	425	524	526	563	606
12	GDP (mil)	14636	14850	18150	22912	23405	25592	28137
13								
14	each categories per capita							
15	year	1977	1978	1979	1980	1981	1982	1983
16	agriculture	87.76	83.08	84.6	91.26	100.74	106.43	114.52
17	industry	88.32	93.87	145.03	183.78	189.16	176.51	174.89
18	service	148.35	150.9	175.03	224.65	211.45	261.05	293.74
19	fertility	5.186	5.144	5.102	5.06	4.964	4.868	4.772
20								
21	year	1977	1978	1979	1980	1981	1982	1983
22	industry	88.31879	93.8743	145.0303	183.7819	189.159	176.5139	174.8859
23	fertility	5.186	5.144	5.102	5.06	4.964	4.868	4.772
24								
25								
26	year	1977	1978	1979	1980	1981	1982	1983
27	service	148.346	150.897	175.026	224.649	211.452	261.049	293.743
28	fertility	5.186	5.144	5.102	5.06	4.964	4.868	4.772
29	cru. birth	38.6	38.7	38.8	38.9	38.9	39	39
30	cru. death	15.5	15	14.6	14.2	13.9	13.6	13.3
31								
32	sumser	73.57	1024.47	1199.5	1424.15	1635.6	1896.65	2190.39
33	sumind	525.85	619.731	764.76	948.54	1137.7	1314.21	1489.1
34	sumagri	577.85	660.93	745.53	836.8	937.54	1043.97	1158.49
35								
36								
37	fertility: Number of children per women							
38	crude death & birth: Per 1000 persons							

	Q	R	S	T	U	V	W	X
1	Sheet 2							
2								
3	Distribution of GDP							
4	year	1984	1985	1986	1987	1988	1989	1990
5	agriculture	19.27	19.27	19.63	19.09	18.43	17.3	18.34
6	industry	28.15	27.54	25.33	27.25	28.62	27.53	23.79
7	service	48.71	49.62	49.5	46.55	48.37	48.26	57.88
8								
9	GDP, GDP per capita							
10	year	1984	1985	1986	1987	1988	1989	1990
11	GDP cpt	648	719	729	708	605	649	665
12	GDP (mil)	30643	34690	35880	35545	30978	33858	35396
13								
14	each categories per capita							
15	year	1984	1985	1986	1987	1988	1989	1990
16	agriculture	124.83	138.57	143.18	135.26	111.55	112.25	121.99
17	industry	182.32	198.01	184.7	193.02	173.28	178.63	158.21
18	service	315.44	356.77	360.94	329.73	292.94	313.13	384.96
19	fertility	4.676	4.58	4.44	4.3	4.16	4.02	3.88
20								
21	year	1984	1985	1986	1987	1988	1989	1990
22	industry	182.3156	198.01041	184.6985	193.0155	173.2774	178.6263	158.2129
23	fertility	4.676	4.58	4.44	4.3	4.16	4.02	3.88
24								
25								
26	year	1984	1985	1986	1987	1988	1989	1990
27	service	315.44	356.766	360.937	329.734	292.843	313.133	384.962
28	fertility	4.676	4.58	4.44	4.3	4.16	4.02	3.88
29	cru. birth	39.1	39.1	38.2	37.3	36.5	35.6	34.7
30	cru. death	13	12.7	12.1	11.5	10.8	10.2	9.6
31								
32	sumser	2505.83	2862.6	3223.53	3553.27	3846.11	4159.24	4544.21
33	sumind	1671.41	1869.42	2054.12	2247.14	2420.41	2599.04	2757.25
34	sumagri	1283.32	1421.9	1565.07	1700.34	1811.89	1924.14	2046.13
35								
36								
37	fertility: Number of children per women							
38	crude death & birth: Per 1000 persons							

	Y	Z	AA	AB
1	Sheet 2			
2				
3	**Distribution of GDP**			
4	year	1991	1992	1993
5	agriculture	18.14	18	17.87
6	industry	23.91	23.27	22.38
7	service	57.95	58.65	59.74
8				
9	**GDP, GDP per capita**			
10	year	1991	1992	1993
11	GDP cpt.	604	643	697
12	GDP (mil)	32790	35556	39357
13				
14	**each categories per capita**			
15	year	1991	1992	1993
16	agriculture	109.62	116.13	124.65
17	industry	144.47	149.53	156.09
18	service	350.14	376.85	416.66
19	fertility	3.8	3.73	3.66
20				
21	year	1991	1992	1993
22	industry	144.4722	149.5271	156.0882
23	fertility	3.8	3.73	3.66
24				
25				
26	year	1991	1992	1993
27	service	350.14	376.849	416.658
28	fertility	3.8	3.73	3.66
29	cru. birth	33.7	32.6	31.5
30	cru. death	9.3	9	8.7
31				
32	sumser	4894.35	5271.19	5687.85
33	sumind	2901.73	3051.25	3207.34
34	sumagri	2155.75	2271.88	2396.53
35				
36				
37	fertility: Number of children per women			
38	crude death & birth: Per 1000 persons			

Figure 15: Fertility Rate

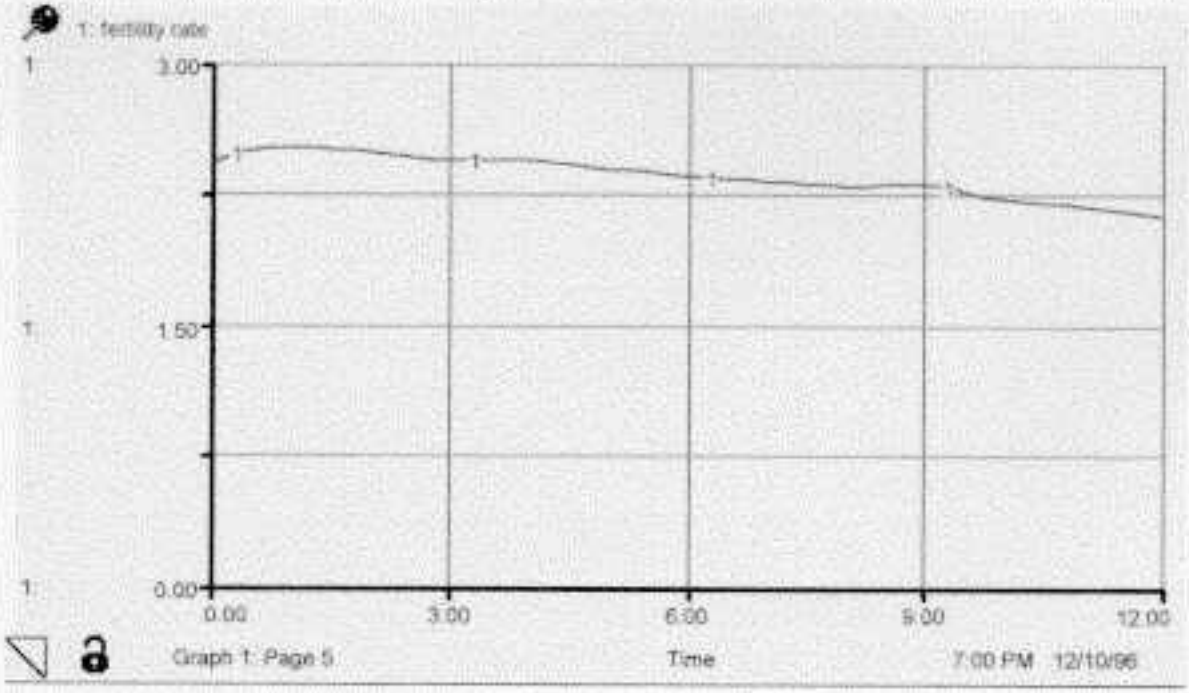
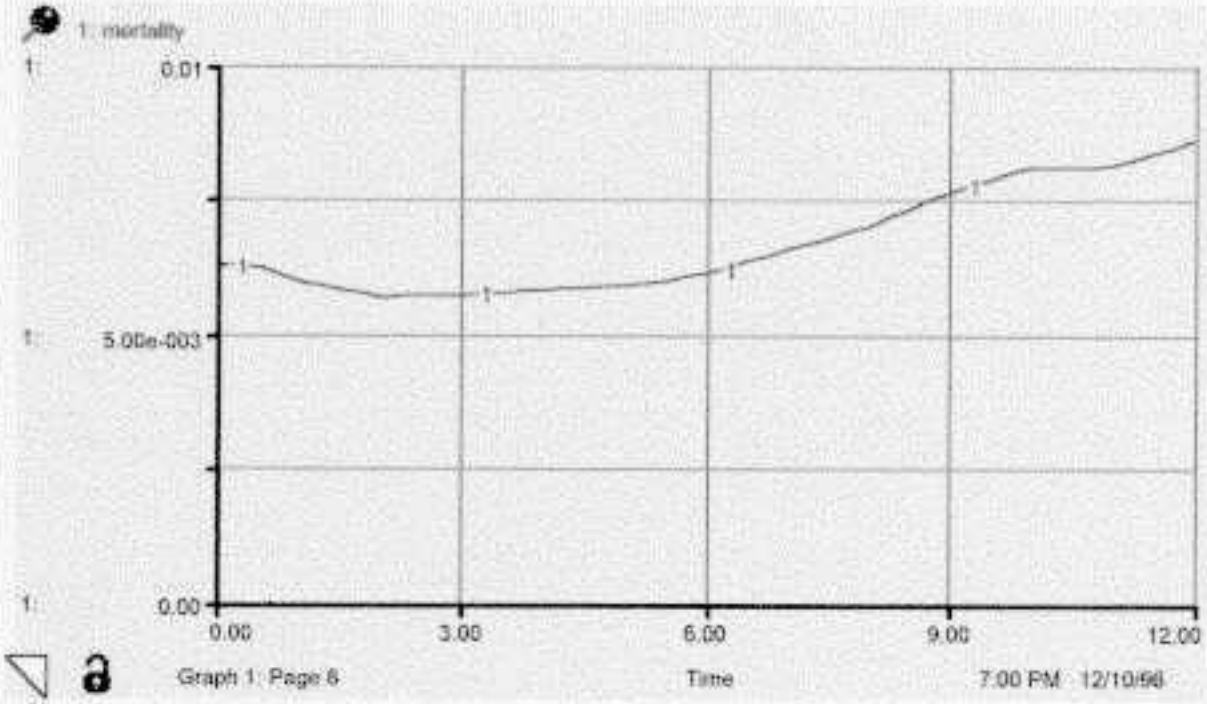


Figure 16: Mortality Rate



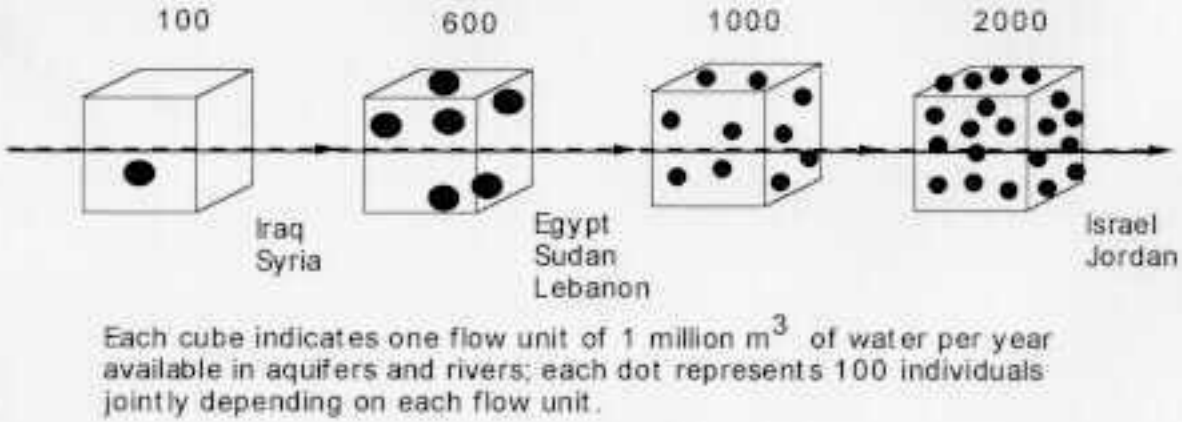


Figure 1: A graphical visualization of the water scarcity existing in the region. Adapted from: Falkenmark, M and G. Lindh (1993). Water and Economic Development. In: Water In Crisis. Gleik, P. H. Oxford University Press, New York.

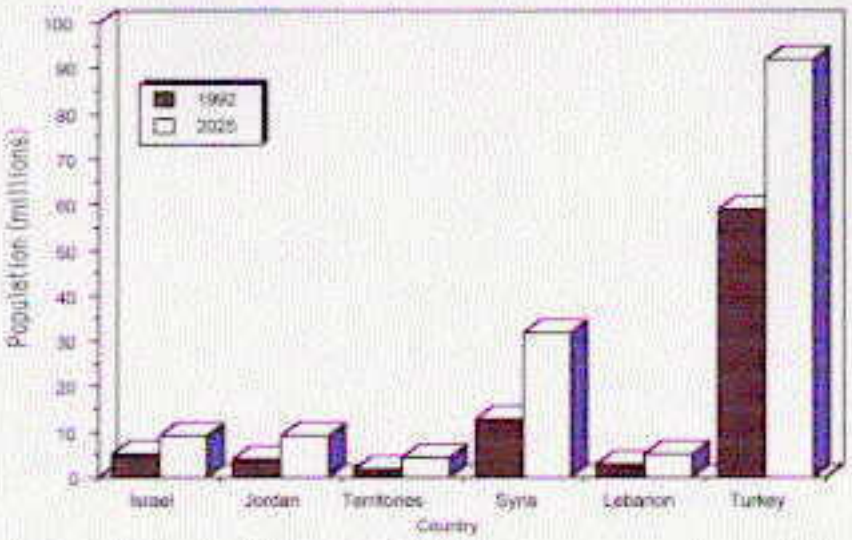


Figure 2: The current and expected population for the countries of the Middle East. Source: Fishelson, G. (1995). The value of freshwater in Israel, Jordan, the West Bank and Gaza. International Conference on the Peace Process and the Environment. Tel Aviv University, Tel Aviv, Israel.

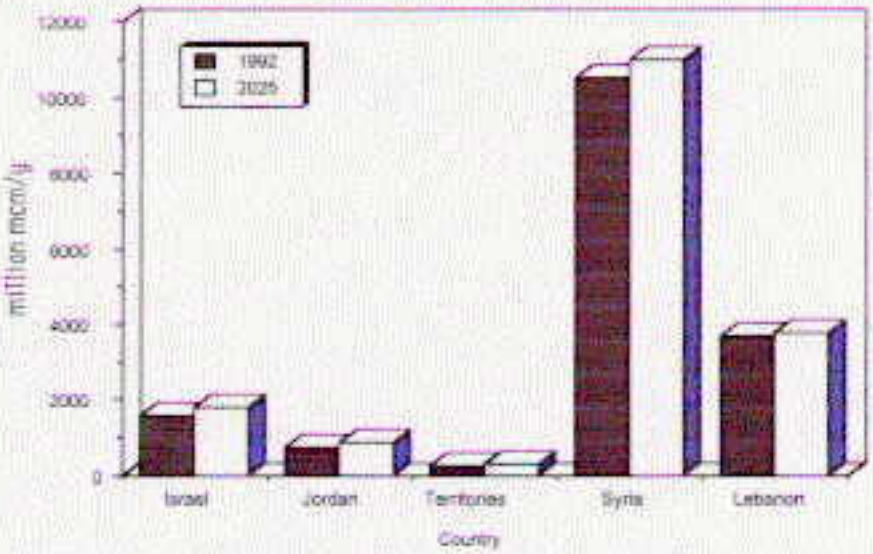


Figure 3: Current and expected fresh water according to the average sustainable yield (ASY). Source: Fishelson, G. (1995). The value of freshwater in Israel, Jordan, the West Bank and Gaza. International Conference on the Peace Process and the Environment. Tel Aviv University, Tel Aviv, Israel.

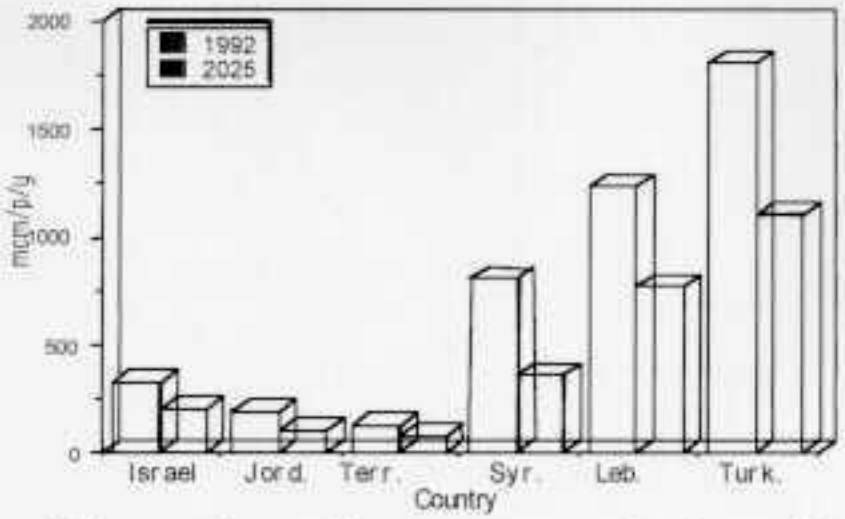


Figure 4: Current and expected water amount per capita. Source: Fishelson, G. (1995). The value of freshwater in Israel, Jordan, the West Bank and Gaza. International Conference on the Peace Process and the Environment. Tel Aviv University, Tel Aviv, Israel.

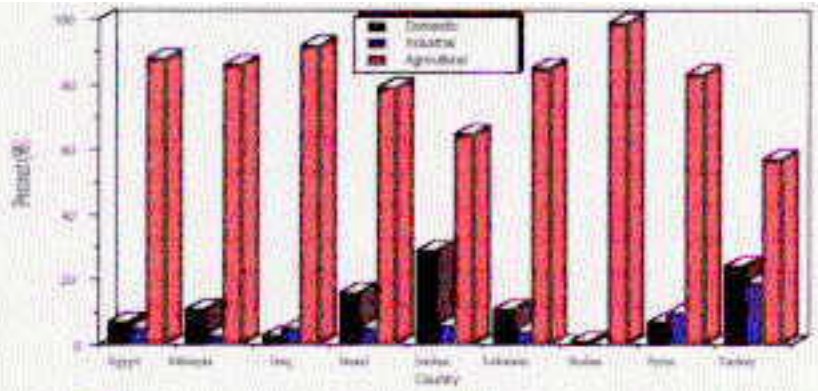


Figure 5: Fresh water withdrawal by sector for the countries of the Middle East and North Africa. Source: World Resources Institute. (1992-93). A Guide to the Global Environment. Oxford University, New York.

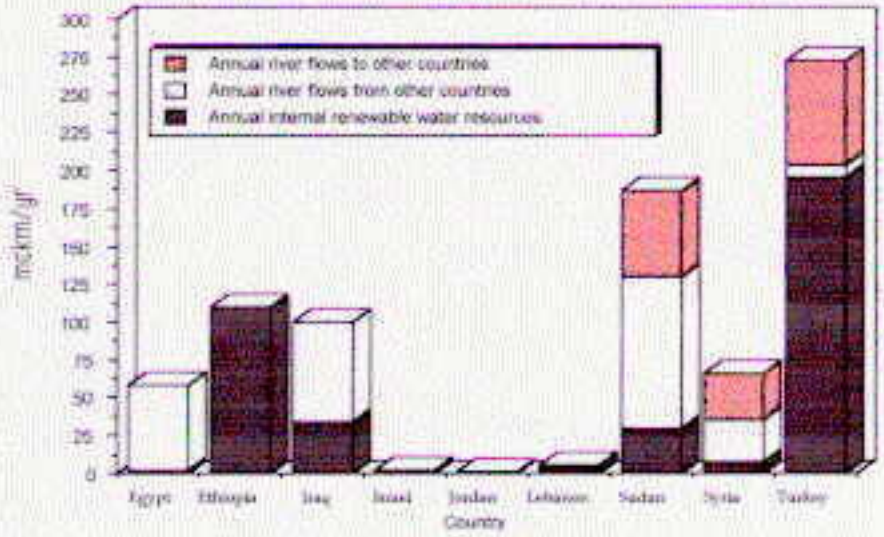


Figure 6: The origin of fresh water resources for the countries of the Middle East and North Africa. Source: World Resources Institute (1992). World Resources 1992-93. A Guide to the Global Environment, Oxford University Press, New York.

Figure 7: The "Third River", a recently completed drainage canal in southern Iraq (Source: Hillel, 1994)

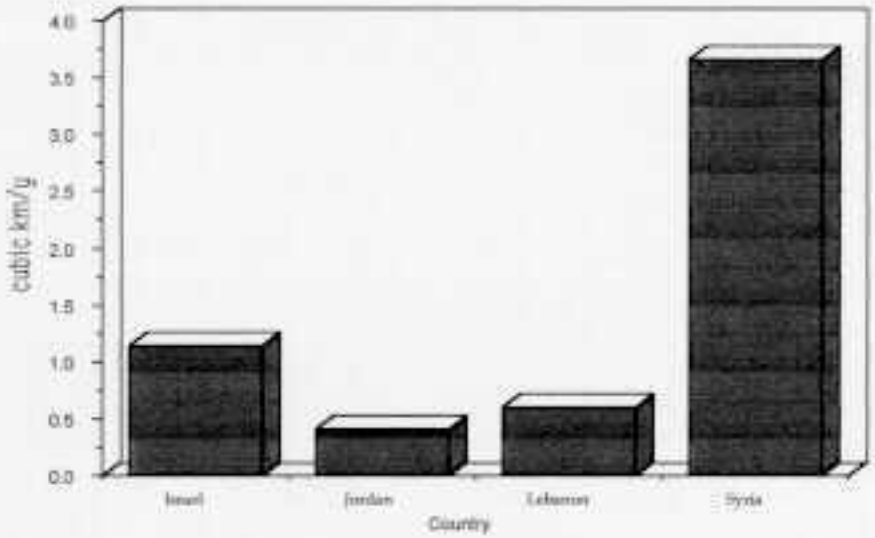


Figure 8: Available groundwater sources for the Arab region. Sources: Shahin, N. (1989). Review and assessment of water resources in the Arab region. Water International, 14 (4): 206-219.; Shelef, G. (1995). The coming era of intensive wastewater reuse in the Mediterranean Region. International Conference on the Peace Process and the Environment, Tel Aviv University, Tel Aviv, Israel.

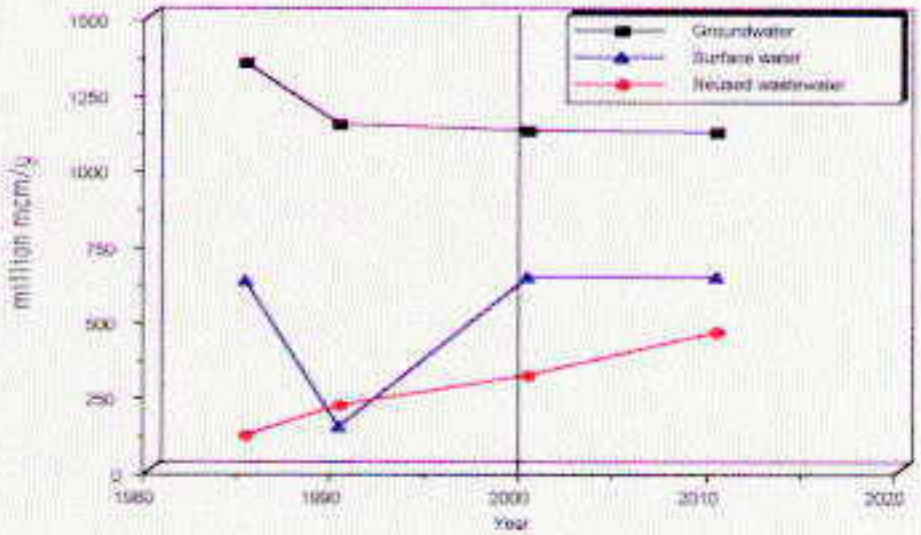


Figure 9: Current and expected water resources for Israel. Source: Shelef, G. (1995). The coming era of intensive wastewater reuse in the Mediterranean region. International Conference on the Peace Process and the Environment, Tel Aviv University, Tel Aviv, Israel

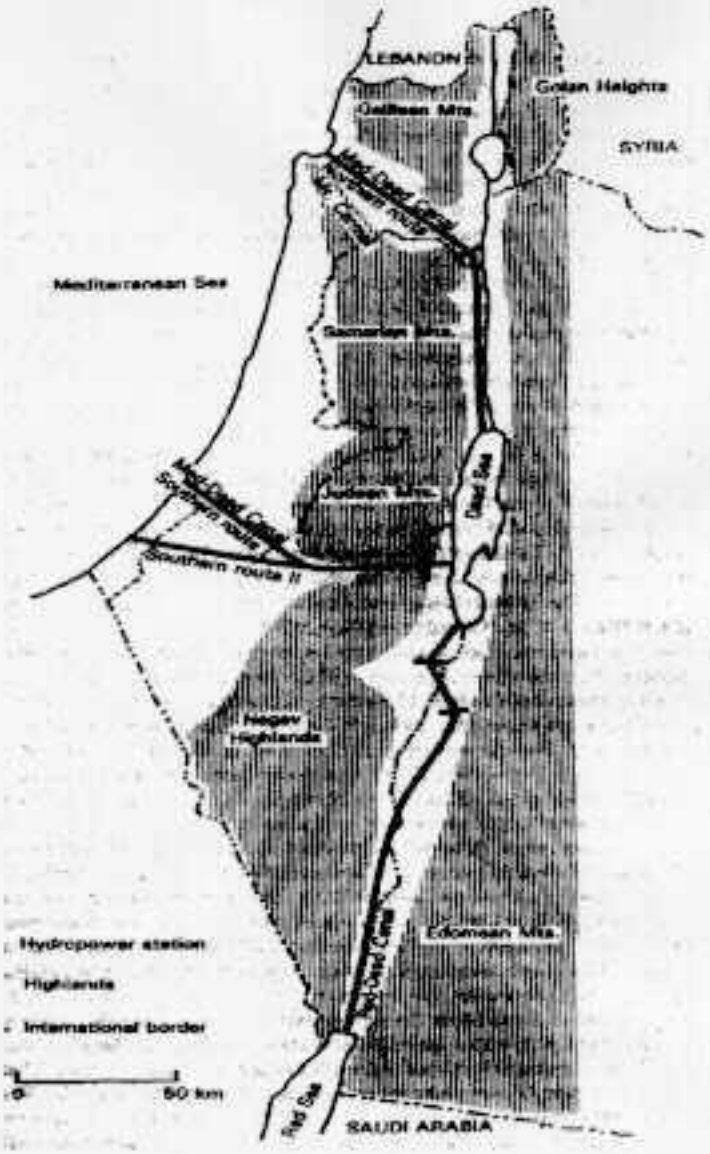


Figure 10: The "Med-Dead" and the "Red-Dead" canals of the proposed Intersea canal project (Source: Hillel, 1994).

Finally, an imaginative project put forward by a Canadian company is the transfer of as much as

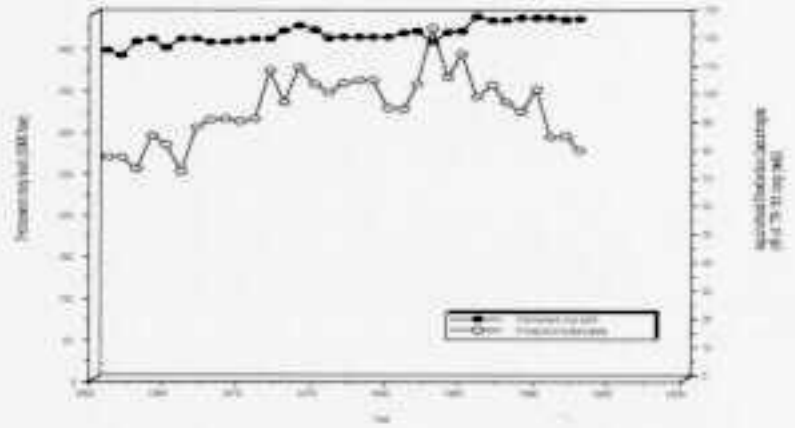


Figure 11: The agricultural transition for Israel (Source: World Resource Database Diskette, 1996).

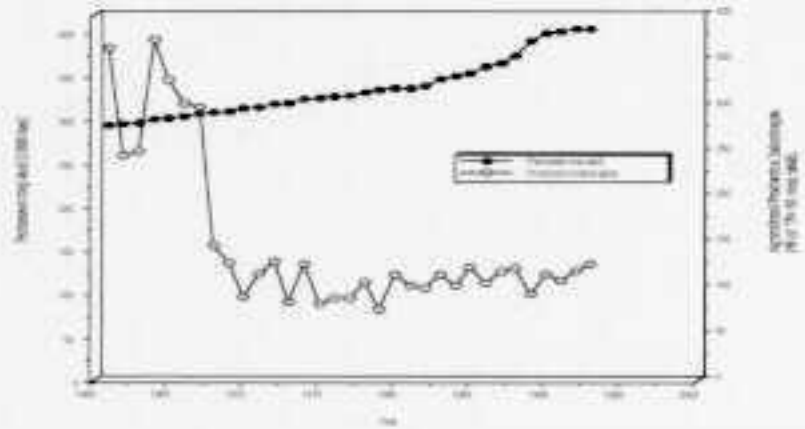


Figure 12: The agricultural transition for Jordan (Source: World Resource Database Diskette, 1996).

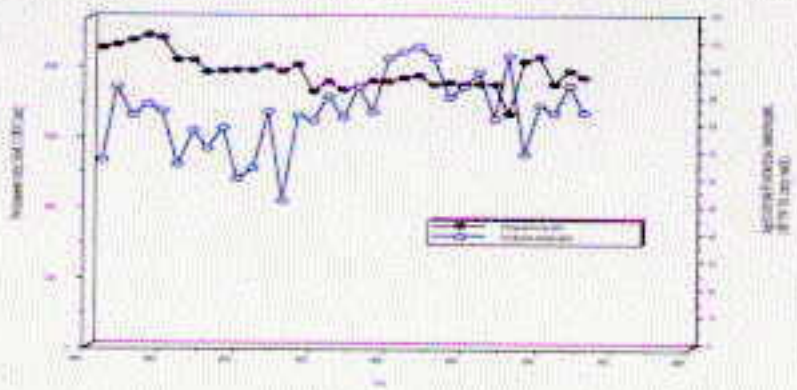


Figure 13: The agricultural transition for Syria (Source: World Resource Database Diskette, 1996).

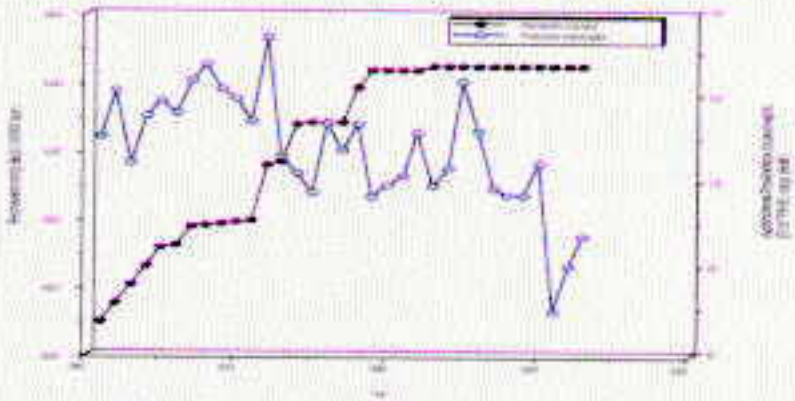


Figure 14: The agricultural transition for Iraq (Source: World Resource Database Diskette, 1996).

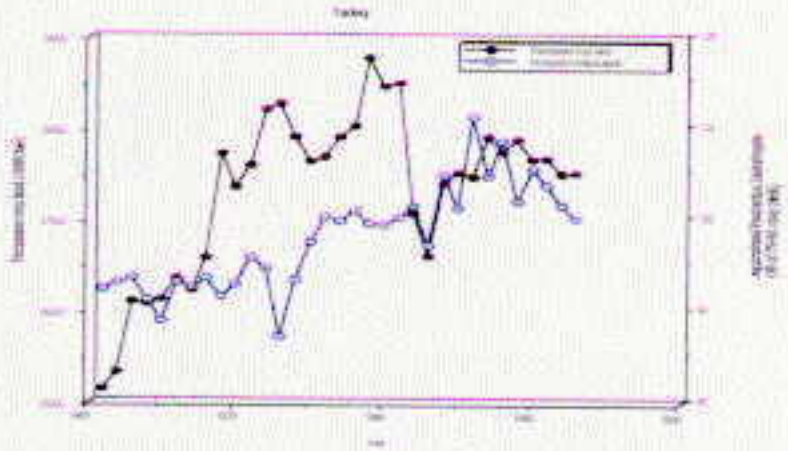


Figure 15: The agricultural transition for Turkey (Source: World Resource Database Diskette, 1996).

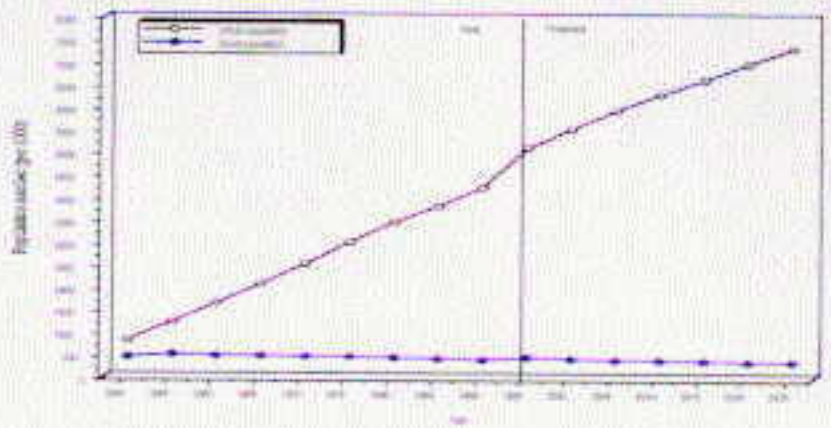


Figure 16: The urbanization transition for Israel (Source: World Resource Database Diskette, 1996).

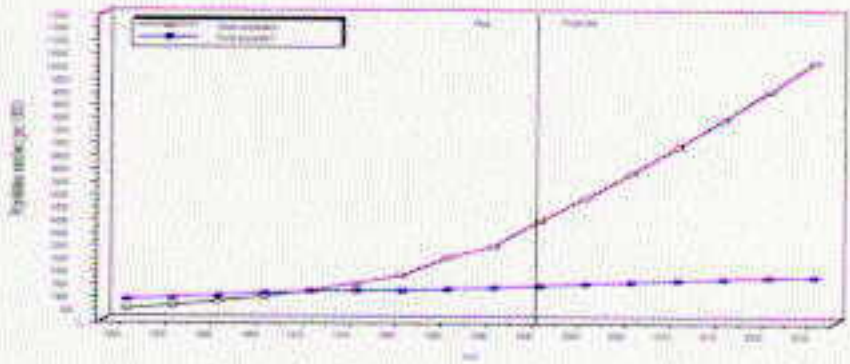


Figure 17: The urbanization transition for Jordan (Source: World Resource Database Diskette, 1996).

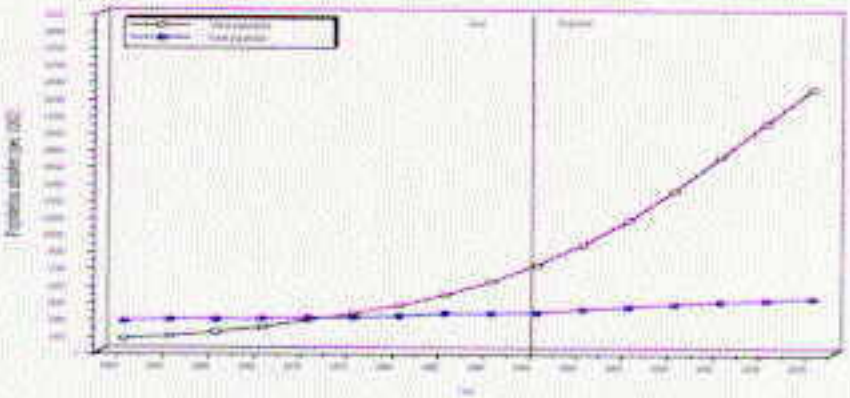


Figure 18: The urbanization transition for Syria (Source: World Resource Database Diskette, 1996).

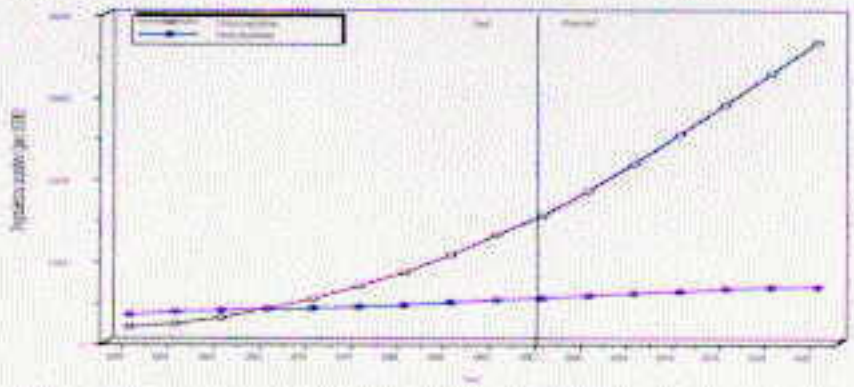


Figure 19: The urbanization transition for Iraq (Source: World Resource Database Diskette, 1996).

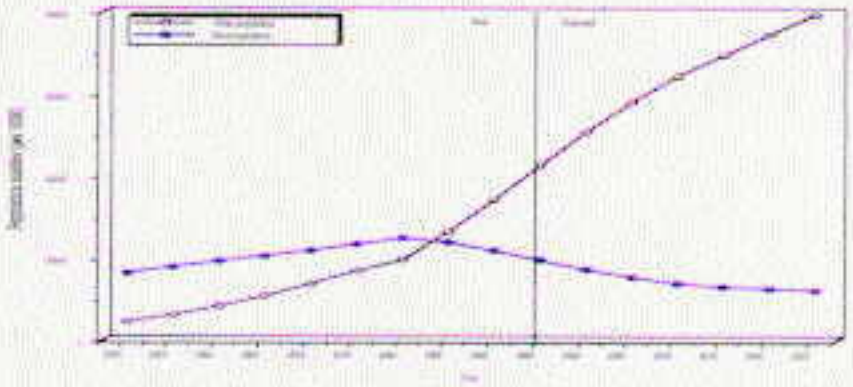


Figure 20: The urbanization transition for Turkey (Source: World Resource Database Diskette, 1996).

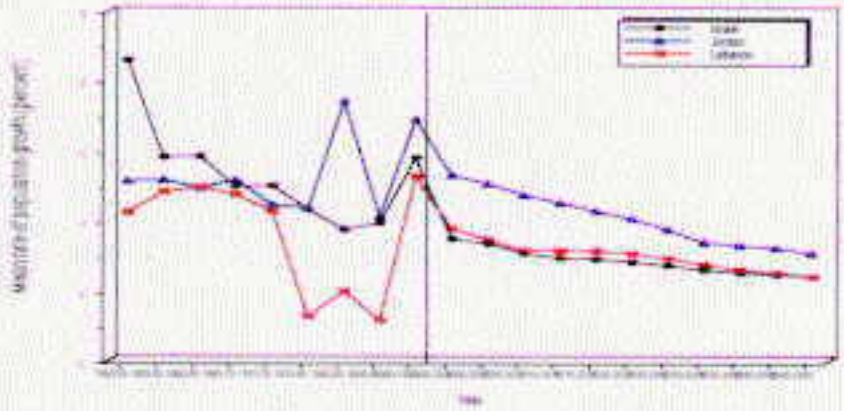


Figure 21: The mean rate of population growth for Israel, Jordan and Lebanon (Source: World Resource Database Diskette, 1996).

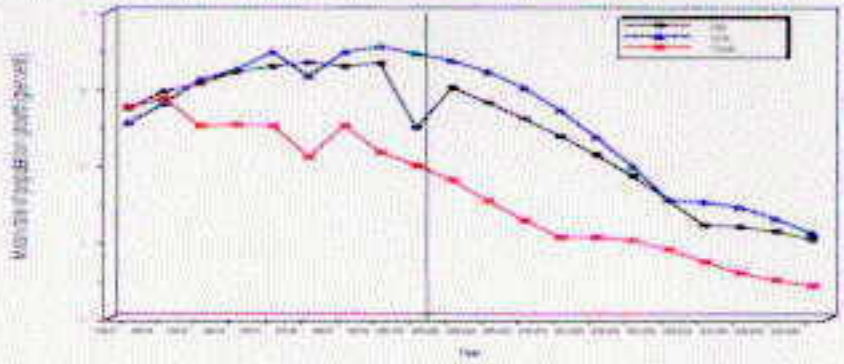


Figure 22: The mean rate of population growth for Iraq, Syria and Turkey (Source: World Resource Database Diskette, 1996).

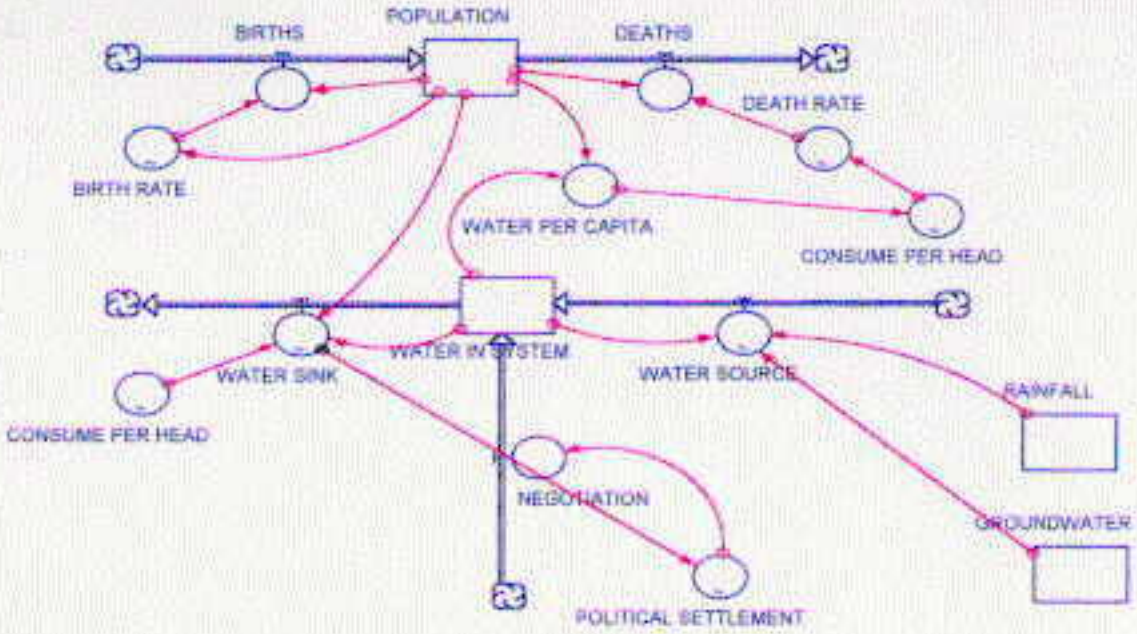


Figure 23: A theoretical model to describe the interactions between population growth, water consumption and the need for a political settlement.

