ABSTRACT

SURVIVAL GEOGRAPHY OF
TROPICAL SOUTH AMERICA

BY MARTIN E. MCGUIRE

IN RECENT YEARS ESPECIALLY SINCE WORLD WAR II ANTHROPOLOGY HAS BEEN CALLED UPON TO CONTRIBUTE AN INCREASING RANGE OF SERVICES TO PUBLIC AND PRIVATE INTERESTS REFLECTING THE EMERGENCE OF THE UNITED STATES IN GLOBAL AFFAIRS. ANTHROPOLOGISTS HAVE CONDUCTED A NUMBER OF SUCH STUDIES FOR THE ARTIC, DESERT, TROPIC INFORMATION CENTER OF THE AEROSPACE INSTITUTE OF THE UNITED STATES AIR FORCE. THE PURPOSE OF THESE STUDIES IS TO PROVIDE MEMBERS OF THE ARMED FORCES WITH ALL POSSIBLE KNOWLEDGE ABOUT THE GEOGRAPHIC AREAS IN WHICH THEY MUST OPERATE TO HELP THEM SURVIVE UNDER THOSE CONDITIONS WHERE THEY DO NOT HAVE NORMAL LOGISTICAL SUPPORT.

THIS STUDY IS CONCERNED WITH THE TROPICAL ENVIRONMENTS OF SOUTH AMERICA AND INCLUDE THE FORESTS, THE SAVANNAS, AND THE DESERTS TREATING EACH AS A SEPARATE ENVIRONMENT. ESSENTIAL TO SURVIVAL IN THESE ENVIRONMENTS ARE:

1. THE PHYSIOLOGICAL EFFECTS OF THE ENVIRONMENT UPON THE INDIVIDUAL AND THE EXTENT TO WHICH THEY PRODUCE PHYSICAL AND PSYCHOLOGICAL STRESS,

2. THE TOPOGRAPHIC CONDITIONS EFFECTING TRAVEL AND DURATION OF THE SURVIVAL SITUATION, AND

3. THE ECOLOGICAL ASPECTS OF THE ENVIRONMENT RELATING TO SOURCES OF FOOD, NATURAL MATERIALS FOR THE MANUFACTURE OF TOOLS AND OTHER IMPLEMENTS ESSENTIAL TO THE EMPLOYMENT OF SURVIVAL TECHNIQUES, AND THE DISTRIBUTION AND USE OF AREAS OF HUMAN HABITATION.

IN REVIEWING THE CONTENT OF THIS STUDY FOR ITS ANTHROPOLOGICAL SIGNIFICANCE, SEVERAL FACTORS ARE TO BE CONSIDERED. THE STUDY IS SEEN AS AN APPLIED ANTHROPOLOGICAL UNDERTAKING IN WHICH NECESSARY DATA IS CONSIDERED AS BEING CONSISTENT WITH ANTHROPOLOGICAL METHODS AS THEY RELATE TO THE SPECIAL INTERESTS AND FIELD EXPERIENCES OF ANTHROPOLOGISTS. THE NEEDS OF THE DATA ARE RELATED TO THE BEHAVIOR OF INDIVIDUALS OR GROUPS OF INDIVIDUALS UNDER STRESSFUL CONDITIONS GROWING OUT OF UNFAMILIAR ENVIRONMENTAL AND SOCIAL SITUATIONS. AS DIFFERENT FROM ACADEMIC PROBLEMS THE SITUATIONS FOR WHICH THE DATA ARE PRESENTED CONSTITUTE REAL-LIFE BEHAVIOR WITH THE SURVIVAL OF THE INDIVIDUAL AT STAKE. THE GEOGRAPHIC AREA IS ONE OF RELATIVE REMOTENESS IN WHICH MUCH OF THE AVAILABLE INFORMATION HAS COME FROM THE FIELD WORK OF ANTHROPOLOGISTS IN THE STUDY OF THE INDIANS OF SOUTH AMERICA. IT IS FROM SUCH SOURCES THAT DATA PERTAINING TO SUBSISTENCE ACTIVITIES AND SOCIAL BEHAVIOR ARE DERIVED AND EVALUATED IN TERMS OF A SURVIVAL SITUATION.

AS A CONCLUDING STATEMENT IT IS POINTED OUT THAT THE DATA ARE ORDERED IN A PARTICULAR WAY FOR A PARTICULAR PURPOSE. THEY COULD HAVE BEEN REORGANIZED IN SEVERAL DIFFERENT WAYS TO MEET ALTERNATIVE OBJECTIVES BY SHIFTING THE EMPHASIS AND RELATIONSHIP OF THE COMPONENTS COMPRISING THE DATA AND THE INCLUSION OF ADDITIONAL DATA OR MAKING EXPLICIT MUCH THAT IS IMPLIED HEREIN OR OMITTED AS BEING INAPPLICABLE TO THE PURPOSE OF THE STUDY.

APPROVED John D. Naughton
CHAIRMAN

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SURVIVAL GEOGRAPHY OF TROPICAL SOUTH AMERICA

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TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS	ii
INTRODUCTION	1

PART I. TROPICAL FORESTS OF SOUTH AMERICA

Chapter		
I.	THE PHYSICAL ENVIRONMENT	11
	Distribution	11
	Characteristics	12
	Tropical Deciduous Forests	17
	Transitional Zones of Forest Vegetation	19
	Climate	21
	Temperature and Humidity	21
	Rainfall	22
	Relief and Drainage	23
	Trafficability	32
	Land	32
	River	34
II.	REGIONAL TOPOGRAPHY	39
	Guiana Highlands	39
	Magdalena and Cauca River Valleys	44
	Atrato River Valley	48
	Lake Maracaibo Basin	49
	Orinoco Delta	51
III.	INDIANS OF THE TROPICAL FORESTS	54
	History and Distribution	54
	Dress and Ornamentation	57
	Subsistence Activities	58
	Agriculture	59
	Hunting	61
	Fishing	65
	Preparation of Food and Drink	67
	Forest Products and Manufactures	71
	Settlement Patterns	73

PAGE

Social and Political Organization 75
Religion, Magic, and Medicine 77
Contact with the Indians 83

IV. FOOD SOURCES 88

General 88
Insects 91
Mammals 95
Reptiles 101
Fish 103
Birds 104
Wild and Cultivated Plants 107

V. HEALTH AND HAZARDS 114

Tropical Diseases 114
Starvation 116
Heat and Thirst 118
Snakes 120
Arthropods: Insects and Arachnids 128
Diptera (Mosquitoes, Flies, etc.) 129
Arachnids (Spiders and Scorpions) 131
Hymenoptera (Bees, Wasps, and Ants) 132
Fish 134
Crocodillian: Caiman and Crocodiles 136
Mammals 139

VI. SUMMARY 143

PART II SAVANNAS OF SOUTH AMERICA

VII. THE PHYSICAL ENVIRONMENT 151

Distribution 151
Characteristics 152
Climate 153
Relief and Drainage 154
Biotic Factors 155
Savanna Vegetation 159
Fauna 169

VIII. REGIONAL DESCRIPTION 178

The Llanos of Venezuela and Colombia 178
Distribution 178
Relief and Drainage 178
Climate 187
Regional Travel and Destinations 188

PAGE

THE RUPUNUNI SAVANNAS 192
DISTRIBUTION 192
RELIEF AND DRAINAGE 193
CLIMATE 195
REGIONAL TRAVEL AND DESTINATIONS 195
THE CAMPOS OF BRAZIL 196
DISTRIBUTION 196
RELIEF AND DRAINAGE 197
CLIMATE 200
REGIONAL TRAVEL AND DESTINATIONS 201
THE GRAN CHACO 203
DISTRIBUTION 203
RELIEF AND DRAINAGE 204
CLIMATE 205
REGIONAL TRAVEL AND DESTINATIONS 206

IX. SURVIVAL FACTORS 207

GENERAL 207
INHABITANTS OF THE SAVANNAS 209
FOOD SOURCES 212
VEGETATION 212
ANIMALS 215
BIRDS 218
REPTILES 225
RIVER ANIMALS 225
INSECTS 227
HEALTH AND HAZARDS 228
TRAVEL AND NAVIGATION 232

X. SUMMARY 237

PART III DESERTS OF SOUTH AMERICA

XI. THE PHYSICAL ENVIRONMENT 242

DISTRIBUTION AND GENERAL DESCRIPTION 242
CLIMATE 245
PHYSICAL FACTORS 245
TEMPERATURES, PRECIPITATION AND HUMIDITY . . . 246
WINDS 248
FOG AND MIST 249
EL NINO 250
REGIONAL DESCRIPTION 251
THE DESERT REGION OF PERU 251
THE ATACAMA DESERT 256
DESERT VEGETATION 261

XII. DESERT CULTURE 264

HISTORY 264

PAGE

THE PEOPLE 266
SUBSISTENCE ACTIVITIES 269
DOMESTIC ANIMALS AND STOCKRAISING 273
HUNTING AND FISHING 275
FOOD AND DRINK 277
RELIGION 281
MEDICAL PRACTICES AND CURATIVES 283
SUMMARY OF SOCIAL ASPECTS 284

