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PIONEERING IN SAN JULIAN: A STUDY OF ADAPTIVE STRATEGY
FORMATION BY MIGRANT FARMERS IN EASTERN BOLIVIA

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PIONEERING IN SAN JULIAN: A STUDY OF ADAPTIVE STRATEGY
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Dissertation Abstract

The study had three principle objectives. The first objective was to observe and analyze the process of adaptation or adjustment of a population of highland-born and raised peasant farming households as they establish themselves in a pioneer agricultural resettlement or colonization zone called the San Julian Project in eastern Bolivia. The second objective was to test the appropriateness of a model as an analytic tool in understanding the adaptation of pioneer populations. The model is based on ecological and cybernetic concepts such as: the ecosystem as a set of complex direct and indirect challenges to populations; negative and positive feedback as means for explaining retention and change of behavioral and organizational patterns in adaptation; and natural selection as the testing of adaptive solutions to environmental challenges. The third objective was to identify and analyze the effects of an integrated, or multi-component, set of activities in assistance, education, subsidy, and extension managed by private, Bolivian governmental, and international agencies. These activities were viewed as a comprehensive manipulation of the process of adaptation; a molding of adaptive challenges and opportunities to be confronted by the peasant migrant population through decisions made largely by people outside of the population.

11

The San Julian Project is located approximately 160 kilometers (100 miles) to the northeast of Bolivia's second largest city, Santa Cruz de la Sierra. The city is the capital of Bolivia's largest department (equivalent to a U.S. state) and the center of an economically booming agricultural and petroleum-producing region. The San Julian Project is the most recent large frontier colonization zone in the large and expanding crescent-shaped area of settlement activity north of the city. For the last twenty-five years migrants from Bolivia's more heavily populated western regions of the Altiplano or high plateau and its associated high valleys have been settling in this crescent. The large majority, 80-85%, of the migrants have come and spontaneously established themselves along roads cleared for petroleum exploration, logging activities, and the founding of directed settlements. These directed projects have provided aid, ranging from almost complete subsidization to limited service and infrastructure support, for 15% to 20% of the migrant population.

The population involved in the study has settled in the San Julian Project since 1972. In part, the study considered the adaptation of all 1200 households established in the zone. In addition, samples of that population were more closely examined through, for example, the use of a quantitative survey instrument with 100 farmers in ten of the nucleos or forty



household units. The study identified the general ecosystem of the settlement zone, the specific ways in which the environment is being manipulated by external agencies, and the varieties of adaptive or resource utilization strategies developed by the population.

The primary method of data gathering was participant-observation based on repeated open-ended and directed discussions and interviews with members of the migrant population, and other people involved with planning and execution of the efforts to aid the population. This included persons at local, regional, and national levels. The study amplified its view of the process of adaptation of the pioneer population through several methods including: ethnographic photography to record visual data in the colonization zone and other places; aerial photography to examine the configuration of settlements, the agricultural productive activities, and the modifications occurring in the physical environment; research in private, governmental, and university archives and documents; and the application of a quantitative survey to test the basic conclusions developed by the end of the study. Further, data on the adjustments which the migrant population were making to the new environment were enhanced by brief periods of participant-observation in several areas from which migrants had come in the western regions of Bolivia.

12

The first finding of the study was that the model of the adaptive process provided a means of identifying the most crucial aspects of the establishment of settlement, productive activities, and social organization in the new location. These aspects centered on the formation of strategies for the utilization of the available resources. A model of resource use strategy formation is proposed in the study and various cases are cited as illustrations. The author proposes that the "success" of settlement not be defined in the terms of planners and administrators, but rather as relative to the goals of the individuals and groups within the migrant population. The variety of strategies produces a variety of goals and, therefore, a variety of definitions of success.

The second finding concerned the aid extended to comprehensively support migrants through the initial founding of their settlement, improve their health and productivity through education and extension, and promote the organization of effective decision-making structures. The accomplishments of these efforts are particularly marked when compared to previous similar efforts in Bolivia and other Andean countries. The author sees the reasons for this in the flexibility of program personnel in development of their activities, only carrying out those most relevant and appropriate to the needs of the population. Further, project personnel avoided, as much as possible, the creation of a dependency relationship with the population.



Hess Abstract - 5

The third finding of the study was the presentation of a set of postulates, derived from the San Julian experience in the directed resettlement or colonization of migrant populations. These postulates indicate possible key variables in the adaptive process and means to positively affect these variables for the benefit of migrant populations.

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During the writing of the dissertation, my wife, Laura, who I appreciated the tireless work of, served as editor, councilor, and friend. I also want to thank Ian Rawson for providing constant thematic and stylistic guidance during the writing, going beyond the call of duty of his position on my committee. Finally, I need to thank Betsy Goodale and her Wang Word Processor, who brought the effort to a conclusion.

Of course, my greatest debt of gratitude goes to the pioneer farmers of the San Julian Project. I learned from them and tried to share with them. I believe there are no braver people than those colonists who risk so much as they literally carve a new life out of the frontier forest of eastern Bolivia. As I worked, laughed, drank, walked, and rode my bicycle with them, I came to respect, admire, and care for them. I believe that many of them are finding a way of life that they consider an improvement over the past and I want to wish them the best throughout the years. I hope that this study can in some way positively affect their future and of other pioneer colonists.

TABLE OF CONTENTS

CHAPTER ONE.....Page 1
The Model of Pioneer Adaptation

CHAPTER TWO.....Page 32
The History and Present Situation of Pioneer Colonization

CHAPTER THREE.....Page 77
The San Julian Ecosystem

CHAPTER FOUR.....Page 101
Unique Structures in the San Julian Environment

CHAPTER FIVE.....Page 136
The People and Culture of San Julian

CHAPTER SIX.....Page 201
Adaptive Strategies in San Julian

CHAPTER SEVEN.....Page 257
Conclusions: The Analysis of Pioneering as Ecological Process

BIBLIOGRAPHY

APPENDIX ONE
Photographs

APPENDIX TWO
Maps

APPENDIX THREE
Tables

APPENDIX FOUR
Figures

APPENDIX FIVE
Graphs

CHAPTER ONE

THE MODEL OF PIONEER ADAPTATION

Introduction

This study examines the process of adaptation of pioneer migrant farmers as they move to settle a frontier colonization zone in eastern Bolivia called the San Julian project. The analysis will be based on viewing the individuals and groups occupying the frontier as a population which must articulate itself in an ecosystem and develop a strategy for exploiting its resources. The first chapter presents the theoretical framework for analysis, derived from ethology, biogeography, ecological anthropology, and cybernetics and systems theory. The chapter concludes with the statement of a model of the pioneer adaptive process which provides a structure for the remainder of the study by identifying the key questions in understanding the process. The model was developed to provide a framework for analysis of the total process of pioneer migration. In the present study, not all elements of the model were utilized in data gathering and analysis, rather emphasis was placed on the events in the pioneer process which occur once the migrants have reached the new habitat. The second chapter discusses pioneer colonization in South America, in general, and in Bolivia, in particular. Historic social events and movements are related to population relocations leading to the flow, in the last thirty years, of residents of the western

highlands and contiguous valleys to the present frontier for settlement in the eastern lowlands of Bolivia. The third chapter begins the description of adaptation to the particular ecosystem of the San Julian colonization zone by detailing its geo-physical and biotic components, and the history of human settlement in the zone prior to recent colonization. The fourth chapter examines the unique features of the San Julian ecosystem which are designed to aid and, at the same time, to channel adaptive efforts of colonists in ways thought to be desirable by development agents.

Chapter five describes, in detail, the major patterns of behavior and organization of the San Julian pioneer population. These include: areas of origin; demographic structure; technoeconomic activities; social relations and networks; and values, goals, and ideology. The sixth chapter separates and identifies components of an exploratory model, derived from selected elements of the original model, of the formation of strategies for meeting the challenges and exploiting the resources of San Julian ecosystem. The chapter also examines what success and failure mean in relation to the evaluation of outcomes of strategy execution by pioneers. One of the principal contributions of the present study is the proposition that adaptive success in the pioneer situation can only be defined relative to the values embodied in the goals set by the individual pioneer and by groups of pioneers. The last chapter offers conclusions based on the application of ecological

analysis of pioneer adaptation in San Julian. Especially important are the unique features in the San Julian situation which offer indications for understanding and aiding pioneer colonization in similar places. Postulates will be presented concerning the significance of various means of intervention in the pioneer process. They will derive from ways in which intervention in San Julian helps pioneers leap over the hurdles of adaptive challenges and the ways other aspects of the intervention have created hurdles.

Methodology

The primary data base for the study is ethnographic participant-observation and interview material collected during a thirteen month period in Bolivia from August, 1977 to September, 1978. Trends and patterns noted in ethnographic participant-observation served as the bases for two quantitative surveys administered to colonists who settled in 1976 and 1977. Chapter five draws heavily from this quantitative material. The model of pioneer adaptive strategy formation presented in Chapter six was generated from emic categorizations of the frontier situation and decisions which had to be made in it. The study also presents information made available to the author by the Instituto Nacional de Colonización (hereafter INC), San Julian office. Important sources covering analysis of colonization in Bolivia and other South American nations were available to the author in the INC library in La Paz and in other libraries.

The explanatory and predictive capability of the model will be especially important as efforts currently are being made by international, national, and regional organizations to promote and/or aid pioneer migration to lowland areas determined to be frontiers. Combining detailed study of the ecosystems, social groups, and sociocultural traditions and behavior, the model can describe the processes which occur in the opening and settling of frontiers. Further, the model is useful in identifying possible ways to alter the process through the introduction of structures and options according to goals determined to be desirable by and for the populations concerned. These possibilities of alteration will be labelled development efforts. These efforts are significant in the case of San Julian.

Pioneering as Ecological Process

Whether labelled pioneer colonization (Thompson, 1973), settlement schemes (Scudder, 1973; Palmer, 1976), or frontier migration, adaptation to new ecosystems is a question of human population dispersion and organization. Adaptation specifically includes what occurs as a pioneering population is generated from an existing population and enters a new habitat, the geophysical part of the new ecosystem along with its plant and animal population establishes a niche in the new habitat, its place in the network of energy and information flow. This is accomplished by initiating exchanges with many elements of the ecosystem, including inorganic nutrient cycles, animal and plant populations, and other human populations.

The viewpoint from which pioneering is examined here derives from the new ecology, a "holistic approach wherein interactive, integrative, and emergent properties" are comprehensively studied (Odum, 1977:1292). Drawing from various currents of thought in the fields of ethology, biogeography, ecological anthropology, and cybernetics, a model of the pioneer adaptive process will be developed. The model will provide a general framework for the rest of the study. Data presentation and analysis will involve key areas of the model, while other areas will be the object of continuing research.

The term model is used here in the way that Orlove defined and utilized it, advancing "a set of analytical categories which may be useful in a wide range of situations...these categories...predispose the investigator to examine certain causal links...(within)...a general analytical framework rather than a set of specific predictions (Orlove, 1977:14, 18). By identifying the general outlines of the process of pioneer migration, "the test of the model lies as much in its utility as in its validity...its greatest strength is its ability to offer precise and parsimonious explanations of the responses of specific" individuals and groups to the concatenation of structures and events in a given environment (Orlove, 1977:18).

The model will be tested by examining one particular pioneer migrant population, that of the San Julian project in the northern part of the department of Santa Cruz in eastern

Bolivia. The San Julian colonization zone is only one area of settlement in the widespread migratory movement to the eastern departments of Bolivia from the highland mountains, plains, and valleys of western Bolivia. In turn, Bolivian eastward migration is only one part of the overall movement toward the eastern lowlands of the Amazon basin by all Andean countries. Further, highland to lowland pioneer migration is a world-wide phenomenon (Rhoades, 1978).

The utility of the model will be tested by analyzing the adaptive process of the peasant migrants in San Julian. The intent of the model is to explain the various strategies and combination of strategies for adaptation. An operational model can then be generated which will be relevant to adaptation to the San Julian ecosystem.

Ecological Analysis of Frontier Populations - Previous Contributions

Ecological analysis has been carried out in several different ways by authors interested in the adaptations of human populations to frontier zones. Margolis (1977) has looked at the process of human occupation of cash cropping frontiers as analagous to certain forms of population dispersion found among other animals and plants. Scudcer (1973) and Palmer (1974, 1976) have written about African settlement schemes, delineating the many interdependent aspects of the occupation of new, and even starkly contrasting, environments by relocated populations.

Palmer (1976), in particular, has very usefully applied the concept of "ecological imperialism" (Rappaport, 1971:14) to the planned, sometimes forced, relocation of human populations. Through the "simplification of ecological structure... within the immediate sphere of influence of the alien exploitative system," Palmer sees a structure of exchanges between the dominated and dominating populations analagous to the trophic levels of energy flow in an ecosystem.

Thompson (1973) applied ecological analysis to several aspects of pioneering by human populations including the selection process by which individuals become pioneers, the development of patterns of settlement, and the evolution of social organization in frontier settlements. Further, Thompson (1977) has supported the use of ethological evidence for cross-species comparison of pioneering in population dispersion. The present study builds upon the work of these authors in the application of ecological principles to human pioneer migration.

Clues from Ethology on the Dynamics of Dispersion and Organization

To begin building the explanatory framework of an ecological model of pioneer migration which can then be tested for its utility by examining one area where the phenomenon is taking place, it is necessary to draw from the field of cross-

species behavioral study or ethology. This provides a theoretical foundation for the social process of population dispersion and the generation of pioneer individuals and groups.

Thompson stated that "a recurrent process in human history has been the colonization of frontier areas by pioneers" (Thompson, 1973:1). He went on to assert that "if one included the initial geographic radiation of the first proto-hominids... this is a process older than Homo Sapiens himself" (Thompson, 1973:1). It is indeed a process older than man or proto-man; it is a ubiquitous means of dispersion of living species.

Before going further, it is necessary to establish a foundation for the use of cross-species observations and theories when discussing human population processes. As Diamond (1977:249) points out, "one is often warned when the possible relevance of animal findings to understanding man is suggested ...(that) 'man is basically different from animals'." He goes on to comment that (Diamond, 1977:249):

in fact, however, every animal species is basically different from other animal species...faced with this diversity...a common framework for understanding such unlike distributions as those of the giraffes, rose-breasted grosbeaks, cockroaches, and oak trees (has been developed) by seeking relations among key variables of processes...Like other species, man reproduces, dies, disperses, exploits environments of varying stability and productivity, adapts phenotypically and genetically, is subject to interspecific competition, and (still like other species) differs from other species in particular characteristics of each of these processes.

The process, or variable, as Diamond labels it, that will be of prime interest here is dispersion.

Dispersion, in this sense, is derived from its use by animal ethologist V.C. Wynne-Edwards (1962, 1963, 1965). The concept covers all the behavior involved in the distribution of animal populations in their various habitats. Most importantly, it illustrates how gregarious or social species structure or organize themselves in localized populations while participating in the flow of energy and information in an ecosystem; while utilizing their niche.

The basis of social organization is the dispersion of populations for the efficient use of the environment. As Wynne-Edwards points out, "the habitat should be made to carry everywhere an optimum density...without making any parts so crowded as to subject the inhabitants to privation, or leaving other parts needlessly empty" (Wynne-Edward, 1962:4). Admittedly a highly complex, multi-variant, and dynamic phenomenon (see Brush, 1975), carrying capacity is a measure of intra-specific regulation and is crucial in understanding the process of dispersion. Intra-specific regulation works as a systems governor, a homeostatic control which "constantly restrains (the population) while in the midst of plenty, from over-exploiting their resources" (Wynne-Edwards, 1962:7). It creates pressure towards "an optimum balance in the rate of circulation (if nutrients, i.e. energy sources) and in the proportion of the total (of resources) that is held at any given moment by the animal biomass, the plant biomass, and the remainder of the system" (Wynne-Edwards, 1962:8).

He posits an underlying process characterized by "a society constantly adjusting its population density...to match the optimum level of exploitation of available food resources" (Wynne-Edwards, 1962:14). It is a subtle and complex patterning of social behavior accomplished through the creation of a society defined as an "organization of individuals that is capable of providing conventional competition among its members" (Wynne-Edwards, 1965:1545).

This is based on the fact that (Wynne-Edwards, 1965:1545):

the undisguised contest for food leads in the end to over-exploitation, so that a conventional goal for competition has to be evolved in its stead; and it is precisely in this...that social organization and the primary needs of all social behavior have their origin.

Through the differential allotment of conventionally defined signs, signals, and goals, society is organized. Competition for conventional goals allows for the formation of structure for social behavior; "social organization is originally set up to provide the feedback for the homeostatic machine" (WynneEdwards, 1962:15). Groups gather information about their population density and resource availability, and then act to either raise, lower, or maintain their numbers through such dispersionary mechanisms as generating pressure for migration.

The information for the differential allotment of resources is processed and disseminated to the members of a population through display and exclusion. A complex combination of interdependent characteristics becomes apparent as it is differentially manifested in individuals in the population. Through what Wynne-Edwards calls epideitic display, the playing out of a patterned series of purely

conventional social acts and interactions, individuals within a population gain information as to the ranking of members and the overall size of the population, allowing for the regulation of a population in relation to its resources.

Ranking produces and is reinforced by two forms of differential or exclusive control; territorial exclusion and sexual selection. The former is exclusion from control of social property. The idea of social property has four components: (1) it provides conventional objectives for competition, (2) adults engage in a contest for it which leads to a determination of local dispersion, (3) the number of holdings in any given area is conventionally limited and these limits have marked effects on breeding behavior, and (4) through the allotment of social property, a ceiling is imposed on local carrying capacity (Wynne-Edwards, 1962:162).

Social property is more than the geographic space in which resources are located. As Wynne-Edwards commented, "the holding of property can be highly symbolic...such as nest sites for birds" (Wynne-Edwards, 1962:194). The competition for social property is channeled through social communication, as in epideitic display, by which individuals convey their desire to gain or retain social property and status through many means, threat and bluff being the primary ones. Other highly complex symbols have evolved, such as scent-marking in many mammal species and barbed wire in our own.

Sexual selection functions to provide enough but not too many participants in the recruitment of the population's next

generation. Through the use of conventional symbols and genetically programmed signals in what is called epigamic display, individuals gain differential access to willing partners for reproductive activities. The strange, if not bizarre, spectrum of coloration, scent, and other markers in patterns of sexual selection reveal the close interrelationship of genetic constituents and conventional behavior.

From the above social processes, a hierarchy is created in society. As shown, in the dispersion involved in territorial exclusion and sexual selection, members of a population, through a complex process of display and competition for conventional symbols, become identified and ranked according to their differential success in the 'game' of social life. The general principle that the degree of exclusionary pressure is density dependent and interdependent with limiting factors in the carrying capacity of the habitat applies here. Ultimately, loss of the 'game' can mean failure to gain access to the social property needed for group membership, outlets for reproductive drives, and even the necessary nutritional resources for survival.

However, Wynne-Edwards shows that this is not usually the outcome; rather, "selective pressure...does not succeed in promoting a general recourse to deadly combat or treachery between rivals, nor does it, in the course of generations, extinguish the patient compliance of subordinates with their lot...the reason for this appears to be that social status depends on a summation of diverse traits, including all the

hereditary and environmental factors that predicate health, vigor, and survivorship in the individual" (Wynne-Edwards, 1963:626). Most individuals in a population, due to the complexity and variation between genetic and learned or conventional traits crucial to competition, can find a means of successful or tolerable inclusion within social boundaries of populations under relatively stable environmental conditions.

In cases of environmental fluctuation or the breakdown of population limiting mechanisms, the process of social organization, through conventionalized competition, works to identify surplus or marginal individuals and groups by exclusionary mechanisms and hierarchical structure. Herein lies the direct contribution of Wynne-Edwards to the understanding of pioneering.

Only in certain cases do there appear pressures for members of populations to leave, resulting in two phenomena that have the same function: migration and pioneering. The former can be called the safety-valve function, "an almost universally available means of rapidly reducing population density in an area where the optimum has been exceeded...for the purpose of density reduction its effect can be accurately and automatically adjusted to the size of the particular emergency" (Wynne-Edwards, 1962:480). The latter phenomenon, pioneering, can be usefully differentiated from the first because "it fulfills the need for extending or restocking the range where this would be advantageous" (Wynne-Edwards, 1962:480).

Young members of society and all marginal groups are available, given the appropriate configuration of conditions, for leaving their home or source population. Often even populations long adapted to a stable environment, whose population size and available resources are in equilibrium, provide a surplus to send away as pioneers. There exist even more in unstable populations, unstable either due to their organizational structure or availability of resources, individuals or groups available for pioneering.

The similarities in function between migration and pioneering center on the fact that "the same social pressure can be exerted to disperse pioneers as to evict the surplus of overcrowding" (Wynne-Edwards, 1962:482). The exclusionary principles work to identify marginal individuals, "luck can turn an eviction into a timely act of colonization...just as pioneers can easily fail in their mission" (Wynne-Edwards, 1962:482). The crucial questions concern what pressures lead to exclusion and expulsion, which groups or individuals are identified as marginal and for what reasons, and what occurs in the emigrant group as it adapts to new resources within the context of a new ecosystem, either succeeding or failing to evolve as a new society with its own patterns of resource use and conventionalized behavior.

Work on just these questions has been going on in recent years in the field of biogeography, which shares cross-species interests with animal ethology. MacArthur (1972), MacArthur and Wilson (1967), and Diamond (1974, 1977) in particular have labelled the dispersion of pioneers as "colonization cycles". These cycles "involve changes not only in distribution but also in reproductive strategy, dispersal strategy, resource harvesting strategy, niche breadth, and competitive dominance" (Diamond, 1977:251). All of these will play a part in the building of a model of the pioneering process or colonization cycles of human populations.

One of Diamond's observations related to the statement of the model is the fact that there are (Diamond, 1977:257):

two types of strategies (for counteracting) the omnipresent risk of local extinction (of a pioneering population): either to concentrate on preventing it from happening or else to let it happen and concentrate on reversing it by recolonization. The former is the strategy of old colonists, which have lost much of their dispersal ability, can rarely reverse local extinctions by recolonization, and become restricted to stable or extensive habitats, where extinction is rare. The latter is the strategy of expanding colonists, which have high dispersal rates and can therefore occupy small and unstable habitats recolonizing as extinctions occur.

Both of these kinds of pioneering are observable in human population dispersion. Margolis (1977) has thoroughly discussed the isomorphism of the adaptations made by human populations in frontier areas with those made by other animal and plant populations, which disperse by rapid recolonization on a constantly moving frontier. Emphasis here will be on human pioneer populations which have opted for a strategy of

more permanent occupation of a niche in a newly settled habitat. This strategy, as Diamond (1977) illustrated, requires very different actions on the part of colonizing or pioneering populations than those who are rapidly and successively recolonizing new ecosystems.

While concentrating on the process of pioneer adaptation of populations who are more permanent rather than on those constantly mobile, the latter will be considered in the presentation of data on pioneer migration to San Julian. A range of strategies for adaptation of pioneer migrants is found, from those opting for permanent settlement in the new location to those planning to move on to another area soon after arrival in San Julian.

The question of permanence of settlement is important when dealing with evaluation of and recommendations for development efforts in the colonization zone. For the model, though, emphasis is placed on the process leading to adaptation to one habitat through developing a niche in that location rather than on the creation of a niche that calls for exploitation of a series of habitats.

Pioneer Adaptation and Cognitive Process

With these cross-species generalities in mind, attention can now be turned to distinctive or species-specific aspects of human pioneer dispersion, which brings in an element of significance most elaborate in our own species. It is especially important in the establishment of such new forms of

adaptation as pioneering. Bennett has referred to the phenomenon of (Bennett, 1976:848):

Anticipation (which) in the human realm may appear in the form of purpose, needs, desire, foresight, will or simply consciousness of continued existence... cognition and symbolism (confer) a 'timebinding capacity' on human behavior... much human behavior is devoted to reordering phenomena to avoid a random or entropic state.

Through cognitive processes, "the future is structured by what the organism does in the present, which in turn has been conditioned by what happened in the past" (Bennett, 1976:848).

In the case of the pioneer migrants in San Julian, the situation is dynamic as they confront, in most cases, an entirely different ecosystem than that in which they were born and in which they learned their first adaptive strategies. The term ecosystem will be used throughout to mean the entire environment in which a population must articulate itself, including geo-physical, biological and socio-cultural elements. While most migrants have gained some knowledge of the new ecosystem prior to settling in San Julian, a minority arrived there directly from the dramatically contrasting ecosystems of western Bolivia. Thus, the migrants' understanding of the ecosystem, goals of adaptation, and means for pursuit of those goals are in a tremendous state of flux.

Because "human thought has its own patterns which involve a highly developed ability to connect (and disconnect) concepts as well as stimuli", anticipation or cognitive process "may lead to construction of a reality far removed from the best

adaptive patterns" (Alland, 1975:68). Again, Bennett (1976:850) affirms that:

for adaptational theory, the key is the cognitive capacity to visualize changes in contemporary phenomena, that is, to conceive of new things and thereby establish new anticipations.

The migrants in San Julian develop a perception of the reality of their new situation. A variety of strategies for adaptation are produced as the migrants establish an understanding of environmental possibilities. The adaptive strategies vary greatly, for example from extreme exploitation of soil and forest to careful conservation of these resources. Other examples are the diversity of social arrangements in community formation, and the pursuit of individualistic as compared to group beneficial goals. Further, San Julian is the location of a multi-faceted development project being carried out to aid migrants in adaptation. The project components have significant effects on the way the pioneer migrant perceives his environment.

The major anticipation of concern in the analysis of pioneering is "the utilization of resources for the satisfaction of human purposes," something which is "generated within the social organ" which has "no reliable controlling relation to rational considerations such as sustained resource yield" (Bennett, 1976:850). Conventional representatives of reality derive from a structure of anticipations or cognitive constructs.

This structure provides a link with what has already been presented about conventional competition in the establishment of the organization of social species. However, the cognitive processes which establish human conventional behavior are not based on a simple set of limiting factors that constitute the carrying capacity of a population in a particular ecosystem. Rather, perhaps more than all other species, human beings determine carrying capacity due to their ability to manipulate environmental factors and augment geo-physical factors with those created by the innovations which arise through cognitive process.

It will be apparent in discussion of San Julian that limits arising from geo-physical, climatological, technological socioeconomic, and socio-political sources do impinge on carrying capacity possibilities. Various means of altering carrying capacity through the application of development efforts will be considered.

Thompson's analysis (1973) of the interrelationship of environmental factors and a pioneering population's past sociocultural patterns is relevant to this last point, because these patterns are the cumulative results of individual coping behavior. Speaking of the interplay between the sociocultural system developed by a population in its former location and the exigencies of the new situation, he sees a 'deculturation' occurring. This is a process which could be considered trial-and-error experimentation. The pioneers test aspects of their

former adaptational behavioral system, including its view of reality, to see what will work in the new area. The result is the creation of a "new, more complex culture...which resembles the old one in many details but which in many ways is essentially different" (Thompson, 1973:3). Elements are proven to be adaptive or maladaptive and are accordingly retained, rejected, modified, or allowed to be forgotten.

For the pioneer migrants of San Julian, this will definitely be important for analysis of the patterning of behavior during adaptation. The migrants appear to be undergoing a process of testing and developing modes of behavior. Some traditions of highland peasant life are retained as the traditions and patterns of lowland life are being evolved.

Britan and Denich (1976) provide insight into the dynamics of the testing of previous anticipations, coping behavior and cultural constructs of the individual in the pioneering process, from which group sociocultural patterns evolve. Their focus on the crucial relationship between the individual and society in such periods of rapid social change as pioneering by human populations. They note properly that much ecologically oriented anthropology has focused on isolated and relatively unchanging groups, without considering the fact that populations exist with extensive ties outside the localized community, and that change is constantly occurring in all sociocultural systems.

They assert the usefulness of 'formalist' analysis of individual action and decision-making. This mode of analysis

demonstrates "how individuals perceive possibilities within their immediate situations and make choices in order to best fulfill goals set according to culturally defined values" (Britan and Denich, 1976:57). Of most relevance is their conclusion that "social structures and cultural institutions exist only through the enactment, by individuals, of the behavior that culminates in persisting patterns...conversely individual behavior is delimited by external conditions and structures that define possible courses of action" (Britan and Denich, 1976:57).

Through the examination of "rapid social change", which characterizes most pioneering situations, they see a "dynamic of constant assessment, evaluation, and choice among alternative attempts to achieve subsistence goals from environmental possibilities...in which changes in the range of possibilities can be quickly incorporated into the actor's cognitive framework" (Britan and Denich, 1976:69). The analysis of individual adaptive behavior within an overall context of social change demonstrates that "changes in behavioral patterns did not emanate from the alteration of value systems, but of action possibilities" (Britan and Denich, 1976:69).

In examining the adaptive process of the colonists of San Julian, emphasis will be placed on how individuals and groups organize and act. Their organization and action reflects an assessment of the structure of possibilities offered by the ecosystem and from traditional patterns. The possibilities in

the ecosystem include the structured opportunities arising from development efforts.

Finally, in the dynamic situation of pioneer adaptation, if social process is evolutionary in the sense that it produces viable alternatives for adaptation, then it requires the "engendering of diverse competition" (Burger, 1963:209). Burger views sociocultural change as a type of evolution, as processual not directional. The changing environmental variables select individuals in pioneer populations as they adapt to the new ecosystem. These populations are prime examples of systems in transformation, demanding innovation and testing the variations within the individual and collective behavior patterns of the group for those which will maximize success.

There is a great deal of variation among individuals and groups and their adaptive strategies in San Julian. Competition for social influence, political control, and economic advantage all demonstrate these variations. The kind of attitudes and structures which underlie the development efforts and how they interact with the attitudes of the pioneer migrants will be examined.

Cybernetics in the Understanding of Pioneering Adaptation

Two major concepts which help form the basis of the model of the pioneer adaptational process come from the field of cybernetics or systems theory. First, Maruyama (1968) indentified the feedback effects of exchanges between numerous

variables in any system, in this case sociocultural systems, as the system processes information and energy from its environment. Two types of cybernetic or mutual causal control processes occur in sociocultural systems. Maruyama discussed systems in which deviation or change in one variable or a set of variables is controlled by change in the state of another variable or set of variables. The variables play off against each other to maintain the state of the entire system within a stable range of variation. The classic examples of these kinds of homeostatic systems are the fly ball governor, which keeps a machine operating within a certain range of tolerance, and the thermostat, which senses variations in room temperature and kicks in appropriate heating or cooling devices to maintain a temperature within a set range of variation. Ritual has been identified as at least partly a system of control for keeping belief and behavior within ranges of socioculturally defined tolerance (see Rappaport, 1968).

There are also systems in which deviation or change in any variable or set of variables is not controlled by changes in other variables, and the feedback effects of amplified change work to transform the state of the system. Examples of morphogenesis or the 'snowball' effect are numerous, including the growth of cancer cells in the process of deterioration of the living systems in which they exist, and compound interest in banking. The evolution of agricultural and industrial levels of sociocultural integration out of the earlier hunting and gathering level is another example of positive feedback.

In fact, simple uncontrolled population growth through reproductive success is one of the most ubiquitous biological examples of the operation of positive feedback. These two models of negative feedback, in the case of homeostasis, and of positive feedback, in the case of morphogenesis, will be useful in looking at the process of adaptation of pioneer populations. Both phenomena are evident as the challenges of a new environment are faced.

The utility of the concept of feedback in the analysis of the San Julian situation will derive from examination of how modifications of structures and action possibilities can lead to change in behavior and norms and values. Further, the introduction of innovation from development efforts will be detailed as they relate to maintenance and transformation of traditions and behavior.

Deutsch (1968) sees societies as information processing systems, "complex feedback networks...(which) deal with 'messages' or 'symbols'" (Deutsch, 1968:392). Messages provide a sensitivity to changes in the state of such variables in the system as carrying capacity. If the message acquires "a relatively stable association with another event outside the net, or with any other messages within it", it becomes a symbol (Deutsch, 1968:394). The use of messages and symbols, such as those which communicate the conventions of competition, is structured according to rules which govern the distribution of

'attention' and priorities in expediting competing messages. These rules work as structural alternatives , and, as part of such elaborate information processing systems as the human mind or society, are dynamic because (Deutsch, 1968:394):

with the aid of experience the network of the human mind can change its own structure of preferences, rejections, and associations...and what seems to be true of the general plasticity of human mind in its evolution in the life of the individual seems even more the case of the plasticity of the channels which make up human cultures and institutions...in the same proportion to the ability of those cultures to survive and spread. (emphasis mine)

Society, according to Deutsch is a learning net which functions "in response to changes in the net's surroundings or in response to the internally accumulating results of the... net's past" (Deutsch, 1968:398). Bennett (1976) was speaking of the same fact concerning human populations when he pointed out that "a conception of culture as the precedents people use to construct patterns of coping is more appropriate for an adaptational approach" (Bennett, 1976:851). This concept will serve in the analysis of pioneering situations as a means of further refining an understanding of what aspects change and what remain the same, as the new learning net is formed and either fails or succeeds to provide the information and structure for a population's adaptation to a new ecosystem. The learning net serves to carry out "strategic coping... the attempt to realize individual and social objectives through the mobilization of social and material resources" (Bennett, 1976:851).

A Model of Pioneering

An ecosystemic view of society has been developed above from the work of ethology, ecological anthropology, and cybernetics, in order to provide an understanding of the process of pioneering. This ecosystemic view asserted that populations are inextricably interdependent with their environment for the purpose of gaining access to resources and processing them for their own survival.

The process involves a structure of communication within the group. The communication is of a special kind: the communication of information coded into messages by the group. This communication leads to the allocation of resources and is coded into symbols which are the goals of competition. Access to or proprietorship of the symbols is related to at least three phenomena: territorial exclusion, sexual selection, and the hierarchy established through conventional competition.

Through the communication of epideitic display, individuals in the population gain access to the symbols, to be the 'winners' in the 'games' which lead to the working of the three phenomena. Excess members, termed marginal, are identified in inverse proportion to their abilities to 'win'. If there are unexpected fluctuations in environmental limiting factors, marginal individuals or groups are forced to migrate as a safety valve. If a stable population produces a repeated excess, marginal members become pioneers and leave to establish a niche in a new habitat.

Information processing abilities of species become more complex as one moves up the evolutionary scale. Within human

groups, the intricacies of symbolic codes and the process of their manipulation manifest themselves in a bewildering array of behavior patterns. At the heart, though, lies the simple truth that, no matter how coded, the dynamic process of conventionalized competition identifies more and less marginal members and ranks them overtly and covertly.

These members, however, have the ability to play off their options, one of which is the bold move of pioneering, settlement of areas hitherto not part of the dispersion pattern of the source population. Another option is an attempt to radically alter the structure of conventionalized competition, often called revolution or civil war, but that is not relevant here except that founders of the pioneering group might opt for a radical restructuring of the social order in their new situation.

This is not often the case, however, because the normative system of channel preferences (values, beliefs, ideology, ritual) within an individual or a society's learning net can be relatively inelastic. Rappaport's analysis of the negative feedback function of ideology identifies how this occurs (1968). However, if the challenges to a population's traditionally established adaptive strategy are insurmountable in the new situation, then maximization for a group's survival can take place. Members of human populations can change sociocultural system variables in order to successfully

survive. As Bennett remarked, "different cultures are simply products of time and spatial position that affect experience... (they are) subject to change as experience and environment change" (Bennett, 1976:850).

As Maruyama among others has shown, changes in any aspect of the system can initiate a positive feedback process and transform a group's sociocultural patterns through providing new codes for conventional competition and new values attached to them. Again, it is necessary to emphasize that variations within a group's members (variation in genetic constitution, resource control, life experiences, and values) provide the raw material for innovation and for the development of new patterns.

The model below consists of a set of theoretical propositions in which pioneering is projected as the outcome of a population processing energy and information from its environment; forming its niche in the ecosystem of which it is a part.

- 1) Pioneers are marginal individuals or groups within the population in their place of origin or source community. Their identification as marginal is based on limitation or denial to these individuals or groups of access to adequate resources through the social communication of competition. Adequacy of resources is defined relative to the anticipations they develop as to their desired state of resource control. The inadequacy of their resources and their marginality will be evident in overt patterns such as

overcrowding and/or in covert patterns such as underemployment. Marginal individuals and groups are not necessarily those most disadvantaged in relation to resource control; they may perceive their situation as relatively inadequate and anticipate improvement in other places. Part of these perceptions will be biological, such as nutritional adequacy and disease, and part will be psycho-social, such as status relative to others.

- 2) Either through expulsion because of socially defined and sensed population pressure expressed in their identity as marginal, or choice to leave due to these same pressures, the pioneering individuals or groups move to a habitat not previously exploited by the source population. The choice to leave is: the area of inter-play between population pressure, availability of resources, and individual variation. Essential to the last variable, as a distinct characteristic of human beings, is the cognitive capacity of anticipation.
- 3) Adaptation in the new situation requires that the pioneering individuals or groups articulate themselves within a larger ecological community or ecosystem; they must establish a niche. This includes complex interrelationships with geo-physical elements such as hydrological cycles and soil types, and with biological elements such as animal and plant species. There are also complex interrelationships with human populations in the

region. Besides other local human groups, adaptation must be made to overlying systems such as national governments, economic markets, international agencies, and development efforts.

- 4) In meeting the exigencies of the new ecosystem, there will be a testing of the suitability and validity of the source community's behavior patterns and social institutions. This testing will lead to the retention, modification, and/or rejection of these patterns or institutions; the development of new patterns or institutions; or adoption of elements from another population's behavior patterns, both those of previously settled peoples and those designed innovations introduced by development agents.
- 5) The process of adaptation creates an inter-play for maintenance or transformation of previous behavioral and institutional patterns by testing the viability of individual and group solution for survival. Individuals and groups will attempt to find workable solutions in their new situations even if these choices might establish new patterns quite different from those of the source community. Individual success amid group failure would illustrate the importance of individual variation as a basis for selection in adaptation. The generation of a viable community, emerging from a structure of relations and exchanges among individual pioneers would reveal the way in which social groups can modify, innovate, or retain sociocultural behavioral patterns and institutions in

adaptation. This may even include the adoption of, to a varying extent, organizational and behavioral patterns introduced through development efforts.

- 6) As adaptation is an on-going process, pioneers constantly process and analyze the results or outcomes of niche development and retain, modify, or reject previously developed modes of adaptation. This can result in abandonment of further attempts to adapt in the frontier ecosystem or continuation of those attempts.

The study will focus exclusively on steps three through six of the theoretical model. Most important in the decision to focus the study was the fact that most pioneer colonists in the field site had left their areas of origin long before arrival in the San Julian colonization zone. They were entering this particular pioneer situation after living and working in similar areas. Therefore, it was judged to be more useful to devote attention to the frontier area and adaptation to it, rather than divide time more evenly in investigation of conditions and processes which generated the pioneers from the areas of origin. Further, the earlier stages in the process have already received extensive attention in the literature of economic development and applied anthropology, whereas analysis of the adaptive process in frontier ecosystems has not received such attention.

CHAPTER TWO

THE HISTORY AND PRESENT SITUATION OF PIONEER COLONIZATION

Introduction

Pioneering, as one form of human population dispersion has been described and analyzed in various parts of the world. One such area is the Andean region of South America to which the associated eastern lowland forest and plains form a frontier for pioneer migration. A good deal of "evidence from various sources seems to suggest that ...colonization of... areas east of the Andes has been a form of relief from the high population pressure and oppressive tenurial regimes characteristic of the Andean zone" (Preston, 1969:281).

The pioneering, or colonización as it is widely known in South America, of interest is that which has occurred in the present century, proposed and supported by governments in the region and by international agencies working there. Regional overviews of the phenomenon exist in Nelson (1971), Crist and Nissly (1973), Dozier (1969), Eidt (1963), Stewart (1968), and Smith (1968). Discussions of pioneering in individual countries and regions are numerous, some of them include: for Colombia, Smith (1968); for Ecuador, Casagrande, Thompson, and Yound (1964); for Peru, Stewart (1965), Eidt (1962); for

Argentina, Eidt (1971); and for Paraguay, Stewart (1967). The University of Wisconsin Land Tenure Center has a basic bibliography (1968) and subsequent supplements (1971, 1974, 1977) of sources on South American pioneering.

Further sources include: for all of Latin America, OEA (1972); for Venezuela, Gobierno de Venezuela (1972);

for Brazil, Unterrichter (1972, Government of Brazil (1968), Schrewe (1968), Moran (1975), Davis (1977); for Ecuador, Bolivar (1975); for Colombia, Gobierno de Colombia (1974); for Peru, Durham (1976), Gobierno de Peru (1972), Martinez (1969, 1976); and for Paraguay, Giles (1976).

In general, the process of pioneer colonization in South America has involved the establishment of farms or homesteads by migrants who arrive from outside of that area designated as the frontier. This process usually implies some degree of ecosystemic transition, as in the case of Ecuador, Peru and Bolivia where highland indigenous and mestizo peasants have moved to the lowland tropical and sub-tropical forest and savanna. The intra-regional relocation of populations is not usually considered to be colonization. Land is usually allocated in grants in amounts far in excess of the amount of land the extra-regional migrant held in his place of origin. Land tenure arrangements usually enable the migrant to obtain title to the grant at a minimal cost, provided he remains on the land and works it.

Intervention by national and international agencies has often been associated with pioneer colonization in South America. Intervention has varied from making the process of adaptation in the new ecosystem more difficult, to having little or no impact, to aiding adaptation. Many of the colonists, a majority in the case of Bolivia, have founded homesteads and communities spontaneously without promotion or aid by agencies. However, government action has been crucial even for spontaneous settlers, as governments establish the frontier as a zone for population relocation. Governments can create "empty" frontiers through such means as seizure of land from large landlords and pressuring indigenous populations. Governments create settlement frontiers, resorting even to the genocide of indigenous populations, because of their desire to increase productivity of the land, decrease political-economic tension in previously settled areas, and/or occupy land so as to actively maintain its inclusion as part of the territory of the nation. All of these factors are relevant to the case of Bolivia, to be presented below, and in the case of the San Julian project in particular. Throughout examination of the story of pioneer colonization in Bolivia, general features of the model of the pioneering process are illustrated.

The frontier area to which the pioneers of interest here have come is the northern Santa Cruz region of eastern Bolivia. Information on colonization in this area and in

eastern Bolivia in general is relatively abundant. The first publications on these topics appeared in the late 1950's and early 1960's. Foremost was the work of Heath (1959, 1960, 1964) and Crossley (1961) who examined the movement of highland peoples in the late 1950's in the context of the overall economic growth and history of settlement of the Oriente. Sakari (1966) was one of the first academic field studies of the problems of adaptation in colonization.

Much of the work produced on pioneer colonization has been the result of contracted evaluation and assessment by international agencies. The first set of such studies produced what has been recognized as one of the most comprehensive works done on colonization, that of Marus and Monje Rada (1962). Other studies carried out at this time included Patch (1962), Ferragut (1961), and Cappelletti (1965). The Bolivian government also had personnel undertaking investigations in this period, including Linares (1964).

The next set of work done included an extremely thorough socio-economic survey of colonies and highland villages by Wessel (1968) and an intensive critique of the social and environmental effects of pioneer colonization by Henkel (1971). Another study done in this time period was by Hickman (1968), who viewed colonization as it related to other forms of social

change. One of the weakest works ever done, in reference to its quality of analysis, was produced by Edelman (1968). The first and most comprehensive study of the Japanese and Rykyuan immigration to eastern Bolivia was carried out by Thompson (1970, 1973).

Additional work was written in this period by authors contracted by Bolivian and international agencies such as the critique of colonization done by Ribeiro (1969). Studies were continuously being produced by the Bolivian government's personnel including Galleguillos (1969, 1976) and a bibliography of works by Torrico Arze (1967).

The work of two German authors, Reye (1970) and Schoop (1973), contributed much to the evaluation of colonization as a social and economic process in a regional and national context. Another significant work was that of the British geographer, Fifer (1973) who especially emphasized the role of colonization in occupying national territory previously unimportant to the rest of the nation. Wiggin's study (1976), an analysis of colonization by a British sociologist, is one of the most critical ever written, and, while suffering from poor supporting data, is one of the most important.

Those involved in aiding in the solution of the problems of pioneer migrants have produced several significant analysis

of the colonization process. One of these was written by Zierten (1971) and served in the planning of development efforts in the San Julian project, the object of the present study. Other people involved with these efforts who have carried out investigations included Graber (1972) and Epp (1975). The former was a multiple site economic production and labor organization study. The latter was a presentation of the carefully developed rationale behind the settlement program in the San Julian project.

The USAID sponsored more research on the problems of colonization done by Roberts (1974), Keller and Aitken (1973), and Royden and Wennergren (1973). They examined respectively the economic, social, and infrastructural means of aiding pioneer migrants. This round of investigations was directly related to the San Julian and Chane-Piray projects.

Among the most recent academic work done on colonization in the eastern region of Bolivia, three studies are outstanding for their comprehensiveness. Hiraoka (1974), a cultural geographer, traced the process of human settlement of the Santa Cruz region from the prehistoric period to the present. Stearman (1976), a cultural anthropologist, outlined in great detail the various forms which migration takes as highland people have moved and are moving to the Oriente (1973, 1976, 1978). Zeballos (1975), an agricultural economist and former

director of the Bolivian government's National Colonization Institute, presented the best economic data available on colonization, especially for comparison of income among the various types of pioneer settlements. While not yet published, the work of Weil (1977) promises to be extremely important on the spontaneous settlement of highland migrants.

Bolivia: Introduction to Colonization and Population

Distribution

The history of Bolivia exhibits the working of the principles of population organization and dispersion expressed in the theoretical model of the pioneering process. This study will examine that history, especially the story of the population relocations which have occurred in the last 60 years. The movement of people has been from the western highland region of the Altiplano and its contiguous valleys to the eastern lowland region of the Oriente (see Map 1). In particular, how pioneers have been generated from a population and how they have met the challenges of adaptation to a new ecosystem will be identified.

Most of the people of Bolivia live in the one third of the country which includes the western highland Altiplano and closely associated valleys such as the Yungas and Cochabamba, rather than in the two thirds of the country in the eastern lowland zone called the Oriente (see Map 1). Today, approximately 85% of all Bolivians reside in the highlands and associated valleys and 15% live in the eastern lowlands.

Table 1 presents population distribution by major land area in Bolivia. The columns showing total and rural population demonstrate that the traditionally settled areas of the Altiplano, Valleys and Yungas remain as those most heavily populated. This is even more interesting in relation to the next two columns, which detail land area and proportionate shares of the total land area for the separate regions. The last two columns illustrating regional population density proceed logically from the previous information, as the heaviest densities are found in the Northern Altiplano, the Central Altiplano, the Valleys and the Yungas. Table 2 further indicates that, while much of Bolivia is not considered as potentially useful for crop or cattle production, there do exist approximately 4.271 million unused hectares in the prime productivity category and another 6.5 million hectares of more marginal but potentially useful land (see note b).

The regional imbalance of population and the existence of much unused land lie at the heart of the forces which have led to the movement of populations that is the object of study here. Statistics vary greatly in quantifying the migration from the western to the eastern regions of Bolivia. The figures are as low as approximately 50,000 families and 250,000 people (Zeballos, 1975) and as high as approximately 62,500 families and 312,000 people (Galleguillos, 1976). A basic problem with any estimate is the prevalence of spontaneous migration without census registration with the government.

Prehistoric and Colonial Era Factors in Population Distribution

The reasons for this pattern of population distribution stem from pre-Hispanic and colonial population organization and dispersion. The Altiplano and associated valleys were settled by peoples with highly advanced sociopolitical institutions, an urbanized settlement pattern, and an intensive agricultural and pastoral technology (see Rowe, 1947; Murra, 1968). Contact with and interest in settlement of lowland areas to the east of Peru and Bolivia by highland populations has been recorded by the Spanish chroniclers for the Inca period. As early as the time of the third Inca ruler in the succession of thirteen which ended at the time of the conquest, Capac Yapanqui gave orders for the establishment of colonies in an area then called the yunca or warm land. The sixth Inca, Roca, ordered expeditions to conquer antisuyu or the eastern part of Peru and Bolivia. He met with little success. The ninth Inca Pachacuti ordered his son, Capac Yapanqui, to conquer the Musu, what is now known as the Mojos of eastern Bolivia. At that time, Capac Yapanqui reported extremely difficult going because of confronting a very different physical environment, being plagued by many lakes and swamps, and fighting the "fierce and inhuman Chirihuana" people. The Inca empire was never able to extend its control to the eastern lowlands of Bolivia. While not being able to conquer the areas to the east, the Incas did maintain contact with the area, because "as the Indians along the frontier of the Andes... are barbarous and warlike people... captaincies and regular garrisons were established in many places" (Cieza deLeon, 1960:61).

One institution of the Inca empire that is interesting here and has its modern analogies even in the San Julian project was called the mitimaes or mitima-kuna in Quechua. They were "those persons who formed the transplanted populations, a system perfected by the later Incas in order to govern newly conquered territory" (Von Hagen, 1960:59). There were three kinds of mitimaes: military, who held outposts; political, who were present to insure the allegiance of newly conquered lands; and economic and cultural, who occupied thinly populated districts so as to bring the Incaic way of life and methods and to increase the use of the Quechua language (Von Hagen, 1960:59). The Inca wanted to maintain the good will of these crucial populations (Cieza de Leon, 1960:60):

as the Incas were aware of how reluctant peoples are to leave their native land and the surroundings they know, in order that they should carefully accept this exile, they treated the people with special considerations; to many they gave arm bands of gold and silver, and clothing of wool, and feathers, and women, and they enjoyed other privileges.

