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**Families and the Rural Environment: Some Linkages
Among Agriculture, Population and Environmental Degradation**

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My task in this paper is to address "...the role of families in the relation between human activities and the environment." I assume the organizers were being generous in their request by giving me broad latitude in relating the family as a unit to both population and environmental questions. Indeed, it is my view that rural, farm families in the developing world represent a critical decision-making unit with regard to both agricultural and demographic change and that these decisions can have important environmental consequences. However, the request to prepare a five-to ten-page briefing paper necessitated a drastic narrowing of focus to a limited subset of issues.

One of my interests over the past decade or so has been on the connections between the agricultural circumstances of farm households in developing nations and their demographic behavior. This focus has major implications for the environment because rural, farm families constitute the overwhelming majority of the population in most developing countries, and potentially exert a profound effect on at least two major environmental resources--land and water. I attempt to develop a subset of these linkages in brief form in this paper and offer a hypothesized model for some of the relationships between household and family demographic composition and land degradation.

It hardly seems profound to observe that farm households throughout the developing world are the primary units making land use, food production and demographic decisions (particularly with regard to migration and fertility), and that development policies and programs designed to influence one set of decisions are likely to have consequences for the

other. Yet, a careful reading of most demographic and agricultural development policies, and the research literature supporting them, reveals scant recognition of this seemingly commonplace observation. In retrospect, it seems almost incredulous that the World Fertility Survey in interviewing almost 225,000 women in 42 developing countries, the overwhelming majority of whom most likely earned their livelihood from agriculture, failed to ascertain whether or not they were landowners, tenant farmers, sharecroppers or landless laborers. This is roughly equivalent to conducting a major health or demographic survey in the U.S. and failing to ascertain the occupation of those interviewed.

It should be recalled that a separate module was developed in the WFS for community-level variables and an economic module was even created. However, there was no agricultural module nor any systematic data collected on the agricultural circumstances in which farm households were seeking their livelihood. This omission seems all the more egregious in light of the recognition that we often define individuals' and families' position in the rural status hierarchy by noting their relationship to land, i.e., landless laborer, landowner, tenant farmer, and so forth (Stinchcombe, 1961). Indeed, the rural resident's relationship to land is often as descriptive of his or her life chances as occupation is for the urban resident. The Demographic and Health Surveys contain only a minimal improvement on this score.

The exact reasons for the relative paucity of research relating agricultural and demographic variables at the family or household level are not entirely clear to me, but would appear to reflect in large part the way we academics have organized our worlds. Demographers tend to be liberal

arts trained economists or sociologists with little background, interest or understanding of agriculture. Agricultural scientists drawn from the production fields such as agronomy, animal science, or even agricultural economics, have tended to ignore population issues except as a factor stimulating demand for agricultural commodities. Regardless of the reasons for the inattention to the connections between agricultural development and demographic change at the household or family level, the result is a major gap in our understanding of two phenomena that have important linkages to each other and to the environment in developing nations.

Population and the Environment: Household-Level Linkages

Although issues of population growth and environmental degradation are often phrased in macro terms at the societal level, both processes are at least in part the outcome of decisions made by individual couples, families and households. An understanding of the impact of population growth on environmental degradation obviously necessitates an explanation of the connections between the dominant economic system in relation to the environment. In a predominantly rural, agricultural society the relationships among farm household demographic circumstances and the agricultural production systems they employ may be crucial in determining the future course of one form of environmental damage--land degradation. Given the space limitations of this paper, and for illustrative purposes, one form of land degradation--soil erosion--is used to examine connections between the variables of interest.¹

¹Although the focus here is on land degradation, similar arguments can be made for the impact of production practices on water quality. The transport and contamination of surface and groundwater resources by agricultural chemicals, including fertilizers, pesticides and herbicides, is well-established, as is contamination of water from inappropriate and

Before turning to a model of relationships among agricultural production patterns, household demographic composition and land degradation, it is important to understand the set of resources that rural, agricultural households possess with which to earn their livelihood. At any given time, a farm household has a limited set of resources including land (rented, owned, sharecropped), labor (determined by household size, as well as age/sex composition), and capital (in various forms). These resources may be combined in a multitude of ways to produce sustenance for the household. The quantity and quality of land, the size and demographic composition of the household, including the human capital of members, the amount of capital and level of technology available, as well as the presence of off-farm employment opportunities, are all combined in different household strategies for meeting the basic needs of the unit and realizing the aspirations of individuals and families within the household. Massey (1990) has argued eloquently for such a model in the explanation of migration. While I agree that it is eminently applicable to this phenomenon, I would argue that the basic conceptualization describes a much broader set of demographic and economic responses on the part of households and families to their environment.