XIII. SURVIVAL FACTORS 286

TERRAIN 287
CLIMATE 289
WATER 289
FOOD 290
TRAVEL AND NAVIGATION 290

XIV. SUMMARY 295

XV. CONCLUSIONS 299

APPENDIX A 302

BIBLIOGRAPHY 308

INTRODUCTION

GROWING OUT OF THE ANTHROPOLOGICAL STUDIES FORMALIZED IN 1934 BY THE BUREAU OF INDIAN AFFAIRS, ANTHROPOLOGISTS HAVE BEEN CALLED UPON INCREASINGLY BY THE UNITED STATES GOVERNMENT BOTH IN CAREER POSITIONS OR ON A PART-TIME BASIS FOR SPECIFIC TASKS FOR WHICH THE ANTHROPOLOGIST IS SINGULARLY QUALIFIED. WITH THE ADVENT OF WORLD WAR II THE UNITED STATES WAS SUDDENLY CONFRONTED WITH THE PROBLEM OF TRANSITION FROM A POSITION OF RELATIVE ISOLATIONISM TO ONE OF WORLD-WIDE INVOLVEMENT. THERE WAS A MOST SERIOUS LACK OF INFORMATION IN STRATEGICALLY APPLICABLE FORM AVAILABLE ABOUT THE MANY LANDS AND PEOPLES HERETOFORE OF NEITHER POLITICAL OR ECONOMIC INTEREST. EVEN MORE SERIOUS WAS THE LACK OF A PLANNED APPROACH TO THE DEVELOPMENT OF SOURCES OF INFORMATION TOGETHER WITH EVALUATIVE PROCEDURES FOR VALIDATING INFORMATION AFTER SOURCES HAD BEEN ESTABLISHED. IT WAS UNDER THESE CONDITIONS THAT THE EXPERIENCES OF THE ANTHROPOLOGISTS BECAME OF SIGNIFICANT STRATEGIC VALUE. KENNARD AND MACGREGOR IN ANTHROPOLOGY TODAY (PAGE 836) COMMENTING UPON THIS ASPECT OF THE ANTHROPOLOGIST'S SERVICES STATE ". . . USUALLY IN COLLABORATION WITH OTHER SOCIAL SCIENTISTS, THEY WERE CALLED UPON TO CONTRIBUTE EITHER SPECIAL KNOWLEDGE OF THE CULTURE OR AREAS THAT HAD LONG BEEN THE PRIMARY FIELDS OF ANTHROPOLOGICAL INVESTIGATION OR THE THEORETICAL BASIS FOR HANDLING PROBLEMS DEALING WITH PEOPLE OF OTHER CULTURES."

SINCE THE WAR THE DEMANDS HAVE INCREASED BOTH IN NUMBERS OF

INDIVIDUALS AS WELL AS IN THE RANGE OF CONTRIBUTIONS. IN HER PAPER "ANTHROPOLOGISTS IN THE FEDERAL GOVERNMENT" IN HUMAN ORGANIZATIONS (PAGE 36), MARGARET LANTIS CONCLUDES THAT THERE WERE 175 ANTHROPOLOGISTS EMPLOYED FULL-TIME BY THE FEDERAL GOVERNMENT IN 1958. SIGNIFICANTLY THIS DID NOT INCLUDE INDIVIDUALS WORKING BY CONTRACT SUCH AS THAT GOVERNING THE FUNDING AND OBJECTIVES OF THIS STUDY. LANTIS FURTHER POINTED OUT THAT IN SPECIFIC REGIONS FIELD-EXPERIENCE, "DOWN-TO-EARTH" KNOWLEDGE, AS WELL AS BOOK KNOWLEDGE OF AN AREA MADE THE ANTHROPOLOGIST PREEMINENTLY QUALIFIED FOR SPECIFIC TASKS. FROM ANSWERS TO QUESTIONNAIRES AND COMMENTS GIVEN BY TEN MATURE ANTHROPOLOGISTS IN THE FEDERAL GOVERNMENT, LANTIS MAKES THE FOLLOWING CONCLUSIONS AS TO GRADUATE STUDENT NEEDS:

> A) BETTER TRAINING IN SUCH SPECIALTIES OF METHODOLOGY AS STATISTICS AND THE TECHNIQUES OF GEOGRAPHY . . . B) SUBJECT SPECIALTY SUCH AS CHILD DEVELOPMENT, NUTRITION, HISTORICAL RECONSTRUCTION, OR PHYSIOLOGY (SINCE IN THE IMMEDIATE FUTURE THEY ARE MORE LIKELY TO BE HIRED FOR THESE THAN THEIR BASIC TRAINING IN CULTURAL OR PHYSICAL ANTHROPOLOGY), AND C) A BETTER UNDERSTANDING OF MODERN UNITED STATES CULTURE. (PAGE 41)

IN A SIMILAR VEIN, LAURA THOMPSON IN THE JUNE 1944 ISSUE OF APPLIED ANTHROPOLOGY (PAGE 13) STATES:

> THE WORK WHICH THE GOVERNMENT ADMINISTRATOR EXPECTS FROM THE ANTHROPOLOGISTS OFTEN IMPLIES NOT ONLY THE USUAL ROUTINES OF FACT GATHERING; OF EXPLAINING BEHAVIOR, INSTITUTIONS AND SENTIMENT PATTERNS OF ONE GROUP TO ANOTHER; OF EASING INTER-PERSONAL OR INTER-GROUP RELATIONS--IN SHORT, OF 'TROUBLE SHOOTING.' IT IMPLIES THE EXPLORATION AND SYSTEMATIZATION OF A NEW FIELD. THIS FIELD IMPINGES ON SEVERAL DISCIPLINES INCLUDING ANTHROPOLOGY, SOCIOLOGY, PSYCHIATRY, SEMANTICS, ECOLOGY, EDUCATION, AND GOVERNMENT ADMINISTRATION . . . . . THE GOVERNMENT ADMINISTRATOR IS BASICALLY CONCERNED WITH THE WHOLE OF HUMAN LIFE IN ITS MANIFOLD MANIFESTATIONS. HE WORKS WITH PEOPLE IN RELATION TO EACH OTHER AND TO THE NATURAL RESOURCES . . . . HIS PROBLEMS ARE IMMEDIATE AND VITAL WITH HUMAN WELFARE AND HUMAN LIVES AT STAKE.

THE APPLIED ANTHROPOLOGIST IN ACCOMPLISHING A SPECIFIC TASK FOR A CLIENT MAY BE REQUIRED TO DELIVER A COMPLETED REPORT COVERING NOT ONLY

HIS OWN SPECIFICALLY ANTHROPOLOGICAL KNOWLEDGE BUT ALSO TO DEVELOP AND INCORPORATE IN THE REPORT DATA FROM OTHER FIELDS OF SCIENCE WHERE SPECIAL KNOWLEDGE IS NEEDED.

STATEMENT OF THE PROBLEM

THE ARTIC, DESERT, TROPIC INFORMATION CENTER OF THE AEROSPACE RESEARCH INSTITUTE, UNITED STATES AIR FORCE IS ENGAGED IN A CONTINUING EFFORT TO GATHER INFORMATION ABOUT ALL PARTS OF THE WORLD OVER WHICH ITS PERSONNEL MUST OPERATE. THE PURPOSE OF THIS INFORMATION IS TO PROVIDE MILITARY PERSONNEL WITH AVAILABLE KNOWLEDGE THAT WILL ENABLE THEM TO SURVIVE IN ANY GIVEN AREA WHERE THEY MIGHT BE FORCED DOWN. THE PROBLEM CONFRONTED HEREIN IS TO COLLECT AND EVALUATE AVAILABLE KNOWLEDGE CONTRIBUTING TO SURVIVAL OF THE INDIVIDUAL IN THE TROPICAL ENVIRONMENTS OF SOUTH AMERICA. THE PROBLEM CAN BE DIVIDED INTO TWO PARTS: (1) THE COLLECTION AND EVALUATION OF DATA ABOUT THE FORESTS, SAVANNAS, AND DESERTS OF TROPICAL SOUTH AMERICA, AND (2) THE PREPARATION OF A MANUAL FOR SURVIVAL BASED UPON THE DATA OBTAINED. ESSENTIAL TO THE DEVELOPMENT OF THE KNOWLEDGE PERTAINING TO SURVIVAL IS THE STUDY OF THE GEOGRAPHICAL REGIONS WITH REGARDS TO:

1. THE PHYSIOLOGICAL EFFECTS OF THE ENVIRONMENT UPON THE INDIVIDUAL AND THE EXTENT TO WHICH THEY PRODUCE PHYSICAL AND PSYCHOLOGICAL STRESS,
2. THE TOPOGRAPHIC CONDITIONS EFFECTING TRAVEL AND DURATION OF THE SURVIVAL SITUATION, AND
3. THE ECOLOGICAL ASPECTS OF THE ENVIRONMENT RELATING TO SOURCES OF FOOD, NATURAL MATERIALS FOR THE

MANUFACTURE OF TOOLS AND OTHER IMPLEMENTS ESSENTIAL TO THE EMPLOYMENT OF SURVIVAL TECHNIQUES, AND THE DISTRIBUTION AND USE OF AREAS OF HUMAN HABITATION.

THE RELATIONSHIP OF THE PROBLEM TO ANTHROPOLOGY

THE FOLLOWING PRESENTS THREE DIFFERENT ASPECTS OF THE STUDY WHICH ARE CONSIDERED BY THE AUTHOR AS RELATING DIRECTLY TO ANTHROPOLOGY:

1. THERE IS PRECEDENCE IN THE USE OF ANTHROPOLOGICAL METHODS AND KNOWLEDGE IN THIS PARTICULAR FIELD OF INQUIRY. THE ARTIC, DESERT, TROPIC INFORMATION CENTER HAS FOR A NUMBER OF YEARS FOUND IT EXPEDIENT AND DESIREABLE TO UTILIZE THE SERVICES OF ANTHROPOLOGISTS. THEIR METHODOLOGICAL APPROACH TO HUMAN BEHAVIOR AS WELL AS THEIR SPECIAL KNOWLEDGE OF GEOGRAPHICAL AREAS, RESOURCES, HUMAN ECOLOGY AND ETHNOLOGY HAS BEEN SPECIFICALLY APPLIED TO SURVIVAL STUDIES, TACTICAL PROBLEMS RELATING TO GEOGRAPHIC CONDITIONS AND SOCIAL PROBLEMS RELATING TO CONTACT SITUATIONS WITH INHABITANTS OF UNFAMILIAR GEOGRAPHIC AREAS TO WHICH NORTH AMERICAN PERSONNEL HAVE BEEN AND CONTINUE TO BE ASSIGNED FOR DUTY. THE NATURE OF THIS APPLIED ANTHROPOLOGY IS CITED IN <u>ANTHROPOLOGY IN THE ARMED FORCES</u>, EDITED BY LOUIS DUPREE, FORMERLY RESEARCH AND EDITORIAL SPECIALIST (ANTHROPOLOGY), ARTIC, DESERT, TROPIC INFORMATION CENTER.
2. THERE IS A COLLECTION OF SUBSTANTIALLY ANTHROPOLOGICAL DATA USED IN THE REPORT. WITH THE EXCEPTION OF THE EM-

PHASIS UPON THE DESCRIPTIVE DATA PERTAINING TO TOPOLOGY THE ORIENTATION OF THE STUDY IS THAT OF INDIVIDUAL (OR GROUP) UTILIZATION OF, AND ADAPTATION TO THE ENVIRONMENT. GERMANE TO THIS RELATIONSHIP IS THE CATALOGUING OF ANIMAL AND VEGETAL FOOD SOURCES AND MATERIALS UTILIZED BY THE INDIGENOUS POPULATIONS, METHODS OF PROCUREMENT, AND WHERE APPROPRIATE, METHODS OF UTILIZATION. IN ADDITION, ETHNOLOGICAL DATA RELEVANT TO CONTACT SITUATIONS ARE PRESENTED IN GENERALIZED FORM IN ORDER TO ALLOW FOR A RANGE OF POSSIBLE BEHAVIOR PATTERNS AND AT THE SAME TIME PREPARE THE INDIVIDUAL WITH A GENERAL GUIDE FOR HIS OWN BEHAVIOR.

