HUMAN FACTORS INVOLVED IN THE DEVELOPMENT OF A WATERSHED IN YABUCOA

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I. INTRODUCTION

1. Nature and Importance of the Study

A watershed project was planned for the Southeastern part of Puerto Rico, at a cost of over four million dollars. The area lies entirely within the municipality of Yabucoa, between latitudes 18°N and 18°07' 30" N, and longitudes 65°45' W and 66° 00 W. The watershed is approximately 14 miles long and varies from three to six miles in width. It covers an area of 31,700 acres or 49.53 square miles. Its overall purpose was to protect the area from heavy floods which in the past had caused severe economic loss of property and even of lives.

The watershed project, as planned, included measures designed to eliminate floodwater damage to the land, homes, roads and bridges. Additional measures were included to improve the drainage conditions in the flood plain area to the extent that higher yields of sugar-cane and greater carrying capacity of pastures would be attained. In addition, the floodwater retarding structures would have a sediment pool of over 90 acres which would be developed as a recreational area in the future.

Besides the structural measures, land treatment practices are required since the adoption of soil conservation practices by the farmers is considered a pre-requisite

for the success of the watershed project. It is expected that after completion, the frequency, depth and duration of flooding will be significantly reduced on the 7,500 acres of flood plain land; that sediment damage will be reduced by about 67 percent; and that approximately 6,800 acres of agricultural land, will have benefited from the improved drainage.

It is commonly accepted that the success of any innovation such as a watershed project, is attained not only when such innovation is structurally sound from a mechanical engineering point of view, but also when the people, whose lives would be affected by such innovation, are taken into consideration. This is referred to as social engineering. History shows that many innovations, no matter how structurally sound, have failed when the views of the community involved were ignored, when they did not understand the innovations and when they felt that their security was threatened.

The Yabucoa region, for which the watershed project was planned, is mainly an agricultural area. It is inhabited by farmers of different economic and social levels who depend on agriculture as their main source of livelihood. There farmers are thus occasionally exposed to the unpredictable forces of nature associated with the agricultural industry. One of these forces, the frequent floodings of the Guayanés River, as already mentioned, has caused severe losses. Consequently, any successful attempt to develop the watershed will rely heavily on how the people envision their future under the new or modified situation resultant from such innovation.

People react to change in different ways. Their reaction in terms of actions

and decisions is dependent on the social, cultural and economic factors that characterize their lives. The residents' points of view on the project, their knowledge of and attitudes toward it, are important in determining their reactions.

In synthesis, the ultimate success of the watershed project in the Yabucoa area will depend heavily on how the people of the area react toward it.

2. Objectives of the Study

Awareness of the importance of the situation described in the previous paragraphs led to the idea of undertaking a study to:

1. Determine some of the personal characteristics of the people of the area in terms of, among others: age, education, occupation, income, size of the family, and levels of living.
2. Characterize the community in terms of such socio-psycological factors as, community solidarity and cohesion, population mobility, use of community main services and their attitude toward the present and the future.
3. Ascertain the knowledge, attitudes, and opinions of the people toward the Guayanés River Watershed Project.
4. Determine the farming situation of the area.
5. Arrive at conclusions and formulate suggestions which may help in the program development process and in the evaluation of the watershed project.

It is envisaged that the accomplishment of the above objectives will assist in counteracting difficulties which may arise in the development of the project. The results may also assist in alleviating the constant decline of agriculture in the area under study. It is hoped that this research may be a precedent for future studies under similar conditions in Puerto Rico and a benchmark for evaluating changes in the area studied.

3. Population and Sample

The population for the study consisted of 632 families who would be most affected by the watershed project --603 families from the highlands who experienced erosion of their lands, and 29 families from the low-lying plains who were directly affected by floods.

The final number consisted of all 29 families from the lowlands and a 30 percent sample from the highland dweller, and since farming was an important source of livelihood for those of the highlands, these families were stratified according to the size of farm operated and from these, a final random sample was drawn from each stratum as shown in Table 1. Of this number, interviews were carried out with 190 families: 29 from the lowlands and 161 from the highlands.

Table 1. Distribution of Farms in the Highlands with Reference to Size

Guayanés River Watershed Area, Puerto Rico, 1968

Size of farm in the highlands	No. of farms in the population	No. of farms in the sample	Percent
Small (20 acres of less)	488	127	26.1
Medium (21 to 40 acres)	85	42	49.4
Large (41 acres or over)	30	15	50.0

4. Data Gathering Techniques

Data about the general conditions of the area were gathered from secondary sources, such as the farm inventories of the Agricultural Extension Service and

records of the Soil Conservation Service and of the Departments of Agriculture, Education and Health. Supplementary information was obtained by direct observation in the area of such aspects as farm equipment, house surroundings and the availability of facilities such as electricity, running water, roads, schools and recreational facilities.

A questionnaire was used to obtain information regarding the general characteristics of the people, their educational level, attitudes, opinions, and their farm situation in relation to land tenure, and agricultural practices followed. Interviews were carried out by trained personnel and the researchers themselves to 190 families as already explained: 29 from the lowlands and 161 from the highlands.

II. THE PEOPLE OF THE AREA

Almost in one-hundred percent of the cases, the man was reported as the head of the household. Only three women in the highland were considered in such a status. Of the couples studied (173) 86 percent were reported as legally married (88 percent in the lowlands and 72 percent in the highland).

1. Age of the Head of the Household

The heads of the household were chronologically a relatively mature population as reflected by an average age of 54 years; heads of households in the lowlands, however, were somewhat older than the total population with an average of 58 years as comprared to 53 years for those in the highlands. This condition is reflected in the frequency distribution by age group. While for the total sample as well as for the highlands the distribution approached normality, in the lowlands the age distribution was geared to the right as can be observed in Table 2: 58 percent of the cases in the highlands fell in the 40-60 years bracket whereas in the lowlands the highest

proportion concentrated in the over 50 years bracket. Furthermore, the proportion of heads of households 61 years of age and over, was significantly higher than those 30 years or under for the total population studied, as well as for both lowlands and highlands sectors.

Table 2. Percentage Distribution of Head of Household According to Age

Guayanés River Watershed Area, Puerto Rico, 1968

Age	Lowland n = 29	Highland n =161	Total n = 190
20 or less	0.0	0.8	0.6
21 - 30	4.1	0.8	1.2
31 -40	8.2	14.9	13.4
41 -50	4.1	32.1	28.8
51 -60	37.8	26.2	27.6
61 -70	20.4	14.3	15.0
71 -or more	25.4	10.9	13.4
Total	100.0	100.0	100.0

Table 3. Percentage Distribution of Housewives According to Age

Guayanés River Watershed Area, Puerto Rico, 1968

Age	Lowland n = 29	Highland n = 161	Total n = 90
20 or less	0.0	0.0	0.0
21 - 30	3.7	8.4	7.8
31 - 40	11.1	21.0	19.5
41 - 50	22.2	34.6	32.4
51 - 60	37.0	19.8	22.4
61 - 70	18.6	12.7	13.7
71 or more	7.4	3.5	4.2
Total	100.0	100.0	100.0

The high proportion of heads of families in the higher age groups is something to be considered for any future planning in the area.

2. Age of the Housewife

For the total population, on the average, the housewife was eight years younger than her spouse, however, the housewife in the highlands was, on an average, five years younger than the housewife in the lowlands. Sixty-four percent of the housewives in the highlands could be considered in the reproductive ages, as compared with 37 percent in the lowlands. (Table 3.).

3. Formal Education of the Head of Household

The formal education of the household, as measured by the number of years of school attendance completed, provides an interesting contrast between the two sectors studied. Although the average formal education for all heads of households was closed to functional illiteracy (3.99 years), significant differences appeared between the highland and lowland residents. The average formal education of the head of the household was higher in the lowland, with 6.14 years in school as compared to 3.14 years in the highland. Consistent with this observation, it was noted that the proportion of functional illiterates (people with 3 years or less of formal education) was higher in the highlands (54 percent) than in the lowlands (38 percent). Only 13 percent of the heads of households in the highlands achieved elementary school level as compared to 44 percent of the heads of household in the lowlands (Table 4).

Table 4. Percentage Distribution of Heads of Household According to Formal Education

Guayanés River Watershed, Puerto Rico, 1968

School Level Attained	% Highland n = 161	% Lowland n = 29	% Total n = 190
3 years or less	54.6	37.9	52.1
4 - 6 years	31.7	17.3	29.5
7 - 9 "	6.2	24.2	8.9
10 - 12 "	5.6	10.3	6.3
13 or more	1.9	10.3	3.2
Total	100.0	100.0	100.0

4. Formal Education of the Housewife

The pattern observed for formal education of the housewife does not depart much from that observed for the head of household. The average number of years for all housewives was 3.43; for the lowland 7.69, and for the highland 2.66 years. About two-thirds (65 percent) of the housewives in the highlands can be considered functional illiterates. While 89 percent of the housewives in the highlands attained elementary school level or less, 48 percent of those in the lowlands achieved above that level of formal education. (Table 5.)