The key question here is not: do human populations respond to demographic or environmental pressure by altering their agricultural production, economic and demographic behaviors? Rather, the key questions appear to be: what type of responses do they make, in what order, if any, in what period of time, and what types of policies might alter the nature and/or timing of these responses? Some have argued these responses are excess application of animal wastes.

hierarchical in nature in that populations first tend to exploit those economic alternatives provided by the available technology, followed by technological improvements such as land intensification, i.e., a Boserupian response. "Next to occur are the "economic-demographic" responses of out-migration involving initially, only the temporary loss (seasonal out-migration) of a household member, because it (is) less psychologically traumatic for the household, but later, to the extent necessary for sustaining the household, the permanent loss of one or more members (out-migration). Ultimately, the whole household may have to migrate away.... Finally, the last adjustments to take place historically have tended to be those related to fertility...(Bilsborrow and Geores, 1991:44-45)."

Fertility-related change presumably occurs late in the process due to the substantial costs associated with behavioral changes in marital roles, sexual activity and the use of foreign birth control methods. A full discussion of these responses and the potential for government policies to alter their timing and magnitude, is beyond the scope of this paper, yet the present focus on the relationship between the agricultural production patterns employed by rural households and their relationship to household demographic composition and to their environmental consequences should be viewed in this larger framework.

Agricultural Production and Environmental Degradation

Land degradation continues to receive much attention as one area of environmental concern in developing nations. However, land degradation is not merely the outcome of a set of physical processes. In the case of soil erosion (only one type of land degradation), for example, it involves characteristics of the physical environment such as the erosivity of

rainfall or the erodibility of soil. Land degradation can also be markedly influenced by the social and economic system in which it occurs. Omission of either set of factors is likely to yield an incomplete analysis.

Physical characteristics of the land such as the slope, soil composition, vegetative cover, and climatic factors such as the erosivity of rainfall are proximate determinants of soil erosion. An understanding of these factors is fundamental to explaining soil erosion in a given locality. Yet, without examining the social and economic system that results in soil erosion and land degradation, we are left with a technical explanation of soil erosion, as represented by the Universal Soil Loss Equation, but with little guidance as to how it might be slowed, reversed or otherwise altered.

The dominant cropping patterns and management practices are heavily influenced by the economic and social systems in which they are located. It should be emphasized that management practices represent the area of greatest possible policy intervention and potential impact. Hudson (1977:173), for example, estimates that the power of erosivity to produce variation in erosion within a country is on the order of a ratio of 5:1, channel terraces altering topography and runoff might have an effect of 2:1, but "...land and crop management techniques could result in the erosion changing by a ratio of 1,000 to 1." Cropping patterns and land management techniques thus deserve careful examination, as do the factors that lead farm households to adopt any given land use pattern.

Figure 1 presents a simplified model of relationships among household demographic characteristics, agricultural production patterns and land degradation under varying agroclimatic and socioeconomic environments. As

Figure 1 about here

Figure 1 suggests, agricultural production patterns and characteristics of the agroclimatic environment are proximate determinants of farm land degradation in developing countries and the only factors hypothesized to have direct effects on land degradation. Agricultural production practices include cropping intensity, animal production and nutrient management techniques, tillage methods, conservation practices, and technology, all practices at least partially under the control of the household. The agroclimatic environment includes those physical attributes such as the erosivity of rainfall and the erodibility of soil beyond the control of the individual producer, but also includes the slope of land used that is potentially manipulable. One response of farm households in developing countries to increasing population pressure has been to bring land of increasingly steeper slope into production.

Where land is communally owned and the costs of degradation are spread over a large number of households, as in much of Sub-Saharan Africa, individual families or households may have little incentive to protect the soil and conserve land resources. Conversely, farmers who own their land or who have secure use rights granted to them are usually more willing to invest in land improvements and embrace conservation practices.

Household size and composition are hypothesized to be important in determining the agricultural production patterns employed by a given household. The size of the available labor force in relation to the land area, the number of adults and children in the household, and the opportunity costs of farm labor in comparison to off-farm work can all combine to influence the intensity of agricultural production and land use

patterns of the household.