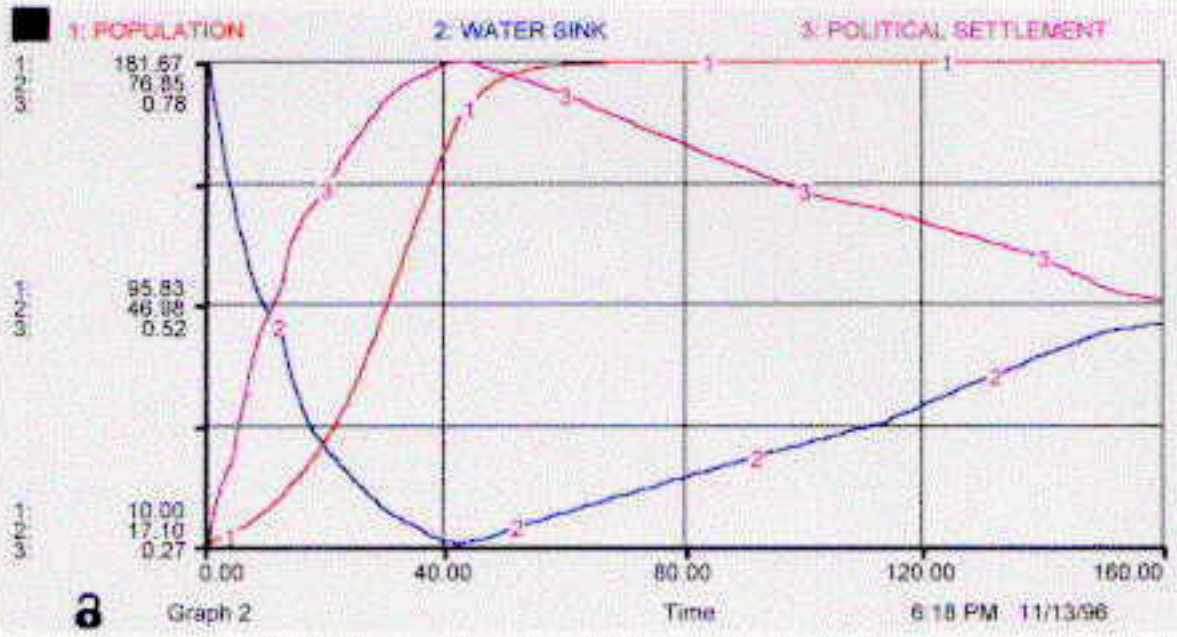
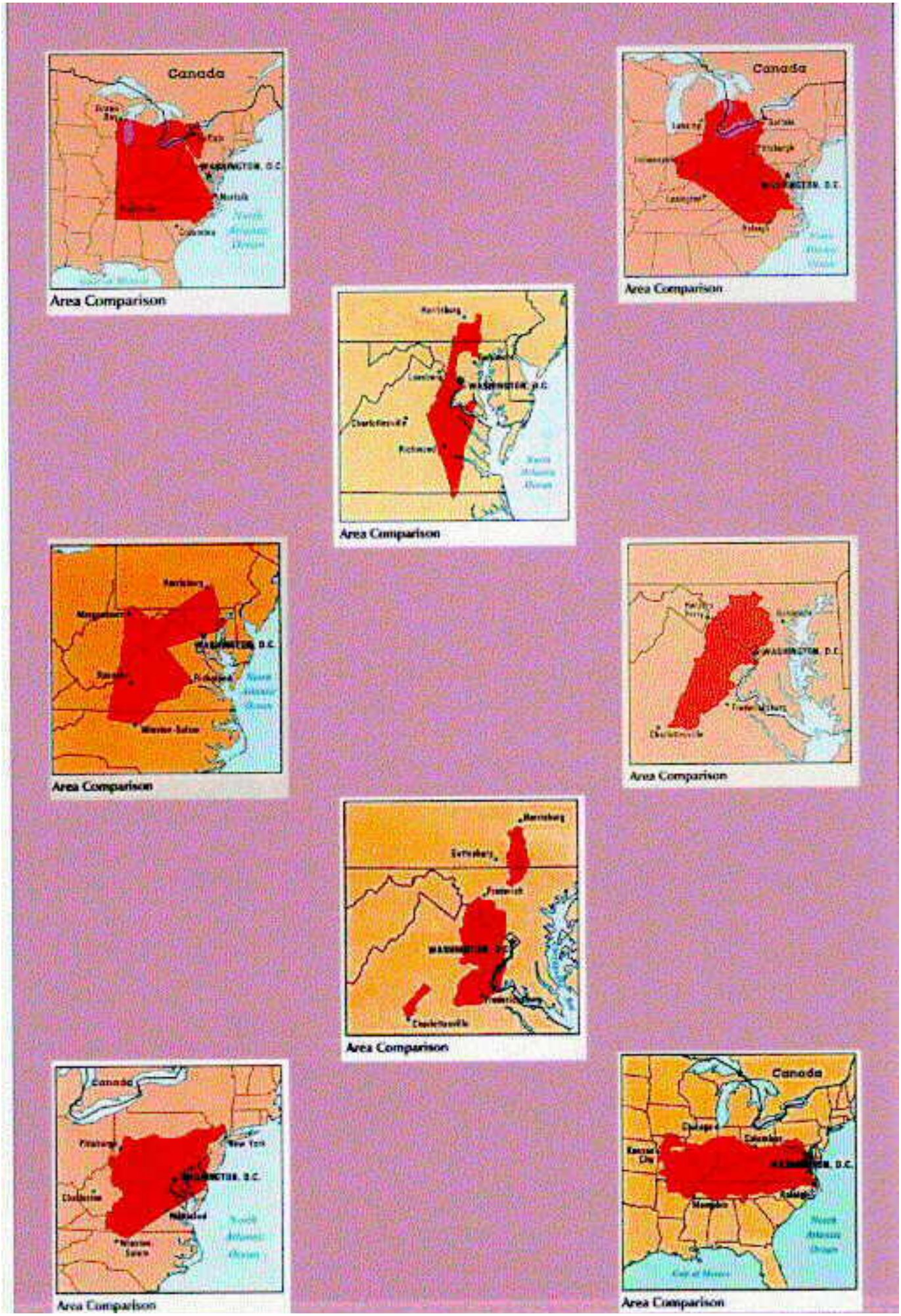
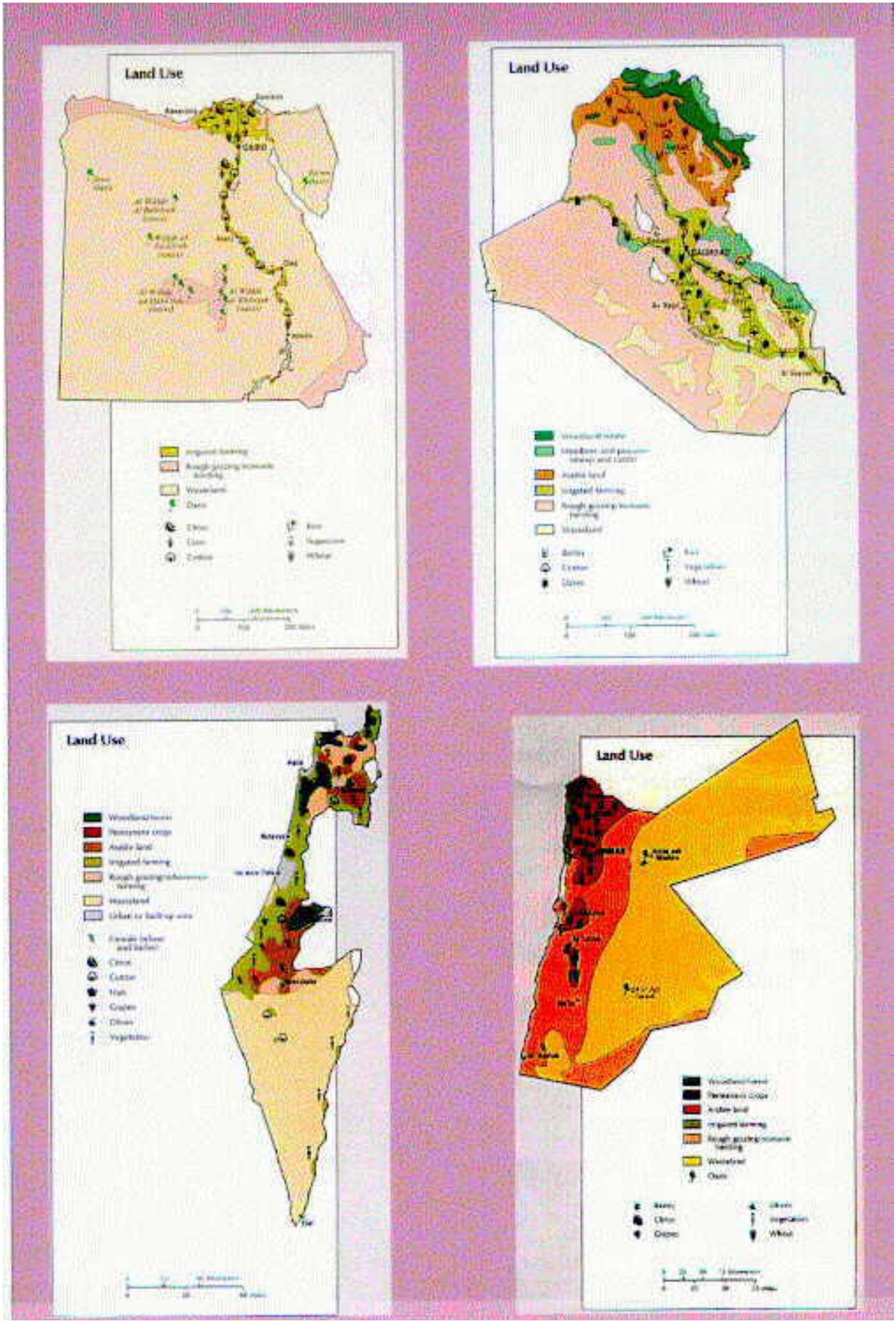
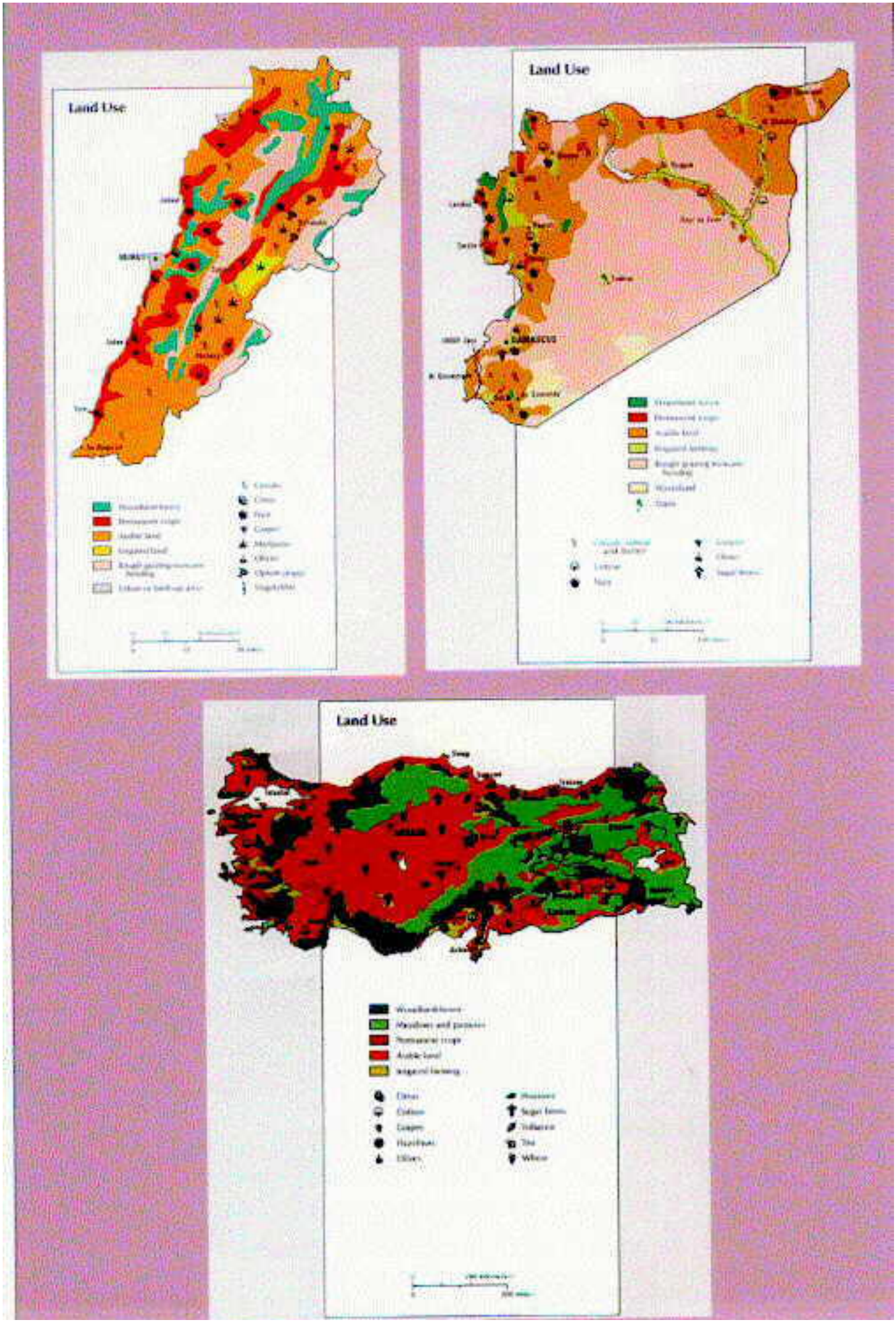


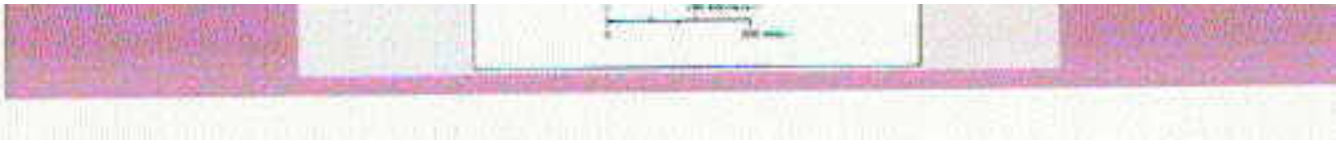
Figure 24: A graphical outcome of the above model for the parameters: population, water sink and political settlement.


Canada
Area Comparison
Canada
Area Comparison
Area Comparison
Area Comparison
Area Comparison
Area Comparison
Canada
Area Comparison
Canada
Area Comparison


Area Comparison
Area Comparison

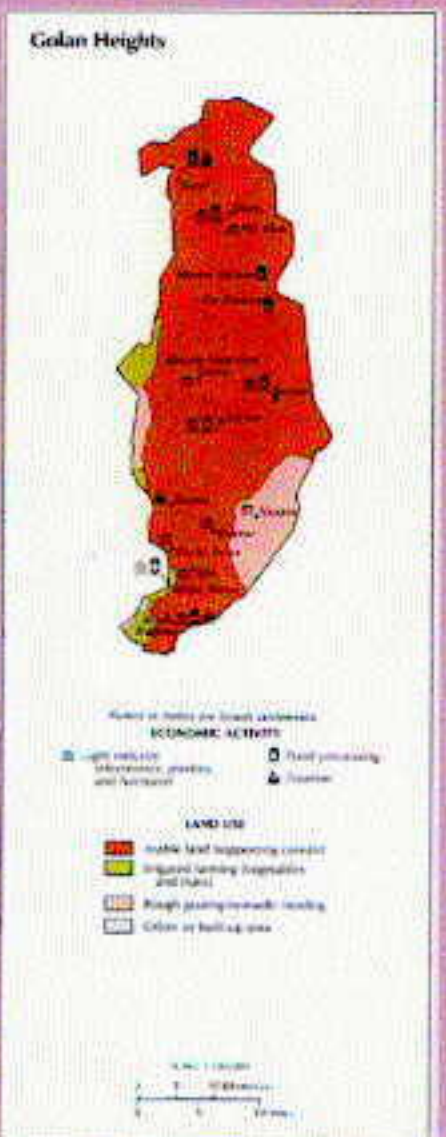

Land Use
Land Use
Land Use
Land Use


Land Use
Land Use
Land Use

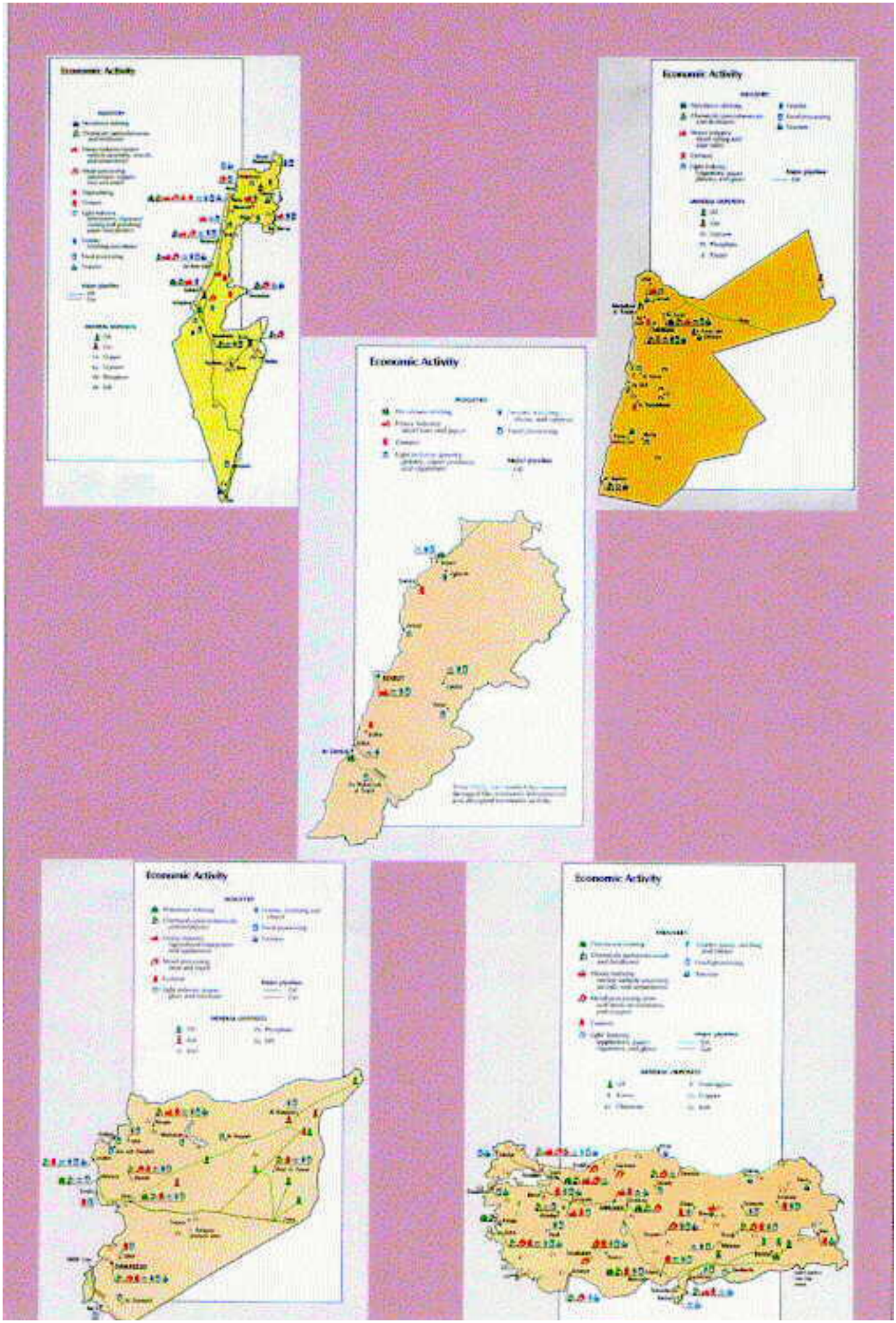


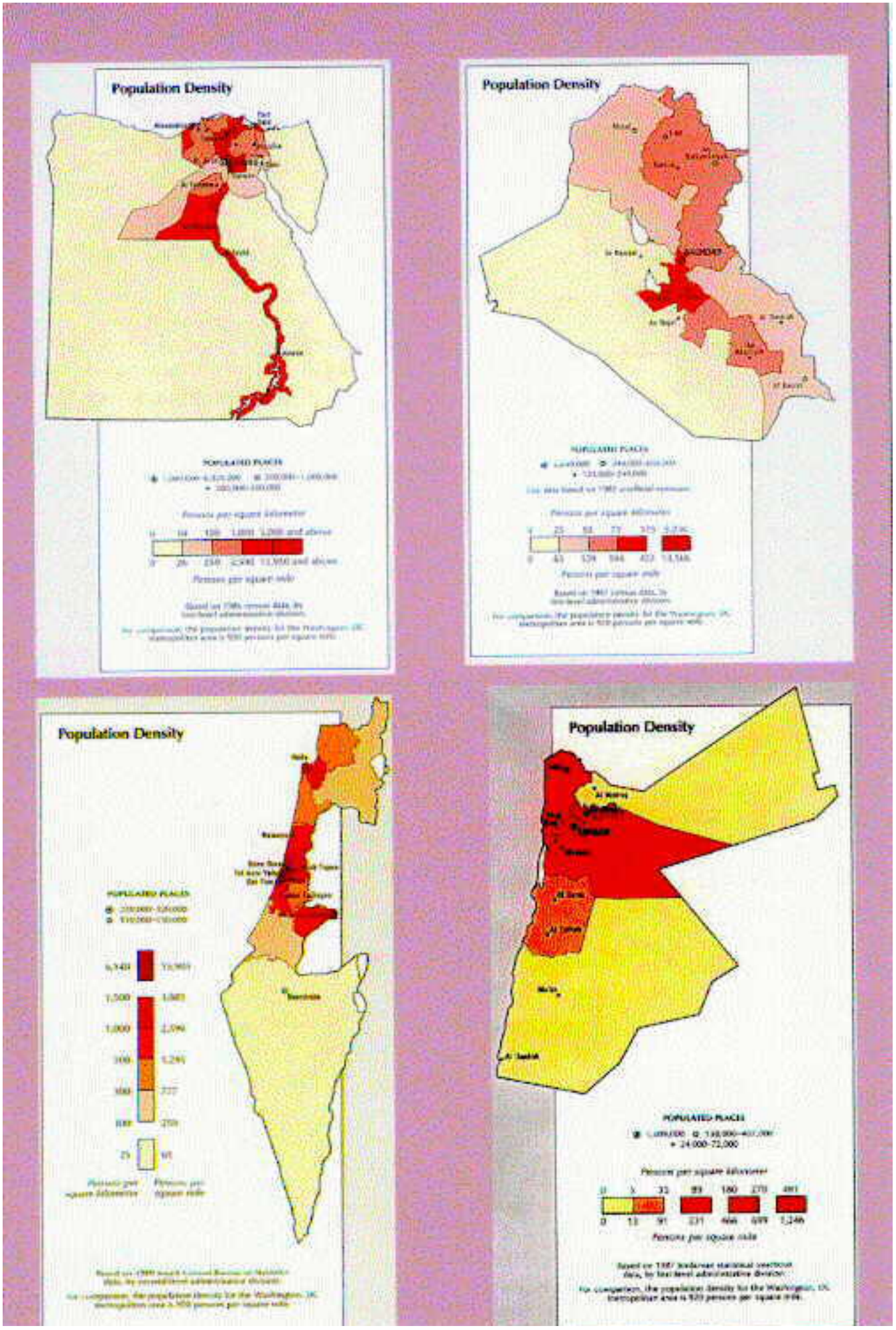

Economic Activity

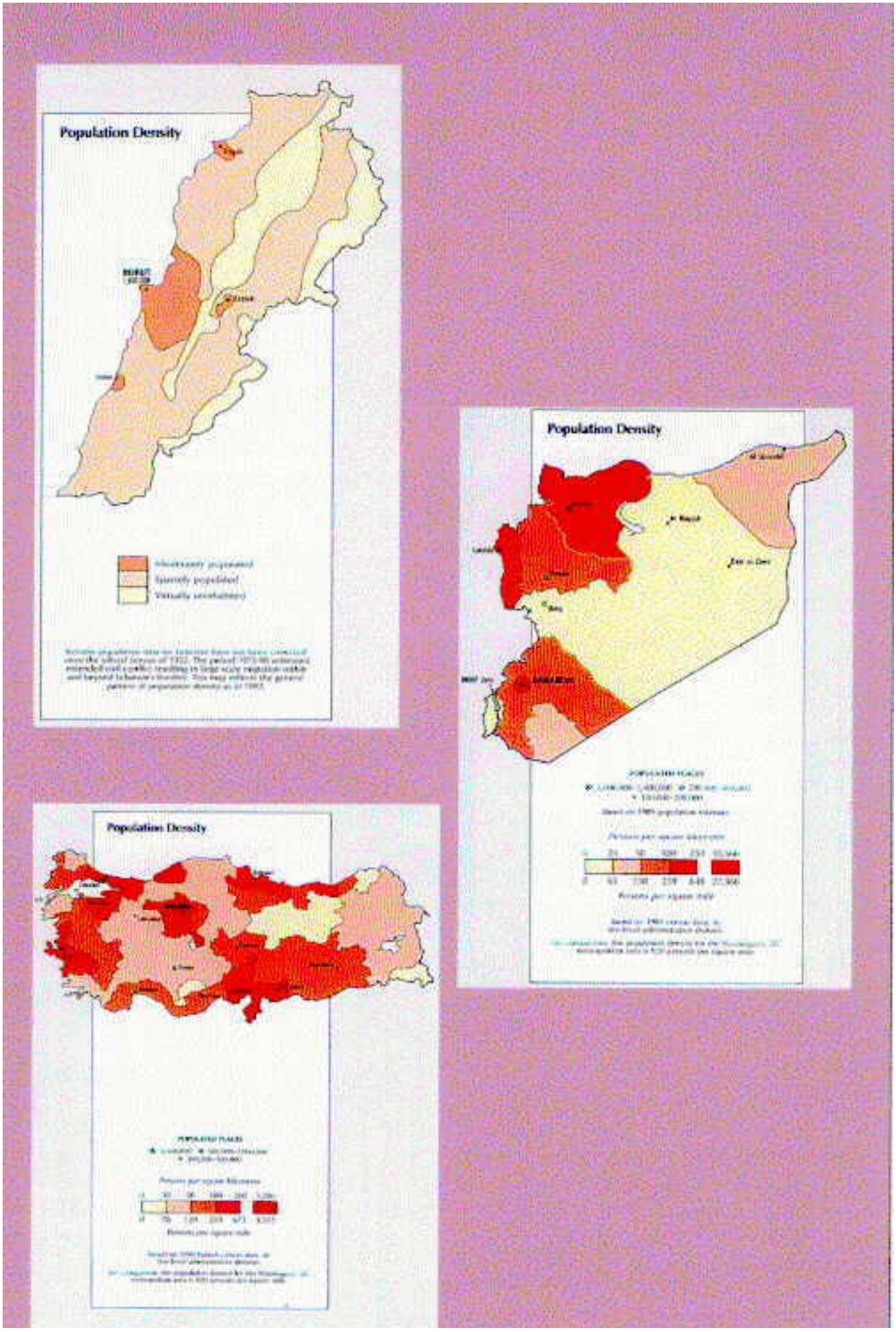

Gaza Strip

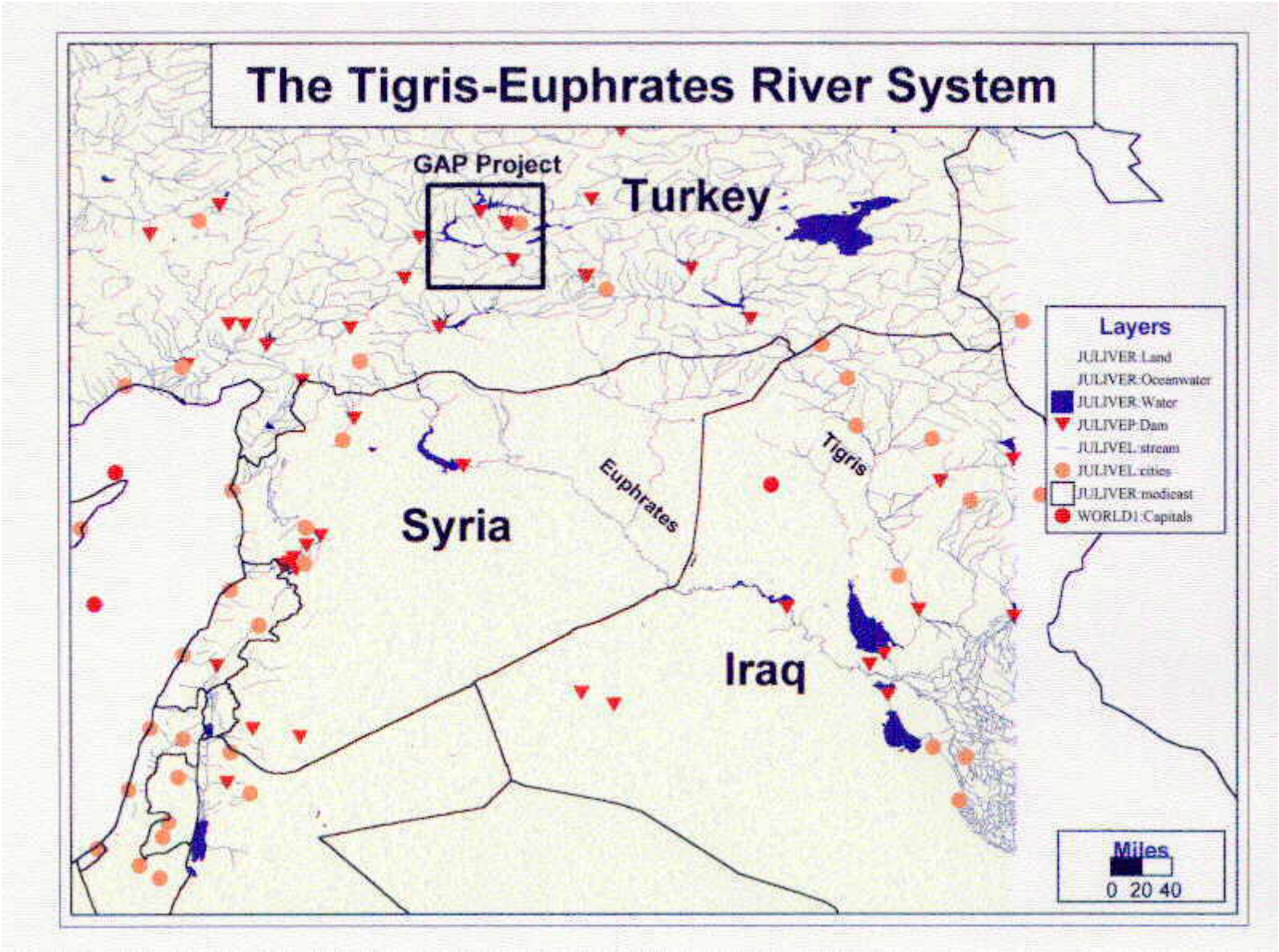

Golan Heights

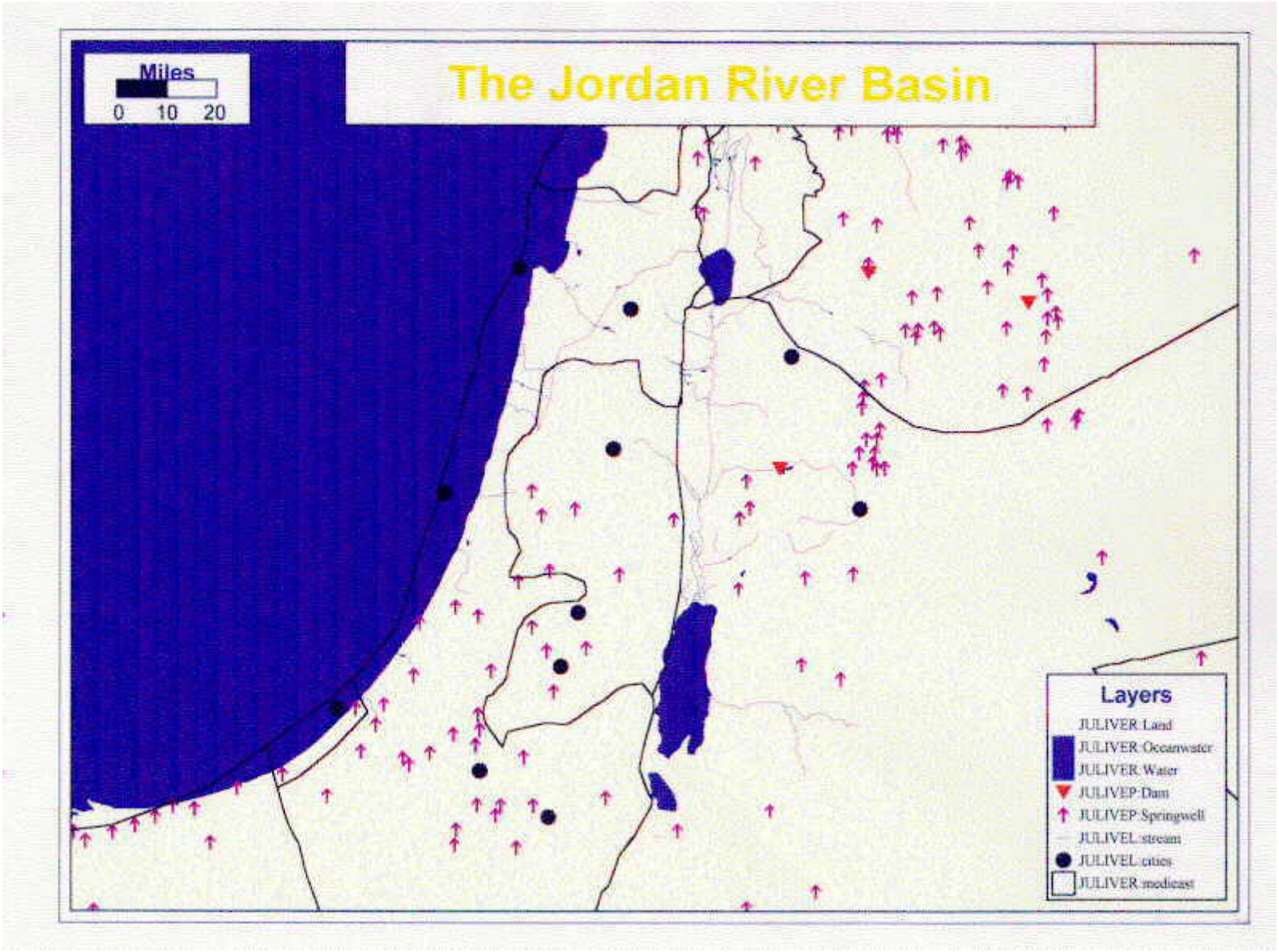

Economic Activity

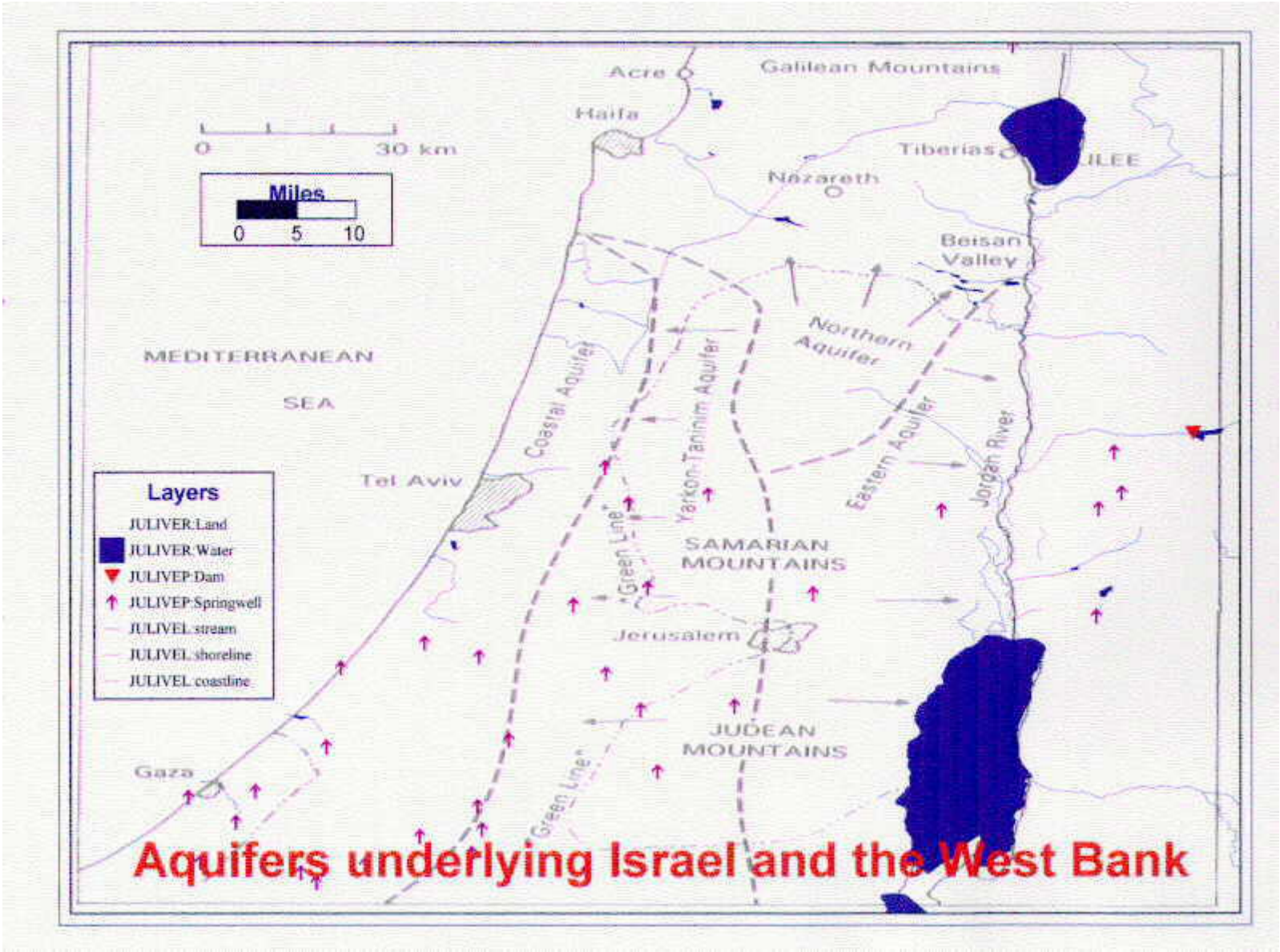

Economic Activity
Economic Activity
Economic Activity
Economic Activity
Economic Activity


Population Density
Population Density
Population Density
Population Density


Population Density
Population Density
Population Density


The Tigris-Euphrates River System
GAP Project
Turkey
Syria
Euphrates
Tigris
Iraq
Layers
JULIVER:Land
JULIVER:Oceanwater
JULIVER:Water
JULIVEP:Dam
JULIVEL:stream
JULIVEL:cities
JULIVER:mideast
WORLD1:Capitals
Miles
0 20 40


Miles
0 10 20
The Jordan River Basin
Layers
JULIVER Land
JULIVER Oceanwater
JULIVER Water
JULIVEP Dam
JULIVEP Springwell
JULIVEL stream
JULIVEL cities
JULIVER mideast


Acre
Galilean Mountains
Haifa
0
30 km
Miles
0 5 10
Tiberias
Nazareth
Beisan Valley
Northern Aquifer
MEDITERRANEAN
SEA
Coastal Aquifer
Yarkon-Taninim Aquifer
Eastern Aquifer
Jordan River
Layers
JULIVER:Land
JULIVER:Water
JULIVEP:Dam
JULIVEP:Springwell
JULIVEL:stream
JULIVEL:shoreline
JULIVEL:coastline
Tel Aviv
"Green Line"
SAMARIAN MOUNTAINS
Jerusalem
JUDEAN MOUNTAINS
Gaza
Green Line
Aquifers underlying Israel and the West Bank

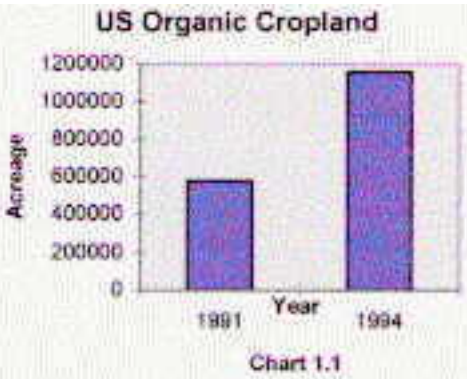


Chart 1.1

Chart 1.2

Source: Mergentime, 1995

Chart 1.3 Source: Mergentime, 1995

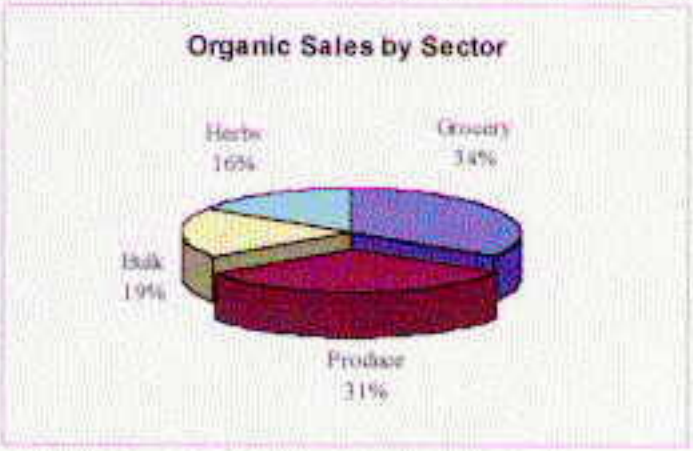
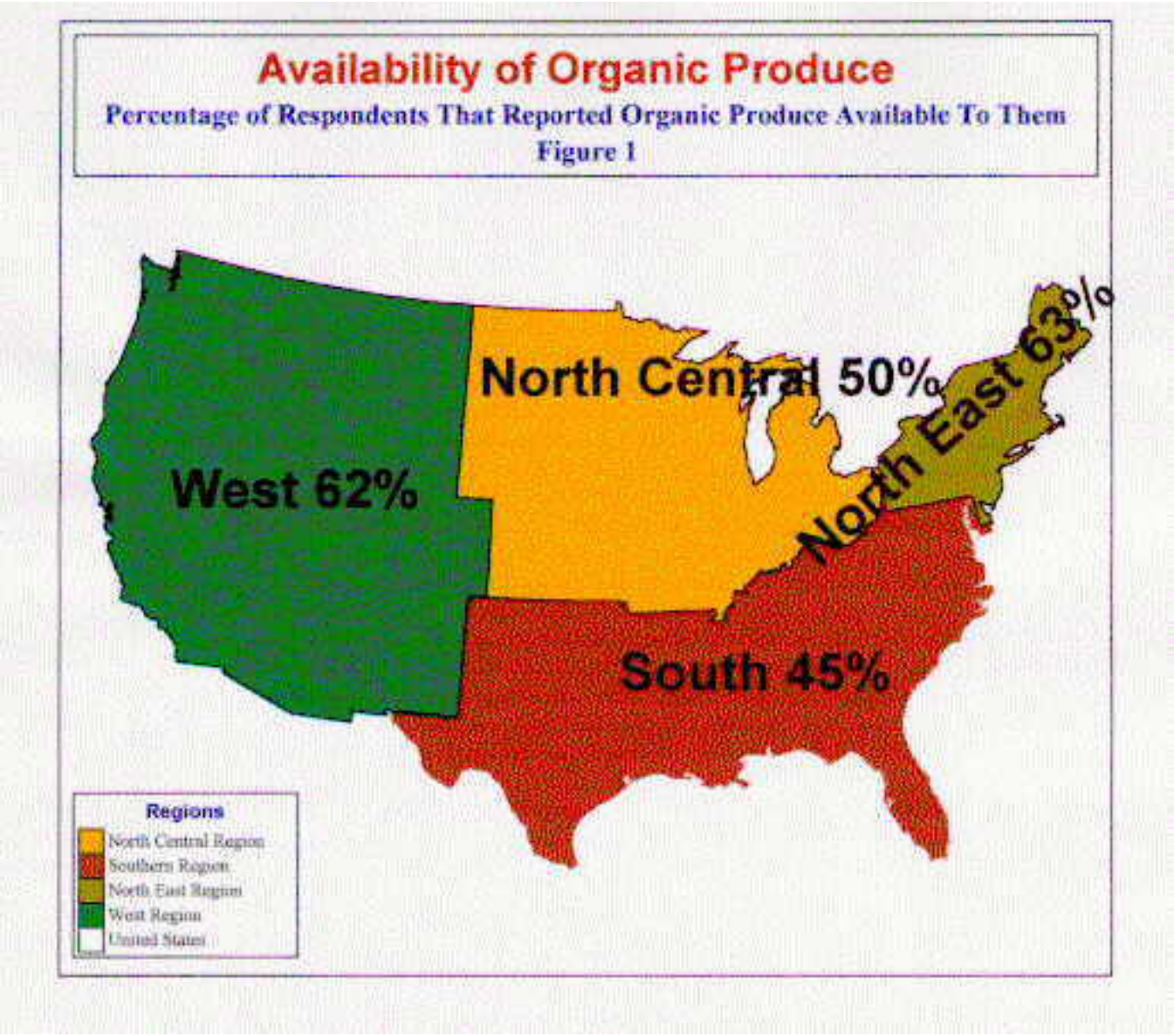


