

DRAFT

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Understanding and Coping with Natural Disasters: El Niño in Latin America and the Caribbean

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This loss of quality of life felt by the population will last longer than the disaster itself, and its price, which cannot be quantified, is comparatively much higher than the quantifiable amounts of social damage.

Ecuador: Evaluation of the effects of the 1982/83 Floods on Economic and Social Development, E/ECLAC/G.1240, May 16, 1983, page 13

Abstract

The economies of some Latin American countries were pummeled by the most recent El Niño event; costs in terms of poverty, growth, and natural resource degradation were very high, and in some instances partially avoidable. Policymakers and international lending institutions are scrambling now on two interrelated fronts. First, action is needed to get these economies back on track, taking care first to lift out of poverty those who suffered most from El Niño 1997/98. Second, wherever possible, investments are needed to reduce or even avoid the losses associated with future El Niño events, and perhaps other natural disasters, too. But time, resources and absorptive capacity are limited, so priorities must be established. But how? To set priorities for action and investments, a better understanding of how El Niño-type events affect the poor, and how these effects might be undone, is needed. Past efforts to quantify the impacts of El Niño have been inadequate for these tasks: stocks of assets and flows of products have been confused; valuations of these have not been systematic; and quantification efforts have never focused on a complete set of assets held (and lost) by the rural poor. This paper addresses these issues by setting out a conceptual framework for assessing the impact of natural disasters in general on the asset portfolios of rural households and communities, paying special attention to El Niño events. Similarities between El Niño shocks and those posed by seasonality and drought-induced famines are also examined. Implications for policy and IDB lending are explored.

Keywords: El Niño, poverty, asset portfolios, Latin America, policy

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1. INTRODUCTION

El Niño, what is it? -- El Niño is a particular type of climatic phenomenon that has periodically produced natural disasters for many years. It is characterized by a rapid rise in seawater temperature in the Pacific Ocean off the coast of Peru and consequent changes in weather patterns (usually large deviations from normal air temperatures and increases in rainfall over a distance of several thousand kilometers along the equator). El Niño events occur more-or-less predictably every 2 to 7 years, lead to droughts and/or floods, and have global impact. (See Gates, 1993, chapter 7, or <http://rossby.cdc.noaa.gov/ENSO/enso.description.html>) Figure 1 compares recent El Niño (above-zero measures) and La Nina (below-zero measures) events as regards their severity and their duration.² Figure 2 compares recent El Niño events in greater detail. Both figures suggest that the 1997/98 El Niño event is the second most intensive in the past 50 years, though not the longest lasting, that El Niño are becoming more frequent, and that the temporal pattern of climate change may be changing (the bi-modal nature of the 1997/98 El Niño is novel to the series examined here). Increasing intensity and frequency of El Niño shocks may make them more difficult to prepare for and recover from, issues taken up after a discussion of accounting for the costs of these events.

[Figures 1 and 2 go about here.]

Very Expensive Environmental Shocks -- By any calculation, El Niño shocks are very expensive to world economies, especially to those of Latin America. The most recent El Niño event (which is still running its course) has caused billions of dollars in damage to private and public property, loss of life, and slowed growth and progress on poverty alleviation. Available information is still incomplete, but cost estimates for particular countries (e.g., Ecuador, see Vos et al) and for the region as a whole are large, and are expected to be much larger than the cost of the 1982/83 El Niño event, which was estimated to be approximately \$5 billion for Latin America and the Caribbean, and which caused approximately 800 deaths and left over 600,000 homeless (New York Times, August 2, 1983).³

But, while all would probably agree the cost of the most recent El Niño shock is large, how are these cost estimates arrived at? What combinations of prices and quantities are multiplied and then summed to calculate El Niño damage? Perhaps most important, how do the rural poor 'enter into' these calculations, directly and/or indirectly? These issues are critical, because failure to include and/or properly value all the damage may alter not only the 'bottom line' cost calculations, but can misguide policymakers as regards what investments need be made, where, and when. This can be true even if the total costs of an El Niño shock arrived at by different methods are the same, but the compositions of these costs are different – policies to prepare for and react to shocks based on different calculations may be quite different.

More completely accounting for El Niño damage is difficult, but necessary. Efforts to quantify the damages linked to El Niño events have usually focused on: emergency aid (a flow) required to meet the immediate needs of populations effected; costs of reconstruction of transportation infrastructure, schools, hospitals, and machinery (stocks) damaged or destroyed by floods, landslides, etc.; crop losses (flows); livestock losses (stocks); lost labor income due to increased unemployment (flows); and reconstruction costs for (usually urban) dwellings. (See for example, ECLAC 1983.) These costs can then be expressed in term of individuals affected

²The source for El Niño diagrams is: NOAA-CIRES, Climate Diagnostic Center, U. of Colorado at Boulder.

³Estimate for 1982/83 El Niño costs represent the sum of costs for Cuba, Mexico and Central America, Ecuador and Northern Peru, Southern Peru and Western Bolivia, Southern Brazil, Northern Argentina and eastern Paraguay, and Bolivia, as reported in The New York Times, August 2, 1983.

and/or as a proportion of GDP. (See, for example, World Disasters Report, 1997, chapter 10.)

But important gaps remain in fully assessing damage, e.g., some private assets, such as land, are not generally included. Moreover, methods for estimating the values of both stocks and flows, when reported, are often not based on market values, and when they are, the timing of valuation exercises does not take into consideration market disruptions due to El Niño effects or reflect the likely timing of outlays needed to repair damages. Perhaps most important, ownership of damaged or destroyed assets is generally not attributed, thereby limiting our abilities to identify the direct impact of El Niño on the poor. Missing also from these calculations are the values of assets 'used up' by the poor to survive an El Niño event, the income that these lost assets could have generated, and the savings/investments required to replace them. Finally, communally held assets (and the flows from them) are generally not accounted for, with the notable exception of ocean waters and fishing grounds.

Policy Issues Linked to El Niño – And policymakers should care about a change in accounting for natural disasters such as El Niño. Key objectives of policymakers faced with El Niño events are to smooth consumption over these shocks (i.e., keep households from falling into poverty), and minimize the negative impacts of these shocks on economic growth and poverty alleviation (i.e., continue to reduce poverty levels generally). But if available measures of the impacts of El Niño shocks omit key assets held by the rural poor, effects on poverty will be underestimated. Or, if impacts on a complete set of assets can be measured but cannot be attributed to poor and non-poor segments of the rural population, then effects on poverty may also be underestimated -- the effects of losing 500 head of cattle will depend on who owned them (CEPAL, 1983, pg. 30). Moreover, if post-El Niño growth (and especially savings) are insufficient to rebuild asset portfolios, the rural poor may never recover. These and related issues may become even more important in the future if future El Niño events become more frequent and intense, and therefore more destructive as regards the asset base of the rural poor.

What is needed, then, is a new accounting framework for assessing the impacts of El Niño on the rural poor that effectively deals with these issues. But where to begin? This paper suggests an asset portfolio approach as a point of departure for assessing the impact of environmental shocks in general, taking the floods associated with El Niño as one extreme example of such shocks. Section 2 sets out this asset portfolio approach in the context of small-scale agriculturalists and uses it to conceptually assess the impact of an El Niño event on poverty, productive activities and investments. Section 3 provides some generic examples of the usefulness of this approach in predicting the impacts of, and smallholder responses to, El Niño events. Section 4 discusses an array of context-setting variables that affect the impact of El Niño-type shocks on the poor. Section 5 examines the characteristics of El Niño shocks and how these overlap with characteristics of seasonality and the preconditions for drought-induced famines. Section 6 contains conclusions and policy implications.