One use of the mitimaes was quite significant in the light of the pioneer colonization of the Twentieth Century (Cieza de Leon, 1960:62):

if, perchance, they had conquered territory in the highlands or plains or on a slope suitable for plowing and sowing, which was fertile and had a good climate, and was empty of people (emphasis mine) they quickly ordered that from nearby provinces that had the same climate as these, for the good of the health, enough

people come in to settle it, and to these lands were given, and flocks, and all the provisions they needed until they could harvest what they planted... after this manner many valleys of the plains and villages of the highlands were settled.

The imposition of Spanish control over the Inca empire and Aymara kingdoms introduced new elements of settlement pattern and socio-economic organization which led to large scale population dislocations in the highlands (see Rowe, 1957; Murra, 1970; Smith, 1970; and Keith, 1971). There are several important institutions. First was the encomienda through which the Indian population was assigned to work for encomenderos, who were Spaniards selected for this reward by local and royal authorities. The allotted population owed service and labor to the encomendero. The process of transition from this system to that called the hacienda is not important here except to note that the institution and its structure of relations and resource control remained largely intact. It is also important to see that the hacienda system left pockets of land as communal property for localized Indian populations. They were called comunidades indigenas. The concentration of Indians for exploitation of their labor and services, caused population dislocation and decline.

Other Spanish institutions contributed to the disruption of Indian groups. The first, the mita, based on a pre-Hispanic

institution of a rotating labor obligation to the state, required labor, in mineral extraction or other odious tasks designated by the Spanish, from all men living in comunidades indigenas. This served to stimulate the abandonment of home villages and relocation to areas in which men did not owe labor. The repartimiento was a tax paid by those Indians in comunidades indigenas which required the purchase of goods, usually not wanted, at exorbitant prices. Because of its basis in assignment by localized communities, it was another cause for migration, as payments could be avoided if an Indian was living in an area that was not his place of origin.

In general, the Spaniards could not tolerate the high altitude conditions in the Bolivian Altiplano, so they forced or promoted concentration of settlements in lower valleys. The importance of the utilization of many altitudinal levels with correspondingly adapted animals, plants, and technology was not generally recognized or considered crucial by the Spanish. Further, the former pattern had meant that there were many small dispersed settlements which exchanged products among themselves. The centralization of settlements, especially that which established the hacienda system, greatly disrupted the former system of adaptation of Andean Indian populations. All these forces, the encomienda and hacienda, the mita, the repartimiento, and the centralization of settlements, along with the introduction of diseases to which the population had

little or no immunity led to a devastation of the population and lowering of density. Only in the last ten to twenty years have highland populations reached the levels they had attained at the time of the Spanish conquest. As the chronicler wrote (Cieza de Leon, 1960:62):

in the days of the Incas there was very little arable land in these kingdoms that was not under cultivation, and all as thickly settled, as the first Spaniards who entered this realm can testify. To be sure, it is a sad thing to reflect that these idol-worshipping Incas should have had such wisdom in knowing how to govern and preserve these far-flung lands, and that we, Christians, have destroyed so many kingdoms. For wherever the Spaniards have passed, conquering and discovering, it is as though a fire had gone, destroying everything in its path.

During the Spanish colonial period, in general the Quechua and Aymara speaking populations were forced to remain in the highlands to provide the labor force for mining and agriculture. While all of the institutions just mentioned were important, most crucial to understanding the eventual migration pattern of pioneer colonization to the east or Oriente in the 20th Century is the system of land and labor allocation called the hacienda which evolved from the encomienda.

Under this system, a landlord or hacendado controlled a large amount of land on which lived a dependent population of peasants, variously known as colonos or peones. The nature of

the dependency was defined by the fact that the landlord had exclusive proprietorship over the hacienda and would allow the peasants to use small sections of it for their crops and animals. In return for this grant of access to the landlord's property, the peasants were obligated to perform tasks on the greater part of the estate, raising the landlord's crops and herding his animals. Personal service and debt peonage were often part of the dependency ties. This is a very generalized description of the system, but it illustrated the establishment of a particularly unequal hierarchy of resource control, one which served as a pattern over a wide area of the Andean highlands.

Prehistoric and Colonial Era Background to Bolivia: Eastern Frontier

Two thirds of Bolivia lies in a broad sub-tropical and tropical forest plains known as the Oriente. This area is part of the Amazonian basin and its tributaries and of the Brazilian Shield. Human occupation has always been sparse relative to the western highlands and associated valleys, and was particularly so in prehistoric times. Heath comments that "the tropical lowlands of eastern Bolivia constitute a relatively isolated region in which intersocietal contacts have been minimal in worldwide perspective" (Heath, 1964:1). Parejas (1976) and Riester (1975) present ethnographic

material which show that groups ranged in technology from nomadic hunting and gathering and band-level organization to shifting cultivation and chiefdom-level organization. Denevan (1966) presents much evidence of the latter for the Llanos de Mojos in northeastern Bolivia in what is today the Beni department.

The northern Santa Cruz region, the center of pioneer colonization over the last 25 years, was occupied by peoples who combined hunting with simple horticulture and had only small political groupings. They were principally of the Ayureo and Chiriguano ethnic groups.

The first Spanish contact with the Inca Empire was made through what is today the Santa Cruz department of Bolivia. It was (Metraux, 1947:465):

An attack from this area by Chiriguanos allied with the Guaranis... led by Alejo Garcia, a Spaniard captured by the Indians and promoted to captian... the first white man to see the outposts of the Inca Empire, five years before the 1527 landing of Francisco Pizarro at Tumbes.

Nonetheless the region rapidly became a backwater of the Spanish empire.

The original goal of Spanish settlement of the Santa Cruz region was to provide a base for expeditions to discover the mythical treasure of El Dorado, thought to be a city of gold in

the interior of South America. As that goal was found to be unattainable, a large number of the Spanish left the area. They left because of the isolation of the region from the centers of mineral wealth in the Andean highlands and from centers of trade and commerce on the Atlantic. Those few who remained could only realize the goal of controlling their own land and servants and slaves, and of serving as the minimal presence that royal authorities wanted in order to hold the area for the Spanish empire.

Heath (1960, 1964) describes the "ethno-genesis" of the colonial population and their sociocultural organization. The outline of the process was as follows (Heath, 1964:3-5):

The problems of colonial administration were far more complex in this zone than in the more densely populated areas of Latin America... There was no pre-existing complex bureaucratic structure in which the Spaniards could simply usurp the dominant positions of former native leaders. On the contrary, control had to be local and personal in the inland llanos... In the absence of large sedentary villages and political federation, it was only with difficulty that conquistadors were able to establish settlements where Indians were brought together to furnish them with food, labor, and women... The limited capacity to provide wealth was implicitly recognized in the special royal ruling by which the normal annual tribute to the Crown was reduced in this region to the sum of only two balls of cotton thread. In such a situation, it is not surprising that Spanish and indigenes were in a relationship nearer symbiosis than exploitation... Encomenderos (predecessors

of hacendados or finqueros in Santa Cruz) were required to remain in the area and many of them took native women as wives and concubines... Change in customs took place rapidly under such circumstances.

The finca system developed from the encomienda with the following structure of relationships. The finquero, or owner, controlled the land but more importantly controlled the labor of a dependent population through a system of debt peonage. The dependent groups were either inquilinos (sharecroppers) or jornaleros (day workers). It may be more accurate to consider the relationship one of interdependence, due to the reciprocal nature of obligations and the fact that the region was always short of labor, which required finqueros to be relatively more generous and tolerant than in other parts of Spanish America. However, control of most resources rested with the finqueros, making the rest of the population dependent on them.

Another group of settlers in the colonial system of settlement was the small group of independent homesteads of tolerados (squatters). They were largely beyond the control of the finquero, but ultimately could be subject to him if the toleration of the squatting ended. This group existed as a direct result of the tremendous amount of land relative to human population.

The religious settlements founded by Jesuit priests known as reducciones and misiones were also very significant.

Hiraoka (1974: 88-89) describes them as follows:

Although the religious compounds in the Santa Cruz area were founded by various orders, they shared certain fundamental traits. First, the natives were persuaded to abandon their villages and move into the reducción. Then they were taught the Catholic faith, along with sedentary ways of living based on agricultural and industrial skills... the grouping of aboriginal populations in compact settlements was a major prerequisite in establishing missions. Once the Indians had been grouped, they built the church, the missionaries' dwellings, storage buildings, shops, and houses for themselves, under the direction of the priests. Land was opened for cultivation of subsistence and commercial crops... The superior site conditions enabled the settlements to prosper under management of the priests, and even in later times, the advantages of mission sites were recognized, so that the former religious settlements have become the major regional urban centers.

For the purposes of the study, there are two characteristics central to understanding the place of the northern Santa Cruz region in the population growth processes of Bolivia which culminated in the region becoming a frontier for pioneer settlement. First, northern Santa Cruz was isolated from the activity and growth of the highland region. Second, inter-related with this isolation, it was an area with a low population to land ratio; to a large degree, it was uninhabited, particularly as a result of the population concentrations carried out by the Jesuits in the late sixteenth through the mid-eighteenth centuries. These characteristics had profound effects in defining the social organization of resource control in which labor was more crucial than land.

While depopulation occurred in the highlands, as mentioned previously, the areas which were settled had a skewed system of resource control. There was a relative abundance of peasant laborers relative to the small amount of land which they were allowed to use. This was even more exacerbated after the wars of independence from Spain when criollo and mestizo elites began a concerted effort to seize valued land to include in the hacienda system from the comunidades indigenas. The situation combined unequal resource control with socio-politically created demographic pressure on resources, which was a complete contrast to that of the Oriente and Santa Cruz. It was fundamental in creating the highland peasants' perception of Santa Cruz as a frontier for settlement and eventually led to the migratory flow of modern pioneer colonization.

The Beginning of Eastward Migration

Beginning in 1830, the national government enacted legislation to promote the migration of highland Bolivians and foreigners to the eastern lowlands, including northern Santa Cruz, through measures such as land grants and sales. In 1886, 1905, 1910 and 1920, various measures were promulgated for this purpose.

Several specific schemes illustrate the lack of knowledge and lack of communication between the western region and the

frontier area. President Gregorio Pacheco established the Ministry of Colonization in 1886 to encourage settlement in all of the eastern part of the country. Beginning in 1901, various plans were made to grant large tracts of land to foreign colonists recruited through Bolivian consultates in Europe and North America. Some of the more grandiose included the Banque l'Africaine of Brussels scheme (1901), "Alfalfa" Bill Murray's project (1920-1925), and the British Bolivian Oil and Land Syndicate (1922-1929). They all had in common the fact that they were unrealistic projects based on misinformation, if not outright fraud.

Two factors did lead to a limited growth of human settlement in the region of Santa Cruz. The first was an increase in export demand for cinchona bark for production of quinine. This tree grows wild in the northern Santa Cruz region and spontaneous pioneer migration brought people there to collect bark. The second factor was the gradually increased importance of the region as a supplier of food products for the more heavily populated regions of Bolivia.

However, as rapidly as the cinchona trade arose and the sale of agricultural products increased, other events mitigated these factors. Cinchona began to be raised on commercial plantations in the East Indies and sold at much lower prices in the world market than the Bolivian product, destroying its

export marketability. Agricultural products at lower prices also began to be supplied to the highland region of Bolivia by new railroad connections to the Pacific, greatly discouraging production in the the northern Santa Cruz region. In addition to this, the boom in rubber exports drew people away from this region towards the Amazonian forests to the north. Indeed, the region's population experienced an overall decrease in this period.

Modern Pioneer Colonization - First Phase 1920 to 1952

The first phase of the modern pioneer colonization began in 1920, with the founding of a settlement called Todos Santos del Chapare in the eastern tropical lowlands of the department of Cochabamba. Modern pioneer colonization has the following characteristics: 1) it is the settlement of peasant migrants whose areas of origin were in the western region of Bolivia, either in the Altiplano, high mountains, or high valleys; 2) it has been promoted by the national government and international agencies, in some cases even to the extent of massive monetary and personnel investment. The Todos Santos migrants were highland peasants from the Cochabamba department. "Military objectives as much as the desire for political and economic contact with the northeastern region of Bolivia motivated" this move in colonization by the government. (Ziarten, 1971:2). The military objectives were the need to occupy national

territory and, most importantly, establish a presence of western Bolivians in the Oriente, where separatism and regionalism had always been strong. In 1924-1925, there was an uprising calling for the independence of the Santa Cruz department. Separatism and regional autonomy became much less important by the end of the 1920's and the beginning of the 1930's as Bolivia turned its attention to the external threat of war with Paraguay.

Related to this threat and to the growing interest of the western region in the Oriente was the discovery and subsequent exploitation of petroleum resources in the east. This spurred the improvement of channels of communication and exchange, which was encouraged by international petroleum companies. From the beginning of the modern period, the development of petroleum resources was controlled by and intended for the benefit of extra-regional, even extra-national, interests. Some analysts have gone so far as to state that the Chaco War, which began in 1932 between Bolivia and Paraguay, was in reality a fight between proxies for Gulf and Standard respectively.

The outbreak of the war in 1932 between Bolivia and Paraguay found the highland region of Bolivia connected by land to the war zone east of Santa Cruz only over old ox-cart trails. Rapid construction in 1931-32 provided the first

overland route suitable for motorized transportation. Agricultural production in the region increased greatly in order to supply the Bolivian fighting forces. By the end of the war in 1935, the department of Santa Cruz was supplying 50% of the food for the nation's military.

A further effect of the war was that Bolivian peasants, many for the first time, were exposed to the eastern region of their country, a land which quite literally had been alien to them. The impressions were not all positive as the mud, heat, and mosquitoes must have been devastating to the inhabitants of the high, arid, and cold west. However, the economic opportunities and productivity of the east must have been impressive.

As negative were the effects of the war on the country in general, the conflict did stimulate recognition of the potential of the Orient, especially the northern Santa Cruz region, in contributing to national economic growth, which resulted in efforts to occupy and exploit the east. Colonization was a means of accomplishing the opening of the land.

Another factor which led to new efforts at colonizing the Oriente was the generation of an incipient movement toward reform of the resource distribution system of land tenure under

Presidents Toro and Busch from 1936 to 1939. A populist and radical movement began with the founding of several leftist parties, ranging from the reformist MNR to the revolutionary PIR and POR. Leaders came from disenchanted young members of the elite class, embittered by the wretched performance of government leaders during the Chaco War. These leaders had been older members of the elite. Miners were the central focal point of organization for improved working conditions, better wages, and eventually, the nationalization of the tin industry. Heavily populated agricultural zones, such as that of Ucurena in the Cochabamba Valley, became areas of foment for change and reform. Under the influence of radical students and Chaco War veterans, peasants began to organize. In 1936, a sindicato rural was formed and its peasant members took over their hacienda by assuming the rental payments. Local landowners quickly moved to end the control of the sindicato and were successful, but the transformation of rural resource distribution had begun. It culminated in the Revolution of 1952-53 which caused significant changes.

Colonization, from the beginning of the reform movement, was advocated as a way to provide land for the landless of western Bolivia and to improve national agricultural production.

Eventually, the Oriente, including the northern Santa Cruz region, was seen as a potential area for resettlement of highland peasants as part of the reform movement and to alleviate population pressure in the highlands. At first, though, it meant providing land for lowland-born Chaco War veterans in the northern Santa Cruz region.

The first colony of the modern period in Santa Cruz was founded in 1937. An engineer from the Ministry of War and Colonization led an army unit in building a road extending from Santa Cruz to Rio Yapacani towards Puerto Grether on Rio Ichilo. Along part of this road, the army unit cleared a small area of the forest and built simple shelters (see Map 2). Colonists, mostly local Chaco War veterans, were given agricultural tools, a year's supply of food, simple shelters, and fifty hectares of land. By 1940, 200 settlers had arrived, and the area had been named Colonia German Busch. However, the withdrawal of army assistance and administration in 1945 led to the rapid abandonment of the area. Hiraoka related this failure to (1974:132):

- 1) the lack of a dependable road to Santa Cruz, the major marketing center; 2) the absence of markets large enough to absorb the products; 3) the absence of a bridge across the Rio Yapacani, which seriously hindered traffic, especially during the rainy season; 4) the selection of colonists ill-suited to frontier situations; 5) the lack of administrative and technical assistance following the withdrawal of most of the colonization batallion.

The problems of the failure of this first modern pioneering attempt have recurred in subsequent efforts.

Colonization also took place as settlers migrated to the Chapare of the Cochabamba department, opening the Presidente Busch colony in 1938, to the Alto Beni of the Beni department in 1946, and to the Angostura-La Guardia area of the western part of the Santa Cruz department between 1952 and 1956 (see Map 3).

Other events during this first phase of modern pioneer colonization led to an expansion of the economy of the Oriente, one of which was the Bohan Plan of 1941-42, developed as the outline of U.S. aid to Bolivia. It was part of the wave of import substitution policies which was being attempted in many Latin American countries. This plan called for increased mineral production and export, development of a national road network, and expansion and diversification of agricultural production to replace imported goods and to sell in export trade. The last two goals affected the lowlands, particularly Santa Cruz. The call for establishing transportation routes led to the beginning of construction of the long discussed rail connections from Argentina through Yacuiba and Brazil from Corumba and the paving of the road from Cochabamba, all converging on Santa Cruz. While not directly affecting the transfer of population from the western region to frontier

colonization zones, the opening of the east to improved transportation and the increase of its production were part of its perception as a land of promise.

The goal of improving agricultural production led to the building during the 1940's, of new agricultural product processing plants, sugar and rice mills. Fletcher (1975) discussed the increase of ourput of refined sugar from zero in 1943 to 228 tons in 1952, and rice production in the same period rising from 3.5 million to 14 million tons. With the construction of processing plants, some of the region's population were stimulated to increase the area and intensity of commercial and food crop raising. The main participants in the increase were the finqueros who continued to control the land and labor. Others who benefitted from the growth of the processing industry included those associated with it, such as the owners of and workers in refineries, transportation entrepreneurs, and, to a lesser extent than all others, the agricultural labor force. This labor force became increasingly constituted by highland peasants who would migrate seasonally for the zafra or sugar cane harvest. This seasonal flow became an important way of stimulating pioneer colonization, as it introduced potential pioneers to lowland economic opportunities.

Background to the Second Phase of Modern Pioneer Colonization

In April of 1952, the MNR Party took control of the Bolivian government. It is a well-documented and well-studied phenomenon (see Malloy and Thorn, 1971; Malloy, 1971; Alexander, 1958). The most important event of the revolutionary process for the interests of the study is the Agrarian Reform Decree of August, 1953. Relevant to the development of the Santa Cruz region was the decree's proclamation of the end of the hacienda or latifundio system, the need for colonization and occupation of the Oriente, and the importance of increased agricultural production to enable the country to be initially self-sufficient and later an exporter of crops for (see Heath, 1959).

The first part of the decree called for the end of the hacienda system of land tenure and legalized many of the land seizures carried out by peasants in 1952-53. It affected the northern Santa Cruz region because it declared that land not held by clear title could be seized and allotted to someone else. In this area that had traditionally been thinly populated, few large landholders had ever bothered to secure title to the land which they claimed. With the Agrarian Reform Decree, if a large landowner could not prove that he had title to his land, and that it was being used productively, some or

all of it could be claimed and expropriated. Thus, the sharecroppers, daily wage workers, and squatters attempted to claim part of the large estates on which they had lived and worked in the past. The seizure of land by tenants began soon after the decree, but never was as extensive as in parts of the highlands.

Many of the *figueros* of the region exercised options to increase the productivity of their efforts primarily through the credit program established by the new national regime. By obtaining credit for new seed, larger storage facilities, and modern agricultural machinery, the large landowners could increase production, and as, if not more important, create the image of being agro-businessmen rather than 'feudal landowners'. By renting the equipment at a fixed rate in a period of extremely rapid inflation, those able to afford initial payments could easily make a profit on the use of machinery. With the monetary stabilization of 1956, some of these large landowners quickly got rid of the machinery they were using and returned to less productive techniques, such as labor intensive cropping and fallowing for long periods. However, the increase in production did add to the impression held by government planners and highland peasants that now Santa Cruz was a land of promise.

Another effect of the declaration of the end of the hacienda system was indirectly but profoundly relevant to the history of pioneering in the northern Santa Cruz region. In the highlands and associated valleys, land seizure and parceling of former estates led to the marked increase of minifundia or small, dispersed plots. Some of these were maladaptive as population pressure on existing land resources increased and participation in the cash economy grew (see Heath, Erasmus, and Buechler, 1969; Carter, 1964; McKewen, 1975).

This is not to agree with those authors who have stated that population growth and the creation of minifundia were generalized phenomena in all of the western part of Bolivia. Limited areas of increased population pressure and maladaptiveness of dispersed small plot agriculture did exist. This occurred because of the presence of one or more of the following conditions: an inheritance system in which all males received land equally; localized areas of high population density; concentrated fertile agricultural and rich pastoral resources; and most significantly, increased participation in the cash economy. These kinds of conditions were most evident in the northern part of the Department of La Paz, the Cochabamba Valley, the lower elevation valleys around Sucre, and the valleys of the southern part of the Department of Potosi, particularly the Tupiza Valley.

In Andean rural areas which have large population concentrations, land with good growing and pasture producing characteristics has been in heavy demand since human populations began agricultural and pastoral exploitation. The division of these areas into dispersed small plots can be very rational when considered in conjunction with networks of exchange of products between extended kin utilizing various niches in a range of altitudinal levels (Murra, 1972, labelled this the "vertical archipelago"). These networks arose as an extremely adaptive socio-economic production and exchange system before the Inca empire. Barter and trade is documented over wide areas from Inca times onward. This system has largely continued through the Colonial and later eras to the present. It is even the model for a new scheme for economic development organized by Bolivian social planners called ayni ruway in Quechua, or to create through cooperation.

A further fact which illustrates the rationality of dispersed small plots is that the primary subsistence crop at high altitudes, the potato, is produced through cloning. Varieties become extremely specialized or adapted to micro-habitats and will yield only in these limited zones. Another aspect of the high altitude environment proves the rationality of this kind of farming; micro-climatic events, particularly localized hail storms, which can destroy entire fields. Security of having some harvest is gained by dispersal of plots (Blair, personal communication). Subsistence needs

can be met quite effectively in areas of high population concentration with dispersed small plots or minifundia, especially if the traditional exchange systems continues to effectively function.

Pressures for migration arise when individuals or groups have elected to participate in the cash economy. The dispersed small plots they had been using prove inadequate to meet the new need for quantity production of marketable commodities. The former system of dispersed small plots and exchange between extended kin who exploited various altitudinal levels, thus, became non-rational in the context of the desired market participation.

Further, when expansion of production was undertaken by highland individuals or groups, there has been a lack of investment by national and international development agencies in facilitating resource exploitation, such as improved pasture for camelid raising and wool sale. Even more critical has been the lack of development efforts to supply infrastructure such as roads and water systems. The former would help greatly in enhancing the marketing of products and the latter would be an aid in the improvement of hygiene and health. One can reasonably assume that the lack of effort to support, enhance, or create conditions for economic betterment in the rural areas of the highland has been part of overt and covert decisions to encourage migration.

On occasion, economic investment has exacerbated the difficulty of highland rural life. A prime example is the new mineral refinery at La Palca, 15 kilometers north of the city of Potosi. The plant will draw its water for processing from a small local river. The plant's feeder pipes will eliminate the water supply of the entire length of a formerly agriculturally productive valley which, by irrigation, has supported approximately 500 peasant families. The effuse which the plant produces will make the river's downstream flow poisonous and unusable. The extreme example of this mineral refinery illustrates a general tendency to overlook, if not inhibit severely, rural productivity in the western region. This tendency is significant to note because it has been too easy for some writers and government authorities to attribute migration to processes of natural population growth and inherent difficulties of the highland peasant existence, and not to processes which can be affected by development efforts designed to create conditions which might stimulate economic growth in western rural areas without population transfer.

Migration has occurred in three forms. The first is the most significant in terms of quantity. It is the movement of rural peasants to the cities, rural to urban migration. Three cities, La Paz Cochabamba, and Santa Cruz, have been the target of most of this relocation. One rationale for encouraging this migration could have been the desire to provide a labor force

for industrialization, but industrialization has been extremely slow. The result of rural to urban migration has been an increase in unemployment and underemployment.

The second form of migration is the movement to foreign countries, primarily to Chile or Argentina, although there is some migration to Brazil and Peru. The duration of the move ranges from seasonal to permanent. Most often this is migration to agricultural areas, such as the Arica Valley of northern Chile or the sugar or tobacco regions of northern Argentina, where migrants work as part of a landless labor force or rural proletariat. It is significant that this movement is a more or less permanent part of the adaptive strategies of many Bolivian highland rural peasants. While being an important means of survival for these people, it is an indicator of their inability to maintain themselves adequately through use of resources in their areas of origin.

The third form of migration is rural to rural migration within Bolivia. The seasonal movement of western rural peasants to the Oriente to work on large commercial or agro-business enterprises is one part of this kind of migration. The other principal form of rural to rural migration is the object of study here, pioneer colonization or the settlement of frontier areas for agricultural and cattle-raising exploitation.

The high levels of investment in support of colonization and of the agro-business enterprises in the east indicate the skewedness of regional emphasis for development funding by governmental and international sources. Ladman and Tinnermeier (1979) present evidence that the crisis of the Bolivian Agrarian Bank is due to speculation and boom and bust in cotton raising in the Santa Cruz department. Wiggins (1976) and Kitt (1977) indicate that support of colonization by the government has been mainly designed to produce a landless labor force or rural proletariat for the agro-businesses.

The present study will return to this issue, but it is important to recognize that regional imbalance in development investment, what some have called the "Santa Crucifixion" of Bolivia, has played a major role in the production of migrants from the highlands to the lowlands. Wiggins (1976) is too extreme in stating that colonization leads only to a decline in living conditions, socio-cultural disintegration, and proletarianization. Zeballos (1975) presents data that show that income, one indicator of life condition, rises for the average pioneer migrant to 2.7 times the average highland peasant farmer. The transitional process of adaptation for the pioneer cannot easily or simplistically be labelled negative or positive.

To return to 1952-53, the MNR government established a policy of encouragement of colonization in 'unoccupied' territory in the eastern lowlands, rather than investment in increasing productivity in the western highlands. Lands inhabited only by indigenous populations are often considered 'unoccupied' by the planners and promoters of frontier settlement (for the case of eastern Ecuador, see Whitten, 1976; for the case of eastern Bolivia, see Riester, 1975).

Most important in the decision to advocate and develop colonization of the Oriente were: (1) the comparatively lower costs of parcelling out unclaimed land, rather than change the distribution of agrarian resources in the highlands; (2) the need felt by the government to occupy national territory only tenuously connected to it (Bolivia has lost half of its original land since winning its independence from Spain in 1825); (3) the anticipation of profits from mineral and timber resources in the lowlands; and (4) the decrease of chances for a realignment of the distribution of power in the more heavily populated part of the country. The last point has been discussed earlier in the identification of the tendency to avoid investment in the economic development of rural peasant groups through expansion of their productivity and ability to generate income in their highland areas of origin. On a macro-level, the decision to develop the east was an example of the working of hierarchical resource control which is basic to

the model of the process by which a population, in this case a nation, generates pioneers. The Oriente was adopted as the target of settlement because of its traditional image as undercrowded, if not empty. Its resources, in large part, were not yet distributed and, therefore, the granting of land would upset no significant part of the existing power structure.

Modern Pioneer Colonization - Second Phase 1952 to the Present

Since 1952, many pioneer settlements have been established in the eastern region of Bolivia. The best way to begin discussion and examination of the process of pioneer colonization, especially the nature of the adaptive process of the migrants, is to identify a typology of frontier settlement types.

In the process of adapting to a new environment, three settlement types have emerged among the frontier colonists (see Table 3). The first are those called oriented or directed. These are the object of heavy investment of national and international funding and personnel. There is a high degree of selection of colonists, much material support given to them, and close supervision and direction of their activities. The second category is called semi-oriented or semi-directed. These are settlements which receive limited infrastructural and

logistical support from the government and/or international sources. Typically roads, houses, wells, schools, and health services are promised and to some extent provided for these settlements. The third category is that of spontaneous settlements. These are colonies founded completely at the initiative of migrants. No governmental or other support is arranged, although if successfully established these settlements have often found means of obtaining needed infrastructure and services. The first two categories are responsible for the settlement of about 15% of the total pioneer colonist population and the third category for the remaining 85% of the frontier migrants.

It is important to remember that this typology was created by those implementing the projects and programs of colonization, including the Bolivian government, international organizations, and foreign governments. The kinds of programs offered and services and infrastructure provided, both physical and social, helped structure the opportunities available to settlers and create perceptions about opportunities, which was a crucial part of the process of adaptation to the new environment.

The first colony of the directed or oriented type was the Cotoca settlement founded in 1954 to the east of the city of Santa Cruz (see Map 2). It was subsidized by the United Nations' Andean Mission, the Bolivian Development Corp. (government agency), and the Civic Action Program of the

Bolivian Armed Forces. Food, shelter, seed, and even a monthly salary were provided the 100 colonists by the agencies. Hiraoka's criticism (1974) of the German Busch colony is very relevant here: a high level of paternalism and dependency were created limiting colonist initiative or sense of control of their own lives and property; it was not an area particularly suited to agriculture; colonists were selected who had little or no experience in or knowledge of tropical agriculture; and marketing was difficult due to poor transportation. It was a project "characterized by its excessive paternalism (defined as the dependence of colonists for all means of livelihood), interventionism, and its high cost" (Ziarten, 1971:4).

Next to enter the area of colonization promotion and assistance were the United States Agency for International Development (hereafter USAID) and the Inter-American Development Bank (IDB). In conjunction with the Bolivian Development Corporation, they undertook a directed colonization project at Caranavi in the Alto Beni region of the Beni department between 1960 and 1962. It was very similar to the Cotoca project in its excessive paternalism and use of land not recommendable for agriculture. Further, it "wasted money on services other than those essential, did not complete assignment of land to colonists, was slow to distribute titles to land, and badly located community centers" (Ziarten, 1971:5).

Directed colonization has been subsequently undertaken in the Yapacani region of the Santa Cruz department, in the Chimore region of the Cochabamba department, and in the Alto

Beni region of the Beni department. Many criticisms from development analysts and lending agencies were made of these first efforts in the 1950's and 1960's. A number of the more important early studies, including Marus and Monje Rada (1962), Patch (1962), Ferragut (1961), and Cappeletti (1963, 1965), were undertaken to understand and evaluate the problems. Out of these works came a recommendation to organize all agencies and institutions dealing with colonization in one agency. In 1965, the Instituto Nacional de Colonizacion (INC) was established. The first major effort of the INC was the directed settlement of the Chimore, Alto Beni, and Yapacani regions in cooperation with USAID and the IDB. While considered more successful than earlier projects, these settlements have been plagued with many of the same problems.

The San Julian project, since the start of the Orientation Program and the use of the nucleo settlement pattern in 1972, has been a zone of directed colonization. However, in many ways, it must be considered quite unique.

The second category of colonies are those labelled semi-directed or semi-oriented. This kind of colonization began with the Aroma colony founded in 1954 to the northeast of the city of Santa Cruz (see Map 2). The Bolivian Development Corporation and the Civic Action Program of the Bolivian Armed Forces agreed to provide limited aid, including land clearing, house construction, and seed for the first harvest of the new colonists. Semi-directed colonization was a classic example of the Bolivian proverb "entre hecho y dicho hay mucho trecho"

(between what is said and done there is a great deal of distance). In the case of Aroma, as in the cases of Huaytu founded in 1954, Cuatro Ojitos founded in 1956, and Caranda founded in 1955, there were severe problems for the colonists. Delivered help never matched that which was promised, even though the promised help was minimal. The programs of settlement were never financially secure, decreasing both effectiveness and continuity of development efforts. The transition from the military land-clearing activities to the next stages of extension and social services by civilian agencies was badly planned and poorly executed. These projects also suffered from at least some of the problems which have been mentioned for directed colonization, especially those related to selection of inappropriate areas for settlement and poor transportation infrastructure.

The third category of colonies are those labelled spontaneous. Approximately 85% of the settlers who have migrated from the western regions of Bolivia to the eastern regions have done so spontaneously. Typically, small or large groups of migrants move down petroleum exploration trails, along penetration roads built into areas of projects of directed settlements, or locate on the margins of areas designated for directed colonization. Settlement has often been a several step process. The first step is the movement to the east for seasonal labor in the sugar harvest or zafra of the northern Santa Cruz region. During this period, new

agricultural techniques are learned, the climate is assessed for tolerability, and the social and economic environment is studied by potential migrants. This can be done by a male household head, a married couple, a group of male members of an extended family, or an individual peasant, or any combination of the above. If conditions are judged favorably, the migration of entire nuclear or extended families or segments of these families will take place. Another form of organization of spontaneous settlers is that of sindicatos or syndicates which occupy and claim land as a unit. Spontaneous migrants, thus, benefit from a process of self-selection and self-organization.

Several excellent studies including Wessel (1968), Henkel (1974), and Zeballos (1975) present data which support conclusions that "public investment in spontaneous colonies produces higher economic returns as compared to oriented (directed) groups" (Zeballos, 1975:40). Most government reports downplay this data, an understandable bureaucratic self-defense reaction. One major reservation concerning the conclusion of the above authors which seems valid is that the sponsored or directed settlements have been more closely observed and analyzed than the spontaneous settlements. The suffering in spontaneous zones due to difficulties of adaptation has not been assessed with anywhere near the detail it has been in directed and semi-directed efforts. An exception is the work of the Weil's (see Weil, 1977). However, these authors are correct in stating that the spontaneous pioneer colonists have been more successful. Spontaneous

colonists have usually a greater deal of ability to enter into commercial production and thus have higher incomes, and have a greater stability in their settlements. These are the usual determinants of success in colonization evaluation and will be examined critically later.

In the particular colonization zone on which this study focuses, the San Julian project, migrants are settled under the auspices of a comprehensive scheme which combines elements of directed and semi-directed efforts. However, most of the pioneers of the project have lived and worked to some extent in the lowlands of the Santa Cruz department prior to moving to San Julian. This experience ranges from a brief period of seasonal labor on the agro-industrial farms where cotton and sugar are grown to work as a laborer for small farmers in other colonization zones to holding and farming land of their own in other zones in the lowlands. Therefore, San Julian is, for the majority of its inhabitants, simply a new part of an overall pattern of step migration.

Kipp points out the steps of migration as: 1) foraging, the temporary foray into neighboring regions in order to supplement local resources while maintaining primary identification with the home community; 2) circular migration, the establishment of relatively permanent ties between sending and receiving communities and the periodic movement of migrants between them with the appearance of double identification on the part of the migrant; 3) permanent emigration, a change of

residence and a shifting of the migrant's primary identification from home village to the migrant community (Kipp, 1978:210 from Graves and Graves, 1974). The majority of settlers in San Julian are in the second and third steps of migration. Within that process there is an interesting pattern, the ability and desire to integrate more than one location in the lowlands through a pattern of multiple resource exploitation. Conaway saw this as a process of circular migration; the "combination of rural, home base subsistence economy and a town or urban capital earning economy" (Conaway, 1977:28). The migrants of San Julian have an even more complex variety of combinations of resource use patterns. At this point, it is important to see that they are people who settle in the zone because of their own decision to include farming there as another of the options they have explored and will explore in the process of migration.

One other form of colonization is that of foreign immigration. Japanese, Rykyuans, Okinawans, Canadian and Mexican Mennonites, and Italians have all settled in the Santa Cruz area. The Asians have been aided to a great extent by their governments and the Mennonites brought with them a great deal of capital and equipment. One important study of the Japanese at San Juan de Yapacani exists (Thompson 1970). They will be mentioned here only in relation to their part in the adaptive process of pioneer colonists that migrate to the Oriente from within Bolivia. For example, the colonists at the

Okinawa colony now serve as employers of Bolivian peasants in seasonal labor and as buyers of cash crops, often from the same peasants. Another example is the colony founded by Mennonites who had been living in the Chihuahua state of Mexico which serves as a market for some product of the pioneer colonists in the San Julian project.

This chapter has provided the historical and contemporary background to pioneer colonization in Bolivia. In particular, some of the problems or difficulties that are involved in the adaptive process are evident. These arise from the need to establish interdependencies and exchanges with the new or frontier ecosystem, all aspects mentioned in the model of the adaptive process presented in the last chapter. Next, attention will be turned to the specific colonization zone of San Julian, how it became an area of pioneer settlement, and the structure of the ecosystem it provides for adaptation by the settler.

CHAPTER THREE

THE SAN JULIAN ECOSYSTEM

Introduction

The ecological setting of the San Julian colonization zone has shaped man's attempts, over the years, to settle in this area. Many of the ecosystem components function as stress factors for human adaptation. A stress factor is defined here as one which affects the formation of strategies in the adaptive process of the pioneer farmer. These may be negative or positive. This chapter will provide a basic understanding of geo-physical and biotic components of the ecosystem.

Review of the history of human use of the area will begin with an examination of the human component of the ecosystem. This chapter will only briefly describe the place of humans in the ecosystem prior to the beginning of the colonization efforts of the last ten years. After presentation of this material, the next chapter will detail the evolution of the integrated development program which promotes and structures the settlement of the highland migrant population.

Geo-Physical Components: Precipitation

The northern Santa Cruz region, of which the San Julian zone forms a part, contains a variety of ecological settings. The variety arises largely from two sources, topography and

precipitation. The former will be discussed below. Concerning variability of precipitation, Hiraoka comments (1974:19):

The heaviest rainfall is confined to a narrow belt of about 50 to 80 km.'s bordering the northeastern face of the Andean foothills... the yearly average is 3600 mm. ... while at the Japanese colony of San Juan de Yapacani 65 km. to the east of Rio Ichilo the amount is 1900 mm. ... to the east and south where there are no mountain barriers, precipitation averages decrease to about 800 mm. per year.

The variability of rainfall is also found in its seasonality or periodicity. In the wetter areas to the west in the Andean foothills the rainfall is distributed throughout the annual cycle. Moving east and south of the area, the rainy season lasts from October to March and the dry season from April to September. These seasons correspond respectively with the high sun period or summer and the low sun period or winter.

Precipitation usually takes the form of strong, sometimes sustained, heavy rainfall, rather than frequent but less severe showers.

The San Julian zone lies approximately 150 to 200 km.'s east of the wettest part of the northern Santa Cruz region (see Map 2). It has a wet, high sun or summer season between October and April and a dry, low sun or winter season between May and September. Rainfall has been infrequently and inadequately measured, but estimates range from 850-900 mm. annual average in the southern part to 1100 mm. annual average in the northern part of the zone. Variability and frequent

unpredictability of seasonal precipitation are major geo-physical stress factors for human adaptation, especially by agriculturalists. This is obvious because the pioneer farmers at present rely solely on rain-fed cropping. One example of the effects of variation in rainfall in the zone is the fact that corn yields are higher in the drier, southern parts and rice yields are higher in the wetter, northern parts. Precipitation will be of major concern in the design and implementation of agricultural production development efforts in the zone. Short, medium, and long-term effects of land clearing on precipitation have been a major ecological concern in colonization in tropical and sub-tropical areas. Lord (personal communication) specifically commented about San Julian that there is a possibility for a general dessication of the land through the effects of land-clearing on precipitation and wind patterns.

Geo-Physical Components: Temperature and Wind

Hiraoka cites data that the "mean temperatures in the plains around Santa Cruz are fairly uniform throughout the year, ranging between 23.9°C. and 24.4°C." (1974:24). This is somewhat lower than many tropical lowland regions because of the phenomenon of the surazo or southern wind. These are polar fronts which arrive frequently and throughout the year from the south. They originate from air mass movements in the Antarctic region and pass through the interior of southern South America up to the Santa Cruz region. Temperatures remain below normal for several days to two weeks after the arrival of surazos.

Marked temperature variation was noted by the author in the period of field work. In the early summer period of late October several days of temperatures of 40°C. and higher were recorded, while one front of southern winds arriving in the winter period of mid-August dropped temperatures to 0°C. One estimated average of annual temperature is 22.6°C., most probably a diurnal average. The generally high temperatures, occasionally extremely high, serve as moderate to acute stress factors for the highland migrants whose previous experience have been largely in much cooler environments. Land clearing in the process of colonization may very well have the effect of permitting greater extremes in temperature fluctuation, particularly at the previously covered and shaded ground level.

Wind, sometimes very strong, but almost always present is also a major stress factor. The arrival of the surazos are usually accompanied by strong winds. The southern polar fronts can include heavy rainfall, especially in the low sun period, but they can also be free of precipitation. Hiraoka also discusses the (1974:25):

fairly strong winds of equatorial origin
(which) blow throughout the year from the
northwest, but their intensity is
increased from September to February when
the southern winds become more frequent.

These winds are called nortes because of the northwestern direction of their origin.

Winds can be a severe stress factor for colonists in several ways. First, winds are relied upon at the crucial point of burning in the slash and burn cycle. Their absence,

especially if prolonged, or arrival from a direction not anticipated can lead to failure to get a clean burn, or even to damage to structures and people. Another major stress produced by the winds is that of eolian, or wind borne erosion. Winds, either from the northwest or from the south, are recurrent, almost constant, throughout the year. Dust is often picked up from roads or cleared fields, which can be health hazard and cause the loss of valuable topsoil. Further, the arrival of strong winds at the time when grain crops are ripe for the harvest can cause heads of grain on the stalks to blow to the ground and be lost. Intercropping of taller and shorter plants and the growing of trees as windbreaks serve as adaptations to this problem and must be included in any efforts to improve agricultural production.

Geo-Physical Components - Topography and Soil

Hiraoka identifies three major topographical areas in the Santa Cruz region which are "1) serranias de Santa Cruz, Florida, y Limón: 2) Cerros de Caranda-Colpa; and 3) Llanos de Norte de Santa Cruz" (Hiraoka, 1974:29). The first two will not be discussed here as they are markedly different from the last in which most of the agricultural colonies are found, including that of San Julian. The flat plain called the Llanos de Norte de Santa Cruz or Llanos de Grigotá lies to the east and northeast of the Andean foothills stretching to the beginning of the Brazilian Shield at the Rio San Julian. Elevation ranges from 410 meters above sea level at the city of

Santa Cruz to 220 meters at the confluence of the Rio Grande and the Rio Ichilo. There is only one area where the undulating plain is broken by low hills, near Santa Rosa, 80 km. north of the city of Santa Cruz.

The plain contains four major streams: the Grande, Piray, Yapacani and Ichilo. These slowly wind through the region in broad and shallow channels. The courses of these rivers often change especially after rainy season floods have swelled their size and caused them to overrun their previous banks. There are also streams which usually hold water only during the rainy season. They are variously known as arroyos, quebradas, and cañadas. They can also change their course from year to year, but more often re-appear in the same location depending on seasonality of precipitation. They are of major importance in relation to road building activities, as they can seriously hinder traffic by washing out roads built during dry seasons when they were not present or not easily apparent. A final feature of topography of the area are the numerous swamps or curiches. These are low-lying depressions, some of which hold water year-round, others of which do not. They are significant to the human population because they serve as breeding areas for the many species of mosquitos, and as water sources for domestic animals.

The San Julian colonization zone lies on the eastern edge of the Llanos de Norte de Santa Cruz between the Grande and San Julian rivers (see Map 4). The hills which mark the beginning of the major geological feature of the Brazilian Shield begin

just beyond the present eastern edge of projected colonization near the San Julian river (also called the San Pablo). The area has no marked topographical variation, with an estimated grade variation of only 0 to 2% (See Photograph 1). No change in this relief occurs until after crossing the Rio San Julian. Elevation ranges from 230 to 250 meters above sea level.

There is one large stream which did not appear to hold water throughout the year, at least during the period of fieldwork. However, the only flowing water courses present in the colonization zone are those called quebradas or cañadas which can be found in many locations during the rainy season. Low-lying swampy areas or curiches are found in many locations within the presently settled area and can be extremely large as in the case of nucleo 13. They become even greater in size in the northern and eastern part of the colonization zone. For example, a 500 to 700 meter diameter swampy area is located where the center of nucleo 35 should be situated, and a swamp approximately 1 km. wide lies immediately east of the nucleo centers of Nucleos 30 and 33.

The topography and water courses of the San Julian zone offer some stress factors to the pioneer farmer population beginning to settle there. The flatness of the terrain means that there is little opportunity for water erosion. However, the winds blowing almost constantly over this flat area, once it is denuded by the expansion of agricultural activities, could cause much eolian erosion. The water courses of the zone

offer stress in the form of damage to roads, many of which were built without a thorough survey of probable tendencies of water movement. A recurrent complaint and significant economic problem was the cutting of roadbeds by flows of water in quebradas and cañadas. These rainy season streams did offer a welcome protein food resource in fishing. The curiches are another stress factor in the environment because they are the breeding grounds for numerous species of mosquito. They also inhibit some kind of cropping, but they are good areas for rice production. Curiches are also favorably viewed if they hold water year round and can supply water for animal raising.

In relation to water and its seasonal flow, the activities of opening of settlement in the San Julian zone cause significant modifications in two ways. First, land clearing activities lessen greatly and almost eliminate the forest cover which previously broke the force of falling rain and kept much of it from immediately reaching the ground. There was, therefore, a greater chance for absorption of water below the surface. Land clearing means that there is and will continue to be a greater tendency for runoff of precipitation. Secondly, the numerous raised road beds with their accompanying runoff ditches form a system of dikes and canals for channeling the greater runoff. The localized flooding of the center of nucleo 13 in December, 1977, was attributed by project officials to the effects of the access road bed in creating a dike across a previously existing flood plain. The realized and potential effects of road construction are not all

negative. Channeling and pond construction along the German Highway has provided an area for dry season animal and human bathing water supply and pond construction has been proposed along the Brecha Casarabe in order to support pisciculture experiments. However, the alteration of drainage and rain flow patterns is an important fact of the colonization process and must be included in planning and construction.

The soils of the northern Santa Cruz region are mostly alluvial in origin. The major streams of the region have worked for a long time to bring deposits to the area from the mountain regions to the west and south. Hiraoka notes that "soils developed on such terrain are strongly influenced by materials brought from the source region," affecting color, consistency, and chemical structure (1974:30). Three basic types of soil in the region are podzolic soils, sandy regosolic soils, and alluvial soils. The latter is the primary type being agriculturally exploited in the northern Santa Cruz region and covers approximately 70% of the area. Within the region (Hiraoka, 1974:53):

probably the best agricultural soils of the region are focussed on moderately to well-drained interfluves, located usually on flood-free zones...a typical soil under forest cover consists of a top layer of dead leaves or branches (2-2.5cm.) followed by a brown to yellowish brown horizon of friable silty clay loam (0 to 30cm.), in which the particles form a weakly to moderately developed granular structure. The third layer consists of similar materials and structure. Below this stratum, a deep deposit of friable yellowish brown silty loam with weakly developed structure continues.

Information specifically about the soils of the San Julian zone is found in a massive study of the agricultural potential of all the territory of Bolivia (Cochrane, 1973). There are two zones differentiated by the direction of their drainage. The first area called the Rio Grande Norte is an area of old alluvial deposit from the Rio Grande. It drains toward the north and west and includes some 189,000 hectares. Cochrane comments that (1973:358):

The soils of all the region are quite uniform. The topsoil is generally brown with moderately subangular blocked granular structure, they are silty clay with a lighter sub-soil which is weakly structured and generally heavy (becoming clayey in wetter parts of the year). Carbonate precipitation is often seen in the soil...The soils have been classified as entisols...Analysis would indicate that soil fertility is satisfactory.

The second area that Cochrane identified as part of the San Julian colonization zone is called Rio San Julian Viejo. Drainage is towards the Rio San Julian, however, some areas are low and water stands during part of the year. Cochrane notes that (1973:315):

Soils are brown, muddy to clayey with a moderately subangular blocked granular structure, and moderately developed and mottled in the subsoil. Internal drainage varies from moderate to slightly imperfect. The soils in general are well-drained and the fertility is good.

The determination of the agricultural potential of the area was the primary purpose of the study he conducted. This

is also a major stress factor in the development of adaptive strategies by the pioneer farmers. Cochrane cites as suitable a category of crops he calls "semi-humid" including: cotton, rice, camote (a sweet potato), sisal, kenaf, mocorroro, peanuts, mijo digitado, corn, sicino, sorghum, soy beans and manioc. However, he strongly emphasized the area's potential for the growth of pasture grasses in support of beef and/or dairy cattle raising.

Biotic Components: Natural Vegetation

The northern Santa Cruz region contains two major types of natural vegetation. North of a line roughly connecting Buena Vista to Puerto Banegas is the "monte grande" (Hiraoka, 1974:42). This is, or was before the arrival of agricultural settlements, "a magnificent selva... with a canopy (averaging) between 25 and 35 meters, while the second layer, often hard to distinguish, rises to a height of 15 to 25 meters... the ground is covered by mosses, ferns, and grasses, with shrubs and bushes sometimes reaching as high as five meters" (Hiraoka, 1974:42). As one moves eastward and southward from the Andes, in the general direction of the San Julian zone, "the top layer becomes more open and undergrowth increases... the plant cover also decreases in height along water courses and around curiches" (Hiraoka, 1974:44). Before incursions by loggers or pioneer farmers (Hiraoka, 1974:45):

an average hectare in such a forest contained between 30 and 40 different species and density varies between 300 and 400 trees per hectare... the highest story of the selva is dominated by straight-boled massive trees... many of economic value, such as, mara (swietenia mahogani), ochoho (hora crepitans), tajibo (Tecoma spp.), cedro (cedrela fissilis), almendrillo (tarralea opositifolia), and verdolaga (Pdocarpus angustifolia).