Chart 1.4 Source: Mergentime, 1995


Availability of Organic Produce
Percentage of Respondents That Reported Organic Produce Available To Them
Figure 1
West 62%
North Central 50%
North East 63%
South 45%
Regions
North Central Region
Southern Region
North East Region
West Region
United States

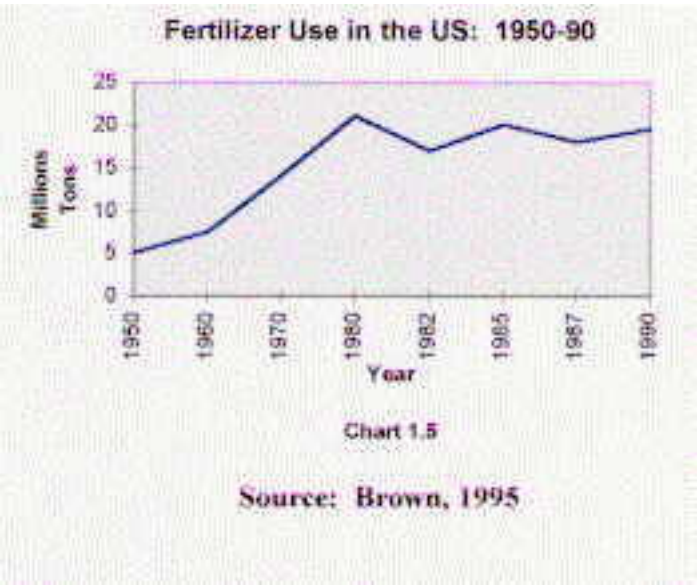


Chart 1.5

Source: Brown, 1995

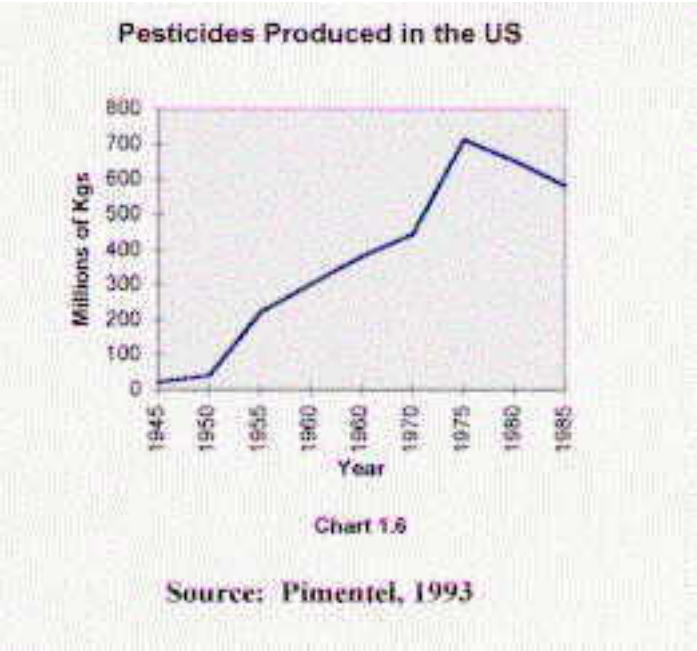


Chart 1.6

Source: Pimentel, 1993

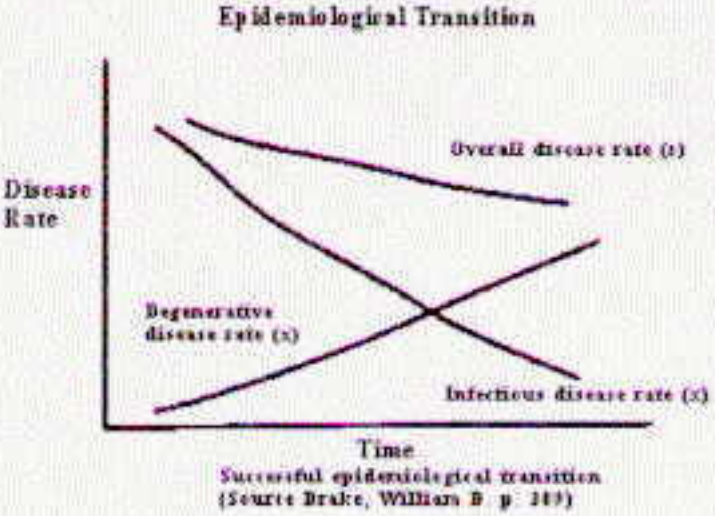


Diagram 1.1

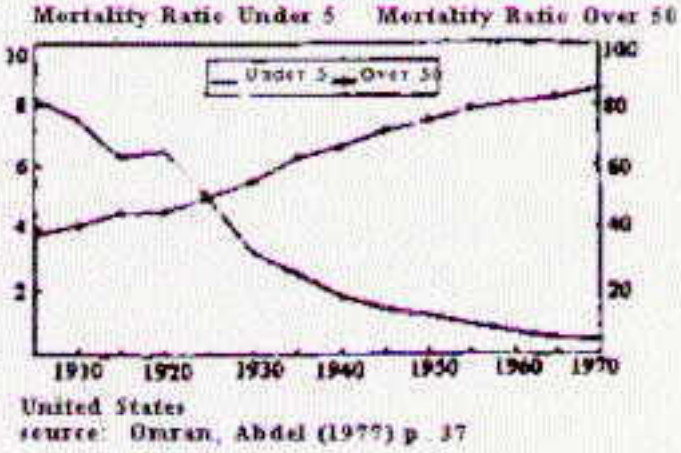
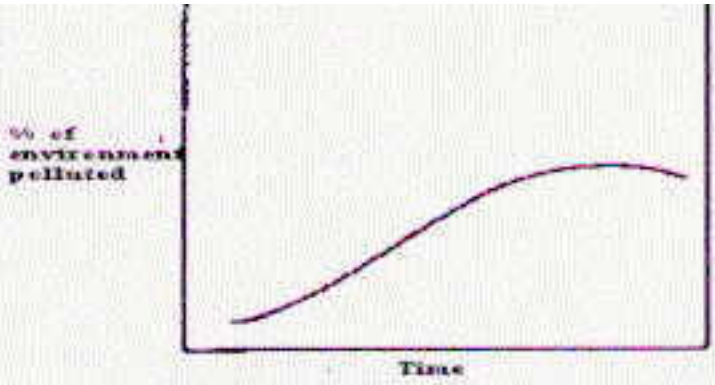
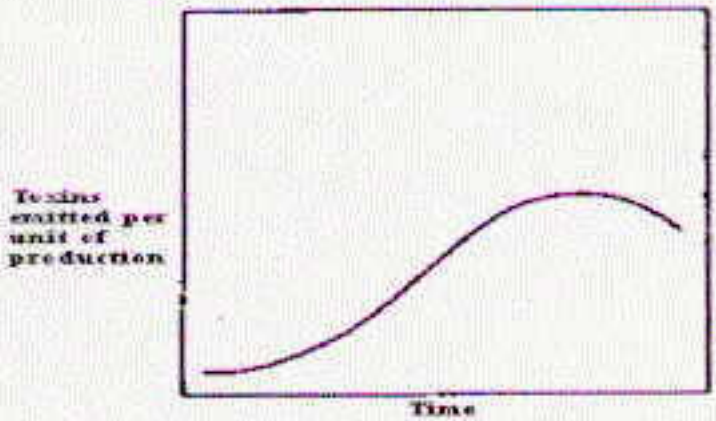


Diagram 1.2 Source: Drake, 1993

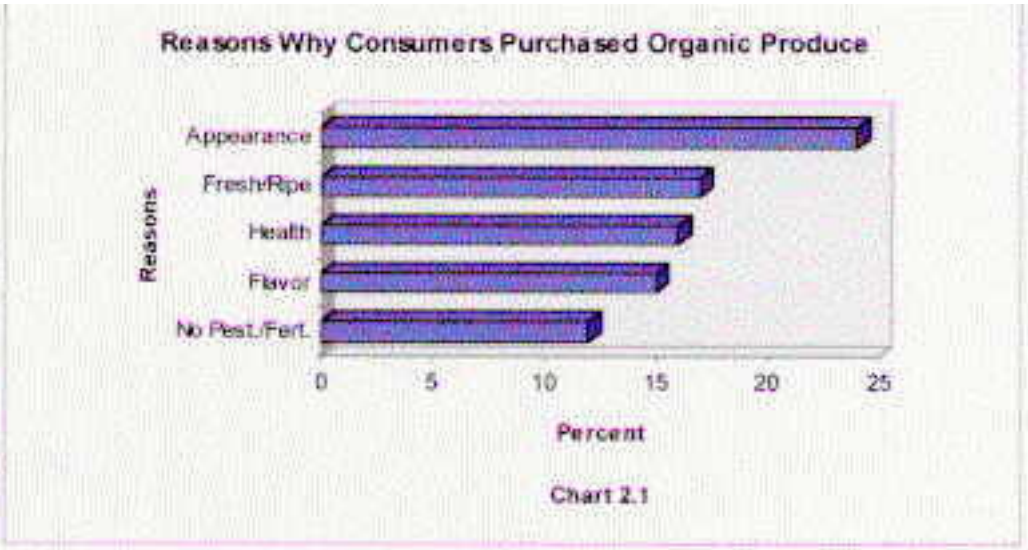


Source Brake, William B p 325

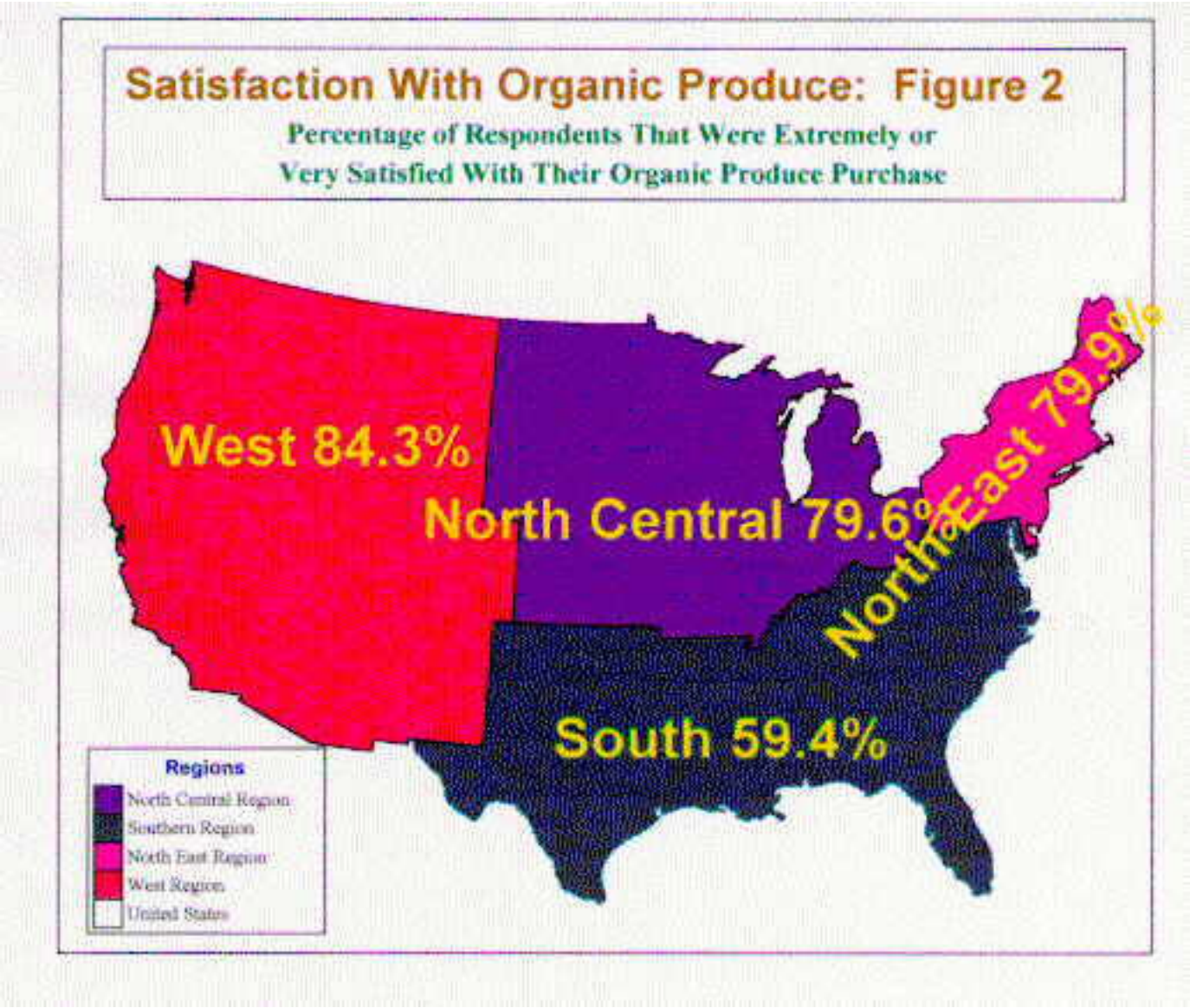


Source: Brake, William B p 325

Diagrams 1.3 and 1.4



Source: The Packer, 1996


Satisfaction With Organic Produce: Figure 2
Percentage of Respondents That Were Extremely or
Very Satisfied With Their Organic Produce Purchase
West 84.3%
North Central 79.6%
North East 79.9%
South 59.4%
Regions
North Central Region
Southern Region
North East Region
West Region
United States

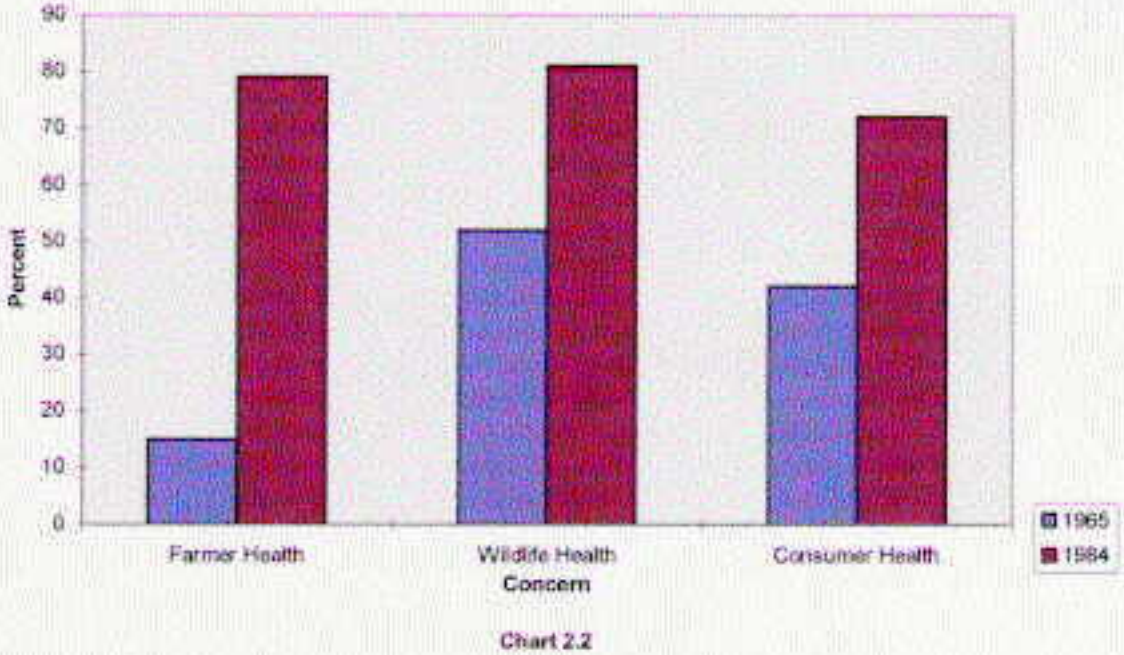


Chart 2.2

Source: Sachs et. al, 1987

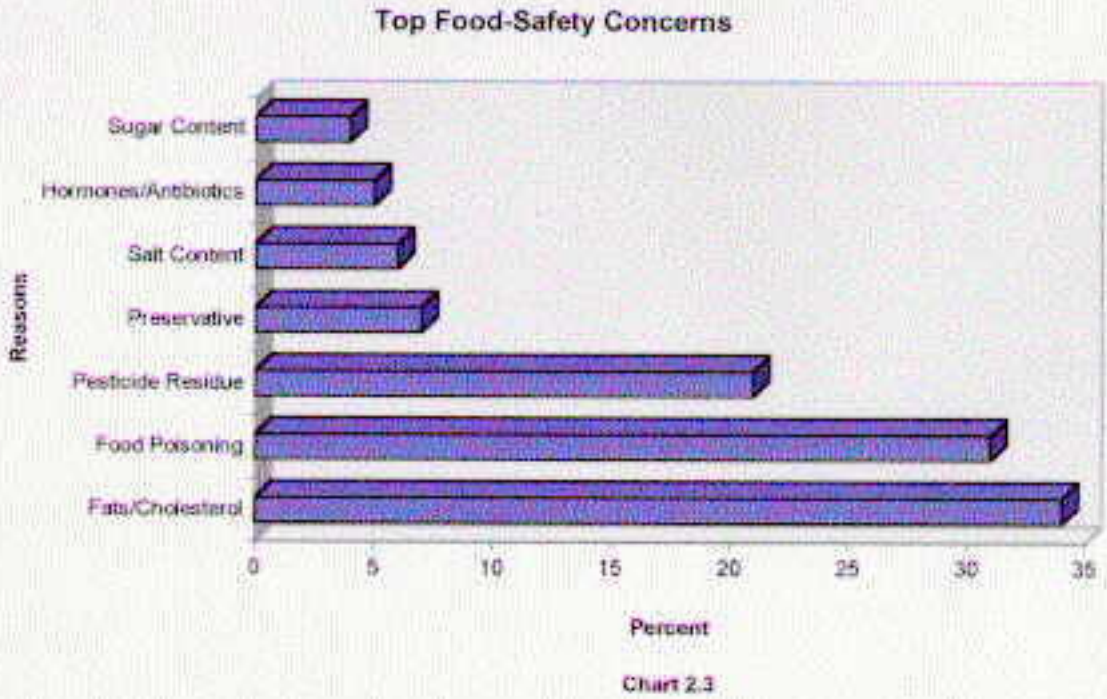


Chart 2.3

Source: Buzby and Skees, 1994

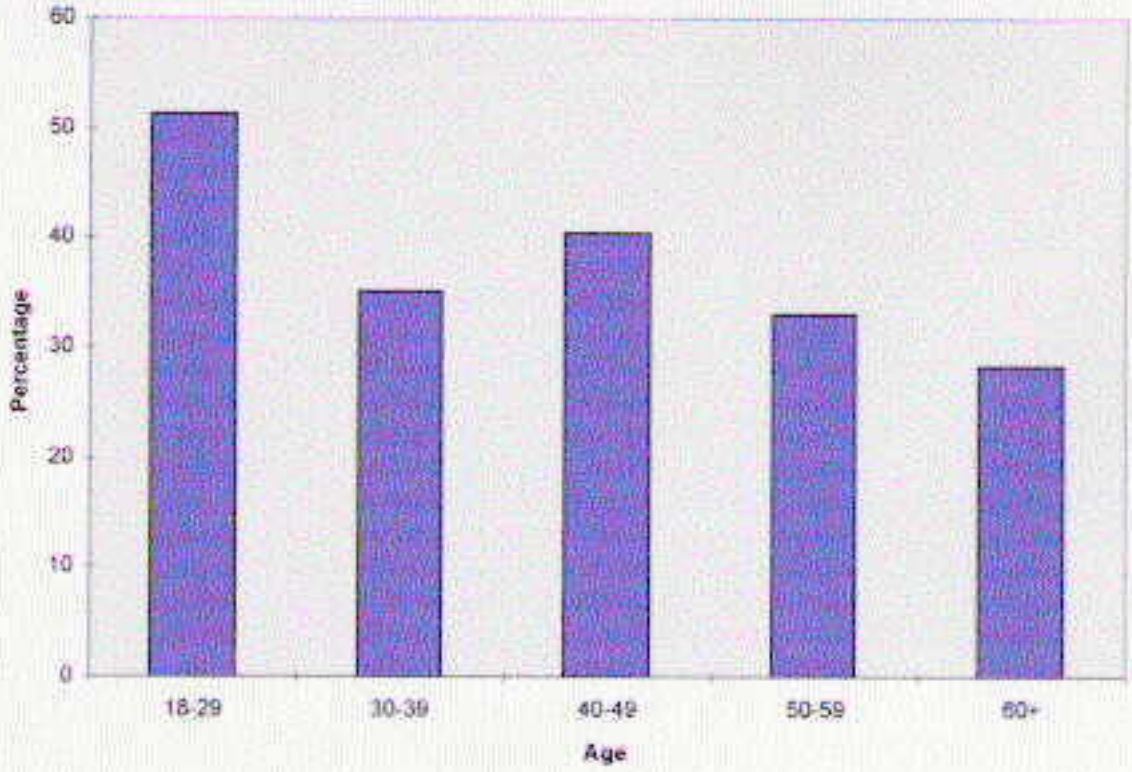


Chart 2.4 Source: The Packer, 1996

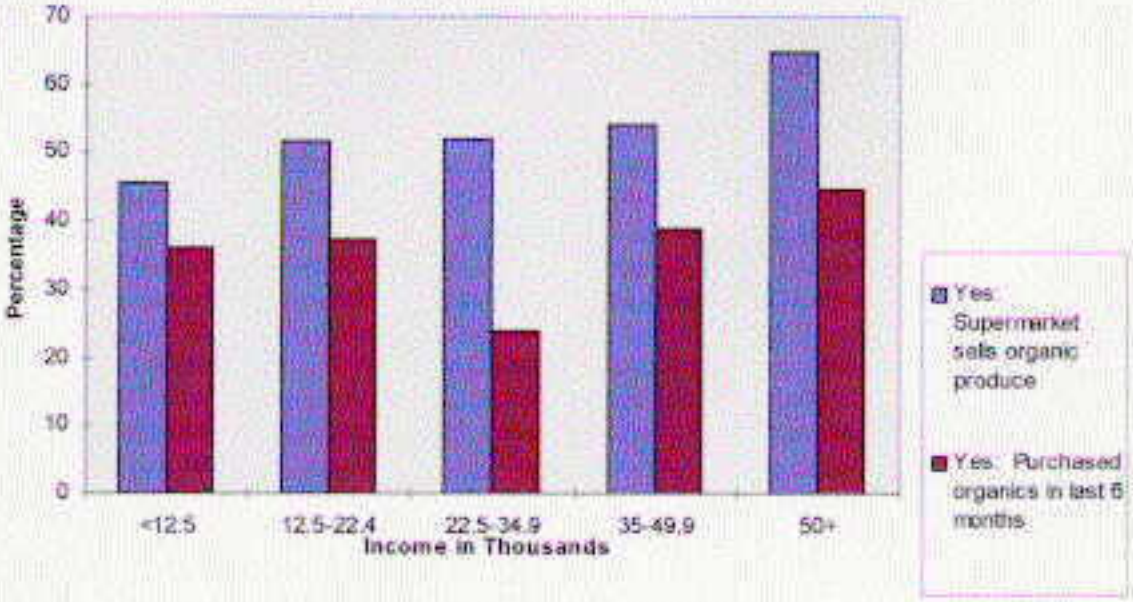


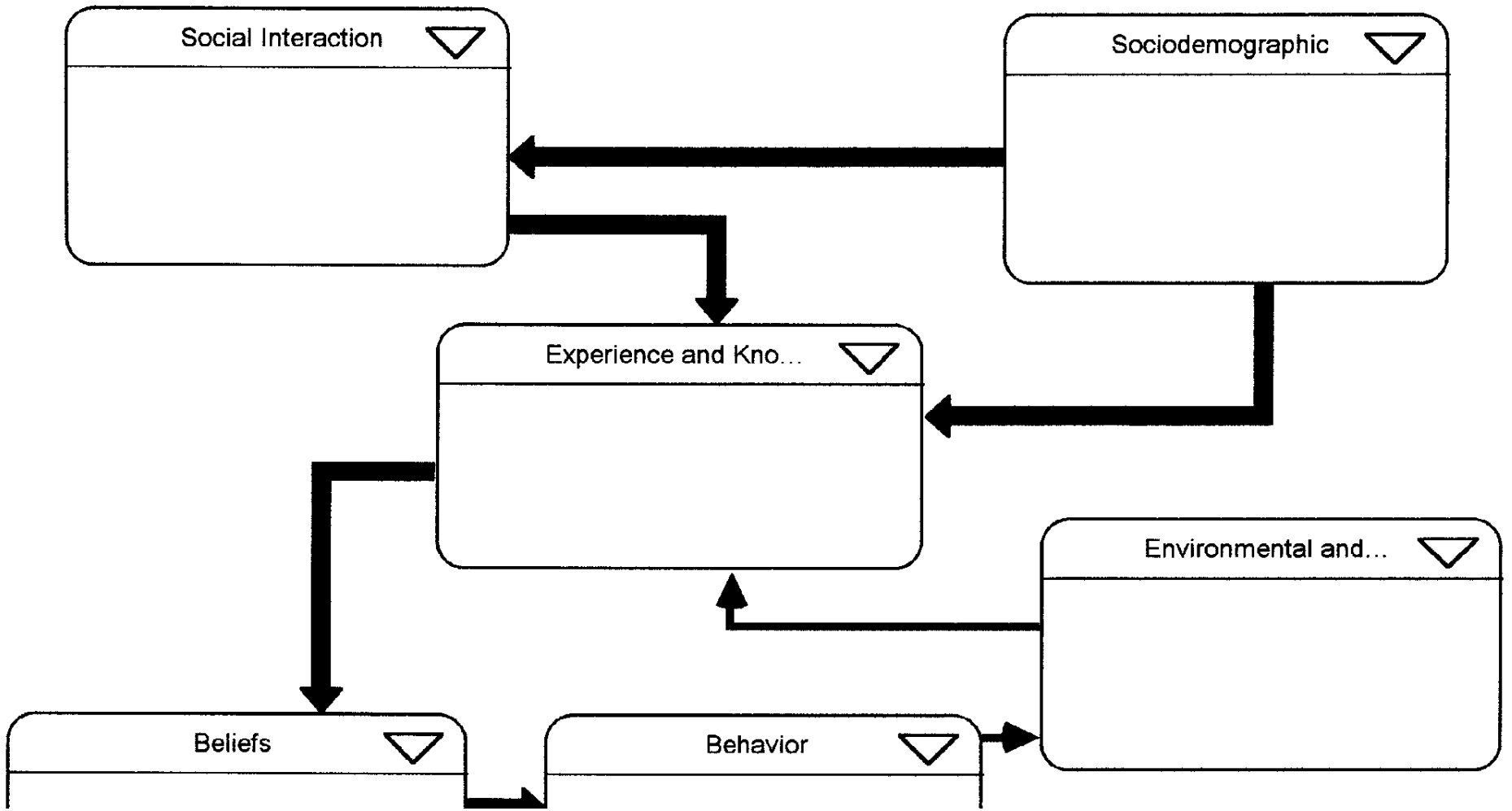
Chart 2.5 Source: The Packer, 1996

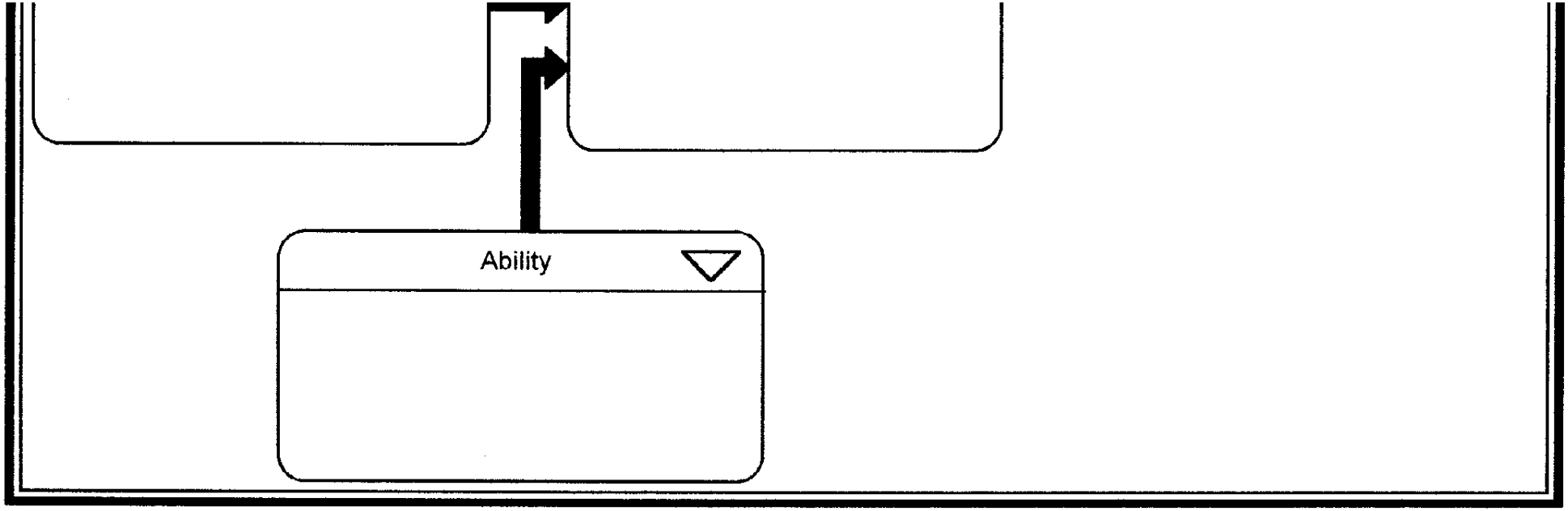
Chart 2.6 Source: The Packer, 1996

Stella Model Map

Organic Agriculture and Consumer Behavior: A Model for Change

>>Scroll Right to Input Variables for the Model>>




Ability

Stella Model Inputs

Variable Inputs

>>Scroll Right for Graphical Outputs>>

Sociodemographic Variables

Restore | Age = 62 | ?
20 — 70

Restore | Education = 1 | ?
0.0 — 1.0

Restore | Income = 200000 | ?
10000 — 200000

Belief Variables

Restore | Health = 5 | ?
1.0 — 5.0

Restore | Environment = 5 | ?
1.0 — 5.0

Knowledge Variables

Restore | Pr5duction = 5 | ?
1.0 — 5.0

Restore | Environmental Effects = 5 | ?
1.0 — 5.0

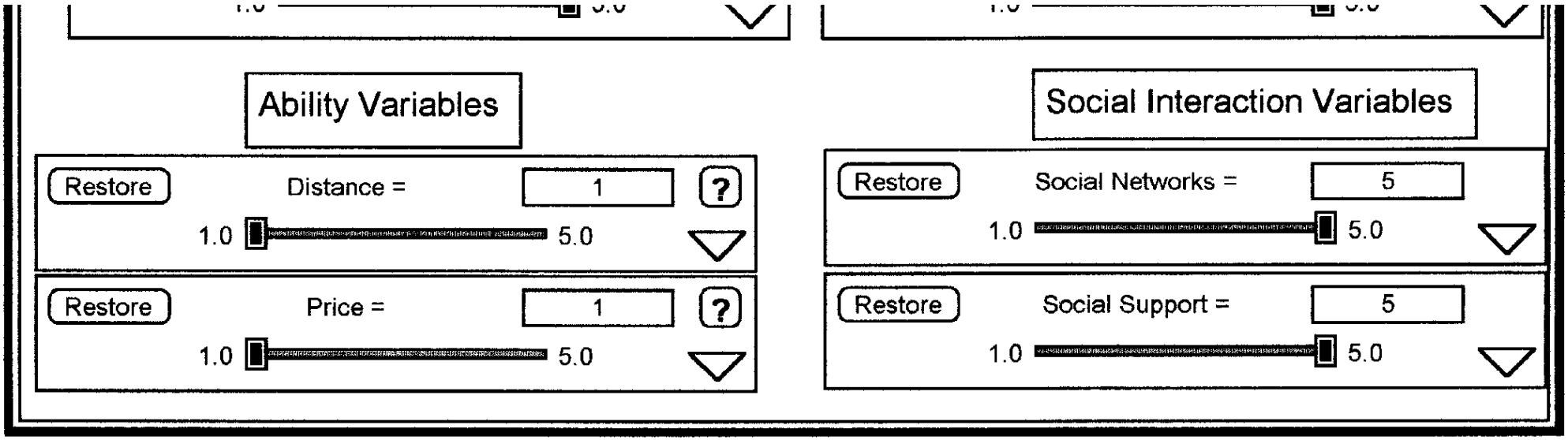
Restore | Health Effects = 5 | ?
1.0 — 5.0

Experience Variables

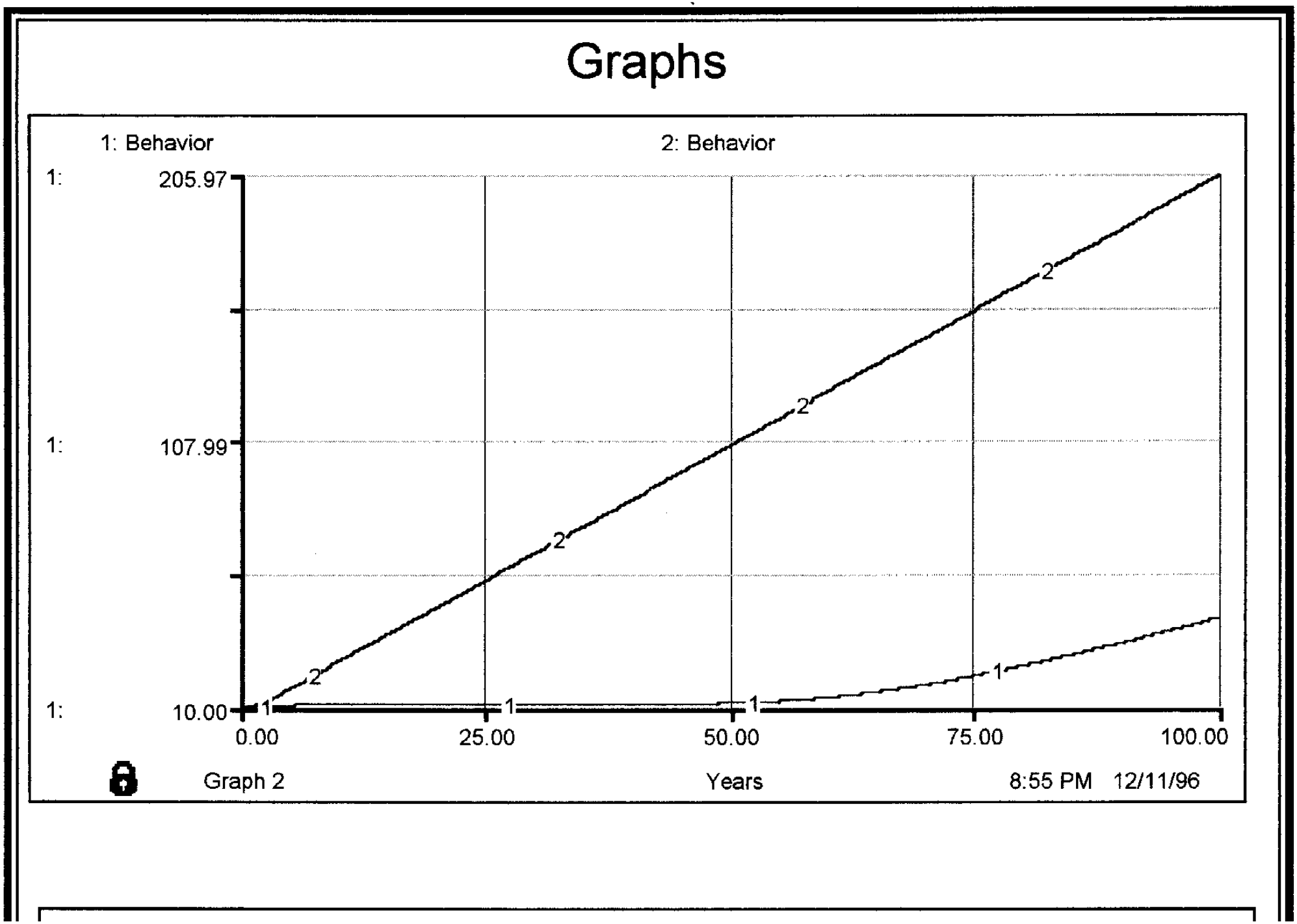
Restore | Production = 5 | ?
1.0 — 5.0

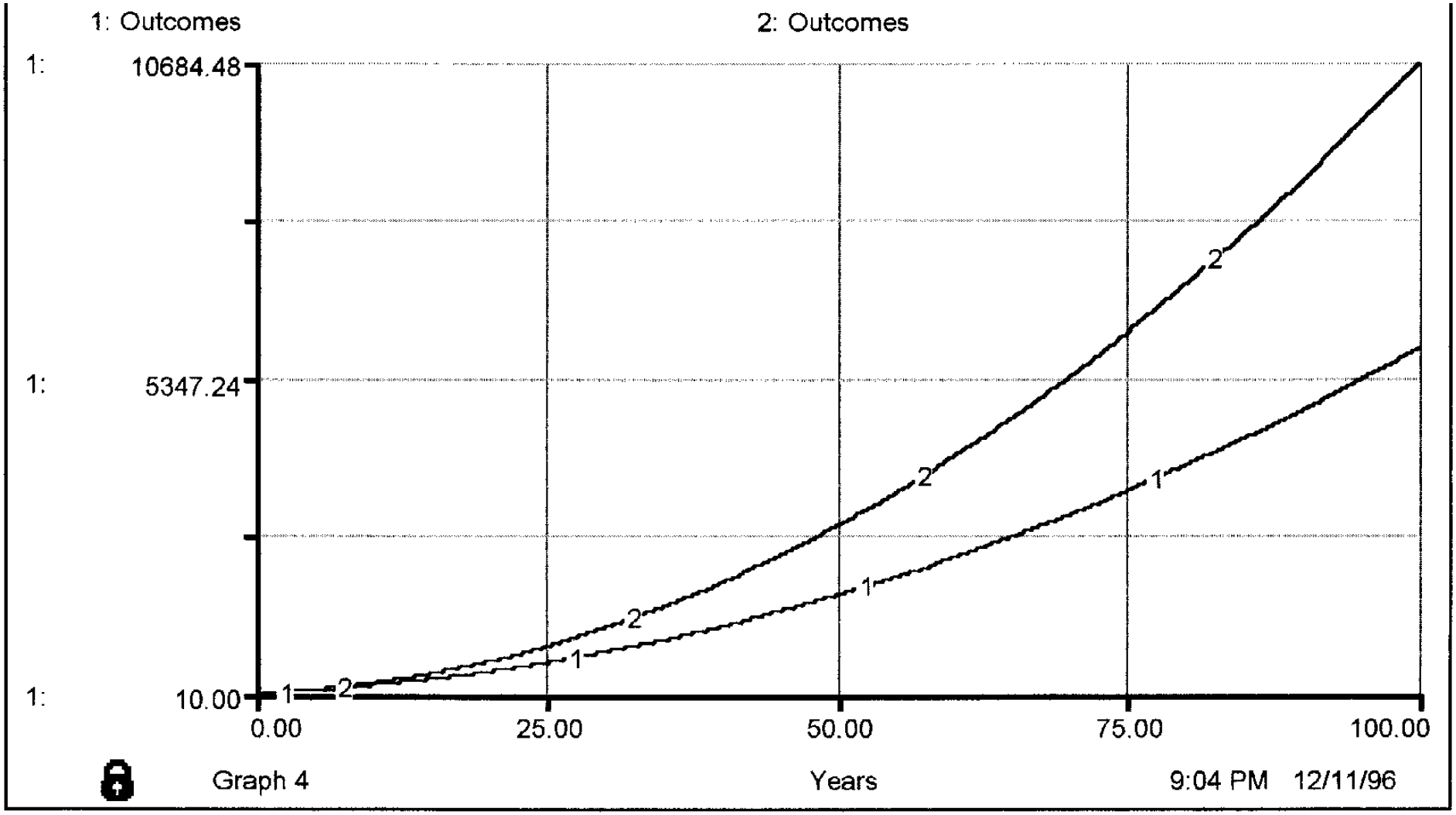
Restore | Env Effects = 5 | ?
1.0 — 5.0

Restore | Healt Effects = 5 | ?
1.0 — 5.0

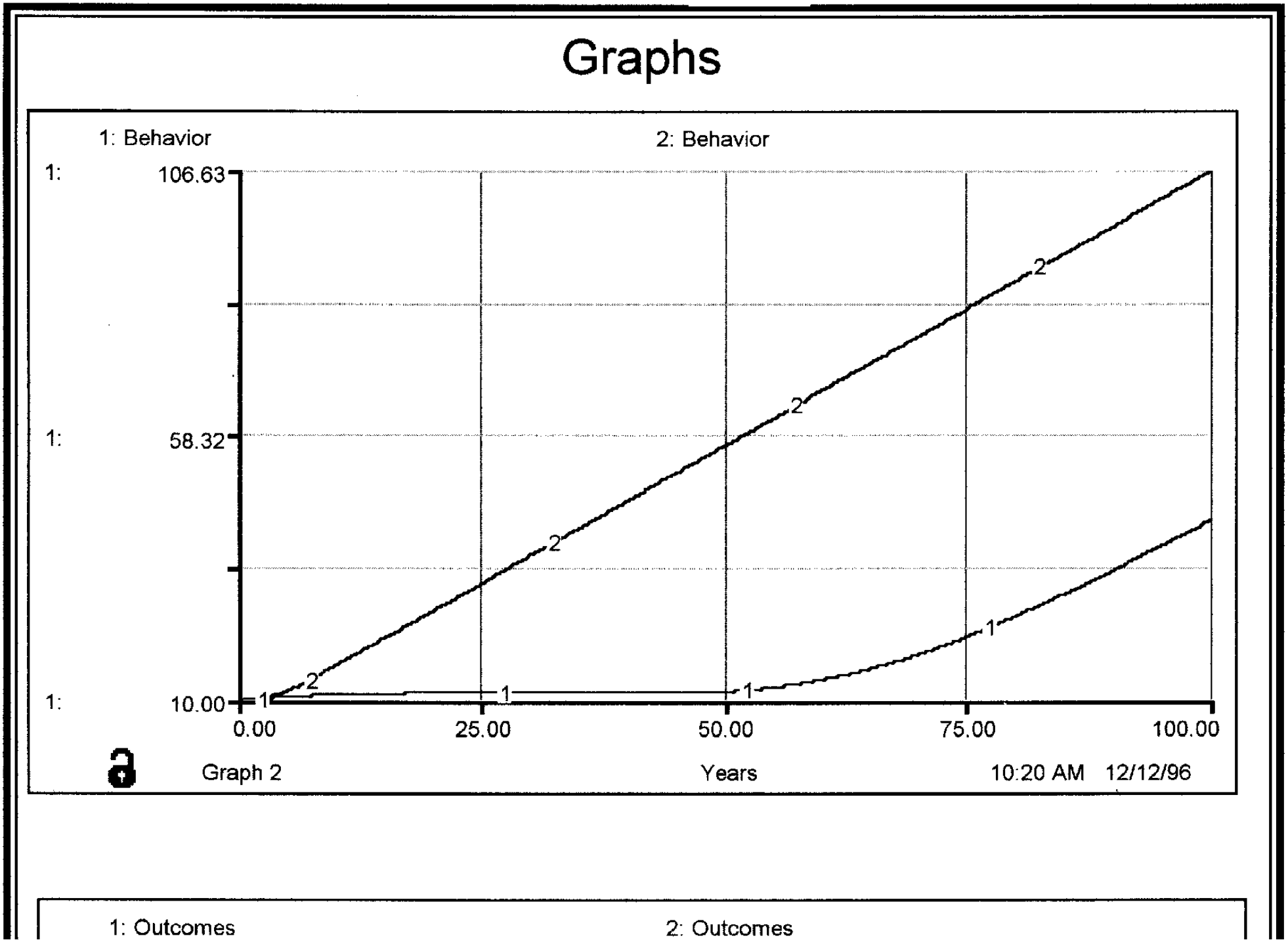

Ability Variables
Restore
Distance =
1
1.0
5.0
Restore
Price =
1
1.0
5.0
Social Interaction Variables
Restore
Social Networks =
5
1.0
5.0
Restore
Social Support =
5
1.0
5.0