2. EXAMINING EL NIÑO SHOCKS USING AN ASSET PORTFOLIO APPROACH

A Conceptual Framework for Examining the Impact of El Niño – Reardon and Vosti (R/V) (1992 and 1995) set out a conceptual framework that defines a range of types of poverty as the range of lack of the various assets and income flows derived from them. A household might be well-endowed in one asset but poor in another; the nature and extent of asset portfolio 'skewness' can influence environment/poverty links, and hence the impact of an environment shock on poverty. This framework differentiates between types of environmental shocks (e.g., droughts versus floods), and suggests that rural household and village income, land use, and investment strategies *determine* the impact of environmental shocks on poverty, and that this behavior is conditioned by factors such as price and interest rate policy, village infrastructure, and technology. The approach also distinguishes between "welfare poverty", measured according to income, consumption, or

nutrition criteria as is common in the poverty and food security literature, and "investment poverty," the ability to make investments in resource improvements to maintain or enhance the quantity and quality of the resource base. This concept will be useful in assessing households' and communities' abilities to rebuild after El Niño shocks *without* external assistance, which assets will require external assistance to rebuild, and what the form and timing of such assistance ought to be.

A Typology of Poverty -- Examining the asset portfolio of the rural poor asks the question "poor in what?" Households and villages have the following assets: (a) natural resources, composed of water (ground and surface), ground cover and its (bio)diversity (trees, bushes), wild fauna and flora, and soil/land; (b) human resource endowment, composed of education, health, nutritional status, skills, and number of people; (c) on-farm resources (livestock, farmland, pastures, reservoirs, buildings, equipment); (d) off-farm resources (local off-farm enterprise capital and migration activity capital); (e) community-owned resources such as roads, dams, and social institutions; and (f) social and political capital. (See the center box in Figure 3.) These assets (stocks) are used to generate flows of product and/or cash income. The level and composition of that income determines whether households are poor and how poor they are.

[Figure 3 -- Asset Composition of Poverty, goes about here]

An asset decomposition of poverty will be useful only where the fungibility of assets is limited. The existence, conduct, and performance of labor, capital, and product markets conditions this fungibility, which in turn determines how easily and via what process households can convert one form of wealth to another (say household labor into farm capital, or land into cash). Where markets are absent or underdeveloped (even just seasonally), or where there are constraints to market access (tied to resource endowments), one asset market or holding can be isolated from another. Asset-specific poverty can influence livelihood activities and investment decisions with possible adverse implications for some components of the environment.

El Niño events, as characterized earlier, can wipe out one or more assets from a household's portfolio, either literally by destroying the physical asset (e.g., farm improvements washed away by flood waters) or by dramatically reducing its value due to prolonged collapses of asset markets (e.g., declines in the value of farm land in areas made unreachable due to the collapse of physical infrastructure). In either case, the asset portfolio is radically skewed; households can become poor as one or more components of their asset portfolio vanish or become worthless. (See the left side of Figure 3 linking an El Niño flood with the major components of the household asset portfolio, using large arrows.) Moreover, El Niño events can disrupt asset markets, forcing smallholders to rely on non-market mechanisms (biophysical and other) to convert assets; these alternative processes can be very slow, and may also come at high cost to the poor.

"Welfare poverty" versus "investment poverty" -- The literature treating households suffering from what R/V call "welfare poverty" uses criteria based on income, consumption, and nutrition, e.g. based on a benchmark minimum income sufficient to attain minimum caloric intake (below which one enters "ultra-poverty" according to Lipton, 1983) or to meet an anthropometric standard (Lipton and van der Gaag, 1994), or to buy a diet just sufficient given a regional diet level and composition (Greer and Thorbecke, 1986). These measures may be appropriate for assessing human misery, but may not be the appropriate benchmark for use in assessing poverty levels in the context of analysis of the impact of El Niño events. Purely "welfare-poverty" criteria can miss the potentially large group of households that are not "absolutely poor" by the usual (consumption-oriented) definition, but are too poor -- in that their surplus above the minimum diet line is still too small -- to make investments necessary to rebuild household assets to their pre-El Niño state. "Investment poverty," the cut-off point for which is the ability to make such investments, requires higher levels of production and savings over potentially long periods of time. El Niño shocks often require large investments to recover from, leading to large increases in ranks of the rural poor under the investment poverty definition, some of whom would go

uncounted if only the welfare poverty indicators are used.

Typology of environment -- The natural environment can be decomposed into (ecologically interdependent) categories: soil, water (ground and surface), biodiversity (of flora and fauna), and air. This decomposition of the environment raises two issues. First, the overlap between environmental categories and the asset portfolios of the rural poor is not complete, i.e., some natural resources (e.g., air) are not considered assets by the poor, either because of their abundance (and hence low value), or because these resources are not involved in production processes in ways under farmers' control. Second, environmental shocks often affect groups of categories of natural resources, rather than the entire vector. For example, a drought may affect surface water but not ground water, so the extent to which the poor have access to a particular natural resource by different means can dramatically affect the impact of an environmental shock involving that component of the natural resource base.⁴

Behavior of the Poor: Environment/Poverty Links and El Niño Shocks – Figure 4 shows the poor household's resource allocation to income earning activities and investment and the environmental consequences of this allocation, in a simple two-period framework. (1) The household starts with a set of household food security and livelihood objectives. (2) In period 1 the household has access to a set of natural resources, human capital, on-farm and off-farm physical and financial capital, community-owned assets, and social and political capital. (3) The household is also faced with a set of "external conditioning factors" (prices, policies, technologies, institutions, community assets). (4) The household allocates its labor, land, and capital to income-earning activities and investments in two sectors, agriculture and nonagriculture. (5) The livelihood activities and investments have environmental consequences on-farm and via externalities, off-farm. (6) The activities and investments, plus the environmental consequences, alter the household's access to resources and capital, hence the household has a new stock of assets as it enters period two, and begins the allocation again.⁵

[Figure 4 -- Household Resource Allocation and El Niño Shocks, goes about here.]

The remainder of this sub-section traces the income and investment strategies of rural households during a 'normal' year (imagine covering up the far-left box in Figure 4), and contrasts this process and its outcomes (in terms of poverty, in particular) with processes and outcomes during an "El Niño" year (now, imagine 'revealing' the far-left box in Figure 4).

(a) *Income strategies – a normal scenario*

To manage risk (ex ante) and cope with loss (ex post), faced with the high risk that typifies agriculture in environmentally-fragile areas, the rural poor earn income from a variety of sources, shown in Figure 4: in farming and livestock husbandry, in gathering (local flora and fauna), and in the nonagricultural sector (in local and migration activities). But the poor's strong incentive to diversify income is not always matched by capacity,

⁴The impacts of El Niño are not always symmetrical. For example, floods and severe droughts can destroy perennial tree crops, but droughts usually leave infrastructure intact, thereby speeding recovery once normal weather patterns resume. This paper examines the case of El Niño-induced floods, but the framework is useful for assessing other types and intensities of environmental shocks.

⁵Note that the level and type of poverty (in terms of asset categories) affects *what* income and investment strategies the household follows, and *how* it carries them out.

which can be undermined by their asset poverty and completely eliminated during major environmental shocks.