The utility and economic value of a number of these species will be noted below.

The palms which dominate the middle layer of the monte grande include species such as the motacu (Attalea princeps), chonta (Astrocarium chonta and Guilielmo insignuis), pachiuba (Iriarteia exorrhiza), sumuque (cocos botriphora), sancudo (Iriarteia spp.), Palmito (Iriarteia phaecarpa) and cusi (Orbignia phalerata). Hiraoka cites evidence which was borne out by the author's field experience that (1974:46):

the height, density, and composition of plant cover serve to diagnose the underlying terrain conditions... the pampa mojada a grassland patch found in the forest, indicates not only poor drainage but also the presence of an impermeable hardpan about 50 to 80 cm. below the surface...dense stands of motacu and cusi palms...indicate terrain below the normal drainage level...terrain with good drainage is indicated by the predominance of ferns in the shrub layer."

To the south of the Buena Vista-Puerto Banegas line "the lesser precipitation, coupled with greater seasonality and unreliability of rains, causes the canopy to become increasingly open, the trees to be shorter, and the proportion of deciduous plants to increase" (Hiraoka, 1974:46). This is the area called the Bosque Ralo with a canopy of 20 to 25 meters

and a density of approximately 370 trees per hectare. Economically significant trees include the tajibo (Tecoma ipe, Tecoma ochracea) and the cuchi (Astronium graveolens). Palms compose the intermediate layer, the carondai (Copernicia cerifera) and the totali (Acrocomia totali) are the most abundant varieties.

As stated above, the San Julian colonization zone is a transitional area. Most of the zone can be characterized as belonging to Hiraoka's monte grande type. In areas not yet heavily affected by logging and/or settlement, the top canopy of hardwoods with the associated middle layer of palms still stands. Cochrane (1973) stated that both of the sub-types of land use areas he identified in the zone are seasonal deciduous forest with a canopy to the height of 25 meters.

The problem in the application of either typology is that they are gross categorizations which result from limited study of one particular area, in this case the San Julian colonization zone. Within the area of present settlement, there is variation evident on the ground and in aerial survey. The southeastern edge of the zone, towards the spontaneous area of Los Angeles and nucleos one through nine are closer to the Bosque Ralo type of Hiraoka's classification (see Photograph 2). However, the marker of drier zones, xerophytic vegetation, do not appear in abundance. Where great disturbance by logging and settlement have not taken place, the canopy appears thinner and not as tall as the more northern part of the zone. Palms, particularly the motacu predominate, though, as they do further

north. Moving north, the canopy is taller and thicker, with the economically valuable hardwoods of the monte grande appearing in greater numbers (see Photograph 3). Motacu palm constitutes up to 50% of the trees, as shown in the transects in Table 4 (the author is indebted to Rexford Lord, Center for Human Ecology and Health, Mexico City for this information). However, the zone in the north has been heavily harvested for up to 20 years and it is difficult to understand what the area's natural vegetation was before this alteration. The phenomenon which Hiraoka (1974) mentions of abundance and concentration of palm species as indicative of areas of moderate to poor drainage was confirmed by ground observation. Further, it was noted that areas of extremely low growth or grassland patches indicated areas of hard sub-surface pan.

The natural vegetation is an important factor in the formation of adaptive strategies of the pioneer farmer. Positive effects are numerous as much of the flora is useful and some can even offer income production. All construction materials during the initial phase of settlement come from the hardwoods and palms of the forest. Useful hardwoods include the ochoo, crupau, and mara, and the useful palms include the motacu, chonta, and sumuque.

Income could be produced from the sale of the valuable hardwoods such as the mara, tajibo, cedro, and ochoho; but past and present logging has robbed and is robbing the settlers of a return on these trees. Much of the colonization zone has been

the object of intense legal and illegal lumbering by local large landowners, other entrepreneurs, and even government officials and agencies. Some informants intimated that the entire colonization scheme was really only a means of building roads for the benefit of timber interests. It is not likely that is really the case, but it is true that the pioneer farmers, except in a very few cases, have not received the value of the economically profitable species on their land. The pioneers live with this problem and it has caused repeated confrontations and conflicts with local large landowners, the INC, and other persons. Some farmers have used valuable timber overlooked or left behind by loggers for construction or for production of charcoal for sale, but few if any have directly profited from sale of timber on what supposedly is their own land.

The natural vegetation has another positive effect on adaptation of the pioneer farmer in its provision of a habitat for numerous game species. The importance of the fauna will be examined below, but here it is necessary to point out the crucial role played by the undisturbed forest as an ecological setting for animal life. Further, natural vegetation serves as a wind break, cutting down on wind erosion, a major potential problem noted above.

The flora of San Julian zone can also be a negative factor in the process of adaptation of the pioneer farmers. First, there are some species, notably the palo santo (Triplaris caracasana) and the una del gato trees, that can cause problems

ranging from minor irritation to severe disability. The palo santo is a problem for those not knowledgeable of the environment, as the author can personally attest, but becomes rapidly recognizable. The tree is the habitat for colonies of a species of ant which has a highly poisonous bite. It is most prevalent in previously uncleared forest. The una del gato is just one species of thorny trees and bushes found in primary and secondary growth.

There is a fundamental question relating to natural vegetation which involves the strategy of clear cutting almost all species, except the motacu palm, during the land clearing phase of the slash and burn cycle. Recent observations by an ecologist noted the waste of many valuable species by clear cutting (Lord, personal communication). Typically, only motacu palms, left for their production of leaves for roofing material, and palo santo trees, left because they are too dangerous to try to fell, remain standing before a plot is burned. Plans exist to leave a 500 meter wide green belt of untouched forest between settlements. It is hoped that they remain in force when farmers reach the limits of their farm allotments. The author recognizes the need for land clearing. Care must be taken, however, for the maintenance of windbreaks and growth of economically valuable species, valuable both for construction and for income generation. Further, the elimination of a major source of oxygen production and other macro-environmental effects of the alteration of the environment must be monitored.

Biotic Component: Animal Species

The northern Santa Cruz region originally had abundant animal life, from insect to reptile to mammal life. The most useful approach here is simply to mention the more important animal varieties found in the San Julian colonization zone and to discuss their impact on pioneer settlement.

Insect species include several major categories. There are various ants such as the tiny red biting and stinging ants of the palo santo tree, the tropero or cazador (army) ants which march in long files and attach all living things in their path, the large black elephantine ants that reach 2-3cm. in length, and other numerous species. There was an incredible variety of butterflies and moths. In their caterpillar phase, some of these species can be a major stress factor by eating plants grown by farmers and by providing an irritating or poisonous sting. There are also many grasshopper and cricket species in the zone. Finally, in this brief look at insect species, it is necessary to mention the many mosquito varieties, all of which the author had close experience. This includes the anopheles species which is the carrier of the malaria plasmodium to humans.

There are also many arachnids in the San Julian zone. There are black widow spiders, several varieties and sizes of ticks, and tarantulas, all of which can be significant negative stress factors. Other species play a positive role by consuming insects that would otherwise eat food crops.

Reptiles are also present in great numbers. Most significant are snake species, including small innocuous garden varieties, small poisonous snakes such as coral snakes, large constrictors of the boa variety, and a moderately long (up to 2 meters) poisonous rattle snake called the cascabel pua, one of which was found in the author's house. Iguanas are common; one prominent form is the peni, a species with a high pitched whistle.

Amphibians are numerous in the rainy season, often so abundant as to fill whole settlements with a deafening roar of mating and territorial calls. These include many sizes and colors of frogs and toads which live on dry land, in trees, in streams, and on the edges of curiches.

Birds are numerous in the environment of the colonization zone. They vary greatly in size, coloration, and niche (see Table 5). Ducks, parrots, egrets, owls and hawks are all common. Several species serve as negative stress factors in eating seeds and the ripe heads of grain crops. Other species have a positive effect by consuming rodents near houses and in fields. The author was one of the few people in the last few years who has seen the largest bird species in the area, the ostrich.

Mammal species are numerous and very significant for the human population. In the first phase of settlement, they are the major source of flesh protein (see Table 6). There are two species of wild pig, the smaller taitetu and the larger t:opero or puerco del monte. The tatu or armadillo is ubiquitous and

prolific. The paca or joche pintado is considered the best tasting meat. The coati or tejon serves as a game species and as a pest because it eats domestic poultry. There are monkeys of several species in the zone, but the author did not see many of them or gain an idea of any role they played in settler diet or lives. Deer, tapir and anteaters are relatively infrequently killed, but valued for their meat. The abundance of bats, among them vampires, will play an important role as settlement proceeds to the more humid north. They are reported to be present in significant numbers in that area, and could cause severe health problems for humans and domesticated animals. The jaguar or tigre has a great emotional, but lesser actual, effect on human populations. They have been known to attack hunting dogs and children. One jaguar was shot when it was reportedly stalking a road construction crew surveyor.

Altogether, this area was considered rich in its faunal resources. This can be related, to a great extent, to the fact that the San Julian zone is undergoing ecological modification and provides areas of ecotones, micro-zones of transitional habitats. Lord comments (personal communication):

With the opening of clearings in the forest one should expect an increase in the relative abundance of certain species as well as immigration of species adapted to open areas... the roads and clearings provide a considerable amount of ecotone (edge) which previously was scarce. The fame of superior animal abundance associated with ecotones is a phenomenon universally acclaimed. In addition the planting of crops close to the forest edge provides an abundance of food for those species which can eat corn, rice, etc. as

well as an abundance of weed seeds. The roadside ditches and borrowpits now provide sources of water over extensive areas and extending into the dry season, where previously many mammals and birds had to converge on the scattered streams in the forest. The net effect should be an increase in the abundance of many species.

Many of the inter-relationships of the human population with animal species are those of predator and prey. Others such as those of ticks and mosquitos are of parasite and host. In a few cases, such as of the jaguar, there could be a relationship in which the human species is the prey. This is especially true as humans thin out the usual prey of the jaguar through hunting and habitat elimination and land clearing, leaving the jaguar less and less variety of prey (Lord, personal communication). Another form of parasitism is the new food source which human cropping provides for birds, wild pigs, armadillos, rodents and other species (see Table 7).

The alteration of the ecosystem will also lead to new niches for insects, especially those who serve as human disease vectors, because of the availability of new favorable habitats such as standing water for mosquito breeding. Further effect of settlement is the elimination, or at least reduction, of species chosen as prey by colonists. This was noted by many informants to be already taking place. For example, it was reported that as late as seven years ago, troops of up to 500 to 700 wild pigs were seen, but that in the last few years none over 50 had been sighted. Many people mentioned that the hunting of armadillo was excessive in the extreme and many fewer were present near the communities settled only one to two

years ago. The changing relationships of humans to other animal species is an area which will be important to watch in the coming years, both for those which are positive and those which are negative for those populations.

The Human Component of the Ecosystem: General Background

No archeological investigation has taken place in the area of the San Julian colonization zone. Occasionally pot sherds are found and the author heard of one burial of unknown date which appeared to be a flexed burial in an urn. The only useful way to begin to establish an understanding of the changing human component of the ecosystem is to draw from ethnographic sources which describe the people who occupied the area up to the recent present. This is the Ayureo ethnic group, information on which has been compiled by Riester (1975, 1976) and Fischermann (1976).

The Ayureode were hunters and gatherers who only seldom grew crops, very different from the inhabitants of the Mojos described by Denevan (1966). Fischermann (1976), discussing the Ayureode of the northern Chaco, states that they broadcast seed at the beginning of the rainy season in natural clearings, and that they undertook no land clearing activities or soil preparation. They left crops to grow by themselves returning only to harvest them at the end of the rainy season. These people were nomadic, living in bands of no more than 100 people, and often fought in long vengeance feuds over territorial incursions. They were incorporated in permanent

settlements only 30 to 40 years ago. Until then, they strongly resisted incursions of "blancos" (their label for any non-Aureode). The settlement of Fortin Libertad, established around 1945, (see Map 4) very near the present day San Julian colonization zone was an army base for operations intended to "pacify" the Ayreode to the south. One informant recounted this as a time of "hunting savages". The zone of San Julian was probably part of the territory of the northernmost Ayureode, but was on the margin of both the Chiquitano, a large group to the east, and the Siriono to the north.

To the east of the Rio San Julian, Jesuit missions were founded and flourished in several places from the late 17th century to the time of the expulsion of the Jesuits in 1767. They were responsible for the founding of the reducciones mentioned in the last chapter. After expulsion of the Jesuits, there remained concentrations of population. However, the area of the San Julian colonization zone, between the Grande and San Julian rivers, was never part of the Jesuit mission efforts.

Large estates did develop, whose territory included parts of the San Julian zone. The small center of activity adjacent to what is now the headquarters of the National Colonization Institute called Los Cafeces was at one time an estancia or ranch. The only artery of transportation connecting the settlements to the east of the Rio San Julian to the Rio Grande and beyond was the old road between ranches which passed through Los Cafeces. The old family ranches are extremely important for the present day process of settlement as they have been

given defacto control of several nucleos which impinge on their property rather than go through the arduous and politically difficult process of expropriation. Logging by these families has also been a significant drain on the supply of economically valuable timber.

Logging became a major industry by 1960, in what would become the San Julian colonization zone. Several informants recalled working for logging interests there in this time period. The fact that much of the area is void of valuable hardwoods stems from the heavy logging which went on in the 1960's. Logging trails and exploration trails for petroleum were constructed in the 1960's. The arrival of the National Colonization Institute (INC) to establish their headquarters at Los Cafeces was attributed by some to their interest in getting part of the logging "action". For whatever reason, the areas now settled along the German highway called La Florida, Vergel, and Los Angeles were opened for semi-directed settlement in 1968. Wells were sunk every 4 kilometers and communal land for schools and football fields were placed beside them. Settlers were granted 50 hectare lots in rectangles and had a 200 meter frontage on the road and were 2500 meters deep. Settlers slowly arrived as transportation was extremely poor and as distances were great to regional markets. There was a relatively even mix between settlers of highland and lowland origin. The village grew at the INC headquarters, becoming the center for market activity, school construction, and health service delivery.

Settlement of pioneer farmers in communities called nucleos began in 1972. By 1978, approximately 30 nucleos were settled. The rest of the story of the entrance of the human component in the San Julian ecosystem will be the focus of the remainder of the thesis. Before discussing this, however, the evolution of the development project which has provided a structure for the movement of approximately 1200 families to the area will be outlined.

CHAPTER FOUR

UNIQUE STRUCTURES IN THE SAN JULIAN ENVIRONMENT

The overwhelming majority of pioneer farmers have settled in the San Julian project since 1972. There are three facets of the San Julian environment which differentiate it from that found by all other pioneer colonists who have settled in Bolivia's eastern frontier up to that time: 1) an Orientation Program (hereafter OP); 2) a unique settlement pattern; and 3) the provision of infrastructure prior to initial settlement.

For the colonists who have participated in an OP, it has provided instruction and guidance designed to ease the difficulties of confronting the tremendous task of founding new agricultural settlements located in sub-tropical forest. Further, the OP is meant to aid in the adaptive process in order for the farmer to gain access to technology and marketing which would enable him to settle permanently in San Julian. A supportive ideology is transferred by the OP for cooperative and communal action, even though it still supports individual capital accumulation. The overt and covert aim of those who have planned and executed the OP has been to provide the colonists with aid and education while avoiding a relationship of dominance and dependance.

In addition to the OP, all of the migrants who have arrived in San Julian from 1972 to the present have moved into communities that have a settlement pattern design different

from all other colonization zones in Bolivia. This is the nucleo pattern and will be discussed below. In addition to the nucleo pattern, the settlement design included planning for centrally located areas for marketing and services. These are called nucleos centrales within nine community units called Nucleos Asociados de Producción Agropecuario (hereafter NADEPA).

The third element which makes the process of adaptation of the colonists in San Julian unique is the provision of basic infrastructure prior to the initial settlement of the communities or nucleos. Basic infrastructure is defined as main and access roads which are passable throughout the year, wells sunk to great enough depths to provide potable water, and clearing of community or nucleo centers. The provision of infrastructure has been only partially successfully executed. However, many of the nucleos, especially those settled since 1975, when a major influx of funds and equipment from the Bolivian government and from the United States Agency for International Development made completion of infrastructure before colonist arrival much more feasible, have benefitted from this feature. However, this is the area of poorest performance of the three development effort features designed to help the farmer household begin life in the zone.

OP and UCC - The History of a Development Scheme

The OP is a planned program which seeks to relieve many of the stresses of the frontier environment while directly promoting social change and economic development. This is an

attempt in what one of the key founders calls "behaviorial modification". To understand how the program evolved, it is necessary to examine the history of the organization which developed it and which presently still carries it out, the United Churches Committee (hereafter the UCC).

The UCC was formed in 1968 by missionaries and members of the Mennonite, Methodist, and Catholic churches. They came to join their efforts in reaction to the suffering evident in various colonization zones, during the first ten to fifteen years after 1952.

The difficulties encountered in the area, which often led to abandonment, and failure of many of the colonization projects, were translated into several areas of immediate and long-term human suffering, which was both apparent and hidden. Especially acute areas were: 1) poor health and disease when migrants arrived in an unknown climate with new disease vectors; 2) increased poverty due to lack of knowledge of regionally adapted agricultural technology, unfamiliar market conditions, and transportation difficulties; and 3) failure in the establishment of supportive social networks and integrated communities. The first may be traced to difficult environmental conditions and lack of preventive and treatment measures through rural health service delivery; the second to ineffective or non-existent agricultural extension, lack of means of obtaining credit, and failure to build roads which could last through the wet season; and the third, to a settlement pattern which literally strung settlers along roads

in a piano-key fashion without regard for providing centers for economic and social interaction and future central service growth. These were the adaptive problems in pioneer colonization which concerned many people involved in the promotion of development, or social and economic growth, in the northern Santa Cruz region.

Those important in the founding of the UCC included a Methodist teacher and school administrator, two Catholic sisters who were teachers in Montero, and several Mennonite Central Committee volunteers working in the area. Early in the 1960's, the Methodists had discussed the possibilities of establishing some sort of orientation school through which prospective colonists would pass as they arrived to find land in the region. From the beginning, it was seen as a buffer and educational experience through which migrants would pass in order to benefit through education in new technologies and modification in attitudes and behavior to those more favorable for successful adaptation.

The first actions were taken to intervene in colonization as a result of a relief effort for people who were forced to flee their farms during the widespread flooding of January, 1968. Many of these refugees were temporarily relocated on the grounds of a former road-building enterprise called the Hardeman Company. This site was located on the northern edge of the small urban center of Montero, 50 kilometers north of the city of Santa Cruz. The camp opened for refugees at the beginning of February, 1968 and remained open until June of

that year. The people in the camp were native lowland small farmers who could no longer stay on their flooded land.

While trying to sort out their belongings and their lives in the refugee camp, these people evolved their own strong and effective decision-making structures. There were foreign and Bolivian personnel working with them, but it was reported that the process of community organization was self-generated. This occurred through meeting the challenges of providing adequate shelter, food, and sanitation for the camp. Several individuals came to dominate the process of forming solutions and carrying out the activities which they involved. However, the efforts made seemed to represent a strong community consensus. The difficulties which confronted the group required group action, and the tasks which were solutions to the difficulties were those common to the establishment of new human settlements.

Relief food had to be distributed, prepared, and consumed. This led to the development of communal cooking, the olla comun or common pot, and distribution of food in a comedor or dining hall, a term directly borrowed from the Bolivian military. Shelter was provided by the construction of galpones or sheds by labor groups organized from the new community. Sanitation was a severe problem as the grounds of the camp had a very high water table. A committee of refugees designed an innovative privy with empty oil drums as receptacles. The communal spirit even reached the point to which many of the group assembled for morning calisthenics. The parallel of this

kind of life to a military training camp is obvious. Crucial for the purpose of understanding the generation of the UCC and the OP is that a strong community spirit was created by the solution of the challenges of establishing a new human settlement.

This lesson was not lost on those who were working with the refugees, who included the Methodist high school administrator, two Catholic sisters, and other Methodist and Mennonite mission personnel. They were integrally involved in the relief effort and must have served, at least partially, in catalyst roles for community organization process as when they were successful in obtaining Bolivian governmental funds and the use of vehicles, and in securing aid from the Oxford Famine Relief Fund (hereafter OXFAM), an Anglo-American organization which worked worldwide in similar situations to the Hardeman Camp.

After solving their basic problems of food, sanitation, and shelter, the leaders of the newly formed community began to discuss and then actively explore possible locations for resettlement, as these people were farmers and did not want to remain in the urban area of Montero. The Methodist school superintendent gave them shotgun ammunition and drove them to the end of the existing road north of Montero. They explored several possibilities and finally decided to apply for a piece of land which was then far north of any other colonization zone, the area now called the Hardeman Colony (see Map 2). The Methodists, Catholics and Mennonites helped them get the grant

of land, and, while having a bad experience with the "help" of a prominent lawyer who subsequently helped himself to a piece of land included in the grant, they set the stage for the founding of the settlement. The church personnel continued working with the community and OXFAM funding provided essential food items in the first few months.

The first step in settlement occurred when all male household heads and other males went to the site. They cut down 3 to 4 hectares of trees and, using the long-developed local knowledge of weather conditions and technology, successfully burned over the still green vegetation in what is locally known as the chamasqueo or green burn. They then built temporary shelters and many brought their families from the Hardeman Camp outside of Montero.

They developed, in concert with several Methodist and Catholic missionaries, a schedule of activities necessary to begin life in the new area, from housing to communal cooking to clearing land to planting the first crop. Crucial to understanding the later developments in San Julian are the following points: 1) the schedule of activities and organization for their performance were emically generated, these people were long-time lowland residents and knew what needed to be done; 2) the activities themselves stressed communal action and organization because many of the tasks necessary for initial settlement of virgin semitropical forest require heavy labor input, thus opportunities arose for the growth of communal decision-making structures and a community

identification; 3) the activities were those basic to beginning life in a new zone, and were not exercises designed to build community spirit having nothing to do with practical reality.

After the first year, the settlement appeared to be successfully established. Gardens had been cleared, houses were built using locally available materials, a health program had lowered infant mortality, and a school was built and functioning. The colonists benefitted from good weather and fertile land as they were able to harvest a bumper rice crop during a year with high rice prices. The abundant harvest enabled their newly formed transportation cooperative to purchase a truck. This was the beginning of the dissolution of the strong initial community spirit, however, as those who learned to drive and maintain the vehicle eventually came to misuse and abuse their privilege and cheat the rest of the cooperative's members. For example, they used coop funds to buy fuel to haul loads for which they collected freight charges and kept the money. They also took long trips on fuel paid for by the coop.

Community cohesion and unity diminished as these events occurred repeatedly. With the change of national government in August, 1971, a minority of community members, who according to the UCC personnel were never "community spirited", manipulated information flow to local political-military authorities. They claimed that the majority of settlers were communists, ripe for guerilla activity. They, therefore, got themselves appointed to positions of power in the community by the regional authorities who were right wing military officers. This

minority has remained in control of political decision-making in the community to the present.

There are several important aspects of the founding of the Hardeman Colony of interest to the study. First, the schedule of activities for initial settlement became established, and could serve as a model, with adjustments and modifications given varying conditions and populations. Second, the core of Bolivians and foreigners in the UCC had been formed, and they continued to pursue their goal of alleviating frontier settlement difficulties and aiding in adaptation. Finally, glaringly evident was the fact that initial community or group oriented values and activities were not sufficient to sustain egalitarian community growth. The unity of the Hardeman Colony community dissolved with the disappearance of the commonly shared threat of extinction and the commonly shared challenge of beginning a new agricultural community. Long-term improvement of agricultural productivity with a commensurate increase in income along with other aspects of better life conditions such as enhanced nutrition, efficient sanitation, and good health, would require more careful planning and an extended commitment by those providing aid.

The next settlement of interest to the study is the colony at a location known as Piray (see Map 2). In 1971, the previously mentioned Methodist and Catholic workers joined with people from the Mennonite Central Committee, who had also been working to help the settlement of colonists, to form a legal entity called the United Churches Committee. By 1971, the UCC

had developed a plan for an orientation program for new settlers to the northern Santa Cruz frontier. The organization had obtained a grant from OXFAM, petitioned the INC for 10,000 hectares of land at the Piray location, and asked for lists of prospective colonists from the INC. The INC agreed and plans for the settlement of 120 families went forward.

When the program opened in June, 1971, only 40 families appeared. This lack of interest has been attributed to the difficulty of transportation, the little information available to possible migrants about the program, and to the over-eagerness, during the earlier registration, of administrators and potential settlers. The program was based on the Hardeman experience with the colonists from Hardeman acting as technical advisors, called orientadores. They provided advice and instruction in land clearing, construction, and the use of locally available materials, especially wood, food and fiber products. Two hectares of hand-cleared land in the community center, communal shelters, a potable water well, and a very primitive access road were provided before the arrival of the colonists. They then passed through a three month schedule of activities and formal educational classes. They were organized for communal labor for land clearing and planting a communal rice crop, for cooking and serving food provided by the OP, and for construction of houses for each family.

Half of each day was devoted to the various activities of labor, most organized communally, and half to formal instruction. This included a traditional emphasis on literacy

instruction, and also such innovative areas as cooperativism in group action and in agricultural extension stressing crop diversification and explaining the use of credit. These all made the OP unique in its form of establishing settlements on the Bolivian frontier.

The same basic schedule was followed there as in Hardeman. The major change in the project was the settlement pattern of the Piray Colony, the way in which the individual farm plots and communally owned land was laid out.

The former pattern was the "piano-key" (see Figure 1 and Photograph 4). The pattern lacked forethought in its implementation as it did not provide any area which could realistically serve as an economic and social service center. The settlement pattern plan did provide potable water from wells located every 4 kilometers and a small area around them for future service area growth, the rectangles indicated in Figure 1. However, with the settlers strung along at great distances, the centers did not effectively serve for service delivery and community formation.

The UCC personnel had developed another form of settlement, which was called the nucleo. A nucleo is a square block of land, 2000 square meters in size (see Figure 2 and Photograph 5). At the center of the nucleo, two to four hectares are designated as communal land, an area in which a deep well for water is located, along with temporary shelters occupied during the OP. Future use of the communal land can include school buildings, soccer fields, marketing centers,

medical treatment posts, and/or cooperative stores. The individual farm plots radiate out in triangular shapes from the central communal area and cover just under 50 hectares. This nucleo pattern was first developed and utilized in settlement of the Piray colony.

The idea behind the nucleo pattern is to provide, immediately upon initial settlement, an area of concentrated social and economic interaction. The nucleo design is a truly unique contribution in the field of planned frontier settlement in Bolivia, as it is a direct application of the experiences of previous colonization and of social planning for the promotion of the growth of community structures. A similar but slightly variant form of this pattern was used in Brazil in colonization along the Trans-Amazon Highway (see Moran, 1975).

In the Piray OP, the colonists learned the immediate technological necessities of survival, established the infra-structure of their community by completing necessary construction, and reaped an ample harvest of rice and sold it through a cooperative. They obtained limited loans for the harvest and land clearing for the next year through a cooperative credit structure.

In Piray, the UCC tried to provide a maximum of leeway in decision-making to colonists, even to the extent of deciding their settlement patterns and allotting their parcels. This was negative to community building because those with more experience in the Santa Cruz area and more knowledge of the topography, soil, and other potential aspects of resource use

in the specific locale were able to manipulate information flow so as to gain an advantage in site selection and parcel assignment. This was an important lesson for the UCC and the OP, because in San Julian they established strict rules about the equitable parcelling of nucleo land.

The Hardeman and Piray experiences produced an empirically generated and realistic OP and the nucleo pattern. These were combined in the design of an integrated development project for settlement of approximately 1100 households in the San Julian colonization zone since 1972. The beginning of the San Julian story is found at the end of the previous description of settlement in Piray. With the change of government in 1971, there was a great deal of unrest and concern over restoring order. The area of the Piray settlement came under suspicion as being a hotbed of anti-government activity, possibly related to the power grab described earlier going on in the nearby Hardeman Colony. A representative of the UCC traveled to Montero to assure various political officials of the falseness of such rumors and to explain the work that was being done.

This opportunity transformed itself into an opportunity for expansion of the activities of the UCC to San Julian. The official in charge of the INC in the region became convinced of the possibilities of the OP in aiding settlers in the San Julian area. Therefore, in the following year, 1972, the UCC moved its operations to the San Julian zone under contract with the INC. Two nucleos were opened for settlement with settlers undergoing a three month OP which now included all of the following (USAID, 1974:19):

(The OP) will give attention to group decision making processes and focus on problems and techniques to improve nutrition, crop husbandry, health care, community cooperative organization, building construction, land clearing, animal husbandry, and other programs designed to give settlers confidence in adjusting to their new environment and to increase their capacity to deal with the physical and ecological problems of the lowlands.

Table 8 gives the order of nucleo settlement (see Map 4). The settlement of nucleos in 1972 through 1975, those designated 1, 2, 4, 6, 7 and 8, was executed with extremely limited funds for construction, food, equipment, seed, and personnel salaries. Funds were only available from the INC budget, OXFAM, and a few other minor sources. No more than two nucleos were settled in any one year. Because of the lack of roads to the settlement areas, travel to the Rio Grande from the INC headquarters was impossible for much of the rainy season, except on foot or horseback. Nucleo 3 was left open for occupation by locally born migrants without an OP or well construction.

In 1975, two major events occurred which completely changed the scale and magnitude of the development of the San Julian zone. These were, first, a funding and technical assistance program of the Federal Republic of Germany. In the program, an all weather, gravel highway was constructed from the Rio Grande to the Rio San Julian.

The second event was an agreement between the government of Bolivia and the USAID for joint funding of the construction

of a new road extending 100 kilometers to the northeast from the highway beginning at kilometer 42. The road would be called the Brecha Casarabe. It would pass through and, thus, open for settlement the prime agricultural zone between the two rivers. Further, lateral access roads would be constructed and settlement infrastructure provided, particularly deep water wells. Finally, an agreement was made for the coordination of USAID, INC, and UCC for the settlement of up to 5000 families through annual orientation programs from 1975 to 1980. Roads, wells, and community center land clearing would be provided by USAID and INC; and a model of directed social change and economic development would be used by the UCC in its orientation program to provide initial guidance for settlers. UCC funding came from the Bolivian government, OXFAM, and other small sources. The plan called for the settling of up to 30 nucleos annually by the last two to three years of the project.

In 1976, two nucleos were opened for settlement, with partial settling of three additional nucleos. In 1977, eleven nucleos were settled, followed by ten others in 1978. The data for 1979 is not available, but no more than nine nucleos are expected to be founded (Miller, personal communication). Thus, a total population of approximately 1500 households were or will be settled, in contrast to the projected total of approximately 5000 households in the GOB/USAID contract. The more important reasons for this discrepancy include: administrative intransigence, personnel difficulties, transfers and cuts of funds, uncoordinated planning, and just plain bad luck with the weather, machinery, illnesses, and

communications. However, to dwell on these problems found universally in development projects, would be to overlook the unique positive and negative aspects of the project.

Description and Critique of the OP of San Julian

The elements of the OP cover four basic areas of challenges or stress factors in beginning a new settlement. These are health and nutrition related to bio-physical stress factors, agriculture and construction related to technological stress factors, organization of labor related to economic stress factors, and social cohesion and decision making related to social and ideological stress factors.

Insect and snake bites are one form of bio-physical stress for highlanders without previous exposure to the lowland environment; swelling, scratching, and subsequent infections are a very serious problem. Open wounds from scratching combine with the highland tradition of very infrequent bathing to cause skin infection. Snake and spider bites offer other dangers. The Orientation Program works to alleviate these stresses when its personnel, such as the nurses or the home improvement specialist, advocate frequent bathing, and clothes washing and supply medicines sold at cost.

Water supply in San Julian is provided by the Bolivian government's National Colonization Institute. Each nucleo, in its central communally owned area, is supplied with a well sunk to a depth between 50 to 100 meters, which usually produces safe and potable water. Problems have arisen with the use of cheap materials, too rapid drilling leading to gaps and breaks

in the shaft and casing, and poor maintenance by the community members themselves of their own pumps. In addition, UCC personnel claimed that mineral content, notably magnesium, is very high in the water of two of the wells. Diarrhea and the general debilitation of physical condition was said to result. Monitoring of water quality and mineral content has been an aim of the OP, but it has not been able to carry through with this effectively.

The problem of attaining nutritional balance and adequate caloric intake is another bio-physical stress. Intervention is extensive by the Orientation Program for the first nine months. A great deal of food, almost all needed for subsistence, calculated for balance and calories, is supplied through the distribution of World Food Program foodstuffs (see Photograph 6). However, after the depletion of this supply, the migrant diet usually lowers in quality and quantity. Some families, though a minority, do continue a relatively balanced diet. The Orientation Program not only provides the World Food Program material, but also foodstuffs that are designed to ease the transition in diet from that of the highlands to that of the lowlands. This is done by the provision of highland food items in the communally shared common pot such as quinoa, potatoes, broad beans, and even occasionally the beloved and ritually important chuno. Further, the personnel of the Orientation Program are able to work closely and in a practical way with the families or small groups which have the responsibility, on a rotating basis, for community food

preparation. This provides the opportunities for instruction in sanitary food preparation and nutritionally balanced meal planning (see Photograph 7).

Disease is a stress particularly in relation to intestinal parasites and tuberculosis. Many of the parasites are new to highland populations, especially the various worms and micro-organisms that can seriously weaken adults and cause the death of children. The Orientation Program tries to counteract this by vigorous advocacy of environmental sanitation practices. Tuberculosis is present in a very small portion of the population, but there are several severe cases. Severe cases are supposedly screened out by a medical examination given entering colonists by the National Colonization Institute, but this only rarely is done. The warmer, tropical conditions have been associated in other colonization zones with the exacerbation of serious tuberculosis cases and this could occur in San Julian. The personnel of the Orientation Program try to maintain surveillance of the bad cases and supply medicines or recommend treatment when possible.

After bio-physical stresses, the next factors to be considered are those which are labelled technological. These relate to the necessary activities to supply food, income, housing and other needs. The migrant needs to raise his crops, to have transportation for selling produce and buying other goods, and to be able to construct houses and other buildings.

Lowland agricultural technology is very different from that of the areas of origin of most of the colonists. It is a

slash and burn or extensive system, whereas that of the highlands is much more of a permanent field or intensive one. Therefore, the migrants must learn much to perform the productive tasks for subsistence and cash cropping, although a large majority of the migrants in San Julian have had experience in lowland productive technology through seasonal labor in the agro-businesses or cotton and sugar, through seasonal labor for other small farmers, or through work on their own farms in other parts of the lowlands.

To augment the previous experiences of the migrants and to provide instruction to those knowing nothing of the lowland productive technology, the OP has retained from its earliest days the staff position of orienter. He is always a fellow colonist, either of local or highland origin. If the latter is the case, then he has lived in the lowlands for a significant period of time. The orienter instructs and works with the new colonists during the crucial periods of the first four months. These include land clearing, house construction, and planting the first harvest and fruit trees (see Photograph 8). In addition, extensionists work with the farmers, presenting options and possibilities for improvement of their methods of cropping and animal raising. Finally, as part of the OP, the new colonists are given all seed for the first harvest, a variety of which allows the execution of a strategy of crop rotation, and several different kinds of fruit tree stems for vegetative reproduction (see Photograph 9).

Transportation is one area of environmental stress linked to the productive technology just mentioned. Even in their first year, the agricultural colonies of the northern Santa Cruz region are involved in cash cropping for the regional market, if only in a minor way. Many of the agricultural colonies have had their economic growth potential severely limited by roads which were impassable during much of year. At its inception and until 1975, San Julian was effected by this problem. After 1975, however, San Julian has been the object of intensive road building which, though plagued by many delays and slowdowns, is now almost to the point of providing all weather access to most kinds of vehicles year round. Public transportation by bus is supposed to arrive to points far within the colonization zone in 1980, much earlier than to most previously settled colonization areas. Many problems remain, but road construction will provide the advantage of access to the regional markets for selling and buying.

Shelter and building construction is another area of technology which requires a great deal of change from former highland patterns. Building materials and house design are entirely different from those of the highlands. Necessary changes stem from the greater heat and precipitation. Again many of the settlers in San Julian have had experience with construction in the lowlands. However, the orienter is available to advise and give practical instruction to these colonists and those with no knowledge of lowland construction technology (see Photograph 10).

The next category of stress which must be met by the migrants is that of finding a way to organize themselves for crop production and animal raising, for marketing of whatever surplus from subsistence is available, and for obtaining consumer goods which they cannot product or manufacture themselves. Traditional modes of labor organization, particularly those of labor exchange in ayni and mink'a are utilized in San Julian, especially for periods of intense labor needs such as house construction, land clearing, and harvesting. Individual family labor organized along age and sex divisions carry out much of the daily activities and also seasonal activities such as seeding and weeding. Wage labor is utilized, but few pioneer farmers can afford it except for brief periods when labor demands are greatest for all settlers, leaving fewer able or willing to participate in labor exchange, notably during the harvest and land clearing. Related to the option of wage labor employment is the fact that those who are utilizing a strategy of multiple resource exploitation seem to find wage labor more feasible than participation in labor exchange. This is logical because they are working in other locations where they may even temporarily reside. Their less transient neighbors cannot call upon them for exchange of labor and they cannot enter the exchange system. This necessitates the hiring of labor.

The Orientation Program organizes productive activities for the first four months of settlement through its schedule

and through its use of the principle of communal work projects. This schedule of tasks is considered by the staff and colonists alike as the basis of the entire program, and is essentially the same one generated ten years previously by the Hardeman colony settlers. The communal labor work begins with the construction of basic infrastructure, proceeds through land clearing for house sites and fields for the crops, and includes work in a communal garden and house construction. Communal work projects are traditional in highland village social life, and the Orientation Program builds upon that tradition and attempts to broaden it in inculcating a community-oriented mentality.

The marketing of products and the provision of consumer goods in colonization zones of the northern Santa Cruz region usually involves brokers and other entrepreneurs. Marketing is done by selling the harvest in the field to a rescatador or buyer who takes the crop by way of his own transportation to the regional markets, or by paying freight costs to a transportista who owns the means of transport on which the farmer travels with his harvest to sell in the regional market. Consumer goods are provided through many small stores, of which there are often almost as many in a village as there are residents. Profit margins in these stores can fluctuate greatly depending on levels of competition, demand, and supply.

With this pattern in mind, the marketing and provision of consumer goods in San Julian seems to illustrate an interesting variation. The colonists in several of the nucleos have

utilized their community-wide decision-making structure, largely developed during the Orientation Program, to band together and contract for transportation of their harvests jointly, allowing some control of price and assuring the availability of transport when it is needed. This has not occurred in all nuclei, but has occurred especially in those in which people have settled who had lived together previously. Future plans of those working in the Orientation Program for continued development of community and inter-community structures include the possibility of marketing organized on a large-scale cooperative basis. This plan would be closely linked to the present efforts in providing consumer goods for the settlers through consumer cooperative stores. During the Orientation Program and after it, the cooperative stores function through voluntary membership of colonists. However, the cooperative store does seem to be a stress factor in the sociocultural environment for many of the settlers, because it contrasts greatly with the traditional model of many small stores with their fierce competition and fluctuating prices. In the San Julian zone, small stores have appeared and many colonists expressed their desire to open a store. The payment of membership fees to the cooperative provides stable and low prices with occasional dividends in the consumer's cooperative, but this is an innovation in socioeconomic patterns and therefore is differentially accepted by colonists according to their own understanding and orientations.

The final area of stress in the adaptive process of the migrants of San Julian is called structural-attitudinal and has to do with the evolution of the value system or world view of the migrants and how it is manifested in their behavior. This is obviously an area which is enormously complex. Attention will only be drawn here to one aspect: the inter-play, if not conflict, between the attitudes advocated by the Orientation Program and those existent in the mind of the colonists.

The concepts of marginality and individualism have been both overworked and misused in much of the literature on migration. However, they can be useful in understanding the migrants of San Julian. These people have more or less permanently left their areas of origin, many having left years previously. It is true that there still exists a good deal of flow of both information and goods for many of the colonists with their origin communities. Taking as given that the conditions of limited access to resources, poor growing conditions, inadequate marketing structures, bad roads, and all other reasons given by colonists for their decision to migrate exist more or less in equal amounts for the entire origin population, then there is something in these people which motivates them to move. In some way, these people are marginal in their origin populations. The colonists and those people who have worked with them for years comment repeatedly that colonists are individualistically oriented and highly acquisitive. The reason given most often for migration is

"wanting to better myself and my family economically". The pattern of multiple resource exploitation for the economic betterment of the individual family or the extended family also lends support to this idea.

With this in mind, then, there may exist a basic incongruence with the goals and values underlying much of the Orientation Program.

The OP emphasizes communal activities and structures, from the organizing of labor to the functioning of the consumer's cooperative. However, it was stated often by Orientation Program personnel that the central purpose of their work, and the aid and instruction given the colonists, is to lessen the costs of settlement in the virgin forest frontier and to make more rapid the growth of services and structures of social life. This represents a realistic attitude and reflects the fact that these migrants are not considered to be malleable nor moldable by the program, but rather are seen as human beings with their own orientations, attitudes, values and patterns of behavior. To the extent possible, the structuring of activities has attempted to encourage communal thinking and cooperative action and thus is a factor to which the pioneers have needed to adapt. Some colonists are oriented in these directions, others are definitely more individualistic.

The desire to avoid paternalism is another theme in the ideology of the OP staff. This is expressed in the staff training literature and courses and repeatedly appears in daily work and conversation. It is even carried to the point of asking OP staff to avoid the establishment of fictive kinship

ties with colonists, in the belief that this would be a vertical social relationship of dependence. It could be too extreme if emphasis on autonomous problem-solving were to result in the denial of needed services, but this has not occurred. Paternalism and dependence are not equivalent to the reasonable provision of services which can be expected of departmental and national agencies.

A further note about the OP and the people who carry it out is that they are a set of individuals who do not resemble in motivation, attitudes, or behavior, the model of the more typical service provider in Latin America, the bureaucrat. This is a relevant concern because the OP is supposed to become a part of the land settlement policy of the Bolivian government. The present program is staffed by a set of individuals with a great deal of empathy with the colonists. They have achieved the level of success they have had by their willingness and ability to innovate. Therefore, easy replicability could prove impossible. The staff is essentially marginal to the overall group of service providers or bureaucrats in Bolivia.

Finally, the values and ideology of the OP staff lead to the promotion of a particular set of outcomes in exploitation of the San Julian ecosystem. These result in the more or less permanent occupation of the zone by small farmers either working individually or in cooperating groups. This study, when it analyzes the outcomes of adaptation, will show, though, that the outcome promoted by the OP is only one of several possibilities. The OP is a social change effort designed to promote a certain kind of resource exploitation.

The lack of religious rituals for Catholics, who are the majority of colonists, is a final stress related to the above. Later discussion will amplify on the reasons for which UCC personnel do not perform these rituals. There was no evidence that colonists desired to establish regular performance of the rituals to institute the typical Latin American civil religious hierarchy, but even the sacramental ceremonies were difficult to arrange. For evangelical Protestants, there was no lack of association and ritual.

The Nucleo Settlement Pattern - A Critical Appraisal

The nucleo settlement pattern has been briefly introduced above. Besides the square community block concept with its community center and triangular-shaped farms radiating out to the boundaries, there is another facet of settlement design briefly mentioned before: the nucleo central, a differently designed unit found on the main road, either the German Highway where nucleo 2 is central, or the Brecha Casarabe. On the latter, the nucleo central is found in every third nucleo beginning with nucleo 14. The nine nucleos surrounding the central nucleos are all part of a NADEPA, Association of Nucleos for Agricultural and Livestock Production. The design of the central nucleo is presented in Figure 3. The farmers with land in the central nucleo locate their houses in its center, but must go further to reach the edge of their fields, beyond the circunvalacion. Within that zone, every household of the nine nucleo NADEPA unit has a right to a house site

because it is planned to be the urban center. Further, within the urban center, a zone of commercial lots are designated for services and stores. There was much evidence while the author was working in the zone that these areas were developing into marketing and social centers and that farmers in the NADEPA's were actively taking advantage of their urban lots. Further, services, such as stores and rice and corn mills were being established in the central nucleo. The author saw this occurring in nucleos 2 on the German Highway and 14 and 23 on the Brech Casarabe.

There is one point of conflict surrounding the central nucleo design. Other nucleos, especially 1 and 11, have decided they want to have some of the same functions and assume the same importance as the planned central nucleos. Nucleo 1 has actively sought to persuade the lateral nucleos associated with it, 4 and 7, to build their second houses and establish a town site in nucleo 1's center. They have had a good deal of success in this with nucleo 4, but less with nucleo 7. The former is linked to nucleo 1 by many kinship ties, the latter is not nearly as related by kinship. The dynamic of these conflicts demonstrates that the importance of being a central nucleo, particularly as it relates to being a center of economic activity, is readily apparent to the farmer. The central nucleo concept seems to be an effective innovation in settlement design, promoting rapid service provision and performing an important central place function.

There remains a large question, though, about the effectiveness of the basic nucleo design in promoting economic growth, community solidarity, and cooperative structure formation. As compared to the piano key pattern of settlement, there is greater equality of access to water and services such as schools and, when built, medical treatment posts and stores. Houses are built in proximity, at least initially, and therefore social interchange opportunities are enhanced.

However, it is not readily apparent that these types of communities will have greater success in the development of economic or social institutions than spontaneous or directed colonization locations. In fact, some observers find the nucleo plan to be irrational because of its layout (Schorr and Lord, personal communication). They claim it is irrational, particularly in relation to energy expenditure for transportation of produce or livestock. Simply put, the largest expanse of land available to each farmer, lies at the greatest distance from the center of the community, and thus to existing roads. Plans do exist for roads to be constructed around the outside perimeter of the nucleo centers. In the case of nucleo 18, farmers have kept clear a road which radiates out from the nucleo center, placed centrally on all four sides, and which they plan to connect with a perimeter road. However, no perimeter roads have been built. Rather, the commonly found solution is for each farmer to have a path, in a few cases wide enough for vehicular traffic, winding back into their parcel. Further, for at least some of the year,

second houses are being built deep within the parcels in order to safely warehouse the harvested crop and to reduce distances to the field. Informants even expressed the desire to build their house away from the others so as to have peace and quiet. It is not implied here that the nucleo pattern is not a useful experiment in settlement design. Rather, there are flaws in the plan, as in any innovation, and they must be recognized.

Provision of Infrastructure - A Critique of Institutional Performance

The third aspect which supposedly makes the San Julian Project unique in the history of Bolivian colonization is the completion of infrastructure before the arrival of colonists. San Julian, in many ways, shares problems with other projects; that it has performed as well as it has illustrates its remarkable planning and execution.

From 1972 to 1975, access trails connecting the nucleos 7, 8, 4 and 6 to what would become the German Highway were to be built prior to opening their settlement. Nucleos 1 and 2 were located on the main road between the Rio Grande and the Rio San Julian, which was not improved until the commencement of the German government's project in 1974. Wells were to be drilled and two hectares of land were to be machine cleared, including removal of all tree trunks and stumps in the center of each nucleo. In the first year, 1972, when nucleos 1 and 2 were

opened, this was completed. However, in late 1973, in 1974, and in 1975, nucleos 8, 7 and 6 experienced much delay and were provided the items at the last minute. In the case of nucleo 7, the colonists had to stay in make-shift shelters in the forest for 15 days until the road was completed, their village center cleared, and the well drilled. In the case of nucleo 8, settlers simply stayed in nucleo 2, subsisting on joco or squash and refusing to enter their nucleo until it was readied for them. These were perhaps the worst examples from the early phase of the project when the INC budget from the GOB, when managed correctly, was barely adequate. When the miniscule budget was combined with poor maintenance of equipment, bad weather, and outright profiteering as local INC officials rented out land-clearing equipment to local large landowners and pocketed the money, delays are even more understandable.

With the signing of the agreement between the GOB and USAID in 1975, San Julian entered a major growth phase. The quantity of nucleos settled each year was supposed to increase to 10 in 1976 and 1977, and up to 30 in 1978-80. Construction of the Brecha Casarabe was planned to a distance of 100 kilometers, with a raised roadbed and a gravel, all-weather surface for all of that distance. At every five kilometers, beginning at kilometer 14, access roads were to be built five kilometers in length on either side of the main road to enter the lateral nucleo centers. Every village was to have a well sunk to between 30 and 60 meters, with potable water assured

community. The water supply was to be monitored by regular testing. Finally, all nucleos were to have between two and three hectares cleared in the community centers; all trunks and roots were to be removed. Central nucleos, those planned as urban centers for marketing and services, were to have the same center area machine-cleared. A 200 to 300 meter belt called the circunvalación was also to be machine-cleared to provide a marker of limits for the planned urban center. All of this was to be completed before the arrival of colonists to each nucleo.

It would not be particularly useful to report all of the problems that have arisen in the years since the initiation of the contract. However, there are several important points to mention. Road construction of the Brecha Casarabe, the main highway in the zone, suffered greatly because of the delays in negotiations for the letting of the contract. When major construction did begin in January, 1978, progress was rapid. Some informants said it was too rapid and that specifications allegedly were overlooked or ignored. This part of the project seems to be moving toward completion, only experiencing temporary delays. In April, 1979, access to a gravel supply became a major obstacle, as the bridge over the Rio San Julian washed away in the tremendous rains of earlier that year.