Table 5. Percentage Distribution of Housewives According to Formal Education, Guayanes River Watershed, Puerto Rico, 1968

School Level Attained	Highland n = 161	Lowland n = 29	Total n = 190
3 years or less	65.2	20.7	58.4
4-6 years	23.6	20.7	23.2
7-9 "	8.7	24.1	11.0
11-12 "	2.5	10.7	5.3
13 or more	0.0	13.8	2.1
Total	100.0	100.0	100.0

5. Size of the Family

The size of the household, defined as the number of people at home (relatives or not), when related to factors such as age, sex and education, provides basic information for planning important community activities such as employment, education and recreation.

The average size of the household for the whole area was above the average size of family for the island, 6.65 to 5.2. A significant difference was observed between the lowlands and the highlands,that of 3.97 and 7.13 members respectively. In nearly 36 percent of the cases, there were 3 or less members in the lowland as compared to only 17 percent in the highland. On the other hand, the number of cases with 10 or more members constituted more than 25 percent in the highland and only 7 percent in the lowland. (Table 6.).

Table 6. Percentage Distribution of Families According to Size of Household Guayanes River Watershed, Puerto Rico, 1968

Size	Highland n = 161	Lowland n = 29	Total n = 190
3 or less	16.8	65.5	24.2
4 - 6	26.7	17.2	25.2
7 - 9	31.0	10.4	27.8
10 - 12	16.8	6.9	15.2
13 - 15	8.1	0.0	6.8
16 or more	.6	0.0	0.8
Total	100.0	100.0	100.0

6. Occupation of the Head of the Household

Farming was the main occupation of the head of the family, male or female, followed by housekeeping, commerce and skilled labor in that order. A higher proportion of household heads in the highlands were farmers than in the lowlands.

On the other hand, the proportion of merchants in the lowlands was higher than in the highlands: 17.5 percent as compared to 7.5 percent, respectively. Likewise, the proportion of household heads who were skilled workers was also higher in the lowlands than in the highlands (Table 7.). Only five household heads were classified as professionals:-one from the lowlands and four from the highlands.

Table 7. Percentage Distribution of Heads of the Household According to Main Occeupation Guayanes River Watershed, Puerto Rico, 1968

Occupation	Lowland n = 29	Highland n = 161	Total n = 190
Farmer	48.3	60.9	59.0
Housekeeper	13.8	9.3	10.0
Farm worker	0.0	5.0	4.2
Unskilled worker	0.0	3.1	2.6
Skilled worker	13.8	6.2	7.4
Merchant	17.3	7.5	8.9
Professional	3.4	2.4	2.6
Uncertain or Unemployed	3.4	5.6	5.3
Total	100.0	100.0	100.0

The stability of the occupational structure in the area is reflected by the extensive time period that each head of household has been engaged in his main occupation. Eighty-four percent of all household heads had devoted more than 11 years to their main occupation. (Table 8). The average number of years was 30.9 in

the lowland and 27.8 in the highland. The relatively stable occupational structure may be considered as an additional indicator of the community cohesion which is discussed in another section of this report.

Table 8. Percentage Distribution of Heads of Household According to Years Devoted to Their Main Occupation Guayanés River Watershed, Puerto Rico, 1968

Years Devoted	Lowland n = 29	Highland n = 161	Total n = 190
Less than 1 year	0.0	1.8	1.6
1-10 years	17.3	13.7	14.2
11-20	13.8	19.3	18.5
21-30	24.1	28.0	27.4
31-40	20.7	21.1	21.0
41-50	17.3	9.9	11.0
51.60	3.4	3.7	3.7
61-70	3.4	1.9	2.1
71 and over	0.0	.6	.5
Total	100.0	100.0	100.0

Given the opportunity, 31 percent of the household heads would change their main occupation. The three main reasons given were the low prices of farm products, poor physical condition of farmers, and their having become tired of farming. An interesting fact is that the proportion that would change their main

occupation in the highlands (33.3 percent out of 159 cases) was twice as high as that from the lowlands (17.8 percent out of 28 cases). Highlanders mentioned low prices of agricultural products as the main reason for considering abandoning agriculture, while lowlanders mentioned the declining rate of agriculture.

When asked to forecast the future of farming as an occupation for the Guayanés watershed area, 72 percent answered that farming was declining, 19 percent that its future was uncertain, and only 9 percent that it was promising as an occupation. (Table 9). There was no major difference between lowlanders and highlanders with reference to the opinion that farming was still a promising enterprise. On the other hand, lowlanders were more pessimistic about the future of farming, and highlanders were more uncertain about its future.

Table 9. Percentage Distribution of Heads of Household Forecast of Farming as an Occupation for the Future, Guayanés River Watershed, Puerto Rico, 1968.

Forecast	Lowland n = 29	Highland n = 161	Total n = 190
Uncertain or regular	6.9	21.1	18.9
Going down or falling	82.8	69.6	71.6
Promising	10.3	9.3	9.5
Total	100.0	100.0	100.0

7. Occupational Mobility

A hypothetical question was formulated for the heads of families with reference to what occupation they would elect to go into, in the event that they were compelled to abandon farming. Their answers showed that over one-third (36 percent) from the

lowland stated that they were unable to work, as compared to 22 percent from the highlands. The preferred occupation were merchants in the lowlands and skilled workers in the highlands.

Apparently, income was the motivating force in these choices; both merchants and skilled workers were presumed to be making "good money" in Puerto Rico.

In the highland sector, around 61 percent of the residents (Table 7), identified themselves as farmers in comparison with 48 percent in the lowlands. Farmers felt that the future of agriculture as an occupation was declining; this decline may be also reflected by the fact that there was a significant decrease in the number of sons who chose their father's occupation--farming as their future choice of occupation. This is clearly illustrated in Table 10. Whereas 76 percent of parents of present households in the highlands were farmers, only 48 percent of their sons chose that occupation, while in the lowlands the figures were 76 and 60 percent respectively. Furthermore, only 51 percent of all farmers interviewed preferred agriculture as an occupation for their sons:--40 percent from the lowlands as compared to 52 percent from the highlands. In sum, the trend indicates the following--in the highlands 93.7 percent of the fathers of interviewees were considered by their sons to be farmers: that proportion dropped to 60 percent for the interviewees themselves and to 51.7 for their sons. In the lowland the figures were 75.9, 48 and 40 percent respectively. (Table 10.)

Table 10. Relationship of Three Successive Generations and Farming

Guayanés River Watershed, Puerto Rico, 1969

Generation	Lowland	Highland
	Percentage dedicated or aspiring to agriculture as an occupation	
First generation (father of interviewees)	75.9	93.7
Second generation (interviewees themselves)	48.0	60.0
Third generation (sons of interviewees)	40.0	52.0

The proportion of parents who were willing to have their sons follow their own occupation (farming) was higher than the number of sons who actually chose farming as their main occupation. In the lowlands 60 percent of the parents were willing that their sons should be farmers, as compared to 57.6 percent in the highlands.

Although the actual answers could be considered somewhat unrealistic, the farmers were questioned on their willingness to insist that their sons follow their own occupation. This question was included because parents may often compel sons to follow the paternal occupations. If they actually did exert pressure over their sons toward that goal, the success of the effort must be considered only moderate when only 52 and 40 percent for the highlands and lowlands, respectively, actually followed their father's occupation.

8. Occupations Aspirations

Occupational aspirations in this study were classified at two levels: first, the occupations that parents would prefer for their sons and daughters; and second, the occupation they thought their sons and daughters would pursue under existing circumstances. (Table 11 and 12.).

Table 11. Percentage Distribution of Heads of Household According to their Occupational Preferences for their Sons and Daughters, Guayanés River Watershed, Puerto Rico, 1968

Occupational Levels	Lowland		Highland		Total	
	Sons n = 20	Daughters n = 22	Sons n = 132	Daughters n = 132	Sons n=152	Daughters n = 154
Farming	5.0	0.0	2.0	0.0	2.6	0.0
Housewife	0.0	0.0	0.0	3.8	0.0	3.3
Farm works	0.0	0.0	0.0	0.0	0.0	0.0
Unskilled works	0.0	0.0	0.0	0.0	0.0	0.0
Skilled works	5.0	0.0	22.0	3.0	19.8	2.5
Merchant	5.0	0.0	5.0	0.0	5.3	0.0
Professional or Semi-professional	80.0	95.5	68.0	89.4	69.0	90.2
Indefinite, not sure	5.0	4.5	3.0	3.8	3.3	4.0
Total	100.0	100.0	100.00	100.0	100.0	100.0

Occupational preferences of parents were consistently of a higher level for their daughters than for their sons. In general, preferences were also higher in the lowlands

than in the highlands. About 69 percent of the parents preferred professional or semi-professional occupations for their sons and 90.2 percent for their daughters, followed by skilled labor occupations, especially for their sons. Parents both from the highlands and lowlands seemed to be more realistic as to the occupation that they felt their children were actually going to enter as compared to the ones that they preferred for them, for while 69 percent of parents preferred professional or semi-professional occupations for their sons, and 90 percent preferred the same for their daughters, they felt that only 19.3 percent of the boys and 34.9 percent of the girls were actually going to enter such fields. (Table 11 and 12). Parents turned to less prestigious and lower remunerative occupations such as skilled labor (37.6 percent) and farming (19.3 percent) for the boys: and for the girls (36.7 percent) chose housewives, and 24.7 percent skilled labor.