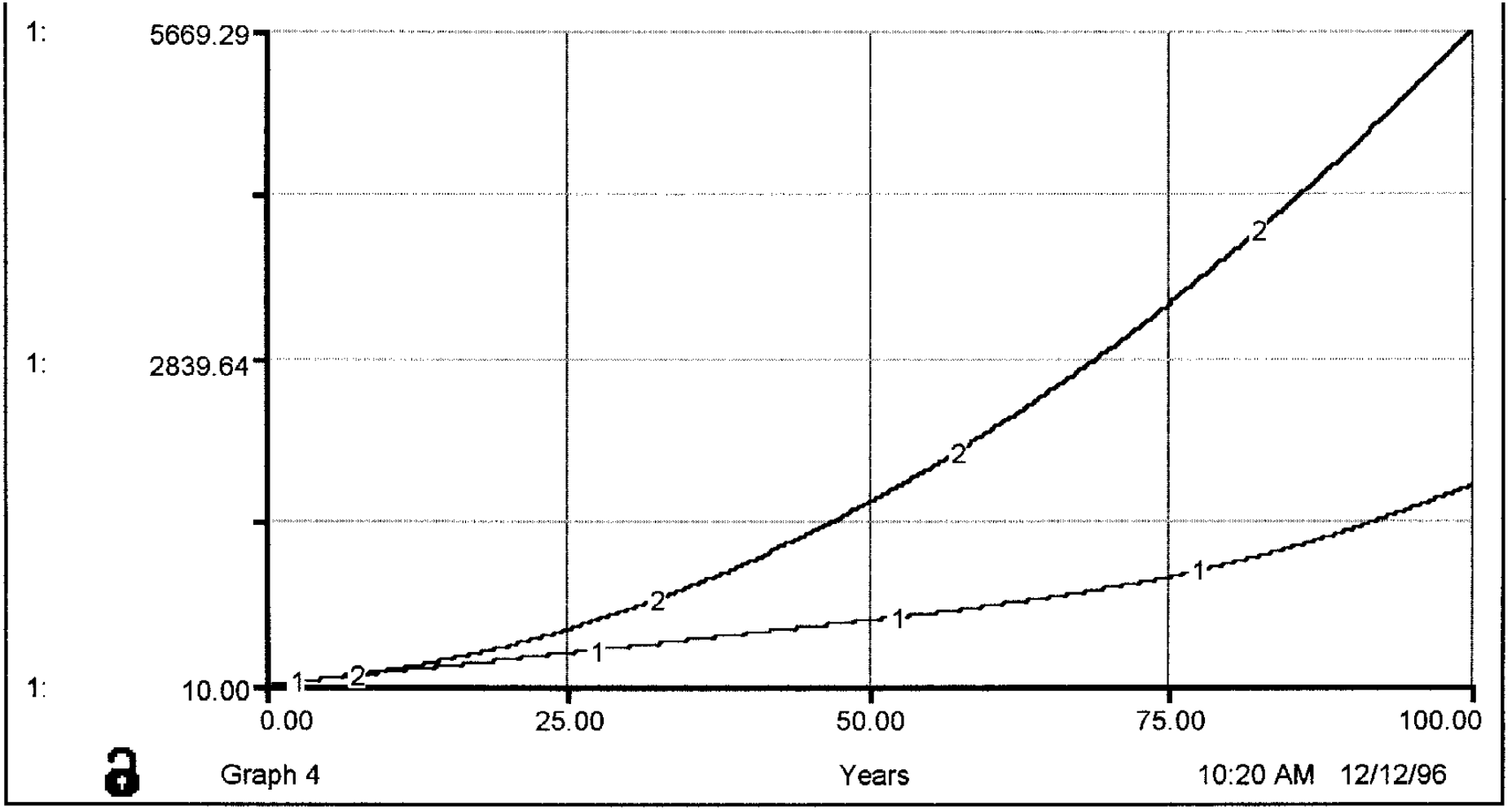
Stella Graph 2: "Worst" & "Best" Case Scenarios



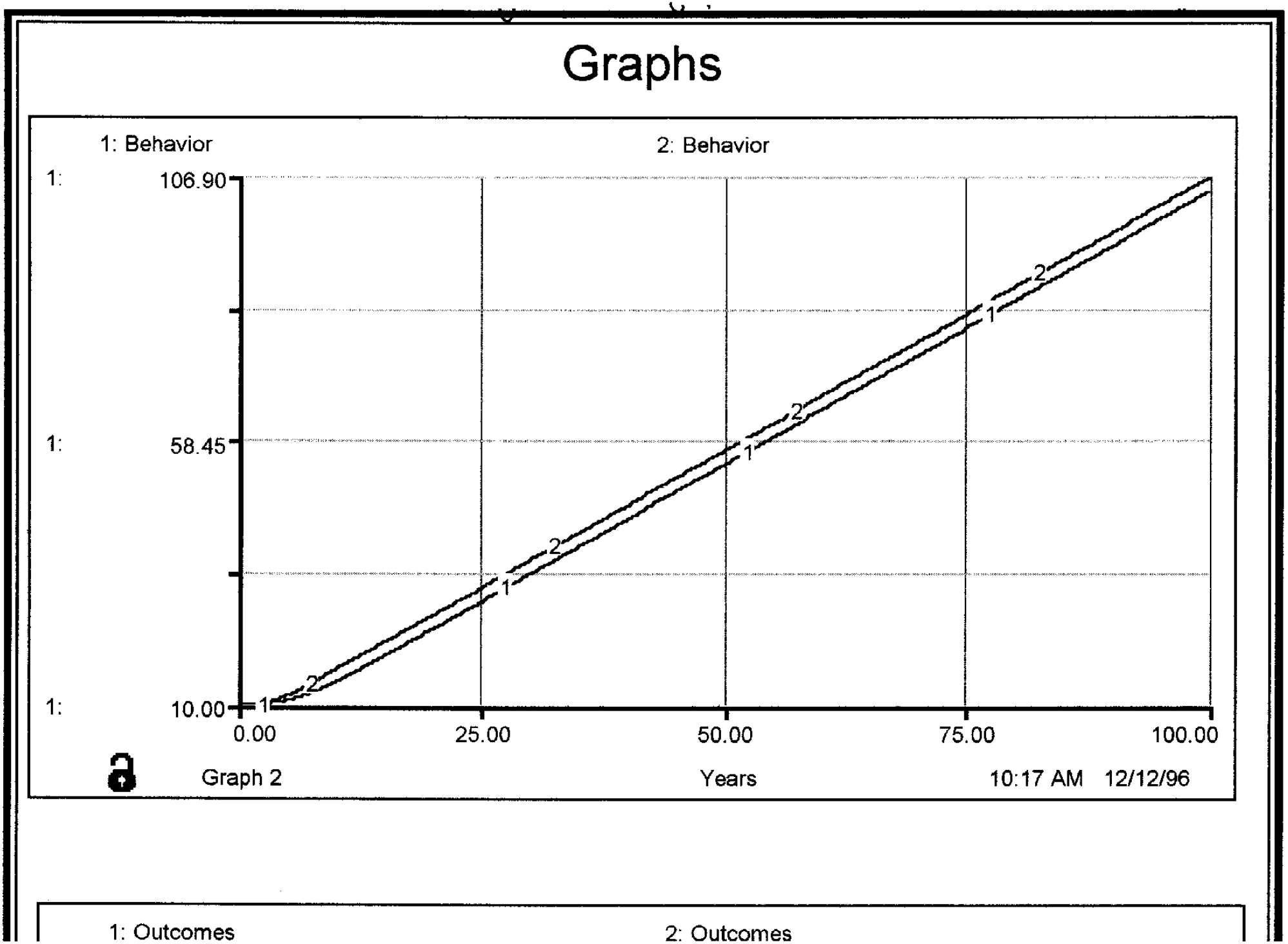

1: Outcomes
2: Outcomes
1:
10684.48
1:
5347.24
1:
10.00
0.00
25.00
50.00
75.00
100.00
Graph 4
Years
9:04 PM 12/11/96

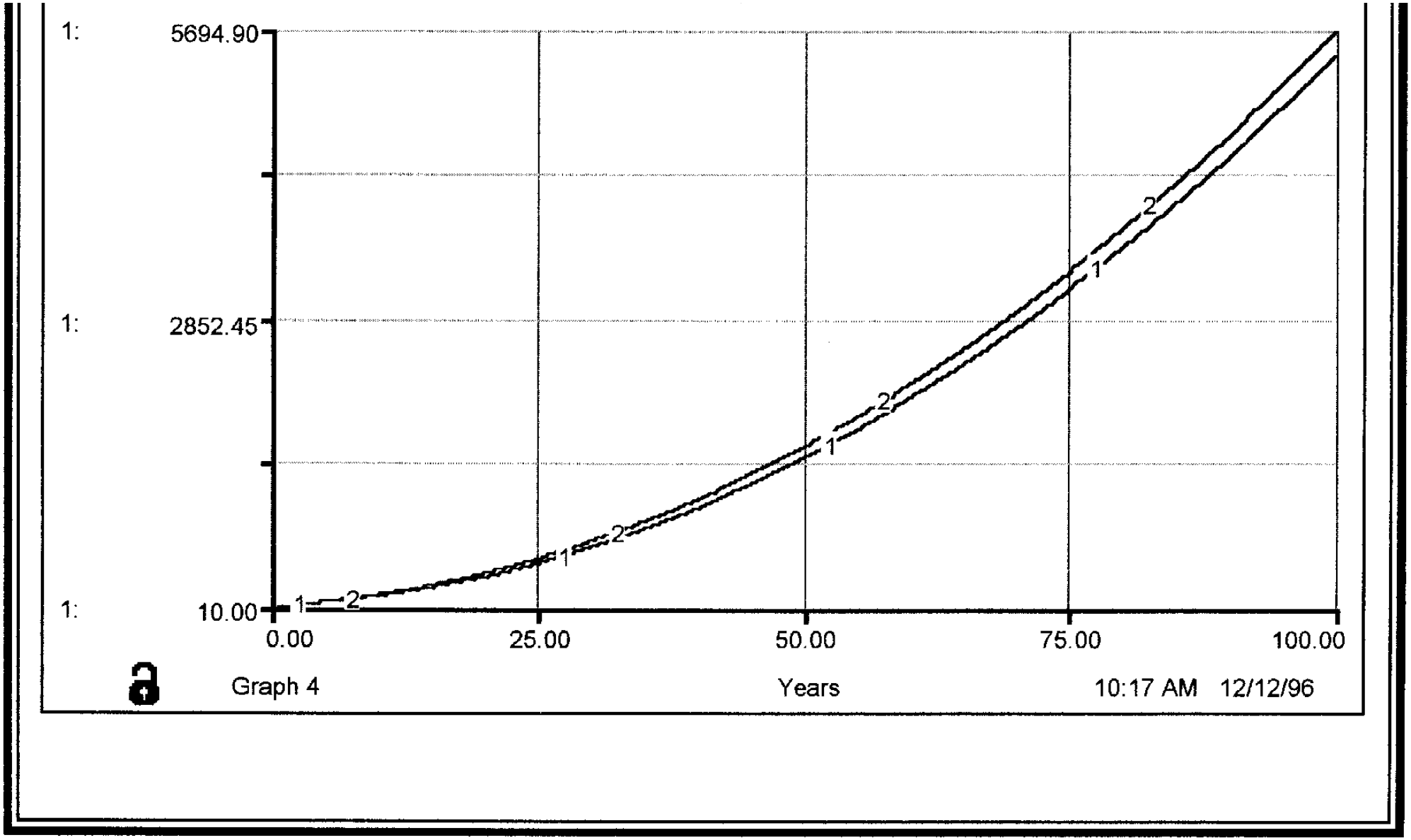
Stella Graph 2: "Low" Sociodemographic & Changes in Knowledge/Experience



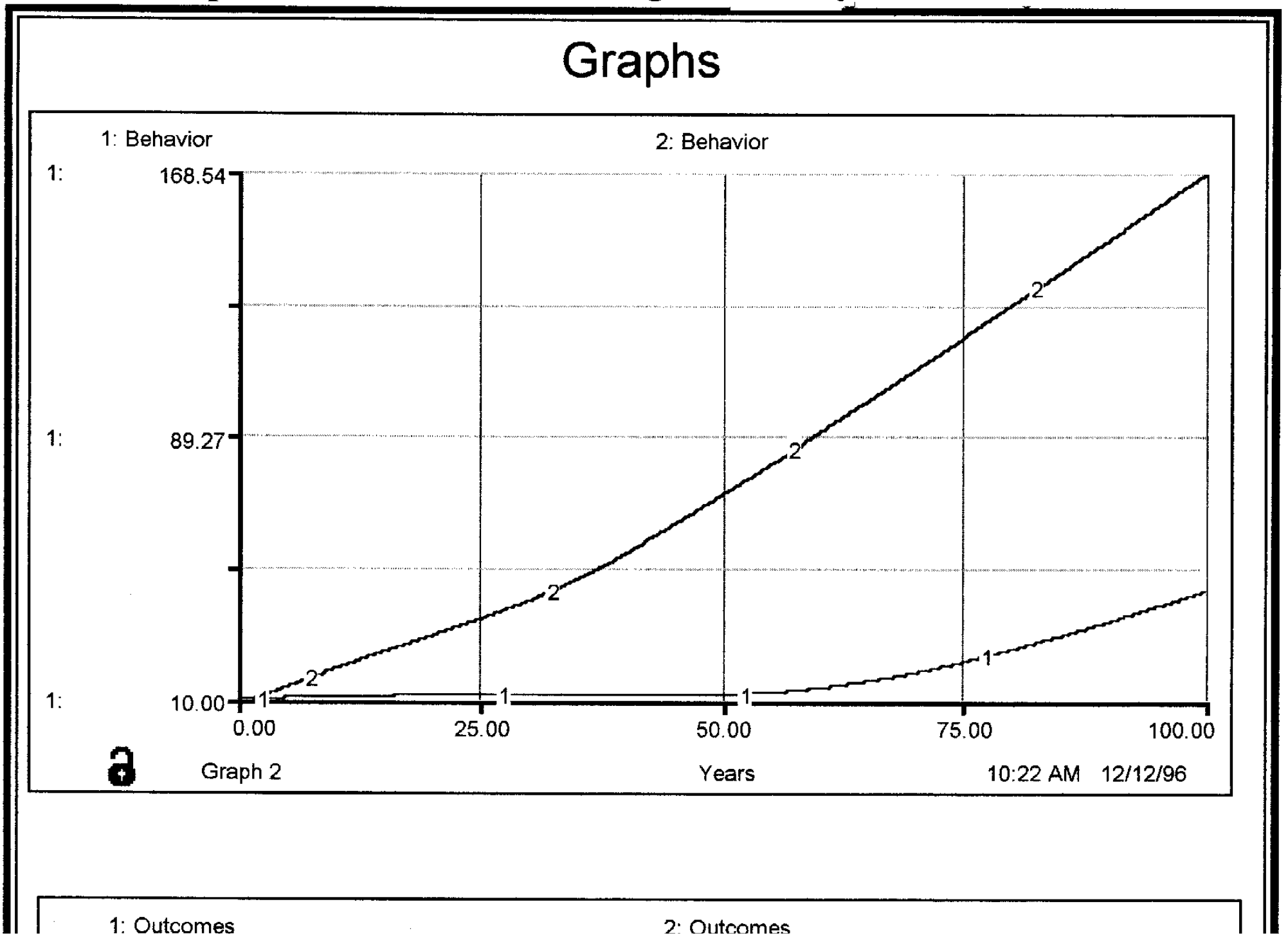

1:
5669.29
1:
2839.64
1:
10.00
0.00
25.00
50.00
75.00
100.00
Graph 4
Years
10:20 AM 12/12/96

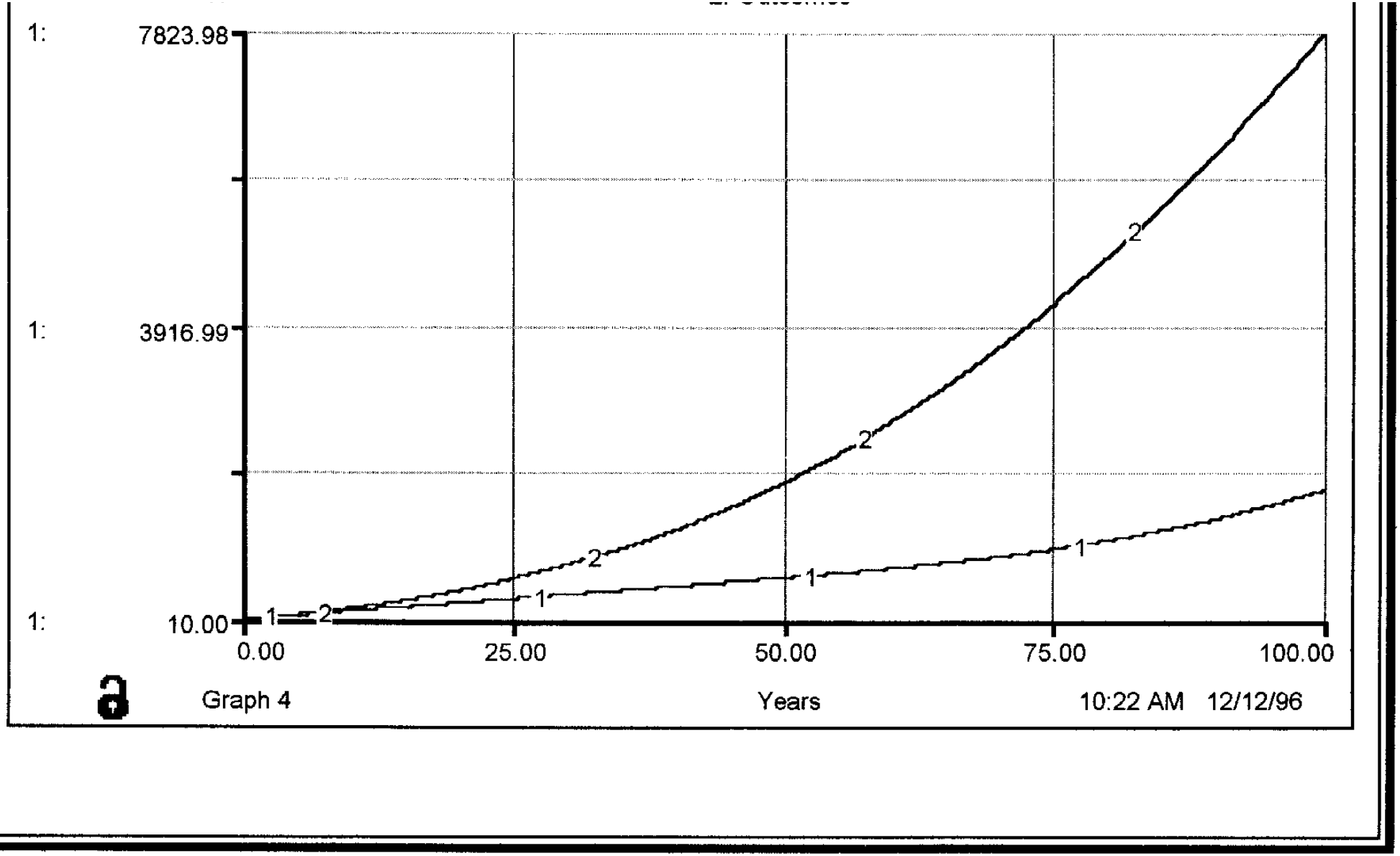
Stella Graph 3: "Wealthy" Sociodemographics & Changes in Experience/Knowledge



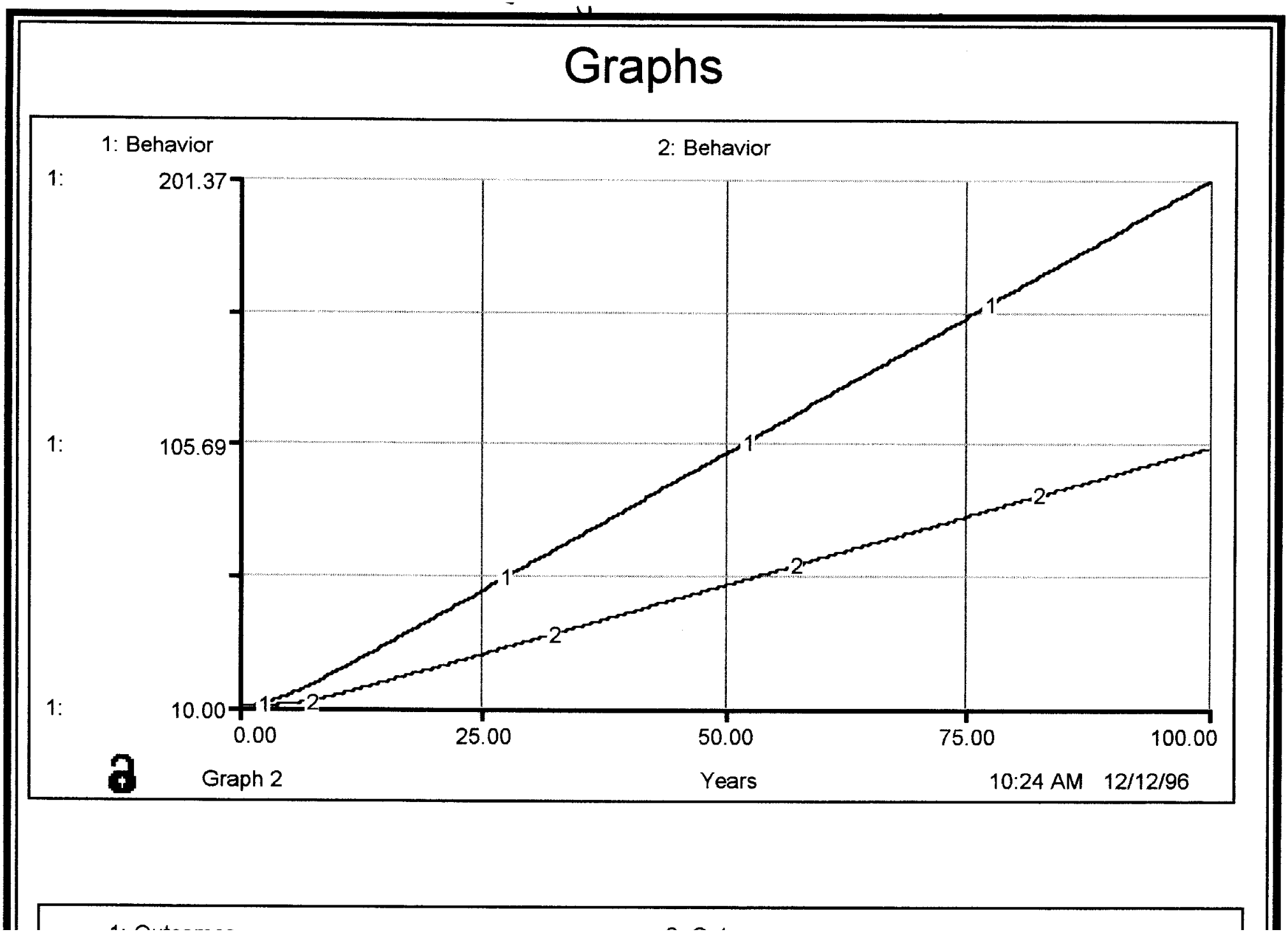

1:
5694.90
1:
2852.45
1:
10.00
0.00
25.00
50.00
75.00
100.00
1
2
Graph 4
Years
10:17 AM 12/12/96

Stella Graph4: "Low Income & Changes in Ability




1:
7823.98
1:
3916.99
1:
10.00
0.00
25.00
50.00
75.00
100.00
Graph 4
Years
10:22 AM 12/12/96

Stella Graph 5: "Wealthy" and Changes in Ability



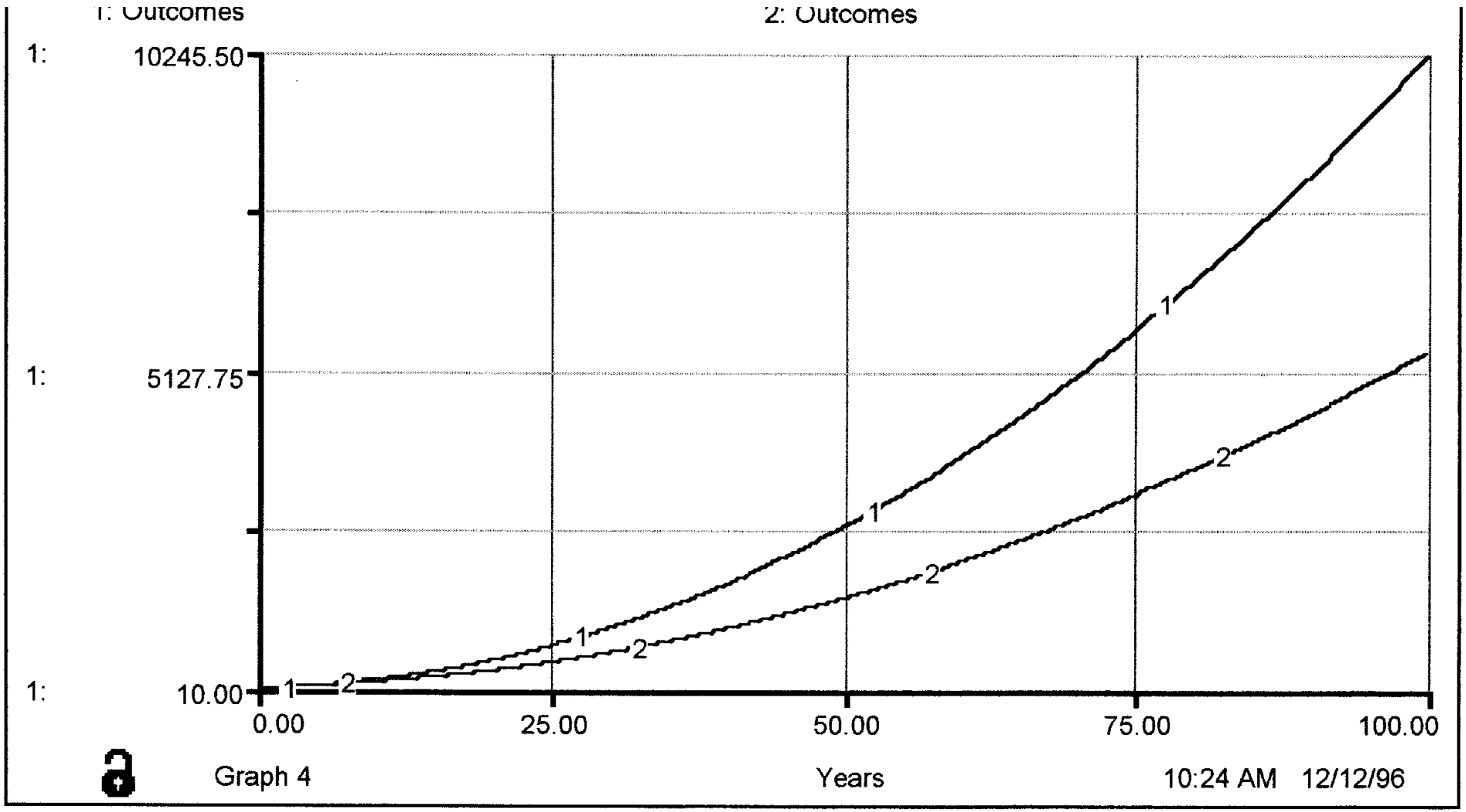
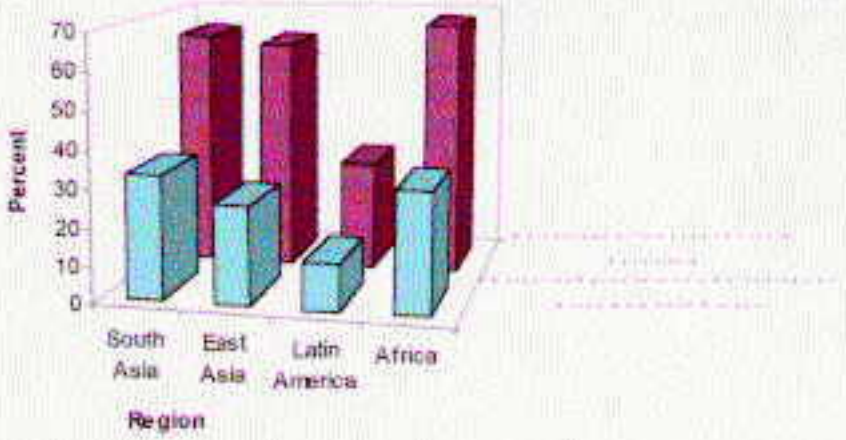

1: Outcomes
2: Outcomes
1:
10245.50
1:
5127.75
1:
10.00
1
2
0.00
25.00
50.00
75.00
100.00
Graph 4
Years
10:24 AM 12/12/96

FIGURE # 1

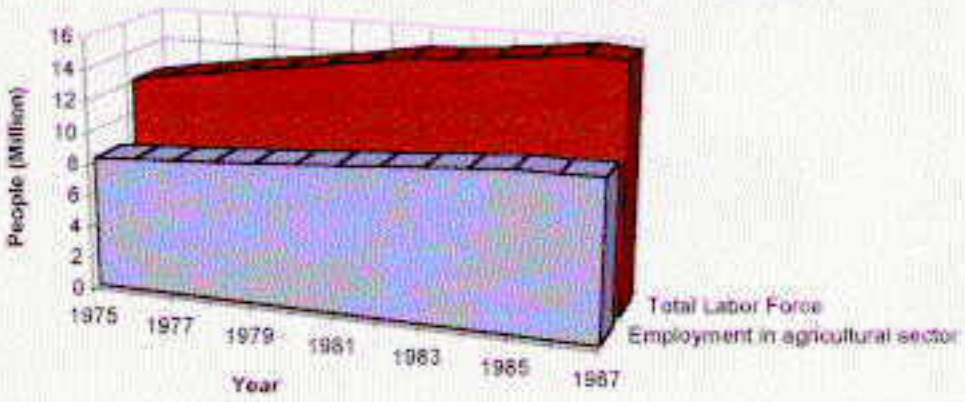
Output and Employment in Third World Agriculture, 1990



Source: Michael P Todaro, Economic Development Fifth Edition, Longman, 1994

FIGURE #2

Total Labor Force & Employment in Agricultural Sector, Burma

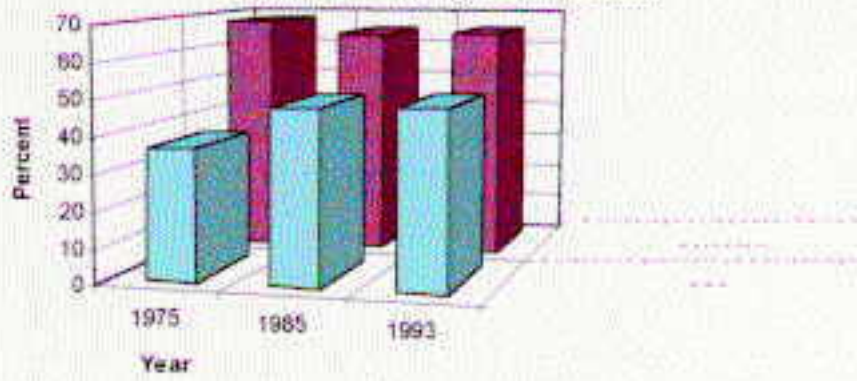


Source: Asian Development Bank, *Key Indicator 1994 ,1995.*

FIGURE #2 shows Burma's total labor force and employment in the agricultural sector.

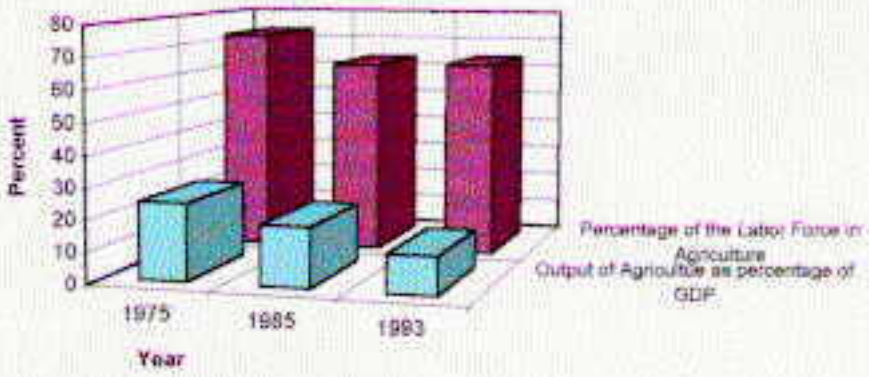
FIGURE #3

Output and Employment in Burma



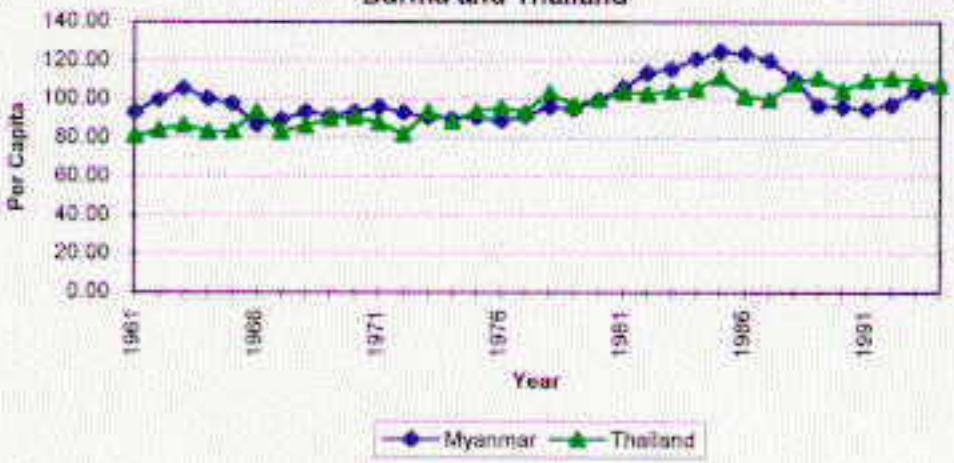
Source: ibid.

FIGURE #4
Output and Employment in Thailand



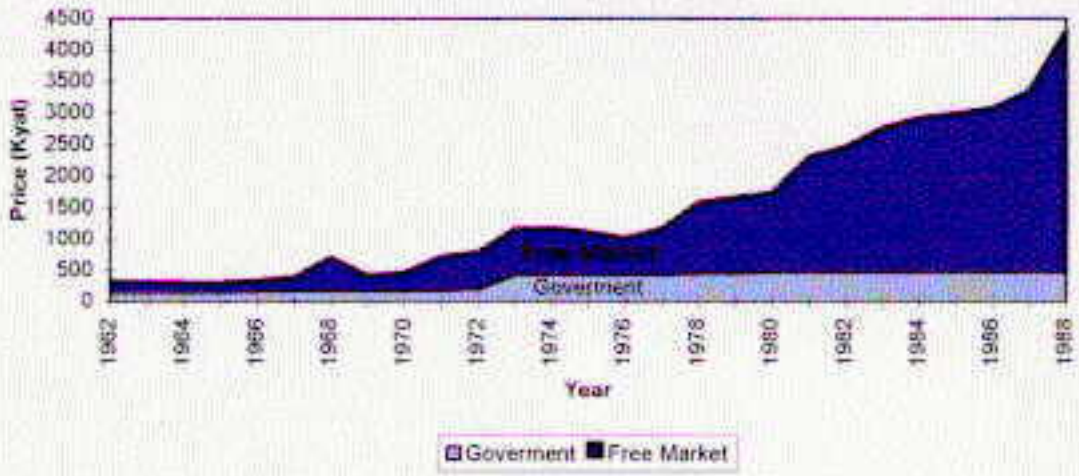
Source: Asian Development Bank, Key Indicator 1994, 1995.