The construction of the lateral roads has been a much less successful story than that of the Brecha Casarabe. The INC road building crew has been in charge of the task and often appears to have done its work rapidly, either not to specifications indicated or without being flexible enough to

amend plans when needed. The construction of these roads sometimes also suffered because of administrative decisions to use equipment for construction on the main road, clearing nucleo centers, or, as reported by informants, for rental to local landowners. If not constructed well or maintained adequately, the colonists living in the lateral nucleos will be seriously disadvantaged in the transportation of their goods, either for sale or consumption, by poor lateral access roads.

The drilling of wells has been, for the majority of nucleos, performed reasonably well. However, in the cases of nucleos 15 and 18, sandy and muddy water began to be pumped within a year of drilling, probably indicating slipshod work. The well in nucleo 12 went dry in the first year, and, while perhaps not drilled and constructed correctly, there were definite errors in maintenance committed by colonists. INC has sunk a second well in nucleo 12, which is a credit to their commitment to supply needed infrastructure.

A more serious difficulty exists in nucleos 9, 17 and 29 in which wells were correctly installed, but in which water with a high mineral content is claimed to be a persistent taste and health problem. Recurrent diahrea and nausea have been reported as the result of high concentrations of "salt" and "magnesium" in the water. This has, in the case of nucleo 9, been linked supposedly to the deaths of up to twelve infants. The negative factor this problem illustrates is not poor installation, but rather infrequent, inadequate, or a total lack of monitoring of water quality, mineral composition, and bacteriological condition.

Reliance on a single well in each nucleo can be dangerous and, when equipment has broken down, major crises have ensued. Most nucleos have been instructed in well equipment repair, have committees of individuals who are responsible for this task, and have funds for equipment replacement purchase. However, as the case of nucleo 12 demonstrated, failure in solving well problems can result in extended periods of use of inadequate and unsafe water supplies resulting in illness. A final problem for the nucleos settled after 1977 has been the mass purchase of faulty pumping equipment by a former high INC official as a result of a profiteering scheme. Overall, the colonists have benefitted from having a potable water supply from the first day of settlement, extremely rare in colonization in Bolivia. However, the provision of this item of infrastructure has experienced many problems.

A final area of infrastructure provision has been the clearing of nucleo centers and the areas around central nucleos before the arrival of colonists to them. Since 1975, the beginning of the USAID-GOB contract, this has not been an area of difficulty. In the first year, 1976, more nucleo centers were cleared than could be settled and this has been true in all subsequent years. Further, the construction of provisional shelter, galpones or barracks and food storage facilitates or parques, has been completed in almost every nucleo prior to settlement. The latter task is the responsibility of a crew hired by the UCC working with materials supplied by the INC. The location of village centers has even adequately taken into account varying terrain and water shed structure, as evident in the layout of nucleos 13 and 22.

The unique aspects of the San Julian environment within which pioneer farmers have adapted has now been presented. The next chapter will provide a detailed examination of important features of that population. Following that, the process of formation of adaptive strategies will be described and analyzed as the pioneers establish solutions for the achievement of goals for their new lives in the San Julian zone.

CHAPTER FIVE

THE PEOPLE AND CULTURE OF SAN JULIAN

This chapter describes the population of San Julian from the point of view of its origins and modes of adaptation to a new area. Several distinctive features will be noted in the description of the population. The demographic structure of the population exhibits an imbalance most obvious in the large numbers of single male households. The techno-economic activities of the population display a wide range of options in exploitation of the resources of the ecosystem. The forms of social organization reflect variation among traditional kinship bases for relationships and new patterns in relations between individuals and groups. Finally, the values and goals of the members of the population provide the motivations for the various kinds of adaptive behavior and patterns of organization.

The data describe the population in both a qualitative and a quantitative manner. The qualitative data was obtained by the author over the entire length of fieldwork. The quantitative data derives from three major sources. First, statistics covering the entire population were available from the Department of Social Promotion of the INC office at San Julian. Second, the author carried out a survey of a limited set of questions with most colonists in the nucleos settled in 1977. This set of data will be labelled the first survey. When information comes from less than the full universe of that

set of nucleos, it will be noted. The third set of data come from a more comprehensive survey instrument administered by the author to a sample of 100 colonists. This will be called the second survey. Nine nucleos founded in 1977 and one founded in 1976 were chosen, ten individuals were interviewed in each nucleo.

Areas of Origin

Almost the entire population of the nucleos settled from 1972 to the present in the San Julian colonization zone, with the exception of nucleo 2, are migrants who were born and raised in the western highlands and valleys of Bolivia. Representatives can be found from every department (equivalent to U.S. state) in the western and southern regions. This area is called the Interior by those living in Santa Cruz. A few colonists were born in the department of Santa Cruz, but they are a very small minority. Locally born Bolivians or cambas are a majority in nucleo 2, settled by local native residents who were permitted by the INC to move in and occupy the nucleo after having an OP. Nucleo 3 also is settled by lowlanders, but due to its isolation was not included in the study. In the areas of spontaneous and semi-directed settlement, opened before 1972 along the German highway (known as Areas 1, 2, 3 and 4), there is a large representation of cambas. However, the study will only discuss nucleos settled from 1972 to the present.

The total of colonist households included in the study and settled as of the beginning of May, 1979 was 1097. This includes all nucleos except nucleo 3. Table 9 presents data from all nucleos by department of origin of the colonists. Potosi is the department most heavily represented in the totals. Seven nucleos contain colonists from one sub-region of Potosi, which in this study will be labelled the Yocaylla area, after the largest town in the area. These colonists had their entrance to San Julian arranged by a Belgian Catholic missionary working in that province, who had a special relationship with key San Julian project personnel. Indeed, if the effect of this connection is discounted, the Potosi percentage would drop considerable. However, the history of recruitment and selection of the colonists and their groups shows that, while the largest single group, from the Yocaylla sub-region, arrived as a direct result of intervention and manipulation by foreign development agents, other examples of such arrangements are found. Many colonists have moved to San Julian by their own decision, but the flow has been subject to a great deal of selective manipulation by non-migrants, primarily UCC and INC personnel.

Statistics on areas of origin from data assembled by the author were only obtained for a sub-set of the total population. Table 10 presents the first survey data from all households in the nucleos founded in 1977 except nucleo 10. The percentage of colonists from the Potosi department is very

close to the total nucleo statistics of the INC. Other departments vary much more from the INC data. Most significant is the strong representation from the southern Altiplano and valley departments of Potosi, Cochabamba, and Chuquisaca. The data from the author's second survey, which includes one different nucleo than the first survey, can be found in Table 11. It shows the same tendencies toward dominance of Potosi and other southern departments as found in the other sets of data.

The recounting of the process of the opening of thirty nucleos by the end of 1978, will demonstrate the complex ways in which colonists select and are selected for settlement. Most come from the southern Altiplano and central valley departments of Potosi, Cochabamba, and Chuquisaca, because of the geographic contiguity of these regions to Santa Cruz. Several studies show that this is a general phenomenon in Bolivian colonization (Keller and Aitken, 1973; Hiraoka, 1974; Stearman, 1976; Zeballos, 1975). The detailed discussion below will show that there have been intervening factors such as the efforts of the Catholic sister in Potosi. However, most colonists decided to move into San Julian after having migrated to Santa Cruz, at least on a seasonal basis if not permanently. This has been referred to earlier as step migration. For example, 88% of the sample from the author's second survey had worked outside of their area of origin before coming to San Julian. Of those, 10% had lived and worked in

Chile and Argentina, and 78% had done so in Santa Cruz. The steps of migration include: 1) seasonal wage labor for the sugar or cotton agro-industries, usually in harvesting but sometimes in weeding; 2) seasonal wage labor for small farmers in the colonization zones, most often in land clearing, weeding, and/or harvesting; 3) wage labor in urban service and construction; and 4) marketing and small scale commerce such as street vending in urban and rural town areas. Any or all of these can be combined. Most colonists moving to San Julian are familiar with agriculture and life in general in the lowlands of Santa Cruz.

The selection process for entry to San Julian begins when the individuals or groups decide to apply to one of the regional INC offices or when they are recruited to apply to these offices by INC or other governmental or non-governmental personnel such as missionaries. When the interesados or interested persons apply, they present a list of applicants or, if they are individuals, they are grouped with most recent individual or group applicants. Officially, entry to a nucleo in San Julian is on a first come first serve basis; but the rule has been circumvented in various ways. Often, key project workers from the INC or UCC have a special relationship with a group of applicants or someone working with a group of applicants. Other times, equal chance for entry is overlooked if the national headquarters of the INC in La Paz directs the project INC staff to accept certain individuals or groups. When spaces are left vacant in settled nucleos, new settlers are either recruited by colonists in that nucleo or pay for the

right to move in after applying in the San Julian INC office. Payment is made to the departing colonist, if he is still present, and to the nucleo community fund to offset the labor costs of the group during the OP in constructing and maintaining community facilities.

Nucleos 1 and 2 were opened in 1972 with an OP lasting for three months (see Map 5). Nucleo 1 was settled by 18 colonists, most of whom had learned about San Julian and been helped to organize for the move by a Catholic sister working in the Yocaylla sub-region of the Potosi department. This sister had heard of San Julian in the previous year and had contacted INC/La Paz and the UCC about the possibilities of arranging for the movement of people from the area in which she was working. Few, if any of them, had lived in the lowlands prior to the move to nucleo 1. The OP they underwent had the same basic format used in the Hardeman and Piray colonies.

Nucleo 2 was established in the same year, but in a much different way than Nucleo 1. The second nucleo was settled by lowland-born and raised colonists. Thirty locally born people went through an OP which concentrated much less on teaching aspects of technology, but rather promoted cooperative formation, and provided literacy, hygiene, and nutrition education.

In 1973, approximately twenty more highland settlers arrived to settle in Nucleo 1 and 10 lowlanders came to complete Nucleo 2. This completed the 40 household quota for each nucleo. The Potosi highlanders entry into the zone was

arranged by the same Catholic sister. The latter group of lowlanders were recruited from surrounding areas, especially between Nucleo 2 and the Rio San Julian. Some of these settlers already claimed ownership or at least usufructory rights on the land. To solve any potential conflict, all who wanted to settle were simply incorporated into the nucleo.

Nucleo 8 was the next target for settlement. At the time, relations between Chile and Bolivia were very tense. A group of 18 repatriated or expelled Bolivians who had been living in Chile were recruited in La Paz for settlement in San Julian. They attracted a good deal of attention in the Santa Cruz and Montero press as they waited for settlement, demanded assurance that the infrastructure was complete in San Julian, and the OP ready to help them. They moved out to the zone in October, 1973, to find that road building from nucleo 2 to nucleo 8 was barely started and the nucleo was certainly not near completion. All 18 colonists stayed in nucleo 2 and lived there on a limited diet of joco or squash and little else. Finally, in late November, 1973, they entered their nucleo. This was the beginning of the onset of the rainy season, an inauspicious time to initiate land clearing. The OP was carried out to the extent possible.

In 1945, nucleo 7 opened for settlement. All but two of the original 36 colonists were from the same Yocaylla subregion in Potosi as those of nucleo 1. Their two week campout in the forest with no well, while they waited for the infrastructure

to be completed, was mentioned in the last chapter. The Catholic sister was present with the group as they waited and then began their OP. The wait gave them an opportunity to learn about lowland life conditions and technology from their relations and friends in nucleo 1. In fact, many of these people had decided to migrate to San Julian because of the flow of goods and information from the zone to the northern Potosi region. It was also in 1974 that numerous complaints from local residents led to the decision by the INC that nucleo 3 would be left open for spontaneous settlement. It was occupied by lowlanders from the area between the nucleos and the Rio San Julian.

In 1975, nucleos 6 and 4 were opened for settlement. Thirty colonists moved to nucleo 6, all of whom came from the same area of the La Paz department and were being repatriated from the Arica Valley in Chile. There they had worked as seasonal agricultural laborers and some even rented or owned small plots of land. When tension mounted again between the governments of Bolivia and Chile, these people were told they would have to leave. An educated young woman, representing herself as a representative of the INC in La Paz, met with the group and recruited them to go to San Julian. She said the land was fertile, that irrigation would soon be installed and that there were plans to build a tomato canning factory near San Julian. When they arrived there, the thirty colonists were disappointed because not only were many of the promises not true, but the road to their nucleo was poorly built and their

well produced salty-tasting water. Seventeen settlers left, but the following year 27 colonists arrived to complete the nucleo quota. Some of them had come back after leaving and others were new colonists. The original settlers of nucleo 6 had an OP in 1975, and, in 1976, they conducted an OP for the second group of their kin and friends who arrived to complete the 40 households.

Nucleo 4 was settled by 18 residents from the same sub-region of northern Potosi as the colonists in nucleos 1 and 7. This nucleo was almost not settled because over half of its land lies on the property of the Zapito private farm, and the INC had no intention of dispossessing the owner. However, the colonists arrived and, even when told there was no money available to conduct an OP, they still wanted to settle. They were provided the necessary infrastructure and the World Food Program foodstuffs, which were a regular part of the OP.

In 1976, as mentioned above, 27 more colonists arrived to complete nucleo 6. They were the last to settle prior to the beginning of the USAID/GOB contract. Differences between nucleos colonized before and after the contract relate particularly to the quality of road building and the timing of preparation of the infrastructure, which was closer to schedule after the contract went into effect. In 1976, twenty-five colonists moved into nucleo 5. They had all registered with the INC office in Montero, as individuals; there were no major social sub-groupings in the community. The only existing ties arose from the fact that many had lived as seasonal workers, peones, or small farmers in the Yapacani colonization zone.

This year also saw the start of construction of the Brecha Casarabe. Three nucleos, 11, 12, and 14, were scheduled for settlement in the Brecha area. The Catholic sister working in Potosi had talked with the head of the UCC and they agreed to encourage men to bring their entire families with them in 1976. They were scheduled to settle two nucleos. The largest pioneer contingent ever to arrive to settle in a nucleo up to that point, some 250 men, women, and children, came in mid-July of 1976. They found that not only was the Brecha not completely built to nucleo 11 where they were supposed to settle, but that nothing had been done to clear the nucleo center or sink the well. The group split up with some women and children staying with relatives in nucleos 1, 4, and 7. Others stayed in nucleo 9 which had been cleared and prepared the previous year. INC and UCC personnel decided they did not want to settle nucleo 9 until a group of colonists definitely chose to do so because it had a very salty tasting water supply. This group from Potosi reportedly was thinking strongly about requesting settlement in nucleo 9. Nucleo 11 was completed just at that point and the group moved there. Many of the men had been working with relatives in the nucleos 1, 4, and 7, and had already begun to learn the new technology of the lowlands. The OP began in nucleo 11. Another group from the same area in Potosi were denied access to a nucleo for 1976, after some had sold their animals and other goods in preparation for the move. It was one of the worst examples of the effects of poor communication and delayed infrastructure completion.

In 1976 a large, well-organized group arrived to settle in nucleo 12, but were dissatisfied at the conditions of the nucleo and the rules of the OP about permanent occupation during the four months. They left soon after arrival. A small contingent of highlanders who had lived in the lowlands for a few years and who had registered in the INC office in Montero, moved to nucleo 14 in 1976. This group of 10 to 12 colonists had a modified OP.

1977 was the first year of settlement of a large number of nucleos. Eleven were opened in that year. It was also the first year that all infrastructure was complete before the arrival of colonists in each nucleo, even if only by a few hours or minutes. Two nucleos, 13 and 15, were composed of colonists from the Yocaylla sub-region of Potosi. They arrived to find relatives in nucleos 1, 4, 7, and 11 and benefitted from these established connections. Nucleos 12, 14, 17, and 18 were settled with colonists who had all lived more or less contiguously in a lowland colonization zone called the Littoral, which they left north of Montero because of flooding. Their areas of origin were largely the southern Altiplano and valley departments; 90% were from Potosi, Cochabamba, and Chuquisaca. Nucleos 10, 16, 20, and 21 were composed of highlanders who had lived in the lowlands for varying periods of time, but in different places. There were few inter-household connections existing prior to settlement in San Julian. The colonists of nucleo 9, the last settlement on the German Highway, were all from the La Paz department. They were kin, friends and fictive kin of the repatriated La Paz

colonists of nucleo 6. They decided to settle despite warnings that the salty water supply could offer health problems. The colonists decided that the apparent fertility of the land offset potential difficulties of the water supply.

In 1978, ten nucleos were settled. The author did not work extensively with this group. However, it was ascertained that nucleo 19 was settled mostly by colonists with kin in nucleo 20, and the same was true of the colonists of nucleo 24 with those in nucleo 21. This meant that many in nucleo 19 came from the distant western department of Oruro, and many in nucleo 24 came from the area of the town of Koi Pasi in central Potosi. Nucleo 22 has a majority of residents from one part of the southern department of Chuquisaca, recruited by the INC. The contingent that year from the Yocaylla sub-region of Potosi, were the Catholic sister works, all settled in nucleo 32. Many of the settlers of nucleo 30 were living as laborers, tenant farmers, and/or colonists on land around San Pedro, north of Montero. They are almost all highlanders. The majority of colonists in nucleo 29 are from La Paz and Oruro departments and were recruited by the INC office of La Paz.

Demographic Structure of the Population

The population of San Julian is heavily weighted toward young, adult males. In a sub-set of the first survey including all households from nine of the eleven nucleos founded in 1977, 33.4% of all members of the population (223 individuals of 667)

were males between the ages of 16 and 30. Single male households are present in great numbers. INC statistics reveal 46.9% of the households settled as of 1978 were single male households. The author's sub-set from the first survey showed that 30% of the households were unmarried males and 16% of them were married men living in San Julian without their families, which together would total very close to the INC statistics. The sample of that sub-set from the second survey included 30% unmarried male households and 21% households in which the married male head was without his wife and family during the OP.

Graph 1 is representative of the population found for most of the San Julian zone. It is a young expanding population which is in short supply of adult females. Graphs 2 through 10 show the demographic structure of 9 of the 11 nucleos founded in 1977. The variation reflects the kinds of individuals and groups who live in these nucleos, especially in relation to several issues of the demography of the population.

Frontier or pioneering populations, as discussed in the first chapter on a cross-species basis, are often heavily young, male, and adult, in their demographic composition. This can be related to energy efficiency and protection of child-bearing members of the population when entering new habitats.

Many informants, when discussing sex ratios in populations of agricultural frontier areas of northern Santa Cruz, stated that the original populations they had known in the zones

ranging from Cuatro Ojitos to Cotoca to Yapacani were young, adult males. The demographic data presented here for part of the San Julian population support this view. There are several factors which affect the demographic composition of the population.

First, the tasks for beginning the settlement are extremely demanding of heavy and sustained energy output and, in particular, demand arm, shoulder and upper body strength. Traditionally in the lowlands, these tasks have been performed by males; women have not cleared the jungle. The population longest adapted to the region, the Ayureode ethnic group, demonstrates that fact. The groups of Ayureode which are now employed in commercial tree-cutting are all young males.

Second, beyond the issue of energy efficiency, the heavy male emphasis or machismo has an effect on population structure. It is assumed by many that women cannot perform as well as men in the tasks of establishing new settlements, and this belief is accepted by both men and women. Discussion of the division of labor by sex in nucleos where women are present will disprove this, as in those nucleos women performed tasks as well as, if not better, than men.

Further, a pattern of multiple resource exploitation with a spouse living in other locations, contributes to the married male living in the nucleo alone. Of the colonists interviewed in the second survey sample, 20% stated that their wives were caring for children and maintaining property in other locations.

Another important factor which influences demographic composition is the structure of the group which forms the nucleo. Three examples illustrate this point. Nucleo 13 contains colonists who all are from the same village, Turqui, in the Yocaylla sub-region of Potosi. They arrived in 1977, and were encouraged to and did transfer many nuclear and extended families intact (see Graph 4). The sex ratio is nearly balanced at all age levels. In the same year, nucleo 10 was founded by a group of colonists composed of migrant workers and peon laborers literally pulled together from the streets of Montero by a private community development agency called DESEC. It is an unbalanced population, mostly young, adult males (see Graph 2). Nucleo 14 falls somewhere between these two examples (see Graph 5). It was formed by an existing group of small farmers and laborers who were living in the same area of the Littoral, a spontaneous colonization zone, in another part of the northern Santa Cruz region. Much of the variation in demography can be explained by the kinds of individuals and groups which originally enter the nucleos and how they were selected or recruited.

Another interesting facet of the demography of the colonization zone is the length of time for which settlements have existed. Demographic profile data does not exist to enable comparison of all nucleos founded from 1972 to the present, but INC statistics in Table 12 allow for comparative measures of household size. For all nucleos settled between

1972 and 1978, 2.77 individuals are present in the average household. For eight nucleos settled between 1972 and 1976, the average household size is 3.55 individuals, and for those 21 nucleos settled in 1977 and 1978, the average is 2.5 individuals. Family size does increase over time in the colonization zone. Another trend that shows some indications of change in family composition over time is the presence of a spouse in the household. Of nucleos established between 1972 and 1976, 70.4% of the households had spouses present in 1978; of those founded after 1976, only 46.9% of the households had a spouse present.

Presentation and discussion of area of origin and demographic data has related these factors to the process of adaptation. The major concern expressed by development agents has been how the presence of single male households affects the stability and chances for permanent occupation by colonists of the zone.

It is an important issue because formation of adaptive strategies depends, to a great extent, on family and group structure. If the population is largely transient, young, and single, then social networks do not exist which might support a long-term commitment to settlement in the zone.

Techno-Economic Activities: Production in the Lowland

Colonists in San Julian are farmers on an agricultural frontier. They must carry out an annual cycle of activities related to crop production and animal raising. This involves

growing annual and perennial plants and trees. Table 13 indicates the important food and cash plants and trees, and activities related to growing them. Table 14 presents the domesticated animals important in the zone and the products available from them.

The agricultural cycle on a given piece of monte, or uncleared forest, begins in June and July when the chaqueo, or clearing, takes place. This is the term for the overall process of land preparation. The first step is the rozada when the farmer moves through the forest with a machete, cutting down all undergrowth including bushes and small trees.

To rozar or cut undergrowth for a hectare requires one man between 5 and 10 days, depending on its density, his skill with a machete, and his energy supply. The only vegetation left standing are trees which cannot be hacked down by a machete and the infamous palo santo. The latter, as has been mentioned, is a thin tree but harbors multitudinous tiny red ants with incredible stinging power. One machete blow to this tree brings a shower of blinding pain as the ants shoot out from the core to attack anything which threatens their host. The next stage of the chaqueo is called the tumbada and begins immediately after the rozada in mid to late July. All large trees are cut down, either with an axe or a chain saw. Some hardwoods can reach a meter or wider in girth. The tumbada demands the greatest amount of energy output of the agricultural cycle. To clear a hectare of trees, one man needs

6 to 18 days depending on the number of trees, his skill with an axe, and his energy level.

Chain saw use speeds the tree felling stage greatly, but as yet they are a rare commodity in San Julian. Frequently observed problems with them were a shortage of fuel, maintenance and repair knowledge, and spare parts. With these problems, working with an axe can sometimes accomplish more in less time.

All trees in the future chaco or field are cut down except the motacu palm, because of its future leaf production for roofing material, the sumuque palm, because of its straight trunk used to make boards, and the palo santo, because no one will go near it. The tumbada is followed by a careful cutting of all branches on the large trees and their distribution, as evenly as possible, over the chaco. This is done to assure an even burn and spreading of ashes over the chaco. All cleaning and piling activities end by late August. This is usually the driest part of the year and the farmers let the trunks, branches, and vegetation bake in the sun and dry in the winds of late winter.

By early to mid-September, those chacos which were cleared early, and judged dry enough, are burned over. The area to be burned is bounded by fire lanes, if it lies anywhere near crops, pasture grass, or houses. They are up to two meters in width. The first burn is followed by the farmer working through the branches and trunks, spreading the branches in preparation for the second burn. This is called the

chafreada. Fields are then burned a second time. Farmers enter the fields for a final chafreada that leaves areas open for planting.

Between early October and early November, depending on when the rains begin or are expected to begin, rice and corn are planted. They are often inter-planted or callejonado, but can also be planted in concentrated patches of rice and corn, as the latter can serve as a wind break for the farmer. On an average clearing of 1.5 hectares in the first year of colonization, .7 hectares were planted in rice and .8 hectares in corn. Colonists are supplied three varieties of rice, called Noventón or ninety-day, bluebonnet, and dorado; and two varieties of corn, tuxpeño and cubano, by the OP. The supply allows the farmer to experiment and judge which variety or varieties he might prefer by seeing the differences in growth characteristics and yield.

The timing of the planting is crucial especially for rice growth. This crop is very sensitive to water availability in its early growth and flowering stages.

Following seeding, usually completed in 3 to 4 days, with the use of a bellows seeding machine or dibble stick, the annual and perennial tree crops are planted. One of these is the banana. There are three varieties of banana found in San Julian. They are the walele, a short thick type, the guineo, a longer, thinner banana, and the platano, a longer cooking type. They are grown by vegetative reproduction from chunks of

roots or stems, in patches or groves near the house. First year colonists are supplied some of each type by the OP. Species of yuca or manioc stems are also planted at this time, by vegetative reproduction in concentrated patches or groves. As much as a tenth of a hectare can be devoted to yuca planting, and at least two varieties of yuca were observed. One kind yielded a whitish mature edible root in six months; the other required 8 to 10 months and yielded a yellow root.

Papaya seeds are often planted after the seeding of the grain crops. The tree grows and bears fruit in 10 to 12 months. Citrus tree seeds and pineapple plants are also planted at this time, near the beginning of the rainy season, and will be mature within two to three years. Vegetables, including tomatoes, cucumbers, and lettuce can be planted in this season, but also throughout the year. Two plants with edible roots, the camote or sweet potato and the walusa are grown during this period. Sunflowers, introduced by the OP for animal feed, are planted. The period lasts until late December or early January.

The major task of January and February is the weeding of the corn and rice crop, the carpida. In the second survey sample an average of just under seven working days was spent in weeding approximately 1.5 hectares of the grains. The most dedicated farmers carry out weeding at least twice in January and February. This is also the time for planting peanuts and frejol or beans, but they can be planted even later in the year. Seeds for these are supplied by the OP. By the end of

January, the first corn is ripe for the harvest. There is no better time of the year for eating choclo or corn on the cob. Most corn is left on the stalk to be harvested later after it has dried. The stalk is often bent to permit drying and prevent rain from entering and rotting the corn. Corn is harvested completely by May. Leaving the corn on the stalk provides relatively safe storage in the field compared to the often rat-infested houses.

By mid-to-late February, the rice harvest begins, depending on the length of the maturation of varieties and environmental conditions such as the amount of rain. By March, the rice harvest is in full swing. When mature, rice must be harvested in a relatively brief time period as the heavy heads begin to droop and, if they reach the ground, they will rot or be eaten by animals. The noventon rice can be harvested after 90 days; bluebonnet and dorado requires more time. Harvest of rice required an average of 14 days.

Rice is stored in the tumbadillo or upper platform in the main house of the colonist, or on a platform on the ground floor. Some colonists, usually those who have more land cleared and are planting in areas further from the house than first year farmers, build small shelters out in distant sections of the chaco. This illustrates the difficulty in transport energy efficiency of the triangular shaped farm pattern. After the rice is completely harvested, the colonist can work on harvesting corn and in planting early dry season

vegetables. Another important activity is the home processing of corn and rice for the market. Corn ears are picked by hand and all kernels are bagged in 100 pound units or quintales. Rice is usually bagged before milling in units of 370 to 380 pounds or fanegas. Some rice milling takes place at new commercial mills found in most nucleos located on the Brecha Casarabe.

By late May and into June, colonists are harvesting their early winter crops and preparing for land clearing activities. The area cleared in the preceding year will be planted again. Land is usually cropped at least two years, often three, before it is left to return to secondary forest or barbecho. Colonists in the survey sample planned to interplant corn and rice. The price of corn dipped far below expectation because of overproduction and market saturation in 1978. Farmers were discouraged, and planned to plant less corn in 1979. Projections from farmers in the survey sample were for planting 1.5 hectares of rice and 1.3 hectares of corn in the coming year.

Table 15 illustrates the productive activities which were most often mentioned and observed as providing the most difficulty for highlanders. In machete and axe use, there is a wide range of variation in skill between colonists. Native lowlanders have poetically rhythmic motions which extract large chunks of wood from the hardest trunk with almost every blow. They know how to keep their axe just slightly below its

sharpest point, which is the best method. Highland migrants, with a good deal of experience, can approach the fluidity of the lowlanders, but most fall short of that ability. The control of fire is another crucial technological item for highlanders to learn. In nucleo 15, for example, the majority of colonists were totally new to the technique of fire management, and when the wind changed on the day they were burning their fields, the UCC's social promotor's house and storage almost burned down. The timing of seeding for different plants is another crucial and difficult piece of knowledge to assimilate. It is difficult even for farmers with knowledge of and experience with the environment to predict the best time to plant, and more so for farmers who have little knowledge or experience. The importance of thorough and frequent weeding during the period of crop growth is another area with which highland migrants have some difficulty. One problem observed among a group which had arrived from the Potosi department with little or no experience in the lowlands was the decision to return to the highland village in December and January of 1978 for visiting and participation in local fiestas. They returned to find their rice and corn inundated by weed growth because they had left at the most important time of weeding in the annual cycle. Harvesting is another area which provides a challenge for learning to highlanders new to the lowlands. The technique of cutting rice stalk heads is particularly difficult.

Animal raising goes on throughout the year. In most nucleos, the principal food animal is the chicken. Chickens are raised for egg and meat production, both for consumption and sale. Meat of chickens is not consumed in the home often, but if a farmer has 15 to 30 birds, at least one will be eaten per week or on fiesta days. Eggs and live chickens also are sold to produce cash income and are occasionally traded for barter. Ducks are also raised in San Julian. In nucleo 18, they seemed to outnumber chickens because they were always concentrated in the village center, where a ditch usually held water. Their eggs and meat are consumed and sold. Chicken and ducks are most often sold inside of the colonization zone.

Pigs are raised for cash sale. There may be as many as 3 to 4 households with up to three pigs in a nucleo, but some nucleos have none. Sheep have made their appearance in nucleo 14. Their wool is spun, but no major cottage industry of spinning or weaving existed during the time of the study. Some farmers had horses and mules, but again this was not common. They served for transportation and hauling cargo. The San Julian colonization zone is considered an area with a great potential for cattle raising. One farmer out of all the colonists in the nucleos founded since 1972, had dairy cattle at the time of the study.

Wild animals are an important protein source in San Julian. There was at least one gun used for hunting in every nucleo, in some there were many firearms. Guns are not usually

lent, except between close kin and friends, but the meat is often distributed to kin and friends when the hunting colonist is able to kill an animal. The tatu, or armadillo, is the most common game, followed by the taitetu, or collared peccary. Snakes and iguana are also eaten, but less often than the animals just mentioned. These highlanders had no locally adaptive tabus related to hunting behavior such as those reported for Amazonian colonists in Brazil by Moran (1979). For at least the first year of colonization, hunting is the major method used to supply animal protein.

Techno-economic Activities: A Comparison with the Highlands

Colonists come from differing highland areas with varying ecological conditions. However, the second survey and a personal visit to areas of origin, indicated that some broad trends are common to the highland area. These trends are both similar and dissimilar when compared with those encountered in the highlands.

Table 16 shows that 93% of the survey sample had fathers who were farmers. Of these, Table 17 illustrates that 42% had land at high to mid-range altitudes, approximately 3,000 to 4,000 meters above sea level. They raised a mixture of potatoes, quinoa, grano, haba (broadbean), oca, papa lisa, and in lower sections, corn. They raised sheep, llama and alpaca, burros and horses, and cattle. The second survey sample reported a household average of 34 sheep, 3 llamas, 2 burros,

1 horse and 7 cattle. The number and kind of animals possessed greatly varied, and many families owned no more than a few sheep and burros.

Another 35% of the survey labelled the land utilized in their area of origin as a mixture of high plains and mid-elevation valleys, roughly 2,000 to 3,000 meters above sea level. Another 14% reported their families' land as in the mid-altitude valleys and lower valleys such as the Tupiza Valley of Potosi. Therefore, there is some variation in ecological setting of the parent generation's farming activities, but most colonists were born and raised in the highlands and associated valleys.

The average amount of land used in the parental generation for agriculture was 4.15 hectares. Of the survey sample, 73.4% stated that plots were located in dispersed parcels at different altitudes and elevations. This indicated the classic kind of adaptation to the Andean zone discussed by Murra (1972) and others.

The timing of the cycle of the activities related to crop raising is generally similar in seasonal patterning in the highlands and in the lowlands. Activities which are part of the cycle are often very different. For example, land preparation in the highlands means turning over the topsoil and breaking up clods, done with either a foot plow or a plow pulled by oxen. This is done in the same dry season period as the *chaqueo* or land clearing and burning in the lowlands,

between June and August. Seeding activities reportedly took place between September and November in the highlands, when 81% of the sample said their families undertook these tasks. This is roughly the same time in which seeding takes place in the lowlands. 92% of the sample reported that weeding activities took place in the period of December through February in the highlands, again similar in timing to the lowlands. The major harvest for the year was reported by 89% of the sample to occur between April and June. The timing of harvest activities is roughly identical to that of lowland farming.

Several important differences do exist between the highland and lowland agricultural practices. First, land preparation involves no clearing in the higher elevations where there are few if any trees. In the lowlands, preparation does not include plowing, topsoil is disturbed only by the bellows seeder or dibble stick. Second, fertility is a concern in the highlands and valleys. Fertilization for a sustained yield is part of the activities in land preparation in the highlands. In the lowlands where land is plentiful, at present, land is used for a period of time and left to return to secondary forest growth. Third, all land used in the lowlands is at one elevation and is in contiguous plots, unlike that of the highlands. Fourth, the crops themselves are quite distinct with tubers and grains both playing an important part in the highlands while grain crops are more important, except for the significant food tuber yuca, in the lowlands. Finally, use of

irrigation is important in many parts of the highlands and valleys, 10% of the sample reported a total dependence on it in their areas of origin and 49% reported a partial dependence. No crops are irrigated in San Julian, except in a very minor way to raise small patches of vegetables.

Techno-Economic Activities: Marketing

There is an important area of choice in the decisions that a colonist must make when he is carrying out crop and animal raising activities in the San Julian zone. These decisions are those concerning the degree to which he chooses between subsistence and cash income generating production. All farmers in San Julian produce crops for sale and for domestic consumption. However, the amount of effort to produce the various crops in different quantities reveals the kind of strategy the farmer is pursuing.

Examples of entrepreneurial planning include the colonist in nucleo 11 who planted almost six hectares of corn and had 30,000 pounds of it to sell after the harvest, or the colonist in nucleo 1 who grew three hectares of green peppers to sell to Chinese restaurants in Santa Cruz. The latter made enough profit to build and stock a store. On the other hand, a colonist in nucleo 18 was only interested in providing a good diet for his family and create harmony in his surroundings. He planted a great variety of crops and worked very hard caring for them, but he did not have much to sell for cash income.

These are extreme examples; however, the average colonist would be placed on a continuum much closer to the entrepreneurial type than to the subsistence type. For example, in the sample, the average amount of corn sold was 24.7 quintales (one hundred pound units) and the average amount kept for consumption, both for humans and animals, was 3.85 quintales. This may be more than satisfactory for subsistence needs, but it reveals an orientation toward market production. Animal raising also allows similar choices which indicate subsistence or cash income generating goals.

One statistic from information about life in the highlands in the parental generation is significant here. 34% of the sample reported that goods had been exchanged on a non-commercial basis between kin and fictive kin in the economic life of the parental generation. They were living in different places, at different altitudinal levels, using dispersed plots and pastures, and raising different products. This is a mechanism of vertical integration of different productive zones that enabled these social groups to circumvent and avoid any or much involvement with the cash economy (Blair, personal communication).

There are several options for the San Julian colonists to earn cash income during the annual cycle. One of these is off-farm employment, either in other colonists' chacos in San Julian or outside San Julian. Most often, colonists avail themselves of opportunities to leave the zone after planting is

completed around early December. Some travel all the way to their area of origin; these are usually colonists who have only recently migrated to the east. They can stay up to two months, while their growing rice and corn is engulfed by weed growth which flourishes in their absence. Colonists also find short term employment on lowland agrobusiness farms, in urban construction in Santa Cruz or Montero, or for small farmers in other northern Santa Cruz colonization zones. They are near enough to San Julian to return and manage their farms. Table 18 shows the breakdown of off-farm employment for the second survey sample. Average daily wages in Bolivian pesos and U.S. dollars appear in Table 19. Employment lasts an average of 26 days a year and can range from 1 to 120 days, depending on the job and the colonist's need to return to San Julian (see Table 20).

Wage labor is also possible within and close to the San Julian zone. The Zapito sawmill is one place where colonists from nucleos 11, 12, and 15, those located nearest to it, often go to work. The sawmills along the German Highway also hire temporary employees. Farmers in the spontaneous areas who have been settled longer than those in the nucleos often hire colonists as jornaleros or daily wage workers. One crafty farmer of the spontaneous area of Los Angeles, works as an orienter in the OP every year and identifies new colonists to whom he will offer employment. Work for the construction company building the graveled, elevated roadbed for th Brecha

Casarabe was an option which a small number of colonists were able to utilize during the period between 1978 and 1980. Employment of new colonists and migrant workers by longer established colonists begun in the nucleos on the Brecha before the author left, and it is reported that the trickle of peones and jornaleros became a flood in 1979 (Magrina, personal communication). Working for wages can lessen the time and effort available to the colonists for their own plots as well as provide them with desired cash income; the hiring of workers indicates the economic growth of the zone as well as the potential for increase of income disparities.

Income-producing activities other than crop or animal raising can be carried out in San Julian. These include: carpentry; baking; bicycle repair; carrying loads; selling consumer items; and processing natural products such as charcoal-making or brewing chicha or corn beer for sale. Any of these activities is available to practically any colonist; it is a matter of personal decision and available labor and capital. One of these activities requires much more capital than others; the renting out of the use of a purchased chain saw for land clearing. For an investment of US\$ 400 to US\$ 600 to buy the machine, colonists can charge from US\$ 20 to US\$ 30 to clear a hectare of its larger trees. The problems of this income producing activity are the need for initial capital, the need to have access to a fuel supply, and the need to keep tools and gain knowledge for the maintenance and repair of the

machine. Establishing, stocking, and re-supplying a small store of tiendita is an easier option, but competition is keen with other stores and with the consumer's cooperative.

Techno-Economic Activities: Communication

Transportation is another part of the techno-economic sphere for the colonists. Indeed, one of the features discussed in the last chapter which distinguishes San Julian from other colonization zones is its transportation infrastructure. During most of the year, there is daily bus transport from the German Highway to Montero and Santa Cruz. The crossing of the Rio Grande is the one significant problem that determines if bus service is available or not (see Photograph 11). During much of the rainy season, when large vehicles cannot cross, busses run daily to either side of the river to meet passengers, who cross in small boats, to continue their journey. There is also heavy truck flow on the German Highway and drivers often stop to pick up passengers, usually charging them bus fare for the ride. INC and UCC vehicles also often carry colonists to and from the colonization zone.

The German Highway is an all-weather road, but has great maintenance difficulties from the merciless pounding it receives from heavy logging and lumber trucks. For most of the year, the German Highway is passable and carries all kinds of traffic. The river crossing is the prime difficulty, and a bridge is greatly needed. Such a bridge would be a major,

multi-million dollar project, because the river is constantly shifting its bed over a ten mile wide flood plain. The difficulty in obtaining funds for such a project is in justifying its economic return to investors, whether private, governmental, or international.

The most crucial and long-term transportation problem may be the river crossing, but certainly the most easily felt problem is the almost total lack of reliable and regularly scheduled public or private transport for all of the nucleos on the Brecha Casarabe. The Brecha is a one way road going northwest until it simply disappears. If project planners recognized the need for an adequate road network to exist in the zone, then they should also have planned for an organized system of transport to function, at least until private enterprise brought its own services to the zone. This is not to deny that colonists have been able to utilize INC, UCC, construction company, and other vehicles related to the project for transportation. Indeed, INC and UCC personnel would often go out of their way to provide transportation.

The unpredictability of transport is the key difficulty. This is especially true for goods shipment, particularly harvested and market-ready rice and corn. Average transport costs of 15 pesos per quintal (100 pounds) and 60 pesos per fanega (approximately 395 pounds) could have been reduced with a system of transport in place. However, colonists had to contract trucks to come from the regional market centers, and

some freight haulers charged high prices. The vehicle and fuel limitations of the INC and UCC are recognized. Different planning, funding, and allocation might have made transport easier for the colonist in the first years. Besides goods transport, medical emergency transportation is difficult to obtain. INC and UCC vehicles were always available for use in these situations, if one could be found.

Another related aspect of transportation in the lives of the colonists of San Julian is the fact that approximately two thirds of the nucleos are connected to the Brecha or the German Highway by access roads. Many are impassable during the rainy season because of poor construction or placement. Colonists living in these nucleos, by and large, accept the task of maintaining their own road, something that is set in INC policy. For example, a well-constructed bridge was built by colonists in nucleo 21 in March, 1978 because there was a large washed out area where an arroyo had passed (see Photograph 12). However, for many of the nucleos, particularly 13, 16, and 18, founded in 1977, roads were built without adequate road bed height or without installation of drainage pipes to allow water to pass under and not on top of the road in times of heavy rain. Finally, there were disquieting remarks made about the quality of construction being carried out on the Brecha itself. If this major road is not built and maintained well, then the unique infrastructural advantage the San Julian project is supposed to have will not exist.

Techno-Economic Activities: Construction

Construction is another area of techno-economic activities. For colonists in the first years, all materials are obtained in the colonization zone. The contribution of the OP in the area of instruction in materials selection and in building technology has already been noted. One factor not previously mentioned about the OP is that the buildings used for OP activities serve as models for colonists. These include the parque, built before colonist arrival, where the Social Promotor lives and food and supplies for the OP are stored; the galpones or barracks where colonists live during most of the OP, which is also completed before settlement, except for walls and furniture which the colonists must build; the cocina or kitchen and shed for oven, which colonists must build; and finally, the comedor, or dining hall and meeting place, which colonists must also build. In addition, colonists build latrines and showers with the guidance and instruction of the orienter. Most wood for construction is obtained from the forest surrounding the nucleos; a minor part is contributed by the UCC.

At the end of the OP, all colonists build their own home, which are usually of two floors (see Photograph 13). The ground floor can be for cooking, eating, and other activities of daily life, while the second floor is for sleeping on the tumbadillo floor. Highlanders build beds or catres; most do not know how to or enjoy sleeping in the lowlanders' traditional hammocks. If beds are built or purchased, they are

found on the first floor and the second floor is for storage. A separate kitchen is a feature in many houses and is strongly advocated by the OP. When used in conjunction with a raised hearth, improved hygiene and safety are supposed to result. Many houses also have separate chicken coops. It was noted earlier that shelters for crop storage are often built in distant sections of the farm.

One interesting feature for the study was the presence of highland elements in construction. One of these was baked mud or adobe bricks used for wall construction (see Photograph 14). Local lowland technology has designed a wall of mud mixed with straw placed between wooden boards or beams. Adobe can melt in the intense lowland rains, if the eaves of the roof do not extend far enough to drain water away from the walls. Some highlanders who build walls opt for the lowland practices; others, especially those recently arrived from the highlands, build with adobe. Adobe does survive but exposure to excessive moisture is always a threat, and in that sense, it is less well-adapted to the environment. The construction of a full-size second story is a highland feature found in only one San Julian house.

One further factor to note is the relation between roofing materials and health and wealth. All roofing is done with the leaves of the motacu palm in buildings constructed in the first few years of settlement. Corrugated metal roofs are built on the galpones of the OP and are left by the UCC for the benefit

of the community. The buildings have most often been walled in for schools, sanitary posts, or churches. Corrugated metal roofs only appear on private homes or businesses when accumulated wealth allows its replacement of motacu. It is an item of conspicuous consumption and easier to maintain. The palm leaf roofs also are related to potential health problems, as they can serve as the habitat for various insect and spider species. Particularly dangerous is their possible service for the vinchuca, the kissing bug so named for its manner of biting, which can transfer Chaga's disease. Development agents were not alarmed about this possibility stating the vinchuca did not live in the area, but the situation warrants monitoring.

Techno-Economic Activities: Labor Organization

The organization of labor to perform the necessary tasks involved with technoeconomic activities displays continuities with former highland and valley patterns. There are a variety of ways to accomplish tasks. First, a very few colonists try to do major jobs individually or with only occasional help. One of these colonists had to continually ask the entire nucleo for new volunteers to help him, because when they did help him he was so unpleasant to work with that they never wanted to help again.

A second type of labor organization is much more common. This is the performance of tasks by the nuclear family. For many of the activities, this is the largest group necessary.

However, with average household size being slightly under three individuals, the nuclear family is not a large pool of labor. Animal care, seeding, weeding, repiling debris during burning in the chafreado, and the raising of vegetables, banana trees, yuca, and animals can largely be done by the nuclear family. The woman's tasks in the sexual division of labor in nuclear families which were part of the sample may be found in Table 21. These show that 55% of the women work in household tasks (cooking, cleaning, washing, child care), animal raising (chickens, ducks, pigs), and gardening near the house (raising vegetables, aji or hot pepper, flowers). Another 45% of the sample women performed these tasks and worked in the chaco as an equal partner in agricultural activities. This compares to the reported labor of the women in the areas of origin. 22% of the women there were said to work in the house, take care of and pasture animals, and do light agricultural work. Fully 78.5% of the women in the areas of origin were reported to participate in carrying out all farm tasks, including labor in the fields. Clearly, the woman is a major participant in labor tasks on the Bolivian peasant farm, whether in the Altiplano, valleys, or in lowland colonization zones.

A nuclear family can supply the labor necessary to accomplish tasks such as land-clearing and harvesting. However, it can take much longer for the completion of these activities than if some other form of labor organization were used or combined with nuclear family labor. The delays can

have negative effects as, for example, when land-clearing continues into the period of the onset of the rainy season and a clean burn cannot be obtained, or when rice cannot be harvested before it falls to the ground. The labor of children is important, but demographic information has shown that there are not many families with children old enough to contribute much labor, at least in the most recently founded nucleos.

Another major form of labor organization are groups of related males and females who work together. They can be residents of the same nucleo or of different nucleos. They usually work on the basis of one or the other of two institutions of exchange labor. One is call ayni which means to cooperate in Quechua. In ayni, work parties are organized by a colonist who has a major project. He supplies food, drink, and coca and lime for all persons working. Anyone of them can call upon him to work for them if they have a similar task. The exchange is balanced roughly in days and difficulty of tasks. The other institution is the mink'a. In this form of labor, a work party, usually larger than that of ayni, is formed by a man who has a large one or two day job such as house construction or installation of a new roof. He supplies drink, food, and coca and lime and the termination of the job is followed by music and dancing.

Data from the survey sample indicates the degree of use of exchange labor for the agricultural cycle of 1977-1978. For seeding, 10% of the sample used ayni exchange; for weeding 20%

used it; for harvesting 49% used ayni (see Tables 22-24). Of those reporting use of ayni exchange labor, Table 25 reveals whether persons participating were from the same or other nucleos and if they were or were not kin. The data indicates that ayni exchange, for the sample, occurs almost exclusively within the nucleo almost equally between non-kin and kin. Only 24% of the sample was planning to use ayni exchange in the *chaqueo* or land clearing of June-July, 1978.

The final category of labor organization is that of wage work. When nuclear family labor will not suffice and exchange labor is either not available or not desired, some farmers will hire labor. This is relatively rare in the recently founded nucleos, as shown in Table 26. Typical of those who did hire labor in a one-year old nucleo was a farmer from Cochabamba living in Nucleo 12. He had hurt his foot badly and could not go out to bring in his rice and corn harvest. He also did not have any kin in the nucleo. Further, he was relatively well-supplied with capital and had hired peones before in another colonization zone where he had rented land.

As time passes, apparently, more and more colonists are hiring labor, at least this was the latest report from the 1979 harvest (Magrina, personal communication). Certainly one reason for this wage labor growth is the difficulty of harvesting increasing amounts of rice every year, which must be brought in within a limited period of time.

A brief look at the reported labor organization for the areas of origin of the sample will enable a general comparison. Table 27 indicated that the nuclear family performed 50.5% of the tasks and ayni exchange performed 42% of the work. Table 28 demonstrates the participation of colonists from the sample in labor in their areas of origin. 42% had some involvement in 1977-1978. Table 29 indicates the reported frequency of kin from the area of origin who came to work in San Julian with kin the sample. The flow, for this sample of colonists, appears weighted toward the return of labor to the area of origin. This could be related to the fact that, by and large, the young migrant who left is more mobile than the older people in the area of origin. Further, it is highly probably that the "visit" response marks labor exchange; therefore labor would be relatively even.

Techno-Economic Activities: Distribution of Goods

The exchange of goods is the last area of techno-economic aspects of life in San Julian that will be discussed. The OP requires initial participation in a consumer's cooperative. All colonists join the coop when they enter San Julian. Of the sample, 76% remained as members of the consumer's coop after one to two years of settlement. Centrally located large stores in the central nucleos of each NADEPA supply small stores in each nucleo. Many important consumer items are sold, from salt, sugar, and flour to buckets and bicycle parts. Many

colonists complained, though, that farm items such as fertilizer, seed, and equipment were not available through the coop. Coop managers explained their reluctance to buy such expensive items. No credit is extended from the coop stores because of a policy decision by the managers. When individual nucleo coop store managers were, in a few cases, pressured by kin and friends to give credit, they were criticized by coop managers. The principal problem related to credit and the coop store is that the store operates on a razor thin profit margin. To delay payment in the inflationary economy makes restocking more difficult than it already is for coop managers. If the coop expands into farming supplies and equipment, the issue of credit buying will definitely require policy decisions.