When parents were asked why they thought their children would not attain the occupations, the following were mentioned: lack of money (51.3 percent); too long a career (4.2 percent); children's inability to pursue higher studies (14.0 percent); and lack of interest (26.3 percent). Lack of money was more frequently mentioned in the highland (56.0 percent) than in the lowland (21 percent). Too long a career and lack of interest were more often mentioned by the lowland residents while student inability was mentioned in about the same proportion by both sectors (Table 13.).

Table 12. Percentage Distribution of Heads of Household According to the Occupation They Thought Their Children Will Actually Engage in Under Present Circumstances

Guayanés River Watershed, Puerto Rico, 1968

Occupational Levels	Lowland		Highland		Total	
	sons n = 20	daughters n = 22	sons n = 132	daughters n = 132	sons n = 152	daughters n = 154
Farming	0.0	0.0	23.2	0.0	19.3	0.0
Housewife	0.0	14.3	0.0	42.0	0.0	36.7
Farm work	0.0	0.0	10.4	0.0	8.7	0.0
Unskilled work	0.0	0.0	6.4	3.0	5.0	2.4
Skilled labor	31.6	23.8	40.0	25.0	37.6	24.7
Merchant	15.7	0.0	4.8	0.0	7.1	0.0
Professional or Semi-professional	47.4	61.9	12.8	28.0	19.3	34.9
Indefinite, not sure	5.3	0.0	2.4	2.0	3.0	1.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 13. Percentage Distribution of Heads of Household According to the Reasons Why Their Children Could not Achieve the Occupation of Parents' Choice Guayanés River Watershed, Puerto Rico, 1968

Reasons	Lowland n = 19	Highland n = 125	Total n = 144
Lack of money	21.0	56.0	51.3
Too long a career	15.8	2.4	4.2
Student inability	15.8	13.6	14.0
Lack of interest	36.9	24.8	26.3
No future in the occupation	0.0	0.0	0.0
Other	10.5	3.2	4.2
Total	100.0	100.0	100.0

9. Contact of Family Members with United States

Thirty-seven percent of the families reported having some members living in the United States and approximately one-fith (25%) reported that some relative had visited the U. S. A. at least once in their life. Residents from the lowlands visited the United States more frequently for social and family contacts, while a higher proportion from the highland went in search of employment.

10. Military Service of Family Members

Participation of members of the community in military service constitutes another external community contact. Seventeen percent of the families interviewed had or had had some member in the army. Residents of the lowlands had a higher proportion of members with military experience (34.5 percent) than those of the highlands(14.3 percent), this was probably due to the higher age average of residents in the lowlands, as compared with those of the highlands sector.

11. Fatalism or Optimism

It is hypothesized that people who hold an optimistic (or less fatalistic) view of life are usually better educated, have more contacts with the outside world and are more willing to accept innovations. In this study, a scale of fatalism - optimism consisting of 12 items was used. Weights ranging from one to three points were given to test the reaction of each individual to each specific statement. A higher weight corresponded to a less fatalistic reaction. Based on the weight system adopted, the possible variation ranged from a low of 12 to a high of 36.

The distribution of cases for the areas under study and the total population (Table 14) shows that, people from the highlands were more fatalistic than those from the lowlands as reflected by an average score of 22.4 and 25.3, respectively, thus supporting the stated hypothesis.

Table 14. Percentage Fatalism Scale Score Distribution

Guayenés River Watershed, Puerto Rico, 1968

Scores	Lowland n = 29	Highland n = 161	Total n = 190
12 - 18	6.9	26.1	23.2
19 - 24	44.8	40.4	48.4
25 - 30	37.9	29.2	23.2
31 - 40	10.4	4.3	5.2
Total	100.0	100.0	100.0

III THE COMMUNITY

The success of any innovation depends not only on the participation of its inhabitants as individuals but also, and possibly more important on the feeling of belonging and the esprit de corps that is developed through people's interaction. The extent to which people respond as a group can be determined through a series of indicators which are discussed in the following paragraphs, and which revolve around the concept of community solidarity and conditions of living.

1. Community Solidarity

If solidarity is defined as the degree to which participants cooperate to create and reflect a well-defined image of their situation, the time element is important. Therefore it could be expected that factors such as the use of community services, kinship relations network, interaction profiles with the best acquainted people, and

its dimension of stability, as indicated by time, are indicators of community solidarity and cohesion.

2. Population Mobility

Among the important characteristics of a community regarding planning and implementation of development programs and other activities, population mobility is a critical one, combined with such other characteristics as age, education and size of household. The success of a given program or activity may depend to a great extent on the stability of the population. Stability could insure continuity. On the other hand, it could also occur that a given community may not change much due to a lack of outside contacts. This situation, however, does not seem likely to occur in the Guayanés area due to modern mass media communications and the increasing availability of urban facilities. The relative stability of the population in the area is a positive factor for its future development. For instance, the average number of years of residence in the area was 27, thus indicating a highly stable population. This is true for both the highland and lowland sectors, even though the lowland residents seem to be slightly more stable. (Table 15).

Table 15. Percentage Distribution of Families According to the Number of Years of Residence in the Same Place

Guayanés River Watershed, Puerto Rico, 1968

Number of Years	Highland n = 161	Lowland n = 29	Total n = 190
10 or less	28.0	20.7	26.9
11 - 20	19 .9	20.7	20.0
21 - 30	15 .5	24.1	16.8
31 - 40	15 .5	10.3	14.7
41 - 50	10 .5	6.9	10.0
51 or more	10 .5	17.3	11.6
Total	100. 0	100.0	100.0

Another factor which could be considered an indicator of stability is whether or not people plan to move to another area. Of the total population, only around 18 percent had such plans. Among the reasons advanced for contemplating such a move were lack of resources of the area, the fact that farming was not a prosperous business, and the fact that people got tired of farming as an occupation. On the other hand, the remaining eighty-one percent who were not planning to move, expressed their satisfaction with the place, existing family ties, and the fact that they owned properties.

3. Patronage of Services in the Community

Table 16. Percentage Distribution of Families According to Patronage of Community Services Guayanés River Watershed, Puerto Rico, 1968

Category	Highland n = 161	Lowland n = 129	Total n = 190
Buy clothing	98	69	89
Buy food	96	86	94
Buy medicines	96	93	96
Visit physician	94	69	91
Visit church	100	100	100
Education for children	98	67	93
Go to movies	79	69	75
Go to dances	95	92	94
Buy agricultural products	98	78	95
Buy house equipment	93	82	92
Buy farm equipment	100	70	95

On the basis of the cohesion and solidarity theory, the hypothesis of high solidarity in the Guayanés River Basin area is supported. All community services were patronized by more than 60 percent of the people in the community. (Table 16).

Some differences,however, were detected between the highlands and the lowlands residents. For instance, the residents in the highlands used community services such as schools, movies, and food stores more frequently than the lowlands residents Church and dances were the only two services that were locally patronized at the same rate by both lowlanders and highlanders. The most marked difference between the two sectors was found to be in education. Only 2 percent of the highlanders secured education for their children out of the community, as compared to 33 percent of the lowlanders. Visits to physicians, shopping for farm and agricultural products, also took place more often outside the community in the lowlands than in the highlands.

Medical services and the use of private physicians were used more often by the lowlanders than the highlanders. More than 40 percent of the people from the highlands did not report having used any medical services, as compared with only 3 percent from the lowlands. Since it is less likely that residents from the highlands were healthier than those from the lowlands, it can be inferred that the highland residents were depriving themselves of medical services at a higher proportion than those from the lowlands. The difference could be due to difficulties in contacting a physician due to great distances and lack of transportation facilities, poor economic conditions, or a combination of both. Tradition could also be suggested as a factor to explain such a difference. On the other hand, when people were asked about what action they did take in case of illness, over 90 percent of both highlands and lowlands residents answered that they used prescribed medicines. Only four percent of the highlanders used remedies, but none of the lowlanders reported such practices.

4. Other Indicators of Community Cohesion

It could be expected that in a traditional rural type of society the community would be supported heavily by kinship relations. It could also be expected that the more traditional or rural the community, the closer the kinship ties within the community boundaries. The figures obtained from the study support both lines of reasoning. Close friends and relatives of the head of household and of the housewife in a high proportion in both sectors, resided in the same community, but the proportion was higher in the highlands than in the lowlands. For instance, more relatives of the housewife in the lowlands resided in a community more distant, than relatives of those of the highlands. Therefore, it could be inferred that, in terms of kinship ties, the highland residents were more cohesive than those of the lowlands. These facts are thus consistent with those regarding the use of main community services. It should be noted, however, that the highland communities were farther, less accessible to the urban areas and to the main means of transportation and communication, than the lowland community.