Cropping -- In general, poverty has the most direct effect on the environment via cropping where poverty influences the household's product choice, technology and investment path in intensification of cropping. Boserup (1965) outlines a number of technology and investment paths to agricultural intensification that farmers follow in the wake of increased land constraints and demand for land -- conditions that result from population growth, increased demand for agricultural products, or reduced transportation costs (Boserup, 1965; Pingali et al., 1987). Two broad paths can be distilled from Boserup's framework: (1) a *labor-led* intensification path where farmers merely add labor to the production process on given land, allowing them to crop more densely, and weed and harvest more intensively; (2) a *capital-led* intensification path where farmers augment their labor with variable and capital inputs, in particular fertilizer, organic matter, and capital that facilitates land improvement. Boserup identifies the second path as having higher land productivity than the former. Similarly, Matlon and Spencer (1984) note that the *capital-led* path is more sustainable and productive in fragile, resource-poor areas as the fertility-enhancing input use helps the farmer to avoid exhausting the soil during intensification and the capital (land improvements) help avoid erosion and runoff. By contrast, the labor-led path to intensification is unsustainable, and leads to land degradation and stagnation of land productivity. In situations such as the tropical highlands where demographic pressure and degradation are severe, farm households that follow only the labor led path are in for long-run ecological disaster and further immiseration. (Matlon and Adesina, 1992; Cleaver and Schreiber, 1994) This labor-led path may also lead to increased vulnerability to El Niño shocks.

Hence, in situations of fragile and degrading environments and land constraints, households too "investment-poor" to make the requisite investments for the "capital led" intensification path will find themselves both increasing the rate of degradation and vulnerable to its productivity consequences.

Livestock husbandry and wild food/fuel gathering -- When the poor engage in small livestock husbandry and gathering of wild food and fuel, they do so mainly in the commons or in open access lands, and the activities are usually labor-intensive and require little capital. In relative terms, income in cash or in kind from these activities tends to be more important to the poor than to richer rural households in their diversification and coping strategies. This greater importance makes the rural poor more vulnerable than the rich to the disappearance of edible/marketable wild fauna and flora, and to removal of bush cover (but not necessarily biodiversity per se) that can accompany environmental shocks.

But, while livestock are important to the poor, the poor household usually cannot afford to own many animals. As absolute importance of livestock holding increases with household income, and as incomes rise in rural areas, households invest in more livestock and hence depend more on the commons.

Nonagriculture -- The rural poor in fragile areas diversify incomes and assets into the nonagricultural sector to manage risk and cope with cropping shortfall, as well as alleviate poverty. When the poor engage in nonagricultural activities, they are usually labor-intensive, with little use of capital, thus low entry barriers. Such activities include e.g., small commerce, portage, farm labor, unskilled labor for construction, in addition to long-haul or seasonal migration.⁶

⁶Yet there can be an inverse relation between the fragility of the resource base and the availability of off-farm activities. The latter tend to be plentiful where they spin off from a dynamic agriculture (rural growth linkages) or urban-rural exchange. (Haggblade et al., 1989; Reardon et al., 1994) Thus, environmentally-fragile areas, and perhaps especially those frequently experiencing major environmental shocks, that might benefit from increased off-farm activities may be less likely to create opportunities for them.

(b) Income strategies – an El Niño flood scenario

How income strategies of the rural poor respond to an El Niño shock (a flood) and with what consequences for poverty? Figure 4 provides clues (now, taking into consideration the far-left box).

Cropping – An El Niño flood can eliminate some agricultural activities (e.g., annual cropping) for a year or more, forcing households to rely on other activities (such as those appearing in the right-hand side of box 4 of Figure 4) and/or liquidate assets to meet food needs. Traditional income earning activities at which the rural poor are practiced suddenly become unavailable. Or, put in the context of asset poverty, the returns to land (among the poor's most valuable assets) can be zero for at least one agricultural cycle.

Livestock husbandry and wild food/fuel gathering – The impact on livestock can be devastating. Livestock (and the multi-period investment that it represents) can be wiped out; at a minimum, the markets for livestock products can be disrupted, driving values for them down considerably. Again, in the context of asset poverty, the worst-case scenario has the livestock portion of rural poor's asset portfolio destroyed; a less devastating scenario maintains the herd but has the flow of income generated by this asset reduced, possibly to zero, *at the same time* as other assets cease to generate income. The potential for gathering activities will probably not be greatly affected, with the notable exception of fisheries, and the importance of this activity will increase, putting pressure on this resource, perhaps increasing vulnerability to future El Niño (and other) shocks.

Nonagriculture – Diversification of activities and assets prior to an El Niño shock into the nonfarm sector can have implications for poverty depending on the nature and the severity of the environmental shock, and the size and types of investments required to address it. The effect can be either positive or negative. On the one hand, where the poor successfully diversify into nonagricultural activities, they can become less directly dependent on land, hence less vulnerable to environmental shocks that affect land productivity. For example, cash from nonfarm activities can be used to finance soil conservation and the use of fertility-enhancing inputs. (See Reardon et al., 1994b.) On the other hand, investments in off-farm activities can compete with investments in land conservation, a competition exacerbated by the poor's lack of investable cash or available labor beyond their subsistence needs.

Whether diversification away from cropping or from livestock husbandry will help recover from El Niño shocks depends partly on whether past agricultural activities started a "downward spiral" of degradation (e.g., removal of top soil and bush cover) that would not naturally be reversed without resource conservation investments, and especially whether the environmental shock 'pushed' the ecosystem over a critical threshold. If no critical threshold has been crossed (overstressing the ecosystem's resilience), then income diversification (especially after a shock) might be pivotal to rebuilding the environmental components of the asset portfolio.

Finally, the financial returns to alternative activities (e.g., non-cropping) will likely be reduced substantially as many poor households suffering from the same environmental shock (and often having similar asset portfolios) scramble to meet food needs via this now limited number of alternative sources of income.

Social Capital – Reliance on social capital to directly (via transfers) and indirectly (via borrowing at preferential terms, especially in circumstances of declining asset values) to meet food needs will likely increase during and after El Niño events.

(c) Investment strategies – a normal scenario

Investments (such as in land improvements) embody strategies to smooth asset portfolios enhance and their

potential to generate income. These investments in on-farm and off-farm assets affect crop choice and the type and rate of agricultural intensification and (hence) exposure to environmental shocks.

Land improvement investments are determined by:⁷

(a) Incentives specific to the household, which include: (i) net returns of the investment, which depend on yields and input requirements per unit, and the prices of inputs and outputs; (ii) riskiness of the investment -- which includes short- to medium-term risk associated with price and yield variability, long-term risk stemming from political and policy instability, insecure land tenure, and the likelihood, nature and severity of environmental shocks; (iii) relative returns-- compared to alternative farm and nonfarm investments; (iv) the household-specific discount rate, proxied by household characteristics that heighten the importance of immediate survival to increase the discount rate; the poorer the household, the more immediate survival counts, for example.

(b) Capacity to invest, specific to the household, which include: (i) the environmental categories of assets discussed above, and the flow of cash they generate; (ii) "complementary assets" on-farm (such as a well that provides water to maintain a live windbreak.