FIGURE #5
Agriculture: Production Index Per Capita
Burma and Thailand



Source: ibid

FIGURE #4
Prices of Paddy/Rice



Source: Mya Than,

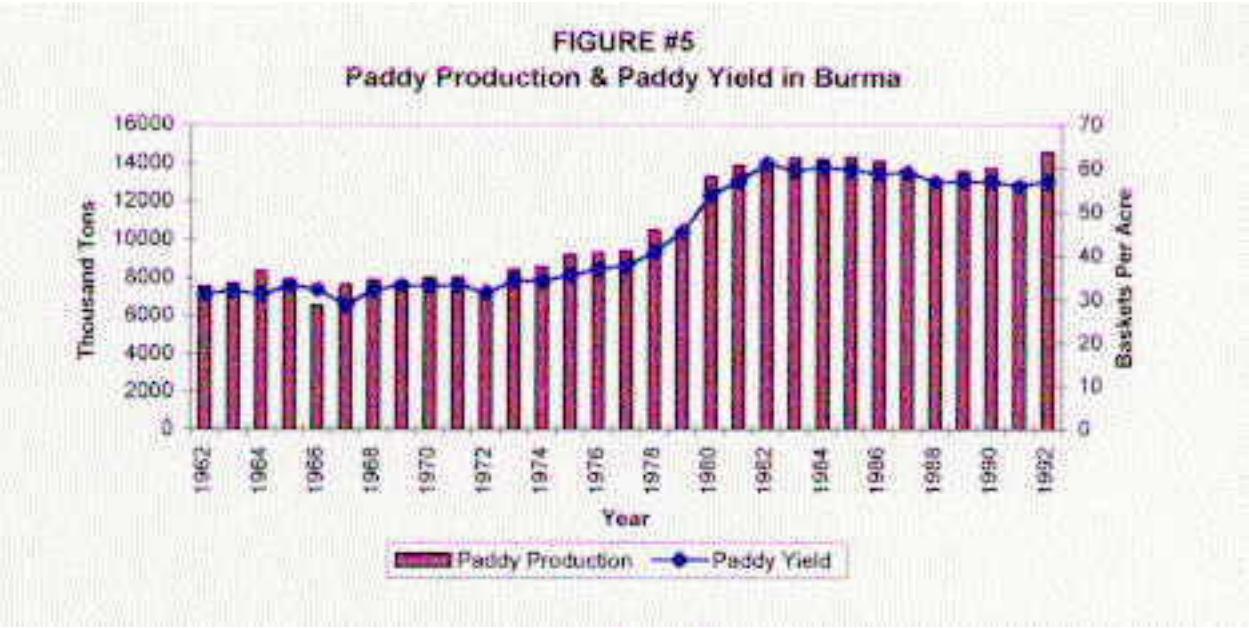
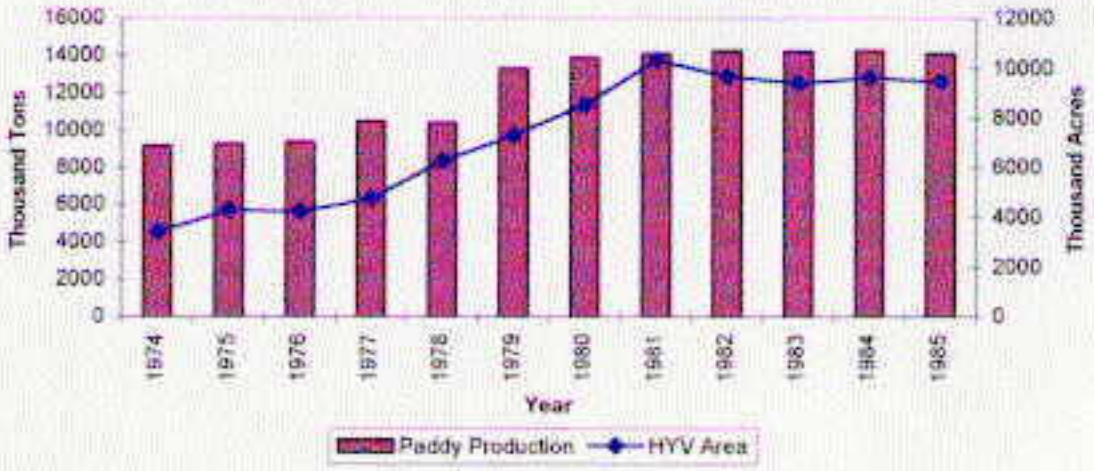


FIGURE #5
Paddy Production & Paddy Yield in Burma
Thousand Tons
Baskets Per Acre
Year
Paddy Production
Paddy Yield

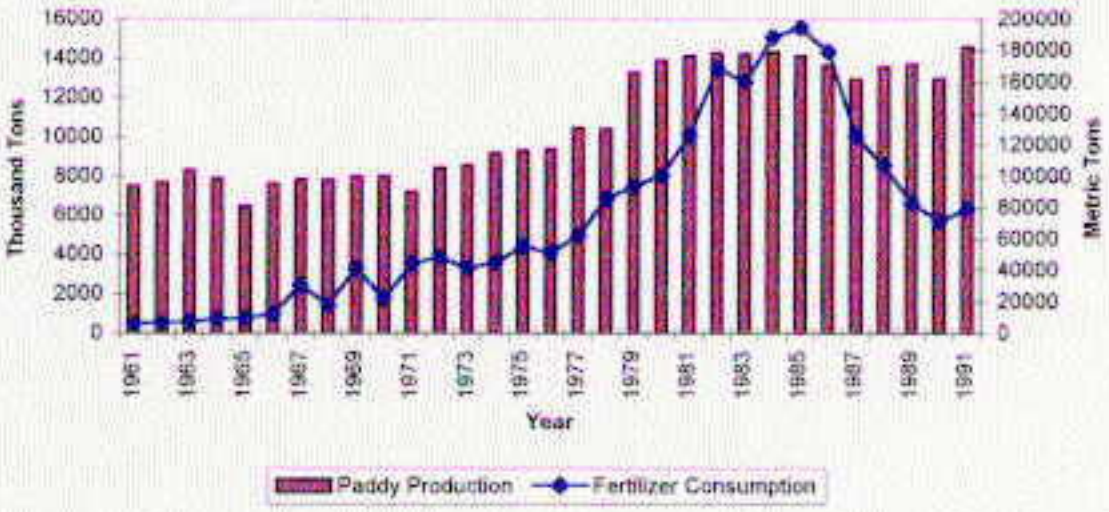
FIGURE #6
Paddy Production & HYV Area during 1974-85



Source

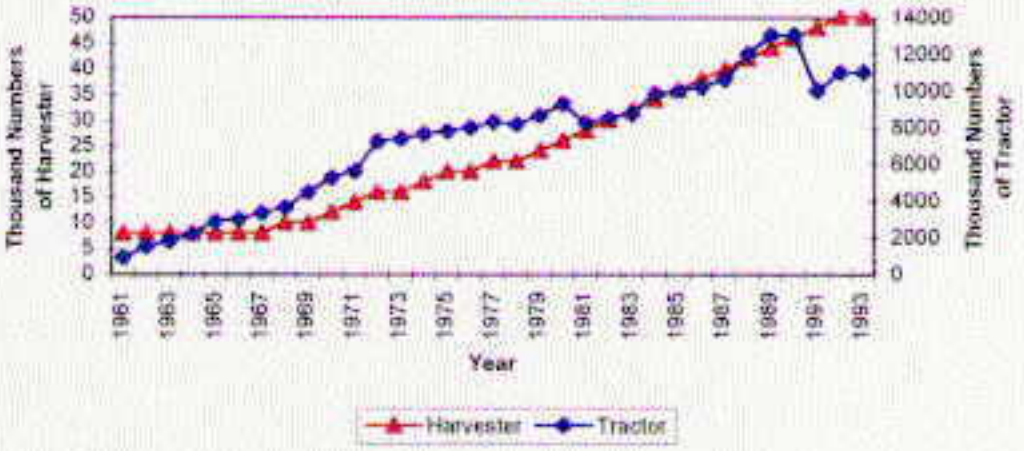
Mya Than, *Growth Pattern of Burmese Agriculture*, Institute of Southeast Asian Studies, Singapore, 1990

FIGURE #7
Paddy Production & Fertilizer Consumption



Source: PADDY PRODUCTION- ibid. And FERTILIZER CONSUMPTION- World Date Resource

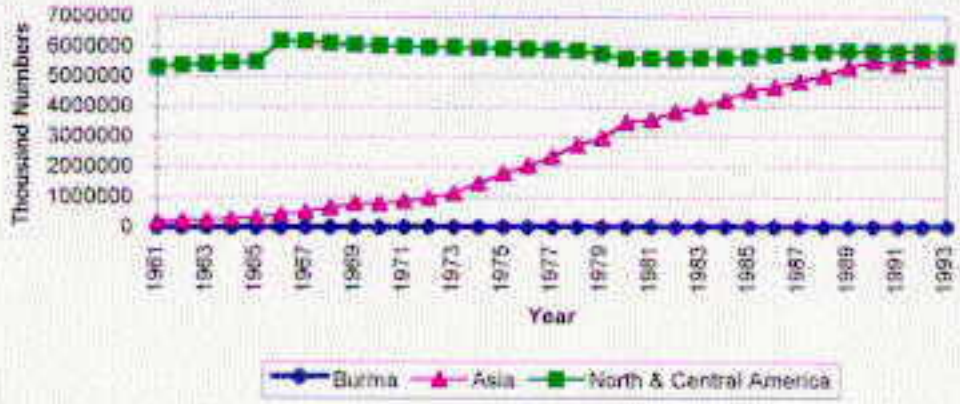
FIGURE #8
Tractor & Harvester in Use, Burma



Source: World Resource Database 1996.

FIGURE #9

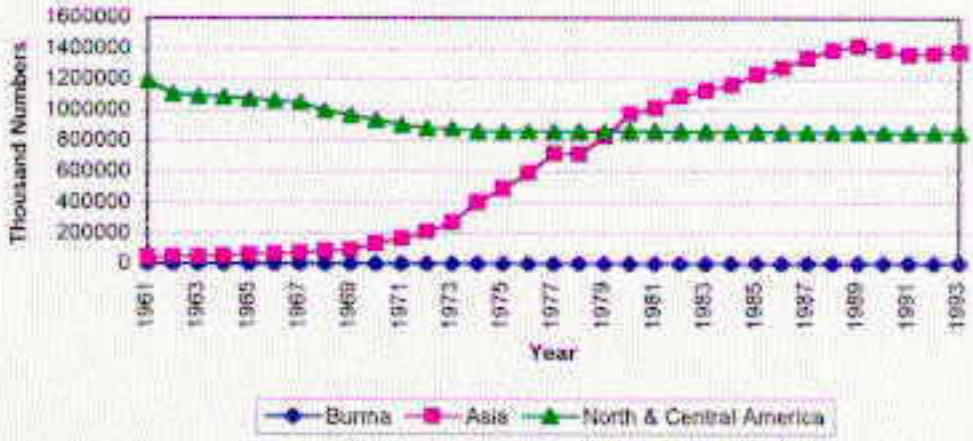
Tractor in Use, Burm, Asia, North & Central America



Source: World Resource Datebase, 1996.

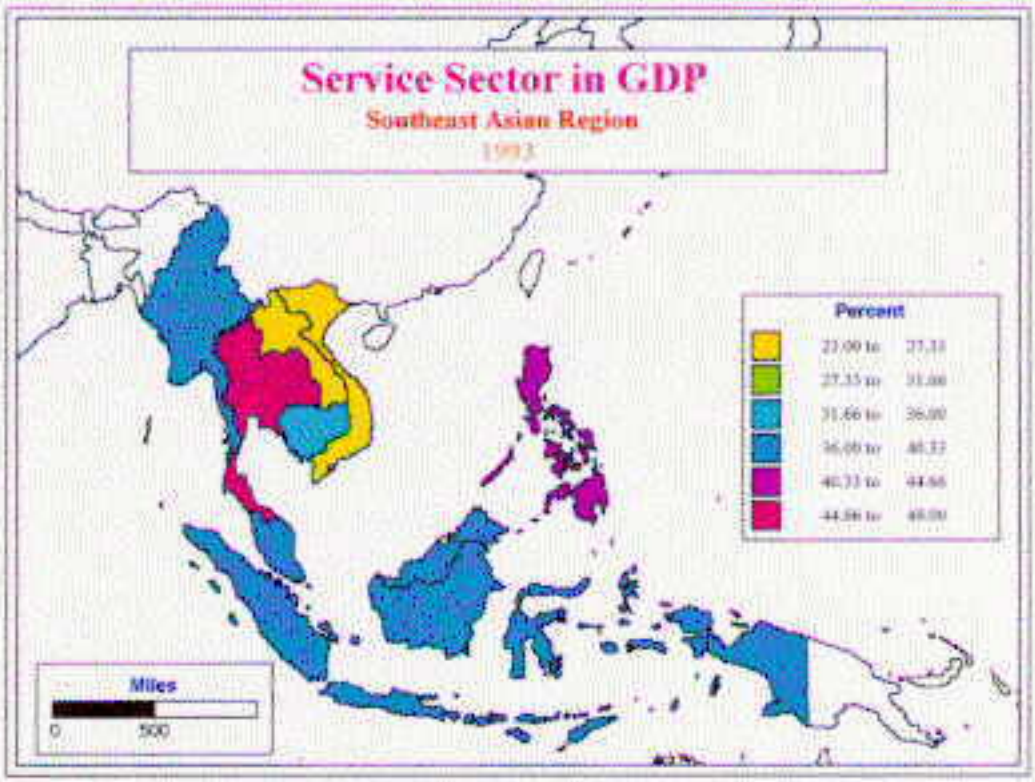
FIGURE #10

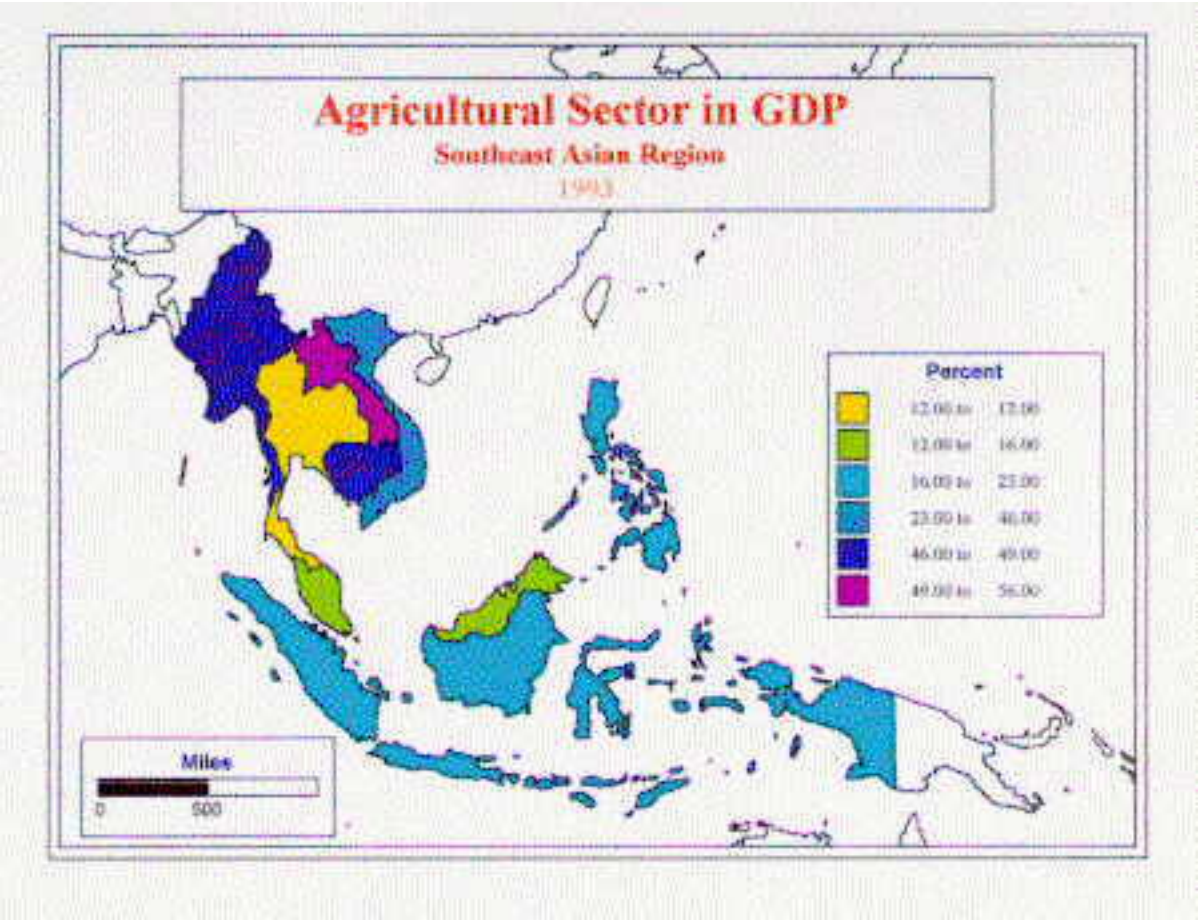
Harvester in Use, Burma, Asia, North & Central America



Sources: ibid.


Industrial Sector in GDP
Southeast Asian Region
Percent
Miles
0
500


Service Sector in GDP
Southeast Asian Region
Percent
Miles
0
500


Agricultural Sector in GDP
Southeast Asian Region
Percent
Miles
0
500

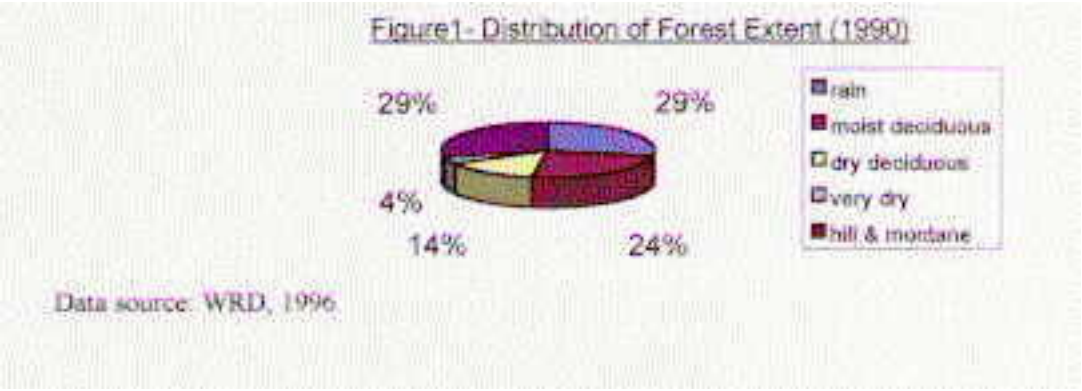
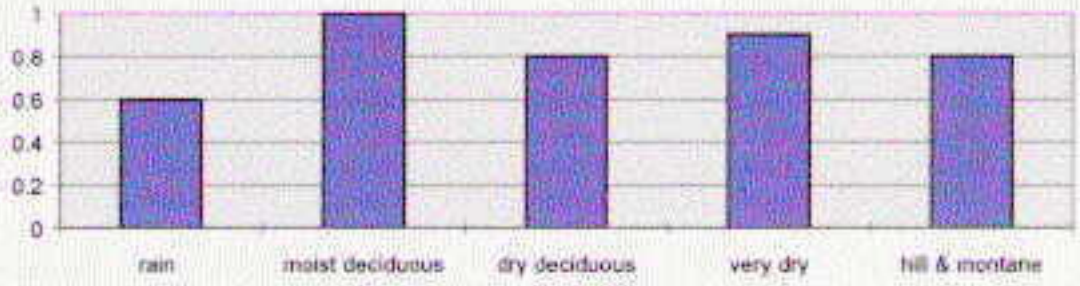


Figure1- Distribution of Forest Extent (1990)
29%
29%
4%
14%
24%
rain
moist deciduous
dry deciduous
very dry
hill & montane
Data source: WRD, 1996

Fig 2 -Annual Change of Forest Extent (%)



Data source: WRD, 1996

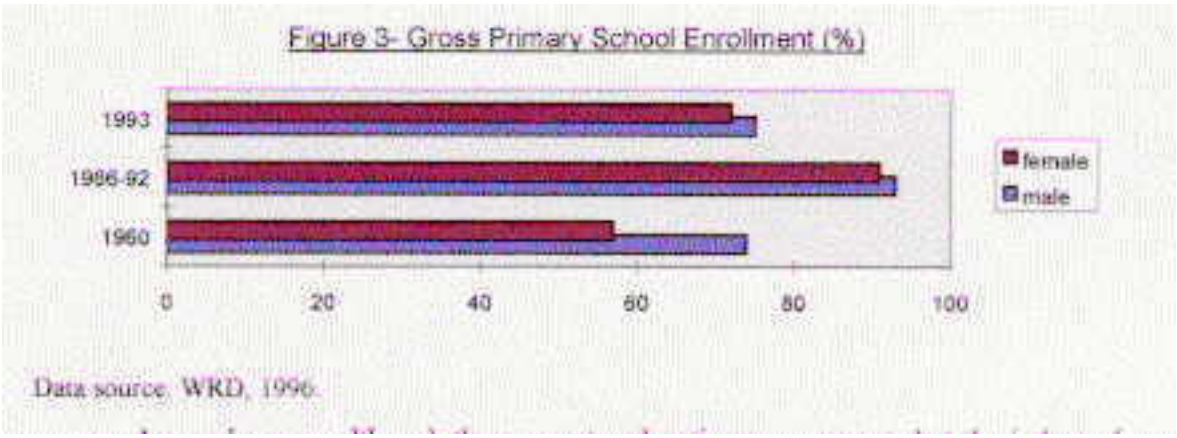
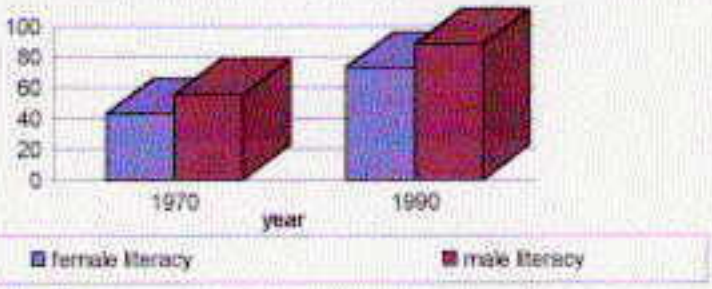


Figure 3- Gross Primary School Enrollment (%)
1993
1990-92
1960
0
20
40
60
80
100
female
male
Data source: WRD, 1996

Figure 4- Adult Literacy (%)



Data source: WRD, 1996

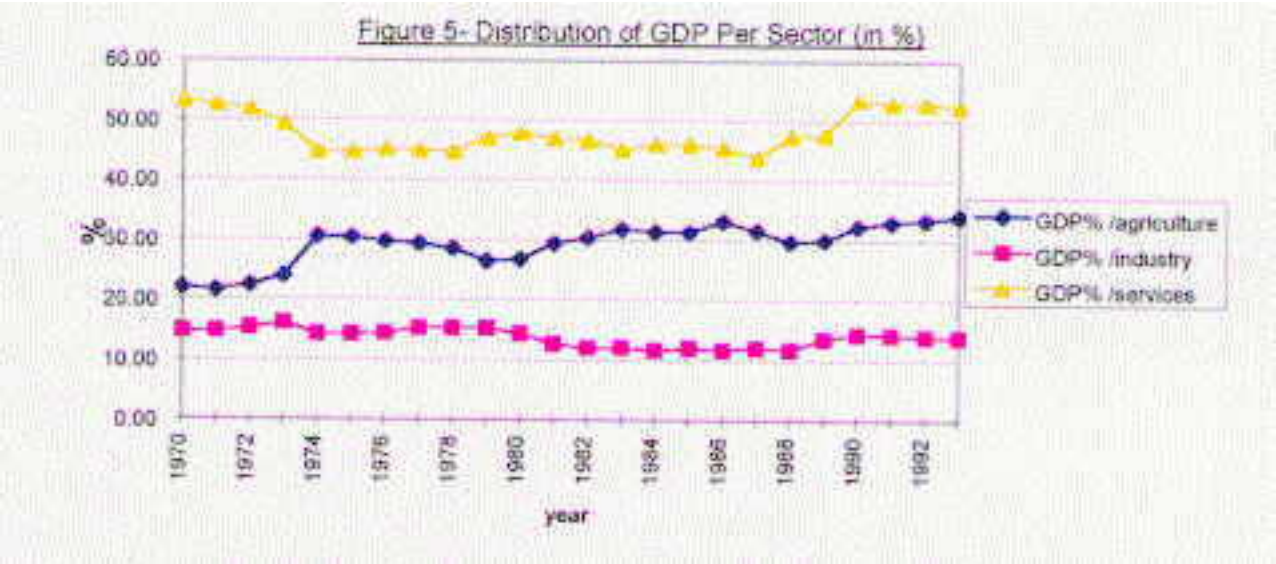
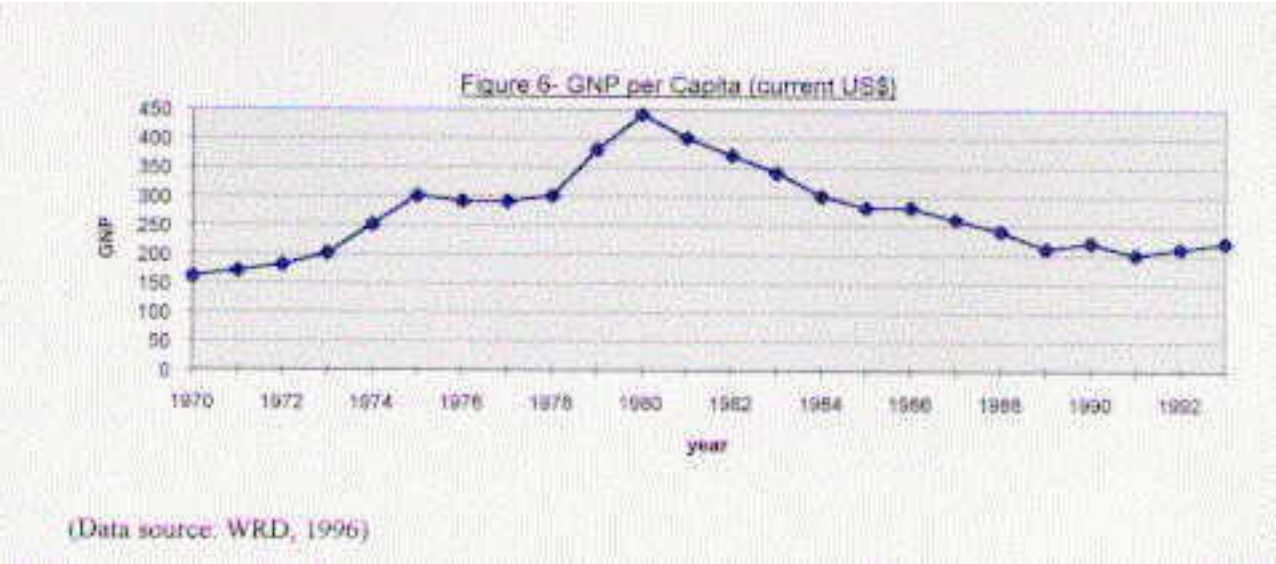
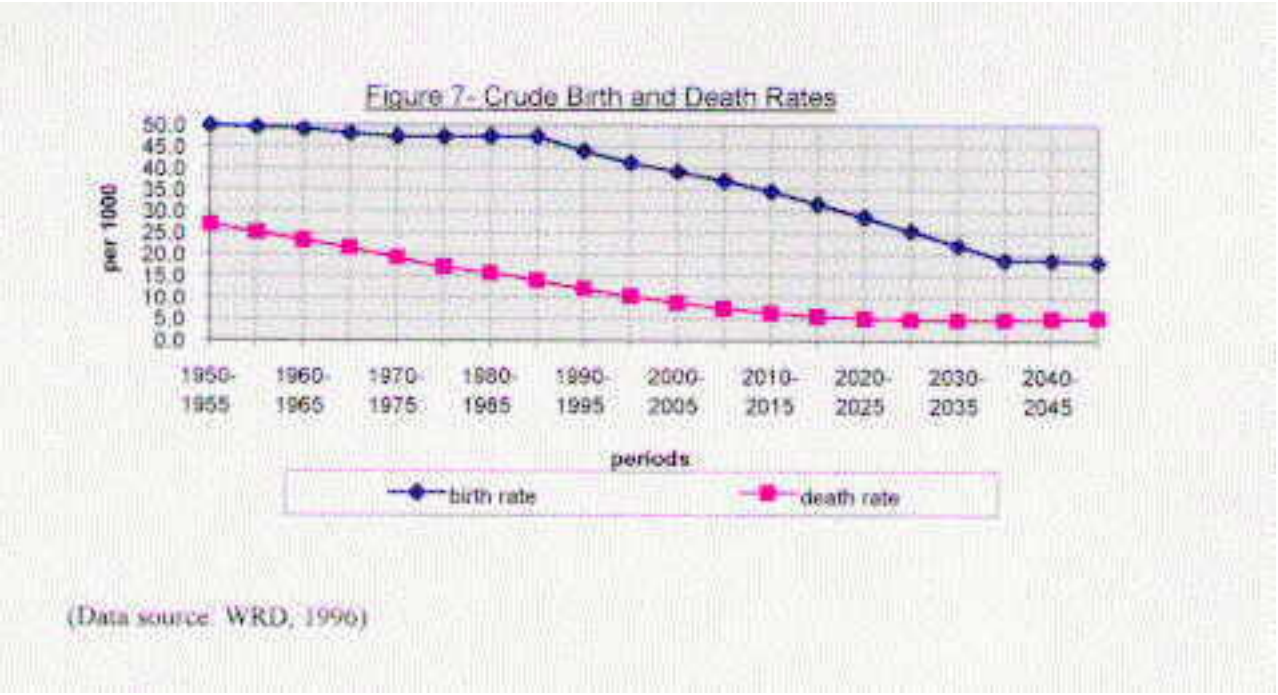


Figure 5- Distribution of GDP Per Sector (in %)
60.00
50.00
40.00
30.00
20.00
10.00
0.00
%
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
year
GDP% /agriculture
GDP% /industry
GDP% /services



(Data source: WRD, 1996)



(Data source: WRD, 1996)

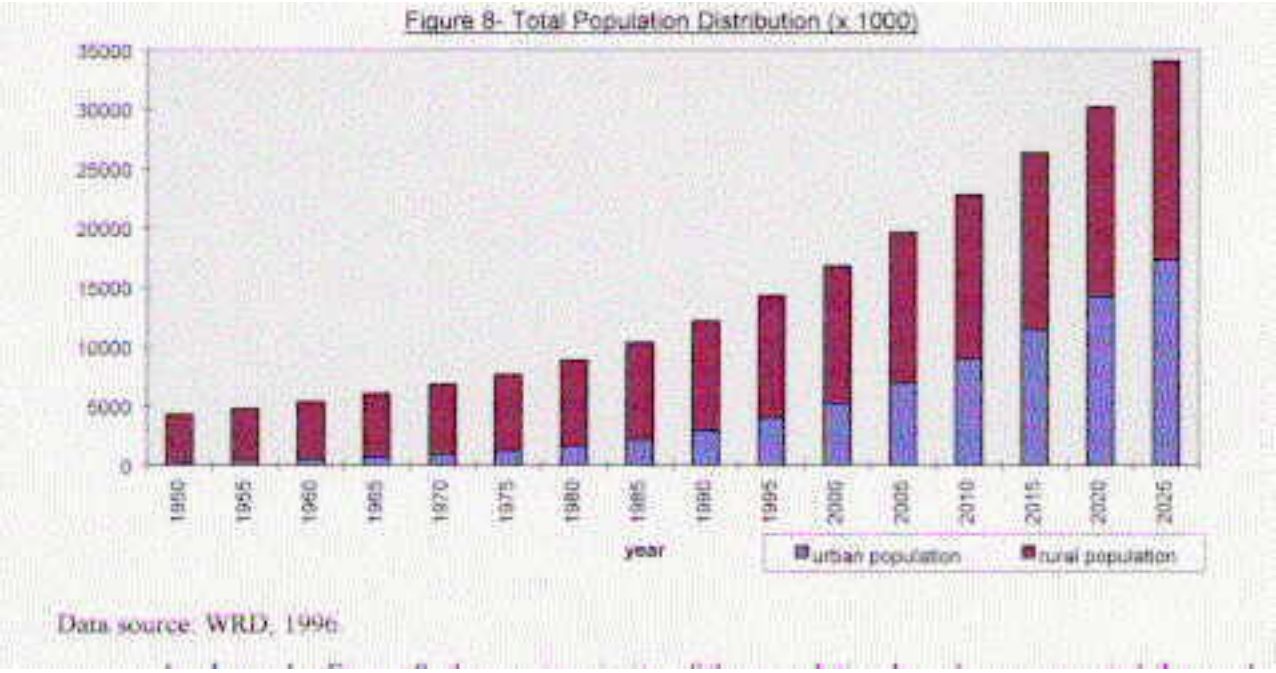
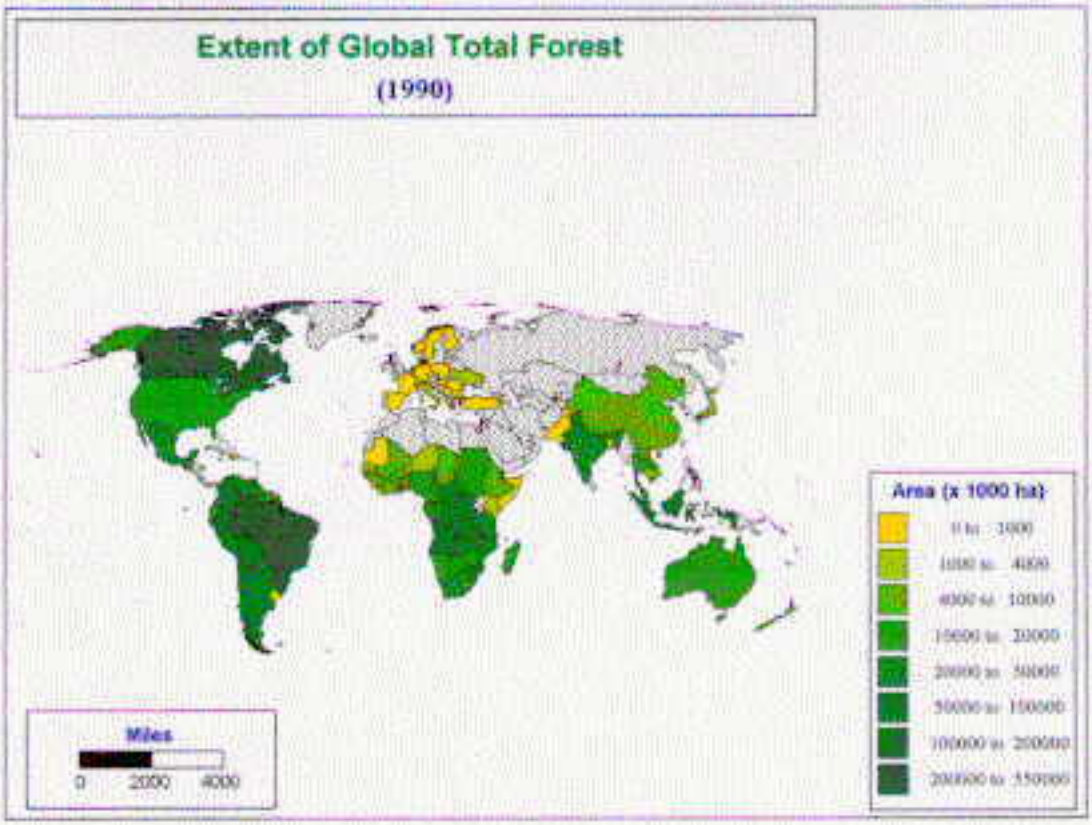
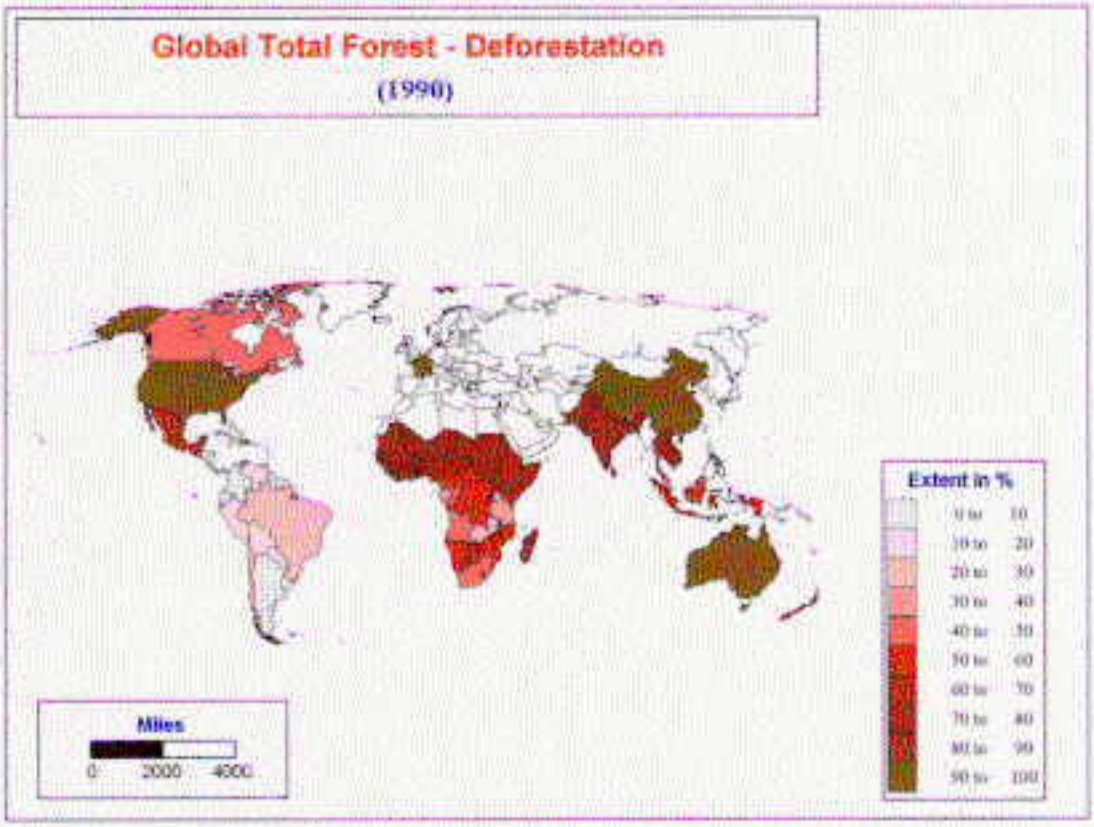
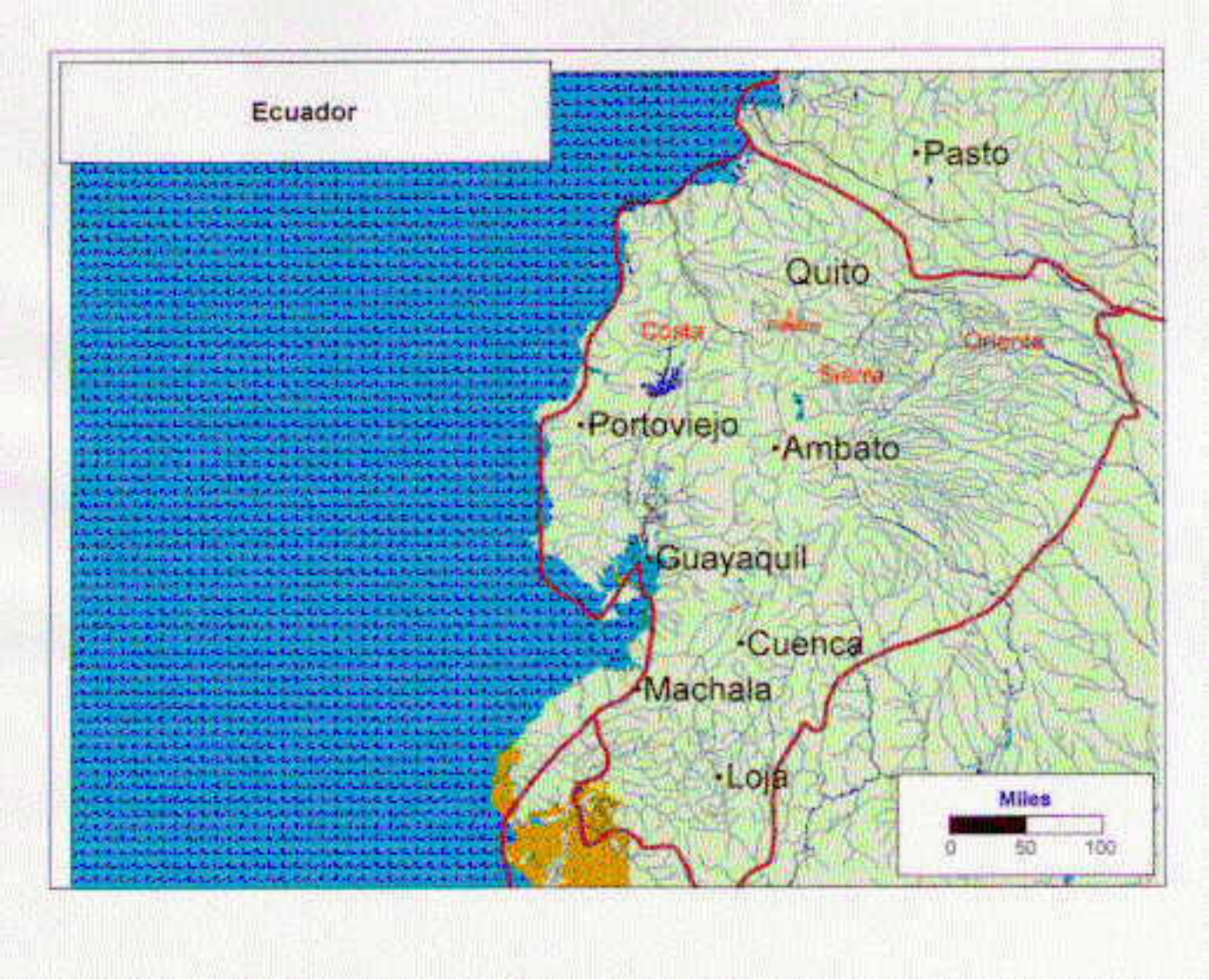


Figure 8- Total Population Distribution (x 1000)
35000
30000
25000
20000
15000
10000
5000
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
year
urban population
rural population
Data source: WRD, 1996


Extent of Global Total Forest
(1990)
Area (x 1000 ha)
Miles
0 2000 4000


Global Total Forest - Deforestation
(1990)
Extent in %
Miles
0 2000 4000


Ecuador
Pasto
Quito
Costa
Sierra
Oriente
Portoviejo
Ambato
Guayaquil
Cuenca
Machala
Loja
Miles
0
50
100


South America
Venezuela
Colombia
Guyana
Suriname
French Guiana
Ecuador
Peru
Brazil
Bolivia
Paraguay
Uruguay
Argentina
Chile
Miles
0
500
1000

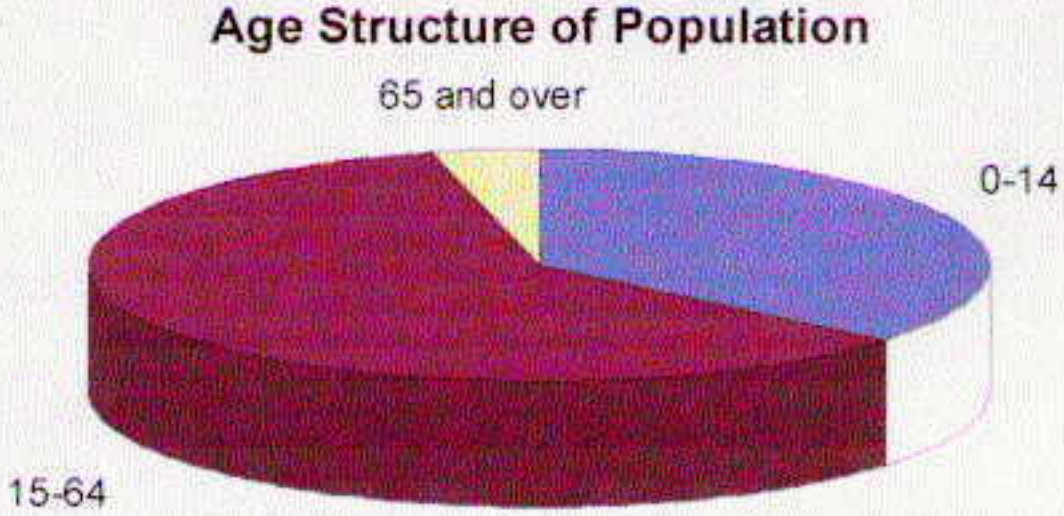


Figure 1. Source: CIA, 1995 Ecuador Fact Sheet.

Figure 1. Source: CIA, 1995 Ecuador Fact Sheet.