The allocation of household labor to farm and nonfarm employment is not merely a function of household land, labor and capital resources. The larger socioeconomic and institutional environment in which the household operates determines the opportunities available to the household to allocate labor to farm and nonfarm employment. Similarly, changes in the opportunity structures off-farm will likely stimulate different labor allocations to farm and nonfarm labor. As Low (1986) has noted for Southern Africa, differential wage rates for farm and nonfarm employment can promote or retard the adoption of new technology. He notes that Swazi Nation Land farmers failed to increase overall maize yields as expected with the adoption of improved varieties. Instead of producing surplus maize for the market using the new varieties, households continued to meet their consumption needs for maize by reducing their on-farm labor, and increasing their involvement in off-farm employment where wage rates were more favorable. Such findings should serve to remind us that we should not view farm households in isolation from the broader set of economic opportunities and institutional settings in which they reside.²

In spite of the logic of models such as those depicted in Figure 1, comparatively little empirical work has been conducted at the farm or household level attempting to relate the demographic composition and structure of households to their land use or their animal and plant

²The term household is employed throughout this paper. It should be noted that for some contexts, the family may be more appropriate as the decision-making unit. In other countries, the homestead, consisting of several households and families, may be the appropriate unit. For example, some research in Swaziland suggests that households are the primary units for consumption, but homesteads are the unit for production purposes (cf. DeVletter, 1983; Low, 1986; Stokes et al., 1988).

production patterns. A preliminary study of land degradation in Swaziland (Stokes et al., 1988) suggested that some conservation practices were unrelated to physical characteristics of the soil, topography or rainfall patterns. Instead, the limited data available indicated that decisions on some land conservation patterns were more closely related to factors such as the size of the homestead, whether they were commercial or subsistence farmers, the amount of land they cultivated, and their use of mechanized power. The relationships among household demographic characteristics, landholdings and ownership practices, the degree of commercialization, and their impact on conservation practices and land degradation deserve greater attention than they have received thus far. This would seem particularly important in areas where fragile soils are highly susceptible to degradation.

Since land is perhaps the critical resource for many rural, agricultural populations, preserving this resource and understanding the factors that influence sustainable land use are worthy goals of future research and policy. At present, our knowledge of how rural households respond to changes in their economic, demographic or agricultural circumstances, and how these relate to their resource utilization and allocative decisions either on or off the farm is largely unknown.

Household decisions on these issues cannot be understood in isolation from the larger social and economic structures in which they are imbedded. The limited evidence available indicates that multilevel models containing characteristics of families and households, as well as attributes of communities, regions or other structural units are needed to understand the choices made by individuals, families or households with regard to

demographic, agricultural or economic issues.

Agricultural Landholdings and Demographic Behavior

Just as the demographic composition of households can influence their production practices, and ultimately, land degradation, the agricultural circumstances of farm families can influence their demographic decisions with regard to migration and fertility. Massey (1990:12) has argued that in Mexico "Landed migrant households not only are more likely to let their lands lie fallow, but those migrant households that do farm are more likely to invest in labor-saving production technologies...further exacerbating the feedback loop connecting migration, agrarian structure, and further migration."

In earlier work, colleagues and I have posited that agricultural landholdings have potentially important effects on the fertility behavior of rural households (Stokes et al., 1986; Stokes and Schutjer, 1984). We hypothesize that landholdings have at least two dimensions relevant to fertility behavior.³ The operational size of holdings controlled by a family or household for cultivation purposes is hypothesized to exert a positive influence on fertility since households with larger holdings require more labor and are able to utilize family labor more effectively. This has been labeled the land-labor demand hypothesis. Conversely, land

³These two dimensions of land lead to different income streams and these sources of income have different implications for fertility behavior. "Owners of agricultural land can receive three types of return: a labor return from working the land, a management return for managing the agricultural production process, and an equity return from their investment. Landless laborers receive only a return to their labor. Tenants of various kinds (sharecroppers, renters, etc.) can receive a management return as well as a labor return. However, only owners capture the returns to equity (Stokes et al., 1986:306)." Consequently, land ownership and size of holdings and the resulting income streams are hypothesized to produce opposite effects on fertility.

ownership is hypothesized to have a negative long-term effect on fertility because it generates an income stream from equity (a return only captured by owners) and can serve as a partial substitute for children as a source of old-age security--the so-called land-security hypothesis.

While this framework has been criticized (Cain, 1985; Thomas, 1991), it continues to be used in a variety of contexts in Africa and Asia (Clay and Johnson, 1990; Nagarajan, 1990). Regardless of whether the empirical evidence ultimately supports or rejects these specific hypotheses, they point to the importance of understanding the connections between the agricultural organization of rural households and their demographic behavior. At present, very little systematic empirical work has focused on these phenomena. If research on these issues is to inform policy, it will require demographers to enlarge their vision of both the micro and macro contexts within which demographic decisions and behavior take place.