(c) "External conditioning variables" common to households in a particular agroclimatic/policy context, which affect technical feasibility and profitability of particular investments, and include: (i) technologies for production and input or output processing; (ii) agricultural and macroeconomic policies, which affect input and output prices; (iii) institutional environment (legal system including land tenure customs and laws, markets, extension services); (iv) the physical environment (soils, rainfall, temperature, diseases and pests); (v) transport and communication infrastructure; and (vi) community-level watershed management infrastructure (such as dams, culverts, and farm-level bunds). (Reardon and Vosti, 1992)

The level and type (by asset category) of poverty affect the determinants of investment. The assets of poor households tend to be mainly labor. Investments that require inputs other than labor, or that are large or "lumpy" are less likely to be undertaken by the poor. The movement of a household from the category of being poor in an asset (such as land) to being "investment poor" in general (not being able to make specific investments required for natural resource maintenance or enhancement), depends on the level of risk (from price and rainfall instability, or from insecurity of land tenure hence risk of appropriation of capital), on the nature of markets, and on whether these translate into lack of sufficient liquidity (to buy labor or materials for certain land improvements), and on the willingness to use the liquidity for the investment in question.

(d) Investment strategies – an El Niño scenario

How will these three categories of factors influencing investments be affected by an El Niño event?

First, the incentives to invest can be dramatically reduced, especially when the gestation period of the investment is long. Large decreases in the profitability of particular activities (even if these decreases last for only one agricultural cycle) can drastically reduce expected returns, and hence investment incentives. If major environmental shocks are perceived to be recurring and frequent, the impact on expected returns is all the worse. Finally, discount rates rise as poverty increases, further increasing the need for quick (though perhaps small) returns, and hence investments in assets that generate them. All these factors can drive investment funds

⁷I focus here on land improvements, since they may be among the most important in preparing for and rebuilding after El Niño floods.

away from agriculture, thereby reducing the returns to agriculture in non-El Niño years and making the poor even more vulnerable to the next El Niño event.

Second, the capacity to invest can be virtually eliminated. Household assets can cease to generate income sufficient to meet food needs, let alone generate investable surpluses. And, formal and informal sources of credit can ‘dry up’ as funds are drawn from investment pools to meet emergency needs.

Third, the ‘external conditioning variables’ that determine productivity and profitability are often dramatically changed by El Niño events, sometimes remain so for extended periods of time. For example, input and output prices can swing wildly before, during and after El Niño events. Transportation and communication are often completely interrupted during El Niño events. So, the economic system providing signals to producers and consumers as regards product scarcity and profitability can break down; in such an economic environment, many investments are put on hold.

Finally, the amounts and types of previous investments in agriculture (products of the three types of investment determinants prior to an El Niño event) can affect the impact of an environmental shock on rural households. For example, labor-led strategies that improve productivity of land over the short term can mine soil nutrients and modify soil structure so as to make this asset more vulnerable to damage from floods. Or, flood-resistant irrigation systems and transportation infrastructure can lessen the blows from El Niño events.

3. ILLUSTRATIONS OF THE IMPACT OF EL NIÑO ON RURAL POVERTY

The following are conceptual applications of the asset portfolio approach to assessing reactions to and impacts on particular types of rural poor of an El Niño event.

*(a) Subsistence farmers: poor in land, physical and financial capital,
but rich in labor, community resources and social capital*

The rural poor make their living from subsistence agricultural activities on marginal lands and have pre-El Niño asset portfolios suggested by Figure 5.⁸ These households can suffer catastrophic losses of land during an El Niño event, radically skewing their asset portfolios towards labor. Returns to labor (perhaps the only household asset remaining) can also fall dramatically due to reductions in labor demand. The values of on- and off-farm capital (and the flows of income they can generate) can also decrease, the former because its links to destroyed cropping activities and the latter due to sell-offs to meet food needs. These drastic reductions in the values of and returns to household assets can increase the poor’s dependency on community resources and social capital to smooth consumption patterns and rebuild assets.

[Figure 5 – Assets of Land Constrained, goes about here.]

*(b) Small-scale agriculturalists at the forest margins: rich in land,
but poor in labor and social capital*

⁸Figures 5 and 6 are for explanatory purposes only, but do reflect the ‘end points’ of the continuum from land-poor farm households in long-settled agricultural areas with strong communities to land-rich smallholders in new agricultural areas with weak communities.

Poor farmers in the Amazon region have access mainly to forest cover and biodiversity, both of which are locally abundant but globally scarce. Markets do not generally exist to translate global demand for these resources into secure income streams for farmers. The poor lack labor, good health, and cash to meet food production and purchase needs. Perhaps most important, these smallholders are relatively isolated and therefore lack secure, local safety nets. (See Figure 6) Farmers use biophysical processes rather than markets to convert plentiful (forest) assets into in-kind income flows to meet food security needs. Surpluses are used to smooth asset portfolios, especially investments in livestock.

During the most recent El Niño event, smallholders experienced an extended and more severe dry season than normal. There were several important impacts. First, crop yields (the flows) decreased, but without loss of land (the asset). Second, farmers experienced decreases in livestock production (milk production and animal weight gain), but again, without losing the productive asset – cattle. Third, this extended dry season reduced the conversion costs of forest to smallholders. Consequently, asset poverty was reduced via the relatively rapid expansion of cleared area. That is, El Niño 1997/98 made it easier and quicker for farmers to shift from one asset (forest) to another (agricultural land).

[[Figure 6 – Assets at the Forest Margin, goes about here](#)]

*(C) The poor in Coastal Ecuador: Rich in water resources and on-farm physical assets,
but poor in financial capital*

Coastal and inland shrimp producers in Ecuador have invested much in the construction of reservoirs and water transport systems. One key production input (water) is harvested from communal sources.

The recent El Niño shock damaged on-farm physical capital, but increased the productivity of water in the production system (via increases in the nutrient content of water due to heavier-than-normal runoff). Production increases outweighed losses to physical capital, yielding short-term net benefits to shrimp producers of this environmental shock. This increased nutrient load carried by runoff waters will be temporary, and so will its benefits to productivity; damage to physical capital will likely have longer term effects. (See Vos et al, 1998)

4. CONDITIONING VARIABLES AND EXTERNAL ASSISTANCE

The impacts of an El Niño shock on poverty are conditioned by the following factors, in part because they influence what can be done *by* the rural poor (the income and investment strategies discussed above) but also because these factors influence what can be done *for* the poor by others in the event of an El Niño shock.

First, the existence, structure, and performance of product, input and asset markets condition the prevalence and type of poverty. Missing or poorly functioning markets (and market agents) making preparing for and coping with El Niño events more difficult, slow and costly.

Second, production and resource conservation technologies embody the substitutability among assets in both production and investment. Changing technical rates of substitution among assets, especially between human-made assets and natural resources (Ruttan, 1992), can alter household decisions and the consequences of environmental shocks. For example, technology change in agriculture that increases land productivity can help

relieve pressure on surrounding forests and hillsides, thereby reducing the physical impacts of El Niño events (especially down stream) and increase surpluses available for rebuilding after a shock.⁹

Third, relative input prices, output prices, wages, and the interest rate affect farm resource use and investment. Complementary "hard infrastructure" (such as culverts, dams, wells, market facilities, and roads) and "soft infrastructure" (such as extension, schools, and medical services) at the village level affects the cost of transactions and of inputs and outputs, and thus private costs of investment in resource conservation. Infrastructure also influences the development of nonfarm activities, the commercialization of agriculture, and urban-rural links, which are important determinants of income opportunities for the poor. As indicated earlier, all these signals can be wildly distorted by El Niño events.