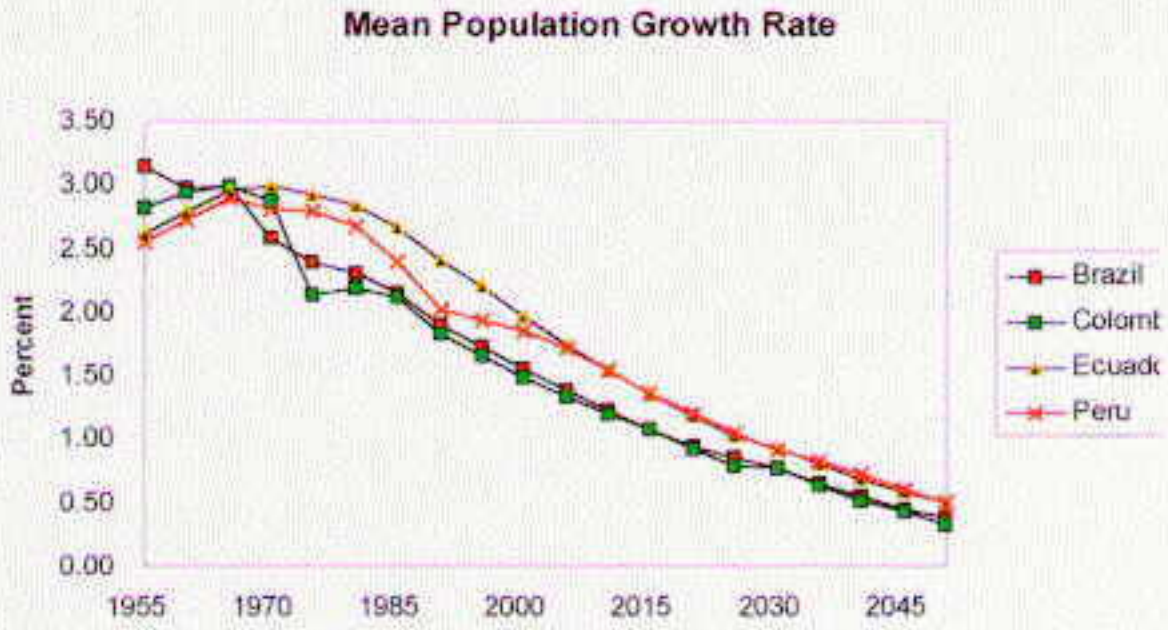
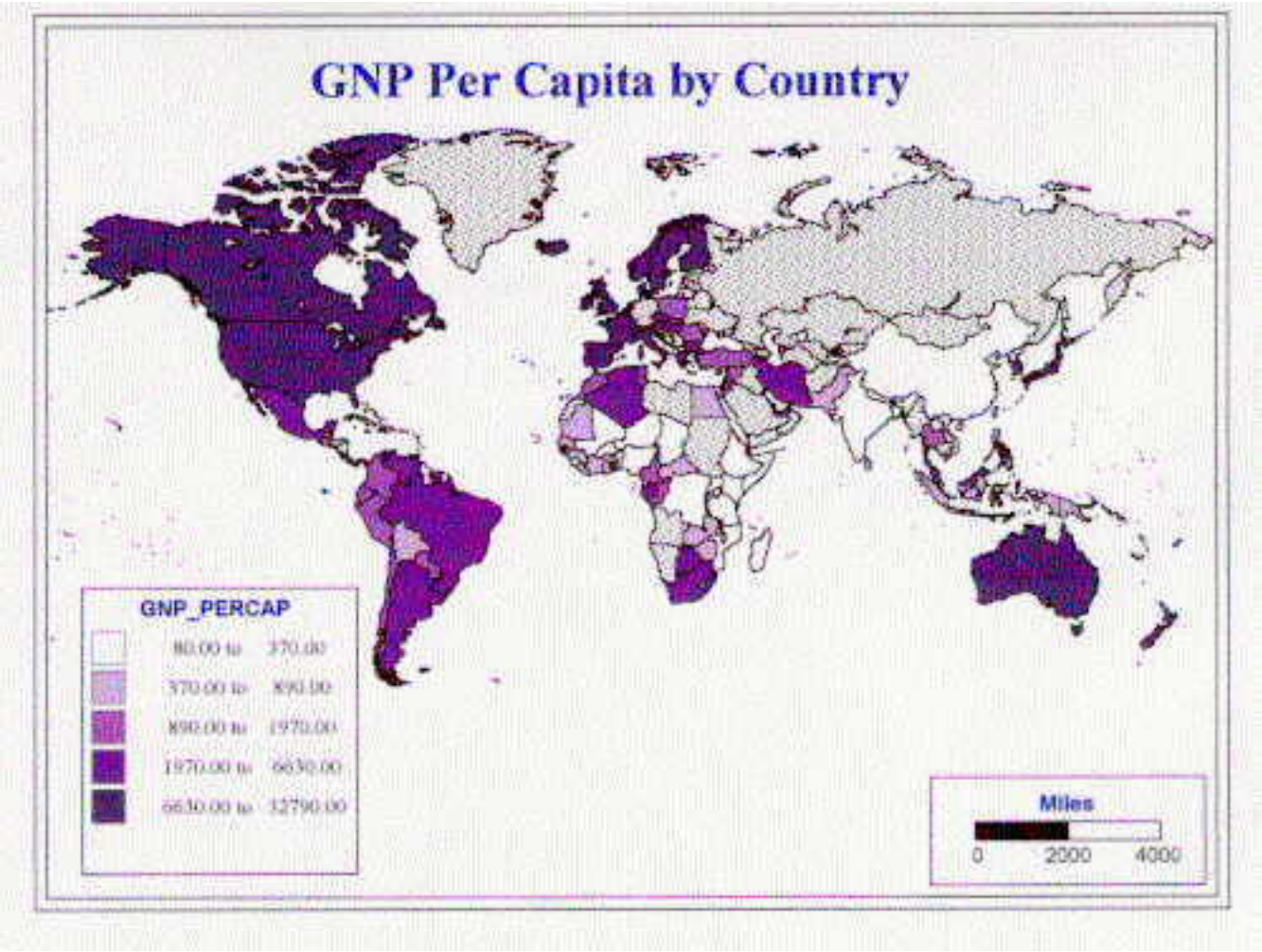


Figure 2. Source: World Resources Database 1996.


GNP Per Capita by Country
GNP_PERCAP
80.00 to 370.00
370.00 to 890.00
890.00 to 1970.00
1970.00 to 6630.00
6630.00 to 32790.00
Miles
0
2000
4000

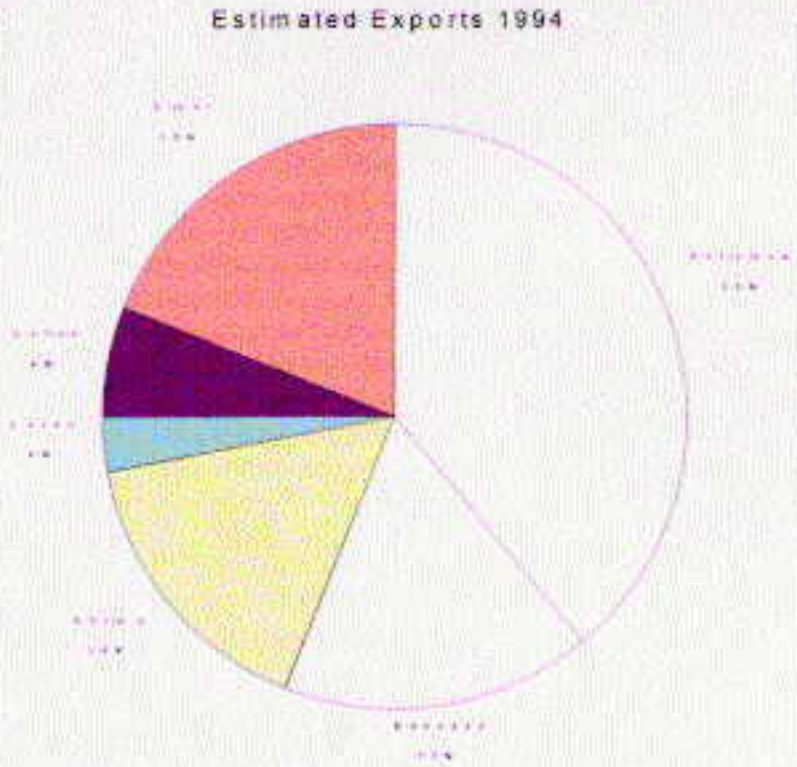


Figure 3. Source: CIA, 1995 Ecuador Fact Sheet

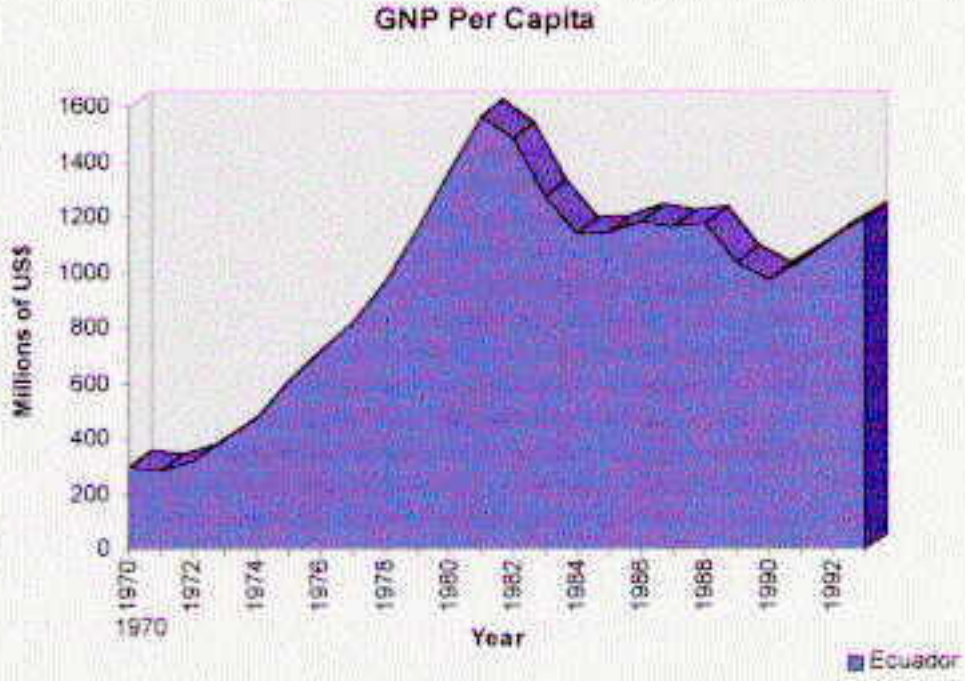


Figure 4. Source: World Resources Data Base 1996

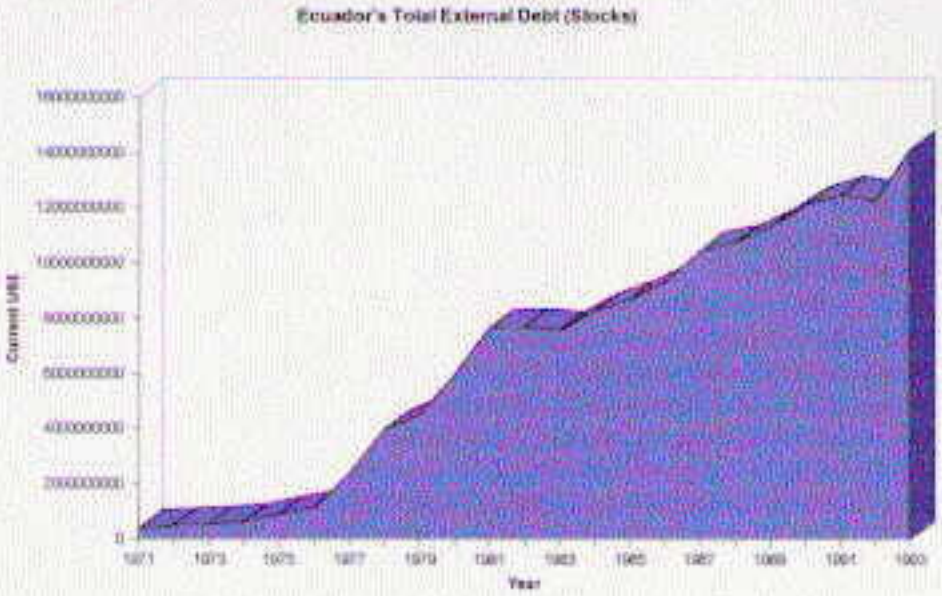


Figure 5. Source: World Resources Data Base 1996.

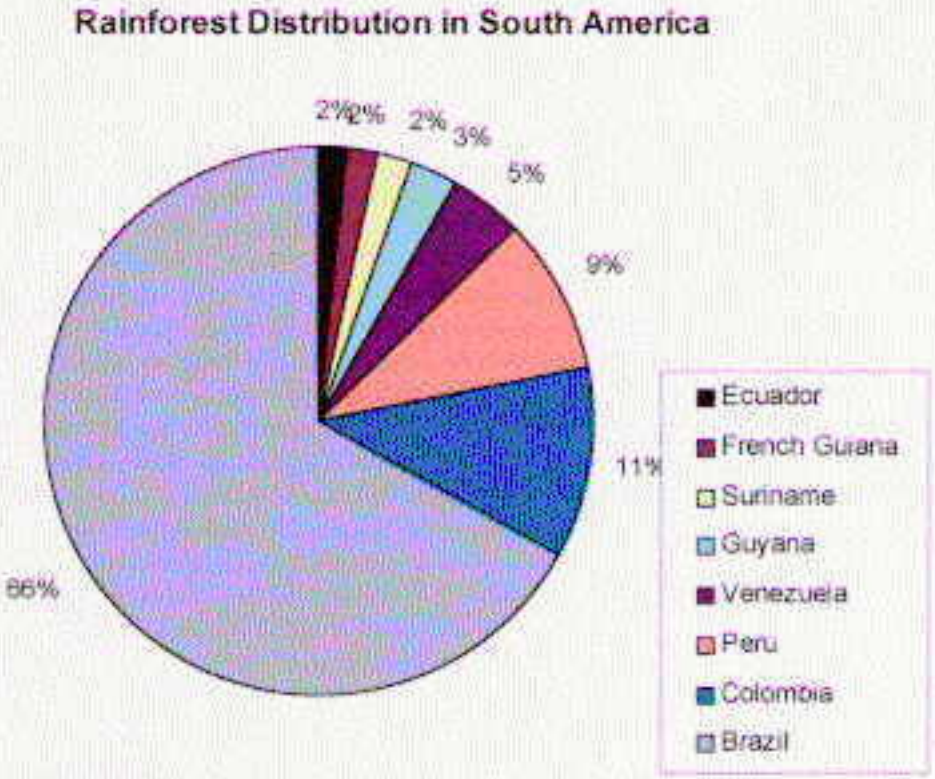
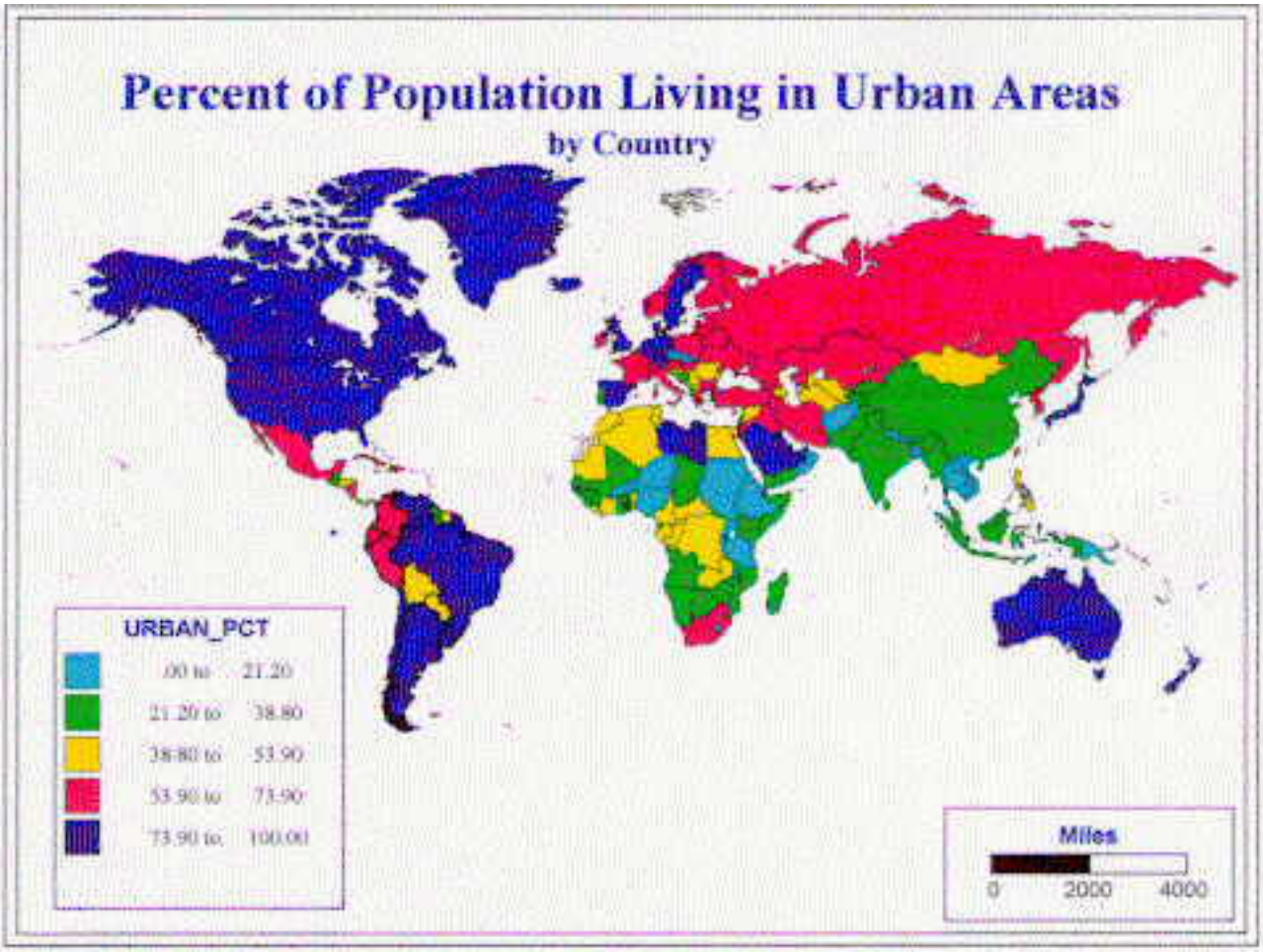


Figure 6. Source: World Resources Database 1996.


Percent of Population Living in Urban Areas
by Country
URBAN_PCT
.00 to 21.20
21.20 to 38.80
38.80 to 53.90
53.90 to 73.90
73.90 to 100.00
Miles
0
2000
4000

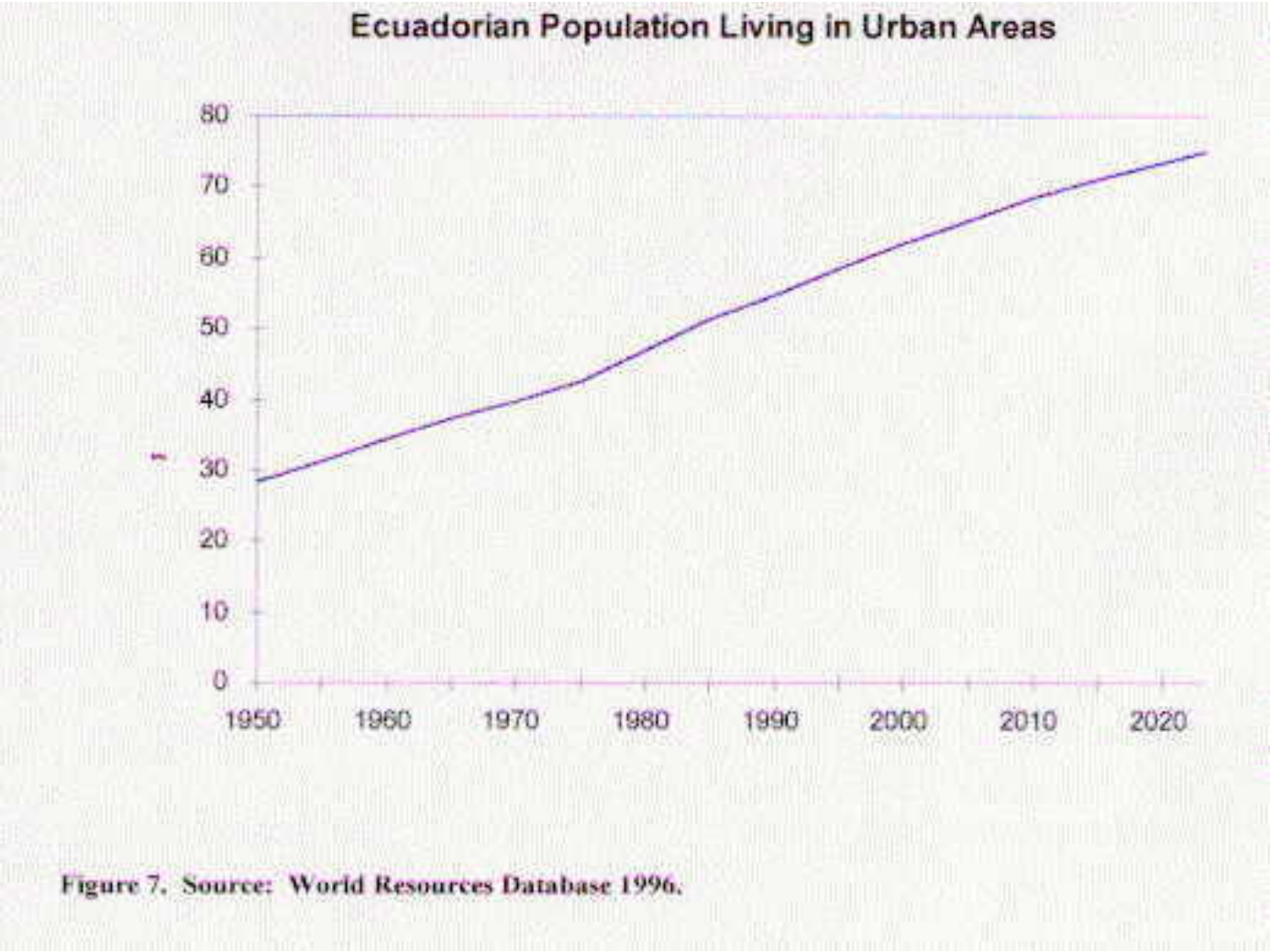


Figure 7. Source: World Resources Database 1996.

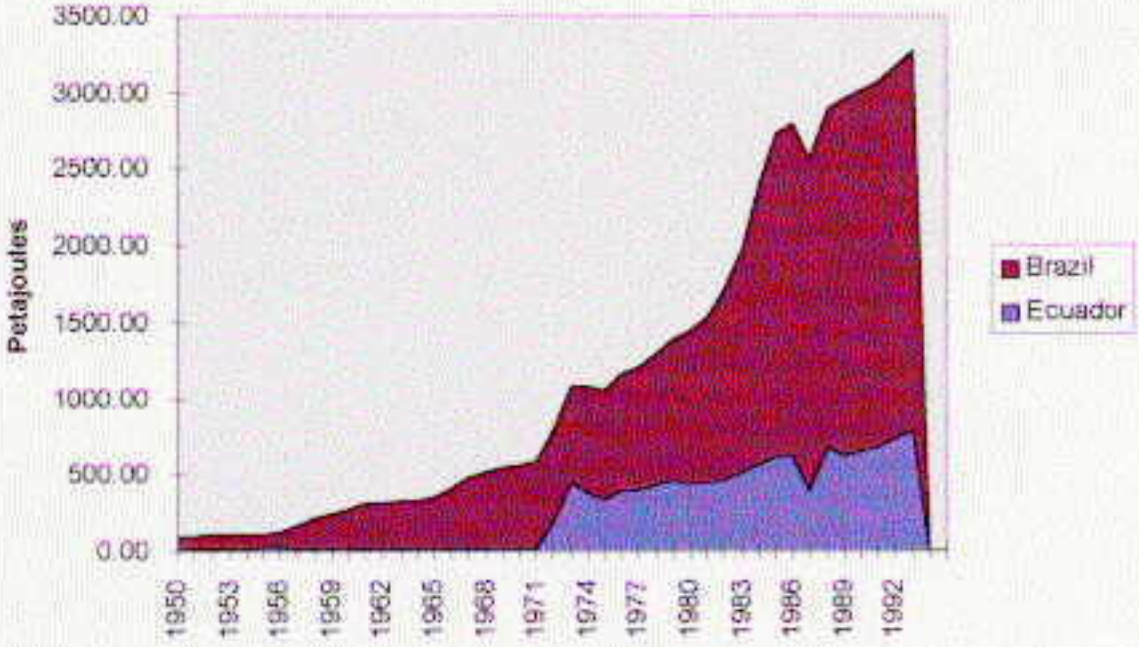


Figure 8. Source: World Resources Database 1996.

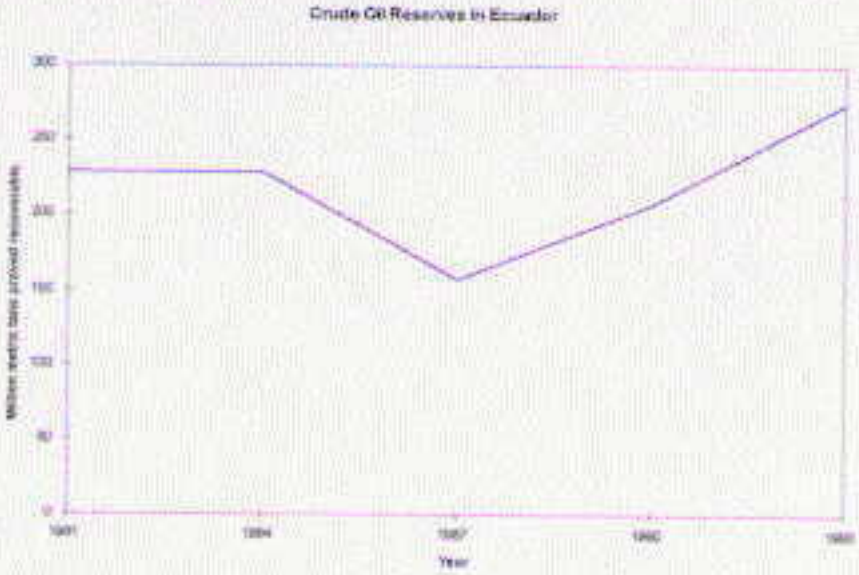


Figure 9. Source: World Resources Database 1996

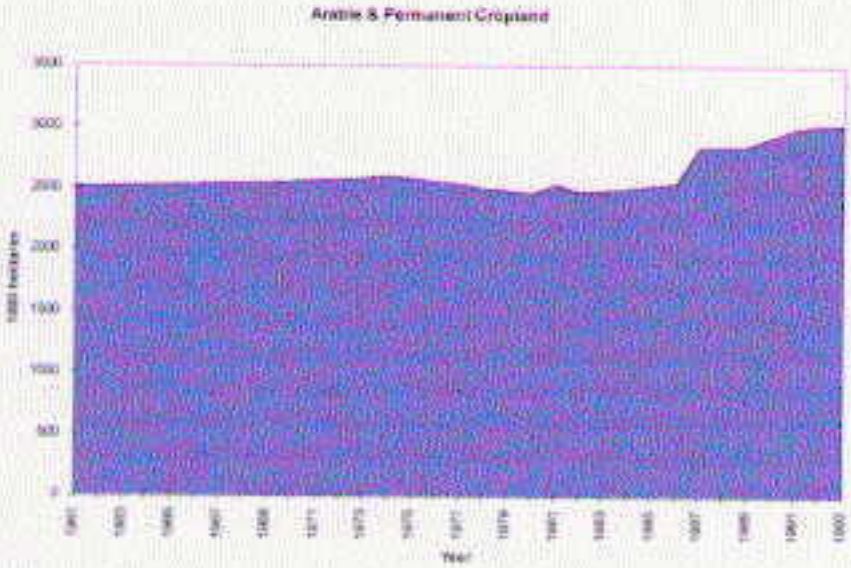


Figure 10. Source: World Resources Database 1996

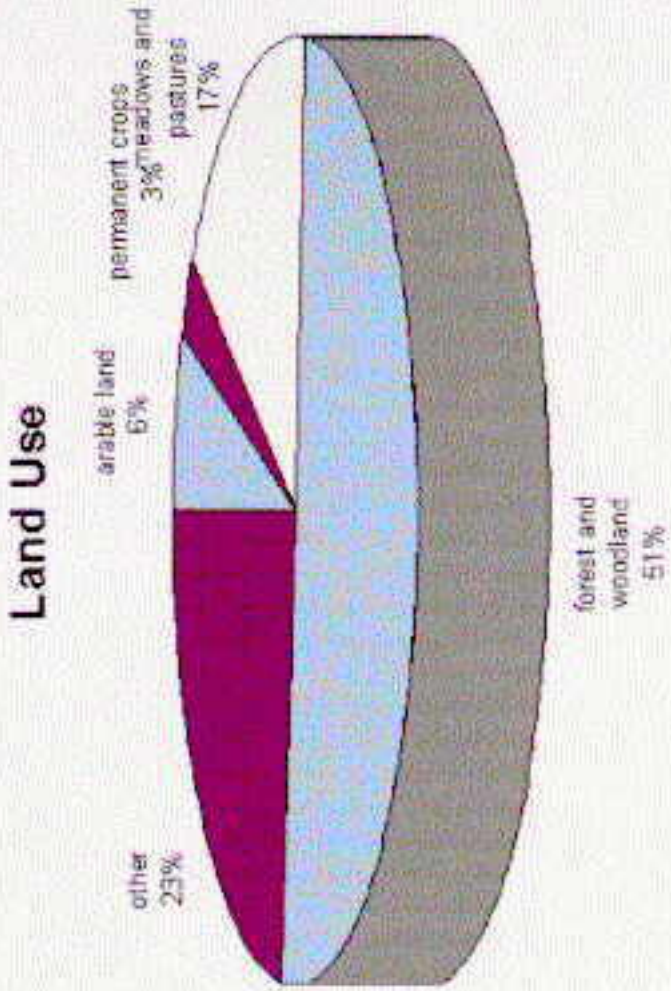


Figure 11. Source: CIA, 1995 Ecuador Fact Sheet

Figure 1

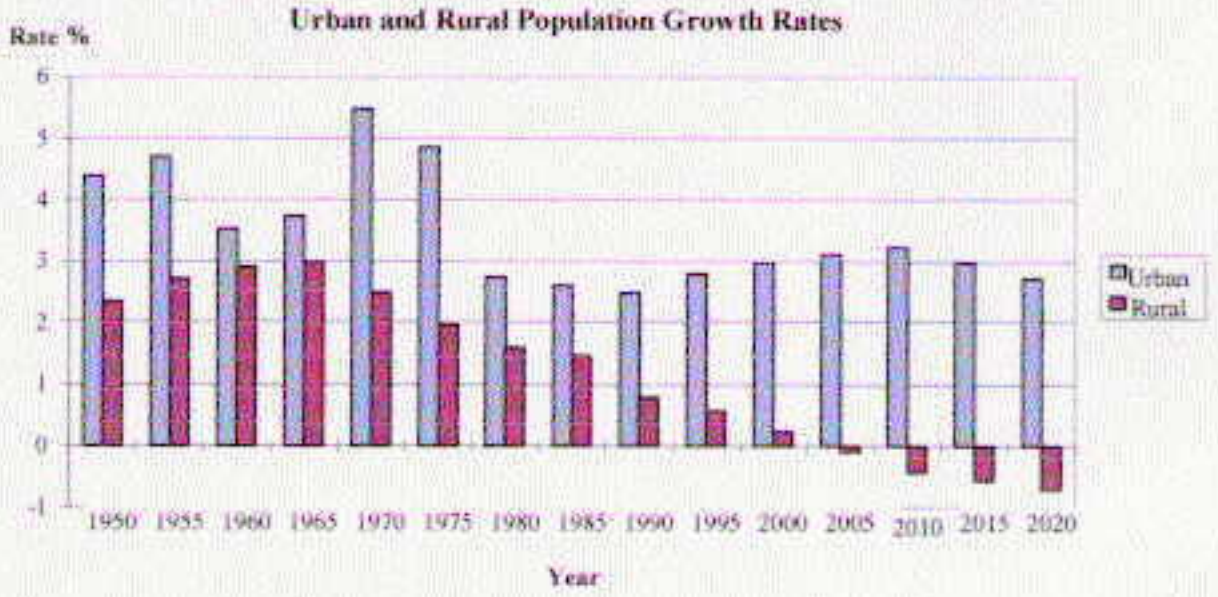


Figure 2

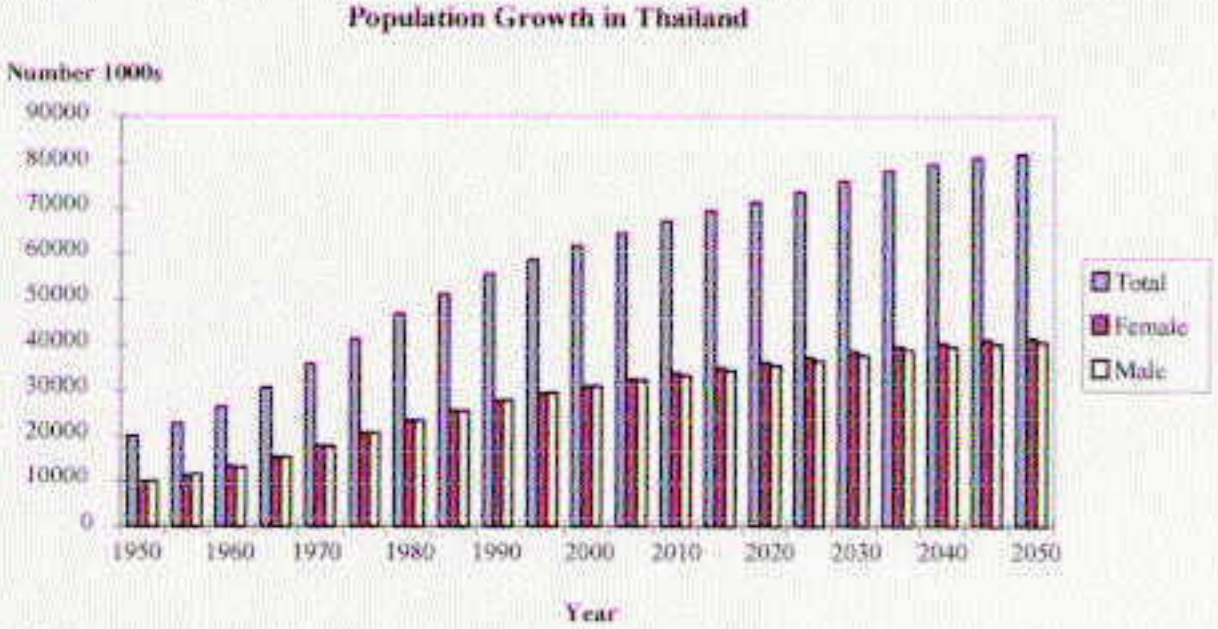
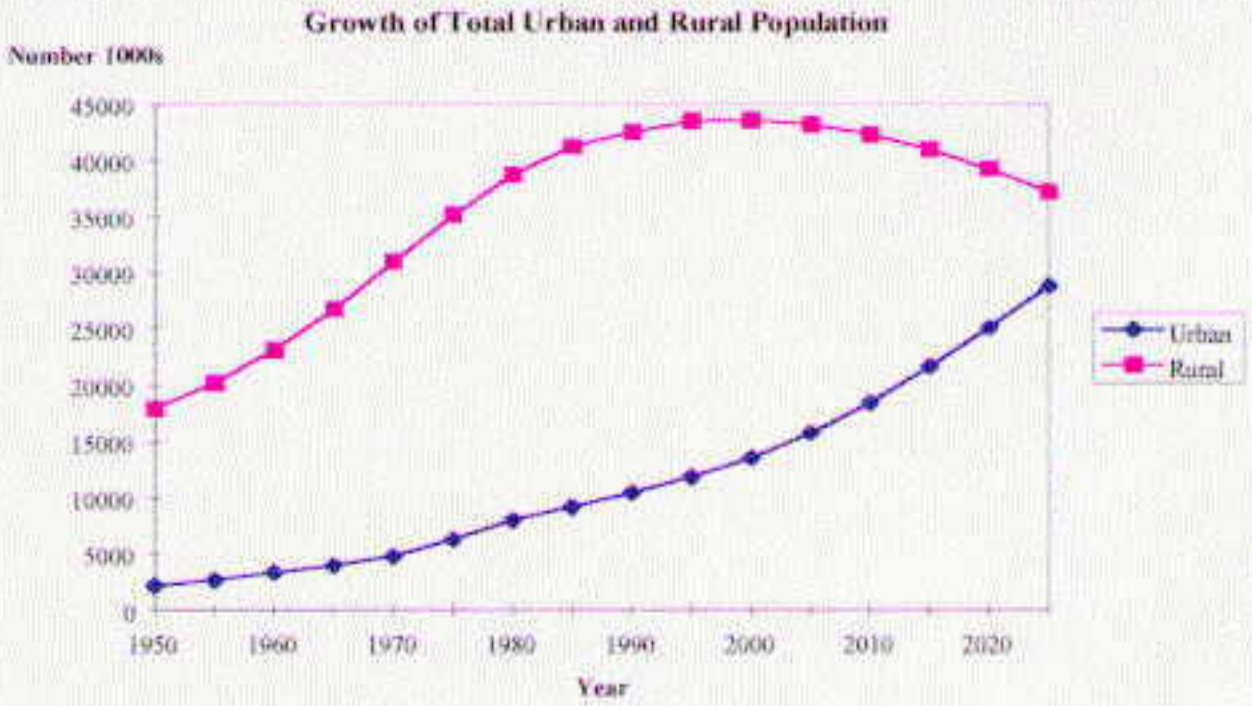


Figure 3

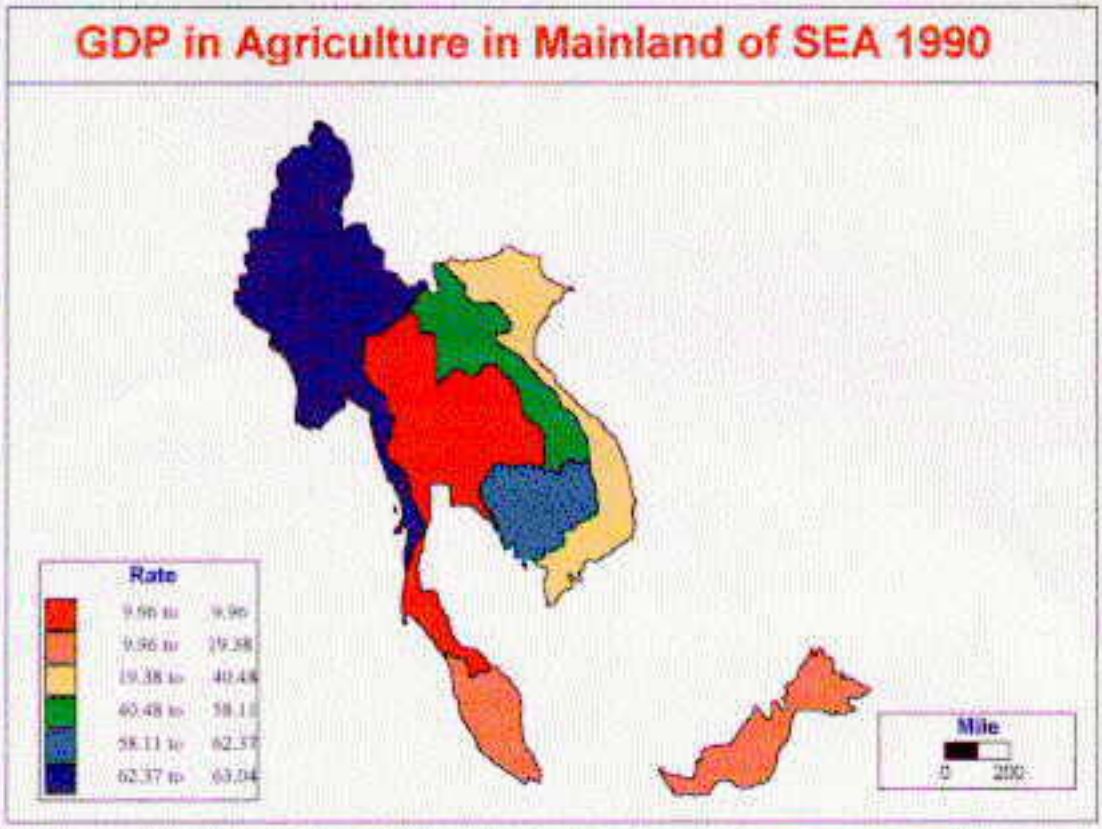


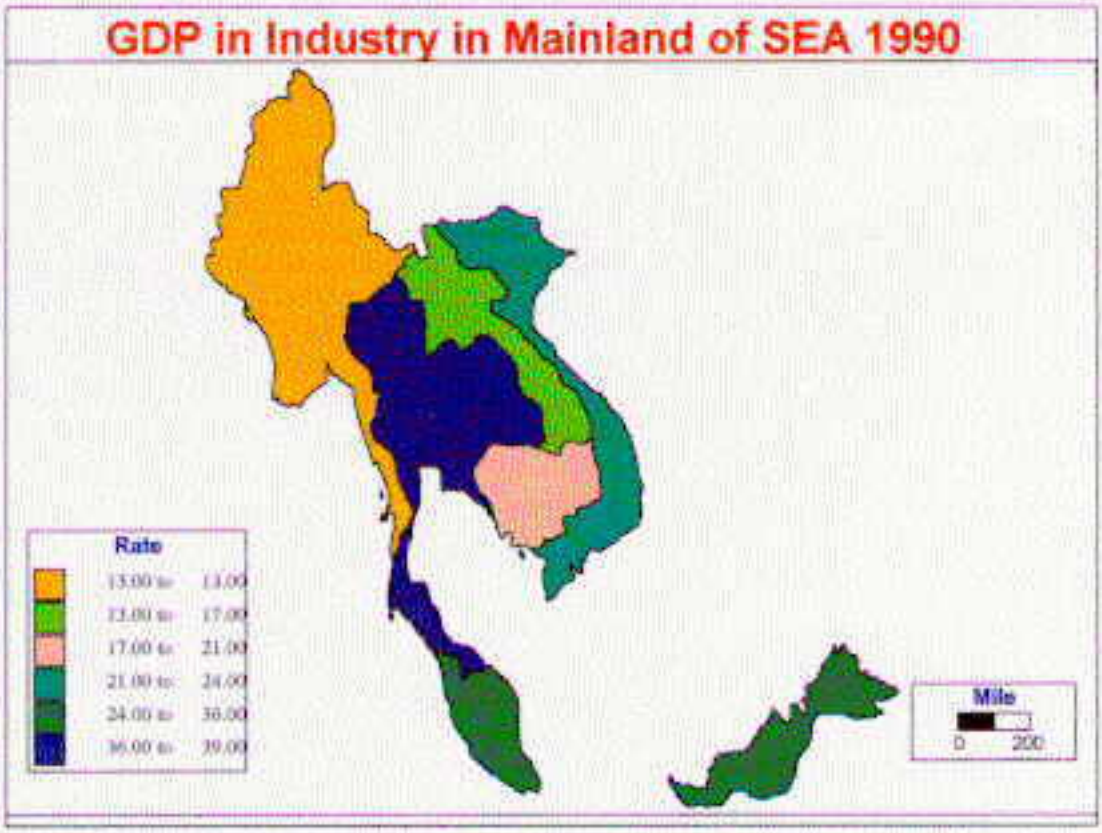
Industrialized Country, Thailand

Figure 4: Inequalities in the Distribution of Gross Regional Domestic Product Per Capita by Region 1978-88

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
BMR	28.7	35.1	41.3	46.9	49.5	52.2	56.1	55.5	61.4	71.6	87
Central	9.5	11.1	13	13.3	13.9	14.6	16.1	17.6	17.2	18.7	24.4
East	19.4	21.3	27.4	22	23.3	24	25.2	27.2	31	31.1	35.8
West	14.6	15.1	19.2	20.2	21.2	20.1	21.2	19.1	19.5	19.8	22.5
Northeast	4.2	4.9	6	6.6	7.2	8.1	8	8.1	7.9	8.3	8.5
North	7.5	8.3	9.9	6.4	8.5	8.3	8.2	6.9	7	8	9.5
South	10.8	12.4	13.7	12.8	13	14.4	15.1	13.7	12.9	14.6	20.4
Thailand	11	12.6	15	12.5	13.4	15.3	14.8	19	19.3	20.8	27.6
All Prefectures	0.84	0.88	0.9	1.04	1.04	1.02	1.07	1.16	1.17	1.25	-
Without BKK	0.69	0.7	0.74	0.61	0.59	0.55	0.57	0.93	0.69	0.69	-
Without BMR	0.56	0.57	0.61	0.54	0.51	0.47	0.48	0.53	0.6	0.55	-