A COMPARISON BETWEEN THE TABLE OF CONTENTS OF THIS STUDY AND THE TABLE OF CONTENTS OF THE OUTLINE OF CULTURAL MATERIALS OF THE HUMAN RELATIONS AREA FILES REFLECTS THE EXTENT TO WHICH THERE IS A CORRELATION BETWEEN THE DATA CONTAINED HEREIN AND THOSE IN THE HUMAN RELATIONS AREA FILES. OVER 170 ITEMS LISTED IN THE TABLE OF CONTENTS OF THE OUTLINE ARE SPECIFICALLY DISCUSSED IN THE BODY OF THIS STUDY. IT IS PERTINENT TO COMMENT HERE THAT THE HUMAN RELATIONS AREA FILES WERE UTILIZED AT THE INITIATION OF RESEARCH IN ASSESSING KINDS AND SOURCES OF DATA AVAILABLE.

3. THE ECOLOGICAL ASPECTS OF PRIMITIVE SOCIETIES HAS BECOME ALMOST CATEGORICALLY ONE OF THE PRIMARY CONCERNS OF ANTHROPOLOGY. AS A DIMENSION OF CULTURE DATA RELATING TO MAN'S TECHNOLOGICAL EXPLOITATION OF HIS ENVIRONMENT ARE

TREATED HISTORICALLY, ANALYTICALLY AND DESCRIPTIVELY. WHEN TREATED COMPARATIVELY THE DATA GENERALLY REFLECTS THE LEVELS OF TECHNOLOGICAL ADVANCE OF CERTAIN SOCIETIES BASED UPON A PARTICULAR SET OF CRITERIA. IMPLICITLY OR EXPLICITLY, INDIVIDUALS WITHIN THESE SOCIETIES ARE "ENCULTURATED" IN WAYS OF DERIVING THEIR SUBSISTENCE ACCORDING TO THE WAYS OF THE SOCIETY. CONSISTENT WITH THE THEORY OF SOCIAL LEARNING THE INDIVIDUAL LEARNS NOT ONLY HOW TO APPLY TECHNIQUES BUT ALSO TO WHAT MATERIALS AND PRODUCTS THE TECHNIQUES ARE APPLIED.

THE UNIQUENESS OF SURVIVAL STUDIES LIES IN THE RE-ORDERING OF THE DATA SO THAT THEY BECOME SITUATIONALLY MEANINGFUL. THE SITUATION INVOLVES THE PHYSICAL SURVIVAL OF AN INDIVIDUAL FROM AN ADVANCED TECHNOLOGICAL SOCIETY WHO HAS BEEN FORCED INTO A PRIMARY ENVIRONMENTAL RE-LATIONSHIP WITH MINIMAL OR NO MANUFACTURED TOOLS. IT IS ESSENTIALLY AN INCOMPATIBLE RELATIONSHIP IN THE INCIPIENT STAGES AND ULTIMATE SURVIVAL IS DIRECTLY RELATED TO SPEED AND DEGREE OF ADAPTABILITY OF THE INDIVIDUAL TO THE EN-FORCED PRIMITIVE LEVEL OF EXISTENCE.

THERE IS A CLOSE CORRESPONDENCE BETWEEN THE INDIGENOUS INDIAN TRIBES AND THEIR ENVIRONMENT AT THE SUBSISTENCE LEVEL. MAXIMUM UTILIZATION OF THE ENVIRONMENTAL RESOURCES USING PRIMITIVE TECHNOLOGY DEMANDS AN EMPIRICALLY THOROUGH KNOWLEDGE OF THE REGIONAL ECOLOGICAL RELATIONSHIP TOGETHER WITH THE MOST EFFICIENT USE OF THE TOOLS AND TECHNIQUES AVAILABLE. THIS EMPIRICAL KNOWLEDGE OF THE ENVIRONMENT

TOGETHER WITH TECHNIQUES OF EXPLOITATION HAVE BEEN STUDIED AND FROM THEM APPROPRIATE SURVIVAL DATA HAVE BEEN INCORPORATED INTO THIS STUDY.

4. IT REPRESENTS A TYPE OF OPPORTUNITY FOR SCHOLARS TO CARRY OUT FIELD RESEARCH IN ANTHROPOLOGY. TO QUOTE MARGARET LANTIS, "YOU WORK IN ANTHROPOLOGY WHEREVER YOU CAN"-- THE OPPORTUNITIES TO ENGAGE IN ANTHROPOLOGICAL RESEARCH IS OFTEN WHERE YOU FIND IT. THIS STUDY IS AN EXAMPLE OF THE FINANCIAL ASSISTANCE AFFORDED A GRADUATE STUDENT TO DO FIELD WORK. THE OPPORTUNITY AROSE THROUGH THE OFFICES OF A FACULTY ANTHROPOLOGIST WHO HAD HIMSELF CONTRIBUTED EXTENSIVELY TO SURVIVAL TECHNIQUES AND PUBLICATIONS FOR THE ARTIC, DESERT, TROPIC INFORMATION CENTER. SIGNIFICANTLY THIS FIELD WORK HAS PRESENTED THE WRITER WITH A DEGREE OF KNOWLEDGE ABOUT SOUTH AMERICA TO THE EXTENT THAT IT HAS BECOME, AND PROBABLY WILL CONTINUE TO BE, HIS MAJOR AREA OF INTEREST FOR PURPOSES OF PURSUING ANTHROPOLOGICAL STUDIES.

RESEARCH PROCEDURES

THIS STUDY WAS APPROACHED AS A RESEARCH PROJECT CONSISTING OF TWO PARTS: (1) THE COLLECTION, COLLATION AND EVALUATION OF PERTINENT DATA AVAILABLE IN THIS COUNTRY; AND (2) THE FIELD TESTING OF COLLECTED DATA THROUGH PERSONAL OBSERVATION, INTERVIEWS WITH KNOWLEDGEABLE INDIVIDUALS MEMBERS OF INVOLVED INSTITUTIONS IN THE GEOGRAPHIC AREAS OF INTEREST. THIS PROJECT ENTAILED THE FOLLOWING ACTIVITIES:

1. COLLECTION OF DATA IN THE UNITED STATES AND IN SOUTH AMERICA THROUGH:

A. LIBRARY RESEARCH WHICH INVOLVED TRAVEL TO THE LIBRARY FACILITIES IN SEVERAL PARTS OF THE UNITED STATES.

B. USE OF INSTITUTIONAL FILES SUCH AS THE HUMAN RELATIONS AREA FILES, THE ARCHIVES OF THE UNITED STATES GOVERNMENT, THE AERIAL PHOTO AND MAPPING SERVICE OF THE CORP OF ENGINEERS, UNITED STATES ARMY.

C. INTERVIEWS AND CORRESPONDENCE WITH KNOWLEDGEABLE INDIVIDUALS.

D. COLLECTION OF PERTINENT MAPS, CHARTS, GRAPHS, PHOTOGRAPHS, AND ILLUSTRATIONS.

E. INITIATION OF CORRESPONDENCE TO SECURE PERMISSION FOR USE OF MATERIALS WHERE NECESSARY.

2. FIELD WORK. THIS PHASE OF THE RESEARCH INCLUDED "FIELD TESTING OF COLLECTED DATA" AND INVOLVED:

A. VISUAL EXAMINATION OF THE PHYSICAL ENVIRONMENTS DESCRIBED

B. OBSERVATION OF BEHAVIORAL ACTIVITIES INCLUDING BOTH ANIMAL AND HUMAN

C. PARTICIPATION IN FOOD GETTING ACTIVITIES AT THE SUBSISTENCE LEVEL

D. SOCIAL CONTACTS WITH INHABITANTS OF THE SURVIVAL AREAS.

ORGANIZATION OF THE DATA

THE PURPOSE OF THIS STUDY HAS BEEN STATED ABOVE. THE ORGANI-

ZATION OF THE DATA CONFORMS TO THE NEEDS OF THE REQUESTING AGENCY. SIGNIFICANTLY, SURVIVAL TECHNIQUES AS SUCH ARE NOT DESCRIBED AT LENGTH. THE MAJOR ENVIRONMENTAL ASPECTS ARE DESCRIBED SO THAT APPLICABILITY OF SURVIVAL TECHNIQUES WHICH ARE PART OF GENERAL MILITARY TRAINING CAN BE RELATED.