Besides the coop store, small stores or tienditas are appearing in many nucleos. The older nucleos such as nucleo 1 and 2 have these stores. Nucleo 1, in fact, is an extreme example of entrepreneurship gone wild as there are 16 small stores, some with a great deal of merchandise and four of which have kerosene refrigerators for sale of cold drinks. Prices fluctuate greatly between the stores and on different days. Competition is great also because the stores carry the same basic goods. However, for the more recently founded nucleos of the Brecha Casarabe, buying in the coop remained the primary means of goods supply. 77% of the sample reported that they bought most consumer goods in the coop store, with only 5%

buying in local stores and 18% buying in the regional urban marketing center of Montero. The latter is interesting in that these colonists preferred buying at prices just slightly below the coop prices and then hauling goods, sometimes paying freight charges, back to San Julian. This does not appear to be energy efficient or rational, but the ability to select among a greater variety in the urban market may have been a factor. Further, goods may be obtained in the city very cheaply if members of the colonists' families or people somehow associated with them will exchange goods, circumventing the need to pay cash at the coop store.

Finally, goods are exchanged between colonists and kin and friends in other places. The survey showed that, in particular, this is true for exchanges with family in the areas of origin. Of those surveyed, 65% reported that goods were sent to the area of origin, and 61% reported that goods arrived from there. Those colonists from the Yocaylla sub-region of Potosi every year sent large portions of their corn and rice harvest back and received highland crops of potatoes and haba or broad beans in return. Colonists who have lived in the lowlands for longer than the recently arrived potosinos also exchange goods with their place of origin, but never in as great a quantity as do the Potosinos. However, those who had been in the lowlands for some time, often exchanged goods with relatives and friends in other parts of the lowlands in a pattern of multiple resource exploitation (Stearman, 1978).

The sample reported an average of 2.2 relatives in other locations in Santa Cruz, including urban and rural places, and exchange of goods and labor was a common element in their relations.

Social Organization in San Julian

The social structure of the colonists of San Julian takes a wide variety of forms. These include the traditional highland extended family and fictive kin of compadrazgo, and new innovative forms such as evangelical protestant "brotherhood" and business partnerships. However, these people are rural peasants and relationships are most often multi-dimensional and locally based. The characteristic of being multi-dimensional refers to a feature of social relations which means they serve a combination of functions. These relations can exist as a means for exchanging labor and/or goods, organizing decision-making, sharing child care, providing organization for religious observances, and celebrating personal and group events. Relationships exist within nucleos and between nucleos. People in other places in the lowlands and/or in the areas of origin are also important to individual colonists.

Kinship is a major thread in the fabric of social organization in San Julian. 48.5% of the survey sample reported having kin in their nucleo and 36% have kin in other nucleos. In the nucleos from the Yocaylla sub-region of

Potosi, "all are related to all" was the common response. This meant that they are units of extended kin, inter-related by blood and marriage. This group includes all residents of nucleos 11, 13, 15, and 32, and parts of 1, 4, and 7.

However, the average number of kin who are household heads in the same nucleo is 1.5 and in other nucleos it is .9. Therefore, a more common kin unit is the man and his wife in nucleo 21 who have two adult sons, one married with two children, as neighbors. They all have farm plots close to each other and pool labor, child-rearing, food preparation, recreation, and votes in nucleo decision making sessions. Other forms of larger kin units are less common. An example is the group of five brothers and four cousins in nucleo 21. They share some labor, child-rearing recreation activities, and often unite to make an impact on nucleo decision-making.

Fictive kin relations of compadrazgo or ritual co-parenthood are less frequently present in San Julian than blood or marriage ties. The most common ways to establish ties of compadrazgo are sponsorship of baptisms, first haircuts and curing ceremonies are sponsored in the event of serious illness. Padrinos or fictive parent sponsors for rituals like weddings are also found in San Julian. There were only three padrinos in the sample.

Only 14% of the colonists had a compadre living in the same nucleo in which they lived and 8% had a compadre living in another nucleo. For colonists in the sample who had compadres

in the colonization zone, the kinds of activities they shared are shown in Table 30. Exchanging labor, traveling together outside of the colonization zone, and hunting together were the most commonly reported activities. One reason that fewer fictive kin relations exist in the sample than kin associations is that many of the colonists are not married, and, therefore would have asked no one to be a sponsor of a wedding, a padrino, or of a baptism, a compadre. Another reason is that, if married, few children have as yet been born, limiting opportunities for baptism ceremonies. It is also difficult to find a priest who will perform the rites in the zone.

Non-kinship associations are the main form of social relationship among colonists in San Julian, with the exception of the nucleos which have colonists from the Yocaylla sub-region of Potosi. These relations are called amigos or friends, vecinos or neighbors, and socios or partners. The tie is multi-dimensional, based on shared experience between people who live near each other, in the same nucleo or within the colonization zone, and who often share production or marketing ventures.

In San Julian, one variation in the bonds between colonists is based on joint membership and belief in one of the evangelical protestant religious sects. Of the thirty percent of the second survey sample who had converted, 93% stated that they had done so as a group with others who converted at the same time. Of this group, 36% reported one weekly meeting of

the new organization, 64% reported attending between two to four meetings a week. The "community of brethren" provided an intense and on-going set of repeated rituals of re-affirmation to converts. The implications of conversion for attitudinal and value change will be discussed later; here it is important to see that conversion provides a set of new but intense social relationships for the convert. In the colonization zone, the evangelical group's relations are multi-dimensional bonds, which are constantly reinforced by repeated rituals.

For more secular non-kin associations, the multi-dimensional nature of connections can diminish to a point at which colonists only base a relationship on jointly shared risk in an economic venture. For example, residents of a nucleo may band together to contract a freight-hauling truck to carry crops to the market, or they might invest in buying a rice polishing mill. However, these often become multi-dimensional over time, if the economic function continues satisfactorily. Partners often become compadres, for example.

The most important relationships for the colonist are those based on traditional kin, fictive kin, and friendship bases. They provide the fundamental means of building the social structure of the colony. They are the bases of the formation of the units for adaptation, those most central to the study's analysis. However, there also existed a social organization of non-traditional, formal units. These are found at the nucleo and inter-nucleo levels.

A nucleo is the unit designed as what planners called a "village site". A new "community" is designated when each nucleo is settled. During the OP, there are weekly or bi-monthly reuniones or meetings to discuss the progress of establishing a settlement, to plan future activities, to provide technical instruction and cooperative formation education, and to allow a rotating set of colonists to gain experience in directing group decision-making activities. While the author observed many meetings, a basic research question was whether a "community" was being formed. Decisions were made, plans were formed, leaders were elected, and lectures were delivered, but it was not clear if a "community" was in the making. Even less obvious was the process of formation of a "community" at an inter-nucleo level, the NADEPA. Representatives from all nucleos met and discussed issues related to the consumer's cooperative, health delivery systems, and athletic events.

The best way to assess if "communities" were being formed is to look at the degree of presence of collective actions and collective identities. The former will be discussed here, the latter in the concluding sections of this chapter. Collective activities include communal work projects, nucleo meetings, and recreational and ritual events. The first category was a major part of the OP. Labor was organized on a nucleo wide basis throughout the schedule of tasks to initiate settlement.

After the OP concluded, work projects continued. However, some nucleos seemed more successful in enlisting group support and enthusiasm than others. It is important here to point out that there is a long standing tradition in highland and valley communities for communal labor projects. Of the sample surveyed, 85% reported at least monthly meetings in their community of origin, and 92% stated that community work projects were carried out, including road maintenance, church and school building repair, and the cleaning of irrigation canals. This continued in San Julian. If communal work activities are a measure of community formation, then it was occurring in San Julian.

Another aspect of collective action is group decision-making. This includes participation in the formulation of alternatives, and selection among alternatives, and carrying out of decisions. The notion of sharing of power in decision-making at the local level is not alien to these Andean peoples. Very unequal structures have existed in the Inca state, Aymara kingdoms, Spanish empire, and the Bolivian republic, but small communities, while led by respected elders, have a tradition of free discussion and expression of opinion.

Therefore, when the San Julian nucleo meetings take place, the process of group decision-making is not unfamiliar. Difficulties enter when relationships between members of a supposed "community" are fragile, if not non-existent. To be sure, factionalism and divisive or poor leadership were present

even in nucleos which were composed of people who had lived together for many years, as the Yocaylla sub-region group in nucleo 7. However, decisions were made more efficiently and accepted more readily in these so-called "homogeneous" nucleos as compared with those nucleos in which colonists did not know each other and had few shared interests. This is not to say that the transfer of segments of existing communities, as in the case of nucleo 13, or of groups which have lived together a long time in the lowlands, as in the case of nucleo 12, does not potentially transfer and even exacerbate pre-existing rifts and conflicts. It does mean that in nucleos constituted by colonists with long-term multi-dimensional ties, relationships and understandings exist which can support community activities. The process of involving all colonists in participation in decision-making in "community formation" in San Julian is a partial reality, but not a complete one. Some nucleos remain no more than a set of individuals and small groups.

Ritual activity is also part of "community" formation in the OP. The colonists march on the first day of settlement to celebrate their arrival. Highland musical instruments, the zampona, charango, and tambor, play out. Marching at civic and religious fiestas is traditional in the colonists' areas of origin. The 6th of August celebration, Bolivia's National Independence Day, in the last few years has brought together nucleos undergoing the OP, for a day of marching, dancing,

sports competition, and celebration (see Photograph 15). These take place in the central nucleos and reinforce nucleo and NADEPA identification.

The clausura or closing ritual is the major fiesta during the OP. At a typical clausura, the nucleo divides tasks including a cleanup of the grounds, food preparation, and decoration of the buildings, especially the dining hall where eating and ceremonies take place. INC and UCC staff arrive and speeches are given. They laud the pioneer spirit of the colonists and the hard work they have undertaken to found their new settlement and build their community. Nucleo officers are sworn in by an INC official, representing the national government, and "certificates of settlement" are given out (see Photograph 16). Supposedly these can be exchanged for a secure title to the 50 hectare land grant, if the colonist stays on the land, works it for two years, and pays about U.S. \$75. No farmers had received titles before the author left the field site and reports since indicate that the titling is still not being done. Nevertheless, all household heads receive their certificates at the clausura. After that, except for the evangelical protestants, dancing and drinking commence as the nucleo celebrates a typical fiesta. Yearly anniversaries of the dates of nucleo founding are celebrated in most nucleos, in a similar manner to the clausura.

Closely related to the nucleo "community" building and the reinforcing secular rituals above are the sports events. These are primarily soccer games and tournaments, but races, on foot or bicycle, can be a part of activities. Soccer is universally popular and is played during rest breaks on the six work days of the week as well as all day on Sunday. Inter-nucleo competition displays a high level of organization with committees and rules. 1978 was the year of the World Cup competition in nearby Argentina. Radios were almost always tuned to the latest clash. A campeonato or San Julian championship competition began with endless rounds of eliminations and playoffs. Indeed, new nucleos founded in that year, even by colonists who did not know each other, eagerly formed teams. Rumors flew about where the good players were, and one nucleo even tried to persuade one joven or youth to change nucleos because of his reported futbol talents. The nucleo transfer or trade deadline passed without action by either side.

Planners recognized the significance of soccer by making the cancha or soccer field a part of the nucleo center layout in each settlement. From the first day of the colonists' entry it was used. The road company was able to assure cooperation and good will by clearing new soccer fields whenever road widening destroyed pre-existing fields. Athletic activity and competition was a major component of building collective identity within and between nucleos and in the NADEPA's.

Sports promote immediate inter-nucleo relationships, but other collective actions are as yet limited. Committees of representatives of member nucleos meet concerning the functioning of the consumer's cooperatives and the health service delivery. NADEPA 1, centered in Nucleo 2 on the German Highway has become important as the location of the consumer cooperative store and member nucleos are clearing the town site, in which each farmer in the nine nucleos is assigned a house lot. Town site clearing and house construction were beginning in NADEPA 2, centered in Nucleo 14, at the end of the author's fieldwork. Reports received since have indicated that this has proceeded rapidly. Before the author left the site, a weekly feria or Sunday market was held in Nucleo 14.

One incident which occurred in July, 1978, indicated the growth of inter-nucleo identity and structure. When national political unrest led to the informal detention, based on groundless charges, of the NADEPA president, all nucleo presidents and/or NADEPA representatives were notified within hours. The vice president of the NADEPA later reported they were resolved to march out and protest the detention. They were also angry because UCC personnel were taken by the political agents. This indicated the generally high esteem in which the UCC was held by colonists. The formation of organizational structure and identity in the other NADEPA's further north on the Brecha was impossible to assess before the termination of fieldwork, as they were only recently founded.

intensity of the 6th of August celebration and sports activities indicated they were proceeding to organize themselves.

Values, Goals, and Ideology in San Julian

Colonists, as do all people, have values upon which judgements for actions are made. The colonists face key issues in adaptation to the San Julian ecosystem with sets of values, which are in a state of flux for many, and establish anticipations or goals based on their way of viewing the world, their ideology. Ideology is defined here as the way the colonists interpret the structure of economic, political, and supernatural relations in the world, and the place they see for themselves in that structure both as individuals and as a class. Choices which manifest values include: what kinds of crops to grow and animals to raise; how to balance efforts made in subsistence production with those made for cash income generation; what kinds of relations and exchanges to have with those remaining in the areas of origin or in other locations; how to practice religion; whether and how to establish an identification and work with large groups in cooperative efforts or with a more limited group for maximization of individual benefit; and, ultimately, whether to stay in San Julian or sell out and move on to other lowland rural areas, urban areas, or back to the areas of origin.

The issue of the social and cultural marginality of the pioneer migrants is relevant to values, goals, and ideology because the choice to leave areas of origin is made by the migrant who places himself or herself is placed by social and economic forces on the margins of the community of origin. Both the push from within the migrant and from within his community, where he/she cannot find ways to satisfy his/her goals, and the pull of the new location, with its opportunities to satisfy whatever values and goals which have made him or her unable or unwilling to remain in the area of origin, are important.

One way to see whether marginality has any relevance in explaining the migration of the pioneer colonists of San Julian is to look at comments by Zierten about the Santa Cruz migrant farmer population in general. He labelled the process of testing and change, called marginality above, as urbanization. This does not refer to the standard academic definition of the tendency to create urban population concentrations at a society level. Rather, Zierten means the process of expanding the outlook of the individual migrant, "to extricate oneself from traditional patterns, attitudes, and values in order to assure modern ones" (Zierten, 1971:8). He further points out that (1971:8-9):

The rural colonization that is occurring now in Bolivia is part of an urbanization process because in reality, the colonists are individuals urbanizing the frontiers of their own country. The fact that they transport themselves physically, from their place of origin to new lands implies, to a certain degree, the abandonment of traditional rural values in favor of those more urban and modern (emphasis in original).

The pioneer colonists of San Julian are, by and large, people whose migration and movement has been a major element in adaptation to their life situation. Information about the parental generation from the second survey sample indicates that 55% of the colonists' fathers had "traveled" or migrated regularly in order to pursue adaptive goals. Table 31 shows the breakdown of explanations for the fathers' moves. Selling goods and products in other locations, even other regions, was one important element. Working in jobs in other places, usually in mining, was equally important. This movement was most often described as the traditional seasonal labor documented for highland and valleys peoples of Bolivia, and not the result of "urbanization" or marginality in the parental generation. However, it did establish a pattern of resource exploitation through mobility.

The migrant sample reported a great deal of migration in their own life experiences. 88% of the sample had lived and worked outside of their area of origin prior to settling in San Julian. Of these, 26% had worked from one to nineteen years (average 3.4) in Chile or Argentina, and 87% had worked from one to nineteen years (average 4.4) in the department of Santa Cruz. The kinds of work done by those who had been in Santa Cruz is indicated in Table 32. This migration is different from that of the parental generation because it is a long-term move, often leading to permanent relocation. This requires major adjustments and often leads to the attenuation or atrophy of connections to the area of origin and its values.

Table 33 presents the differences between the expressed values and the real behavior of the colonists in the sample in maintaining connections with their areas of origin. More colonists placed expressed value on returning to their places of origin for participation in religious and civic fiestas than actually returned. This discrepancy also holds true for participation with kin in the annual agricultural cycle in their area of origin. Distances are traversed by some, but not by the majority. More significant than distance in explaining the lack of participation by colonists in ritual events and agricultural tasks in the area of origin is the fact that the colonists are beginning to identify with the lowland location. Colonists frequently stated that the most important fiesta of the year was the celebration of the founding of the nucleo, "Our life is here now".

If the life arena, for most colonists, has been transferred to the lowlands and San Julian, then they must be developing values and goals appropriate to adaptation there. To begin examining those values, it is useful to look at the way in which the colonists exploit their resources to improve their life conditions. There are three basic types of resource exploitation: 1) heavy investment of capital and labor for conspicuous consumption with a short term view of the future; 2) minimal labor input and maximization of leisure with no coherent view of the future; and 3) heavy input of labor and capital for accumulation of savings for investment in long term

future goals. One way to characterize the three types of resource exploitation is to see the first as a colonist who wants a truck; the second as a colonist who wants to hunt, fish and drink; and the third as a colonist who wants to pray and send his children to urban schools.

The colonist who wants a truck will search for any scheme to make some gita or cash. He will work incredible hours, almost to death; he will invest in a rice polishing mill with money borrowed from many sources; his wife, who often shares his goals or drives her husband to pursue her goals of acquisition, will sell anything she can to make a profit in the Sunday market or at other times. Meanwhile, always stating that these actions are for their children's future, the parents save money by not buying medicines, food items, or school books, in order to garner capital. If the scheming works, they have a truck. They can then move about buying and selling crops and consumer items, always with the maximum profit margin. The wife can open a market stall or store in a larger market such as the San Julian INC headquarters or the Okinawa Colony or, if they really succeed, they can sell in Montero or Santa Cruz, the most important regional marketing centers. The colonist is always watchful of how others are doing in San Julian and ready to invest, loan money, and control the labor of other colonists. If judged propitious, he will sell his parcel or buy others.

The second set of values and goals can be typified by a *camba* or native lowlander. This is not to say, however, that all lowlanders have these values or that highlanders cannot be included in this category. The colonist, with the second resource use values, clears a little land, one to two hectares, and plants enough food to feed his family. However, he prefers to be in the forest hunting, fishing, and being loco para el monte (crazy about being in the woods). Typically, the wife in the family does most of the work on their *chaco* with the crops and, often, she works in wage labor for others trying to earn as much as possible to support the family. Alcohol consumption is important for the man's life style, as he values highly the camaraderie provided by sessions of drinking beer and cane alcohol with his friends.

The third set of goals and values are those of the evangelico, a convert to an evangelical Protestant sect or a member of a reformist Catholic prayer group. This colonist works as hard as the truck driver and tries to accumulate capital. However, he does not invest as easily in risky ventures and avoids blatant exploitation of fellow colonists. His family usually has enough food for domestic consumption, and the needs of children, for medicine, clothes, or school, would have a higher priority. The household is not usually divided by living in different places because the family desires a stable home. They have a fundamental belief in the value of education and a desire for their children to enjoy a

better life, which usually implies an urban existence, but which can also mean a rural existence using improved agricultural methods.

These three characteristics are grossly general categories. There are many colonists who fall between the extremes and who embody various aspects of all three at various time. However, they do sufficiently introduce the ways in which values, goals, and ideologies are manifested in adaptive decisions.

One important element of values is religious conversion. Catholicism, either in its folk-syncretic or reformist form, is the dominant religion in Bolivia. Figures as high as 95% Catholic were quoted by sources in Bolivia. INC statistics in Table 34 reveal that, in San Julian, slightly less than 75% of the colonists identified themselves as Catholic and slightly more than 25% of the colonists identified as evangelicos. Sects found in the population include Methodists, Seventh Day Adventists, Union Baptists, and those who simply call themselves Believers. The sample of 1976 and 1977 colonists from the second survey was 69% Catholic and 31% evangelical protestants. Evangelical protestants can be found in concentrations of 50% or more of the nucleo (nucleos 13, 15, 18, and 30), or as minorities in each nucleo.

There is little of the traditional system of Catholic observances and life, including the fiesta-cargo cycle, patron saint days, and masses to celebrate the sacraments, to be found in San Julian. Only 8% of the sample reported that they

celebrated any form of religious fiesta in the zone. More typical is the celebration of patron saint days of areas of origin, but this is still unusual. 88% of the Catholics felt that masses and fiestas were important, but they did almost nothing to observe them. Small groups of reformist Catholics met regularly to discuss the Bible and solutions to their spiritual problems. 15% of the Catholics in the sample were involved in these meetings, and met as often as evangelical protestants, up to four times a week. Their meetings serve some of the same functions as the evangelical meetings; reinforcing a solidarity of belief among the group and creating a unit of social support. They met with a non-conformist Jesuit priest who was working in the UCC, but most had converted to this form of Catholicism before arrival in San Julian.

The lack of rites and fiestas was not totally the reflection of a lack of interest on the part of the Catholic colonists. Most were not interested in establishing the civil-religious hierarchy and carrying through a round of fiestas. However, the only Catholic priests in the colonization zone were reluctant to celebrate masses, either for the special days of the religious calendar or regular Sunday services. They were not particularly interested in performing sacramental rites. They worked at the formation of cooperatives by general discussion of cooperative philosophy as part of their work in the OP. They also taught non-formal

adult classes in various subjects from mathematics to history to reading and writing. They consciously and purposefully avoided being thought of as priests and playing the traditional role of priests. They explained their behavior as based on their view of the long-standing oppressive role of the Catholic Church and of the need to radically alter that role.

The evangelical protestants had converted from folk Catholicism. 55% of them had converted in the area of origin and 45% had converted while living as emigrants in a place other than the area of origin. They had been evangelicos for as long as fourteen years and for as short a time as a few months. The average length of time spent as a convert was 4 years. Table 35 displays the reasons for converting. Leaving the Catholic life, for the converts, meant abandoning: the fiesta-cargo system with its repeated investments of capital; alcohol consumption, whether at fiestas or other times; and fighting, dancing, and other cosas locas or crazy things viewed as anti-social. Missionaries were present and active in conversion in both origin areas (94% reported their presence) and in migration areas (85% reported). Of those who converted in areas of origin, 77% stated that 50% or more of the entire community had changed religious practice. 92% of the colonists who converted in migration areas reported that "many others" had converted in those areas. Of those who converted during migration, 85% said they were living in colonization zones either renting land or working their own land. In San Julian,

80% of the evangelicals reported that there were others of the sect in their nucleo or one nucleo, 5 km. away, and that they regularly met for prayer, to discuss personal problems, and to worship. 50% met once a week, 30% met twice a week, and 20% met three times a week.

There are several important patterns in the religious conversion data. Conversion occurred almost equally in the areas of origin and during migration. A common feature in both is the apparent social pressure when foreigners and/or urban Bolivians arrived to tell them what they were doing was wrong and offering a "better" alternative. In areas of origin, spending money on fiesta cargos or offices, and drinking and the ensuing fighting were identified by the missionaries as the source of the misery and frustration of poverty felt by the people. Many were convinced that to leave Catholicism meant to leave behind those problems of their socio-economic situation and insure "their place in the kingdom of Heaven".

In migration areas, the established fiesta cycle was rarely in place and operating. Rather, missionaries were able to supply, easily and quickly, introduction to social units of evangelical believers. For many of those who had left the supportive network of kin, fictive kin, and friendship ties of the area of origin, the newly found "brotherhood" of believers could perform many of the same functions. It was a means of adjusting or adapting to a new social environment. In both locations or conversions, the frequent and established rituals

of re-affirmation of the weekly or more often cultos or meetings reinforced the new social relationships and the faith. In San Julian, these cultos are supportive both for origin and migrant converts and were to be the multi-dimensional basis for labor exchange, participation in decision-making, sharing child care, and other activities. Thus, they formed multi-dimensional units equivalent to those of kinship and fictive kinship.

Religious conversion was not the only area of value transformation observed. The young and unbalanced nature of the demographic structure of the population caused the author to concentrate on the question of the place from where spouses were going to be recruited. This led to related questions about colonists in the sample who were already married. 60% had met their wives in their areas of origin, and 40% had met them while in migration. Of those who met their wives in the areas of origin, 72% said that their wife had lived within 10 km. However, only 36% of the sample of the colonists reported that to marry a woman from their area of origin was important to them. Among unmarried males in the sample, a value was placed on selecting a wife from the areas of origin by only 22% of the sample; the remaining 78% stated that they would select a wife from anywhere.

Even more interesting was the response of all colonists, those married or not, to the issue of where their children should look for a spouse. 83% stated that the child could look

anywhere; to select a spouse from the area of origin was important for only 17% of the sample. To compare this to the selection of the compadre, the most important fictive kin individual, 73% of the sample stated that this person could be found in any location. Thus, the key choice in social relationships, that of selection of spouses and of compadres, illustrate the attenuation of localized circumscription of possible individuals for these roles. Of course, the logical extension of this question will be to observe from where spouses and compadres are eventually selected.

The key question about values and goals concerning life style, religion, and social relationships that are in flux is the direction or directions in which they appear to be going. These are "development" questions in the sense that programs and efforts should only be offered which enable the people to move in directions they desire. The problem with the assessment of those directions is their variety including: secularism vs. religiosity; individualism vs. group orientation; capital accumulation vs. maximization of leisure; and other contradictory, disparate sets of values. The next chapter will attempt to make this more comprehensible by analyzing how various adaptive strategies are formulated as colonists operate within the ecosystem.

CHAPTER SIX

ADAPTIVE STRATEGIES IN SAN JULIAN

Introduction - The Analysis of Adaptation - Terms and Concepts

This chapter will describe the variations in adaptive strategies formulated and executed by settlers in San Julian. Analysis of these strategies and the process of their formation centers on three major elements which affect adaptation. The first is the adaptive unit which is the functional unit in the adaptive process. It can be constituted by: single individuals; nuclear families; groups of extended kin; groups of individuals linked by kin, fictive kin, and friend relations; groups of individuals linked only by economic goals; or other combinations of these arrangements. The second element is the set of values and goals which are the underlying motivating forces that influence adaptive unit formation and selection among options in strategic decision-making. The third element is the set of environmental restraints, which exist as the stressors and structures in the ecosystem to which the pioneer migrant must address himself. They limit choices and options as the pioneer establishes solutions for adaptation.

Once the kinds of adaptive units, goals and values, and environmental restraints have been presented, then the various strategies for adaptation can be better understood and examined. Strategies are formulated by decisions made among a

combination of choices or options in several analytic categories including: 1) degree and kind of orientation toward production for market sale or domestic consumption; 2) labor organization within the adaptive unit to accomplish desired tasks; 3) location of unit members during the execution of the adaptive strategy; and 4) the types of resources chosen for exploitation. The options for selection in each category and the ways they are combined derive from the goals and values of particular kinds of adaptive units, given the limitations of the environmental restraints. Finally, the outcome of the adaptive process of the pioneer migrants in San Julian will test the utility of the model, and actual cases of adaptation will ascertain its explanatory power.

There are two facts which must be presented before beginning analysis. First, by necessity, the construction of the model for analysis has been a result of empirical research, quite simply, it was not an apriori framework with which the investigator entered the field situation. Thus, analysis benefits from the uniquely anthropological method. The explanatory power of the model derives from its basis in emic categorizations, the inside view learned through extended contact by the observer. This is important to state only because it was possible to quantify only some aspects of the model; not all factors were identified in time for this to be undertaken. This is not, however, to disclaim the importance of these concepts in the analysis; the process of adaptive strategy formation will be presented accurately and fully.

The other reservation is more significant. By definition, adaptation is an on-going process only terminated by death or disbanding of the adaptive unit. Therefore, any presentation of synchronic data obtained in a limited period is only partially conclusive. This is especially true in an area as dynamic and quickly changing as pioneer or frontier populations and their settlements. However, the San Julian project contained communities founded over a period of seven years and data shows some diachronic range. Further, the model for analysis is cybernetic, examining feedback loops and mutual causal processes; results of strategies, for example, are processed by adaptive units constantly and elements of behavior in adaptation are modified, reinforced, or abandoned. The analysis, therefore, deals directly with the on-going nature of adaptation. Nonetheless, the real test of utility lies in continuing empirical research.

Adaptive Units - Characteristics of Size and Structure

The adaptive unit is the functional unit in the adaptive process which sets goals for, plans activities involved with, utilizes results of, and assesses the success of efforts in production, exchange, and accumulation of resources and income. These units have a great range of variation in size and principles of organization (see Figure 4). The continuum of size ranges from the single individual to the inter-nucleo unit. Parallel to this is a continuum of variation of the

principles of organization of the unit and its function. The single individual unit is obviously self-contained. Beyond the individual, there is a trend of decreasing multi-dimensionality of function within the units. This translates, for example, to economic productivity and marketing becoming the single reason for existence of the unit, although large units organized along religious principles can be multi-dimensional.

At one end of the scale of size is the unit which consists of one individual. In these cases, the units establish no connections or linkages to others in relation to the activities involved with the adaptive process. The exploitation of resources is a totally individual matter. This does not mean that these individuals are socially or economically isolated. This is the smallest, least structurally complicated and least frequently found type of adaptive unit.

The next variety of adaptive unit is that of the nuclear family. Typically, this is the colonist who is the male household head, his wife and any children they might have. Again, the nuclear family is an adaptive unit if all aspects of the exploitation of resources, from setting of goals and planning of activities to the supply of labor required to the responsibility for and use of end results, occurs within the unit. The nuclear family adaptive unit is multi-dimensional in that it functions for socialization, recruitment, sexual outlet, and other activities beyond resource exploitation. In the initial years of nucleo settlement, this is a relatively typical adaptive unit.

The last major category of adaptive unit is that which is organized on a non-kinship, uni-dimensional basis for exploitation of resources, and which is a unit of economic production, marketing, or consumption. At present, this kind of unit is found only at the NADEPA level, the consumer goods cooperative. Promotion of the formation of this kind of unit is a major ingredient in the planning for economic development efforts by government and private agencies.

Goals and Values - The Basis of Adaptive Decisions

The sets of goals and values below were identified because of their repeated appearance in discussions and interviews with the migrant population. They are emic categorizations of the kinds of desired ends the colonists have when living in San Julian.

The first set of goals and values found among the pioneer population of San Julian is that of rapid and intense acquisition of the means which enable a bourgeois life style (see Figure 5). This can take the expressed form of wanting to be a comerciante or marketing middle man, truck driver, storekeeper, or a combination of these occupations. Other goals can exist but are subordinated to the accumulation of capital and control of other resources. Improved nutritional or health status of one's family, for example, can be a goal, but only as subsidiary to the primary goal. Savings accumulated are plowed into increasing resource control but not

to the point of eliminating conspicuous consumption. Thus, an urban house or store may be built or a motorcycle or a truck may be bought. They can be both status symbols and, at least in the case of the truck and store, contribute to the generation of greater wealth. This set of goals and values is found in most of the kinds of units, but is more prevalent in those of smaller size whose resources, capital, and their control can be limited and the level of consumption can be higher.

The next set of goals and values are those of pioneer migrants who utilize resources in order to provide a high level of subsistence and accumulate savings, primarily for the benefit of their children. Avoidance of conspicuous consumption is the characteristic which differentiates this category from the first. The typical unit operating on these values does consume at a high level for the maintenance of nutrition and health of its members, particularly its offspring. Decisions at some points are made in a similar fashion to those made by units operating with the first set of goals and values, but, at many points, there is variation. For example, an urban lot may be purchased, not to construct a showy residence, but to rent to others or build a market stall or store.

As in the case of the first set of goals and values, those units which are oriented toward high savings and delayed consumption are usually found in the smaller, more multi-dimensional units. In larger units, they may be present but are not the principal guides for behavior.

The third set of goals and values are those of a low level of consumption and little desire for the input of effort for resource exploitation because leisure and amusement are highly desired. Activities are valued for their camaraderie, including especially hunting, fishing, and drinking. If these units are families, then subsistence is barely adequate. These goals are only found in the smallest units in terms of size.

The last set of goals and values are those of pioneer migrants who desire adequate conditions of life, but maximize for altruistic or group benefit and/or ascetic purity in their behavior. This is a pattern found primarily among the evangelical protestant sect members. Within the religious converts, there is a strong tendency to draw social boundaries around those professing a similar faith and to channel whatever benefits are gained from resource exploitation within the group. Unit size can be large or small, the latter found when members of the same sect are numerous in the same nucleo, the former when they are dispersed between nucleos.

Environmental Restraints - Stressors and Structures in the Frontier Ecosystem

The adaptive units operating on the basis of their goals and values develop strategies for adaptation to the San Julian ecosystem. However, they are not totally free to select elements of their strategy. Rather, they must work within a set of environmental restraints, which are stressors to which

they must find solutions and structures with which they must deal (see Figure 6). The first restraint to be discussed is the fact that individuals and groups begin the adaptive process in San Julian with a great range in length of experience with and kind of knowledge of the options and choices in the ecosystem. The description of the San Julian ecosystem provided earlier presented the geo-physical and biotic stressors. The detailing of the history of settlement and of the development and implementation of aid and orientation has provided an understanding of the technological, infrastructural, and ideological structures found in San Julian. Further, the economic and political structures have been introduced. The historical discussion of the larger regional, national, and international picture of pioneer colonization has given a more global idea of the economic, political, and ideological structures within which San Julian exists. Each of these factors impinges on or structures adaptive behavior.

Earlier discussion of the history of settlement of San Julian revealed the variation in experience in and knowledge of the eastern lowland ecosystem existing within the pioneer colonist population in San Julian. Migration history data has further illustrated that adaptation in San Julian varies from a confrontation with an alien environment to only the establishment of another lowland farm. This is considered a restraint because adaptation necessarily begins with entry to

San Julian. Migrants are unable to increase their fund of previous knowledge, they either have experience with lowland frontier agriculture or they do not. The kind, quality, and length of previous adaptation can also vary. Some migrants have only worked as sugar cane or cotton harvesters. They have less familiarity with what must be done than migrants who have worked as peon or day laborers for other small farmers or those who have worked small frontier farms of their own in other lowland locations.

Geo-physical stressors are the next set of environmental restraints. The soil and topography are part of this set and have been described earlier. Micro-variation in fertility, precipitation, or drainage are factors totally independent of colonist choice. The climatic stressors are manifest in high temperatures and overabundant rainfall, but, as mentioned earlier, during an annual cycle they may take the form of low temperatures and drought. The high temperatures offer acute problems to highlanders without much experience in the lowlands. The short but intense periods of cold weather and winds are not unfamiliar to the former highlanders, but do cause damage, sometimes severe, to crops and fruit trees.

Water supply and nutrition maintenance are stressors in the general category of geo-physical elements. Water supply in San Julian is provided by the INC. However, the quality of well drilling and pumping equipment varies greatly between nucleos and is independent of colonist action. Another part of

water supply as an environmental restraint is the variation in sub-surface geological configuration. In at least two nucleos, impenetrable layers have been discovered by INC personnel. The result was settling for wells acknowledged to be too shallow, resulting in a "salty" water supply, high in mineral content and causing widespread diahrea. Nutrition maintenance is an area of major intervention by development efforts. However, the complete subsidization of food supply lasts only during the OP and supplemental items continue for only five months after that. From then on, adaptive units must supply themselves.

The biotic component of environmental restraints includes both plant and animal species. Plants can range from positive to negative in their impact on pioneer adaptation. Some species such as the motacu palm and hardwood varieties provide almost all construction and roofing materials. Other plants, such as the uña del gato and the palo santo, are negative stressors in a minor way, being no more than nuisances, but given the possibilities for infection, stings and scratches can be extremely dangerous. The various weeds which can grow in chacos after initial cropping and burning are a fundamental problem and are the basic cause of lowering crop yields and abandonment of fields.

Animals also vary from positive to negative in their impact on adaptation. Insect and snake bites and attacks from animals can injure members of the pioneer population. In the extreme case of poisonous bites from snakes and spiders and

attack from jaguars, the adaptive process can be terminated completely. However, animals can be a very positive element, as game is relatively plentiful and hunting an important source of flesh protein.

There are two geo-physical stressors over which most adaptive units, due to their relatively small size and limited impact on the ecosystem, have little control. They are not totally independent of the actions of the pioneer population, especially at the level of the entire colonization zone. First, carrying capacity of the environment for the human population exists at some upper level. This is dependent, though, on the technology utilized in its exploitation and the degree to which considerations of sustaining the yield of resources are part of that exploitation. Thus, interrelated with carrying capacity is the factor of resource degradation. Two major forms of degradation have occurred and are occurring in San Julian.

The first has been mentioned in relation to the plant component, secondary growth on burned over chacos is a major cause of decreasing yields. Some weed varieties are essentially impenetrable by the present technology of pioneer colonists. Another form of resource degradation is eolian or wind erosion, a result of the slash and burn technology applied to an area which is exposed to constant and frequently strong winds. Both of these factors could be affected by the design and application of development efforts and/or widespread

self-generated modifications in exploitative technology by the pioneer population. However, strategies of adaptation of this population up to the present have had to deal with carrying capacity and resource degradation as environmental restraints. One particular aspect of resource degradation which pioneers and their adaptive units could have an impact on is the elimination of animal game species. This is occurring rapidly, though animals are still relatively plentiful.

Related to the problems of carrying capacity and resource degradation is the restraint imposed by the available technology. Migrants have generally all had to apply the same slash and burn technology due to the lack of credit, seed, machinery, and knowledge to attempt any other technology. Cycles of activities have been similar for all adaptive units. Processing technology of agricultural and animal products is also basically the same for all migrants. For example, the grinding of corn and rice must be done either in the home or by machines in San Julian, with the former method prevailing. Construction technology is a further part of the environmental restraints. Locally available materials are the only economically rational choice for pioneers in their first years unless they bring with them enough capital for the purchase of other materials, such as corrugated metal sheets for roofing. Transportation technology, by which the means of transport not the infrastructure is referred to, exhibits only a limited range of choice for the pioneer population.

The existing infrastructure is another part of the set of environmental restraints. Wells have been previously mentioned, their installation is part of the infrastructural restraints. Maintenance of wells is not a restraint, as communities are charged to carry this out; however, poor original equipment or faulty drilling is a factor independent of pioneer control. Road construction and maintenance is another part of the infrastructure over which pioneers, particularly in the early years of a colonization zone, have little control. Until 1980, colonists residing in nucleos situated on or linked to the Brecha Casarabe will also lack all-weather roads. The residents of the lateral nucleos, five kilometers to either side of the Brecha Casarabe suffer seasonal road problems including total washouts from water erosion. One crucial negative aspect of infrastructure is the lack of a bridge across the Rio Grande. This has affected transport availability since the founding of settlements in San Julian. Quantitative data presented earlier illustrated that bad roads and inability to transport crops is viewed as a general problem by many pioneers.

Transport itself is relatively independent of the control of the pioneer population. Bus and truck transport are provided by entrepreneurs at the highest price which traffic will bear. Daily or frequent bus service is projected to begin in 1980 for the residents of the Brecha Casarabe.

The presence, lack, and/or quality of service facilities is an area of infrastructural restraints. Schools are provided according to policy set by national and provincial authorities. Choice of teachers is not made by the colonists; they can receive someone who has no interest in working with rural children and/or highland children, as occurred in Nucleo 11 in 1978 or someone highly motivated to do this work, as in the case of Nucleo 14 in the same year. Health delivery is also essentially not controlled by colonists, as of 1978. Health promoters were trained and in some nucleos served effectively, but most colonists perceived the infirmary at the NIC as the nearest significant health care facility.

The next major set of environmental restraints for the pioneer population is the economic structure of the Santa Cruz region, in particular, its marketing and pricing structures. Pioneer colonists have effective control over marketing in a very limited manner. Some sell their products to middlemen or rescatadores who set the price of the crop in the field and subtract what they considered as a fair amount from the price for their transportation costs. Another means of arranging marketing transport is the use of the freight hauler, or fletero, to whom the pioneer pays only a set cost per weight unit of product. Colonists have been able to exercise a moderate amount of influence on transport pricing in a few instances when they acted jointly to contract agents to provide this service. This is a possibly significant indication for the designing of development efforts around cooperative marketing ventures.

Pricing of products in the market is not an area over which colonists have had any control. Prices are set largely according to supply and demand on a regional scale and are fixed by large producers. Many products are not controlled by the latter, but rice, one of the major cash crops, definitely has a controlled price. Prices of consumer goods which reach the colonization zone, can be a factor on which the colonists can exercise some control as long as they remain united in their consumer's cooperative. However, pricing will range widely if private entrepreneurs become the primary or only outlets for consumer goods.

Access to credit is provided through only a few means. The major outlet is the Savings and Credit Cooperative managed by the Belgian Oblate brothers. This organization is, to a great extent, self-managed by its colonist members and, therefore, it is not completely an environmental restraint. Another source of credit is the Bolivian Agrarian Bank. As described earlier, its work in the zone has been ineffective to this point, but the establishment of a new office at the INC headquarters could mean more effective service. Another source of credit, more along the traditional lines of Latin America peasant culture, is the loaning of money by more wealthy colonists, merchants, or middlemen against future crops. This occurred in Nucleo 8 during the period of the study, and in this case the colonists received a fair market price for their crop.

The political decision-making structure is another restraint for pioneer migrant adaptation. Specifically, decisions made about resource use at a regional and national level have been crucial at certain points in the history of settlement. These decisions included the original decision to make this area a colonization zone, the provision of main and access roads, and the selection of the kind of aid to be provided. Further, political decisions include: what kinds of equipment to provide, the rights of ownership to timber, and the future location of settlements within the zone. These have been made and are being made largely independent of the pioneer population.

Ideological structures are also environmental restraints for the pioneer; in particular, the egalitarian, communitarian, and regional autonomy promoting basis of the ideology of the most important development agents. This ideology exists in complete contrast to the internationally dependent, capitalist, individualist orientation of the urbanized culture which exists in the economically booming Santa Cruz region. The playing off of pressures between development agents and the national bureaucratic institutions demonstrated the basic contradictions. At the level of pioneer colonist adaptation, there is also an interesting and dynamic tension evident when strategies are formed after participation in the OP.

A final area of environmental restraint, related closely to the last two mentioned, are the long-term, but nonetheless

decisive effects of overlying structures of international dependency. Bolivia is extremely weak in terms of resources, trained personnel, and capital, and it needs a great deal of support to maintain its economy and quality of life at present levels, not to mention move toward expansion of the economy or improvement of its populations' life conditions. The boom of the Santa Cruz area has definitely been a case of dependent growth, based on the export of agricultural products and petroleum. This affects the San Julian population in direct and indirect ways. The direct effects include decisions about continuation, expansion, and/or termination of development efforts such as road construction, food supply, and the OP itself.

In identification of the various combinations of strategies developed by the colonists, the environmental restraints will play a major role, both in the production of strategies and in the determination of their outcomes. In addition, the degree of their permanence as restraints will be seen; the actions taken or not taken in strategic choice could transform these factors.

The Categories of Choice in Adaptive Decision-Making

Many colonists enter San Julian in previously formed adaptive units with sets of values and goals to guide and motivate choices. This is true primarily for those colonists who have lived together before in the highlands and/or lowlands

and settle in the same or contiguous nucleos. Other colonists, particularly those who have never lived together previous to nucleo settlement, form adaptive units once they have arrived in San Julian. All adaptive units are confronted by the environmental restraints of structures and stressors in the ecosystem. The limitations become significant as the units make the choices which are part of the formation of adaptive strategies. For the purpose of analysis, categories of elements which form adaptive strategies include: 1) the kind and degree of orientation toward production for market sale or for domestic consumption; 2) pattern of labor organization of the adaptive unit to accomplish adaptive activities; 3) location of unit members for resource exploitative activities; and 4) the types of resources chosen for exploitation.

Market Vs. Subsistence Orientation

Colonists who form adaptive units must decide whether and to what degree they will channel their efforts for production in attaining and maintaining a desired level of subsistence or domestic consumption, for production destined for exchange with other members of the unit or outside of it, and for production in beginning and increasing market participation and cash income generation (see Figure 7). Most farmers in San Julian, since its founding and up to the present, have devoted most of their efforts and land to rice and corn production. This has provided both food and cash. However, they have varied widely

in how much grain has been produced for domestic consumption, how much for exchange, and how much for cash sale. Other crops have been grown and animals have been raised, both to provide variety for home consumption and to meet anticipated cash market demand. Therefore, assessing decisions made in this category can be difficult, if only productive activities are examined; it is necessary to establish whether and to what degree products are consumed, exchanged, and/or sold.

There are four ways to characterize orientation toward market vs. subsistence production. First, there are those adaptive units which put most of their efforts into subsistence or domestic consumption and exchange, but which do produce cash in minor ways. Often, such units sell part of their grain crop, but do little else in the way of market involvement. Second, there are units which are more or less balanced in their emphasis on efforts in productive activities and in the distribution of results for domestic consumption, exchange, and for market sale. This kind of unit probably does not commit itself to highly exploitative and risky ventures, but will try to sell other products in addition to part of its grain harvest. Third, there are units which produce mostly for the market to produce cash income, but which devote efforts in a minor way to satisfy needs of the unit for domestic consumption and for exchange. They supply these needs and avoid the outlay of cash for these items. Finally, there are units which exclusively devote themselves to market or cash income

production and purchase all necessary items for domestic consumption. These units are commercial enterprises which will move into almost any kind of venture which is thought to yield a profit.

Labor Organizaion

The choice of how to organize labor to carry out productive tasks is another category which constitutes part of adaptive strategy formation (see Figure 8). The principle option in this category is the manner of recruitment of labor and the means to remunerate for labor either through exchange or cash or goods payment. The key factor is the kind of relations desired with those participating in and accomplishing the unit's productive tasks. Exchange labor, utilizing institutions of ayni and mink'a, require a different kind of relationship and participation than wage labor, paid in cash or goods.

The first manner of organizing labor is for a unit to rely exclusively on its own members to carry out necessary tasks. Obviously, size and demographic composition is crucial for this mode of organization. The rare single colonist adaptive unit who attempted to exercise this option found it extremely difficult to do so. Taking into consideration the usually small household size and either absence of children or, if present, their young age, the nuclear family had difficulty in relying solely on its own labor.

The second means of organizing is to utilize the traditional labor exchange institutions of ayni and mink'a, described in the last chapter. Not all tasks require recruitment of kin, fictive kin, and/or friends and neighbors to exchange labor, but there are several demanding jobs, including large construction projects, land clearing, and, most importantly, the rice and/or corn harvest. Utilizing another colonist's labor obligates one, in ayni, to return an equal amount of work and supply food, drink, and coca and lime during work on one's own projects. In mink'a, it requires one to supply and usually to spend cash to provide food, drink, and coca and lime. Even more, in mink'a the colonist is required to sponsor a small fiesta to celebrate finishing the task. Further, both exchange institutions, as they were observed in San Julian, involved the recruiter of the group in participation and direction of each stage of the project.

The third manner of labor organization is the use of wage labor or some form of sharecropping or land rental. Of these means of securing labor for accomplishing tasks, only wage labor was observed in the zone during the period of fieldwork. It is likely that sharecropping and rental will appear in San Julian as time passes, as they are common features of colonization zones in northern Santa Cruz. However, at the present in San Julian, labor is paid for by the day, the amount of goods produced, or at the completion of the job. Usually, if close supervision of laborers was possible, they would be

paid by the day; if it were not possible they would be paid by the amount produced or by the overall task. Wage labor allows the colonist doing the hiring to save his own time and effort because he owes nothing except the cash equivalent established for the job. This can be particularly crucial in providing an advantage to the wage-paying colonist who can process and market his product while others are busy fulfilling their exchange obligations. It is also more of a uni-dimensional transaction than exchange labor, which usually implies and requires a multi-dimensional relationship. Paying for labor is also a means of status acquisition. It is a vertical, unequal relationship as contrasted to the horizontal, egalitarian exchange labor.

Location of Unit Members

Adaptive units must decide where to locate members as adaptive strategies are carried out (see Figure 9). This can vary between single, double, or multiple locations, which may be rural and/or urban, and highland or lowland. Multiple resource exploitation as a concept was discussed by Stearman (1978) who explained patterns she had observed in northern Santa Cruz as a modification of the vertical integration of ecological and altitudinal gradients discussed by Murra (1972). Stearman was correct, but long-term and intensive research in the San Julian zone revealed several variants including the traditional vertical integration. Therefore, the typology will more fully and comprehensively describe the general patterns established by Stearman.

The geographic division of adaptive unit members is a rational and logical establishment of an exchange system which increases the advantages accrued to units from productive activities. Of course, the unit which only exploits resources in San Julian does not have that advantage. Other types of units can take advantage of the divided locational patterns which include: a double location with exchange of goods and labor between San Julian and another rural lowland site; a double location with exchange between San Julian and an urban lowland site; a double location with exchange between San Julian and a highland rural site, most probably the area of origin; double location with exchange between San Julian and a highland urban site; multiple locations in the lowland with exchange between San Julian and other rural sites; multiple locations in the lowlands with exchange between San Julian and other rural and urban sites; multiple locations in the lowlands and highlands and/or foreign countries with exchange between San Julian and rural and urban sites. The multiple and geographically widespread strategies are usually only used by the larger adaptive units. Through exchange, ties of kinship, fictive kinship, and friendship are utilized to channel goods in order to circumvent market structures and cash expenditure, and to maximize profit in production designed to generate cash income.