Residents were asked about the best known person in the community and their kinship relation, if any, to them. The best known person was more often a resident of the same community but not necessarily a relative of the respondent. In spite of this, it was found that the best known person was more often a relative in the highlands than in the lowlands.

5. Conditions of Living of the People

Conditions of living is a concept generally used to express the possession or enjoyment of certain specific material items that, according to cultural standards,

contribute to the well-being of the population. For this study fourteen such items were submitted to the families in both sectors of the watershed. (Table 18). The items "possessed" or "enjoyed", were classified in three levels of adequacy- adequate, acceptable, and excellent, with value weights of one, two and three points, respectively. Thus the index score for any family could fluctuate from a minimum of 14 points to a maximum of 42 points.

Conditions of living vary according to factors such as education, income, and size of family. It is expected that persons with less education, large families, and low incomes, for example, have lower conditions of living than their opposite. The results of this study tend to reaffirm such a hypothesis. People from the highlands, who conformed to the conditions above stated, had generally a lower index of living standards than those in the lowlands, as can be seen in Table 17.

Table 17. Percentage Distribution of Families According to the Index of Conditions of Living Attained

Guayanés River Watershed, Puerto Rico, 1968

Index of Condition of Living	Lowland n = 29	Highland n = 161
20 or less	0.00	5.64
21 to 25	0.00	16.83
26 to 30	10.35	41.68
31 to 35	6.90	23.40
36 to 40	65.50	12.45
41 on	17.25	0.00
Total	100.00	100.00

More than 60 percent of 161 families in the highlands scored below 30 points, in contrast with only 10.3 percent in the lowlands. Similarly, whereas only 12.5 percent of the families in the highlands scored 36 points or more, 83 percent of the families in the lowland reached that level.

The lowest score accumulated by any family was 17 and the maximum 42. The average for the highlands was 28.9 and 37.6 for the lowlands. In synthesis, living conditions in the lowlands were around 30 percent higher than in the highlands. Similarly, the lowlanders were more homogeneous in this respect, judging from a standard deviation of 3.8, and of 5.0 in the highlands.

The four items with the highest score in the lowlands were: storage facilities for the kitchen (2.97); building material of walls (2.93); ratio bedrooms to number of persons (2.93); and facilities for the conservation of perishables (2.93). (Table 18). In the highlands, the three items with the highest scores were: facilities for keeping perishables(2.81); the principal building material of walls (2.66) and storage facilities in the kitchen (2.51). These three items also, corresponded to the highest in the lowlands; however, the scores in the highlands were consistently lower than in the lowlands. (Table 18.). The items with lowest scores in the lowlands were: facilities for washing kitchen utensils (2.07); means of transportation for the family (2.14); and protection against insects (2.31). In the highlands the items with lowest scores were: type of floor covering (1.30); means of transportation for the family (1.31); and the source of drinking water (1.69). (Table 18).

Water, was by far one of the major concerns of local residents in the Guayanés area. Besides checking on the adequacy of the source of water, inhabitants from both sectors were asked about the specific problems which they faced in relation to the availability of this important article. (Table 19).

Table 18. Average Score of Adequacy of Individual Items of Conditions of Living

Guayanés River Watershed, Puerto Rico, 1968

Item	Average Score for Items	
	Lowland	Highland
1. Concrete, painted lumber or durotex as principal building material for walls in contrast to other building meterials.	2.93	2.66
2. Terrazzo, tile or vamished lumber as principal building material for floors in contrast to other building materials.	2.69	2.11
3. Use of some floor covering such as terrazzo, rugs and linoleums in contrast with no covering at all.	2.34	1.30
4. Rate of occupation per bedroom: 2 persons per bedroom in contrast with more than that number.	2.93	1.79
5. Use of electricity or kerosene for cooking in contrast with other materials.	2.89	2.43
6. Use of built in or movable cabinets for storing of kitchen equipment in contrast with shelves or no facility at all.	2.97	2.51

Item	Average Score for Items	
	Lowland	Highland
7. Use of refrigerator-electric or gas-to keep perishables in contrast with other systems.	2.93	2.81
8. Washing the dishes with dish-washer or in a dish pan or sink, in contrast with washing in any other type of container or in a brook.	2.07	1.72
9. Use of some mobile owned equipment for transportation	2.14	1.31
10. Use of drinking water from aqueduct (if available) in contrast with water from a river or brook.	2.86	1.69
11. Use of toilet for sanitary purposes instead of a latrine or any other means.	2.86	2.11
12. Use of bath tub with shower or without, for bathing	2.82	1.98
13. Use of some type of protection against household pests.	2.31	1.90
14. Use of electricity or gas for lighting instead of candles and other materials or equipment.	2.86	2.15

In general, 70 percent of the people in the highlands and 14 percent in the lowlands expressed some sort of water problem. The distance that people in the highlands had to travel in order to get water was emphasized by nearly one-third of the families; lack of aqueducts and low water pressure were reported by a relatively high proportion of people in the highlands and by only one person in the lowlands. The scarcity of water during the dry season was understandably reported by some families in both sectors.

In Table 20 information is given on the means of transportation owned by the families. As stated, transportation was a serious problem; especially for the highlands residents. A little over 50 percent of the families in the lowlands owned automobiles

Table 19. Percentage Distribution of Families According to Problems Faced on the Availability of Water

Guayanés River Watershed, Puerto Rico, 1968

Problem	Lowland n = 29	Highland n = 161
1. None	86.21	29.91
2. Lack of aqueduct	0.00	16.78
3. Water too far	3.45	31.68
4. Too dry	6.90	6.84
5. Lack of water pressure	3.45	12.43
6. Contamination	0.00	3.11

and less than 10 percent in the highland. Jeeps or trucks were also used as a means of transportation by some families, in a similar proportion for both areas.

Table 20. Percentage Distribution of Families According to the Means of Transportation Possessed Guayanés River Watershed, Puerto Rico, 1968

Means of Transportation	Ownership	
	Lowland n= 29	Highland n = 161
1. Automobile	51.73	9.32
2. Jeep or Truck	10.35	12.43
3. Animal	0.0	8.08
4. None	37.94	70.20

The use of animals for transportation was reported by 13 families in the highland and by none in the lowlands.

In general, around 70 percent of the families in the highlands reported no means of transportation in contrast to only 38 percent in the lowlands. It is very possible that families in both areas, especially in the highlands, depended to a great extent on public transportation or that it was provided for them, mainly for their children, by government agencies.

An important aspect of conditions of living is home ownership, and its adequacy. To the degree to which a family owns his home one can expect more cohesiveness and stability in the family, as well as in the community to which the family belongs. In this study it was found that almost all families in both sectors owned

their homes:--98 percent in the highlands and 93 percent in the lowlands. The conditions of the homes, however, on the basis of the evaluation made by the interviewers, were consistently lower in the highlands with respect to house interiors, house exteriors and home surroundings. For instance, with regards to the interior of the homes, around 90 percent of the lowland houses were classified from good to excellent, whereas only 45 percent in the highland were classified as such. A quite similar situation was reported by the interviewers with respect to the house exteriors. Home surroundings of around one quarter of the houses in the lowlands and two-thirds in the highlands, were rated from medium to poor, and while houses in the lowlands provided one bedroom for each 1.47 persons, in the highlands the capacity ratio was 1 to 3.97.

Closely related to the above described situation was the control of household pests such as rats, mosquitoes, flies, cockroaches and ants. As was expected, in general, a large percentage of the families from both sectors had problems with pests, especially with cockroaches, mosquitoes and rats. (Table 21). Ants and flies seemed to cause least annoyance, especially in the highlands. The relatively cool climate prevailing in the highlands may account for the low incidence of flies. Rat incidence was lower in the lowlands probably due to control measures adopted, mainly in the sugar-cane fields.

A relatively high percentage of the families in both places did little to control households pests (Table 21). Chemical control was by far the most popular measure used followed by mechanical control. There was not much difference in the control measures used by farmers from the highlands and those from the lowlands (Table 22.).

Table 21. Percentage Distribution of Families Having Problems With and Doing Something About Control of Pests

Guayanés River Watershed, Puerto Rico, 1968

Kind of Pest	Families Having Problems with Pests		Families Having Problems Which Did Something About Control of the Pests	
	Lowland	Highland	Lowland	Highland
Rats	52	72	54	71
Mosquitoes	79	76	79	73
Flies	38	28	27	46
Cockroaches	69	89	25	11
Ants	31	19	36	18

Biological control of some of the pests existed as a natural measure, but none of the farmers made a planned effort to use it.

Table 22. Percentage Distribution of Farmers According to Type of Control of Household Pests Utilized Guayanés River Watershed, Puerto Rico, 1968

Type of Control	Percentage of Farmers Using Pest Controls				
	Rats	Mosquitoes	Flies	Cockroaches	Ants
Mechanical	10.6	11.2	5.2	1.6	2.6
Chemical	45.6	62.3	24.3	24.6	15.7
None	43.8	26.5	70.5	13.8	81.7

Despite the inefficiencies observed in the maintenance of the homes, in the upkeep of surroundings and in the control of household pests, the fact that most families owned their homes is very important in the planning of action programs designed to improve the community in general and the family in particular.