THE STUDY IS PRESENTED IN THREE PARTS, EACH CONCERNED WITH ONE OF THE THREE MAJOR ENVIRONMENTS. THE ORDERING OF THE DATA IS GENERALLY THE SAME FOR EACH PART. THE CHAPTERS, SECTIONS, AND SUB-SECTIONS TEND TO REFLECT THE EMPHASIS OF THE DATA AS THEY RELATE TO SURVIVAL PROBLEMS WITHIN EACH ENVIRONMENT. EMPHASIS ON THE PHYSICAL ASPECTS OF THE ENVIRONMENT INCLUDING THE TOPOGRAPHY SERVES SEVERAL NEEDS. GEOGRAPHICALLY THE FORESTS AND SAVANNAS ARE LITTLE KNOWN. POPULARIZED DESCRIPTIONS HAVE TENDED TO CREATE A CERTAIN DREAD IN THE MINDS OF NORTH AMERICANS ABOUT SUCH ENVIRONMENTS DISPROPORTIONATE TO THE DANGERS AND CONDITIONS THAT EXIST. DESCRIPTIVE DATA IN THE FIRST TWO CHAPTERS OF EACH PART HAS BEEN DESIGNED TO FAMILIARIZE THE READER WITH THE NATURE OF THE ENVIRONMENT. FOR THE MOST PART ONLY THOSE ASPECTS OF THE ENVIRONMENT AFFECTING THE INDIVIDUAL'S PHYSICAL WELL-BEING, MOVEMENTS, SEARCH FOR FOOD, AND SOURCES OF DANGER ARE DESCRIBED.

THE REMAINING CHAPTERS IN EACH PART REFLECT THE DATA DERIVED MAINLY FROM ANTHROPOLOGICAL SOURCES OR WHICH MAY BE INCORPORATED IN ANTHROPOLOGICAL STUDIES. THESE DATA RELATE TO THE ECOLOGICAL ACTIVITIES OF INDIVIDUALS OR GROUPS OF INDIVIDUALS WITHIN THE PARTICULAR ENVIRONMENT.

PART I

TROPICAL FORESTS OF SOUTH AMERICA

CHAPTER I

THE PHYSICAL ENVIRONMENT

DISTRIBUTION

THE RAIN FOREST OF THE AMAZON BASIN ENCOMPASSING TWO AND ONE-HALF MILLION SQUARE MILES IS THE MOST EXTENSIVE CONTINUOUS RAIN FOREST IN THE WORLD. THE AMAZON RIVER, EXTENDING 2200 MILES FROM THE ANDES TO THE ATLANTIC OCEAN, FORMS AN EAST-WEST LINE THROUGH THE CENTER OF THE FOREST AREA. THE NORTH-SOUTH EXTENSION OF THE RAIN FOREST ACROSS THE RIO NEGRO-RIO MADEIRA BASINS EXCEEDS 1200 MILES.

THE AMAZON RAIN FOREST IS COMPRISED OF THREE TYPES: (1) THE TERRA FIRMA OR UPLAND FORESTS (NOT TO BE CONFUSED WITH MONTANE FOREST), (2) THE FLOOD-PLAIN FORESTS, CALLED VARZEA, AND ARE SUBJECT TO FLOODING FROM THE ANNUAL FLUCTUATION OF THE RIVERS, AND (3) THE CONTINUOUSLY INUNDATED FORESTS CALLED IGAPO.

BESIDE THE AMAZON BASIN OF BRAZIL, THE TROPICAL RAIN FOREST ENCOMPASSES MOST OF THE GUIANAS, SOUTHERN AND SOUTH-EASTERN VENEZUELA, AND THE AREAS OF COLOMBIA, ECUADOR, PERU, AND BOLIVIA DRAINED BY THE AMAZON RIVER. NORTH OF THE AMAZON EXTENSIVE NATURAL CLEARINGS CALLED SAVANNAS OCCUR. ASCENDING THE EASTERN SLOPES OF THE ANDES THE RAIN FOREST MERGES WITH AN INTERMEDIATE FOREST ZONE OR SUB-TROPICAL RAIN FOREST COVERING THE EASTERN SLOPES BETWEEN 3000 TO 9000 FEET. THE SUB-TROPICAL RAIN FOREST IN TURN MERGES WITH THE MONTANE FOREST WHOSE CHARACTERISTICS ARE DISCUSSED FARTHER ALONG IN THE TEXT.

There are other tropical rain forest regions non-contiguous with that of the Amazon rain forest but having the same vegetation and influenced by the same climatic conditions. These forests occur along the east coast of Brazil, in Venezuela south of Lake Maracaibo, in Colombia along the Rio Magdalena, and on the western slopes of the Andes in both Colombia and Ecuador.

Characteristics

P. W. Richards states in his excellent book, The Tropical Rain Forests: "Few writers seem able to resist the temptation of the 'purple passage' and in the rush of superlatives they are apt to describe things they never saw or to misrepresent what was really there." It is easily understood why those who derive their conceptions of the "jungle" from travel books are so misled. Too frequestly the writers tend to extend limited experiences and areas of observation into generalized accounts applicable to the tropical forests as a whole. The more usually encountered error or exaggeration is that of ascribing to the rain forest as a whole the characteristics of the vegetation bordering the rivers. Here one does encounter the dense impenetrable "jungle" of popular conception. Such conditions constitute less than ten per cent of the rain forest development.

Before describing the features of the rain forest, it seems advisable to make some explanation concerning several factors contributing to the variations in density and disposition of the plant life. The photosynthetic process which involves the receiving and storage of the sun's energy is sometimes called the "business of

GREEN PLANTS." IN MATURE, PRIMARY, OR VIRGIN RAIN FOREST THE "BUSINESS OF GREEN PLANTS" IS CLEARLY DEMONSTRATED IN THE MANNER IN WHICH THE PLANTS HAVE DISTRIBUTED THEMSELVES IN THEIR DRIVE TO REACH THE SUNLIGHT. HIGH ABOVE IN CANOPY THE PLANT LIFE IS SO THICK THAT THE SUNLIGHT IS COMPLETELY FILTERED OF ITS LIFE GIVING RAYS SO THAT ONLY SHADE TOLERANT PLANTS SURVIVE AT THE GROUND LEVEL AND ONLY A SPARSE COVERING EXISTS ON THE GROUND FLOOR. WHERE THE FOREST HAS BEEN DESTROYED OR OPENED BY MAN FOR PURPOSES OF CULTIVATION OR BY NATURAL CAUSES THE SUN IS ABLE TO REACH THE GROUND. IT IS IN THESE AREAS, CALLED SECONDARY GROWTHS, THAT THE VEGETATION IS EXTREMELY DENSE AND VARIED. SUCH ARE THE CONDITIONS FOUND ALONG THE RIVER BANKS AND IN THE MARGINAL AREAS WHERE CLEARINGS MERGE WITH THE FOREST.

THE ONE MOST IMPORTANT FEATURE OF THE TROPICAL RAIN FOREST IS THE SEEMINGLY INFINITE VARIETY OF SPECIES OF PLANTS (AND ANIMALS) CONTAINED THEREIN. NO ESTIMATE HAS BEEN MADE FOR THE NUMBER OF PLANT SPECIES BUT A FIGURE OF OVER 2500 HAS BEEN ESTIMATED FOR JUST THE LARGER TREES OF THE AMAZON. THE VAST MAJORITY OF THE PLANTS ARE TREE-LIKE BOTH IN SIZE AND STRUCTURE. TREES FORM THE DOMINANT SPECIES OF THE FOREST, HOWEVER, MOST OF THE CLIMBING PLANTS (LIANES) AND MANY OF THE EPIPHYTES ARE WOODY. MANY OF THE SMALL PLANT SPECIES OF OTHER CLIMATES AND REGIONS HAVE REPRESENTATIVES IN THE RAIN FOREST THAT ASSUME THE PROPORTIONS OF TREES. GRASSES (BAMBOOS) GROW TO HEIGHTS OF FORTY TO SIXTY FEET. WOODY CLIMBERS, WHICH IN OTHER CLIMATES WOULD BE SMALL VINES, CONSTITUTE A VERY LARGE PROPORTION OF THE RAIN FOREST VEGETATION AND PLAY A MAJOR ROLE IN ITS ECOLOGY.

THE TREES OF THE RAIN FOREST AVERAGE 100 TO 150 FEET ALTHOUGH RANGING TO HEIGHTS OF OVER 200 FEET. THEY RARELY ATTAIN A GIRTH OF

MORE THAN ONE AND ONE-HALF TO TWO YARDS AND ARE GENERALLY CHARACTERIZED BY THEIR SLENDERNESS WHICH IS FURTHER ACCENTUATED BY THE ABSENCE OF LIMBS EXCEPT HIGH ABOVE IN THE CROWN. THROUGHOUT THE RAIN FOREST THE TREES SHOW A MARKED UNIFORMITY. BESIDE THEIR SLENDERNESS, THE TREES FREQUENTLY DEVELOP FLANGED BUTTRESSES AT THE BASE, THE BARK TENDS TO BE SMOOTH AND THIN, AND THE FOLIAGE OF THE MAJORITY OF THE TREES, SAPLINGS, AND SHRUBS ARE DARK GREEN AND HAVE A SMOOTH LEATHERY TEXTURE. THIS UNIFORMITY TOGETHER WITH THE ABSENCE OF SUNLIGHT GIVES RISE TO THE TERMS MONOTONOUS, SOMBER, AND GLOOMY OFTEN USED WHEN REFERRING TO THE ATMOSPHERE AND APPEARANCE OF THE RAIN FOREST. THE NUMEROUS SPECIES ARE SO DISTRIBUTED THAT VERY FEW OF THE SAME SPECIES ARE FOUND IN CLOSE PROXIMITY. THIS HAS PROVEN TO BE ONE OF THE GREAT DISADVANTAGES TO THE COMMERCIAL DEVELOPMENT OF FOREST PRODUCTS. THE NUMBER OF SELECT TREES SUITABLE FOR INDUSTRIAL USE ARE SO WIDELY DISPERSED THAT THE TIME, EFFORT, AND TRANSPORTATION INVOLVED BECOMES PROHIBITIVE.