Fourth, community wealth (physical and social assets) conditions the poor household's options and behavior and buffers the effects of El Niño shocks in three ways. (a) Community wealth affects insurance and wealth distribution mechanisms, and hence the level and incidence of poverty *prior to* and El Niño event. The distribution of poverty in a community affects the cost faced by and the effectiveness of redistribution and joint-investment institutions in the community. The distribution is governed by rules related e.g. to land tenure and inheritance rights, and to credit collateral. (b) Communities can (and do) invest in productive assets (e.g., irrigation systems) and in insurance mechanisms (e.g., food stocks). (c) Communities regulate access to the commons.

Impact of El Niño on Conditioning Factors – All of these conditioning variables can be affected by an El Niño event, thereby affecting what the poor can do for themselves, and what others can do for the poor. For example, community-level poverty can erode local safety nets; poor villages cannot tend to poor households, especially in the wake of environmental shocks. Or, shock-induced poverty can cause traditional rules governing access to common resources to break down, thereby reducing the access by the poor to these resources and/or leading to their overexploitation and degradation. Disappearance of roads not only severs market links but impeded external assistance.

External Assistance – Large-scale external assistance usually focuses on several key conditioning variables, e.g., roads, dams and water. (IDB 1997) Other assistance focuses on a narrowly defined set of human capital assets, e.g., health and nutrition. (See the right-hand box of Figure 3.) The critical point is this: El Niño affects a broad array of assets held by the rural poor; external assistance targets only a few. While this targeting of external assistance might be very effective in rebuilding the set of assets it focuses on, households and communities are saddled with the task of repairing and rebuilding the remaining assets damaged or destroyed by El Niño, and do so beginning with an income stream and an asset base greatly reduced by this environmental shock. If El Niño events occurred once per century, the rebuilding process might be best left to households and villages; since they are much more frequent events, the net result might be a continual whittling of assets that leaves little base (or hope) for growth.

5. EL NIÑO EVENTS TODAY AND IN THE FUTURE: OVERLAPS WITH SEASONALITY AND DROUGHT-INDUCED FAMINES

⁹However, the ability to convert agricultural harvests into investable capital and carry these surpluses from harvest time to 'investment time' requires functioning markets and savings mechanisms. In their absence, the expected gains in terms of reduced exposure to El Niño events from agricultural intensification may not be realized.

The periodic incidence of El Niño events and the characteristics of the shocks they bring are eerily similar to other periodic natural shocks -- those accompanying seasonal swings in rainfall and those dealt to the rural poor by drought-induced famines.¹⁰ We have learned quite a lot over the past 20 years in how to deal with the former, and about the preconditions for the latter. Might this new knowledge help us in preparing for, coping with, and rebuilding after the next El Niño event?

El Niño Characteristics – El Niño events differ from other natural disasters (e.g., earthquakes) in their predictability, severity, and geographic scope of impact. El Niño events are not random, having occurred historically once every 2 to 7 years. They generally cause large increases in rainfall and flooding, with consequent damage to transportation infrastructure and agricultural production, which generate ripple effects throughout national and regional economies in the form of unemployment, food price increases. Droughts also occur, with consequent decreases in agricultural productivity and unemployment, but with less damage to physical infrastructure.

Drought-Induced Famines – Famine has been characterized as a “catastrophic disruption of the social, economic, and institutional systems that provide for food production, distribution, and consumption.” (von Braun et al, 1998, pg. 1 and Figure 2.1) The preconditions for famines have been identified as: extreme poverty, malnutrition, isolation, poor sanitation. While the key ingredient to modern famines (armed conflict) is thankfully absent throughout most of Latin America and the Caribbean, careful thought should be given to the potential for combined and repeated shocks (environmental and other) to generate some of the other preconditions for famine.¹¹ Preventing droughts from causing famines has required increased agricultural productivity and the opening of rural (and national) economies, and establishing a sound and consistent policy framework for doing so.

Seasonality – Chambers, et al (1981) and Sahn (1989) discuss the seasonal dimensions of rural poverty. Important characteristics of seasonality are: food shortages and consequent increases in food prices; high unemployment and low wages, the inability of privately held food stocks to meet food needs and consequent wasting, and the inability of markets to react to food shortages. These characteristics, too, are relevant for addressing El Niño events, since their continual assault on household assets is becoming too similar to the impacts of El Niño on the rural poor. Effectively reducing seasonality required increases in agricultural productivity and investments in the means by which increased output could be carried over (via trade and storage) from one season to the next. Improving market performance, especially for food grains, was fundamental.

Overlaps Today -- In a sense, then, El Niño events represent a partial overlap between famine preconditions/characteristics and seasonality characteristics: they are extreme climatic events that can lay waste to agricultural production and output from other sectors as well, and they are recurrent and predictable. (See Figure 7.) On the other hand, there are important differences. In part because they are predictable, the entire

¹⁰By setting El Niño events alongside seasonality and drought-induced famines, I do not mean to suggest that El Niño events are small seasonal rainfall blips (at one extreme) or that future El Niño events are likely to induce famines in Latin America (at the other extreme). Rather, the (perhaps increasing) overlapping of El Niño characteristics with those of seasonality and the preconditions to famines triggered (to me) the need to explore these overlaps more carefully, searching for clues as to how to better prepare the rural poor for, and protect them from, future El Niño events.

¹¹Sen (1981) identified 4 types of entitlements that condition access to food: trade-based entitlements, production-based entitlements, own-labor entitlements, inheritance and transfer entitlements. These entitlements map neatly into the asset portfolio approach outlined in this paper, and echo many of the impacts of El Niño shocks on the rural poor identified using it.

set of entitlements do not 'break down' at once; governments and the international community are aware and to a certain extent prepared when El Niño arrives. Also, to date El Niño events have not been annual or biannual events, providing more time to rebuild than between annual cycles of hunger that characterize seasonality. But will these important distinctions hold up over the next 25 years?

[Figure 7 -- Famine, Seasonality, and El Niño: Overlapping Characteristics, goes about here]

Future Overlaps – The intensity and perhaps the duration of El Niño events seem to be increasing. If this is true, it should be a major concern for several reasons. First, annual (seasonal?) or biannual climatic shocks of the intensity and scope of El Niño events could easily destroy forever the asset base of the rural poor, and with it the hope of rising out of poverty. Second, financially strapped governments in Latin America will be unable to muster the resources to deal with such repeated shocks. Third, although the international community is channeling increasing proportions of its aid in the form of disaster relief (versus development assistance), the volume of this relief will be insufficient to deal with more frequent and intense El Niño events, in part because some developed countries will themselves suffer more damage and face higher domestic costs from such shocks.

6. CONCLUSIONS AND IMPLICATIONS FOR POLICY

- *Livelihood Security versus Investment Poverty* -- (Re)Achieving livelihood security after El Niño events will be necessary but *not* sufficient for the poor to rebuild and reshuffle their asset portfolios. Poverty alleviation targets need to be raised; interventions/investments should be increased, refocused towards private asset creation/rehabilitation, and extended in time.
- *Measuring the Impact of El Niño on the Poor* – Traditional measures of the impact of El Niño have not included the stocks and values of assets held (and lost) by the poor, their liquidity or their potential to generate income. New measures need to do so; a difficult but essential task. El Niño shocks do not affect all assets equally, physically and/or financially destroying some while leaving others untouched.
- *Asset Markets, El Niño and the Poor* – Even if the poor's asset portfolios are not physically altered by El Niño events, the values of assets can be affected by market failures, or even market collapses. Major fluctuations in asset values and restrictions on asset conversion/liquidation can cause poverty in the short and long term. Moreover, imperfect product and asset markets may not provide adequate signals to identify (and hopefully help avoid) products/investments with above-average El Niño risk.
- *El Niño-Seasonality Overlaps* – Reliable supplies of non-food inputs into health (water, sanitation, etc.) contribute much to reducing seasonal swings in poverty; the same applies to reducing the impact of El Niño events. However, increasing agricultural productivity *between* El Niño events for products with limited storage potential may not greatly improve food security *during* El Niño years; efficient and stable markets that allow smallholders to convert food to other less perishable assets (and back again) are need.
- *Rural Inequality* -- The distribution of poverty across households *within* communities affects the impact of El Niño shocks through its effect on the wealth of the community and its ability (and willingness) to manage risk, to smooth the consumption of poor during and after shocks, and to build and maintain infrastructure that can help the poor to invest and rebuild.