Food consumption is another aspect of great importance relating to conditions of living of families. The study called for some information on both the food consumed the day before the interview was held, and the proportion of food consumed produced on the farm. Although this study was not one on nutrition, it is possible that a trained nutritionist may very well obtain useful data on the subject. Table 23 presents information on the percentage of families who consumed certain products on the given date. A large majority of the families in both sectors, around

or over 90 percent, had consumed rice, beans and milk the day before the interview. Such foods were accompanied in the lowlands with some kind of meat by most families (28 out of 29) and in the highlands by meat or codfish. Differences noted in food consumption in both sectors, corroborate the thesis that families in the lowlands who, as previously noted, were economically and educationally superior than those from the highlands, consumed foods that were more expensive, and better sources of protein, such as meat (except fish), butter, cheese, and corn in higher quantities. Codfish, which is considered an excellent source of protein was consumed by a larger proportion of the families in the highlands; however, fresh fish was consumed by a very small number of families from both areas. A higher proportion of families in the lowlands used vegetables, but on the other hand, people from the highlands consumed in larger quantities native starchy foods such as tanniers and dasheens. Potatoes, which are imported, were consumed in greater proportion by families in the lowlands, and bananas were consumed in the same proportion by families in both sectors.

Table 23. Percentage Distribution of Families According to Food Products Consumed the Day Previous to the Interviews

Guayanés River Watershed, Puerto Rico, 1968

Food Product	Percentage of Families Consuming Each Food Item	
	Lowland n = 29	Highland n = 161
Rice	93.1	98.8
Beans	89.6	92.5
Milk	96.6	92.5
Tannters	58.7	76.4
Meat (except fish)	96.6	74.5
Codfish	31.0	73.5
Bananas (or plantains)	62.1	62.1
Potatoes	82.8	46.6
Vegetables	72.4	38.5
Dasheens	3.4	27.9
Cheese	58.6	20.5
Butter	69.0	19.9
Fish	6.9	6.2
Corn	13.8	4.3

Table 24. Proportion of Families Producing all or Part of Food Products Consumed by Them the Day Previous to the Interview

Guayanés River Watershed, Puerto Rico, 1968

Kind of Product	Proportion of Families Producing Food on their Farms			
	Lowland		Highland	
	Part	All	Part	All
Fruits	51.7	10.3	95.6	31.7
Eggs	51.7	41.4	89.4	69.0
Poultry	41.4	6.9	84.5	6.2
Milk	58.6	58.6	77.0	62.7
Vegetables	37.9	6.9	50.3	10.6
Pork	27.6	0.0	37.3	3.7
Beef	0.0	0.0	0.6	0.0

Despite the differences and similarities found in the consumption of food, one cannot conclude that the nutrition requirements in one or the other sector were better fulfilled since, no effort was made to determine the quality, quantity and frequency of use of the various products.

A higher proportion of families from the highlands than from the lowlands, produced some of the foods that they consumed (Table 24). This was especially

true of fruits, eggs, poultry and milk. As can be recalled, farmers in the highlands devoted themselves to the cultivation of a variety of farm products, both vegetables and livestocks, whereas in the lowlands land was devoted mainly to sugarcane and livestock. However, some families in the lowlands cultivated some foods and raised livestock in their backyards, for family consumption.

In closing, it should be stressed that community stability and conditions of living are two interrelated aspects of great importance in the planning of any development program or in the introduction of any change in any society.

IV. THE AGRICULTURE OF THE AREA

As previously indicated, agriculture was the main activity of the area studied. Great concern has been expressed by government officials and other interested people on the role and importance of agriculture in the socio-economic development of the Guayanes area, as well as in Puerto Rico in general. Such concern stems from the fact that a larger proportion of the area, especially the lowland sector, is well suited for other types of developments, such as industrial complexes which may affect negatively the future of the agriculture in the area.

1. General Aspects of the Area

Sugar cane and livestock are the two main cash crops of the area, providing an income of more than five million dollars annually. A sugar mill serves most of the agricultural area in the lowlands, employing around 250 workers during the grinding season with a payroll of nearly four hundred thousand dollars. In addition, 1200 field workers are employed in the harvest operations of sugar-cane with a payroll amounting to nearly seven hundred thousand dollars. Pasture lands and coconut growing are addidional crops of economic importance in the lowlands. In the highlands minor crops are cultivated on the majority of the farms. Sugar-cane, tobacco and pasture are also important crops in the highland, but of lesser importance than in the lowlands.

It is estimated that less than 25 percent of the farms in the watershed area entered into an agreement with the soil conservation service. The Guayanés River Watershed, as previously stated, covers an area of 31,700 acres. Of this acreage, 7,830 were in crops in 1968, 10,769 acres in virgin and improved pastures, 9,185 acres

in wood land and brushland, and 3,385 acres in urban and other uses. Most of the highlands consist of dissected plates developed over grandiorite rock. The slopes average 40 to 50 percent. Soils in general have medium to low inherent soil fertility, moderate to rapid subsoil permeability, medium surface drainage, and are well-drained internally. Flood plain soils range from elevated terrace soils to low lying soils of swampy areas.

2. Land Tenure and Size of Farm Holdings

Land tenure and size of farm holdings constitute two factors which may counteract to some extent the displacement of land to other uses. In Table 25 some information on these two factors is included.

Table 25. Percentage Distribution of Owners by Size of Holdings

Guayanes River Watershed, Puerto Rico, 1968

Size of Holdings (in acres)	Highland n=161	Lowland n=29
20 or less	71.3	57.0
21 -- 40	16.7	25.0
41 -- 60	7.5	3.6
61 -- 80	1.4	0.0
81 -- 100	2.3	0.0
101 -- 200	0.0	10.8
201 -- 300	0.7	0.0
301 and over	0.0	3.6
Total	100	100

Land ownership in both sectors was relatively high -97 percent of the families in the lowlands, and 88 percent in the highlands owned land, the remainder rented or administered it. This fact may account for the relatively high stability of the families reported earlier. On the other hand, the size of the holdings owned was relatively small. Around 88 percent of the families in the highlands and 82 percent in the lowlands, owned farms of 40 acres or less. (Table 25). The relatively small size of farms is something to be considered in any future planning of the watershed area. It may be that the presence of many families with small farms represents a handicap for a more commercialized and industrialized agriculture and for the use of modern technology.

3. Technology in Agriculture

The use of improved technology and the technological level of farming was an important part of this study. It has been found that the degree of success a farmer can expect depends heavily on the application of tried and proven agricultural practices. The knowledge gleaned by the agricultural planners of what practices are applied, or are not applied, may serve as a blueprint for diffusing among farmers, the technology most suited to their particular situation. In the area under study the soil conservation practices were especially important for the most efficient use and conservation of water and soil.

The technological level of farming was determined in terms of the number of agricultural practices that each family performed or agreed to have performed on his land, if applicable to his particular situation. Each recommended practice undertaken received a value weight of one point and of zero if not performed. Twenty-

eight agricultural practices were included in the study. Thus the technological level of any family could fluctuate from zero, if none of the recommended practices applicable to his farm were performed to 28, if all applicable were performed. If fact all practices were applicable in one way or the other in both sectors, even though some may have differed to a great extent in their consequence if not realized in one sector, especially the soil conservation practices in the highlands.

Table 26. Percentage Distribution of Families Applying Tested or Recommended Agricultural Practices, Guayanes River Watershed, Puerto Rico, 1968.

Number of Practices Performed	Lowland n=29	Highland n=161
None	6.8	2.5
1 - 2	3.4	1.2
3 - 4	6.8	2.5
5 - 6	13.9	5.0
7 - 8	10.4	12.4
9 - 10	6.8	23.6
11 - 12	6.8	18.0
13 - 14	3.4	13.0
15 - 16	13.9	10.5
17 - 18	17.6	7.5
19 - 20	6.8	3.1
21 - 22	3.4	0.6
Total	100.0	100.0

Tables 26 and 27 show information on the technological level of farmers.

The average technological level of farmers in both sectors was not significantly different: 11.0 points for the highlands and 10.6 for the lowlands. This fact departs from the expected norm since, generally, more educated farmers with higher incomes, higher living standards and larger farms, conditions which were more prevalent in the lowland, have a higher technological level. It should be bourne in mind, however, that in the study no effort was made to evaluate the adequacy with which the practices were executed. For instance, sugar cane and pastures were the main crops in the lowlands, for which certain agricultural practices such as the use of both new varieties, and of standardized analyses of fertilizers, were very common. Both practices were the results of extensive research done by the Experimental Stations. On the other hand, in the highlands the main crops were the starchy type of product referred to as minor crops. Not much research has been done on these crops and many of the practices, such as the use of fertilizers, were the results of the experience of farmers throughout the years. As the study was made, each practice received the same weight.