ONE OUTSTANDING FEATURE JUST TOUCHED UPON ABOVE IS THE OVER-WHELMING PROFUSION OF PLANT LIFE COMPRISING THE CANOPY OF THE RAIN FOREST. EXCEPT FOR THE CROWNS OF THE TREES THE VAST MAJORITY OF THE PLANT LIFE IS COMPRISED OF THE WOODY CLIMBERS CALLED LIANES AND THE EPIPHYTES. THEY ARE AN EVER-PRESENT AND HIGHLY INFLUENTIAL FEATURE OF THE RAIN FOREST. THEY ARE NOT ONLY SUPPORTED BY THE TREES BUT THEY IN TURN SUPPORT A GREAT DEAL OF THE PLANT AND ANIMAL LIFE WHICH FILLS THE CANOPY OF THE FOREST. SOME HANG FROM THE LIMBS OF THE TREES OR OTHER CLIMBERS IN LONG, LOOPING FESTOONS. THEY ARE INTERTWINED WITH EACH OTHER AND WITH THE TREE TOPS ATTAINING LENGTHS MEASURED IN HUNDREDS OF FEET. INSTANCES HAVE BEEN CITED WHERE SEVERAL ADJACENT TREES WERE SEVERED AT THE BASE BUT WOULD NOT FALL BECAUSE OF BEING

HELD BY THE CABLE-LIKE STEMS. THE RELATIONSHIP BETWEEN THE RAIN FOREST TREES AND THE CLIMBERS AND EPIPHYTES IS ONE OF MECHANICAL DEPENDENCE. THE LIANES HAVE THEIR OWN ROOT SYSTEM BUT DEPEND UPON THE TREES FOR A MEANS OF ASCENDING TO THE SOURCE OF LIGHT ABOVE THE TREES. THEY DEVELOP REMARKABLE TENSILE STRENGTH AND FLEXIBILITY AND HAVE MUCH THE STRUCTURAL APPEARANCE OF STEEL CABLES EVEN IN THEIR INTERIOR STRUCTURE. LITTLE IMAGINATION IS NEEDED TO RECOGNIZE THEIR USEFULNESS--NOT THE LEAST OF WHICH MAY BE THAT OF LOWERING ONE'S SELF FROM A TREE-SNAGGED PARACHUTE HIGH ABOVE THE GROUND.

THE EPIPHYTES UTILIZE THE HOST TREES TO GET THEIR SHARE OF SUNLIGHT AS WELL AS TO EXTRACT SUCH OTHER NUTRITIVE NEEDS FROM THE SURROUNDING ATMOSPHERE. EVEN THEIR ROOT SYSTEMS ARE SUNK INTO THE BARK AND IN HOLLOWS FORMED ON THE TREES EFFECTING A SYMBIOTIC RELATIONSHIP WITH THE MOSSES AND OTHER FUNGUSES ADHERING THERETO. NEITHER THE LIANES NOR THE EPIPHYTES ARE PARASITIC--THAT IS, THEY DO NOT EXTRACT NUTRIENTS FROM THE HOST TREE ITSELF. ONE CHARACTERISTIC OF MANY OF THE EPIPHYTES WHICH HOLDS PARTICULAR INTEREST FOR A MAN'S SURVIVAL IS THE PLANT'S ABILITY TO EXTRACT MOISTURE FROM THE ATMOSPHERE AND STORE IT WITHIN ITS STEM. ONE PARTICULAR SPECIE COMMON TO THE RAIN FOREST IS A BROMELIAD CALLED A "TANK" OR "CISTERN." THE LEAVES OF THE PLANT SWIRL INTO A ROSETTE TRAPPING THE FALLING RAIN WHICH DRAINS DOWN INTO THE BULB BELOW THE LEAVES. SOME OF THE LARGER PLANTS CAN HOLD AS MUCH AS A GALLON OF WATER. NOT ONLY WATER IS FOUND WITHIN THE PLANT. NUMEROUS TYPES OF FAUNA INCLUDING FROGS AND INSECTS MAKE THE WATER-FILLED "TANK" THEIR HABITAT--AN ITEM TO REMEMBER WHEN HUNGER OVERRIDES ONE'S SENSE OF DELICACY.

ANOTHER FEATURE BUT ONE NOT APPARENT TO THE UNTRAINED OR CASUAL OBSERVER IS THE STRUCTURAL STRATIFICATION OF THE RAIN FOREST. THERE ARE DIVERGENCES OF OPINION REGARDING THE NATURE, THE NUMBER, AND EVEN THE EXISTENCE OF RAIN FOREST STRATA BECAUSE OF THE DIFFICULTY OF OBTAINING A CLEAR VIEW OF THE FOREST IN PROFILE. THE TERMS STORY, CANOPY, AND LAYER ARE USED SOMEWHAT INTERCHANGEABLE IN REFERRING TO VARIATIONS IN HEIGHT OF THE VARIOUS STRATA. THE CONSENSUS SEEMS TO FAVOR A THREE STORY STRUCTURE, EACH STORY FORMING A LATERAL CANOPY. THE CROWNS OF THE HIGHEST CANOPY AVERAGING ABOUT 150 FEET ARE NOT IN CONTINUOUS CONTACT LATERALLY. THEY TEND TO WIDEN OUT IN AN UMBRELLA SHAPE WITH GREATER WIDTH THAN DEPTH. THE CROWNS OF THE INTERMEDIATE CANOPY HAVE MORE LATERAL CONTINUITY BUT TEND TO HAVE MORE DEPTH THAN WIDTH. THE CROWNS OF THE LOWEST CANOPY HAVE THE MOST CONTINUOUS CONTACT AS WELL AS GREATER DENSITY OF FOLIAGE AND BRANCHING. BETWEEN THE STRATA THERE ARE TREES OF VARIOUS HEIGHTS AND STAGES OF GROWTH WHICH ARE EITHER MERGING INTO OR EMERGING FROM A STRATUM, HENCE, THERE IS NOT A CLEAR CUT DISTINCTION BETWEEN EACH CANOPY.

BELOW THE THREE STORIES DESCRIBED ABOVE THERE ARE TWO ADDITIONAL STRATA CONSISTING OF: (1) SAPLINGS, SHRUBS, DWARF TREES, AND LARGE FERNS, AND (2) TREE SEEDLINGS, HERBACEOUS PLANTS, AND SMALL FERNS. NEITHER OF THESE LAST LAYERS ARE WELL DEVELOPED NOR ARE THEY HIGHER THAN TWO TO SIX FEET. THE GROUND ITSELF IS EITHER BARE, EXPOSING THE RED CLAYEY NATURE OF THE SOIL, OR COVERED WITH A THIN LAYER OF ROTTING AND DECAYING MATTER FALLING FROM THE CANOPY ABOVE. SUCH MOSSES AND SAPROPHYTIC GROWTH THAT EXIST (AND THERE ARE MANY) ADHERE TO THE LIVING AND DEAD TREES.

Tropical Deciduous Forests

Scattered throughout the northern areas of South America are forests which lose their foliage during dry periods where the wet and dry seasons are well defined. If the forests of this type are marginal to the rain forests the trees will be of heights averaging twenty to fifty feet at the lower level and from sixty to eighty feet at the higher level with less density and continuous overhead foliage even during wet season. Epiphytes tend to decrease until they disappear as the deciduous forest extends away from the rain forest. Lianes continue to be a major aspect of the canopy. During the dry season many trees of the lower canopy retain their foliage and such forest may be termed as semi-evergreen. These forest areas are found in the Orinoco Basin and as extensions of the rain forest into the Mato Grosso of Brazil and into the Gran Chaco from the area of the headwaters of the Rio Beni. The undergrowth of these forests is considerably more dense than that of the primary rain forest being more characteristic of secondary growth.

As the wet-dry season becomes more pronounced, the forest gives way by gradual succession from semi-evergreen to fully deciduous forests which entirely lose their foliage during the dry season. In the fully deciduous forests the trees becomes considerably lower in average height and the overhead canopy is somewhat comparable to the foliage of temperate forests in that the tangle of vines have completely disappeared. The undergrowth of low brush consists of thorny brambles. High grasses frequently stiff and razor sharp often fill the spaces between the brush and trees.

INCLUDED AMONG THE TROPICAL DECIDUOUS FORESTS IS THE THORN FOREST. THIS TYPE OF FOREST IS MOST USUALLY FOUND IN CLOSE ASSOCIATION WITH THE SEMI-ARID PLAINS AND SAVANNAS AND IS LOCATED IN VENEZUELA, NORTHERN COLOMBIA IN THE LOWER RIO MAGDALENA AREA AS WELL AS IN THE UPPER VALLEYS OF THE RIO MAGDALENA, AND RIO CAUCA USUALLY AS ISOLATED STANDS. THE THORN FOREST IS COMPOSED OF SCRUBBY, GNARLED, THORNY TREES RANGING IN HEIGHTS FROM TEN TO THIRTY FEET. THE AREA IS MOSTLY OPEN WITH LITTLE OR NO VEGETATION COVERING THE GROUND. SUCH VEGETATION AS DOES OCCUR CONSISTS OF CLUMPS OF STIFF RAZOR GRASS, MARGINAL SAVANNA GRASS, OR CACTUS SCRUB WHICH IS ALSO AN ASSOCIATION OF THE SEMI-ARID PLAIN. FOOD PLANTS ARE ALMOST NON-EXISTENT AND IF FOUND AT ALL WILL CONSIST MAINLY OF ROOTS AND TUBERS OR SUCCULENTS SUCH AS CACTUSES. ANIMAL LIFE OF THE THORN FOREST, EXCEPT FOR THE BIRDS AND BURROWING RODENTS, IS MARGINAL BELONGING MOSTLY TO THE RAIN FORESTS OR SAVANNAS BUT UTILIZING THE THORN FOREST AS A COMMON HUNTING GROUND OR TRANSITIONAL HABITATION.

UNDER THE GENERAL HEADING OF TROPICAL DECIDUOUS FOREST MAY BE PLACED TWO LARGE REGIONS OF EASTERN AND CENTRAL SOUTH AMERICA, THE CAATINGA OF NORTHEASTERN BRAZIL, AND THE GRAN CHACO OF BOLIVIA, PARAGUAY, AND ARGENTINA.