Types of Resources Exploited

The adaptive units, having established their market orientation, their pattern of labor organization, and the locations of their members, must choose which resources to exploit and how to exploit them (see Figure 10). These include crops and animals, and whether to use them for domestic consumption or for cash sale. Further, tree crops can be exploited for subsistence or for cash sale. Natural products, like timber, as well as processed natural products, such as charcoal, can be exploited, usually for income generation. The performance of services and wage labor can also be resources which the adaptive unit can utilize. Finally, adaptive units can use consumer goods as a resource when members of the unit can provide them for sale in retail outlets in San Julian, especially likely if they have unit members in urban areas.

Crops which are exploited include: three varieties of rice; two varieties of corn; peanuts; soya, frejol; vegetables such as tomatoes, squash, cucumbers, and lettuce; pineapple; aji or hot pepper; sunflower; and root crops such as yuca; walusa; and camote. Animals found in the zone include: chickens; ducks; pigs; horses; sheep; and a very few dairy cattle. Tree crops include: three varieties of banana; papaya; citrus, such as lemon and orange; manga; and chitimoya. Timber resources include valuable hardwoods. Collected natural products include: wild animals, used both for their meat and skin; honey; fish; and wild lemons. Services performed in exchange for goods or cash include: hauling loads; bicycle

repair; baking bread; chain saw rental; and other labor tasks. Finally, consumer items can be a resource for an adaptive unit if they are sold in its urban market stall or in its store in San Julian.

Formation of Adaptive Strategies and Outcomes

There are many combinations and permutations of adaptive strategy formation for the 1097 colonists settled in nucleos since 1972. However, choices among options available in certain categories lessen chances that options in other categories will be selected. For example, choice of a value for the maximization of leisure and recreation with goals of hunting, fishing, and drinking lessens or eliminates the likelihood of dedicating almost all or all efforts to the production of cash goods for the market. Therefore, analysis will have two underlying principles: 1) the primacy of values and goals in channeling choices among options in other analytic categories; 2) the fact that categories are very much inter-related and that freedom to combine elements in strategies is limited. These principles are true because the model of adaptive strategy formation and its categories are only heuristic, they are meant to tease apart and categorize a process which is difficult to examine.

A presentation of various adaptive strategies as they were worked out by colonists in San Julian will follow. They will be ranked first by the size of the adaptive units, and the

bases of formation, ranging from kinship to fictive kinship to shared entrepreneurial risk. Next, the differing values and goals will be presented. Choices among options in the various categories follow from there, depending on the environmental restraints which impinge from the structures and stressors of the ecosystem. This will not be an exhaustive presentation as there are far too many possibilities to cover adequately here. Rather, the more important cases of strategy formation which were actually observed in first year nucleos and the outcomes of their strategy execution will be described. Following that, projections for continued adaptive strategy formation and execution will be made by examining the cases of colonists in nucleos which have existed for a longer period of time.

Don Hugo

Adaptive units limited to single individuals are rare in San Julian. One example observed in a nucleo was Don Hugo. He was very old for a colonist; he admitted to being 55 years old and most people said he was at least 65. The upper age limit for a colonist set by the INC is 45, but Hugo was allowed to settle through a special dispensation by an ex-director of the INC. It was never clear why this was done, but he may have been related to the ex-director's family as a peon. Don Hugo's manifest values and goals were to "live well" or have a good level of subsistence in San Julian and sell some products for cash income. His real values and goals turned out to be quite

different. Hugo appeared to balance his market orientation emphasizing production for domestic consumption as much as for income generation.

His labor organization pattern was basically disorganized. He had no kin in the nucleo, but arranged ayni exchange with his neighbors. He developed a friendship relationship with one neighbor, and this man often worked with Hugo. However, most colonists found Hugo to be unpleasant to work with on his own tasks and recalcitrant and complaining when he returned labor to them. Therefore, Hugo had to work alone, or with his one friend, or with constantly changing sets of neighbors. His adaptive unit was limited to one person, so he could locate his exploitative activities only in San Julian. He chose to grow one of the varieties of rice, Noventon, which would be the fastest to harvest, and both varieties of corn supplied by the OP. He grew no vegetables, but planted the banana tree stems, pineapple shoots, and papaya and chitimoya seeds supplied by the OP. Hugo did not have a gun and was never observed to hunt. He had no domestic animals and was not observed performing any service for wages or processing any products for sale.

Hugo did not do much except plant the basic cash and food crops and trees available through the OP. This required a great deal of time as he was old and found it difficult to recruit labor. He appeared not to have any capital to invest in productive activities, and, if he did have it, he certainly

did not invest it. Rather, Hugo's real values and goals for use of San Julian resources were revealed when, after nine months in the nucleo, he arranged the sale of his land and house. INC regulations allow colonists who do not have title to their land only to receive payment for the crops and trees they have planted, the structures they have built, any roads or paths they have built, and the amount of land they have cleared. Since Hugo had invested practically no capital, had been able to arrange to supply labor through exchange, and had been given the seed and tree stems for the crops and trees he had on his property, he essentially made a 100% profit on the sale. He valued the opportunistic acquisition of cash and his goal was to use temporary settlement in San Julian as the means to make the cash. Colonists in the nucleo reported that he made between US\$ 250 and US\$ 350 on the transaction, close to the average annual income of a farmer in the lowlands and several times the average for a farmer in the highland.

Don Eduardo

Don Eduardo is another single individual who has formed an adaptive unit. He is different from most colonists, but not in the same way as Don Hugo. His values are to have a high level of subsistence and live in harmony with his colonist neighbors. He is highly educated, having attended a university, but not having completed a bachelor's degree. He is serving as the president of one of the NADEPA's. He

produces very little for cash sale, his orientation is, rather, toward maintaining an adequate level of domestic consumption. He is inexperienced in farming, in the lowlands or the highlands, and, instead of agricultural work, he devotes much of his time to managing the consumer's cooperative store in the central nucleo of the NADEPA. When he does undertake agriculturally productive tasks, he either does them by himself, if they do not require much labor, or engages in labor exchange with his neighbors with whom he has developed friendships. The location of his exploitative activities is in San Julian, both in his parcel and, because of his leadership and work as NADEPA president and coop store manager, at an inter-nucleo level. He raises all varieties of rice and corn, and has planted all the tree crops supplied by the OP. He does not have any domestic animals, but is known to borrow a gun and hunt. The major resource he exploits is his education and his ability to win cooperation and lead his fellow colonists. After a year in the nucleo, he was a key figure in NADEPA and coop decision-making, and was making an adequate subsistence.

Don Mariano and Dona Rafaela

The adaptive unit of Don Mariano and Dona Rafaela is a nuclear family adaptive unit. They value the acquisition of the means to be entrepreneurs or comerciantes. They also want their daughter to be well-educated and pay for her to live at the INC headquarters in order to attend school there. They

want to establish a combination store, bicycle shop, and pension or hotel-restaurant in the central nucleo in which they have a house site. Their market orientation is heavily towards cash income generation, but they have a very adequate subsistence base. Because she worked in a wealthy urban household as a cook, Dona Rafaela adds a great variety to her food preparation, especially in her use of vegetables.

Mariano utilizes labor exchange, but only for the tasks of heavy and intense labor input, notably the rice harvest and house construction. He, Rafaela, and their daughter work long hours to do other activities such as the weeding, the chafreada, and the corn harvest. The location of their exploitative activities is in their nucleo and in other nucleos and the INC headquarters in San Julian. Rafaela's mother and step-father live at the INC compound and she is able to go there to sell goods on days when there are large concentrations of colonists such as on the national election day of 1978. The location of their activities is in other nucleos because they are quick to seize opportunities to sell products or goods or perform services wherever they can.

They have a range of crops, animals, and other resources which they exploit. Mariano got permission from his nucleo to plant corn in part of the parcelas which had not been settled in the first year because of a shortage of colonists when the group entered their nucleo. He harvested much more corn than most of his neighbors, and he hoped to sell it for a good

profit. Rafaela is raising pigs for future sale, and she has an ever-increasing flock of chickens. Mariano is skilled in hunting and has a gun and three efficient hunting dogs. He often distributes meat to his neighbors. When a sawmill operation run by COFADENA (Armed Forces Corporation for National Development), which was processing and selling trees which should have been the property of the colonists, closed down, Mariano and Rafaela carried hundreds of pounds of bricks and valuable mahogany away from the facility. Weighing barely 150 pounds, Mariano strapped a massive mahogany board that easily weighed twice his weight to his back and walked a mile to his house. His only comment was "hay que aprovechar" (you must take advantage of any opportunity). Rafaela and Mariano built an oven from the accumulated bricks and they rise well before dawn every morning to make bread to sell to fellow colonists in the nucleo. The couple managed the coop store outlet in the nucleo during the OP, and when it was over, gave that responsibility to another colonist. They then began to sell many of the same items as the coop store using their house as a store. After planting his rice and corn and tree crops, Mariano went to Santa Cruz and worked as a brick-layer for six weeks. Mariano also found wage employment as the field assistant to a visiting researcher, and earned enough from this job to hire a peon laborer to clear two hectares for the next year. He is always ready to race somewhere with his bicycle to carry a load for someone, for a fee of course. He worked with

the peon he hired for land clearing in the burning and processing of some valuable timber to make charcoal to sell. Hunters and sawmill workers, passing through the nucleo to work in their clandestine activities (not allowed by INC policy) know Mariano's house as a place to stop for a good meal at a reasonable price. For all, though, Mariano and Rafaela are generous with their food, their house, and their time.

Don Dionisio and Dona Carmen

Don Dionisio and Dona Carmen and their two young sons are an adaptive unit. They devote efforts for adaptation in two locations in San Julian and in the urban regional market center at Montero. They value acquisition and capital accumulation in order to improve their economic status and chances for conspicuous consumption in the urban setting. Dona Carmen spends very little time in San Julian, rather she and the children have a small house and store in Montero. Dionisio spends time in San Julian and Montero. He carries out all labor tasks in relation to production. Their market orientation is heavily weighed toward production for cash sale, with very little production for consumption. Dona Carmen obtains the cash to buy food in town for her and the children. Dionisio utilized exchange labor in the first year for the jobs with heavy and intense labor requirements. He quickly returned the labor received to cancel his obligations. After an ample harvest, he was able to hire a peon to work with him in land

clearing for the second year. Dionisio has gone heavily into rice growing as he anticipates a high price in the next year. He has worked in the Oriente for six years and knows that the large low area or curiche in his chaco will be an asset, holding moisture for his rice crop, and for an assured water supply for the pigs and cattle he hopes to raise for sale in later years. He has planted a small amount of corn and will feed most of it to his pigs. He has a gun and hunts, but only to supply he and his family meat when they are in the nucleo. He utilizes his experience in sawmill work, gained in three years seasonal work in Santa Cruz, and works for two months at a sawmill near the INC headquarters during the early rainy season.

Don Nimio and Doña Dorotea

Don Nimio and Doña Dorotea, with their two girls, form a nuclear family unit. Doña Dorotea did not come to San Julian until the OP was over, in order that their daughter could finish her fourth year in school in their highland village. She arrived in San Julian, her first time in the lowlands, and proceeded to learn about life there. The unit values the idea of establishing their family in a healthy situation, always having enough to eat, and bringing up their children in a stable home with good relations with neighbors. Nimio and Dorotea joined a reformist Catholic prayer group in the highlands and he is one of the founders of a similar group in

his nucleo. They place more importance on supplying an abundant and varied diet for their unit, making minor efforts to earn enough cash for medicine, clothing, and school books. Nimio participates often and extensively in labor exchange with his nucleo neighbors using ayni and occasionally mink'a institutional forms. He has not yet paid wages for any labor. He represents his nucleo on the NADEPA inter-nucleo committee and he is involved with the establishment and improvement of health delivery systems. There is a good chance that his adaptive unit may expand, especially in its labor pool, because several of his kin, by blood and marriage, have settled in a nearby nucleo. At present, the location of the unit's exploitative activities is only their nucleo.

Nimio and Dorotea grow a variety of crops. She has learned quickly to raise vegetables in San Julian. She had done this before while living with her family in the Arica Valley of Chile as a young girl. Nimio worked only two seasons as a cane cutter in Santa Cruz, prior to settlement in San Julian. He had much to learn about lowland agriculture, but has worked hard to do so. He owned a gun when he moved to San Julian and has become a proficient hunter. His friends and neighbors, particularly those who are members of his reformist Catholic prayer group, share the fruits of his hunting. He left San Julian to travel to his area of origin after seeding his first crop. He worked there three weeks in a private tin mine and then returned with his wife and children.

The Villca Extended Family Unit

The Villca extended family unit includes Don Fabian and Dona Felipa, the father and mother of four sons Manuel, Severo, Octavio, and Renato. Manuel is married to Rosa and they have two daughters. Fabian, Manuel, and Severo are colonists with their own parcelas. The Villcas value capital accumulation, but desire more to establish a solid subsistence base and ample food supply. Manuel, more than his father and brother Severo, hopes to be able to produce heavily for cash income. He presently is delaying the pursuit of this goal because of his need to work with the other two, who seek to balance emphasis between production for domestic consumption and cash income generation. Almost all tasks of production involve all three men and the older boy Octavio. It is labor exchange, but the three farms are managed as a unit. For example, the portion of the rice and corn harvest which was destined for sale from all three parcelas was pooled, sold together, and profits divided. The two adult women share child care duties and work together in raising vegetables and in cooking. All members of the family are located in San Julian and have no plans to divide geographically for resource exploitative activities. Severo did go to Santa Cruz to work in construction after the seeding, and returned two months later with a radio, a new ax-head, and a bellows seeding machine, all to be used by the unit. The unit raises all the crops supplied by the OP, and has several chickens. When one of the males is successful in hunting, meat is shared by the unit.

The Pacsi Extended Family Unit

The Pacsi extended family unit consists of Don Juan and Dona Celestina, their son Rene, and three of Juan's single, adult nephews: Alberto, Alejandro, and Roberto. It also includes Juan's father and two brothers and their wives and children in the highlands. All of the men in San Julian are colonists with their own parcelas and are migrants from the Yocaylla sub-region of Potosi. Their nucleo all came from one small area centered around the town of Llahta Runa. Therefore, ties of kinship and fictive kinship exist between most of the households in the nucleo. Further, kin and friends live in seven other nucleos. However, within the nucleo, the colonists are divided into adaptive units.

They are all living in the lowlands for the first time in their lives. They value greatly the acquisition of capital and conspicuous consumption, but feel that it will be some time before they know enough about the technological and economic system to make significant incomes. The members in Potosi want to earn cash from the sale of lowland products in the highlands. For now, they all have a goal of increasing and improving their food supply. They also desire to establish and maintain an exchange of goods and labor between altitudinal zones. At least twice in the first year of settlement, lowland unit members traveled to the highlands, for the most important fiesta, Carnaval, and for participation in the potato harvest. The highland members traveled to San Julian once for

participation in the rice harvest and to begin the corn harvest. One of Juan's brothers, the father of the three nephews, is considering moving into a nucleo, hopefully one close to that of his brother and sons.

The arrival of the portion of the rice and corn harvest to the highlands village, and of the highland potatoes and quinoa to the San Julian nucleo, caused great celebration as the unit integrated the productive capacities of two ecosystems. The members of the unit located in the lowlands all work their parcels in rotation. In the highlands, the unit members also work together. In both places, unit members engage in exchange labor with non-members, but these non-members are usually kin.

The location of members of the unit is dual in the highlands rural area of origin and in San Julian. The younger male colonists work in Montero for two months cutting sugar cane, but do not want to build homes there. Resources exploited in San Julian, include all of the crops and trees supplied by the OP, and a few chickens which live around and between the five houses. In the highlands, the unit grows potatoes, haba, quinoa, grano, and the women pasture llamas on the high plain above the village. Wage labor in lowland sugar cane agro-industry is also a resource exploited. The unit does not have access to a gun and has done no hunting in San Julian. The first year harvest in San Julian was ample, but transportation difficulties and delays made the transfer of corn and rice in bulk to the highlands uneconomical. The younger men in the unit have mentioned that in the next year

they might sell more of their grain in the Montero market. They have said that they would send cash back to unit members in the area of origin, but are not sure if they would send all of the money.

Los Methodistas

The group of 18 households in the nucleo form a loosely tied adaptive unit. It is only loosely connected because the unit functions for two purposes only; meeting once a week for prayer and Bible reading sessions, and to sell the corn and rice harvest together. Within the unit, there are households which form nuclear and extended families and which function for child-rearing, food preparation, and other multi-dimensional purposes. The unit was formed prior to arrival in San Julian, in the northern Santa Cruz colonization zone called the Littoral. As a unit, the 18 households desire to make the maximum income possible from their grain crops, and maintain a "Christian community of brethren", ready to help each other. The latter value appears to be multi-dimensional, but day-to-day mutual support is really a function of smaller groupings within the unit. At the unit level, the maintenance of the Christian community is only done by the weekly meetings. The unit places an even emphasis on production for domestic consumption and for cash income generation.

Within the unit, individual households or combinations of households work together to raise crops, but there is a great deal of exchange labor between all households. There is little

exchange of labor with households outside the unit. Several households have kin who live in the urban marketing center and/or in other lowland rural colonization zones. Therefore, the location of exploitative activities is multiple lowland in rural and urban sites. The urban members are particularly important as they hold the grain and monitor its price in the market. Profits are divided proportionately, according to the quantity of grain each household has contributed. They exploit all crops and trees supplied by the OP. Sale of crops, other than rice and corn, and of the numerous chickens and ducks is completely independent of unit activity. There has been some dissension and dissatisfaction within the unit over the price received for grain crops by relatives of other unit members. They have openly talked about withdrawing from the pool of the next grain harvest, but not about leaving the church. In fact, the unit organized a group effort to build walls for the church in 1978.

The Quispe Brothers - An Adaptive Unit in a Two-Year Old Nucleo

The Quispe brothers formed an adaptive unit in a nucleo which was two years old at the time of the study. Enrique, his wife Marta, and two young sons, live in one household, and Francisco and his wife Luisa in the other. The brothers and their wives place value on capital accumulation and conspicuous consumption. They strongly desire to purchase a truck. They are oriented toward producing as much as possible for the cash

market; they sell products and goods in San Julian, the INC headquarters, and in urban areas whenever possible. The men come from the Yocaylla sub-region of Potosi, but do not work or associate with the extended kin of their family in the nucleo or in other nucleos. Neither of the wives in the unit are originally from Potosi, they met their husbands in Santa Cruz. They did collect funds for rental of a corn grinding machine, from their nucleo kin, but paid them back from the profits.

The labor which they utilized in the year of the study was largely peon wage labor. They worked alongside their peons, and, in the chaqueo or land clearing of 1978, they opened six hectares in one parcela and four hectares in the other. They did not participate in labor exchange at all during the year. The women in the unit raised vegetables, especially tomatoes and cucumbers, and collected eggs for sale in the Sunday market in the nucleo central of their NADEPA. The men and women of the unit have been quite vocal in stating that their nucleo, situated on the Brecha Casarabe, but not as a central nucleo, deserves to be the location of a Sunday market and that the nucleos on either side of it should place their "town" houses in the Quispe nucleo. This would increase its chances of becoming a commercial center. It is also a potentially serious threat to the NADEPA settlement pattern plans. The location of exploitative activities is presently only in San Julian, but they may purchase an urban lot or market stall in Montero.

Both the men have experience in Santa Cruz agriculture and Francisco had lived in Buenos Aires, Argentina, working in construction for five years. They had several pigs, which they slaughter for sale of the meat. The unit also sells its grain, vegetables, eggs, and chickens. They rent the corn grinding machine and are trying to earn enough to buy it. They also have plans to purchase a chain saw in the coming year.

The Mamani Extended Family and Non-Kin Unit

Don Pablo Mamani, his wife, and three sons and their wives, all live in a nucleo which was three years old in 1978. Don Pablo and his kin are originally from a highlands village in the Department of La Paz. They were all living in the temperate valley of Arica in Chile, working as laborers and share-croppers before being repatriated to Bolivia in 1975. They form an adaptive unit with two non-kin highland colonists who settled in the nucleo through purchase of the property of two of the original Paceno residents. They are a unit which is dedicated to the generation of cash income. On the average, each parcela has five hectares cleared in 1978, and each household raises enough for its own domestic consumption.

The reason that these six colonist households are considered a unit is that they all have invested capital and labor in a scheme to make as much money as possible from a jointly raised crop of green peppers and tomatoes. They planted, on land of two of the parcelas, four hectares of each vegetable. All of the colonists, their wives, and some of

their children were involved in planting, weeding, watering, and killing insects in the vegetable plots. Don Pablo owns a truck and they drove the crop to market as soon as it had ripened.

The location of the exploitative activities of the unit is San Julian and the market in Santa Cruz. No member of the unit resides in the latter place, but the sale of the vegetables occurs there. Don Pablo hopes to settle his wife and some of his children in the urban marketing center of Montero with his part of the profits. The adaptive unit only exists for the shared entrepreneurial risk of the vegetable-raising venture, but they are considering trying the same strategy in the future. The resources exploited by the unit are the vegetable crops, Don Pablo's truck, and their own labor and capital. At the time of the termination of fieldwork, it appeared they would be successful in the venture because the truck was working and the price was rising as demand increased from the restaurant market in Santa Cruz.

Don Federico and Dona Claudia

Don Federico and Dona Claudia were two of the first settlers in the nucleo of lowland natives established in 1972. They have six children. Don Federico has cleared eight hectares of his parcel. He places a great value on being free to hunt, fish, and travel in the woods with his hunting dogs and friends and kin from the nucleo and other nearby lowland settlements. Dona Claudia has to do much of the agricultural

work, especially the weeding and the harvesting because Federico is gone. He has cleared a little more than a hectare per year, which has not required a great deal of time, because he is extremely skilled in the use of an axe and machete. When he burns his chaco, he uses his knowledge of the environment in order to best take advantage of the wind and dryness of the felled trees and brush. He usually has a very "clean" burn, little material remains unburned. However, after seeding, he is usually out in the forest again. He cares little about cash income, but is concerned to supply enough food for his wife and children. He sees his contribution to that supply mainly as protein, and thereby explains his long hunting and fishing expeditions. Dona Claudia works as a wage laborer or peon in the chaco owned by a highland colonist in a nearby nucleo for several weeks to make cash for her children's books and medicine.

The labor of the unit is supplied almost entirely by the unit itself, as Claudia and the older children work in the parcel and Federico supplies the meat and labor in land clearing and seeding. The location of their exploitative activities is in their nucleo, other nearby nucleos, in the surrounding forest, and in the town of San Ramon. Claudia travels to San Ramon to sell eggs from her prodigious flock about once every two weeks. Resources exploited included: rice, corn, yuca, banana trees, papaya, chickens, and wild animals, both their meat and their skins. Federico is able to sell hides to buyers who arrived from the city every two to

three months. A profitable sale is followed by a celebration with his friends with a few large tins of cane alcohol which results in the expenditure of most of the income. The family does eat well, the children appear healthy, and goals of the unit are being met.

Don Torribio and Dona Marcelina

Don Torribio and Dona Marcelina and their four children form a unit in one of the first nucleos founded in 1972. They were born near the town of Vallegrande, which is located in a valley at approximately 1500 meters above sea level. It is a low altitude valley between Santa Cruz and Cochabamba. It is not considered truly part of the highlands or the lowlands. The agriculture is intensive, as in the highlands, but lowland products such as citrus fruit, sugar cane, and corn are grown, as well as highland products.

Torribio moved to the northern Santa Cruz region in 1965 when he rented land near the Rio Grande where the crossing for the German Highway is now located. In 1968, he moved to what was then the Area No. 3 of the semi-directed colonization zone of San Julian. In 1972, when the first nucleos were surveyed and organized, he moved into nucleo 2 with others who had been living around the area. They were all locally born campesinos, but Torribio was already a friend of most and had compadres among the colonists. Dona Marcelina was also well-liked and a compadre. The unit values the accumulation of capital for investment in long term growth of resources and for providing educational opportunities for their children.

From 1972 on, he has gained influence and respect among fellow colonists in his own nucleo, of which he has been a leader, and in his NADEPA, of which he has been president and manager of the consumer's cooperative. He has also been involved with UCC personnel. For four years, he was in charge of organizing construction of the OP buildings in new nucleos and for recruiting orienters, usually selected from the native lowlanders of his nucleo because of their long-term experience in the lowlands. He was sent by the UCC to a training course in small motor mechanics and maintenance, and was then placed in charge of the maintenance of all chain saws used in the OP. He continued to serve as an advisor for the selection of orienters. During his years of involvement with the OP, he still has been able to work on his farm and has cleared approximately 15 hectares.

Torribio is innovative and hard-working in the management of his farm. He is the first colonist in all of the nucleos settled since 1972 to plant enough improved pasture grass to support permanent cattle feeding and now has four dairy cattle. Dona Marcelina milks the cows every day, supplying her children and selling the remainder.

Torribio has been able to return and work his land while performing his job with the UCC. He has to hire some labor, but his prestige in the community allows him to find exchange labor partners easily. The location of the exploitation of the unit is in San Julian. They exploit most grain, tree, and

tuber crops, and raise chickens, ducks, and dairy cattle. Torribio is also considered one of the best hunters in San Julian and, when home, often supplies meat for his family and neighbors. Marcelina works hard at home to manage the farm, raise the ducks and chickens, and care for the children.

Los Jovenes - Marcos, Felipe, and Marcelino

Two brothers, Marcos and Felipe, and their cousin, Marcelino, formed an adaptive unit. They were all 18 to 20 years of age and unmarried when they came to San Julian. They arrived in 1974 in the second group from the Yocaylla sub-region of Potosí, with a large group of kin, fictive kin, and friends and neighbors to settle in nucleo 7. The three young men planned to pool their labor and hoped to buy a truck after two to three years. They wanted, therefore, to put most of their efforts into cash income generation, and only a minor effort into raising food for domestic consumption.

Marcos and the other two young men had been to the Santa Cruz department for only two months prior to settling in San Julian. They left from Potosí in April to work in the sugar cane harvest as wage laborers. When they finished in June, they returned to Potosí to collect their belongings for the move to San Julian. They had to undergo the hardships of waiting two weeks before their nucleo was finally prepared. They began to feel misgivings about the whole venture, but seeing the cleared land, growing crops, and large houses of their kin in nucleo 1 convinced them to remain.

After the OP was over, the three young men planted their rice and corn crops and left immediately to return to their village in Potosi for the annual soccer tournament and for the fiesta of Carnaval. When they arrived back in San Julian, they found heavy rains had flooded part of their chacos and their corn, suffering from rotting roots, had grown to only half of its normal height. Strong winds had blown down much of their rice and they were able to harvest very little. They complained loudly about being assigned to a nucleo which was swampy and about being given the wettest areas within the nucleo for their farms.

An older colonist and the only man from the department of Cochabamba settled in the nucleo told them that, after his long experience in the Oriente, he had learned to appreciate wetter areas because rice grew better there and because they served as watering holes for livestock. They rejected his counsel and became angry with him. He had remained in the nucleo after the OP, had carefully and repeatedly weeded his crops, and was bringing in an ample harvest. Jealousy of his success and dislike of the fact that he was not part of the exchange network of the Potosinos finally drove the three young men to take action. They asked him to look at one of their fields and, when in the chaco, they beat him unmercifully.

Felipe and Marcelino immediately left for Potosi, they did not wait to try to obtain payment from the colonists who would move into their parcelas. They did not wait because the INC officials told them that they did not have anyone waiting for

land and that they would not receive much of a price if a new colonist did arrive. Marcos remained and tried to clear more land on which to plant the next year's crop. He involved himself in exchanging labor with his kin and friends, and was able to plant 1.5 hectares of rice and corn for the coming year. He stayed in the nucleo through January to carry out weeding. At the end of the month, he left to go to Potosi for Carnaval. He planned to stay at his village for only a week, but during the fiesta he met a young woman who was distantly related to him, and decided he wanted to marry her. She would have nothing to do with going to the lowlands because she had heard it was unbelievably hot, wet, bug-infested, dangerous, and she would not be able to take her corderos or lambs and llamas with her. He spent two weeks trying to convince her, but she remained adamant. She agreed to wait for him, though, as he had to go back to harvest his rice.

Unfortunately, a surazo or frigid, southern front hit San Julian the day before his arrival. He found much of his rice blown to the ground. He was able to salvage a good deal of the rice, but he decided he had had enough and wanted to investigate the possibilities of selling his land. He found that, for only US \$15 to US \$20 paid to INC officials, he could get them to assess the worth of his parcela at US \$250. He found a buyer in Montero, a migrant from the Chuquisaca department who had just sold his farm in Yapacani. Marcos took the money and returned to Potosi. He married the young woman and was able to build and stock a small store in his village,

which was the third such small store in a village of 60 households.

Felipe returned to San Julian in 1978 to manage his cousin Alejandro's farm. Alejandro had been called to do military service and Felipe offered to raise and harvest his crops. He paid half of the profits on the rice and corn crop and kept all other products for himself and his new bride. Felipe, as of September 1978, was considering buying a parcela if he found one nearby, or asking Alejandro if he could rent part of his farm.

Cooperativa San Simon

An association of approximately 30 families who worked in small, private tin mines in the department of Oruro had a visit from an INC official of the La Paz office. They were told that, in the San Julian colonization project, each of them could receive 50 hectares of land, and that they would receive aid to begin their settlement. If they used the land for two years, they were told that they could receive a clear title to the land. These miners were relatively wealthy, and the idea of investing in land in Santa Cruz sounded potentially lucrative to them. The INC office in La Paz arranged for them to have their own nucleo.

The miners planned to go to San Julian, verify the land grants, and hire peon labor to clear the land and plant crops. They would reside on a rotational basis in order to manage the properties. The crops would be grown almost exclusively for the

market. They hoped to raise pigs and cattle for the regional market.

When they arrived in San Julian, unlike all other colonists of that year, they were driving their own trucks. They had a kerosene refrigerator on the back of the truck and were able to drink cold beer at the fiesta they held on the first night of their arrival. The OP staff had never seen colonists arrive with an obvious amount of capital.

Immediately, problems arose when the cooperative was told by the UCC staff that, to settle in San Julian, they had to undertake the activities of an OP, and, to have an OP, they had to stay and work for four months. They were specifically told that they could not hire peons or day laborers for the tasks of the OP. The entire cooperative, except for a few members, left to go to Montero to protest and appeal the OP rules. They were met on the bank of the Rio Grande by the INC-USAID advisor for the project, the man who had been the driving force of the OP since the Hardeman refugee camp. They were told the rules would not be changed for their case. They were welcome to settle in San Julian, and to work their land in common if they wished. However, they had to reside on the land and work it, at least during the OP. This did not meet their goals for exploitation of San Julian, and they got in their trucks and rode away.

Processing of Outcomes: Success and Failure in Pioneer
Adaptation

Analysis of adaptive strategy formation has allowed for the isolation of variables of goal setting, unit formation, and constraints from the environmental setting. From these basic components, categories of options in adaptive decision-making were identified in the particular situation of San Julian. The composite of decisions constitute an adaptive strategy and, when put into action, produce an outcome. The outcome of actions is analyzed by the individuals and/or groups which make up the adaptive units. They then decide, after weighing their expectations of projected outcomes against their perceptions of the actual outcome, if they will continue, modify, or abandon that strategy (see Figure 11).

The actual cases of adaptive strategy formation sampled the range of variation of the population of San Julian. Whether values were satisfied and goals were fulfilled depended on the individuals and groups in each case. Leaving San Julian or staying there were both successful outcomes relative to the way in which the adaptive unit desired to utilize the ecosystem. They could also have been failure outcomes. For example, leaving San Julian for the Jovenes from Potosí meant failure, while the same outcome meant success for Don Hugo. Staying in San Julian meant that Don Eduardo, NADEPA President, was successfully fulfilling his goals, while staying in San Julian would have meant failure to the miner's cooperative.

The fact that, for this study's analysis, the success or failure of outcomes must be judged relative to the values and goals of strategy formation is its major contribution to studies of pioneer migration.

In colonization literature, to the present, relative success or failure has been judged on the basis largely of rates of abandonment. It is tempting to use this figure, if it is available and reliable, because it quantifies whether pioneer migrants are or are not remaining or living in a zone to which they had moved. There is some logic in using abandonment rates, especially from the viewpoint of the evaluation of effectiveness of efforts made to promote and/or aid migration to designated frontiers. If a person leaves one of these areas in which efforts are being made, then the investment in that person is, in a sense, lost.

Based on this widely accepted criterion for success in settlement of new lands, the San Julian project since 1972 would appear to be successful. In nucleos founded since that year, the abandonment rate has been low, especially compared to most other projects which have been either directed or oriented. Approximately 1 to 2 colonists sell or simply abandon their farm every year in each nucleo. This rate of 2-5% compares quite favorably to rates as high as 50% and even 90% at other earlier projects. Two of the more important factors contributing to this low rate are: 1) for most colonists, agricultural exploitation in San Julian is only

another step in a longer process of migration in the lowlands; and 2) the OP provides an effective introduction to the use of the resources in San Julian.

However, there is a major objection to the widespread acceptance of abandonment as a measure of success in colonization. The objection is based on the fact that permanence of settlement is only one component of the decisions made by pioneer migrants as they formulate their desired strategy for use of frontier ecosystems. One colonist's story, though not a San Julian colonist, illustrates this point perfectly. The colonist moved to a directed project in the northern Santa Cruz region to take advantage of the food subsidy and agricultural extension services available there. He sold his assigned plot, or at least the improvements he had made on it, and, one year later, moved to a spontaneous colonization zone. From the viewpoint of project managers, it was a total loss, but, from the viewpoint of the colonist, it was the successful use of an opportunity to improve his family's nutritional and financial status and to increase his knowledge of agricultural techniques. He also apparently learned enough about the organization of agencies trying to help colonists to lead his fellow spontaneous colonists in securing medical care and schools. For the colonist, his family, and his neighbors, he had increased adaptive chances by abandoning and 'failing' in the settlement of the directed project.

Success and failure in adaptation to the San Julian ecosystem can be defined in relative terms. If a colonist, or group of colonists, invests labor, capital, and time in pursuit of desired outcomes and they fail to produce the expected results, then they have failed. Absolute failure, such as death or total loss of capital invested in a scheme, is rare but easier to identify than relative failure. The author will not attempt to establish a scale of relative success and failure. This will be the object of future study. The study does isolate and identify components of a model of adaptation to a frontier ecosystem. The study also emphasizes the need to re-orient analysis of pioneer adaptation. True analysis is whether pioneers are finding ways to articulate themselves in and use the resources of the ecosystem according to their values and goals. The values and goals of other persons and institutions involved are not the correct bases for judgement of adaptive success.

Cybernetic theory has provided the crucial insight for the above conception of success and failure of frontier adaptation as relative to the goals and values of the colonists and the units they form. The key to analysis of the processing of information and energy by a living system is in seeing how it sets its priorities for action, especially in this case in relation to resource exploitation. The living system, on the basis of its priorities, selects its pattern of activity, carries its plan through, and then assesses the results through

collection of feedback from the environment. The system then maintains, modifies, or rejects its previous priorities, plans, and actions. This is what occurs in the formation of adaptive strategies by the colonists of San Julian.

CHAPTER SEVEN

CONCLUSIONS: THE ANALYSIS OF PIONEERING AS
ECOLOGICAL PROCESS

Pioneer adaptation to frontier ecosystems is one type of ecological process. The initial modeling of the process stated that: 1) segments of existing populations identify themselves and/or are identified as marginal to the population, particularly in relation to their control of resources necessary for survival and/or their perception of their control of those resources; 2) these marginal segments leave the former habitat and move to a new and different one in which they anticipate having the ability to meet their goals, which they were unable to meet in the origin habitat; 3) to establish themselves in the new habitat they must develop a niche or occupation in it, articulating themselves within the total ecosystem by forming relationships with geo-physical, biotic, and sociocultural components of it; 4) while developing a niche, the population will test former modes of adaptive behavior, those relevant to the origin ecosystem, and retain, modify, or reject them, and the population will innovate new modes and/or adopt elements from the modes of adaptive behavior or other populations in the new ecosystem; 5) testing for workable solutions to adaptive challenges selects for individuals and/or groups whose strategies of resource use of

niches are viable, which may lead to total failure by all individuals, individual success amid group failure, or success of groups based on jointly shared risks and division of responsibilities in meeting adaptive challenges; and 6) as adaptation is an on-going process, pioneers constantly process and analyze results or outcomes of niche development and retain, modify, or reject previously developed modes of adaptation. The study has concerned itself with the third through the sixth parts of the model for reasons cited earlier.

The presentation of data provides an understanding of the overall process of pioneer migration in South America and in Bolivia, and in the San Julian zone in particular. The components of the San Julian zone's ecosystem have been identified, including geo-physical elements and their cycling and biotic species. Human settlements in the zone were sparse or non-existent prior to the recent movements which were the primary concern of the study. Socio-culturally structured components of the ecosystem existed, not in the form of populations with which pioneers had to deal, but rather as development efforts of private and governmental agencies. These efforts created unique opportunities for adaptation to the ecosystem, while, at the same time, they limited choices of pioneers for its exploitation.

A number of features of the population, including its areas of origin, demographic structure, techno-economic activities, social organization, and values and goals were

presented. It is clearly evident, from this information, that there is variation in the process which generated pioneers from origin populations, in the anticipations or expectations they have of potential resource use and control in the ecosystem, and in the ways they begin to develop articulations with components of the frontier habitat.

From that information, an explanatory model was developed to analyze the elements of formation of adaptive strategies. First, motivating values and goals, and kinds of adaptive units were identified. The effects of environmental restraints, as strategies unfolded, were identified as they impinge on selection of options for use of the ecosystem. Following that, categories of choice in ways to articulate with the ecosystem and exploit resources were examined. Finally, the explanatory model included the processing of outcome as individuals and/or groups continue to adapt or decide to attempt adaptation elsewhere.

Major Themes in the Analysis of Adaptation in San Julian

Analysis of adaptation in San Julian has centered on several major themes. First, the frontier ecosystem has been prepared for colonists by infrastructure provision including road-building, village site land clearing, and well perforation. Second, the preparation has been manipulated in a more or less coherent way. Settlement pattern planning, intervention in the form of aid in initial adjustment, and

technological transfer have been structured by certain goals of those development agents carrying them out. Third, the selection of individuals and groups has favored certain kinds of pioneers out of the total population of pioneer migrants available.

The San Julian ecosystem has been prepared more comprehensively than any other colonization zone in Bolivia for the arrival and beginning of settlement by pioneer migrants. Most of the population has settled since 1975, the year which marked a great increase in funds available for construction of roads, land clearing in village sites, and well drilling and pump installation. Throughout the study, serious flaws in the execution of plans for provision of these items of infrastructure have been noted. Overall, though, the adaptive advantages offered by such preparation have been part of the opportunities of the ecosystem in which pioneers were articulating themselves. These advantages include: 1) access to markets in lowland rural and urban centers, and highland areas of origin; 2) existence of village sites for social and economic activity; and 3) availability of a reliable and pure water supply.

Intervention in the adaptive process by development personnel has been another major theme in the analysis of pioneer settlement in San Julian. The OP is a set of activities for provision of food subsidy; training in agricultural, livestock raising, and construction technology;

and development of community decision-making processes and identity. The OP is based on the overtly expressed value, on the part of development agents, of producing viable communities of small farmers exploiting the environment in a way which: 1) sustains yields and renews resources; 2) produces good health conditions such as the lowering of infant mortality; and 3) allows for the improvement of living conditions for all without the appearance of markedly unequal control of resources by any individual or group.

The nucleo settlement pattern and nine-nucleo NADEPA pattern are also influenced by the particular socio-economic and political values of the development agents. The inefficiencies of transport in the nucleo pattern cited in earlier chapters were acknowledged by development personnel. The advantages of providing equal access to services and facilities in community centers, and furnishing a central place enabling and enhancing opportunities for social and economic interchange were considered to outweigh other considerations. The planning of an urban central place in the NADEPA pattern apparently was successfully providing a stimulus for the beginning of major economic and socio-political institutional growth at an apparently earlier stage in growth than most other pioneer areas of the northern Santa Cruz region. Conflicts produced between nucleos over desires to carry out NADEPA central nucleo functions attested to the role these centers do and will play. The variation in settlement pattern of the

central nucleos will probably mean that other nucleos, even those located on the main roads, will not be able to usurp their functions as urban residential service, and marketing centers.

A major new integrated program of development efforts, based on the same values as the OP, will be initiated in San Julian in 1980. It is designed to continue to enhance opportunities for adaptation of certain kinds of pioneer colonists as they enter a transition period identified in Nelson (1973) as the consolidation phase. He saw this as a phase of: 1) investment in establishing sustained yields of exploited resources; 2) development of marketing and product processing infrastructure and services; and 3) increase in stability of the population, especially its demographic structure and social organization. The development personnel of San Julian have produced a plan based on the application of social science analysis, including Nelson and others, to the particular situation of the San Julian colonization zone. Research in the zone should center on two questions concerning the reality of the idea of a consolidation phase: if it is occurring, then what modifications, if any, take place in adaptive strategy formation; if it is not occurring, then what happens as time passes and settlements and their populations do or do not change.

The third major theme, which is a unique aspect of the process of adaptation of the pioneer migrants, is the selection

of colonists for and location of colonists in the San Julian project. The established rules for entry state that prospective colonists must present themselves and register in either the national office in La Paz, or one of the regional offices in Tarija, Cochabamba, Santa Cruz, Montero, or in San Julian.

The rule was first changed to allow colonists to settle in San Julian only in groups of 40 or as close to that figure as possible. This modification of the rule stemmed from the decision of development agents that OP activities required a great deal of communal labor and 40 colonists were necessary for completion of the tasks. Further, if whole nucleos were settled simultaneously, the promotion of growth of communal decision-making processes was believed to be enhanced.

The second way in which the first come-first settle rule has been modified was the decision, in the case of twenty of the thirty nucleos settled, to allow for settlement of groups with some form of pre-existing social organization. These decisions were based on a belief that the work of the OP and formation of communities would be advanced by selection of such groups. In the case of the Yocaylla sub-region, from which colonists have come to settle all or parts of seven nucleos, the nucleo was essentially homogeneous with many cross-cutting ties of kinship and fictive kinship, and with existing socio-political decision-making structures. Homogeneity of area of origin was also the basis for selection for settlement

of six other nucleos. Some nucleos of this category are less homogeneous as to their areas of origin, but did arrive in San Julian after having lived in contiguous areas of the lowlands. In the case of four nucleos settled in 1977, one set of leaders had petitioned for entry and organized their move. The length of time living together and strength of common identity varied greatly, but at least some form of relationship and common knowledge existed.

The other ten nucleos settled as of 1978 were heterogeneous as to area of origin, and the colonists, except for small sub-groupings, such as extended families, had never known each other prior to arrival in San Julian. One of these nucleos had been organized by a development agency by recruiting volunteers from the streets of Montero. The rest had simply followed the rules of registration. Most had been in the lowlands, heard about the opportunities of settlement in San Julian, and gone to INC office in Montero or in San Julian.

Once selected, the process of adaptation has been affected by decisions made by key development personnel as to which groups would settle in which nucleos. The two major judgmental factors at work in manipulation of placement were: the amount of kind of resources, capital, and experience of various groups; and the desire to limit opportunities for regional enclaves to develop.

The first factor can be seen in the placement of the colonists in nucleos 12 and 14 in 1977. The colonists settled

in nucleo 12 where the wealthiest and most experienced in lowland agriculture of the group of four nucleos settled by former residents of the Littoral zone located north of Montero. The central nucleo number 14, was assigned to colonists who, by and large, had been the peones or wage laborers of the colonists in nucleo 12 when they lived in the Littoral area. The fact that the immediate economic growth potential was greater in the central nucleo rather than in a lateral nucleo was not lost on the colonists in 12. They marched out in the first week of the OP and demanded relocation to nucleo 14. They were persuaded to reconsider by INC and UCC personnel and all returned to nucleo 12. The overt rationale of the placement was to lessen the effects of initial capital and knowledge inequalities by providing a less advantageous location for those more favorably endowed and a more advantageous location for those less favorably endowed.

The second factor in the manipulation of the placement of groups is to limit the growth of regional enclaves. In 1977, nucleos 13 and 15 were settled by colonists from the Yocaylla sub-region. They were, by and large, homogeneous as to area of origin and had complex, pre-existing social networks prior to settlement. Further, they almost all had kin and acquaintances in nucleo 11. Project managers placed them in two lateral nucleos largely in order not to provide potential for regional separation by contiguous sections in San Julian. The fact that this denied one of the other aims, to build on pre-existing

networks of social and economic ties, was not considered as important. In terms of social analysis, planners did not recognize the phenomenon of ethnocentrism as positive at the inter-nucleo level, but did at the intra-nucleo level.

Postulates for Intervention in Pioneer Settlement

The themes of preparation and manipulation of the frontier environment, planning to promote certain goals of resource use through this preparation and manipulation, and the selection of individuals and groups according to the preconceived notions of who would fit with the planners' goals of settlement provide postulates which may be applicable to other similar situations. General policy implications of these postulates are only tentatively asserted because any situation in which they would be applied would require careful analysis for their relevance and/or need for modification. From the evidence in San Julian, it is apparent that, if the goal of settlement is the establishment of small farmers on land from which they can provide a completely adequate subsistence, contribute to regional and national markets, and maintain the resources of the land while living in autonomous and viable communities in which no individuals or groups gain an unequal advantage in resource use or control, then the following measures are necessary as a minimum:

- 1) Prepare settlements by the construction of all-weather roads, both primary and secondary, which allow access to regional markets and the rest of the nation.

- 2) Provide a potable water supply for all settlers which is located roughly equidistant from all house sites.
- 3) Provide the immediate means of survival, especially for both food, shelter, and seed for the first harvest.
- 4) Establish a settlement pattern which provides for central locations for services, recreation, meetings, marketing, and social interchange. This includes a hierarchy of settlements with future needs for central urban locations.
- 5) Organize group decision-making to carry out all tasks necessary for immediate survival including the preparation of food, completion of shelter, and setting of priorities for other tasks.
- 6) Provide an introduction and training in technology appropriate to the founding of settlement including construction, land clearing, planting, weeding, and harvesting. All training must be relevant and practical to the farmer and the need to establish the settlement.
- 7) Aid in the formation of cooperative associations which can be effectively founded through the provision of consumer items at reasonable costs.
- 8) Avoid paternalistic attitudes and structural dependencies of a material or social kind in planning and executing the above steps. In this way, individuals and groups of pioneer farmers will benefit from the provision of effective planning and aid while developing autonomy from aid providers.

The Adaptive Process in San Julian

Initiating settlement, assuring survival, developing strategies for resource exploitation, and executing those strategies are necessary steps in any migration process to previously unknown environments. The process has been going on as long as species have been dispersing over the face of the planet. The opening and settling of agricultural and cattle-raising frontiers is a current and widespread phenomenon in developing countries today and appears that it will continue to be important into the future. This study examined one particular case, the San Julian Project in eastern Bolivia. Many features of the adaptive process outlined and analyzed in this study are common to other areas of frontier settlement. Some of these features of the adaptive are unique because of experiments which have been and are being designed in the promotion of certain favored modes of adaptation and resource exploitation. The interplay of what pioneers want to do in the environment and what planners want them to do has been of major interest in the study.

The adaptive process is selective and cybernetic. Ecosystem features are selected by colonists based on the strategies they design for their use. At the same time, overlying structures and stressors select among colonists for the fit between the possibilities they permit in behavior and the decisions for strategic action by pioneers. In many ways, settlers may modify environmental restraints. For example, the

colonists of nucleo 17 have moved all of their homes to be in vertical lines facing the Brecha Casarabe, and not in the planned urban radius pattern of the INC design. Restraints also modify adaptive strategies of colonists, seen throughout the study. One example is the NADEPA central nucleo plan which designates central urban sites. The interdependence and feedback of the process will continue as settlers continue to meet the challenges of adaptation to the frontier ecosystem in the San Julian colonization zone.