The main conclusion that could be derived from the data on Table 26 is that the technological level for both sectors was relatively low and, consequently, there is still good potencial for improvement in this respect in both sectors. This conclusion is further endorsed by an examination of each individual practice, and the number of farmers who were applying each in his land. (Table 27).

Table 27
Percentage Distribution of Farmers Applying Individual Agricultural Practices

Guayanés Watershed, Puerto Rico, 1968

Practice	Lowland n= 29	Highland n=161
1- Use of commercial fertilizers	95.4	96.2
2- Use of organic fertilizer	41.7	12.4
3- Use of insecticides	76.1	52.7
4- Use of fungicides	14.3	2.5
5- Use of soil analysis	32.0	33.1
6- Use of lime	40.0	35.6
7- Contour ditching	44.4	38.6
8- Contour planting	44.4	29.9
9- Construction of vegetative barriers	0.0	10.0
10- Construction of mechanical barriers	14.3	22.7
11- Drainage protection	80.0	83.8
12- Construction of deviation ditches	75.0	35.0
13- Planting forest trees	15.3	35.0
14- Planting improved pastures	69.2	70.6
15- Practicing crop rotation	80.0	94.8

Table 27 (cont.)

Practice	Lowland 29	Highland 161
16- Use of crop residues	88.2	86.9
17- Construction of artificial lakes	0.0	0.0
18- Rotation of pasture	68.0	79.6
19- Keeping farm accounts	33.3	6.5
20- Preparing a soil conservation plan	11.5	28.3
21- Use of recommended livestock breeds	46.1	19.0
22- Vaccinating livestock	69.8	35.4
23- Use of commercial feeds feeds for livestock	46.1	19.0
24- Control of parasites in livestock	96.1	91.1
25- Providing replacements for livestock	88.8	74.2
26- Using artificial insemination	0.0	1.0
27- Keeping farm livestock records	23.1	1.2
28- Using veterinary services	53.9	21.2

The control of parasites (96.1); the use of fertilizer (95.4); the replacement of livestock (88.8), and the use of crop residues (88.2 per-cent) for fertilization purposes were the four practices applied by the majority of the farmers in the lowlands. On the other hand, relatively few of these farmers used mechanical barriers, or prepared a soil conservation plan. None used artificial insemination, built vegetative barriers or constructed artificial lakes. It is very possible that some of the latter practices were of no great urgency in the lowlands because of soil topography, even though, under certain circumstances, they could be valuable.

On the other hand, a large proportion of the farmers from the highlands used fertilizers, crop rotation, crop residues and control of parasites, yet few farmers used vegetative barriers, had artificial lakes, used improved livestock breeds, fed commercial feeds to their livestock, or kept farm accounting.

Soil and water conservation is of particular importance in the area studied, especially in the highlands. The information gleaned tends to show that much needs to be done in this respect.

4. Agricultural Equipment on Farms

The use of certain farm equipment by farmers anywhere is conditioned by a series of factors such as soil topography, farming type, economic status of the farmer and availability of rented equipment. In the areas under study the first three factors--topography, farming type, and economic status of farmers sharply differentiated for both highland and lowland areas. The ownership of more expensive and sophisticated farm machinery such as tractors, disk plows, and grass

cutters was practically confined to farmers in the lowlands, although the proportion who owned such equipment was not high (Table 28). The ownership of ox-carts by some farmers may attract the reader's attention, but by and large this type of equipment is rapidly disappearing in Puerto Rico. However, ox-carts are still used in some sugar-cane areas as auxiliary equipment with the use of other machinery. Some farmers owned tabacco-sewing machines, but as could be expected these machines were limited to the highlands where tobacco is cultivated. This type of equipment is, however, quite costly, and its use is not widespread.

The jeep is very popular on farms in Puerto Rico. It is not surprising that one out of every twelve farmers in the highlands and one out of every six farmers in the lowlands, owned this type of equipment.

Table 28. Percentage Distribution of Farmers According to Ownership of Farm Equipment Guayanés River Watershed, Puerto Rico, 1968

Kind of Equipment	Highland n=161		Lowland n=29		All n=190	
	Percentage of Ownership	Num. of Items	Percentage of Ownership	Num. of Items	Percentage of Ownership	Num. of Items
Caterpillars	0.0	0	10.3	10	1.6	10
Other types of tractors	0.0	0	13.9	12	2.1	12
Disk plows	0.0	0	10.4	3	1.6	3
Other types of plows	9.9	16	3.5	2	8.7	18
Ox-carts	1.2	3	20.7	17	4.3	20
Jeeps	8.1	13	17.3	5	9.5	18
Trucks	4.4	7	6.9	3	4.7	10
Grass cutters	0.0	0	3.5	1	0.5	1
Tobacco sewing machine	1.9	3	0.0	0	1.6	3
Rackers	0.6	1	6.9	2	1.6	3
Sprayers	18.6	30	27.0	16	19.5	46

Table 29. Percentage Distribution of Farmers According to Ownership of Farm Buildings Guayanes River Watershed, Puerto Rico, 1968

Kind of Building	Highland n=161		Lowland n=29		All n=90	
	Percentage Possessing	Num. of Bldg.	Percentage Possessing	Num. of Bldg.	Percentage Possessing	Num. of Bldg.
Tabacco Barns	15.6	33	0.0	0	13.1	33
Livestock Barns	2.0	3	14.0	4	3.6	7
Poultry Pens	21.7	42	31.0	9	23.1	51
Storehouses	7.8	16	27.0	10	10.5	26
Water Tanks	20.0	38	14.0	5	18.9	43
Hurricane Shelters	24.8	46	10.0	3	22.6	49

5. Farm Buildings in the Area

The use and ownership of farm buildings, similar to farm equipment, is influenced by various factors. In the the lowlands poultry pens, storehouses, and livestock barns were the most common farm buildings, whereas in the highlands in addition to these, tobacco barns and hurricane shelters were also common. There were no tobacco barns in the lowland (Table 29) and only 3 farmers out of 29 had hurricane shelters. In the highlands these shelters are used as a protection against the powerful winds occasioned by hurricanes, because usually the highland houses are not built as sturdily as those in the lowlands.

The prevalent use of water tanks in the area may be an index of the scarcity of water. Twenty pecent of the farmers in the highland, and 14 percent in the

lowlands owned such tanks (Table 29). However, it was explained that the tanks were without water most of the time because of the prolonged droughts in the area.

In general it was found that the upkeep or maintenance of farm building were of a higher standard in the lowlands than in the highland area.

V. RESPONSE OF THE COMMUNITY TO THE WATERSHED PROJECT

The main purpose of the Guayanes Watershed Project, as already indicated was to develop the area economically, socially and recreationally. One of the chief concerns of the people of the area was the frequent floods of the Guayanés and Limones rivers. The floods not only caused great economic loss of livestock and plantations in the lowlands but also threathened the lives of the residents. In the highlands people faced serious erosion problems which decreased soil fertility and brought about additional changes that negatively affect the agriculture of the region.

As the control of floods was one of the main objectives of the project, it could , therefore, be expected then, that the people in the lowlands would be more interested in and, possibly accrue greater benefit from such activity. The farmers in the highland, on the other hand, were expected to apply certain conservation practices so that soil sedimentation in the lowland could be reduced to a minimum, thus assuring to a great extent the success of the whole project. Consequently, it could be expected that people from both sectors should be consulted by the planners and decision makers of the project.

1. Informatimation about the Project

Ninety seven percent of the informants indicated that they were in possession of some information on the project at the time of the interview. (Table 30). Both sectors were similar in this respect. Apparently the planners of the project had succeeded in informing the people about the activity. The main sources of information were personal contacts, mainly from the promoters of the project and neighbors (Table 31). Mass media such as radio, leaflets, and the press, in that order, were used but in a significantly lesser degree. When comparing both sectors, it was found that information from the promoters was used more or less to the same extent by both lowlanders and highlanders. While sources such as neighbors, radios and leaflets were used to a greater proportion among highlanders the press, however, was used more intensively by residents in the lowlands, who, were a more literature group.

Table 30: Percentage Distribution of Informers According to Whether or Not They Had Heard About the Watershed Project, Guayanes River Watershed, Puerto Rico, 1968.

Heard	Lowland n=29	Highland n=161	Total n=190
Yes	96.6	97.5	97.4
No	3.4	2.5	2.6
Total	100.0	100.0	100.0

The data of Table 31 once more confirms the hypothesis that the highland is a more traditional community type of sector as indicated by the differential use of neighbors and the press as sources of information.

Table 31: Percentage Distribution of Informers According to Use of Sources of Information About the Project, Guayanés River Watershed, Puerto Rico, 1968.