- *El Niño-Famine Overlaps* – Although controversial, future El Niño events may be more intense and frequent than those experienced in the past. If this is true, we could witness some of the same market and social ‘breakdowns’ observed in drought-induced famine situations, with consequent erosion of hope for development. There are limits to the extent and speed with which poor households and communities can reshuffle asset portfolios, and these limits may be reached more quickly in the future. Under this scenario, improving food and asset market performance and investing in organizational capacity will become more critical.
- *Poverty Reduction and El Niño* – Reducing poverty can reduce the impact of El Niño shocks. Reducing poverty via focused investments in particular household and community assets that reduce exposure to El Niño shocks is the best strategy; structuring investments so as to balance short-term (e.g., liquid assets) and longer-term (e.g., human capital) El Niño risks will be key.
- *Economies of Scope at Community Level* -- There may, or may not, be economies of scope in ‘producing’ or protecting different types of assets at the community or regional levels. That is, some organizations may be very effective at protecting or increasing the quantity, quality and even the value of particular household or community assets threatened by El Niño, but very *ineffective* at dealing with other critical assets.
- *Prediction Versus Reaction* -- Our ability to predict (even locally) the nature, timing and intensity of El Niño shocks is increasing quickly. However, the ability of smallholders to modify their production and/or consumption patterns and their investments based on new information is limited. Therefore, while investments in improved El Niño forecasting will likely pay large dividends generally, they may not be sufficient to improve the lot of the rural poor. Examining the impact of El Niño shocks on asset portfolios and asset markets can help identify complementary investments (alongside those in climate forecasting) needed to make more effective use of increasingly accurate climate and weather forecasts.
- *One Potential ‘Down Side’ of Improved Forecasting* – Better and more timely information on weather patterns may not always be a good thing for the environment. For example, informing farmers at the forest margins of a more intense and longer dry season can increase deforestation rates. In such cases, public-sector monitoring efforts need to be stepped up.

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Useful Web Sites

El Niño Description – <http://rossby.cdc.noaa.gov/ENSO/enso.description.html>

Comparisons of Recent El Niño Events – <http://www.cdc.noaa.gov/~kew/MEI/mei.html>