*Source: The Mega-Urban Regions of Southeast Asia p 59


GDP in Agriculture in Mainland of SEA 1990
Rate
Mile
0 200


GDP in Industry in Mainland of SEA 1990
Rate
Mile
0 200

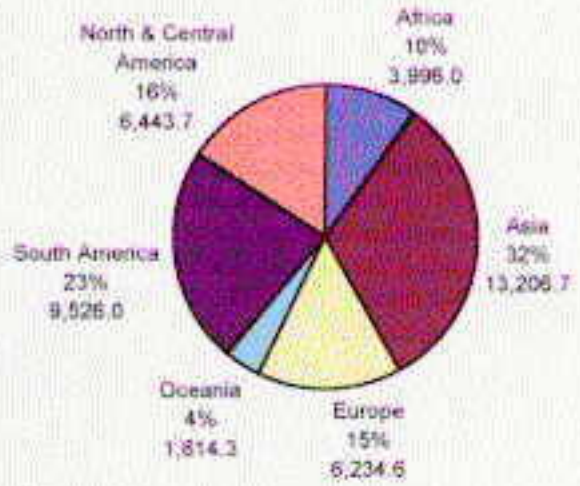


Figure 1: Annual Internal Renewable Water Resources per Continent - Percents and Cubic Kilometers[5]

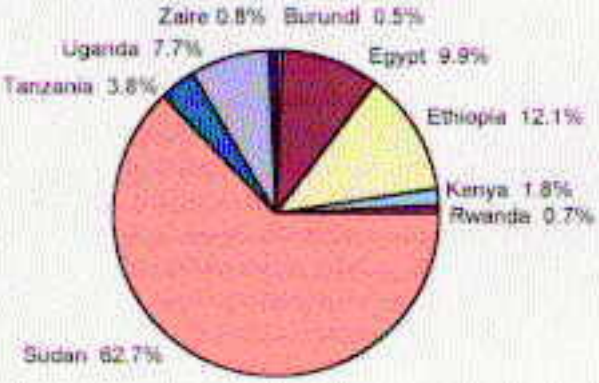
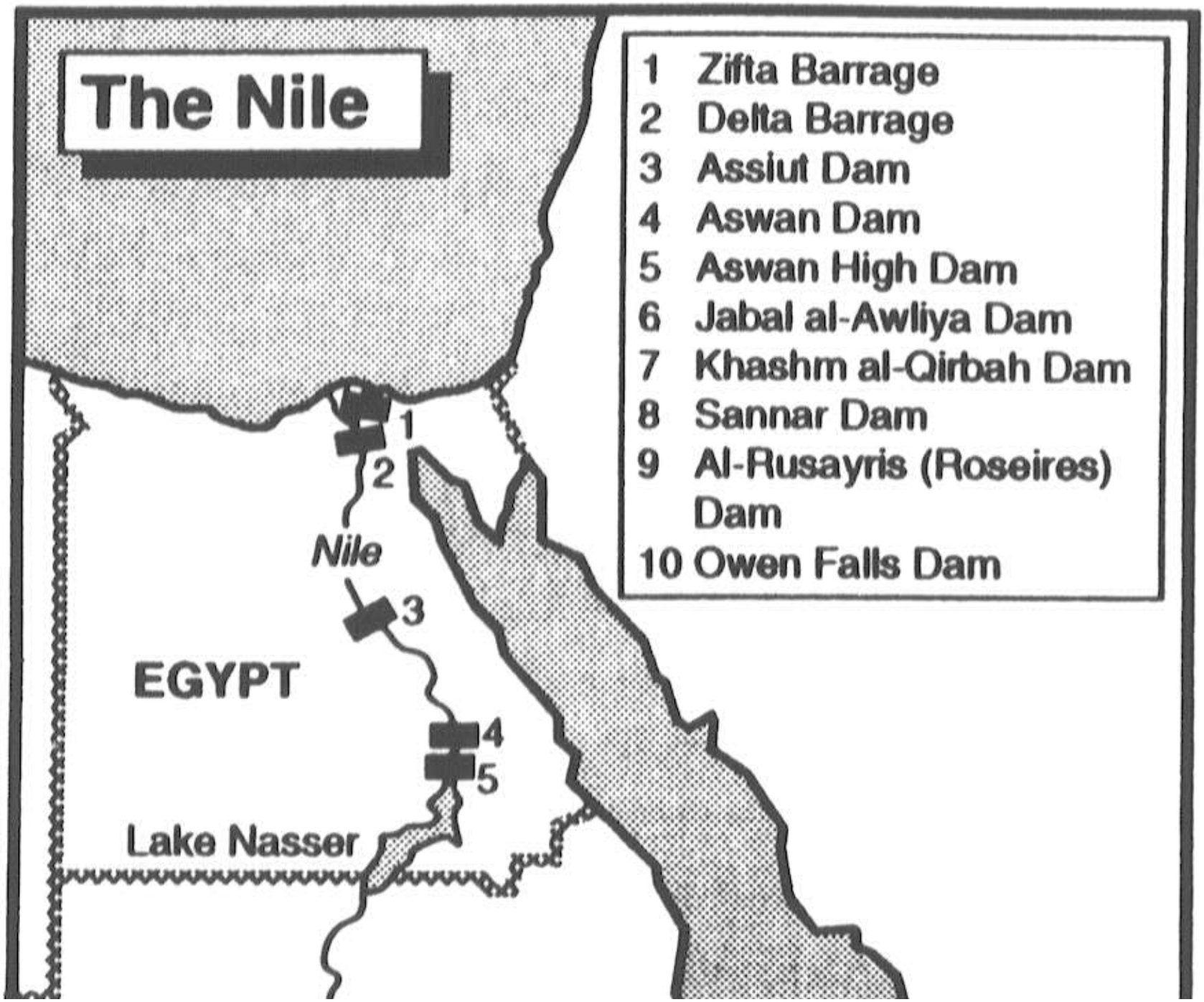
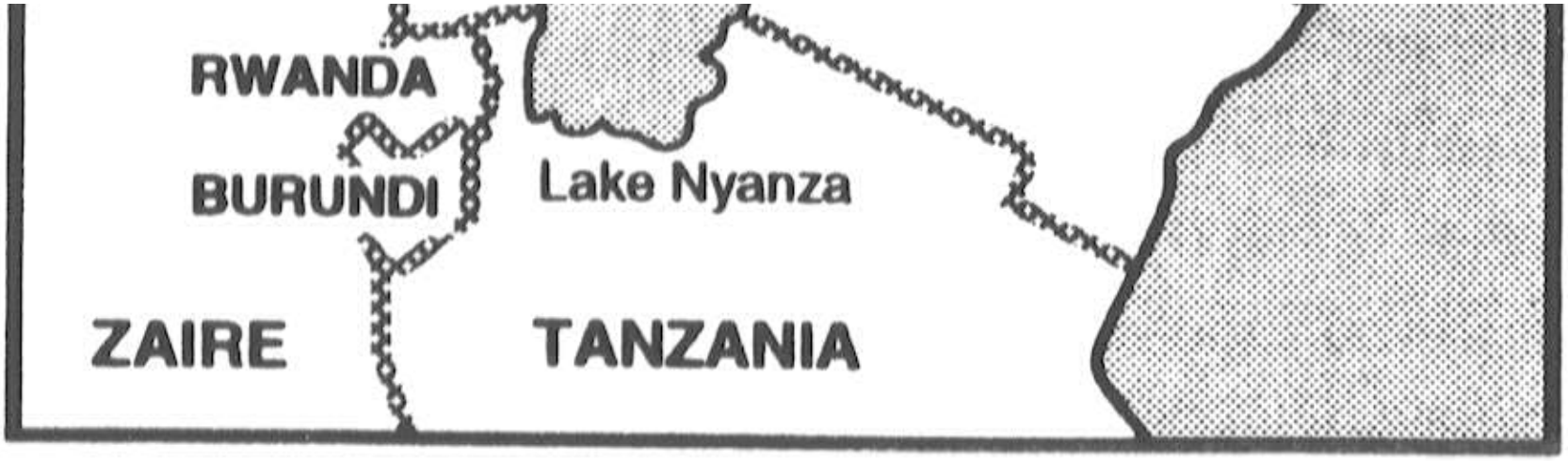


Figure 2: Nile River Watershed Area by State[8]


The Nile
1 Zifta Barrage
2 Delta Barrage
3 Assiut Dam
4 Aswan Dam
5 Aswan High Dam
6 Jabal al-Awliya Dam
7 Khashm al-Qirbah Dam
8 Sannar Dam
9 Al-Rusayris (Roseires) Dam
10 Owen Falls Dam
1
2
Nile
3
EGYPT
4
5
Lake Nasser


Atbara
ERITREA
YEMEN
6
7
SUDAN
8
Blue Nile
Lake
Tana
9
Beles
Jonglei
Diversion Canal
Blue Nile
Sobat
ETHIOPIA
White Nile
SOMA-
LIA
UGANDA
Lake Mobutu
Sese Seko
Lake Kyoga
10
KENYA


RWANDA
BURUNDI
Lake Nyanza
ZAIRE
TANZANIA

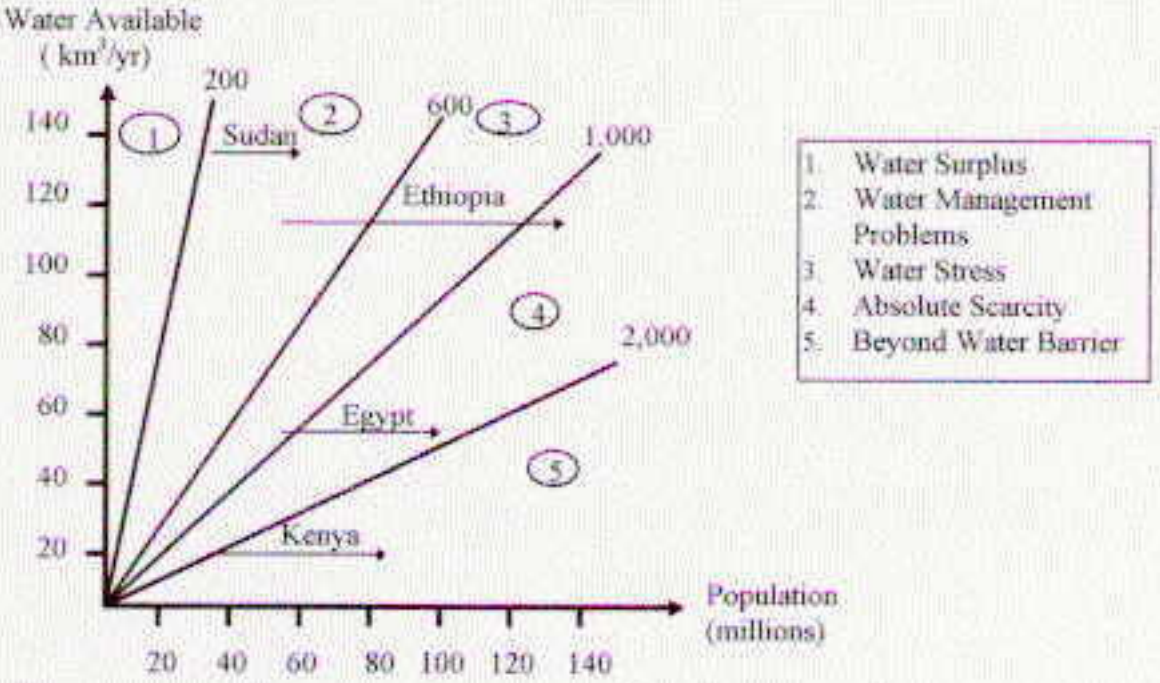
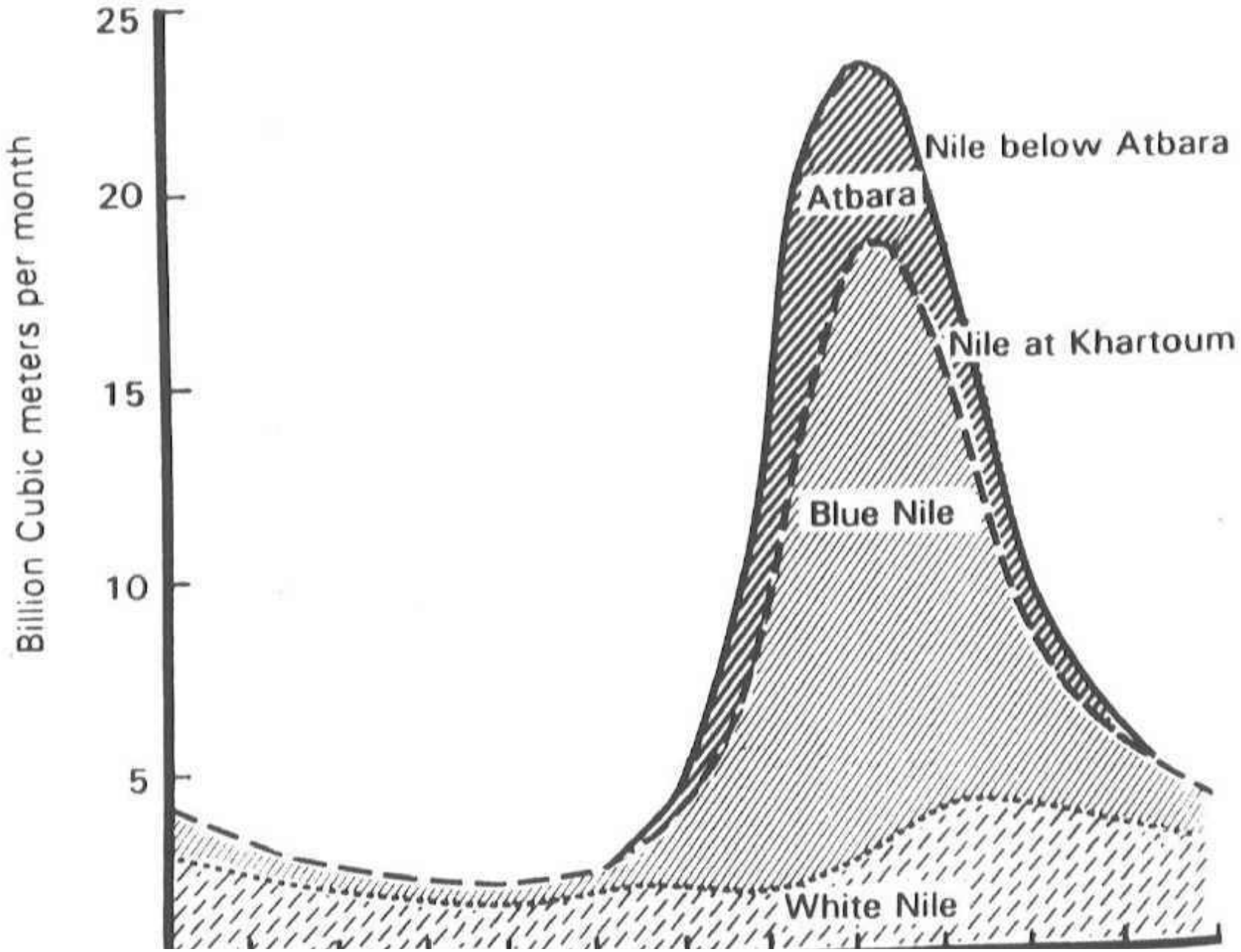
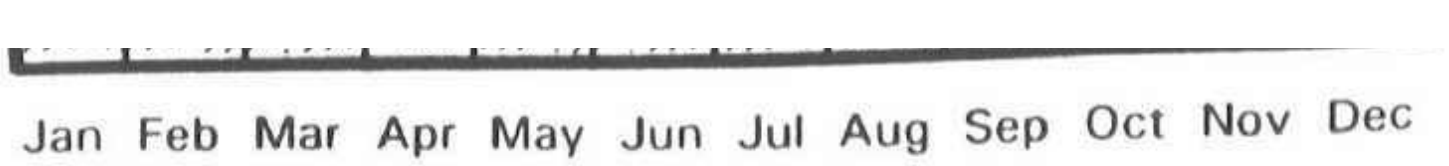


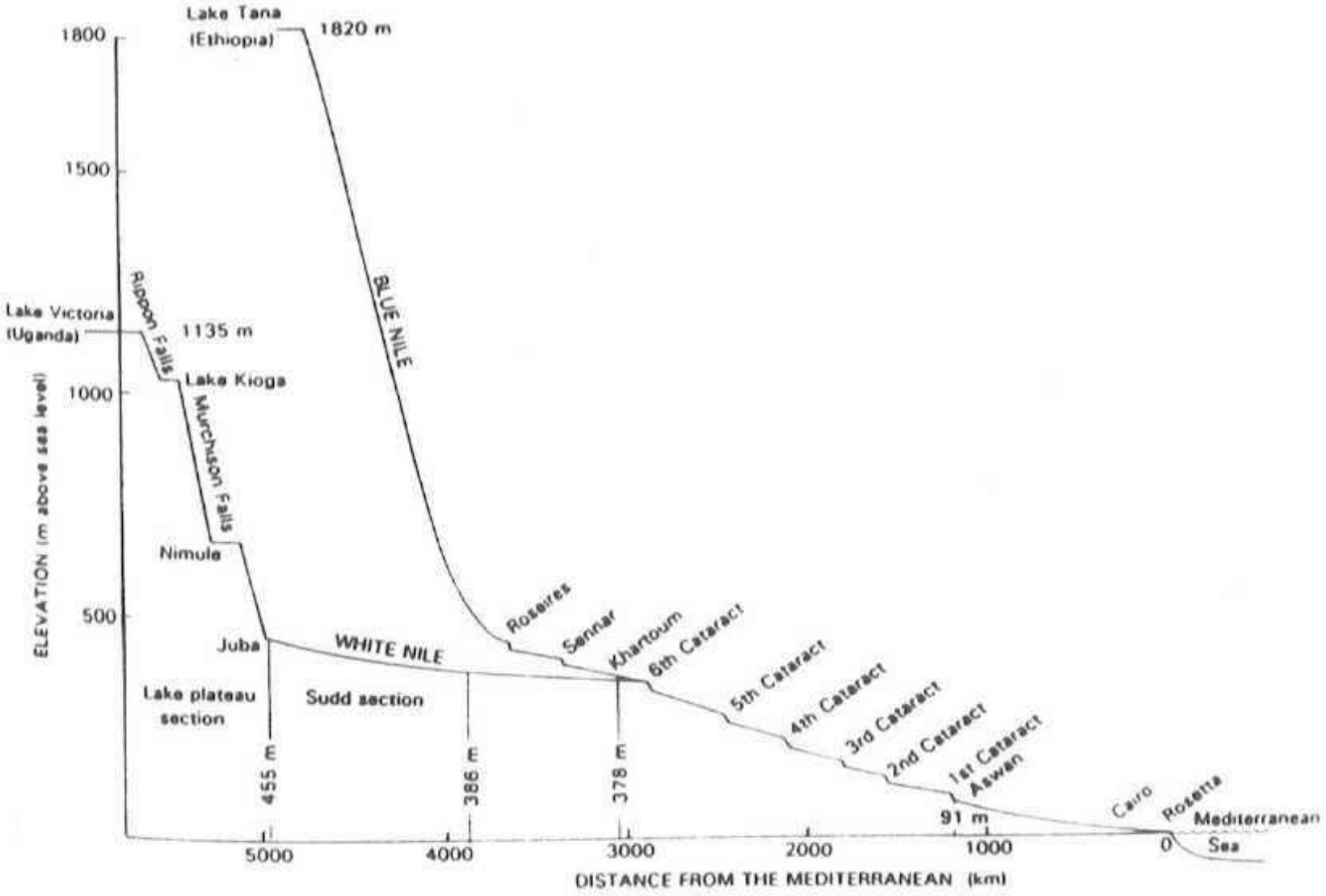
Figure 4: Water Situations for Selected Nile Basin States[12]

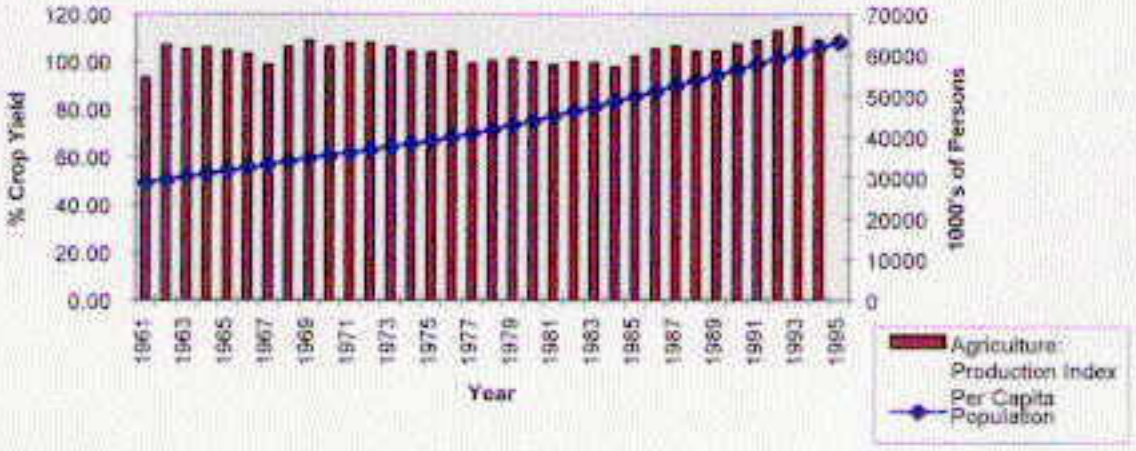
Arrows show increases due to population growth. Lines and numbers (200 - 2,000) indicate intervals of increasing water stress, indicated as number of individuals per flow unit of water (1 flow unit = 1 million m^3/yr). Code numbers (1 - 5 in circles) refer to hydrologic designation


25
20
15
10
5
Billion Cubic meters per month
Nile below Atbara
Atbara
Nile at Khartoum
Blue Nile
White Nile

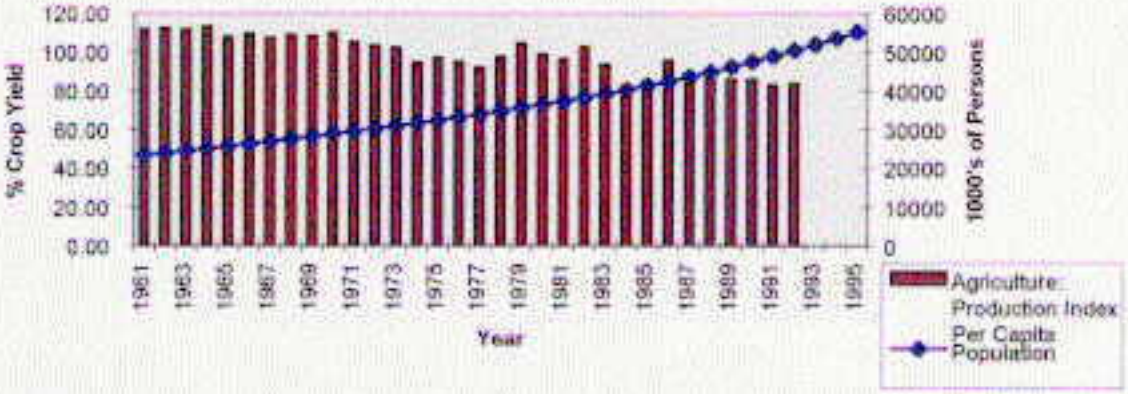


Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

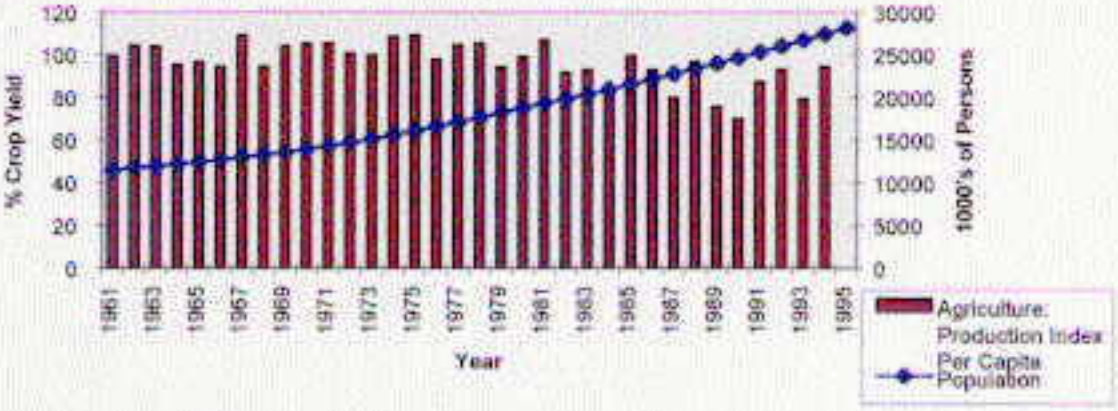

Lake Tana
(Ethiopia)
1820 m
1800
1500
1000
500
Lake Victoria
(Uganda)
1135 m
Ripon Falls
Lake Kioga
Murchison Falls
Nimule
Juba
BLUE NILE
WHITE NILE
Lake plateau
section
Sudd section
455 m
386 m
378 m
Roseires
Sennar
Khartoum
6th Cataract
5th Cataract
4th Cataract
3rd Cataract
2nd Cataract
1st Cataract
Aswan
91 m
Cairo
Rosetta
Mediterranean
Sea
0
1000
2000
3000
4000
5000
DISTANCE FROM THE MEDITERRANEAN (km)
ELEVATION (m above sea level)



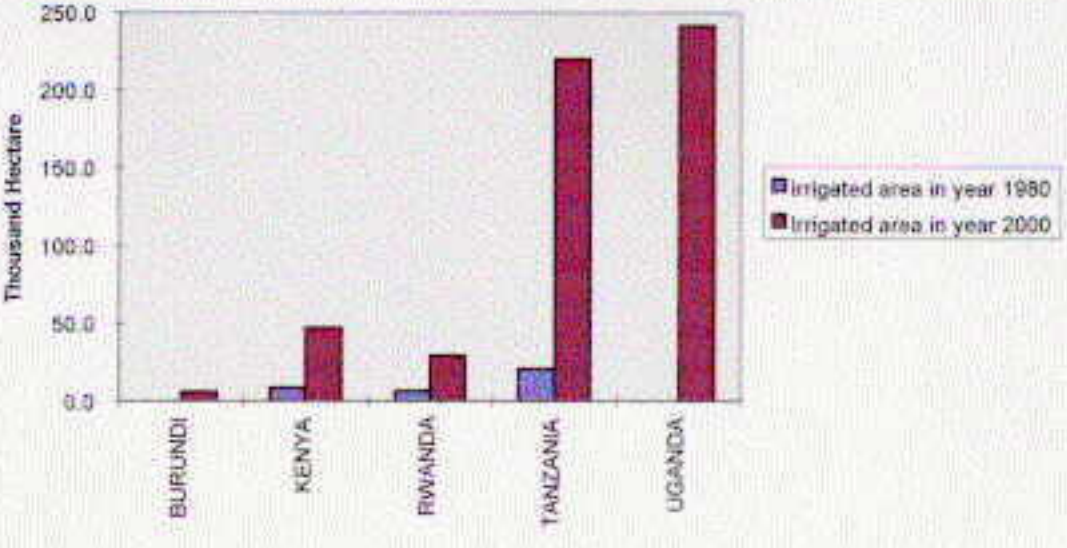
Graph 1: Egyptian Agricultural Production and Population[25]



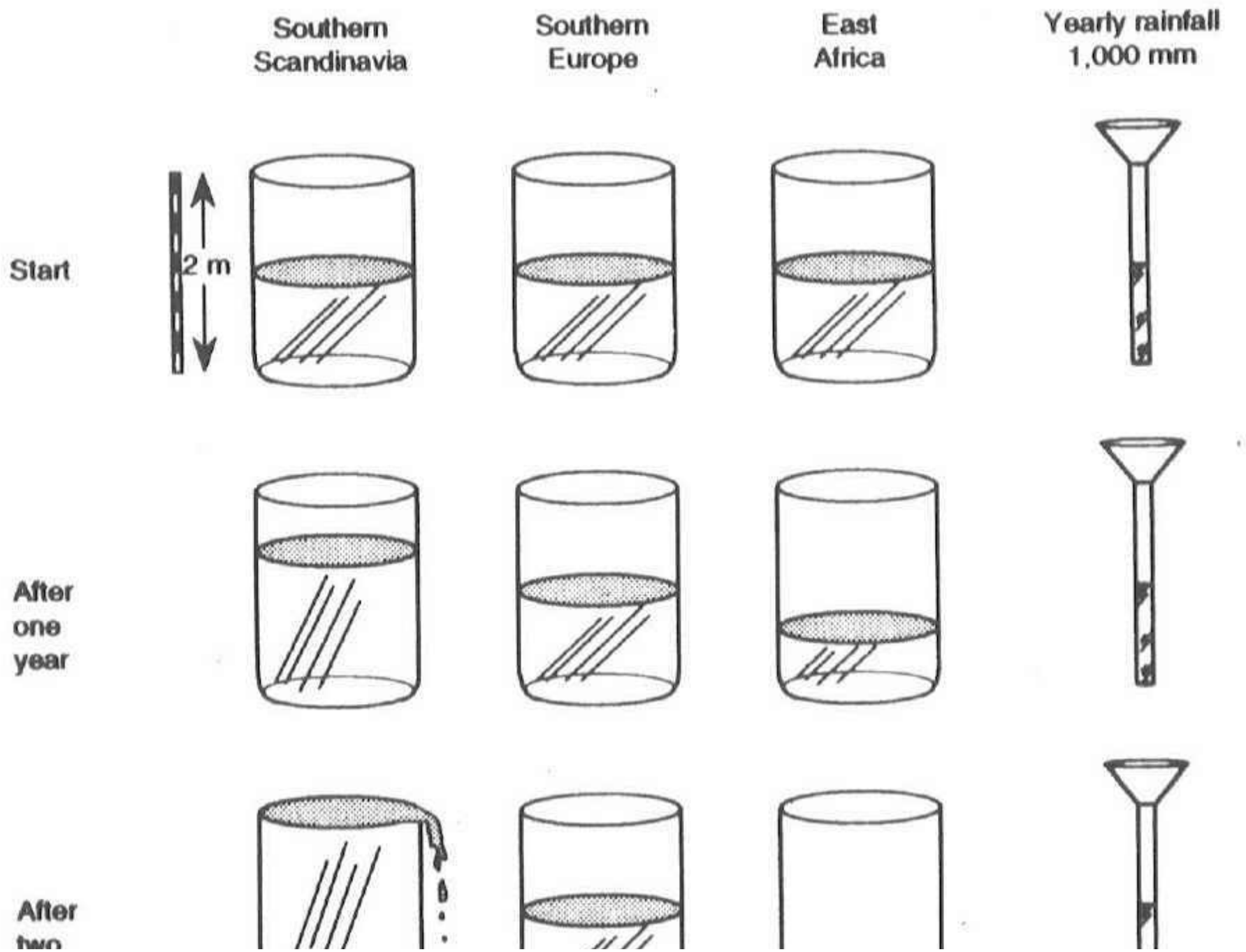
Graph 2: Ethiopian Agricultural Production and Population[26]



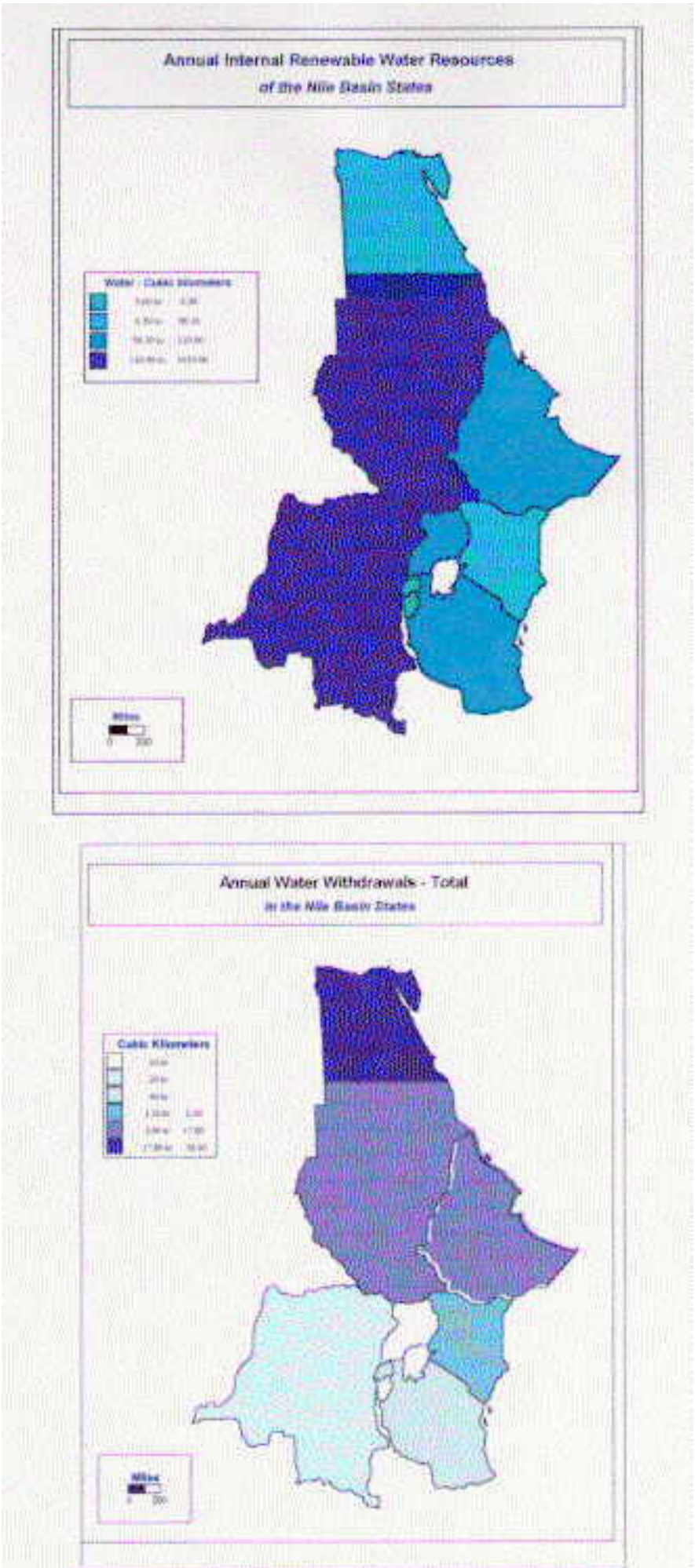
Graph 3: Sudanese Agricultural Production and Population[27]

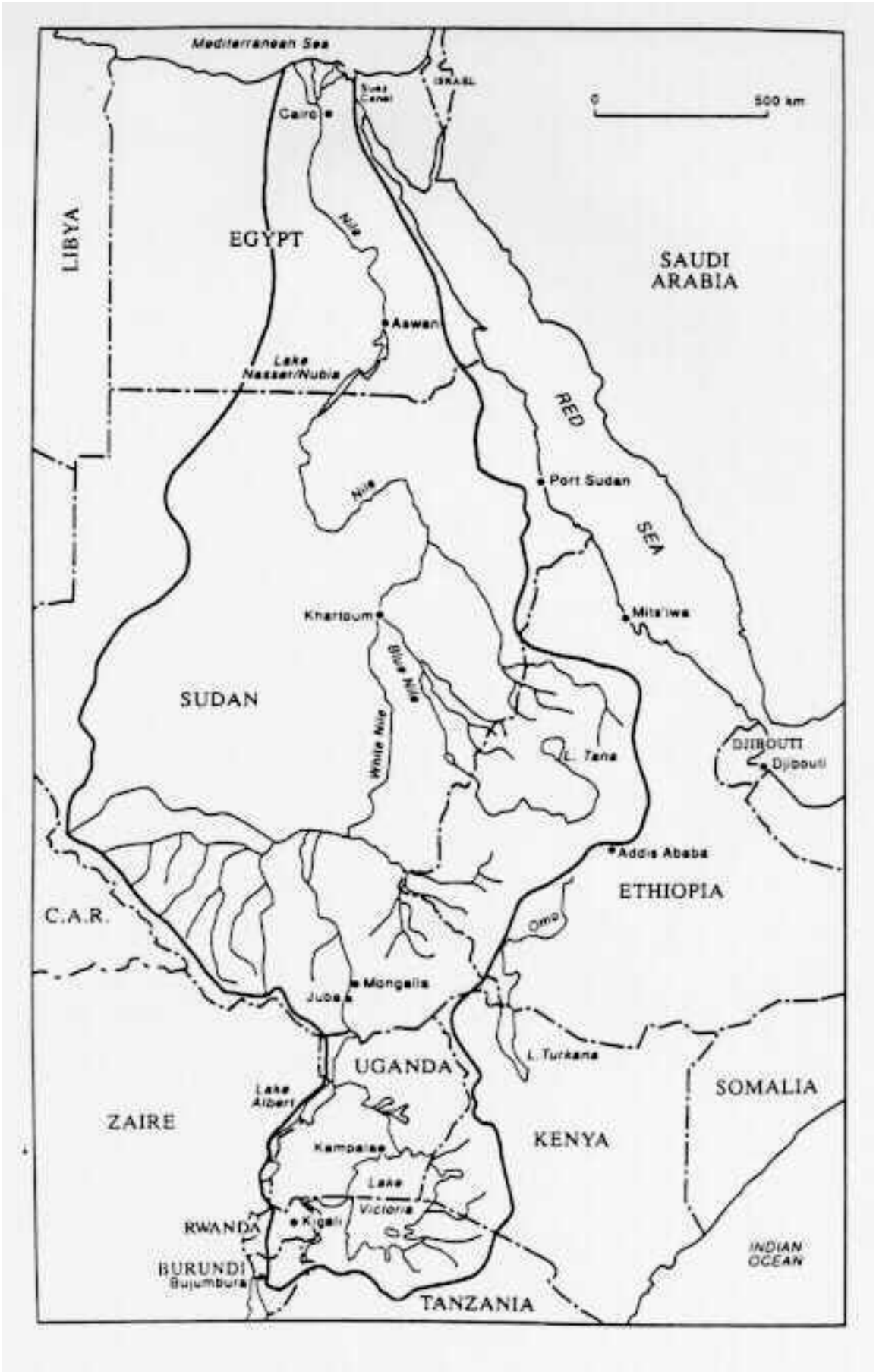


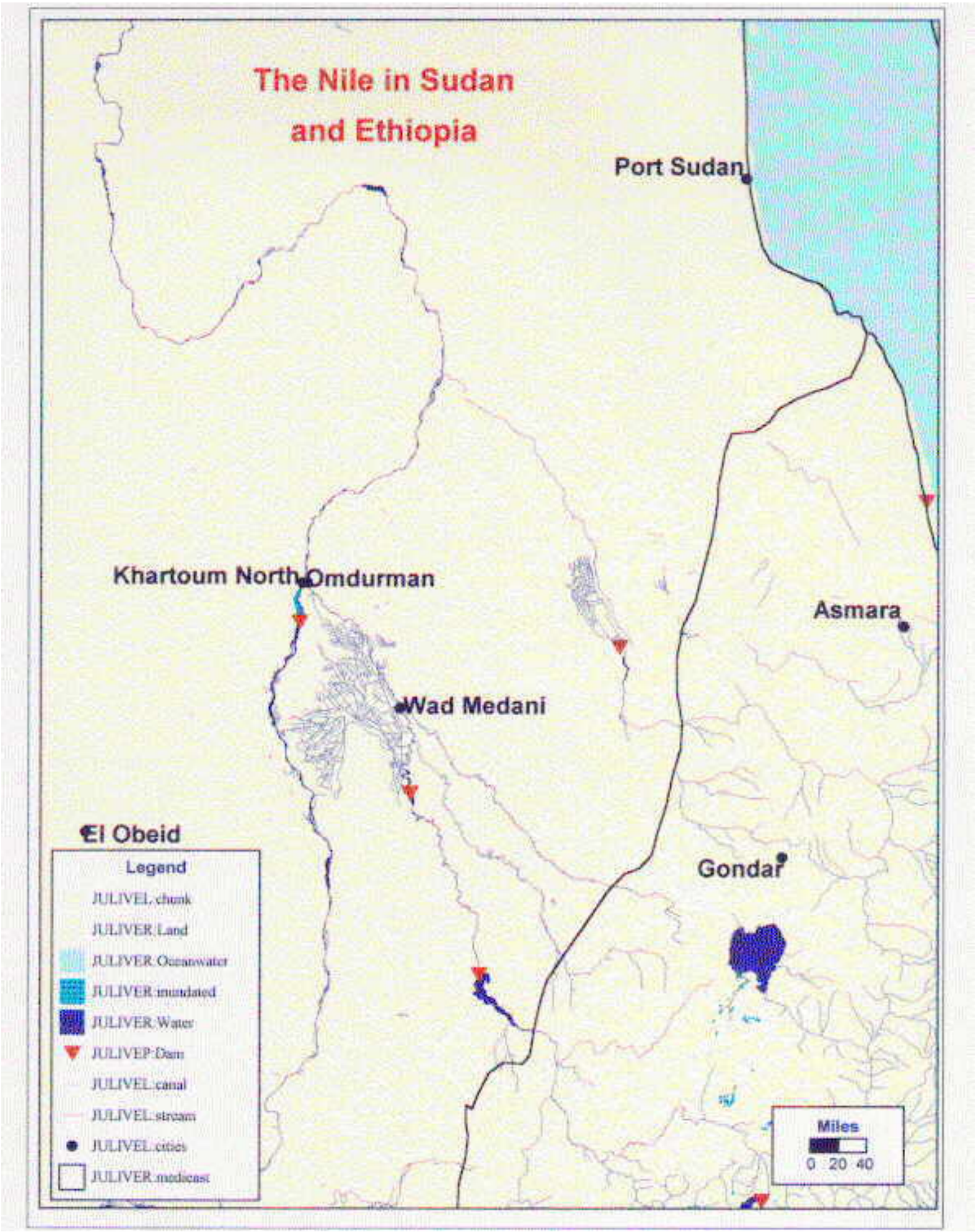
Graph 4: Projected Irrigated Areas[35]