Heard	Lowland n=28	Highland n=160	Total n=188
Press	14.3	0.0	2.1
Radio	0.0	3.7	3.2
A neighbor	25.0	34.5	33.0
An officer	50.0	53.1	52.8
Leaflet	0.0	2.1	2.1
Other	10.7	6.2	6.8
Total	100.0	100.0	100.0

2. Attendance of Residents to Meetings

In spite of the high proportion of people who claimed to be informed about the project, attendance at the ten meetings already held dealing with the matter was below the expected level. (Table 32). For the total population, around 70 percent reported not having attended any meetings at all, 14.2 percent attended only one meeting, 12.6 percent attended two or three, and around 4 percent attended four or more meetings. Proportionately, attendance was higher by the lowlanders. It

should be noted, however, that most of the meetings were held in the Yabucoa urban area which may have facilitated the attendance to meetings by the lowlands residents. This fact tends to emphasize the fact that more importance be given in choosing a suitable place where meetings are held in order to facilitate a more representative attendance by the residents.

Table 32. Percentage Distribution of Heads of Household According to Their Attendance to Meetings Related to the Project, Guayanés River Watershed, Puerto Rico, 1968'.

Number of Meetings Attended	Lowland n=29	Highland n=171	Total n=190
None	55.2	72.0	69.5
1	20.7	13.0	14.2
2 - 3	17.2	11.8	12.6
4 or more	6.9	3.2	3.7
Total	100.0	100.0	100.0

In addition to the fact that most families reported not having attended any meetings, those who claimed attendance had very little or no participation at all in such meetings, as shown in Table 33: they were mainly spectators.

From a theoretical point of view, if people are not personally and actively involved in the planning stages of a project they may tend to keep away and their response in general may not be the best for the success of the activity. Action must be taken by the project officers to ensure people's participation, especially

among residents from the highlands.

Table 33: Percentage Distribution of Heads of Household According to Their Roles in Project Meetings, Guayanés River Watershed, Puerto Rico 1968.

Role	Lowland n=13	Highland n=46	Total n= 59
Expectator	84.6	93.6	91.5
Presided	0.0	0.0	0.0
Committee Member	7,7	4.3	5.0
Made suggestions	7.7	2.1	3.5
Total	100.0	100.0	100.0

3. Attitudes and Opinions about the Project

Attitudes and opinions of the people toward the project are influenced by the extent and type of knowledge provided. As was previously indicated 97.4 percent of the farmers expressed having had some knowledge about the project, and 30 percent reported having attended meetings, mainly as spectators. However, Table 34 indicates that almost 60 percent of the respondents did not know the main purpose of the project, that is, protection from floods. This situation was more pronounced in the highland sector where only 33.9 percent knew of the main purpose, whereas 82.7 percent of the lowland residents answered correctly.

This sharp difference between the two sectors suggests that more emphasis

should be given to educational orientation for residents in the highland areas.

Table 34: Percentage Distribution of Families According to Their Understanding of the Main Purpose of the Project, Guayanés River Watershed, Puerto Rico, 1968.

Main Purpose as Understood	Lowland n=29	Highland n= 159	Total n=188
Does not know	13.8	33.0	30.2
To provide electricity	0.0	0.0	0.0
Land irrigation	0.0	10.0	8.4
To protect land and people from flooding damages	82.7	33.9	41.3
Tourism	0.0	2.5	2.1
Other	3.5	20.6	18.0
Total	100.0	100.0	100.0

The opinion of residents as to who they thought would benefit most from the project is shown in Table 35. Around one-third (1/3) expressed the opinion that all residents would accrue some benefit. However, no major difference was observed between residents from either areas. Around one-third (1/3) also expressed the feeling that lowlanders would benefit more . It is interesting to note that people from the highlands expressed this sentiment in a higher proportion than those from the lowlands 39 and 28 percent, respectively. Very few thought that people from the highland would be benefited. This fact should be considered

by the project planners in any future educational orientation regarding the project.

Table 35: Percentage Distribution of Heads of Household According to Their Opinions on Who Would Benefit more by the Project, Guayanes River Watershed, Puerto Rico, 1968.

To be Most Benefited	Lowland n=29	Highland n= 161	Total n=190
Everybody	34.5	37.9	37.4
People in lowland	27.6	39.1	37.4
People in highland	0.0	3.1	2.6
Indefinite	24.1	6.2	9.0
Nobody	0.0	.6	.5
Don't know	13.8	13.1	13.1
Total	100.0	100.0	100.0

The general opinion of the respondents on the project is shown in Table 36. Eighty percent considered the project to be good or excellent while 12.6 pecent expressed no opinion, 17.3 percent in the lowlands, and 11.8 percent in the highlands. It seems contradictory that a higher proportion of residents from the lowlands (10.3 percent) than from the highlands (0.67 percent) should have expressed a negative opinion about the project. In general, however, the opinion that the project was not desirable was held by only 2 percent of the population.

Exploring a little further the attitudes and opinions of the people toward the project, a question was asked as to their willingness to become involved in it by participating in a commission or committee for its development. Eighty-one percent of the interviewers answered in the affirmative. Willingness to participate was higher in the highlands (86.2 percent) than in the lowlands (55.2 percent).

Table 36: Percentage Distribution of Heads of Household According to Their Opinions on the Project, Guayanés River Watershed, Puerto Rico, 1968.

Opinion	Lowland n=29	Highland n=161	Total n=190
Has no opinion	17.3	11.8	12.6
Project is bad	10.3	.67	2.1
Project is fair	0.0	6.9	5.8
Project is good	48.3	73.9	70.0
Project is excellent	24.1	6.8	9.5
Total	100.0	100.0	100.0

The main reasons given for participation on any committee for the initiation of the project, were that they considered the project very useful for them (76 percent), that they could hasten its initiation (11 percent), and that they would be better informed, about the aims of the project (11 percent). On the other hand, those who indicated that they were not interested in participation on a committee (19 percent) gave as their reasons lack of time (23 percent), little know

ledge about the project, that they lacked the adequate academic preparation, and that the project would be of benefit to only a segment of the population. However, when questioned on their reaction to the possibility of discontinuing the project, fifty-eight percent reacted strongly against that possibility:59 percent from the highlands, and 48 percent from the lowlands.

The image that each sector has of the other is also considered important in the introduction of any idea which requires the combined efforts of both groups to ensure its subsequent success. In the watershed most of the flooding controls, including the structures, would be located in the lowlands, this may result in the expropriation of land from several residents. On the other hand, most of the soil conservation innovations would be undertaken by the highland residents. Thus, the extent to which each sector would comply with what was expected from them is of crucial interest for the project planners. Their image of their counterparts may influence this collaboration. When asked whether or not they considered the residents of the other sector as part of their own community, 86.3 percent of the residents from the highlands envisaged the residents of the lowland as members of the their own community. Similarly, 93.1 percent of the people from the lowlands considered the highlanders to be part of their community. (Table 37). The high proportion of residents replying in the affirmative may again reflect a high community solidarity.

Table 37: Percentage Distribution of Heads of Household According to the Communal Feeling of the Highland Toward the Lowland and Vice-Versa, Guayanés River Watershed, Puerto Rico, 1968.

Feeling	Highland n= 161	Lowland n=29
Are Considered a Part	86.3	93.1
Are not Considered a Part	13.1	6.9
No opinion	0.6	
Total	100.0	100.0

When residents from each sector were asked if they considered their counterpart to be concerned about the problems of the other sector, half of the highlanders stated that the lowlanders were slightly interested, around 42 percent that they were somewhat interested, and only around 5 percent that they were very interested in the problems of the highlands. (Table 38). The lowlanders expressed a similar feeling-more than two-fifths thought that the highlanders were not very concerned about the problems of the lowlands, 38 percent were somewhat interested, and 17 percent expressed the feeling that the highlanders had great interest. In general, the lowlanders had a little more favorable view of this matter than the highlanders, even though in both cases it was the feeling that each sector was not unduly concerned about the problems of the other.

Table 38: Percentage Distribution of Heads of Household According to Degree of Concern of Highland on Problems of the Lowland, and Vice-Versa, Guayanés River Watershed, Puerto Rico, 1968.

Degree of Concern	Lowland n=29	Highland n=161
Little	41.4	50.9
Some	37.9	41.6
Much	17.3	5.0
No opinion	3.4	2.5
Total	100.0	100.0

The extent to which the residents from one sector feels that his counterpart could contribute in solving the problems of the other sector, is also important in the implementation of an idea or project that requires the combined efforts of both sectors for its success. On this matter 69 percent of the lowlanders and 64 percent of the highlanders indicated that their counterparts could help in solving their respective problems. (Table 39) Thirty one-percent of the lowlanders, and 35 percent of highlanders thought otherwise.

Table 39: Percentage Distribution of Heads of Household According to their Opinion on Contribution for the Solution of Problems Faced By The Highland and the Lowland, Guayanés River Watershed, Puerto Rico, 1968.

Opinion	Lowland n=29	Highland n=161
Can Contribute	69.0	64.0
Can't Contribute	31.0	35.4
No opinion		0.6
Total	100.0	100.0

When asked what each sector thought would be their best contribution to solve the problems of the other sector, nearly 40 percent expressed no opinion (Table 40). Of those who did express an opinion, 24.1 percent of the lowlanders thought that they could offer orientation on various problems, while only 19.3 percent of the highlanders shared that feeling. Mutual assistance was expressed by 19.2 percent of the highlanders as compared to 10.4 percent of the lowlanders. Residents of the lowland sector -13.8 percent- felt that highlanders could provide labor, while only 3.1 percent of the highlanders were expecting such contributions from the lowlanders. The sale of products in the lowlands was expressed by 3.7 of the highlanders, while no one in the lowlands expected similar cooperation.