THE ARID NORTHEASTERN PORTION OF BRAZIL, LOCALLY KNOWN AS THE CAATINGA, IS BASICALLY AN OPEN SCRUB FOREST COMPOSED LARGELY OF DECIDUOUS TREES. THIS IS AN AREA WITH A MARKED DRY SEASON AND FAIRLY IMPERVIOUS SOIL WHICH RETAINS NO MOISTURE FOR THE LONG PERIOD OF DROUGHT. HERE AND THERE IN THE CAATINGA, ESPECIALLY TOWARD ITS EASTERN AND SOUTHERN BORDERS, ARE TRUE FORESTS AND INTRUSIONS OF CAMPOS. MUCH OF THE HEAVIER FOREST OF THE CAATINGA HAS BEEN CUT, BUT THE FUNDA-

MENTAL CHARACTER OF THE REGION DOES NOT REFLECT INTERFERENCE BY MAN.

THE GRAN CHACO REGION CONSISTS OF APPROXIMATELY 400,000 SQUARE MILES OF LOWLAND PLAINS EXTENDING SOUTH INTO ARGENTINA FROM APPROXIMATELY 20°S AND LYING BETWEEN THE ANDEAN FOOTHILLS ON THE WEST AND THE RISING UPLANDS OF BRAZIL JUST EAST OF THE RIO PARAGUAY. THE GREAT PORTIONS OF THIS AREA ARE SUBJECT TO CONTINUAL FLOODING AND CONSISTS OF EXTENSIVE SWAMPS ESPECIALLY THE ALLUVIAL AREAS LYING ALONG THE RIO PARAGUAY CALLED EL PANTANAL. MOST OF THE REMAINING LAND IS ARID PLAINS AND THE REGION AS A WHOLE WILL BE CONSIDERED IN GREATER DETAIL UNDER THE SECTIONS DEALING WITH THE SAVANNAS. THERE ARE ISOLATED STANDS OF TRUE FOREST AND FRINGE OR GALLERY FORESTS ALONG MANY OF THE STREAMS. PENETRATIONS OF EXTENSIVE FORESTATION OTHER THAN THE THORN FORESTS OCCUR IN THE BOLIVIAN CHACO AS CONTINUATION OF THE AMAZON TROPICAL FORESTS, OR EXTENSION OF THE HARDWOOD FORESTS CALLED QUEBRACHO, MEANING "AXE BREAKING," EXTENDING AS FAR NORTH AS 22°S FROM ARGENTINA.

TRANSITIONAL ZONES OF FOREST VEGETATION

BEGINNING HIGH ON THE EASTERN SLOPES OF THE CORDILLERA ORIENTAL STILL ABOVE THE LINE OF CLOUDS FROM WHICH THE "CLOUD FOREST" DERIVES ITS NAME, THE ABUNDANT RAINS GIVE RISE TO LUXURIANT GRASSES, HERBACEOUS FLOWERING PLANTS, AND THE OCCURRENCE OF SCATTERED GROUPS OF DWARF TREES. BETWEEN 8,000 AND 10,000 FEET, THE CEJA DE MONTANA, OR "BROW OF THE MOUNTAINS," COMES INTO PROMINENCE. THIS IS A ZONE OF ALMOST PERPETUAL MIST AND FOG. HERE THE TREES ARE OF MEDIUM HEIGHT WITH ONE CONTIGUOUS CROWN. MOSSES, LICHENS, AND FERNS ENVELOP THE TREES AND JOIN WITH THE PROFUSE ENTANGLEMENT OF ORCHIDS, TILLANDSIAS, SOFTWOOD AND HARDWOOD SEEDLINGS, AND MASSES OF DECAYING TREE TRUNKS COVERING

THE FOREST FLOOR.

BELOW THE LINE OF CLOUDS LIES THE MONTANA WHICH MERGES ALMOST IMPERCEPTIBLY WITH THE BASAL FOREST OF THE AMAZON VALLEY. COUNTLESS SPECIES OF HARDWOOD BECOME PREDOMINANT AND THEIR CROWNS ARE MORE DENSELY ENTERLACED BY EPIPHYTIC PLANTS THAN IN ANY OTHER PORTION OF THE RAIN FOREST. THE GREATER PREVALENCE OF EPIPHYTES IS PROBABLY DUE TO THE RELATIVELY GREATER AMOUNT OF MOISTURE AND COOLER TEMPERATURES. NUMEROUS PALMS CONSPICIOUS BY THEIR SHORTER STATURE ARE MUCH IN EVIDENCE AS ARE BAMBOOS AND TREE FERNS. THE FAMOUS CINCHONA FOREST ALSO BELONGS TO THIS ZONE. THE FOREST FLOOR IS MORE DENSELY CARPETED BY MOSSES AND HERBACEOUS PLANTS THAN THE FLOOR OF THE VALLEY FOREST. TRAVEL IS MORE FREQUENTLY INTERRUPTED BY THE OCCURRENCE OF SWIFT FLOWING STREAMS, STEEP GORGES, AND INCLINES USUALLY HEAVILY MATTED WITH UNDERBRUSH AND NUMEROUS FALLEN TREES.

THE TRANSITIONAL ZONE OF VEGETATION HAVING THE MOST SERIOUS INFLUENCE ON THE SURVIVAL SITUATION IS THE MARGINAL STRIPS BORDERING THE RIVERS AND STREAMS. WITHIN THIS SEEMINGLY SOLID WALL OF PLANTS TEEMS MOST OF THE LAND-BOUND FAUNA AND A CONSIDERABLE PORTION OF THE ARBOREAL FAUNA AS WELL. THIS LIVING GREEN WALL IS COMPRISED OF VICIOUS THORNY PLANTS OF EVERY IMAGINABLE SIZE. VINES, LIANES, AND EPIPHYTES HANG FROM THE LOWER REACHES OF THE TREES AND ARE INTERLACED IN A WRITHING MASS WITH THE LOWER GROWING BAMBOOS, PALMS, SHRUBS, AND STIFF CANE. THE GROUND IS COVERED WITH ROTTING TRUNKS OF TREES FELLED BY THE CONSTANT FLOODING OF THE RIVERS. AS ONE'S MACHETE OR SIMILAR CUTTING TOOL SLASHES THROUGH THE EPIPHYTES, STREAMS OF WATER AND SAP SPATTER THE TRAVELER. INSECTS OF ALL SIZES AND EQUIPPED WITH EVERY TYPE OF MISERY-DEALING APPARATUS INFEST THE DENSE MASS.

Beyond doubt, this is the most arduous, tormenting, and difficult land area to traverse. It also represents, to a very large degree, the greatest number of factors for survival. For one, the proximity to a waterway affords the most immediate and purposeful course of action toward reaching civilization. Secondly, there are numerous useful plants including palms with edible fruits, young plants with edible leaves, roots and stems; various types of trees including balsa for making rafts or dugouts; numerous fiber plants, plants for shelter making, plants for drugging fish--in fact, every type of useful plant associated with survival techniques. Thirdly, there are the food source animals which abound in the underbrush. Finally, there is the knowledge that the course of action has been defined with regards to direction and goal.

Climate

Temperature and Humidity. Contrary to popular belief, the temperatures of the Amazon Basin is not excessively hot. The southeasterly Tradewinds blowing across the continent from the Atlantic maintain a persistent cooling effect. The mean annual temperature at Manaos is 82° and the mean annual range is 4°. The absolute maximum temperatures at Manaos and Obidos is 101° and 102° respectively. The lowest temperatures usually occur in the wet season. With increasing distance from the equator, the seasonal variation increases but the overall range will not exceed 8° throughout the Amazon region.

While temperatures are not excessively high the same cannot be said of the humidity. It is from this factor that the "hot house" atmosphere of the rain forest derives; humidity plus the general lack of moving air under the dense forest canopy. In general, the relative

HUMIDITY IS ALWAYS NEAR TO THE SATURATION POINT, PARTICULARLY AT NIGHT. DURING THE DRY SEASON THE DAYLIGHT HUMIDITY WILL OCCASIONALLY FALL TO SIXTY-FIVE PER CENT EVEN FIFTY-FIVE PER CENT, BUT THIS IS EXCEPTIONAL. THE HUMIDITY RISES WITH INCREASING ELEVATION UNTIL IT ACHIEVES A MAXIMUM EFFECT AS EXHIBITED BY THE PERPETUAL MIST AND FOG OF THE CLOUD FOREST ON THE EASTERN ANDES.

THE DAILY TEMPERATURES ARE AFFECTED BASICALLY BY THE INCIDENCE OF SUNSHINE AND CLOUDINESS. THERE ARE TWELVE HOURS OF DAYLIGHT AT THE EQUATOR THROUGHOUT THE YEAR. THE MAXIMUM AMOUNT OF DAILY SUNSHINE POSSIBLE IS ABOUT TEN HOURS. HOWEVER, THERE IS A HIGH DEGREE OF CLOUDINESS WHICH DILUTES THE INTENSITY AND PERSISTENCE OF THE SUN; CLOUDLESS DAYS BEING MOST RARE. THE MEAN DAILY RANGE IN TEMPERATURE IS FROM 3° TO 16°. THUS THE NIGHT TEMPERATURES FREQUENTLY ARE DOWN IN THE LOW 70°s.

WITH INCREASED ELEVATION THE TEMPERATURES BECOME GRADUALLY COOLER--BETWEEN TWO TO FOUR DEGREES PER EACH 1000 FEET OF ASCENT. THE DAILY RANGE OF TEMPERATURES ALSO TENDS TO INCREASE AT HIGHER ELEVATIONS WITH THE NIGHT TEMPERATURES BEING CONSIDERABLY COOLER.

RAINFALL. AS MIGHT BE INFERRED FROM ITS CLASSIFICATION, THE RAIN FOREST VEGETATION IS DEPENDENT UPON AN ANNUAL TOTAL OF RAINFALL IN EXCESS OF A CERTAIN MINIMUM WITH NO PROLONGED DRY SEASON. IN THE AMAZON THE ANNUAL MEAN OVER THE GREATER PART OF THE AMAZON BASIN EXCEEDS 89 INCHES AND IN MANY AREAS EXCEEDS 100 INCHES, ESPECIALLY IN THE UPPER AMAZON REGION. IN THE MONTANA OF COLOMBIA, EQUADOR, AND PERU, THE RAINFALL IS THE HIGHEST OF THE RAIN FOREST REGION DUE TO THE EFFECTS OF THE EASTERLY TRADES. THE HEAVIEST RAINS ARE FROM JANUARY TO JUNE WITH FEBRUARY, MARCH, APRIL, AND MAY USUALLY EX-

CEEDING TEN INCHES EACH.