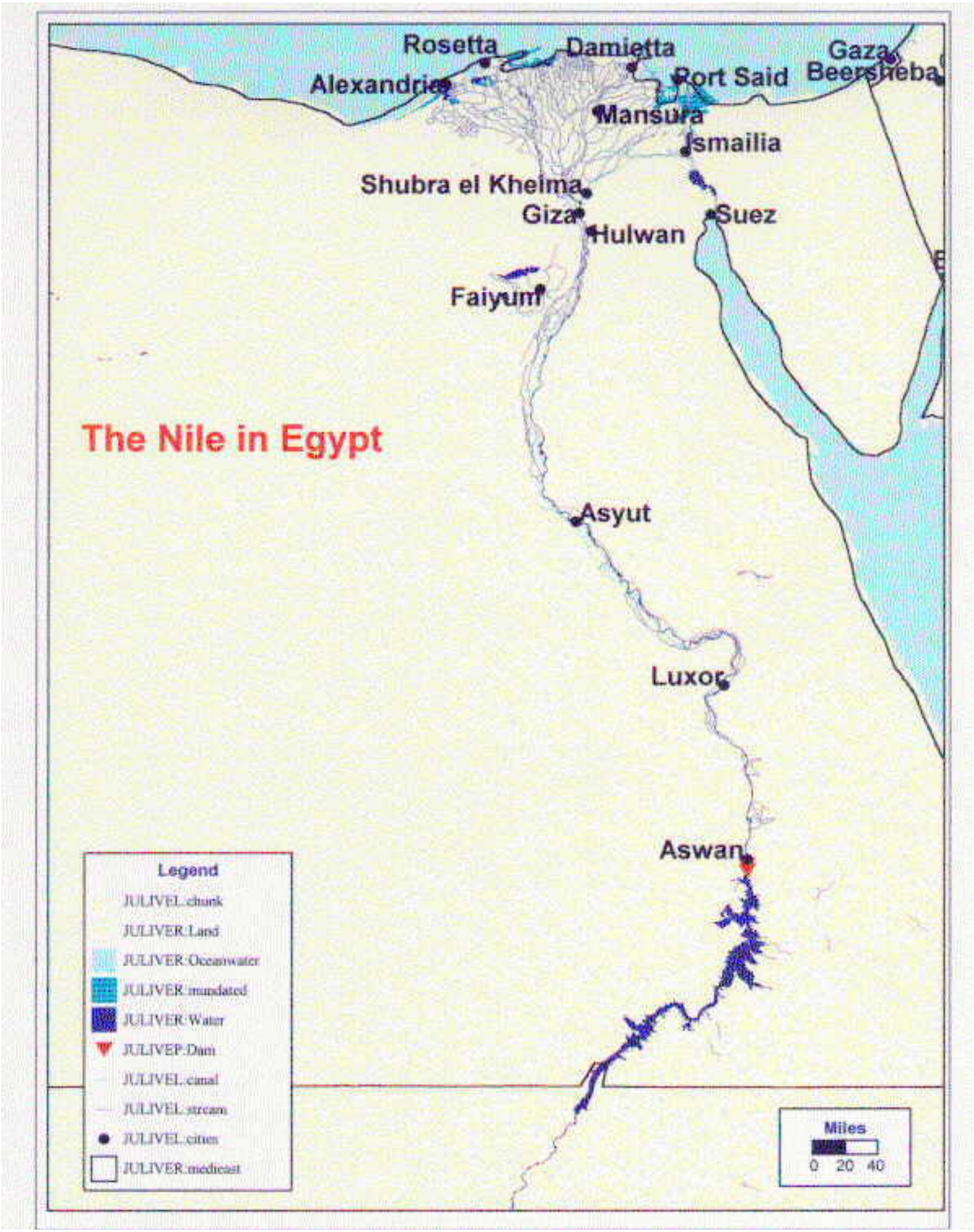

Southern Scandinavia
Southern Europe
East Africa
Yearly rainfall 1,000 mm
Start
2 m
After one year
After two

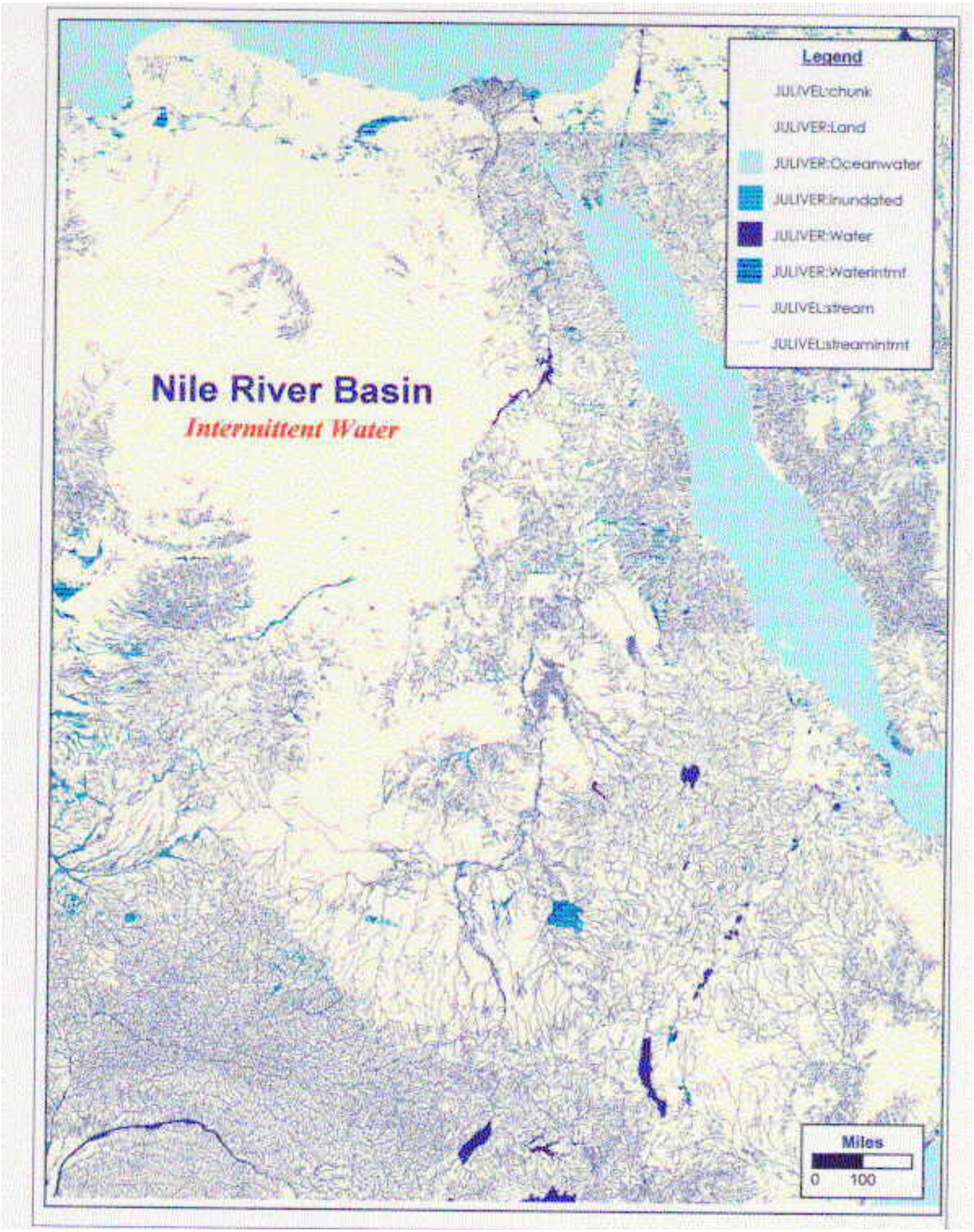
years

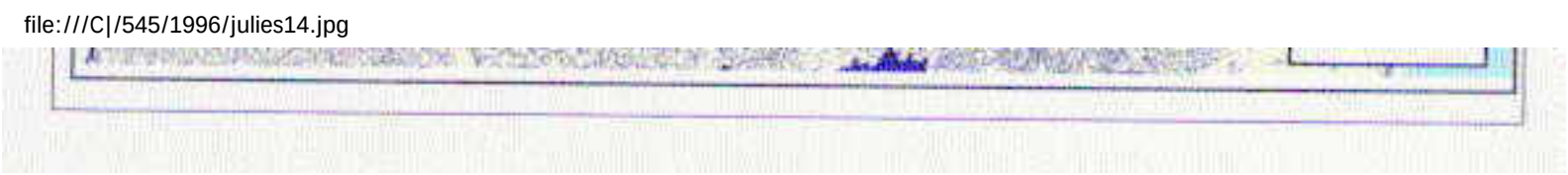

Annual Internal Renewable Water Resources
of the Nile Basin States
Annual Water Withdrawals - Total
Cubic Kilometers

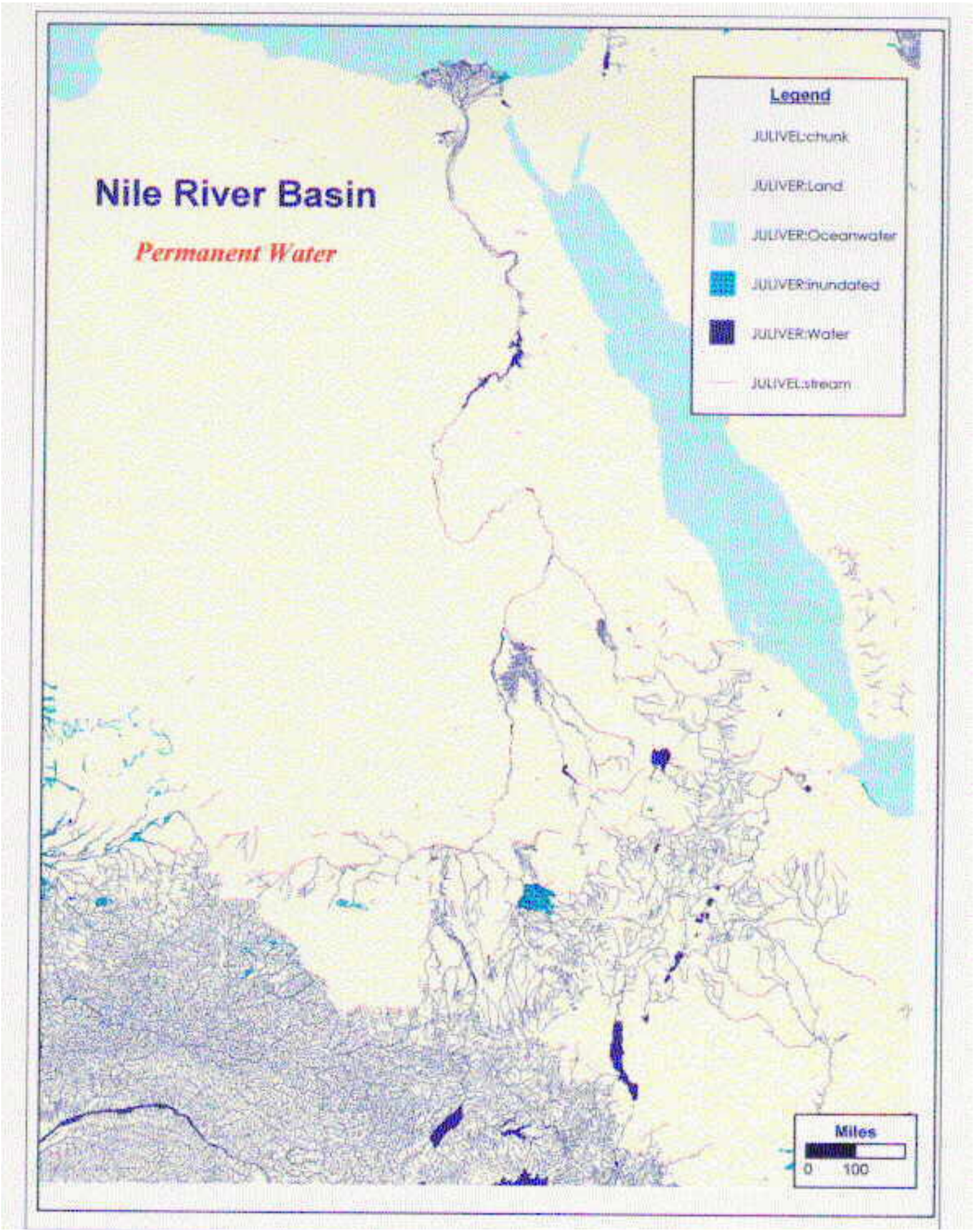

Mediterranean Sea
ISRAEL
Suez Canal
Cairo
0
500 km
LIBYA
EGYPT
Nile
SAUDI ARABIA
Aswan
Lake Nasser/Nubia
RED SEA
Port Sudan
Nile
Khartoum
Mits'iwa
Blue Nile
SUDAN
White Nile
L. Tana
DJIBOUTI
Djibouti
Addis Ababa
ETHIOPIA
C.A.R.
Omo
Mongalla
Juba
L. Turkana
UGANDA
SOMALIA
Lake Albert
ZAIRE
KENYA
Kampala
Lake Victoria
Kigali
RWANDA
INDIAN OCEAN
BURUNDI
Bujumbura
TANZANIA

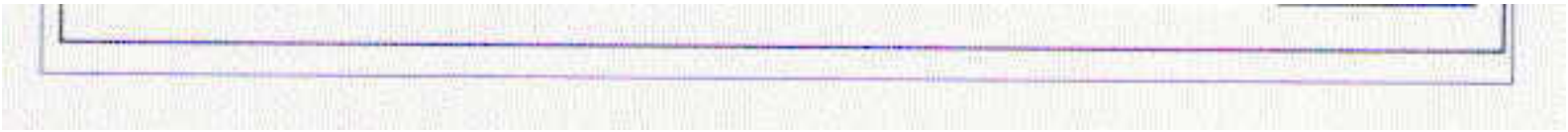

The Nile in Sudan
and Ethiopia
Port Sudan
Khartoum North
Omdurman
Asmara
Wad Medani
El Obeid
Gondar
Legend
JULIVEL.chunk
JULIVER.Land
JULIVER.Oceanwater
JULIVER.inundated
JULIVER.Water
JULIVEP.Dam
JULIVEL.canal
JULIVEL.stream
JULIVEL.cities
JULIVER.mediecast
Miles
0 20 40

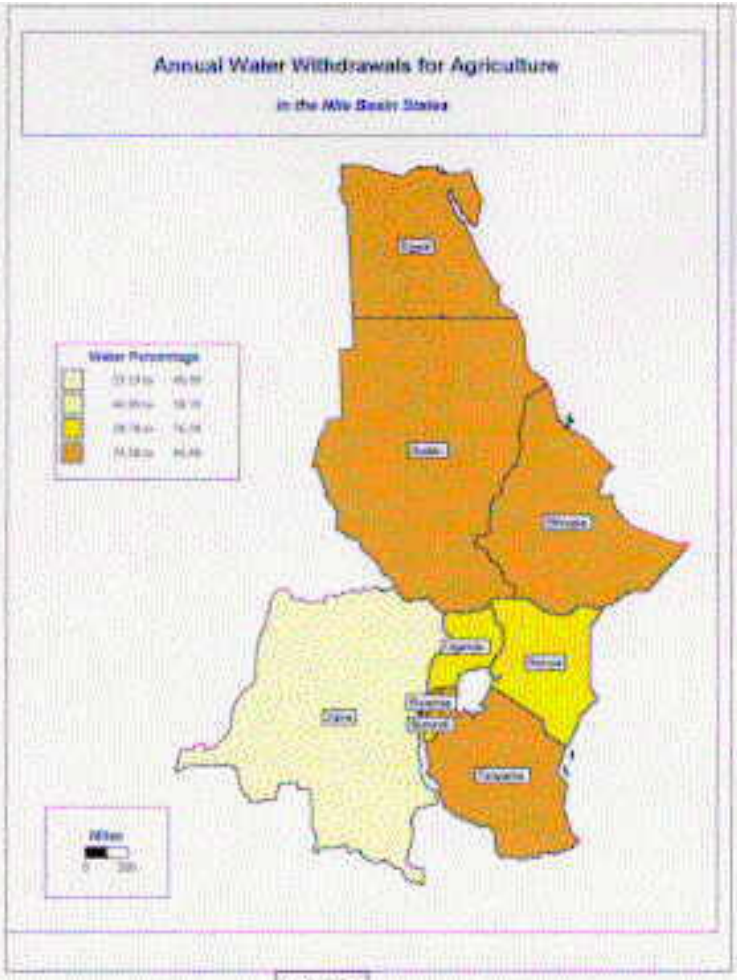

Rosetta
Damietta
Gaza
Beersheba
Alexandria
Port Said
Mansura
Ismailia
Shubra el Kheima
Giza
Suez
Hulwan
Faiyum
The Nile in Egypt
Asyut
Luxor
Aswan
Legend
JULIVEL:chunk
JULIVER:Land
JULIVER:Oceanwater
JULIVER:mandated
JULIVER:Water
JULIVEP:Dam
JULIVEL:canal
JULIVEL:stream
JULIVEL:cities
JULIVER:medicast
Miles
0 20 40


Legend
JULIVEL:chunk
JULIVER:Land
JULIVER:Oceanwater
JULIVER:Inundated
JULIVER:Water
JULIVER:Waterintmt
JULIVEL:stream
JULIVEL:streamintmt
Nile River Basin
Intermittent Water
Miles
0
100

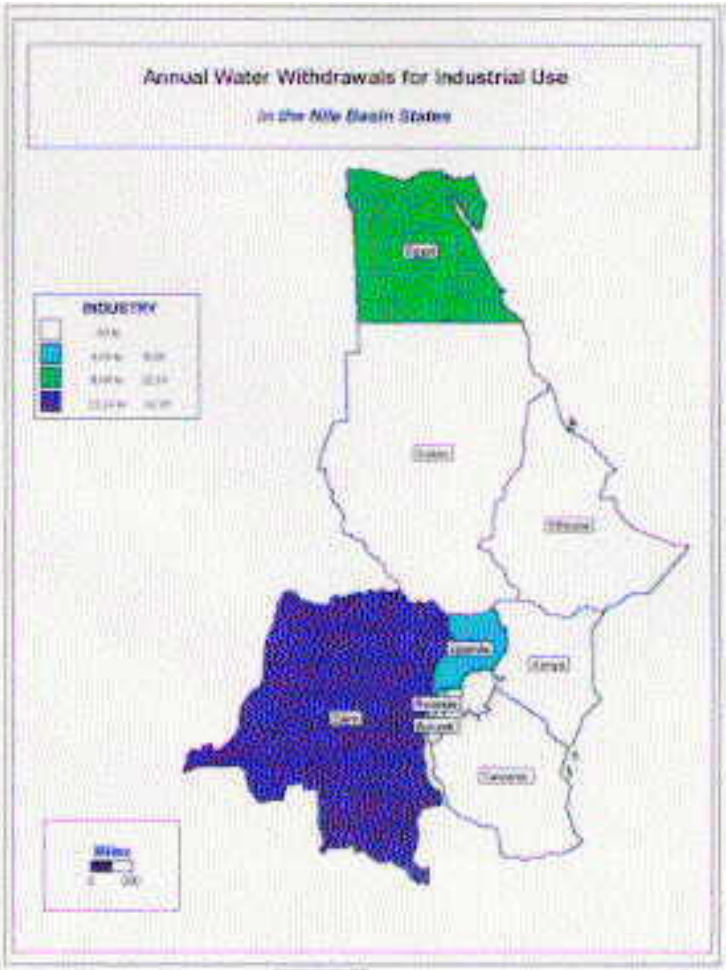



Nile River Basin
Permanent Water
Legend
JULIVEL:chunk
JULIVER:Land
JULIVER:Oceanwater
JULIVER:inundated
JULIVER:Water
JULIVEL:stream
Miles
0
100

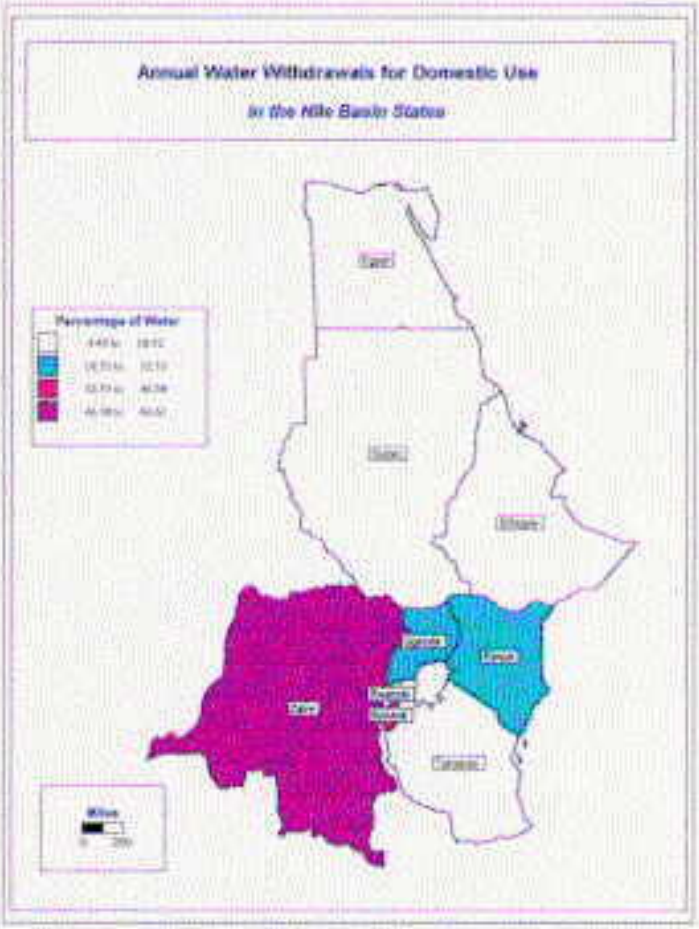




Map 8



Map 9



Map 10


Map 10

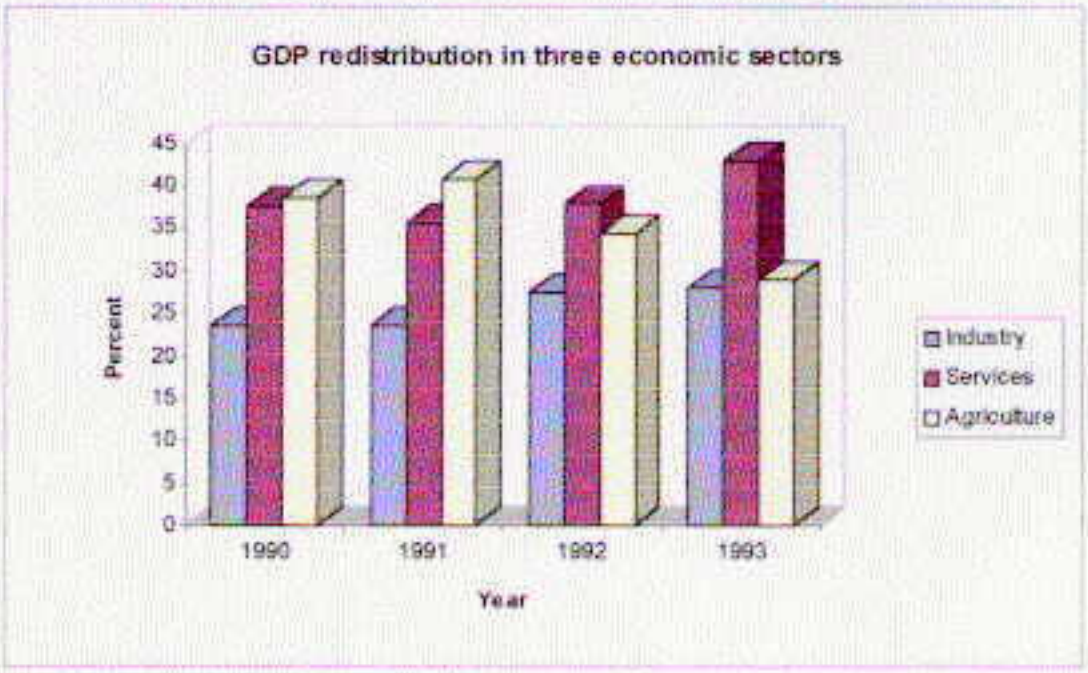
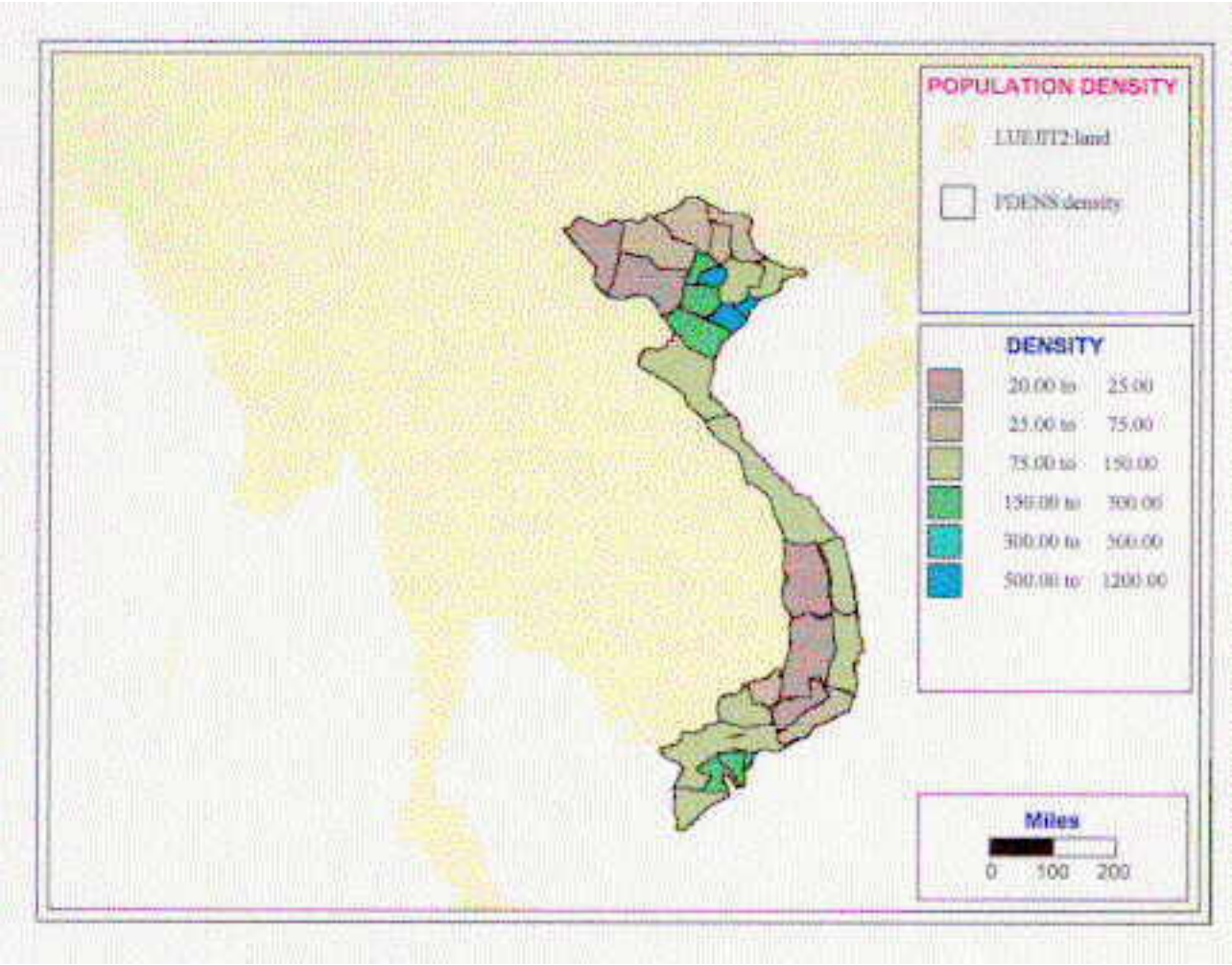


Figure 1 GDP distribution in three sectors from 1990-1993. (%)

Source: Statistical Publishing House, 1993.


POPULATION DENSITY
LUEJIT2.land
PDENS.density
DENSITY
20.00 to 25.00
25.00 to 75.00
75.00 to 150.00
150.00 to 300.00
300.00 to 500.00
500.00 to 1200.00
Miles
0 100 200

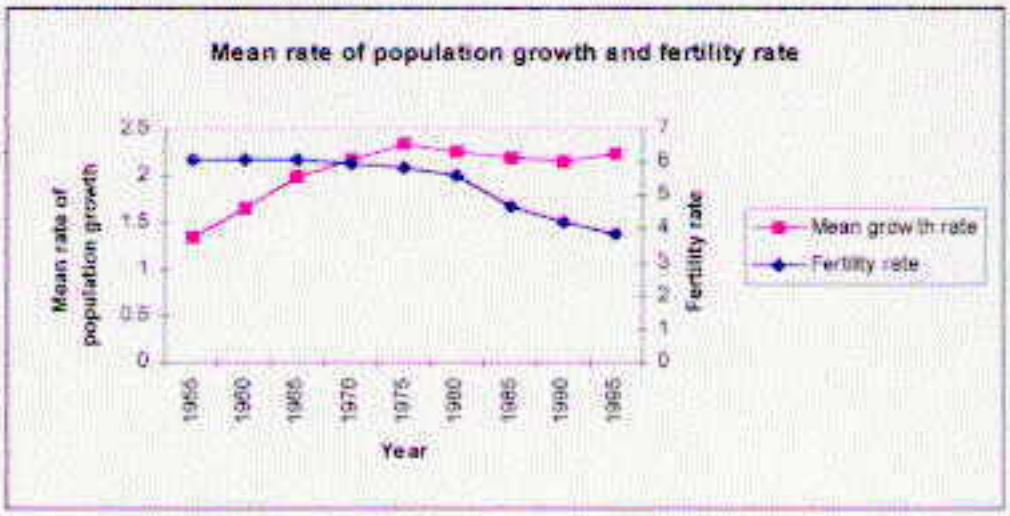
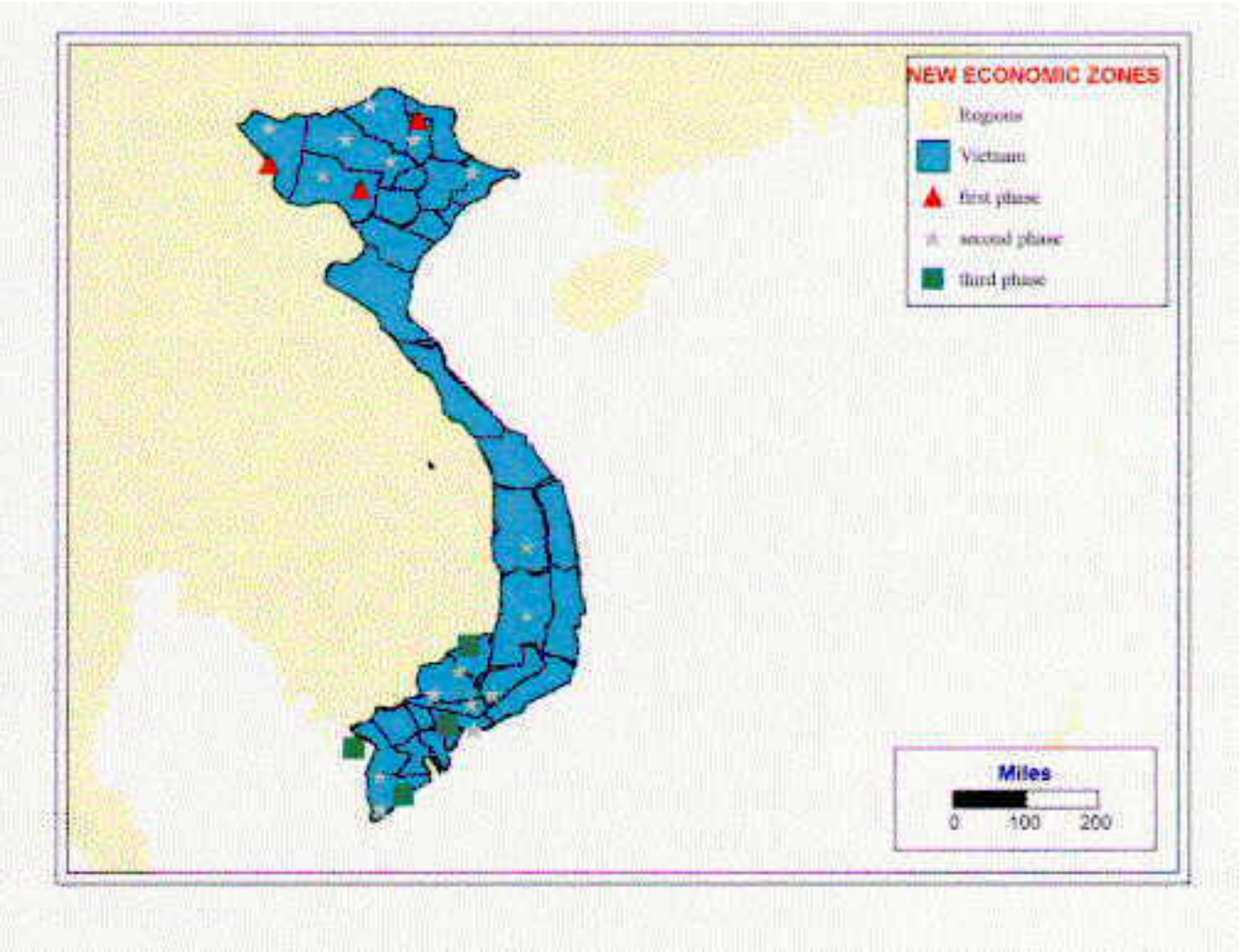


Figure 2 Mean rate of population growth and fertility rate from 1955-1996

Source: WRD, 1995-96


NEW ECONOMIC ZONES
Vietnam
first phase
second phase
third phase
Miles
0
100
200

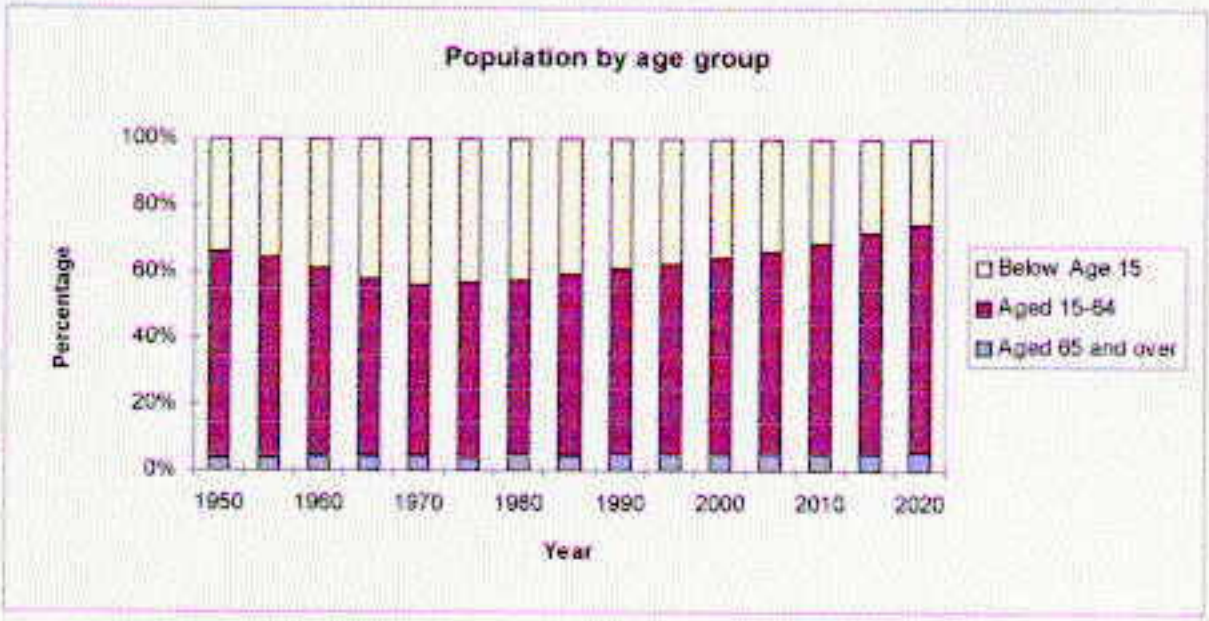


Figure 3 Population by age group

Source: WRD, 1995-96.

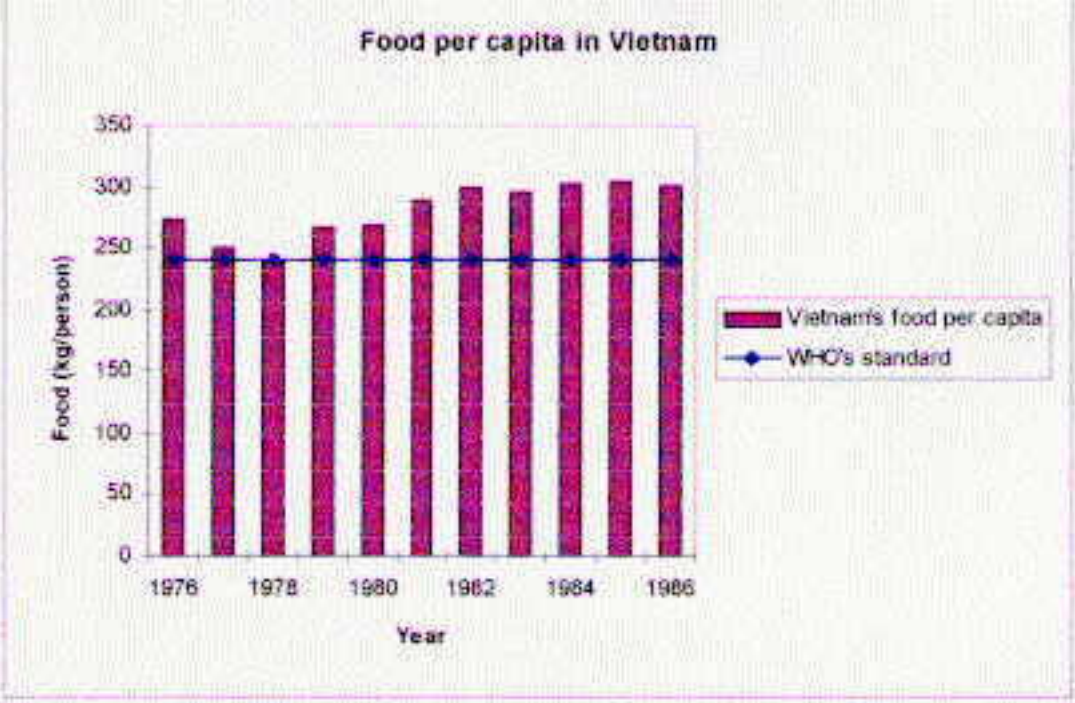


Figure 4 Food per capita in Vietnam

Source: General Statistic Office, 1993.

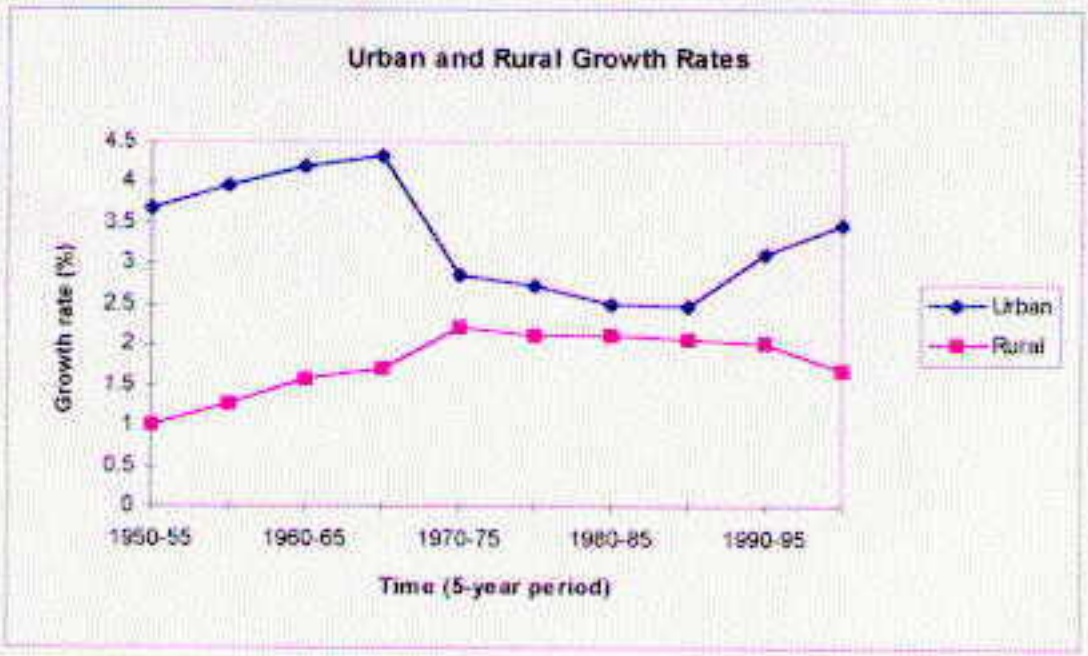


Table 5 Urban and rural growth rate in every five-year period from 1950 and projection to 2000. (%)

Source: WRD (1995-96)

Figure 6 Wood Production

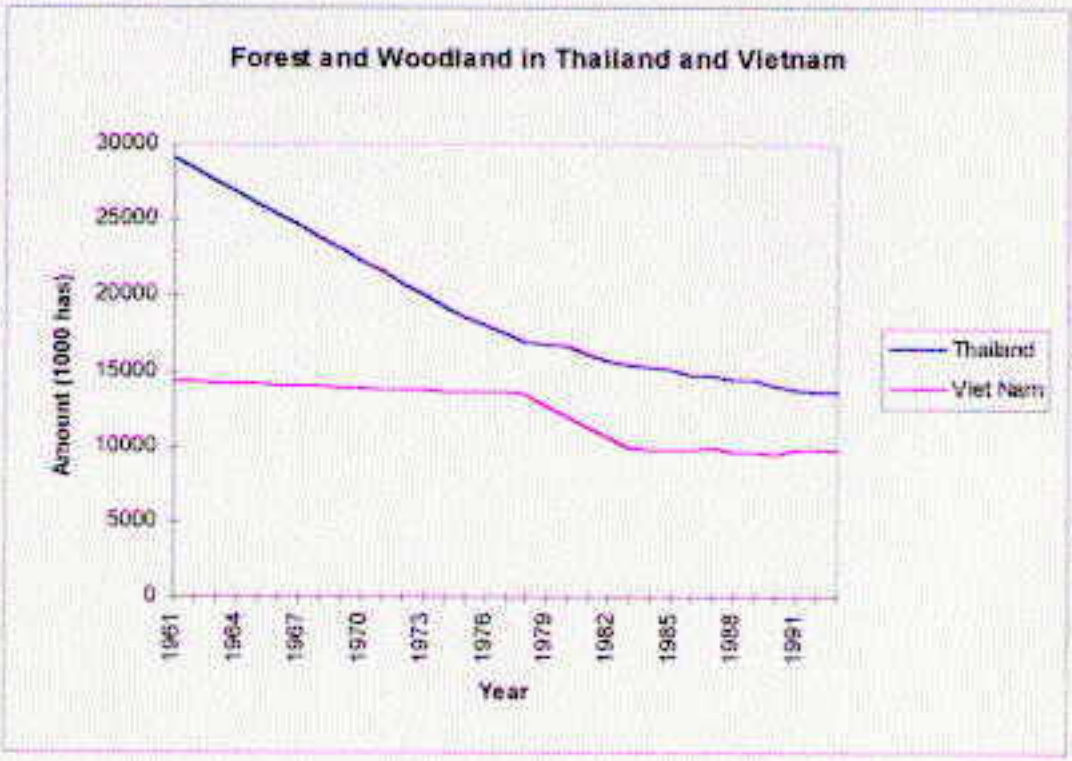
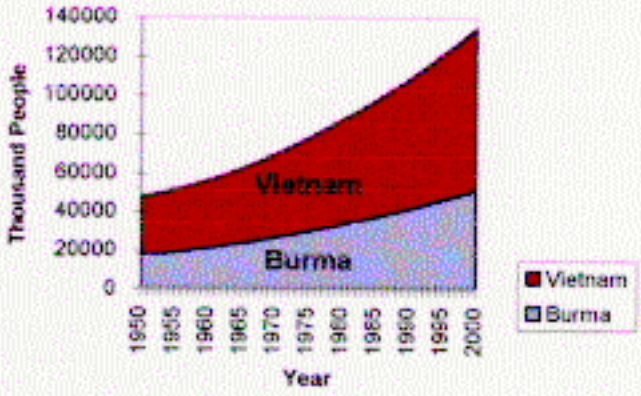


Figure 7 Forest and woodland in Thailand and Vietnam

Source: WRD, 1995-96.

FIGURE #1
Total Population: Burma & Vietnam



Source: World Resource Database