Apparently there was some concern about the way in which the project was being administered, mainly among residents from the lowland sector. Seven out of

29 respondents in the lowlands, expressed the feeling that "good administration" was essential for the success of the project, however, only seven from the highlands, expressed any such concern. (Table 41).

Table 40: Percentage Distribution of Heads of Household According to the Kind of Contribution the Lowland Residents can Provide the Highland Residents and Vice-Versa, Guayanés River Watershed, Puerto Rico, 1968.

Kind of Contribution	Lowland n=29	Highland n=161	All
Provide manual labor	13.8	3.1	4.7
Provide economic help	17.3	15.5	15.8
Sale of products	0.0	3.7	3.2
Provide orientation	24.1	19.3	20.0
Provide assistance	10.3	19.3	17.9
No opinion	34.5	39.1	38.4
Total	100.0	100.0	100.0

Sixteen percent of the highland residents, and 30 percent of those from the lowlands expressed the opinion that the project should be started immediately, on the other hand only 25 percent from the highlands and 10.4 percent from the lowlands expressed their desire for its discontinuance. The desire for an early start of the project may be reflected in the suggestions that more employment and improved water facilities would be provided to the residents of the area. As could be expected a higher proportion of the highlanders made such suggestions:

27 percent to 7.0 percent in the highlands and the lowlands respectively clamoured for more employment while 19 percent in the highlands and 7 percent in the lowland for satisfactory water supplies. Two other suggestions made by some families dealt with seeding fishes in the lake, and providing more information on the project.

Table 41: Percentage Distribution of Heads of Household According to the Kind of Suggestion Made to the Administration Regarding the Development of the Project, Guayanés River Watershed, Puerto Rico, 1968.

Suggestion	Lowland n=29	Highland n=161
1- Project should be accelerated	31.0	18.6
2- Provide more employment and help to community	6.9	26.1
3- Provide help to others	3.5	1.9
4- Provide water	6.9	19.9
5- Seed fish	3.5	0.6
6- Provide good administration	24.1	6.8
7- Discontinue the project	10.4	2.5
8- Provide more information (innovation)	0.0	0.6
9- No comments	13.7	23.0
Total	100.0	100.0

In conclusion, the reaction of residents in the area, who would be affected by the watershed project, is of prime importance. How the community feels, and what knowledge they possess, are important concerns of any institution which intends to introduce a new idea or modified innovation. Any innovation will, in some way, affect the lives of the people. The extent to which people know and understand a change is indicative in the way they react favorably or unfavorably toward such a change. People tend to reject any change which they consider may threaten their security, or which they do not understand, or which just does not correspond to their system of values. In the case of the watershed it may be concluded that, in general, people were in favour of the development of the project. However, the future of the watershed project in the area was very uncertain at the date of the termination of the study. In fact, press releases have indicated that for the present, plans for the project were definitely shelved by the authorities concerned.

VI. SUMMARY OF MAIN FINDINGS AND FORMULATION OF RECOMMENDATIONS

The summary of this study attempts to present the main findings on human factors involved in the development of the Guayanés River Watershed Project in the southeastern part of Puerto Rico, in the municipality of Yabucoa. A 30% sample out of a population of 632 families was studied. Most of the information was gathered by means of personal interviews, although some secondary sources were also used.

SUMMARY OF FINDINGS

A- Characteristics of the Residents of the Guayanés River Watershed Project Area

1. In keeping with patterns of Puerto Rican culture, the man was the head of the household in 98 percent of the families, and 86 percent of the couples were legally married.
2. The main occupation of the head of the family in 58% of the cases was farming, followed by commerce and skilled labour.
3. The heads of households were a mature group with an average age of 54 years. In the lowland sector, however, the proportion who were 50 years or over, was higher than in the highlands, 83 percent in the lowlands and 51 percent in the highlands.
4. Housewives, on an average, were eight years younger than the head of the household. Sixty-four percent in the highlands could be considered in the reproductive age, as compared to 37% in the lowland sector.
5. The average formal education of the household head was close to functional illiteracy, with an average schooling of 5.99 years. The average for the highland was still lower with 3.1 years as compared to 6.1 for the lowland. The situation was correspondingly similar for the housewife.
6. The average size of the household was above that for the island as a whole 6.65 to 5.2; the average for the lowlands was 3.97 as compared to 7.13 for the highlands.
7. The stability of the occupational structure of the area was reflected in the fact that residents of the lowlands had been engaged on an average

of 30.9 years, and those of the highlands for 27.8 years in the same occupation.

8. In general, farming was considered to be a declining occupation, seventy-two percent indicated that farming was declining, 19 percent that its future was uncertain, while only 9 percent felt that its future was promising.

9. The trend in farming as a main occupation in the highlands was as follows: 94 percent of the respondents considered their fathers as farmers; only 60% considered themselves as such and 52% were planning for, or considered their sons farmers. The trend for the lowland also followed the similar declining pattern.

10. In general, parents preferred professional or semi-professional occupations for the sons and daughters.

11. Over one-fifth of the families reported having some member of the family living in the United States or having visited U.S. at least once in their lifetime. Seventeen percent of the families reported having or having had some member in the army.

12. Residents from the highlands were more fatalistic than their counterparts from the lowlands.

B- Characteristics of the Community

1. The Guayanés River Watershed Area can be described as a highly cohesive community with a deep feeling of solidarity as reflected by the

following factors:

a) People had resided in the community for an average of 27 years and very few (only 18%) were planning to leave the community denoting characteristics of a highly stable population;

b) All services in the community (church, stores, etc.) were patronized by more than 60 percent of the inhabitants of the area, and;

c) Most relatives and close friends of the head of the household and his wife lived within the limits of the community.

2. Conditions of living of the families were 30 percent higher in the lowland sector than in the highlands as reflected by an index score of 37.6 out of 42 for the former and 28.9 out of 42 for the latter. Families in the lowlands ranked systematically higher in all the 14 specific items submitted for consideration by both sectors.

3. Water appeared to be a serious problem in the area, specifically among the highland residents. The great distance that people had to travel to get water, and the lack of aqueducts and of high water pressure, were expressed as some of the problems affecting many families in the highlands.

4. Lack of adequate transportation was also considered to be a serious problem in the highland sector, where around 70 percent expressed having no means of transportation.

5. Home ownership was rather high in both sectors: around 97 percent of the families owned their homes. Home conditions, however, were of

a higher-standard in the lowlands than in the highlands.

6. Food consumption of the families from both sectors varied somewhat as noted in the food products consumed the day previous to the interview. The highland farmers tended to consume greater quantities of native starchy products, as contrasted with the higher consumption of protein foods by lowland residents. On the other hand, families from the highlands consumed a higher proportion of the produce they cultivated on their farms.

C- Characteristics of the Agriculture in the Area

1. Sugar cane and livestock were the two main cash crops of the lowland sector while food crops and tobacco were important enterprises in the highlands.

2. Most of the farming activity was undertaken on land owned by the residents of the area -97 percent of the families in the lowland and 88 percent in the highlands- owned their land.

3. In spite of the variation in the type of agriculture in the two sectors, no significant difference was detected in the technological level at which they operated. This level was relatively low in both sectors: aproximately 11 points out of 28.

4. The two agricultural practices utilized by more than 90 percent of all farmers were the use of commercial fertilizers and the control of parasites in livestock. On the other hand, none, or very few farmers had artificial lakes or used artificial insemination.

D- Attitudes of Residents to the Watershed Project

1. Taking into consideration the fact that over 97 percent of the people were informed about the project, actual involvement in it was relatively low-around 70 percent, had not attended any meetings; of those who had attended around 90 percent had done so in a passive role, as spectators. The main purpose of the project was correctly understood by 34 percent of the highland residents, as compared with 82 percent of those from the lowlands.

2. Most of the residents in the area acquired information about the project from radios or public officials, only the residents from the lowlands used the press as a source of information.

3. In general the attitude toward the project was favorable as reflected by the fact that more than 70 percent considered the project good or excellent and many expressed a desire for the continuation of the activity.

4. People from each sector showed much concern for the others' problems, and felt that they could do something to alleviate such problems.

RECOMMENDATIONS

As previously emphasized, the general purpose of the study was to establish a series of criteria which could be used at a later stage to measure or evaluate the success of the Guayanés River Watershed Project in bringing about desirable changes in the lives of the people of the community who would be affected by such innovation. It is the opinion of the investigators that the study provides many benchmarks which

have been conveniently quantified and which could be profitably used for measuring the degree of change engendered, not only by the watershed project, if it is finally developed, but by any other action program which is undertaken in the area studied. It is therefore, necessary, that the results of this study be made available to all interested parties so that they can plan their program in specific ways to accomodate the degree of change as it occurs.