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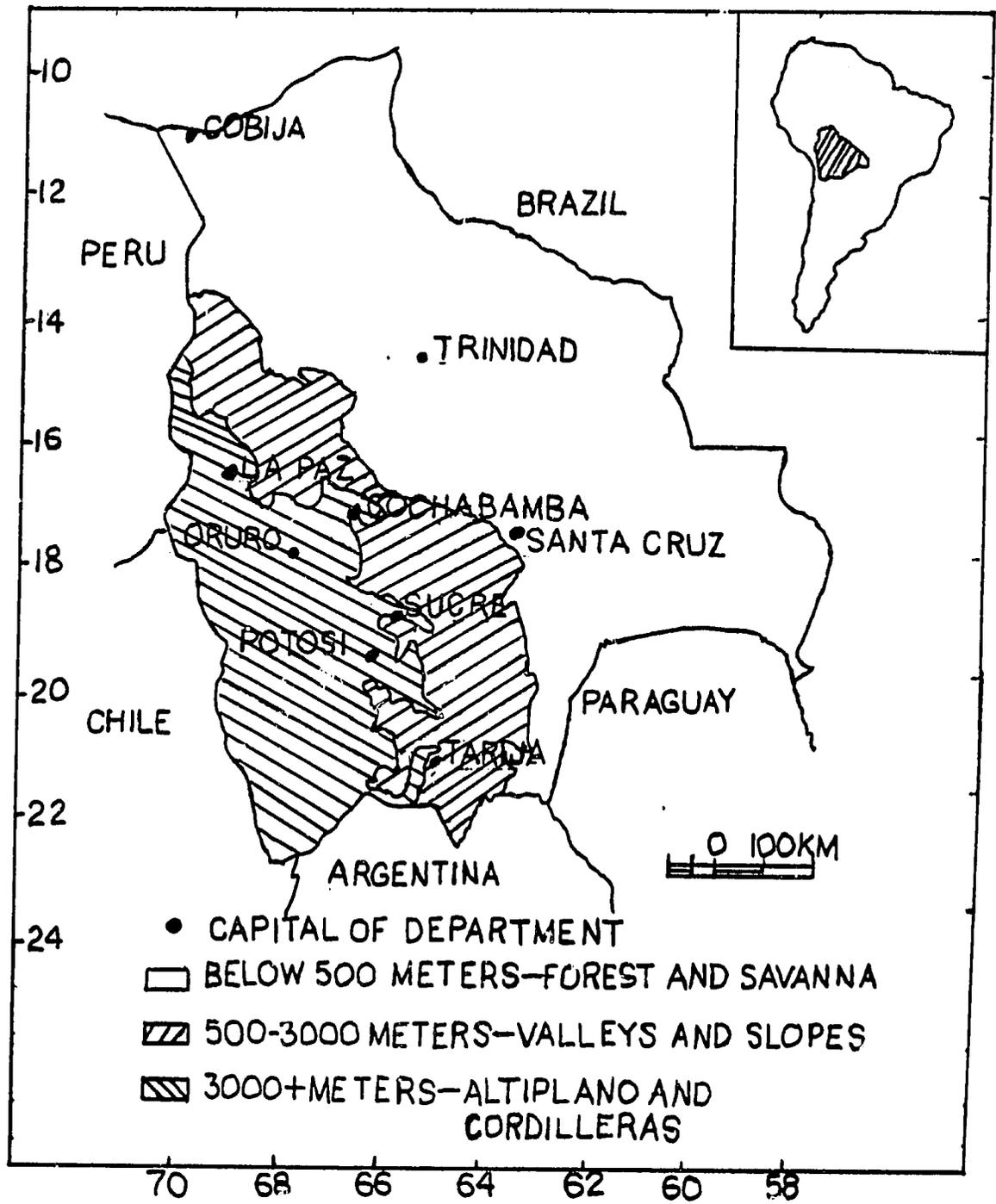
APPENDIX ONE

Photographs

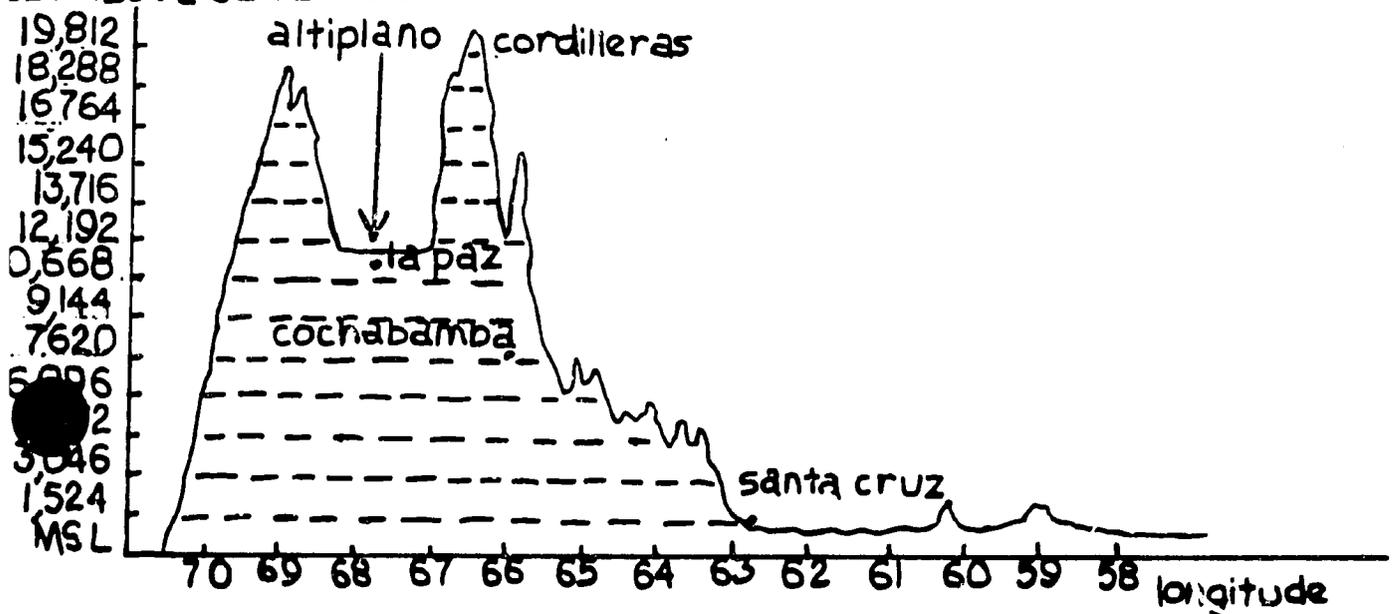
APPENDIX TWO

Maps

MAP I.



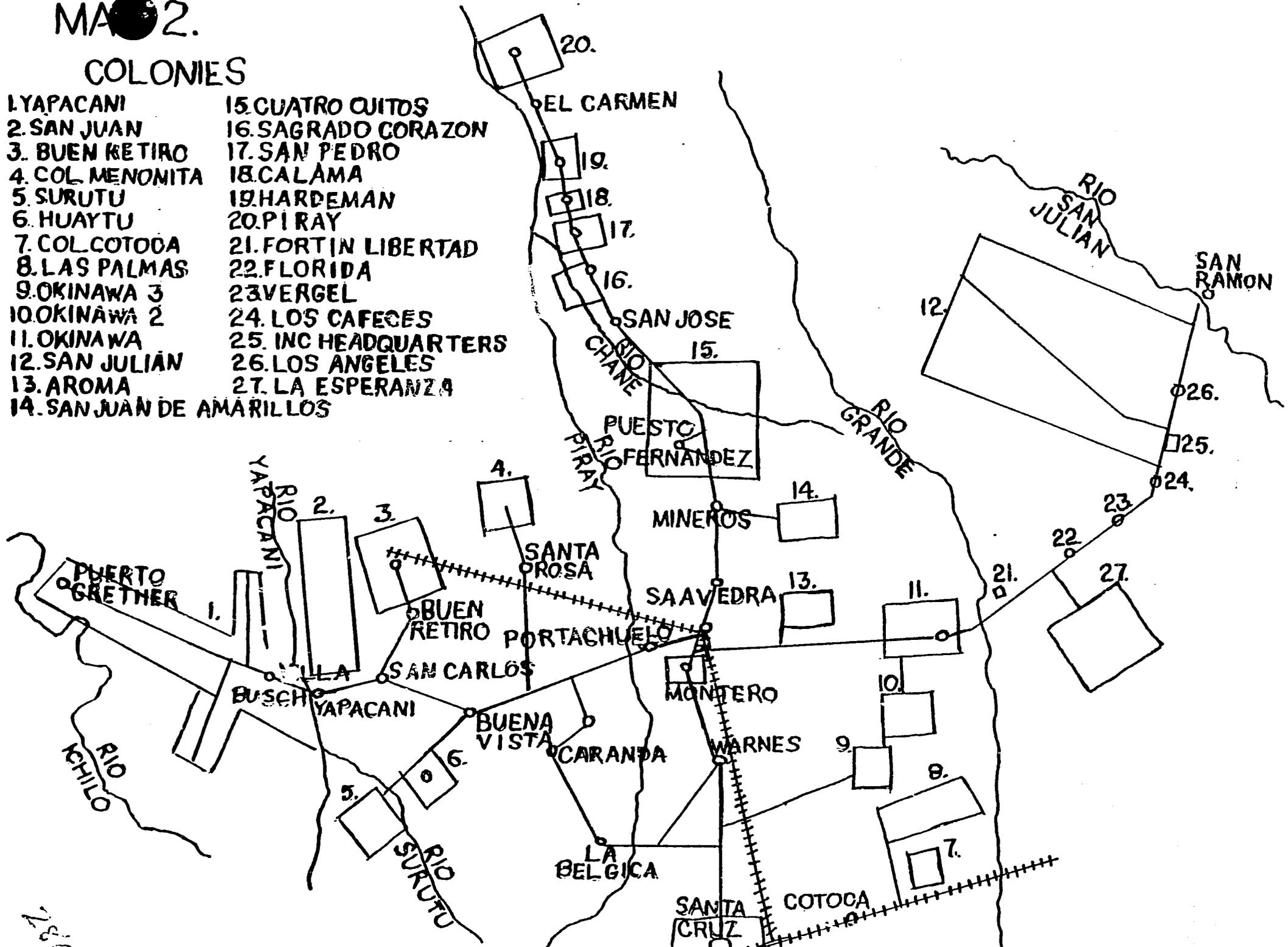
EET ABOVE SEA LEVEL



MAP 2.

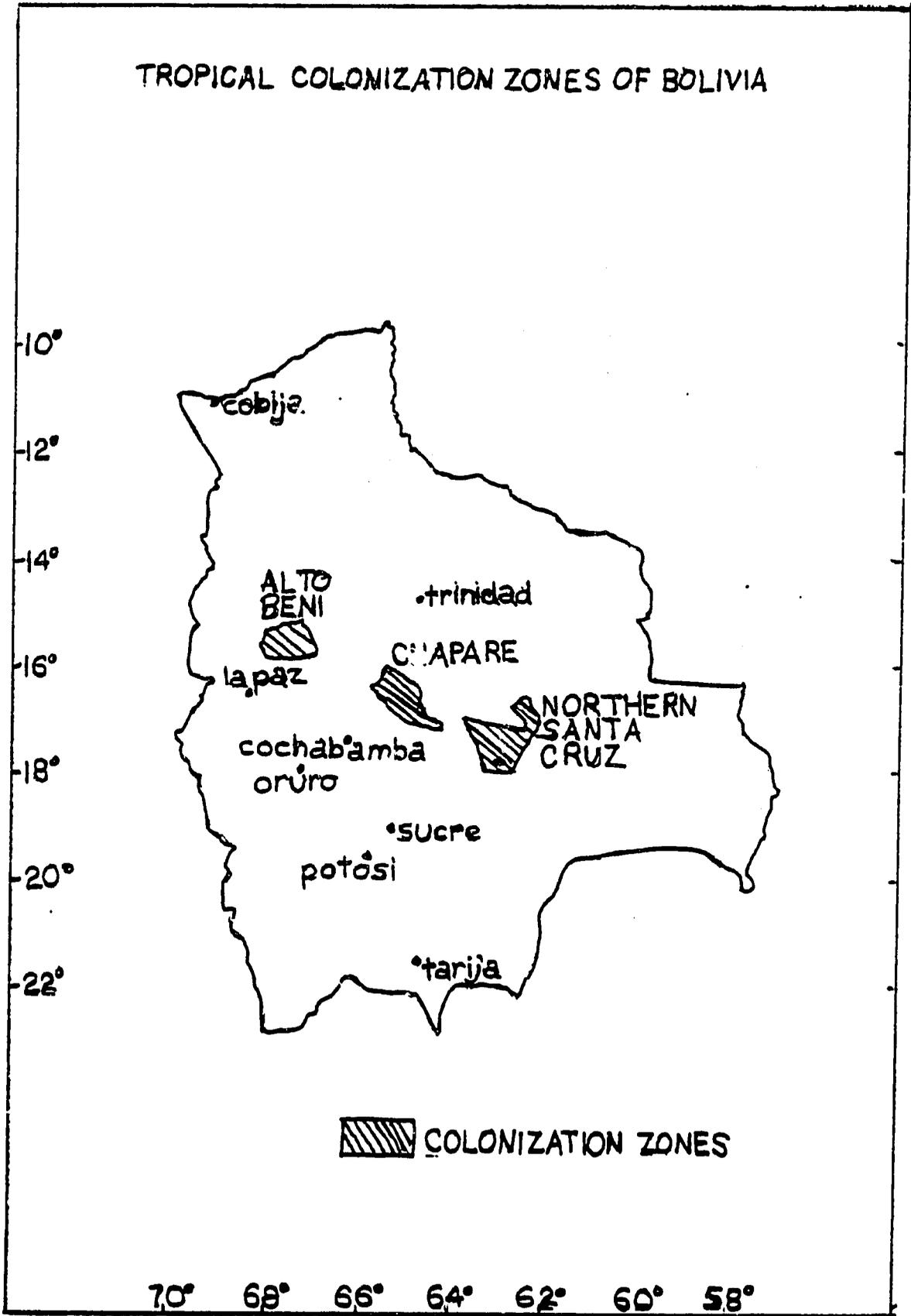
COLONIES

- | | |
|---------------------------|----------------------|
| 1. YAPACANI | 15. CUATRO QUITOS |
| 2. SAN JUAN | 16. SAGRADO CORAZON |
| 3. BUEN RETIRO | 17. SAN PEDRO |
| 4. COL MENONITA | 18. CALAMA |
| 5. SURUTU | 19. HARDEMAN |
| 6. HUAYTU | 20. PIRAY |
| 7. COLCOTOA | 21. FORTIN LIBERTAD |
| 8. LAS PALMAS | 22. FLORIDA |
| 9. OKINAWA 3 | 23. VERGEL |
| 10. OKINAWA 2 | 24. LOS CAFECES |
| 11. OKINAWA | 25. INC HEADQUARTERS |
| 12. SAN JULIAN | 26. LOS ANGELES |
| 13. AROMA | 27. LA ESPERANZA |
| 14. SAN JUAN DE AMARILLOS | |

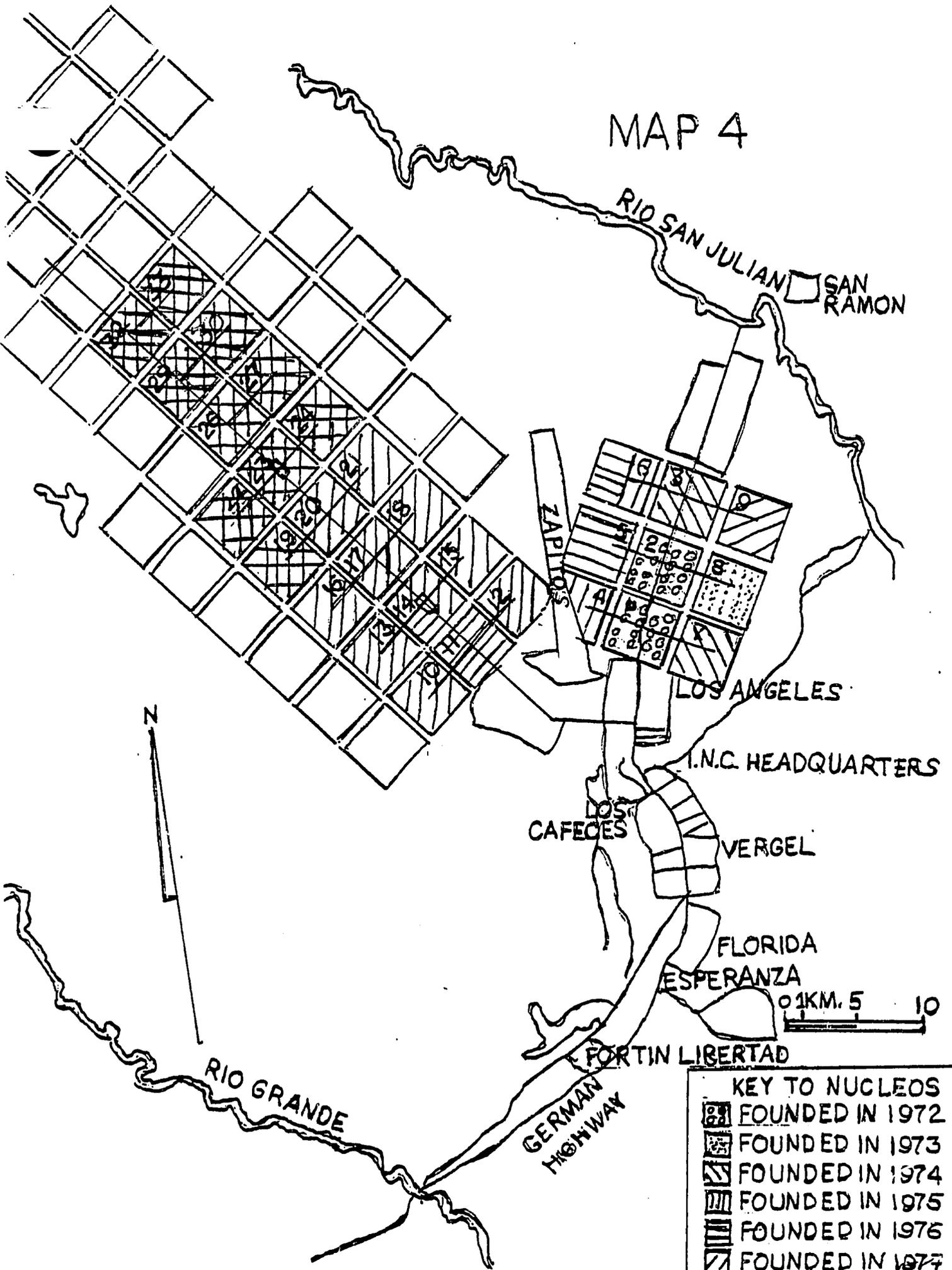


MAP 3

TROPICAL COLONIZATION ZONES OF BOLIVIA



MAP 4



KEY TO NUCLEOS

	FOUNDED IN 1972
	FOUNDED IN 1973
	FOUNDED IN 1974
	FOUNDED IN 1975
	FOUNDED IN 1976
	FOUNDED IN 1977
	FOUNDED IN 1978

APPENDIX THREE

Tables

TABLE 1

REGIONAL DISTRIBUTION OF LAND AREA AND POPULATION IN BOLIVIA - 1972

REGIONS AND ZONES	PERCENT OF TOTAL POPULATION	PERCENT OF TOTAL RURAL POPULATION	LAND AREA ^a SQ. KILO.'S	REGIONAL % SHARE OF LAND AREA	POPULATION DENSITY-TOTAL PER SQ. KILO.	POPULATION DENSITY-RURAL PER SQ. KILO.
I. Altiplano	44.4	38.6	182,048	16.6	54.53	7.48
a. North	17.9	9.3	6,200	.6	148.93	52.66
b. Central	24.3	27.0	94,512	8.6	13.30	10.09
c. South	2.2	2.3	91,315	7.4	1.37	1.00
II. Valles	35.0	39.3	143,411	13.1	12.65	9.66
III. Yungas	5.2	6.5	45,814	4.2	5.86	4.97
IV. Oriente	15.5	15.7	723,560	66.1	1.11	.76
a) Amazon Rain Forest	2.6	3.0	184,358	16.8	.72	.58
b) Beni Plains	2.2	2.5	135,848	12.4	.85	.64
c) Santa Cruz	4.5	2.6	30,828	2.8	7.54	2.97
d) Brazilian Shield	2.1	2.6	243,295	22.2	.44	.38
e) Bolivian Chaco	4.1	5.0	129,231	11.8	1.65	1.36
BOLIVIA TOTALS	100	100	1,094,833^b	100	4.73	3.22

a) Total land area is used to calculate density for both total and rural population since land in urban centers is such a small share of total.

b) Not including Lake Titicaca.

SOURCE: Zeballos, 1975

1982

TABLE 2

LAND AVAILABILITY AND LAND USE IN BOLIVIA - 1972

<u>TYPE OF USE</u>	<u>THOUSANDS OF HECTARES</u>	<u>PERCENTAGE OF TOTAL LAND AREA</u>
Total-Bolivia	109,858	100
I. Forests	29,526	27
II. Pastures and Range	69,391	63
a) Tropical	43,073	39
b) Range and Watershed	26,318	24
III. Waste Land ^a	3,094	3
IV. Prime Land for Crop Productivity ^b	7,847	7
a. Potential not used	4,271	4
b. Fallow ^c	2,502	2
c. In Current Use ^d	1,074	1

- a - Includes Lakes, Rivers, Cities and Wasteland - e.g., Sales de Uyuni (Large Salt Flat in Central Altiplane)
- b - This is land thought to have potential for crop productivity. There is an estimated 6.5 million additional hectares of more marginal land which could be brought into production which is currently classified as pastures, ranges, and forests.
- c - Land currently in fallow stage of traditional rotation system.
- d - Estimate from MACAG, Division de Comercializacion.

SOURCE: Zeballos, 1975

TABLE 4A

A. TREE TRANSECTS MADE IN THE SAN JULIAN REGION
(LENGTH OF TRANSECTS = 1 km)

TRANSECTS BETWEEN * NUCLEOS 29 & 30		TRANSECT BETWEEN * NUCLEOS 32 & 33		TRANSECT BETWEEN NUCLEOS 35 & 36	
Local Species Name	%	Local Species Name	%	Local Species Name	%
Yesquero	12.77%	Ajo-ajo	11.92%	Ocho-o	17.67%
Ajo-ajo	9.58%	Curupau	10.60%	Bibosi	15.09%
Blanquillo	8.51%	Ocho-o	7.29%	Garansillo	6.90%
Curupau	8.51%	Sujo	5.96%	Blanquillo	6.90%
Gichiturique	6.92%	Yesquero	5.96%	50% Ajo-Ajo	6.04%
50% Momoqui	5.32%	50% Gebio	3.97%	Coloradillo	5.60%
Cusi	3.72%	Amaibo	3.97%	Algodonillo	4.31%
Pacobillo	3.19%	Pacobillo	3.97%	Cuqui	3.88%
Toboroche	2.66%	Coco	3.97%	Picana	3.02%
Coloradillo	2.66%	Palo Santo	3.97%	Coco	3.02%
Cari cari	2.66%	Sumuqué	3.97%	75% Palo Santo	2.59%
Sumuqué	2.66%	Gichiturique	3.97%	Yesquero	2.16%
Palo Santo	2.66%	75% Bibosi	3.31%	Bi	1.72%
Picana	2.13%	Mani	3.31%	Toboroche	1.72%
75% Sahuinto	2.13%	Comomosi	2.65%	Sumuqué	1.72%
Garonsillo	2.13%	Cari cari	1.99%	Guayaboche	1.29%
Ocho-o	2.13%	Guayaboche	1.99%	Copaibo	1.29%
Tarada				Tarada	
Colorada	2.13%	Coloradillo	1.99%	Amarilla	1.19%
Porotillo	2.13%	Toboroche	1.99%	Porotillo	0.86%
Amaibo	1.60%	Picana	1.33%	Pacobillo	0.86%
Mara	1.60%	Cusi	1.33%	Cuta	0.86%
Coco	1.60%	Amarillo	1.33%	Gabetillo	0.86%
Sujo	1.60%	Otros (7)	0.66%	Gichiturique	0.86%
Gabatillo	1.06%			Cusi	0.86%
Mapajo	1.06%			Sahuinto	0.86%
Amarillo	1.06%			Mapajo	0.86%
Bibosi	1.06%			Picana Negra	0.86%
Otros (12)	0.53%			Comomosi	0.86%
				Amarillo	0.86%
				Otros (9)	0.43%

39 Species

30 Species

38 Species

*The most abundant tree in all transects was the palm Motacu (Scheelea princeps) which comprised more than 50% of all trees in all transects. For this reason, no count was made of this species, to make more clear the species composition of the other trees. Motocu increased in density from Nucleos 29 to 35, but many had been removed on the transect between Nucleos 29 and 30 for roofing.

TABLE 4B

LIST OF TREES AND BUSHES

<u>English</u>	<u>Local Species Name</u>	<u>Scientific Species Name</u>
<u>Food and Spices</u>		
Cocnut	Coco	<u>Cocos nucifera</u>
Mango	Mango	<u>Mangifera indica</u>
Orange	Naranja	<u>Citrus</u> sp.
Grapefruit	Pomelo or Gre	<u>Citrus paradisi</u>
Lemon	Limon	<u>Citrus limon</u>
Sour Sop	Guanabana	<u>Annona muricata</u>
Banana	Guineo	<u>Musa</u> sp.
Plaintain	Platano	<u>Musa</u> sp.
Tangerine	Mandarina	<u>Citrus reticulata</u>
Avocado	Palta	<u>Persea americana</u>
Cashew	Merey	<u>Anacardium occidentale</u>
Breadfruit	Arbol de Pan	<u>Artocarpus incisus</u>
Breadnut	Pana de Pipitas	<u>Artocarpus</u> sp.
Guava	Guayaba	<u>Psidium guajava</u>
Sapodilla	Nispero	<u>Manikara zapota</u>
Sugar Apple	Rinon	<u>Annona squamosa</u>
Custard Apple	Mamey	<u>Annona reticulata</u>
Papaya	Papaya	<u>Carica papaya</u>
Nutmeg	Nuez Moscada	<u>Myristica fragrans</u>
Tea	Te	<u>Camellia thiefera</u>
Coffee	Cafe	<u>Coffea</u> sp.
Cinamon	Canela	<u>Cinnamomum zeilanicum</u>
Black Pepper	Pimienta Negra	<u>Piper nigrum</u>
Tamarind	Tamarindo	<u>Tamarindus indica</u>
Cacao	Cacao	<u>Theobroma cacao</u>
Annatto	Urucú	<u>Bixa orellana</u>
<u>Wood</u>		
Bamboo	Bambu	<u>Chusquea cuspidata</u>
Mahogany	Mara (Caoba)	<u>Swietenia macrophylla</u>
	Ocho-o	<u>Hura crepitans</u>
	Morado	<u>Peltogine</u> sp.
	Yesquero	<u>Cariniana estrellensis</u>
	Blanquillo	<u>Buchenavia exicarpa</u>
	Curupau	<u>Piptadenia grata</u>
	Kaqui	<u>Diospiros</u> sp.
	Mapajo	<u>Ceiba pentandra</u>
	Bibosi	<u>Ficus glabrata</u>
	Ajo-ajo	<u>Gallesia integrifolia</u>
	Pacay	<u>Inga edulis</u>
	Jichituriqui	<u>Aspidosperma</u> sp.
	Amarillo	<u>Aspidosperma</u> sp.
	Cuta	<u>Myrcine marginata</u>
	Cuqui	<u>Lonchocarpus</u> sp.

287

TABLE 4B (CONTINUED)

SCIENTIFIC NAMES OF TREES

<u>Local Species Name</u>	<u>Scientific Species Name</u>
Ajo-ajo	<u>Gallesia intergrifolia</u>
Algodonillo	<u>Cochlospermum hispiciodes</u>
Amaibo	<u>Cecropia leucocoma</u>
Amarillo	<u>Aspidosperma</u> sp.
Bamba	<u>Chusquea cuspidata</u>
Bi	<u>Genipa americana</u>
Bibosi	<u>Ficus glabrata</u>
Blanquillo	<u>Buchenavia exicarpa</u>
Coco	<u>Guazuma ulmifolia</u>
Coloradillo	<u>Physocalymna scabrimum</u>
Copaibo	<u>Copaifera paupera</u>
Cuqui	<u>Lonchocarpus</u> sp.
Curupau	<u>Piptadenia grata</u>
Cusi	<u>Orbygnia phalerata</u>
Cuta	<u>Myrcine marginata</u>
Gichiturique	<u>Aspidosperma</u> sp.
Guayabochi	<u>Calycophyllum spruceanum</u>
Jichituriqui	<u>Aspidosperma</u> sp.
Maní	<u>Caryocar glabrum</u>
Mapajo	<u>Ceiba pentandra</u>
Mara	<u>Swietenia macrophylla</u>
Momoqui	<u>Caesalpinia peltophoroides</u>
Morado	<u>Peltogyne catinae</u>
Motacu	<u>Scheelea princeps</u>
Ocho-o	<u>Hura crepitans</u>
Pacay	<u>Inga Edalis</u>
Pacobillo	<u>Caryocar</u> sp.
Palo Santo	<u>Triplaris caracasana</u>
Picana	<u>Cordia nodosa</u>
Sahuinto	<u>Aulomoyrcia leucadendron</u>
Sujo	<u>Sterculia striata</u>
Sumuqué	<u>Cocus botryophora</u>
Toboroche	<u>Chorisia ventricosa</u>
Yesquero	<u>Cariniana estrellensis</u>

Note: Scientific names were obtained from "Resultados de preservación en baño caliente-frío y a presión de 25 especies forestales" Dto. Investigaciones Forestales, Min, de AA.CC. y Agropecuarios y de Memoria explicativa del Mapa Ecológico de Bolivia por Orlando Unzueta Q.

SOURCE: Dr. Rex Lord, Pan-American Center for Human Ecology and Health, with the assistance of Sr. Ernesto Rodriguez, Nucleo 2, Proyecto San Julian.

TABLE 5

BIRD SPECIES SUITABLE FOR FOOD

<u>Group</u>	<u>Local Species Name</u>	<u>Scientific Species Name</u>
Tinamous	Perdiz	<u>Crypturellus</u> sp.
Guans	Pava de Monte	<u>Mitu tormentosa</u>
Guan	Pava campanilla	<u>Aburria aburri</u>
Guan	Huaracachi	<u>Ortalis ruficauda</u>
Ducks	Pato negro	<u>Cairina moschata</u>
Doves	Palomas	<u>Zenaida</u> sp. y <u>Columba</u> sp.
Parrotts	Loros	several species

TABLE 6

MAMMAL SPECIES SUITABLE FOR FOOD

<u>Group</u>	<u>Local Species Name</u>	<u>Scientific Species Name</u>
Collared Peccary	Taitetu	<u>T. Pecari</u>
Opossum	Carachupa	<u>Didelphis azarae</u> y <u>D. marsupialis</u>
Monkeys	Monos	several species
Anteaters	Oso melero	<u>Tamandua tetradactyla</u>
Sloths	Perico	<u>Bradypus</u> sp.
Armadillos	Tatu	<u>Dasyopus novemcinctus</u>
Tapirs	Anta	<u>Tapirus terrestris</u>
White-lipped Peccary	Puerco de monte	<u>Tayassu tajucu</u>
Deer	Urina, Guaso y Ciervo	<u>Pudu pudu</u> , <u>Mazama americana</u> y <u>Blastoceros</u>
Rabbits	Tapeti	<u>Sylvilagus brasiliensis</u>
Squirrels	Masi	<u>Sciurus</u> sp.
Porcupine	Puerco Espinoso	<u>Coendou prehensilis</u>
Capibara	Capiguara	<u>Hydrochoerus hydrochaeris</u>
Paca	Jochi pintado	<u>Cuniculus paca</u>
Agouti	Jochi colorado	<u>Dasyprocta punctata</u>
Coati	Tejon	<u>Nasua nasua</u>

SOURCE: Dr. Rex Lord, Pan-American Center for Human Ecology and Health

TABLE 7

MAMMALS AND BIRDS WHICH MIGHT CAUSE CROP AND FOOD LOSSES

Group	Local Species Name	Scientific Species Name	Damage
<u>Mammals</u>			
Opossum	Carachupa	<u>Didelphis azaroe</u>	vegetables, chickens & eggs
Monkeys	Monos	several species	all kinds of food
Foxes	Zorros	<u>Cerdocyon thous</u>	chickens & corn
Mapache	Osito lavador	<u>Procyon cancrivorous</u>	chickens & corn
Coati	Tejon	<u>Nasua nasua</u>	fruit & corn
Bats	Murcielagos	several species	fruit
Vampires	Vampiros	several species	blood of cattle & chickens
Otter	Londra (Nutria)	<u>Lutra sp.</u> & <u>Pteronura sp.</u>	fish & chickens
Weasel	Grison o Huron	<u>Grison cuja</u>	chickens
Eira	Tayra	<u>Tayra barbara</u>	chickens & ducks
Skunk	Zorrino	<u>Conepatus chinga</u>	corn & chickens & eggs
White-Lipped Peccary	Puerco de monte	<u>Layassu tajacu</u>	all kinds of food
Deer	Urina & Guaso	<u>Pudu & Mazama americana</u>	corn and vegetables
Rabbits	Tapeti	<u>Sylvilagus brasiliensis</u>	vegetables
Squirrels	Masi	<u>Sciurus sp.</u>	corn & vegetables
rats	Ratas	several species	stored food & grain crops
Mice	Ratones	several species	stored food & grain crops
Porcupines	Puerco Espinoso	<u>Coendou prehensilis</u>	corn
Tuco-tuco	Topo	<u>Ctenomys sp.</u>	roots of crops
Agouti	Jochi colorado	<u>Dasyprocta punctata</u>	all crops
Paca	Jochi pintado	<u>Cuniculus paca</u>	all crops
Jaguar	Tigre	<u>Felis sp.</u>	chickens, humans (rare occasions)
Collared Peccary	Taitetu	<u>T. Pecari</u>	all kinds of food
<u>Birds</u>			
Hawks	Halcon, Chubi	several species	chickens
Guans	Pava de monte	several species	grain crops
Owls	Buho	several species	chickens
Tinamou	Perdiz	several species	grain crops
Ducks	Patos	several species	grain crops
Parrotts	Loros	several species	corn
Doves	Palomas	several species	grain crops
Tanagers	Azulejos	several species	fruit
Blackbirds	Tordos	<u>Molothrus bonariensis</u> & <u>Leistes millitaris</u>	grain crops
Ches	Monterita	<u>Sporophila sp.</u>	small grains

SOURCE: Dr. Rex Lord, Pan-American Center for Human Ecology and Health.

TABLE 8

ORDER AND YEAR OF SETTLEMENT AND ORIENTATION PROGRAMS
FOR SAN JULIAN PROJECT - 1972-1978

1972	First OP-Nucleos 1 and 2
1973	Second OP-Nucleos 1 and 2; OP-Nucleo 8
1974	OP-Nucleo 7; Spontaneous-Nucleo 3
1975	OP-Nucleo 6; Partial Aid-Nucleo 4
1976	OP-Nucleos 5, 11, 14 Second OP-Nucleo 6
1977	OP-Nucleos 9, 10, 12, 13, 14, 15, 16, 17, 18, 20, 21
1978	OP-Nucleos 19, 22, 23, 24, 26, 27, 29, 30, 32, 33

TABLE 9

DEPARTMENTS OF ORIGIN OF SAN JULIAN SETTLERS

Nucleo	Vacancies	La Paz	Oruro	Potosi	Cocha- bamba	Chuqui- saca	Tarija	Santa Cruz	Beni	Total
1	0	1	3	8	10	18	0	0	0	40
2	0	0	2	0	1	1	0	36	0	40
4	0	0	1	11	0	6	0	0	0	18
5	0	0	1	31	3	3	0	2	0	40
6	1	37	2	0	0	0	0	0	0	39
7	0	0	4	19	3	14	0	0	0	40
8	0	0	29	9	0	2	0	0	0	40
9	1	39	0	0	0	0	0	0	0	39
10	0	2	7	14	11	5	0	1	0	40
12	0	0	0	9	15	6	0	0	0	30
13	0	0	0	39	0	1	0	0	0	40
14	0	1	4	10	14	10	1	0	0	40
15	0	0	1	39	0	0	0	0	0	40
16	1	1	3	13	11	2	0	1	0	32
17	0	2	2	9	12	12	0	0	0	37
18	0	0	2	19	14	2	3	0	0	40
19	0	2	17	5	18	8	0	0	0	40
20	0	0	0	29	2	9	0	0	0	40
21	0	0	0	29	2	9	0	0	0	40
22	0	0	2	9	3	20	6	0	0	40
23	0	2	4	25	1	7	0	1	0	40
24	5	0	0	27	4	4	0	0	0	35
26	1	0	1	31	0	4	1	1	1	39
27	3	0	0	37	0	0	0	0	0	37
29	4	21	15	0	0	0	0	0	0	36
30	4	4	0	8	19	2	1	2	0	36
32	0	0	0	40	0	0	0	0	0	40
33	1	1	17	10	1	6	4	0	0	39
TOTALS	21/ 2%	113/ 10.3%	117/ 10.6%	519/ 47.3%	144/ 13.1%	152/ 13.85%	16/ 1.45%	44/ 4%	1/ .01%	1097/ 100%

SOURCE: INC, Department of Social Promotion, San Julian

292

TABLE 10

DEPARTMENT OF ORIGIN BY NUCLEO
Cocha- Chuqui-

Nucleo	La Paz	Potosi	bamba	Oruro	saca	Santa Cruz	Tarija	Total
9	40 100%							40 100%
12		6 22.2%	16 59%		5 18.5%			27 100%
13		40 100%						40 100%
14		10 33.3%	11 36.6%	1 3.3%	6 20%		1 3.3%	30 100%
15		40 100%						40 100%
16	5 15.6%	7 21.8%	12 37.5%	1 3.1%	4 12.5%	1 3.1%	2 6.2%	32 100%
17	2 5%	16 40%	12 37.5%	2 5%	7 21.8%	1 2.5%		40 100%
18		17 42.5%	14 35%	2 5%	4 10%		3 7.5%	40 100%
20	1 2.5%	6 15%	11 27.5%	5 12.5%	15 37.5%	2 5%		40 100%
21	1 3%	22 66.6%	2 6%		8 24%			33 100%
TOTAL	49 13.5%	163 45.1%	78 21.6%	11 3%	49 13.5%	4 1%	7 1.9%	361 100%

SOURCE: First Survey

TABLE 11

DEPARTMENT OF ORIGIN

- A) MALE HOUSEHOLD HEADS
B) SPOUSES

A) Male Household Heads

<u>Department</u>	<u># of Cases</u>	<u>Relative Frequency %</u>
Potosi	41	41.0
Cochabamba	28	28.0
Chaquisaca	15	15.0
Tarija	2	2.0
La Paz	3	3.0
Oruro	10	10.0
Santa Cruz	<u>1</u>	<u>1.0</u>
TOTAL:	100	100.0

B) Spouses

<u>Department</u>	<u># of Cases</u>	<u>Adjusted Frequency %</u>
Potosi	30	44.1
Cochabamba	21	30.9
Chaquisaca	15	22.1
Tarija	1	1.5
Oruro	1	1.5
No Spouses Present	<u>32</u>	<u>0</u>
TOTAL:	100	100.0

SOURCE: Second Survey

294

TABLE 12

FAMILY COMPOSITION BY NUCLEO

<u>NUCLEOS</u>	<u>NUMBER OF HOUSEHOLD HEADS</u>	<u>NUMBER OF SPOUSES PRESENT</u>	<u>NUMBER OF CHILDREN PRESENT</u>	<u>TOTAL PRESENT</u>	<u>YEAR OF SETTLEMENT</u>
Nucleo 1	40	32	86	158	1.972
Nucleo 2	40	30	83	153	1.972
Nucleo 4	18	12	24	54	1.975
Nucleo 5	40	32	72	144	1.976
Nucleo 6	39	28	53	120	1.975
Nucleo 7	40	24	81	145	1.974
Nucleo 8	40	25	76	141	1.973
Nucleo 9	39	30	104	173	1.977
Nucleo 10	40	19	26	85	1.977
Nucleo 11	40	26	57	123	1.976
Nucleo 12	30	23	51	104	1.977
Nucleo 13	39	32	87	158	1.977
Nucleo 14	40	27	59	126	1.977
Nucleo 15	40	26	67	133	1.977
Nucleo 16	32	20	48	100	1.977
Nucleo 17	37	15	21	73	1.977
Nucleo 18	40	24	34	98	1.977
Nucleo 19	40	17	34	91	1.978
Nucleo 20	40	23	54	117	1.977
Nucleo 21	40	27	50	117	1.977
Nucleo 22	40	13	21	74	1.978
Nucleo 23	40	7	14	61	1.978
Nucleo 24	35	3	3	41	1.978
Nucleo 26	40	9	24	73	1.978
Nucleo 27	37	6	3	46	1.978
Nucleo 29	36	15	49	100	1.978
Nucleo 30	36	15	18	69	1.978
Nucleo 32	40	16	45	101	1.978
Nucleo 33	39	8	14	61	1.978
TOTAL:	1.097	584	1.358	3.039	

Mean Family Size = 2.77

SOURCE: INC Department of Social Promotion, San Julian

295

1971

TABLE 13

ANNUAL AGRICULTURAL CYCLE

	June	July	August	September	October	November	December	January	February	March	April	May
General Activities	Rozar-Tumbar-Chafrear-Quemar (Clear-Cut-Pile-Burn)				Sembrar (Plant)		Carpir (Weed)		Cosechar (Harvest)			
Rice					Plant		Weed		Harvest			
Corn					Plant		Weed		Early-Small Harvest Quantity		Main Harvest	
Banana Trees					Fruit Yield (after 10-11 months)		Plant					
Citrus, Papaya Chitimoya Trees					Papaya Yield (After 9-10 months)		Plant					
Tubers-Yuca, Camote, Walusa							1st Planting 2nd Harvest		1st Harvest 2nd Planting			
Peanuts					Plant		Harvest					
Frejol	Harvest										Plant	
Vegetables	Harvest Tomato						Plant Squash		Plant Tomato Harvest Squash			

TABLE 14

DOMESTIC ANIMAL USE

Kind of Animal	Use
Poultry-Chicken, Ducks	Eggs, Meat
Pigs	Meat
Sheep	Milk, Wool Meat
Cattle	Milk, Meat
Horse, Mule, Donkey	Transport of Persons and Cargo

TABLE 15

PRODUCTIVE ACTIVITIES DIFFICULT FOR HIGHLAND AND VALLEY
PEASANT MIGRANTS

Tree Cutting
Control of Fire
Timing of Seeding
Frequent and Thorough Weeding
Harvesting Techniques

TABLE 16

PERCENTAGE OF COLONISTS WITH FATHERS WHO WERE FARMERS

	<u>Number of Cases</u>	<u>Relative Frequency %</u>
Farmers	93	93.0
Non-Farmers	6	6.0
No Father	1	1.0
TOTAL:	100	100.0

TABLE 17

PERCENTAGE OF ALTITUDINAL-CROP TYPES-PARENTAL GENERATION

<u>CROP TYPES</u>	<u>NUMBER OF CASES</u>	<u>ADJUSTED FREQUENCY %</u>
Highland Crops	42	42.0
Highland and Valley Crops	35	35.0
Valley Crops	5	5.0
Lowland and Valley Crops	9	9.0
Lowland Crops	3	3.0
Non-Farm Father	6	6.0
TOTAL:	100	100.0

SOURCE: Second Survey

TABLE 18

OFF-FARM EMPLOYMENT - 1977-1978

<u>TYPE OF EMPLOYMENT</u>	<u>NUMBER OF CASES</u>	<u>RELATIVE FREQUENCY %</u>	<u>ADJUSTED FREQUENCY %</u>
Agro-Industry and Small Farmer	1	1.0	1.6
Small Farm Peon-Only	27	27.0	44.3
Agro-Industry-Only	15	15.0	24.6
Urban Construction, Service, Marketing	18	18.0	29.5
No Wage Labor - 1977-78	39	39.0	
TOTAL:	100	100.0	100.0

SOURCE: Second Survey

299

TABLE 19

OFF-FARM EMPLOYMENT
DAILY WAGE

<u>Pesos per Day</u>	<u>Number of Cases</u>	<u>Relative Frequency %</u>	<u>Adjusted Frequency %</u>
30	8	8.0	16.3
35	6	6.0	12.2
40	12	12.0	24.5
45	2	2.0	4.1
50	16	16.0	32.7
60	2	2.0	4.1
65	1	1.0	2.0
80	2	2.0	4.1
Missing Cases	13	13.0	
No Wage Labor	38	38.0	
TOTAL:	100	100.0	100.0

20 Pesos = U.S. \$1.00
Mean = 44.184
Mode = 50.000

300

TABLE 20

NUMBER OF DAYS OF WAGE LABOR - 1977-78

<u>NUMBER OF DAYS</u>	<u>NUMBER OF CASES</u>	<u>RELATIVE FREQUENCY %</u>	<u>ADJUSTED FREQUENCY %</u>
1.	1	1.0	1.8
3.	1	1.0	1.8
4.	1	1.0	1.8
5	1	1.0	1.8
7	8	8.0	14.3
10	4	4.0	7.1
14	4	8.0	14.3
15	4	4.0	7.1
20	1	1.0	1.8
21	3	3.0	5.4
30	12	12.0	21.4
42	1	1.0	1.8
45	2	2.0	3.6
60	6	6.0	10.7
90	1	1.0	1.8
120	2	2.0	3.6
Missing Cases	44	44.0	
TOTAL:	100	100.0	100.0

Mean = 26.821

Mode = 30.000

SOURCE: Second Survey

301

TABLE 21

WOMEN'S LABOR CONTRIBUTION - SAN JULIAN

<u>TYPE OF LABOR</u>	<u># OF CASES</u>	<u>ADJUSTED FREQUENCY %</u>	<u>CUM FREQUENCY %</u>
Housework, child raising, cooking, cleaning only	3	4.8	4.8
All above plus raising animals	12	19.4	24.2
All above plus tending a vegetable garden	19	30.6	54.8
All above plus working in most major tasks in the chaco	28	45.2	100.0
Missing Cases	6	-	-
No Spouse Present	32	-	-
TOTAL:	100	100.0	100.0

SOURCE: Second Survey

302

TABLE 22

AYNI EXCHANGE LABOR - PLANTING RICE AND CORN

# OF DAYS OF AYNI	# OF CASES	RELATIVE FREQUENCY %	ADJUSTED FREQUENCY %
1	2	2.0	20.0
2	2	2.0	20.0
3	4	4.0	40.0
4	1	1.0	10.0
6	1	1.0	10.0
0	80	80.0	-
New Colonist*	10	10.0	-
TOTAL	100	100.0	100.0

* Colonists were interviewed who had not yet been in San Julian for an agricultural cycle - they will be designated new colonists.