Figure 1 – Recent El Niño and La Niña Events

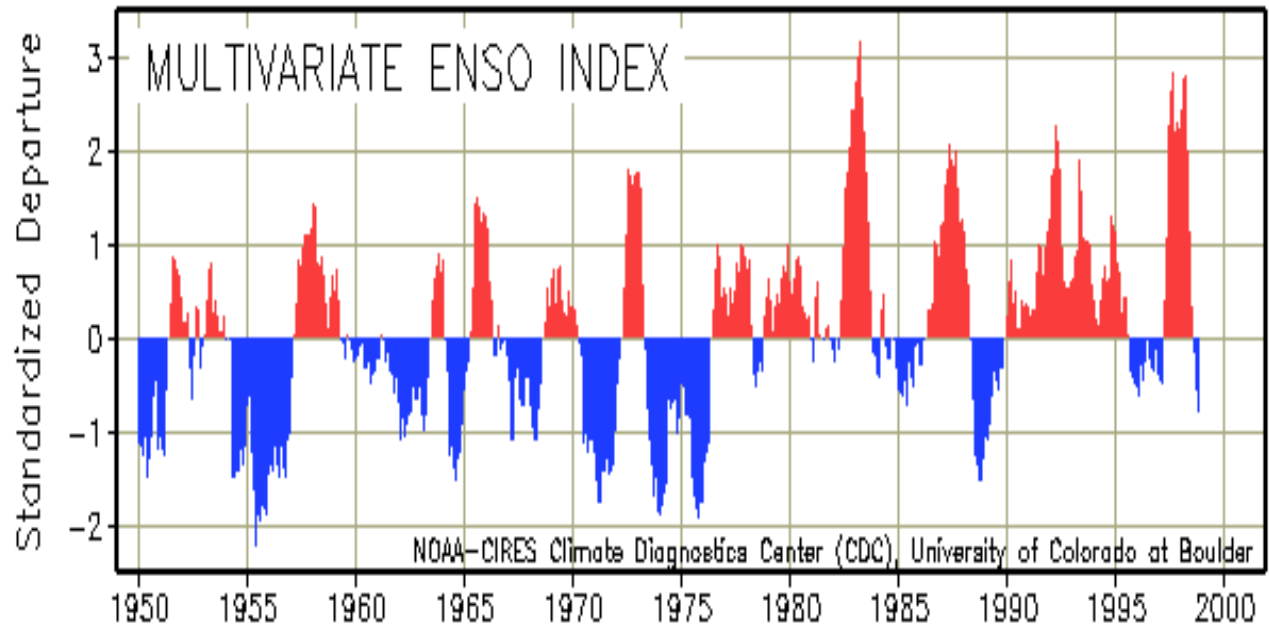


Figure 2 – Comparisons Among Recent El Niño Events

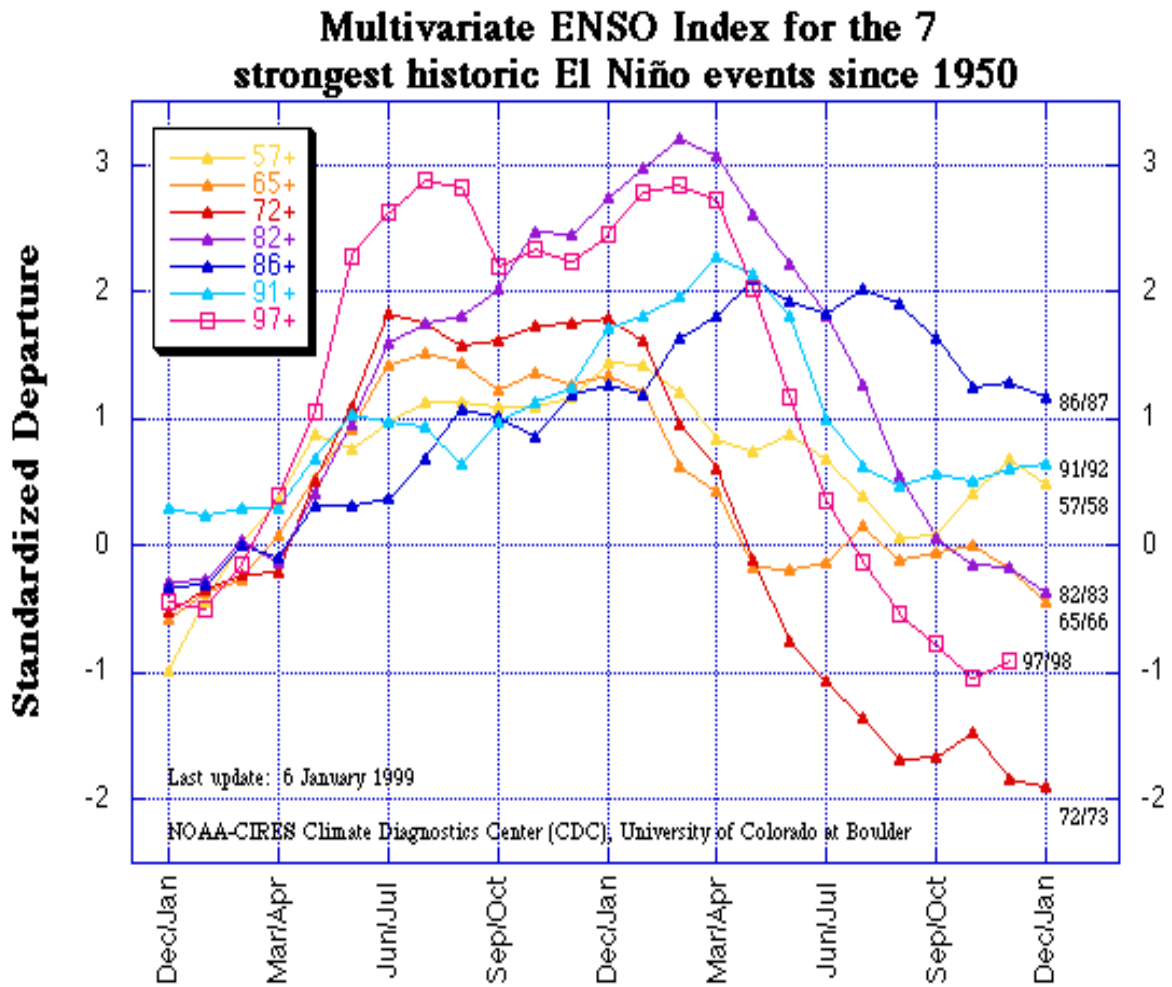


Figure 3 -- Asset Components of Poverty

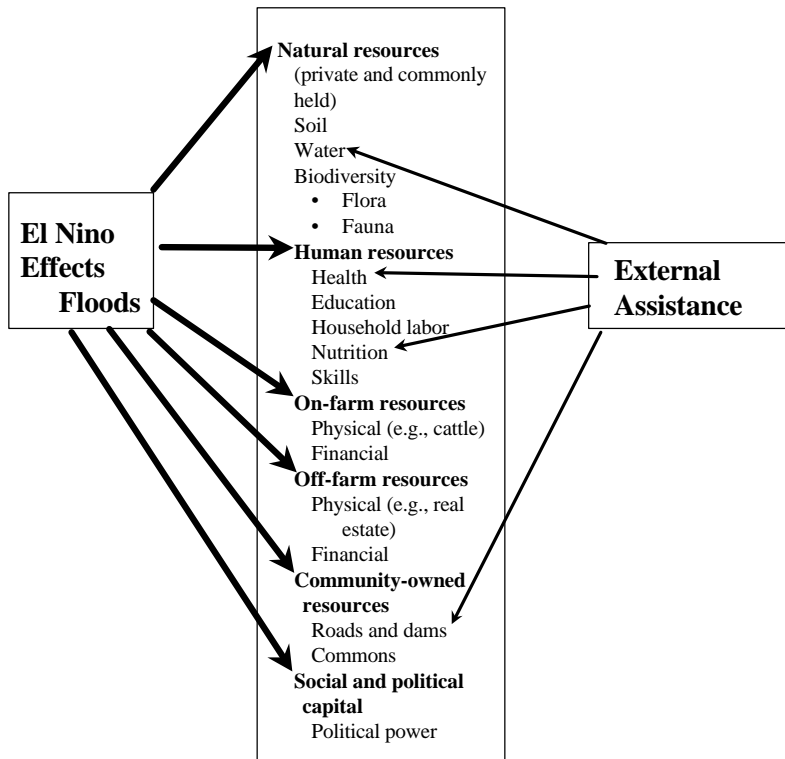


Figure 4 — Household Resource Allocation and El Niño Shocks