While this essay has focused primarily on the possible impact of household demographic composition on land use and agricultural production patterns, and their hypothesized relation to environmental degradation, the potential impact of agricultural landholdings on fertility and migration behavior was also noted. Finally, the impact of environmental quality on the morbidity and mortality of agricultural populations is equally worthy of attention. Rural, farm households and families in less developed countries represent the unit in which the majority of decisions about family size, food production and land use patterns will be made well into the next century. If we want to understand how these decisions are made and what factors are influential--rural, farm families and the agroclimatic and socioeconomic environments in which they live is one place to begin.

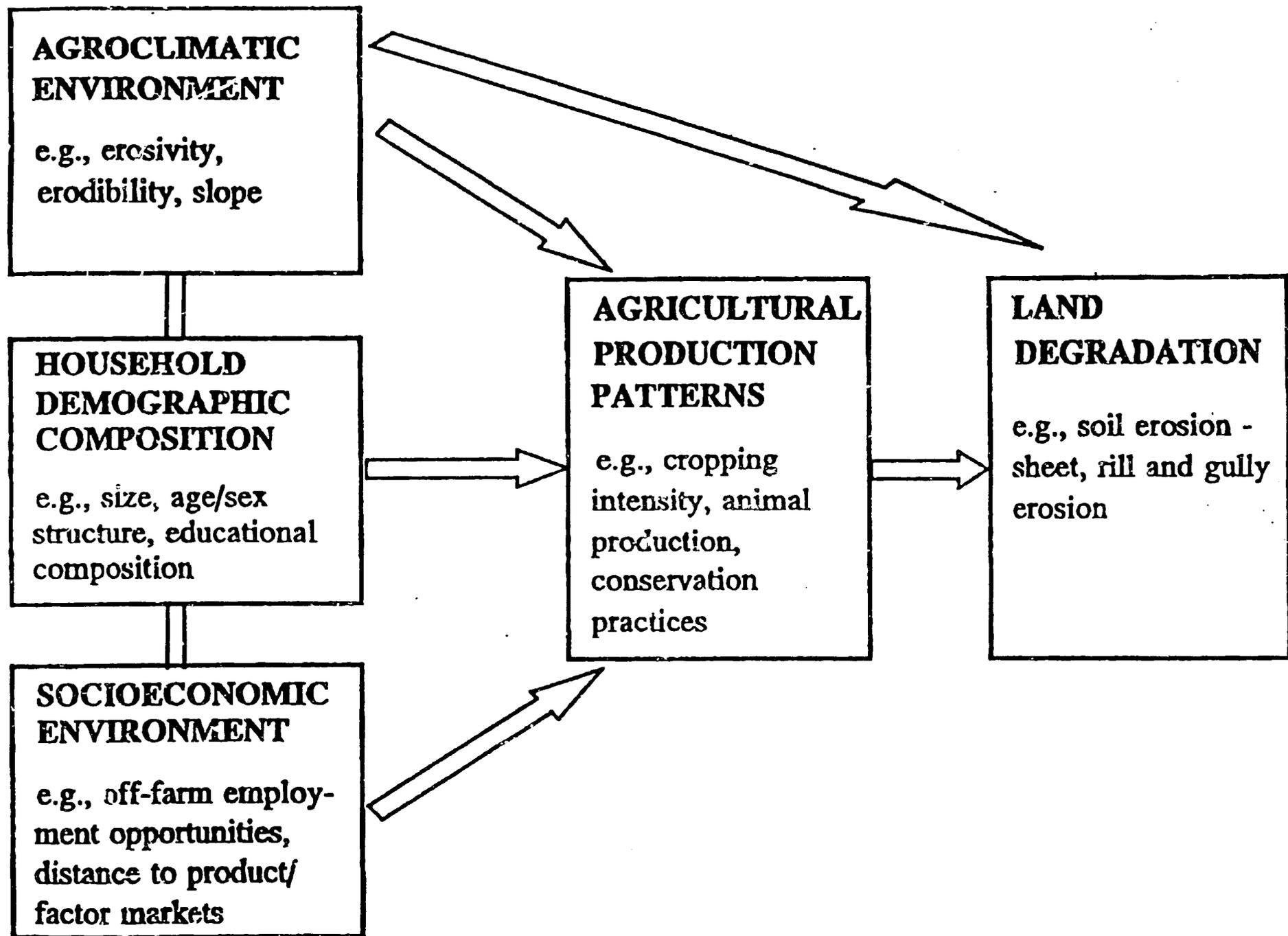


FIGURE 1. Simplified Model of Possible Relationships Among Household Demographic Characteristics, Agricultural Production Patterns and Land Degradation, Under Varying Agroclimatic and Socioeconomic Environments.

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