Mean = 2.800
Mode = 3.000

SOURCE: Second Survey

503

TABLE 24

AYNI EXCHANGE LABOR - RICE AND CORN HARVEST

# OF DAYS OF AYNÍ	# OF CASES	RELATIVE FREQUENCY %	ADJUSTED FREQUENCY %
2	8	8.0	16.7
3	2	2.0	4.2
4	2	2.0	4.2
5	1	1.0	2.1
6	4	4.0	8.3
7	8	8.0	16.7
8	1	1.0	2.1
10	1	1.0	2.1
12	4	4.0	8.3
14	8	8.0	16.7
18	2	2.0	4.2
20	1	1.0	2.1
21	3	3.0	6.3
24	1	1.0	2.1
28	1	1.0	2.1
56	1	1.0	2.1
0	42	42.0	-
New Colonist	10	10.0	-
TOTAL:	100	100.0	100.0

Mean = 10.833

Mode = 2.000

SOURCE: Second Survey

304

TABLE 25

LOCATION OF AYNI PARTNERS AND KIND OF RELATION

<u>TYPE OF AYNI</u>	<u>TOTAL DAYS 1977-78</u>
Ayni from kin in same nucleo	329
Ayni from non- kin in same nucleo	345
Ayni from kin from other nucleo	14
Ayni from non- kin from other nucleo	0

SOURCE: Second Survey

TABLE 26

DAYS OF WAGE LABOR, PAID FOR BY COLONISTS,
1977-78

<u>Period of Activities</u>	<u>Number of Days</u>
Wage in Planting Activities	0
Wage in Weeding Activities	5
Wage in Harvest Activities	216

SOURCE: Second Survey

305

TABLE 27

AREA OF ORIGIN LABOR ORGANIZATION

KIND OF LABOR	PERCENTAGE OF CASES
Nuclear Family	50.5%
Ayni Exchange	42.0%
Wage Labor	7.5%
TOTAL:	100.0%

SOURCE: Second Survey

TABLE 28

PARTICIPATION OF COLONIST IN LABOR-AREA OF ORIGIN
1977-78

TASK	# OF CASES	RELATIVE FREQUENCY %	ADJUSTED FREQUENCY %
Seeding	4	4.0	4.3
Weeding	2	2.0	2.1
Harvesting	23	23.0	24.5
Seeding and Harvesting	2	2.0	2.1
Weeding and Harvesting	1	1.0	1.1
Seeding, Weeding and Harvesting	4	4.0	4.3
No Participation	58	58.0	61.7
Non-Farm Occupation of Origin Family	6	6.0	-
TOTAL:	100	100.0	100.0

SOURCE: Second Survey

306

TABLE 29

RELATIVES' VISITS TO SAN JULIAN

REASONS FOR COMING TO SAN JULIAN "visit"	# OF CASES	RELATIVE FREQUENCY %	ADJUSTED FREQUENCY %
"visit"	37	37.0	39.8
Colonize in same Nucleo	5	5.0	5.4
Colonize in other Nucleo	11	11.0	11.8
Co-reside with Colonist	4	4.0	4.3
Wife for Visit	1	1.0	1.1
No Visitors	24	24.0	25.8
Work	11	11.0	11.8
Missing Data	7	7.0	-
TOTAL:	100	100.0	100.0

TABLE 30

ACTIVITIES WITH COMPADRE

ACTIVITY	# OF CASES	RELATIVE FREQUENCY %	ADJUSTED FREQUENCY %
Work	4	4.0	22.2
Hunt	1	1.0	5.6
Travel	1	1.0	5.6
Work, Hunt	1	1.0	5.6
Work, Travel, Hunt	9	9.0	50.0
Work, Travel	1	1.0	5.6
All Above	1	1.0	5.6
No Compadre	82	82.0	-
TOTAL:	100	100.0	100.0

SOURCE: Second Survey

207

TABLE 31

REASONS FOR MIGRATION OF FATHER

REASONS FOR MIGRATION OF FATHER	# OF CASES	RELATIVE FREQUENCY %	ADJUSTED FREQUENCY %
Selling	25	25.0	43.1
Work	26	26.0	44.8
Llamero	2	2.0	3.4
Sell and Work	1	1.0	1.7
Oriente Work	2	2.0	3.4
No Father	2	2.0	3.4
Father did not Migrate	42	42.0	-
TOTAL	100	100.0	100.0

SOURCE: Second Survey

TABLE 32

KIND OF WORK IN ORIENTE PRIOR TO SETTLEMENT IN SAN JULIAN

CATEGORY LABEL	# OF CASES	RELATIVE FREQUENCY %	ADJUSTED FREQUENCY %
Cotton Agro-Industry Seasonal	6	6.0	7.7
Sugar Agro-Industry Seasonal	4	4.0	5.1
Small Farm Peon	20	20.0	25.6
Cotton and Sugar	2	2.0	2.6
Sugar and Small Farm Peon	3	3.0	3.8
Rented Land	30	30.0	38.5
Urban Service, Construction, Marketing	8	8.0	10.3
Farmed Land Granted in Santa Cruz Colonization Zone	5	5.0	6.4
No Experience in Oriente	22	22.0	-
TOTAL:	100	100.0	100.0

SOURCE: Second Survey

208

TABLE 33

ACTUAL VS. VALUE ON MAINTAINING CONTACT WITH
AREA OF ORIGIN

	ATTENDED ORIGIN RELIGIOUS CELEBRA- TION - 1977-78 (%)	PLACED VALUE ON ATTENDING ORIGIN RELIGIOUS CELEBRATION (%)	ATTENDED ORIGIN CIVIC FIESTA - 1977-78 (%)	PLACED VALUE ON ATTENDING ORIGIN CIVIC FIESTA (%)
YES	24	38	7	41
NO	75	62	92	55
MISSING	1	0	1	4

SOURCE: Second Survey

100

TABLE 34

CATHOLIC AND PROTESTANT AFFILIATION OF
COLONISTS IN SAN JULIAN

NUCLEO NUMBER	VACANCIES	CATHOLICS	PROTESTANTS	TOTAL
Nucleo 1	0	30/75%	10/25%	40
Nucleo 2	0	34/85%	6/15%	40
Nucleo 4	0	11/61%	7/39%	18
Nucleo 5	0	25/62.5%	15/37.5%	40
Nucleo 6	1	30/76%	9/23%	39
Nucleo 7	0	28/70%	12/30%	40
Nucleo 8	0	34/85%	6/15%	40
Nucleo 9	1	29/74.3%	10/25%	39
Nucleo 10	0	37/92.5%	3/7.5%	40
Nucleo 11	0	33/82.5%	7/17.5%	40
Nucleo 12	0	27/90%	3/10%	30
Nucleo 13	1	5/12.8%	34/87%	39
Nucleo 14	0	32/80%	8/20%	40
Nucleo 15	0	20/50%	20/50%	40
Nucleo 16	0	28/87.5%	4/12.5%	32
Nucleo 17	0	28/75.6%	9/24.4%	37
Nucleo 18	0	21/52.5%	19/47.5%	40
Nucleo 19	0	35/87.5%	5/12.5%	40
Nucleo 20	0	36/90%	4/10%	40
Nucleo 21	0	37/92.5%	3/7.5%	40
Nucleo 22	0	38/95%	2/5%	40
Nucleo 23	0	32/80%	8/20%	40
Nucleo 24	5	27/77.1%	8/22.9%	35
Nucleo 26	0	33/82.5%	7/17.5%	40
Nucleo 27	3	7/12.9%	30/81.1%	37
Nucleo 29	4	30/83.3%	6/16.7%	36
Nucleo 30	4	29/80.5%	7/19.5%	36
Nucleo 32	0	35/87.5%	5/12.5%	40
Nucleo 33	1	32/82%	7/18%	39
TOTAL:	20	820/74.7%	277/25.2%	1097/100%

SOURCE: INC, Department of Social Promotion, San Julian

TABLE 35

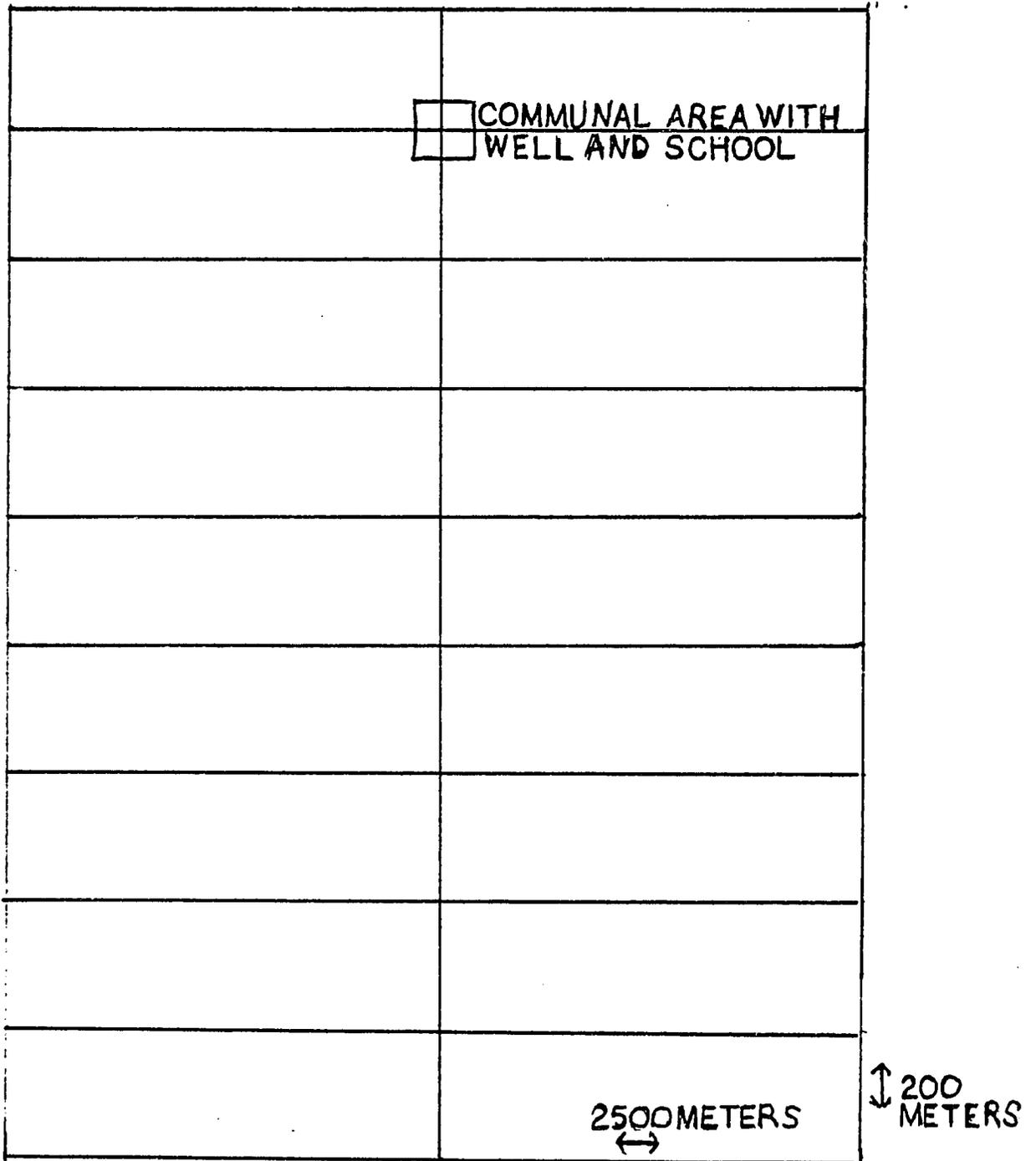
REASONS FOR CONVERTING TO EVANGELICAL
PROTESTANT RELIGION

REASON (S)	ABSOLUTE FREQUENCY %	RELATIVE FREQUENCY %	ADJUSTED FREQUENCY %
Dislike for Catholic life and consulted Bible	4	4.0	13.3
Dislike for Catholic life only	10	10.0	33.3
Consulted Bible	7	7.0	23.3
Social Pressure	6	6.0	20.0
Miracle Cure	1	1.0	3.3
Liked Protestant Religion	2	2.0	6.7
Catholic-No Convert	70	70.0	-
TOTAL:	100	100.0	100.0

APPENDIX FOUR

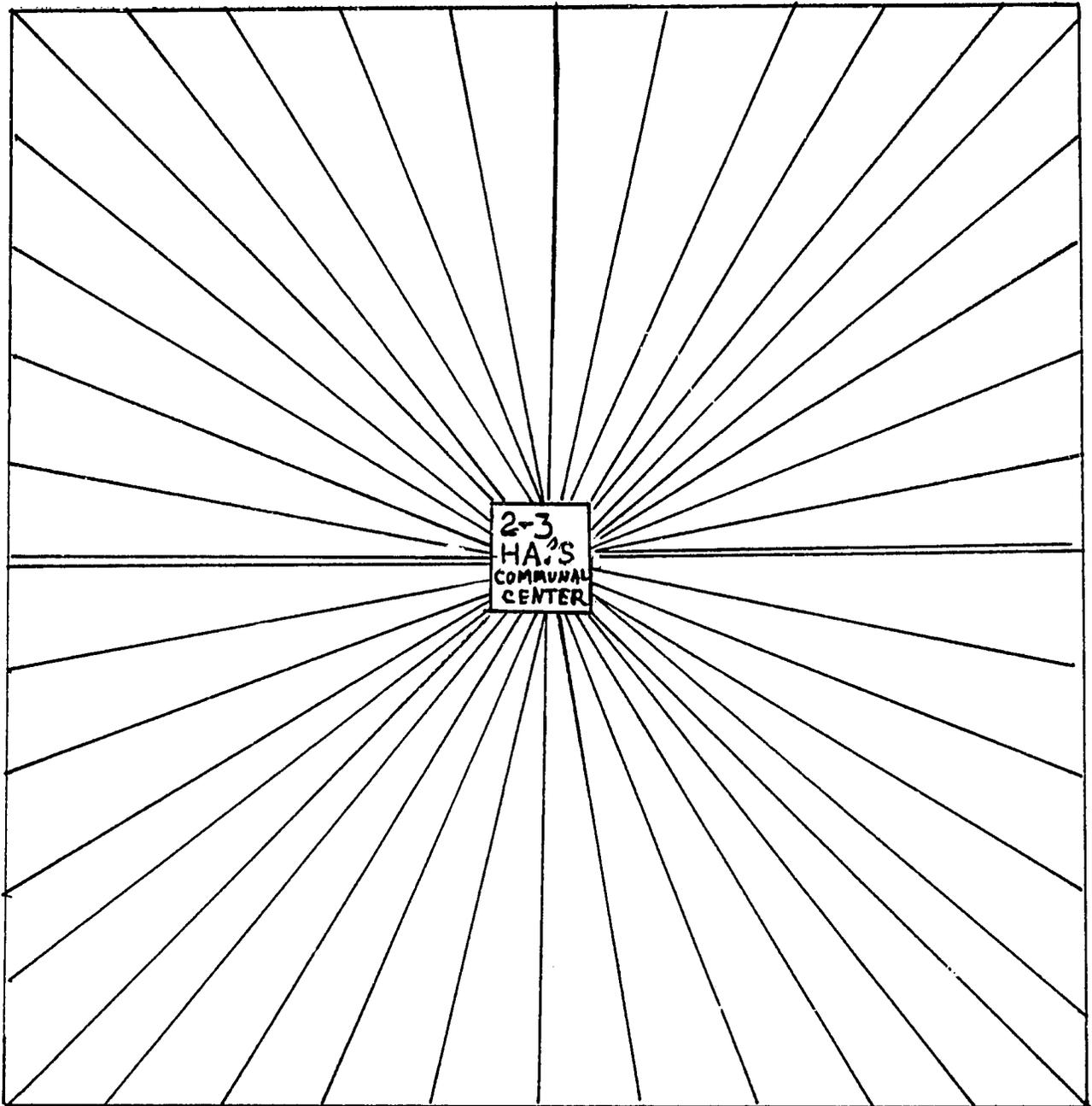
Figures

FIGURE ONE



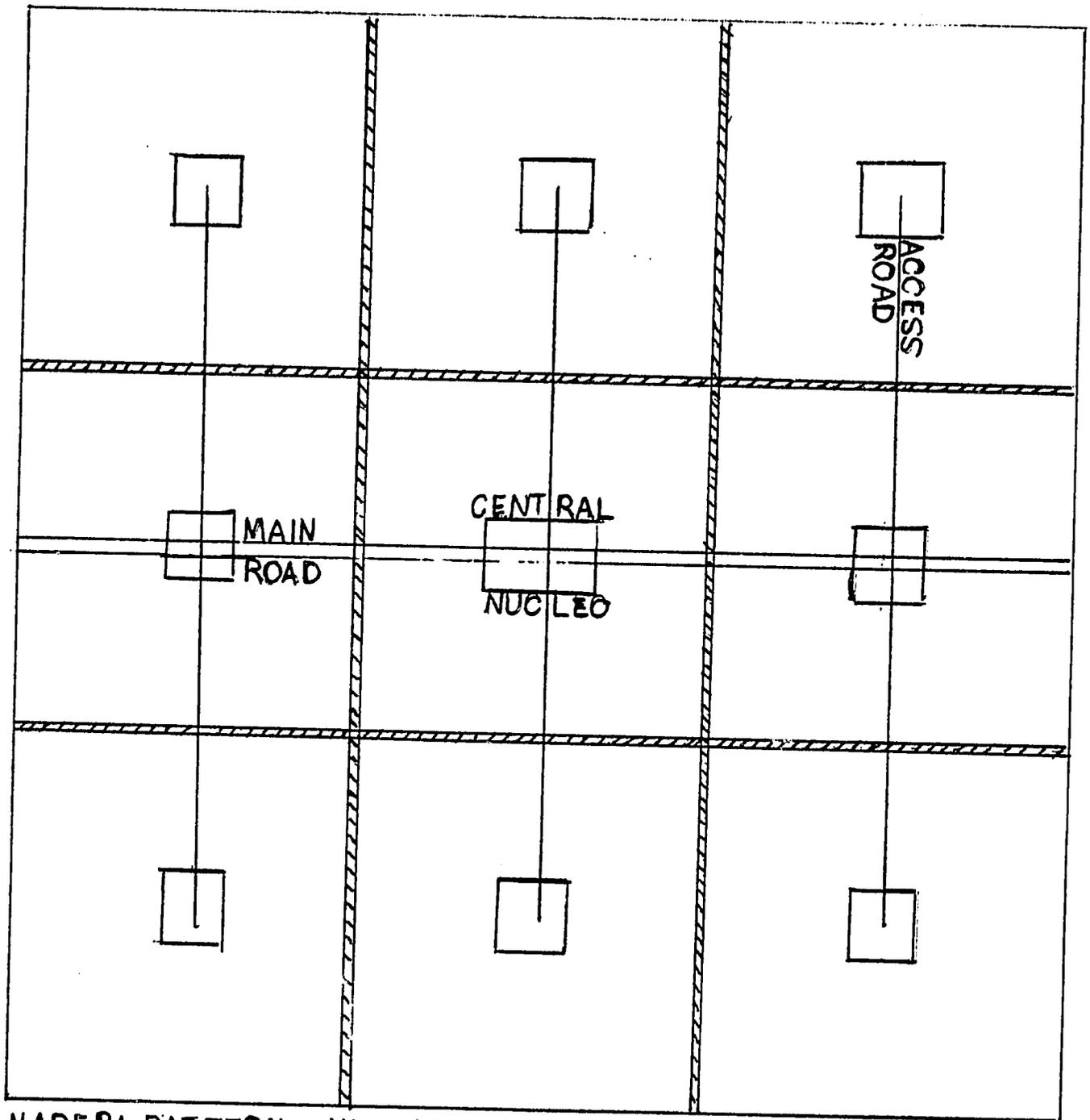
TYPICAL PIANO KEY SETTLEMENT PATTERN

FIGURE TWO



NUCLEO SETTLEMENT PATTERN TOTAL AREA=2,000 HA'S
EACH PARCELA=APPROXIMATELY 50 HA'S

FIGURE THREE

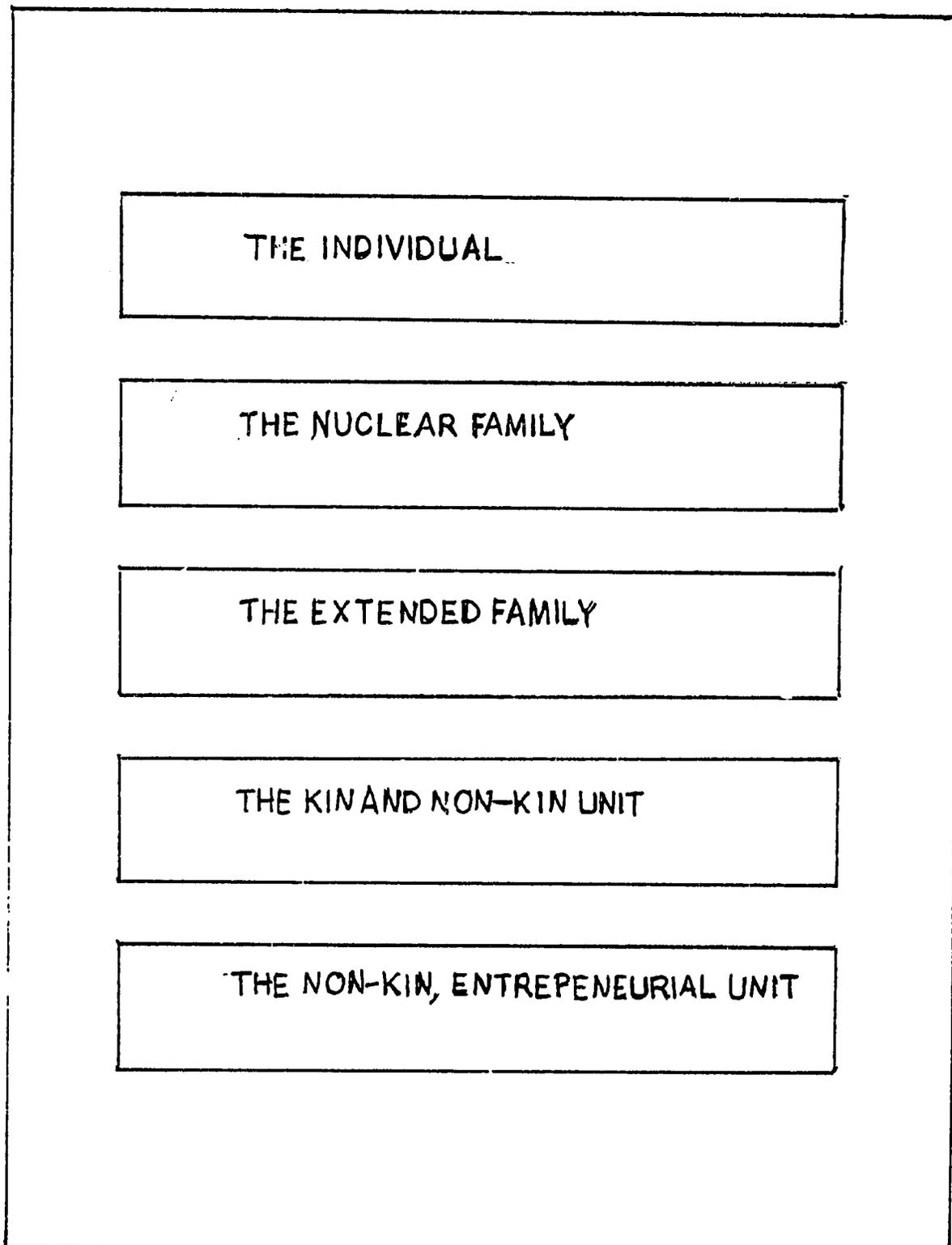


NADEPA PATTERN - NINE NUCLEOS WITH CENTRAL NUCLEO

 - GREEN AREAS

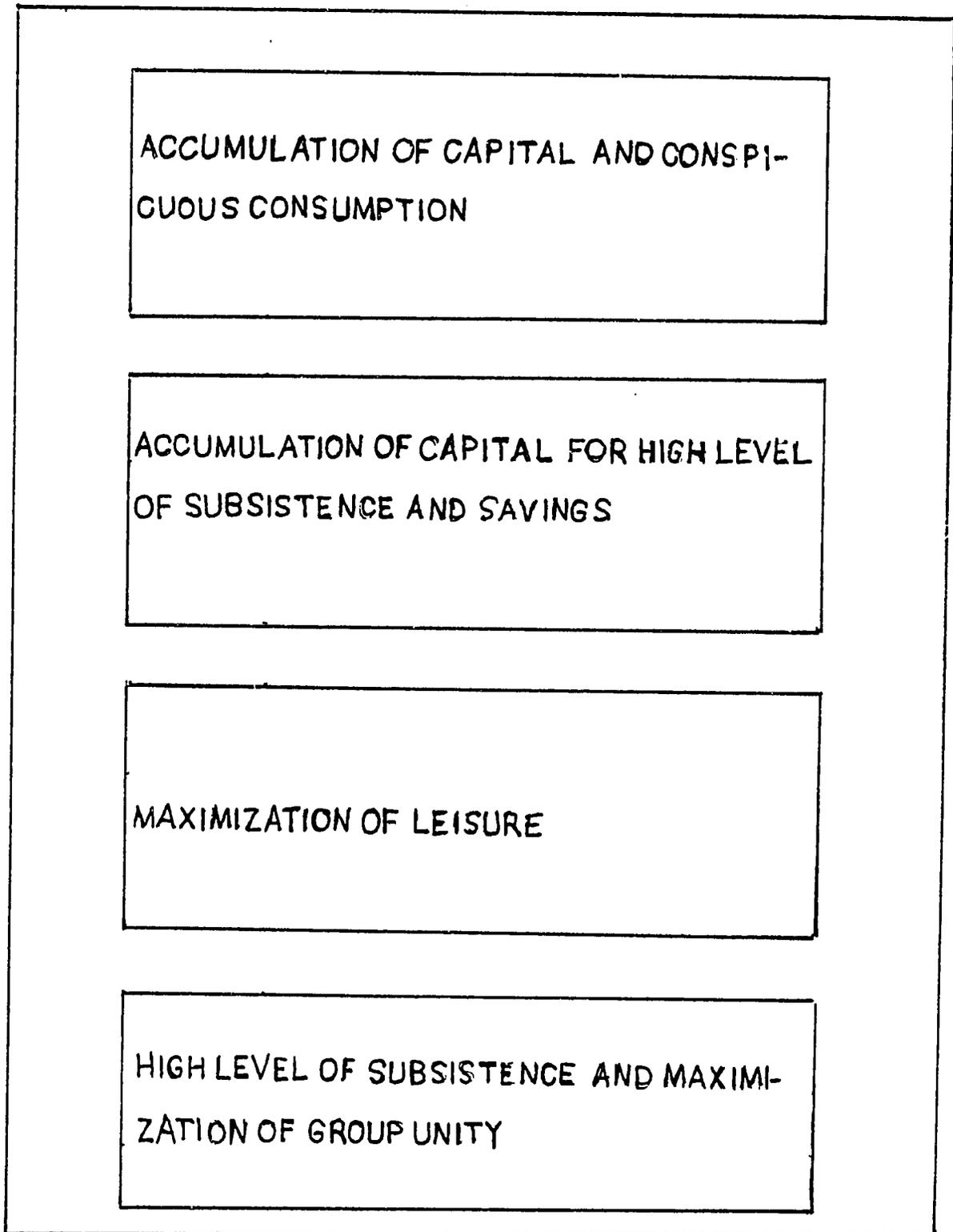
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FIGURE FOUR



ADAPTIVE UNIT TYPOLOGY

FIGURE FIVE



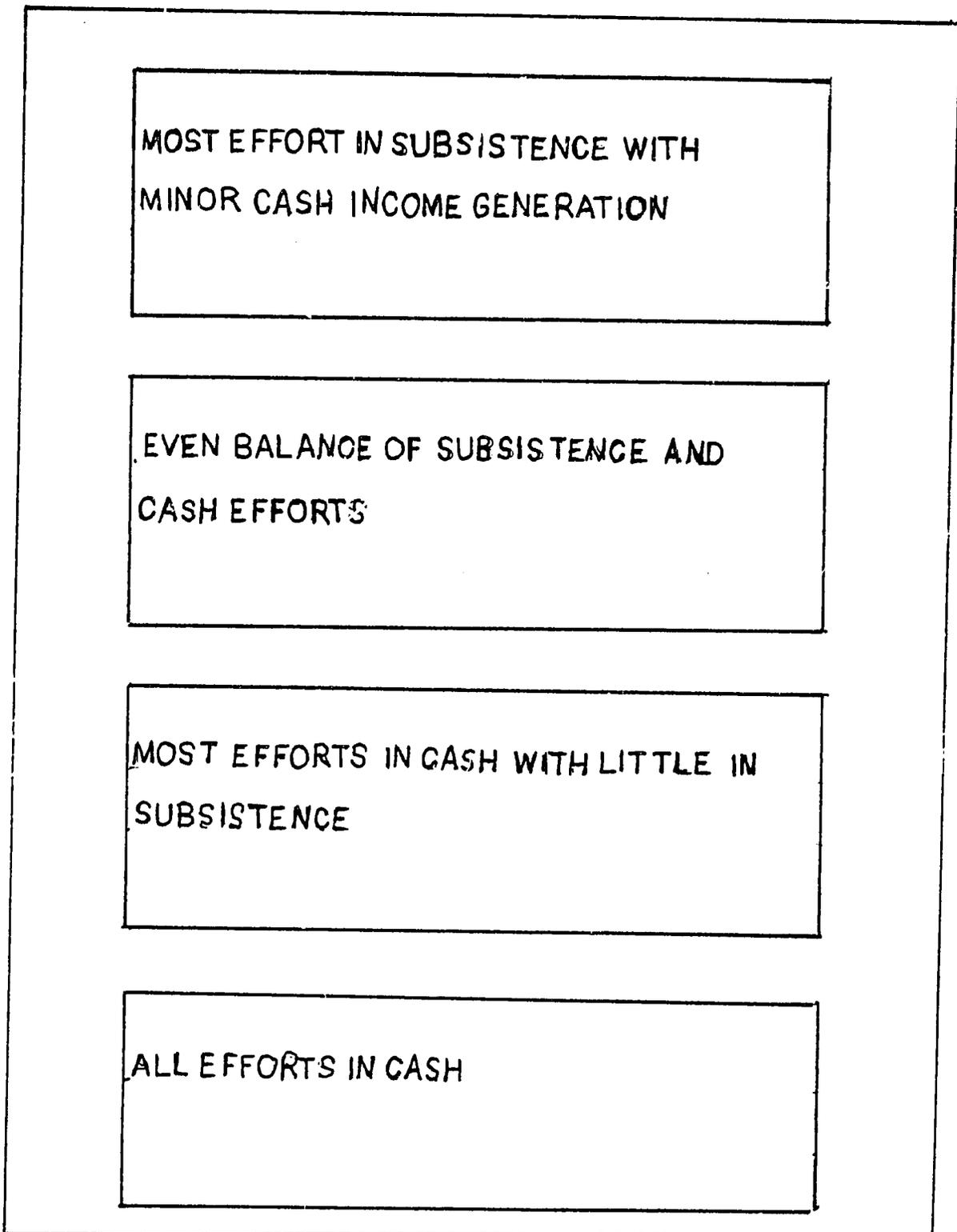
VALUES AND GOALS TYPOLOGY

FIGURE SIX

PREVIOUS KNOWLEDGE AND EXPERIENCE
GEO-PHYSICAL
BIOTIC
TECHNOLOGY
INFRASTRUCTURE
REGIONAL ECONOMIC STRUCTURES
REGIONAL AND NATIONAL POLITICAL STRUCTURE
IDEOLOGICAL STRUCTURE
INTERNATIONAL DEPENDENCE

ENVIRONMENTAL RESTRAINTS

FIGURE SEVEN



TYPOLGY OF MARKET VS. SUBSISTENCE ORIENTATION

FIGURE EIGHT

USE OF LABOR ONLY WITHIN UNIT
USE OF LABOR EXCHANGE INSTITUTIONS
USE OF WAGE LABOR AND OTHER ARRANGEMENTS SUCH AS SHARECROPPING

LABOR ORGANIZATION TYPOLOGY

FIGURE NINE

SAN JULIAN ONLY
SAN JULIAN AND RURAL LOWLAND
SAN JULIAN AND URBAN LOWLAND
SAN JULIAN AND RURAL HIGHLAND
SAN JULIAN AND URBAN HIGHLAND
MULTIPLE - SAN JULIAN AND RURAL LOWLAND
MULTIPLE - SAN JULIAN AND RURAL AND URBAN

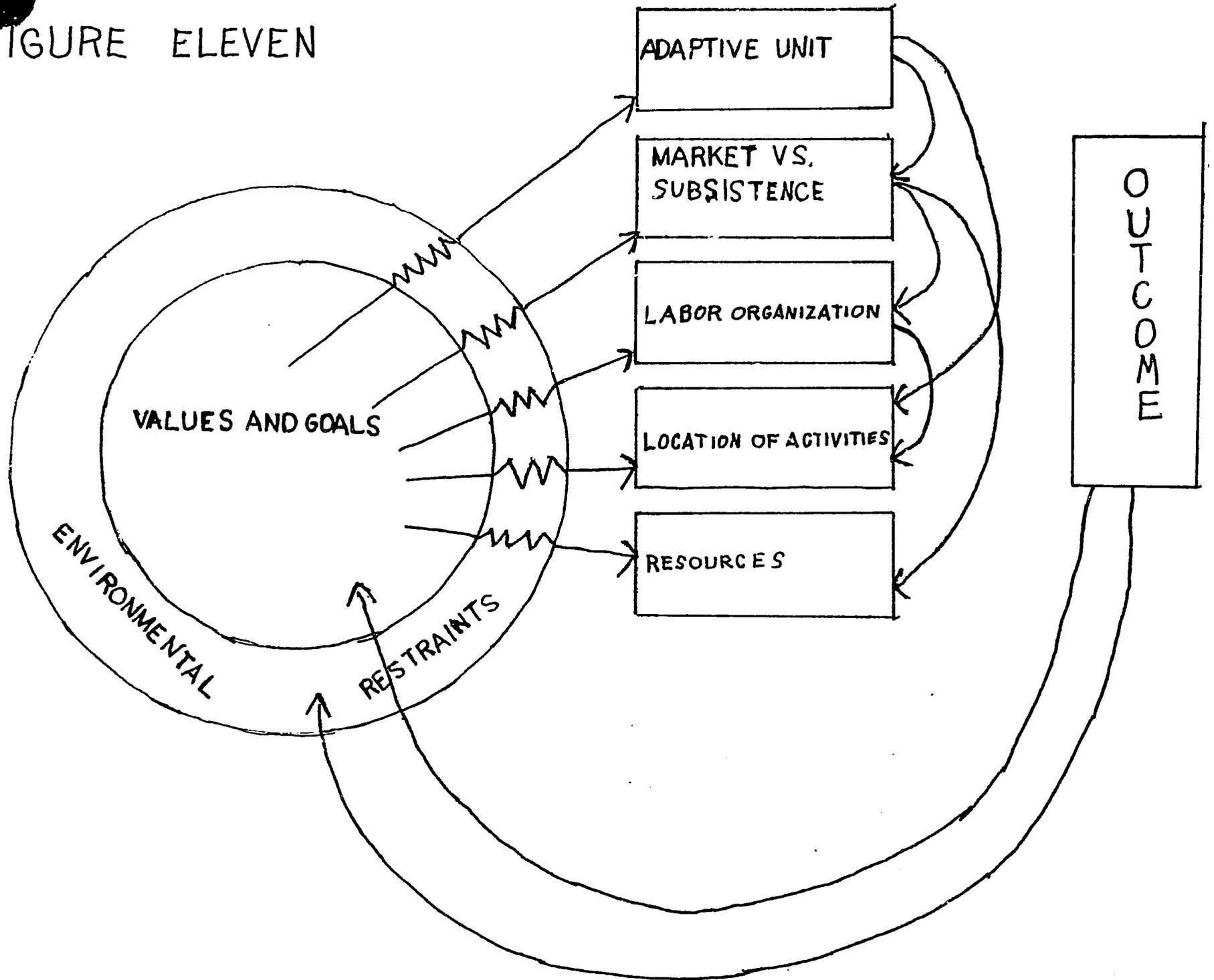
LOCATION OF UNIT ACTIVITIES

FIGURE TEN

ANNUAL CROPS
PERENNIAL CROPS
TREE CROPS
DOMESTICATED ANIMALS
COLLECTED NATURAL PRODUCTS
PROCESSED NATURAL PRODUCTS
SERVICES
SALE OF CONSUMER ITEMS

TYPOLGY OF RESOURCES

FIGURE ELEVEN

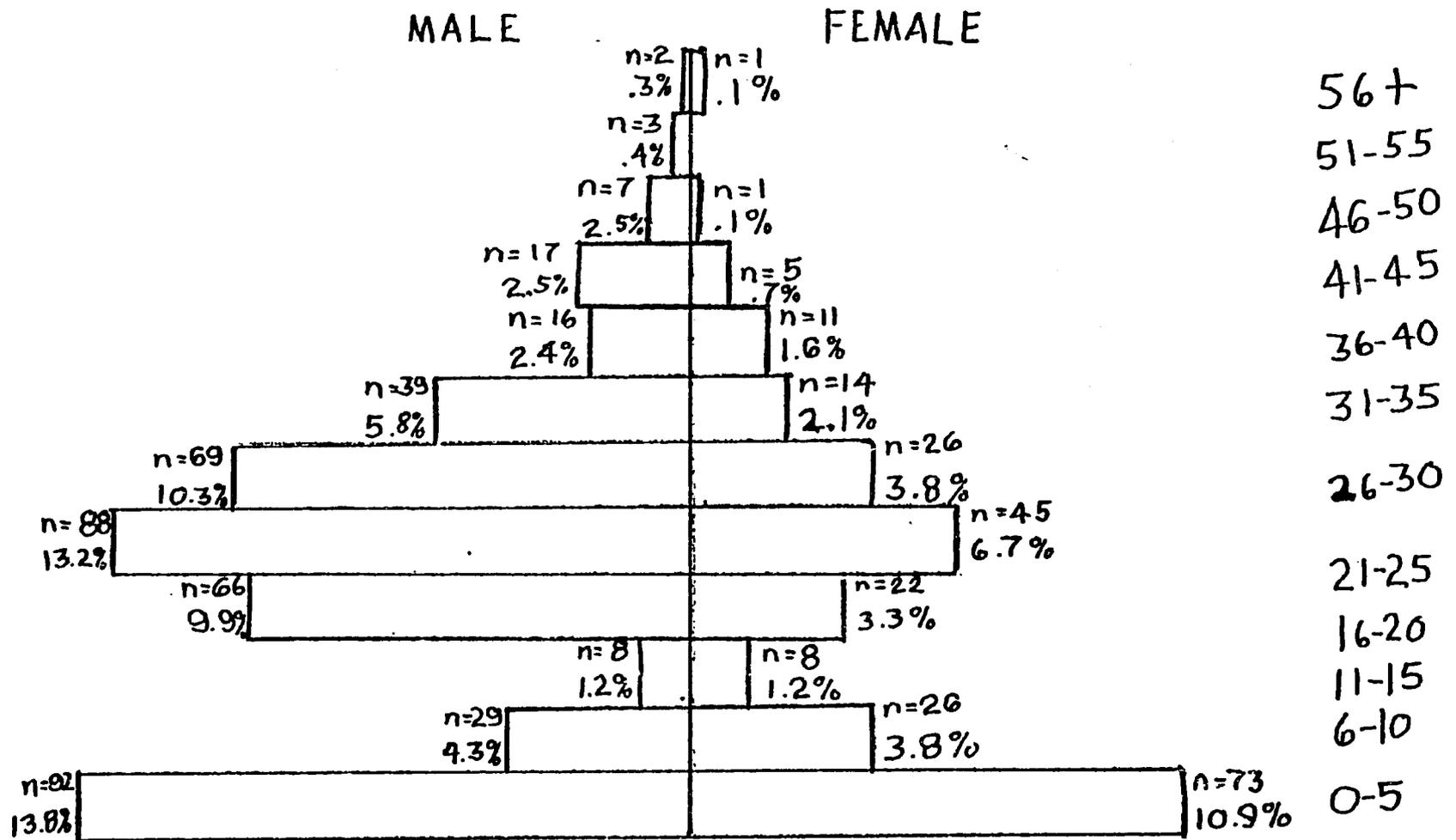


3/23

APPENDIX FIVE

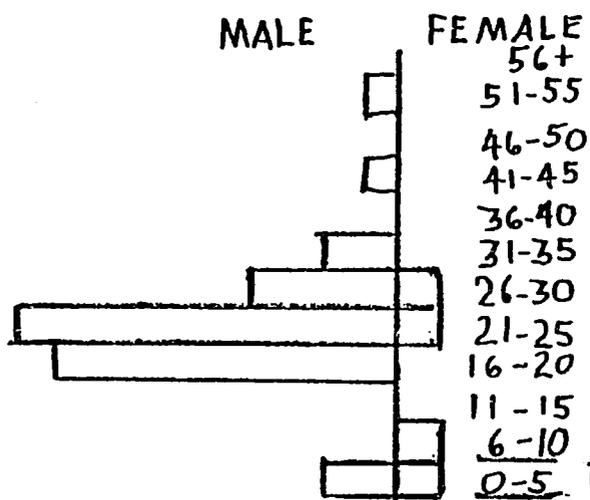
Graphs

GRAPHONE

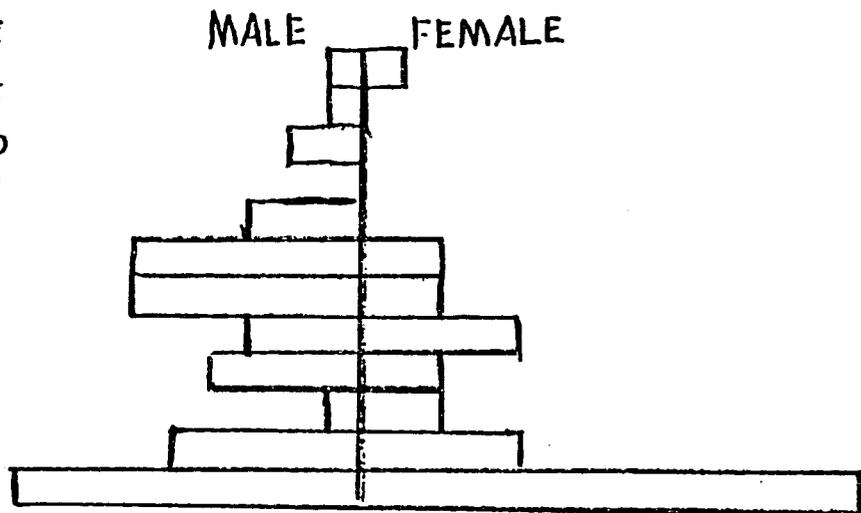


9 NUCLEOS
N=667

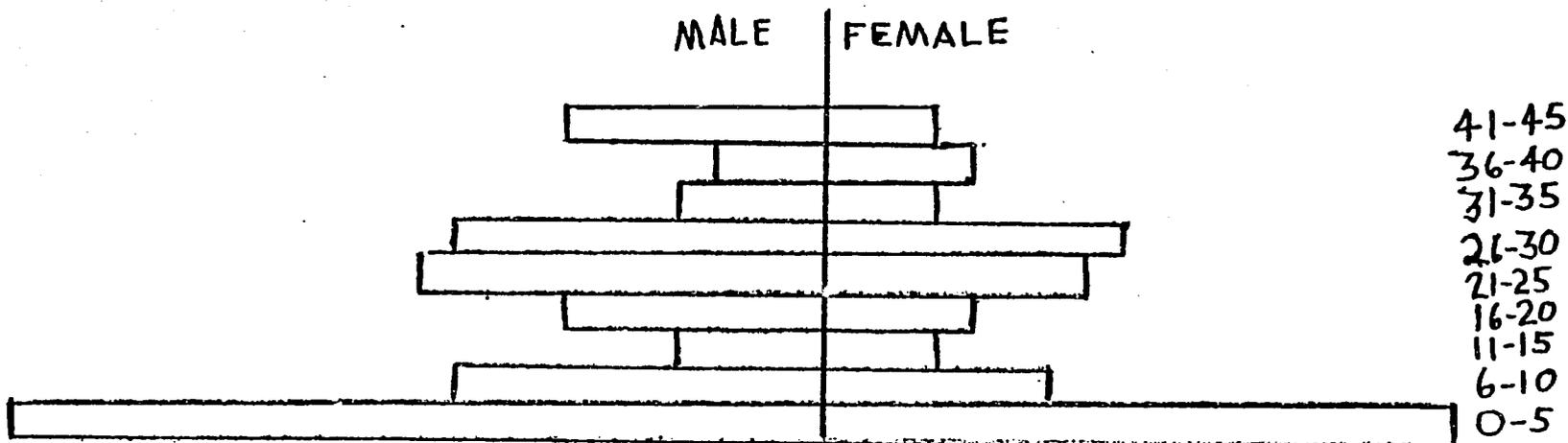
325



GRAPH TWO
NUCLEO TEN



GRAPH THREE
NUCLEO TWELVE

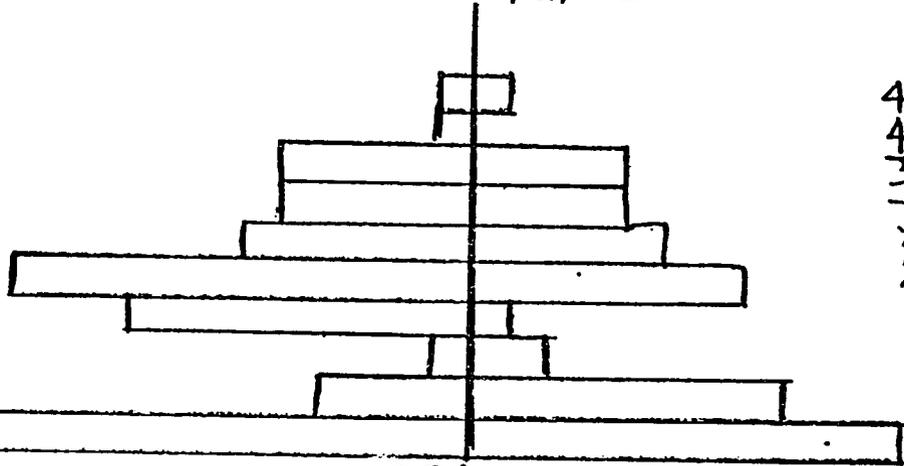


GRAPH FOUR
NUCLEO THIRTEEN

41-45
36-40
31-35
26-30
21-25
16-20
11-15
6-10
0-5

320

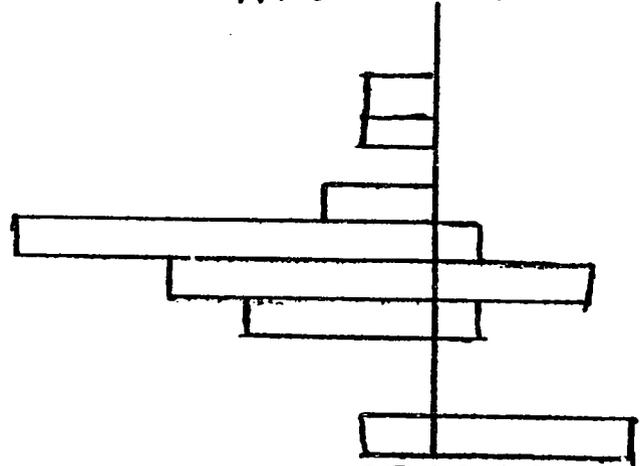
MALE FEMALE



GRAPH SIX
NUCLEO FIFTEEN

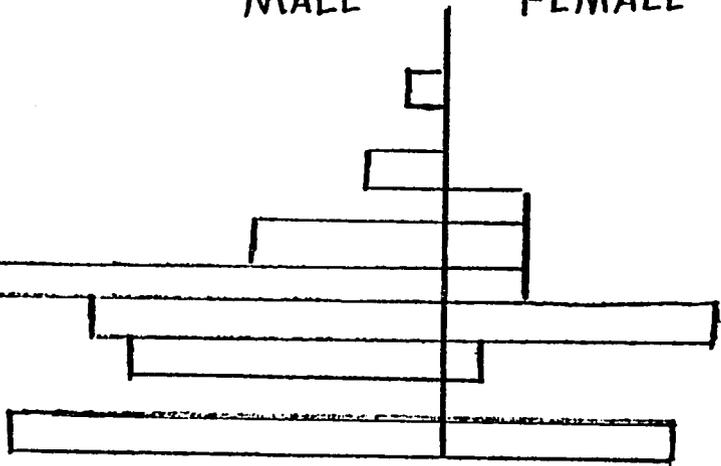
46-50
41-45
36-40
31-35
26-30
21-25
16-20
11-15
6-10
0-5

MALE FEMALE



GRAPH SEVEN
NUCLEO SIXTEEN

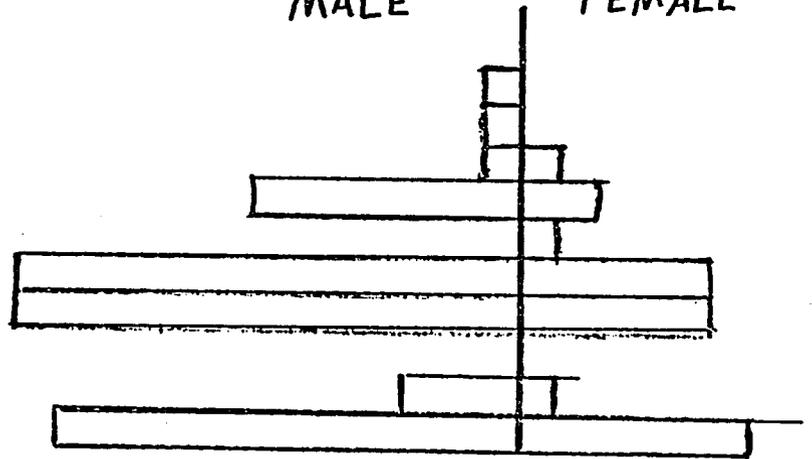
MALE FEMALE



GRAPH EIGHT
NUCLEO SEVENTEEN

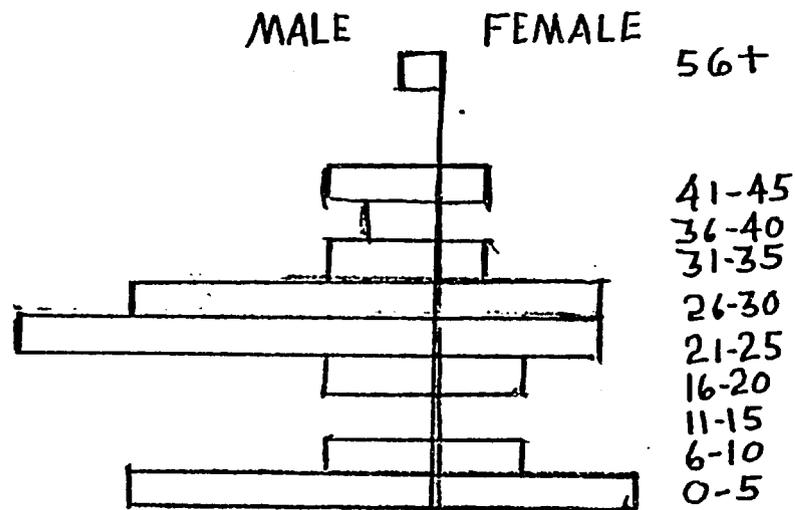
46-50
41-45
36-40
31-35
26-30
21-25
16-20
11-15
6-10
0-5

MALE FEMALE

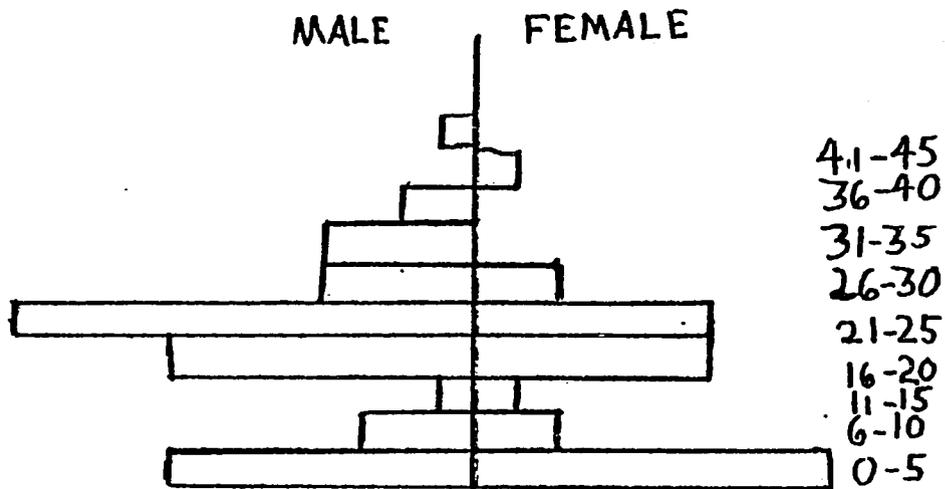


GRAPH NINE
NUCLEO EIGHTEEN

327



GRAPH TEN
NUCLEO TWENTY-ONE



GRAPH FIVE
NUCLEO FOURTEEN

528