EVEN DURING THE RAINY SEASON THE MORNINGS ARE FREQUENTLY CLEAR BUT BEGIN TO CLOUD AND DEVELOP RAIN CONDITIONS BY NOON--AND THEN CLEAR AGAIN LATER IN THE DAY. THIS HAS GIVEN RISE TO A "BEFORE-AND-AFTER-THE-RAIN" TYPE OF SCHEDULING OF DAILY ACTIVITIES. OWING TO THE CAUSATIVE FACTORS, WHICH THIS STUDY WILL NOT EXPLORE, TROPICAL RAINS TEND TO BE SOMEWHAT OF THE DRENCHING TYPE AND ARE FREQUENTLY ACCOMPANIED BY VIOLENT THUNDER AND LIGHTNING.

AN EXCEPTIONAL FEATURE OF THE UPPER AND MIDDLE AMAZON BASIN IS THE OCCURRENCE OF UNUSUAL COLD SPELLS ACCOMPANIED BY "UNSEASONAL" RAINS AND CLOUDS. THIS PHENOMENON, CALLED THE FRIAGEM, IS THE PERIPHERAL EFFECTS OF A MASS OF COLD AIR FROM THE ANTARTICA WHICH EXTENDS NORTHWARD THROUGH ARGENTINA, EASTERN BOLIVIA, AND INTO THE AMAZON REGION. BESIDE THE METEOROLOGICAL DISTURBANCE CAUSED BY THE FRIAGEM, IT CAUSES INTENSE DISCOMFORT TO THE NATIVES WHO TAKE TO THEIR BED OR ANY OTHER SOURCE OF WARMTH.

RELIEF AND DRAINAGE

THE BROAD CONFIGURATION OF THE AMAZON BASIN CONTAINING THE GREATER EXPANSE OF RAIN FOREST OF SOUTH AMERICA CAN BE COMPARED TO A CONCAVE SPATULA. BEGINNING WITH THE LOWER EASTERN SLOPES OF CORDILLERA ORIENTAL AT AN ELEVATION OF 5000-6000 FEET AND EXTENDING EAST TO THE ATLANTIC, THE LAND FORMS, CLIMATE, AND VEGETATION CONSTITUTES A COMPOSITE GEOGRAPHICAL UNIT. EXCEPT FOR THE ELEVATED NORTH-SOUTH STRIP EXTENDING ALONG THE ANDES, THE ENTIRE REGION RARELY EXCEEDS 1000 FEET WITH THE LARGER PERCENTAGE LYING BELOW A 500 FOOT CONTOUR LINE. APPROXIMATELY 10% OF THE LOWLAND AREA, EXTENDING THROUGH THE CENTER AND LOWER PART OF THE BASIN, IS SUBJECT TO PERIODIC

OR CONTINUOUS INUNDATION.

THE GREAT EXPANSE OF LOWLANDS FORMING THE BED OF THE AMAZON RIVER SYSTEM IS COMPRISED OF THREE DISTINCTIVE LAND FORMS. THE VALLEY ITSELF IS LIKE A DEEPER EXTENSICN OF A LARGER BASIN; A BASIN WITH SEVERAL LEVELS REACHING THE OUTER RIM BY A SERIES OF PERIPHERAL STEPS. THIS IS DEMONSTRATED MOST CLEARLY BY THE FALLS AND CATARACTS WHICH CHARACTERIZE EACH OF THE GREAT TRIBUTARIES AS WELL AS THE HUNDREDS OF SMALLER STREAMS IN THEIR FIRST FEW HUNDRED MILES' RUSH TOWARD THE VALLEY FLOOR.

THE AMAZON IS USUALLY DIVIDED INTO THE UPPER AMAZON, THAT PORTION WEST OF THE JUNCTION OF THE RIO NEGRO, AND THE LOWER AMAZON LYING EAST OF THE CONFLUENCE. THE UPPER AMAZON FLOWS THROUGH THE BROAD FLOOD PLAINS. ALONG THE RIVER BANKS NATURAL LEVEES HAVE DEVELOPED WHICH CONTRIBUTE TO THE DEVELOPMENT OF THE SWAMP LANDS IN BACK OF THE LEVEES DURING THE FLOOD PERIODS. THE ENORMOUS AMOUNTS OF WATER POURING ONTO THE LAND ADJOINING THE RIVER DURING THE ANNUAL FLOOD STAGE CREATE NETWORKS OF SWAMPS, BACKWATER LAKES, CANALS, AND CHANNELS FREQUENTLY JOINING MAJOR BODIES OF WATER TOGETHER.

FROM THE WESTERN BORDER FOLLOWING THE ARC OF THE EASTERN ANDEAN SLOPES, THE BASIN BROADENS TOWARD THE EAST REACHING ITS GREATEST WIDTH OF APPROXIMATELY 800 MILES BETWEEN 68° AND 64° W. FROM THIS AREA THE WIDTH DECREASES EQUALLY ON BOTH SIDES OF THE AMAZON REACHING A MINIMUM WIDTH OF APPROXIMATELY 150 MILES IN THE LONGITUDE OF 54°W AND IS MAINTAINED TO THE EAST COAST WHERE THE AMAZON PUSHES ITS GREAT VOLUME OF WATER INTO THE ATLANTIC.

THE GEOLOGICAL HISTORY OF SOUTH AMERICA ENCOMPASSES SEVERAL HUNDRED MILLION YEARS INVOLVING MASSIVE LAND ELEVATIONS, SUBSIDENCE,

RE-ELEVATION, FAULTING, FOLDING, AND VOLCANIC ACTION. PRESENT DAY SURFACE CONFIGURATIONS HAVE CHANGED LITTLE SINCE THE TERTIARY PERIOD THIRTY TO FORTY MILLION YEARS AGO. THE COMPARATIVELY RECENT GIGANTIC UPHEAVAL RAISED THE ANDES TO NEAR THEIR PRESENT DAY HEIGHT. THE SERROS OF THE PLATEAU OF BRAZIL WERE TILTED TOWARD THE INTERIOR. THE ENTIRE PROCESS WAS AS IF A GIANT HAND HAD REACHED UNDER AND RAISED THE ENTIRE CONTINENT ABOUT 300 FEET FROM THE SEA.

THE CONTINENT, TRIANGULAR IN SHAPE, IS BOUNDED ON ALL THREE SIDES BY HIGHLAND MASSES RELATIVELY CLOSE TO THE OCEAN SHORES FOR THE GREATER PART OF THEIR LENGTH. THE CREST OF THE ANDES RARELY EXCEEDS A DISTANCE OF 100 MILES FROM THE PACIFIC SHORE. THE NORTHERN AND NORTHEASTERN HIGHLANDS CONSIST OF THE NORTHEASTERN EXTENSION OF THE ANDES INTO VENEZUELA AND THE GUIANA MASSIF. EXTENDING FROM THE MOUTH OF THE AMAZON, THE EAST COAST OF THE CONTINENT IS DOMINATED FOR APPROXIMATELY TWO-THIRDS OF ITS LENGTH BY THE ATLANTIC SCARP. IN BACK OF THE SCARP THE GREAT BRAZILIAN PLATEAU STRETCHES WESTWARD TO THE ANDES AND SOUTH TO PATAGONIAN PLATEAU. SIGNIFICANTLY, THESE HIGHLANDS ATTAIN THEIR HIGHEST ELEVATIONS AT RELATIVELY SHORT DISTANCES FROM THE COASTS. THE GREATER PORTION OF THE LAND SLOPES AWAY FROM THE COAST WITH THE RESULT THAT THERE IS A MAXIMUM OF DRAINAGE TOWARD THE INTERIOR. THESE HIGHLANDS FORM THE OUTER RIM OF THE GREAT AMAZON BASIN AS WELL AS THE ORINOCO AND THE PARAGUAY RIVER BASIN.

THE WATERS OF THE AMAZON RIVER BEGIN HIGH IN THE EASTERN RANGES OF THE ANDES, THE CORDILLERA ORIENTAL. THE STREAMS, CASCADING DOWN THROUGH THE NUMEROUS GORGES OF THE EASTERN SLOPES, ARE FED BY THE CONSTANT MELTING OF THE SNOW FIELDS ON THE SUMMIT OF THE MOUNTAINS AND THE TROPICAL RAINS WHICH OCCUR ON THE LOWER EASTERN SLOPES ALMOST DAILY.

While still high in the Andes the Amazon receives the contribution of numerous small streams. Here the river is known as the Maranon. Within 400 miles from its source, the Amazon is joined by the Rio Utcubamba, Rio de Yongas, the Rio Magdalena, Rio Llaucan, Rio Chamayo, Rio Jumete, and Rio Huamboya, all good sized rivers in themselves, and many smaller streams. Still 1400 feet above sea level the rivers and streams are swift flowing torrents. In the 400 miles traveled it has a fall of two miles. For the next 100 miles or more the river plunges through a series of narrow, high walled canyons called <u>pongos</u> or "gateways." At Pongo de Manseriche, the Gateway of Parrots, the Amazon is joined by the Rio Santiago. From here on to the Atlantic the great river falls less than two and one-half inches per mile as it traverses the inner valley of the Amazon Basin.

Beyond the Pongo de Manseriche, the river flows southeast for approximately 200 miles to the confluence with the Huallega flowing from the south. Several large rivers including the Rio Morona and the Rio Pastaza join from the north and several smaller rivers flowing from the south. Here the flood plain is narrow, containing numerous islands around which the Huallaga and the Amazon effect a meandering conjunction.