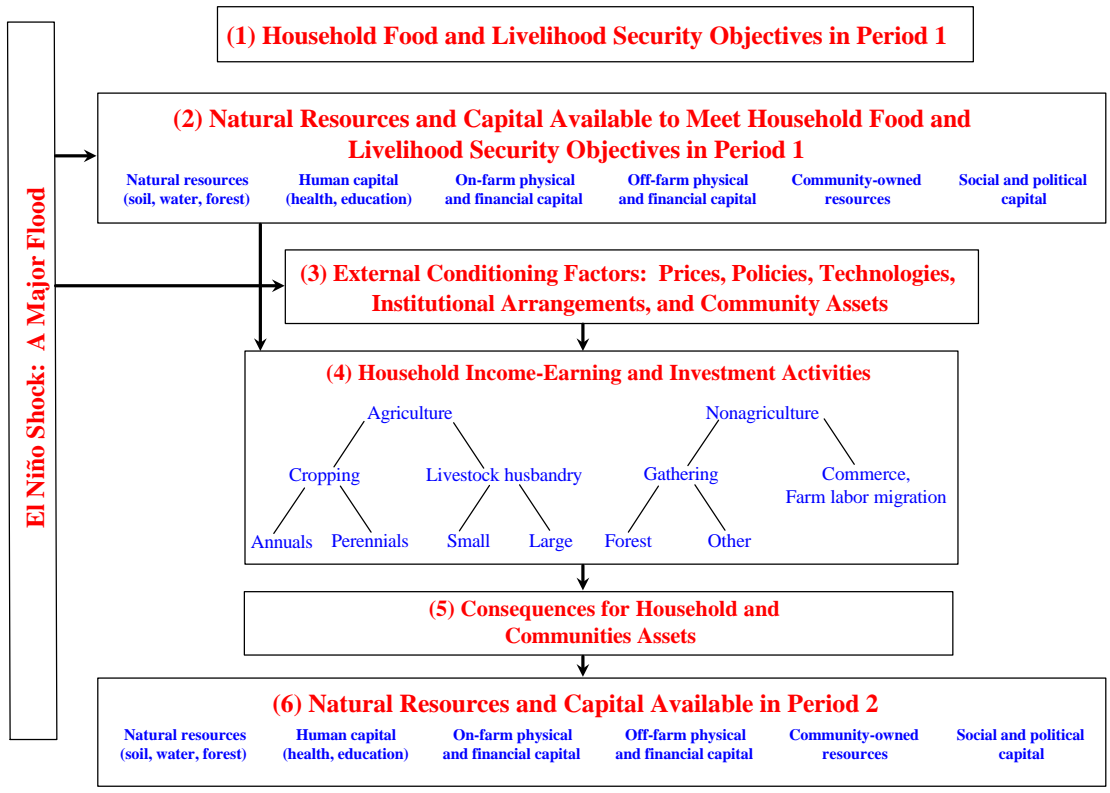


Figure 5 - Assets of Land Constrained
Proportions of Assets, by Category

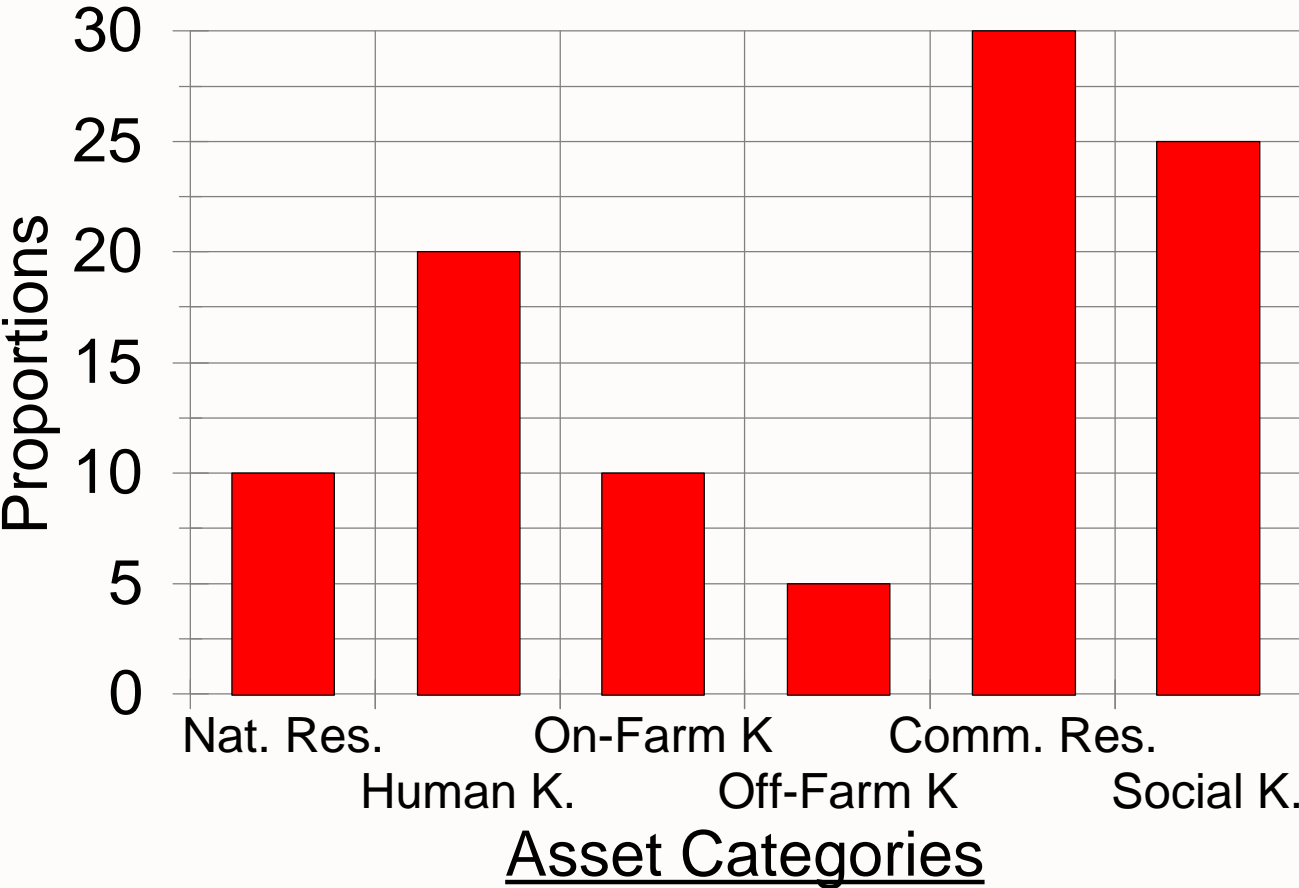


Figure 6 - Assets at the Forest Margin
Proportions of Assets, by Category

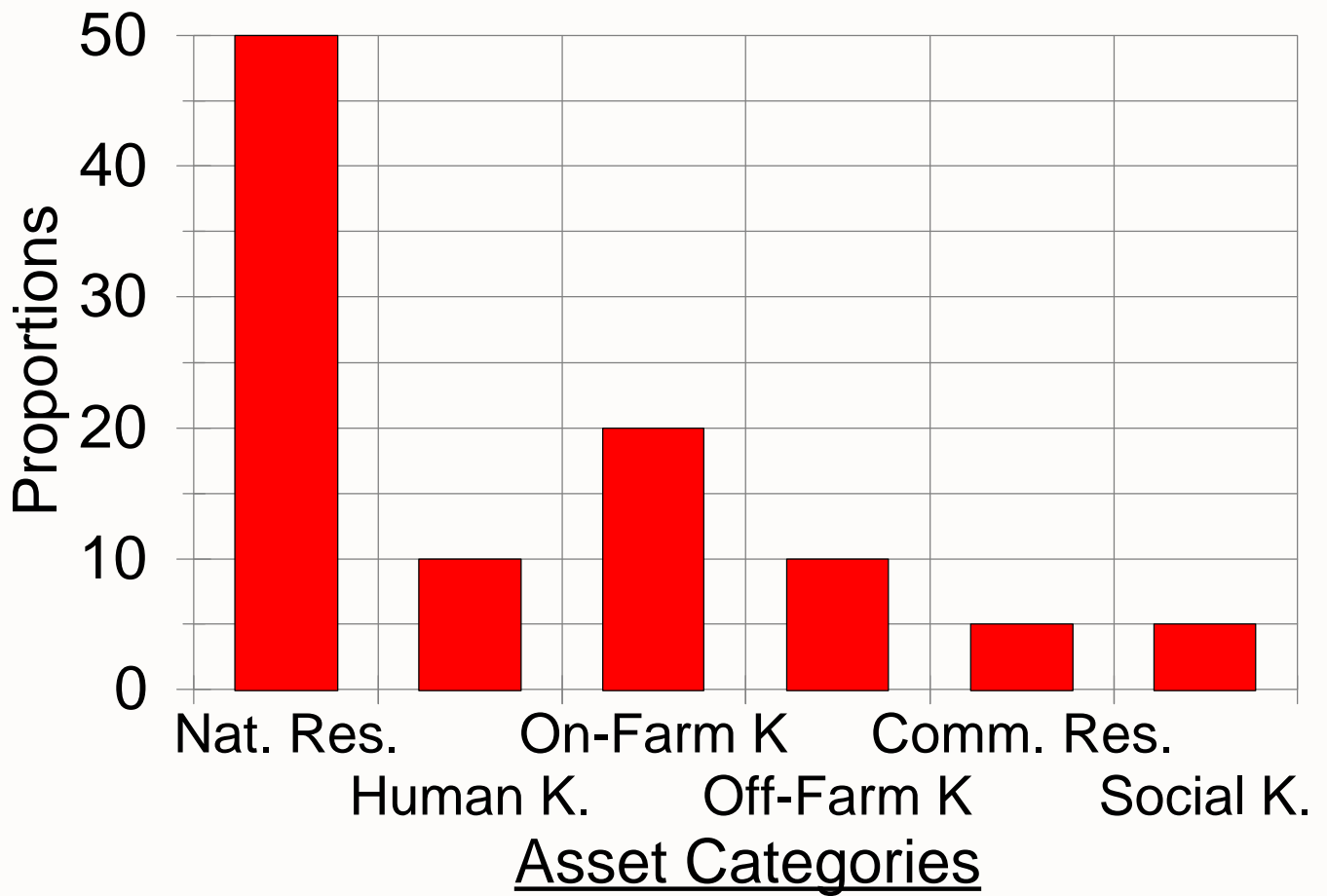


Figure 7 — Famine, Seasonality, and El Niño; Overlapping Characteristics