The river continues northeast for 250 miles where it is joined by the Ucayali which has its origin hundreds of miles south in the highlands of central Peru. The widening flood plains are encompassed by uplands which rarely attain elevations of higher than 100 feet. Continuing more easterly the Amazon is joined by the Rio Napo northeast of Iquitos. Between the Ucayali and the Napo, the numerous rivers and streams entering the main river include the Tigre, the Samiria,

PLUS MANY UNSURVEYED RIVERS FROM THE NORTH SUCH AS THE URITU-YACU, THE CUNINCO, THE ITAYA, AND MANY SMALL STREAMS FROM THE SOUTH. THE MAIN RIVER IS FILLED WITH ISLANDS SOME OF WHICH ARE NOTHING MORE THAN RAISED SAND BARS AND ALLUVIAL DEPOSITS IN THE RIVER.

FOR THE NEXT 300 MILES THE COURSE OF THE RIVER IS MORE EASTERLY AND SOUTHEASTERLY. NUMEROUS ISLANDS, SOME OF THEM OF IMPRESSIVE SIZE, DOT THE RIVER SURFACE. SPITS OF LAND AND SAND BARS PROTRUDE FAR OUT INTO THE RIVER WHICH HAS WIDENED TO APPROXIMATELY TWO MILES IN THIS STRETCH. HIGH BANKS ARE PROMINANT ALONG BOTH SIDES OF THE RIVER ALTHOUGH MORE PARTICULARLY ALONG THE SOUTH BANK. AT TABATINGA, WHERE THE MAIN WATERS ARE JOINED BY THE RIO YAVARI, THE FRONTIER STATION DESIGNATES THE MUCH DISPUTED BOUNDARY BETWEEN PERU, BRAZIL, AND COLOMBIA. THE REGION IS SOMETIMES REFERRED TO AS THE PUTUMAYO AREA FROM THE NAME OF A LARGE RIVER WHICH LIES TO THE NORTH AND EVENTUALLY JOINS WITH THE MAIN RIVER. IT IS DENSELY FORESTED AND UNTIL THE RUBBER BOOM HELD LITTLE INTEREST FOR THE "OUTSIDE" WORLD.

BEYOND TABATINGA THE AMAZON IS CALLED THE SOLIMOES ALTHOUGH THE NAME AMAZON IS BEGINNING TO BECOME KNOWN. THE COURSE OF THE RIVER IS NORTHEASTERLY FOR THE NEXT 400 MILES AND CUTS THROUGH THE GRADUALLY RISING LAND FORMING BLUFFS ON EITHER SIDE. SEVERAL MAJOR TRIBUTARIES, THE AFOREMENTIONED PUTUMAYO, WHICH BECOMES THE ICA BEFORE ENTERING THE MAIN STREAM, FROM THE NORTH AND THE JUTAI FROM THE SOUTH ADD TO THE VOLUME OF WATER FROM MANY OTHER SMALLER RIVERS. AGAIN THE MAIN RIVER IS FILLED WITH NUMEROUS ISLANDS. THE AREA ON EITHER SIDE HAS MANY SMALL LAKES.

EAST OF FONTE BOA THE RIVER FLOWS SOUTHEASTERLY. THE FLOOD PLAIN WIDENS AND THE ALLUVIUM FORMS BROAD STRIPS ALONG THE RIVER. THE

JAPURA RIVER CUTTING THROUGH THE UPLANDS TO THE NORTH HAS, LIKE THE ICA, HAD ITS NAME CHANGED FROM RIO CAQUETA WHERE IT CROSSED FROM PERU TO BRAZIL. LIKE THE RIO PUTUMAYO-ICA, IT IS A MAJOR RIVER WITH AN EXTENSIVE SYSTEM OF TRIBUTARIES OF ITS OWN BEFORE IT JOINS THE AMAZON. FROM THE SOUTH, THE RIO JURUA AND THE RIO TEPE ARE ALSO MAJOR TRIBUTARIES OF THE AMAZON FLOWING FROM THE BRAZILIAN PLATEAU ON THE SOUTH.

THE CONFLUENCE OF THE RIO NEGRO AND THE AMAZON IS, INDEED, A MEETING OF TWO GREAT BODIES OF WATER. THE MAIN RIVER IS NOW OF SUCH WIDTH THAT THE BANKS ARE ALMOST OUT OF SIGHT FROM EACH OTHER. MANY CHANNELS DIVERGE FROM THE MAIN BED FORMING ISLANDS, SAND BARS, AND BROAD MUD FLATS, AND SPITS. SMALLER STREAMS CONTINUE TO EMPTY INTO THE MAIN STREAM. THE RIO NEGRO IS NEARLY FOUR MILES WIDE BEFORE JOINING THE AMAZON. SIDE BY SIDE THE TWO BODIES OF WATER COURSE FOR MANY MILES BEFORE THE BLACK WATERS OF THE RIO NEGRO MERGE INDISTINGUISHABLY WITH THE YELLOW WATERS OF THE AMAZON. MANAOS, ONCE THE THRIVING CENTER OF THE RUBBER BOOM PERIOD, IS LOCATED ON THE RIO NEGRO AT THE CONFLUENCE.

FIVE HUNDRED MILES EAST OF MANAOS, THE AMAZON IS JOINED BY THE TAPAJOS, ITS SECOND LARGEST TRIBUTARY. WITHIN THIS DISTANCE IT IS JOINED BY THE RIO MADEIRA, THAT STARTS HUNDREDS OF MILES TO THE SOUTHWEST IN THE HEADWATERS OF THE RIO MADRE DE DIOS, THE RIO BENI, THE RIO MAMORE OF PERU AND BOLIVIA, AND THE RIO GUAPORE OF THE MATO GROSSO. FOUR OTHER SIZEABLE TRIBUTARIES ENTER THE AMAZON FROM THE SOUTH WHILE FROM THE NORTH FLOW THE RIO URUBU, THE RIO UATUNIA, THE RIO YAMUNDA, AND THE RIO TROMBETAS. THE AREA ON EACH SIDE OF THE MAIN RIVER IS CHARACTERIZED BY EXTENSIVE SWAMPS, BACKWATER LAKES, AND MANY SMALL STREAMS, CHANNELS, BOTH TEMPORARY AND PERMANENT. THE MAIN RIVER IS

FILLED WITH ISLANDS OF VARYING SIZES. PROMINENT BLUFFS ON EITHER SIDE INDICATE THE PROXIMITY OF THE UPLANDS. THE "INNER" VALLEY IS LITTLE MORE THAN TEN MILES IN WIDTH AT THIS POINT. IT WIDENS TO APPROXIMATELY THIRTY MILES FARTHER EASTWARD UNTIL REACHING THE TROMBETAS WHERE IT AGAIN NARROWS. THROUGHOUT THE AREA ON EITHER SIDE OF THE RIVER RESIDUAL SERRAS, WHICH ARE ISOLATED ELEVATIONS, PROJECT PROMINENTLY ABOVE THE LEVEL OF THE PLAIN. THEY ARE GIVEN SUCH NAMES AS SERRA DO PARINTINS, SERRA DO SAPUCUA, SERRA DO VALHE-ME-DEUS ON VARIOUS MAPS, HOWEVER, THEY HARDLY COMPARE WITH THE SERRAS OF THE BRAZILIAN PLATEAU OR THOSE OF THE NORTHWEST BORDER REGION BETWEEN BRAZIL AND VENEZUELA.

NEAR THE JUNCTION OF THE TAPAJOS, THE REGION BOTH NORTH AND SOUTH OF THE MAIN RIVER IS CHARACTERIZED BY HILLY UPLANDS CALLED THE HILLS OF MONTE ALEGRE. THERE ARE FEWER LAKES AND SWAMPS IN THE AREA, HOWEVER, THE MAIN STREAM ITSELF BEGINS TO DEVELOP A NUMBER OF PARALLEL CHANNELS. FROM THIS POINT THE RIVER FLOWS GENERALLY NORTHWEST AND FINALLY ALMOST DUE NORTH AS IT SPILLS THROUGH NUMEROUS INTERLACING CHANNELS AND STREAMS INTO THE ATLANTIC. WITHIN THIS STRETCH THE RIO BAIXO XINGU, OR MORE SIMPLY THE XINGU, AND THE TOCANTINS ARE THE LARGEST OF SEVERAL LARGE TRIBUTARIES ENTERING THE AMAZON BOTH FROM THE NORTH AND SOUTH. THE AREA, A SUNKEN PLAIN, IS VEINED BY VAST NETWORKS OF RIVERS AND CANALS FROM THE XINGU TO THE COAST. NUMEROUS ISLANDS CUT FROM THE PLAIN BY THE MANY RIVERS WINDING INTO OR AWAY FROM THE AMAZON ARE OF VARYING SIZES, THE LARGEST, MARAJO, BEING 24000 SQUARE MILES. THE VALLEY LAND IS ROLLING AND PARTIALLY SWAMPY. THE RISING UPLAND FORMING THE OUTER VALLEY CONSIST OF WELL DRAINED LAND HAVING A GRASS COVER MORE CHARACTERISTIC OF THE PAMPAS. SUCH STANDS OF FOREST THAT PREVAIL HAVE BECOME DECIDUOUS IN CHARACTER AND THE

TROPICAL RAIN FOREST HAS FINALLY ENDED.

THUS FAR, THE AMAZON RIVER SYSTEM HAS BEEN DISCUSSED WITH REGARD TO THE DRAINAGE PATTERN IN RELATION TO THE AXIAL RIVER. THE CHARACTERISTICS OF THE RIVERS THEMSELVES HAVE ONLY BEEN THOUCHED UPON. THE AMAZON, WHICH FOR PURPOSES OF SIMPLIFICATION HEREINAFTER INCLUDES THE SOLIMOES AND THE MARANON, HAS BEEN LIKENED TO A FLOWING SEA. OF THE MORE THAN 1,100 TRIBUTARIES AT LEAST 10 ARE AS LARGE OR LARGER THAN THE MISSISSIPPI. AT ITS PEAK THE RIVER INCREASES IN WIDTH TO HUNDREDS OF MILES FLOODING THE FOREST AND FORMING THE GREAT IGAPOS, OR SWAMPS. THE 40 TO 60 FOOT RISE AND FALL OF THE RIVER IS JUST ONE OF THE EXAMPLES OF ITS AMAZING STATISTICS. IT IS ESTIMATED THAT NEARLY 60 BILLION GALLONS OF WATER PER HOUR ARE POURED INTO THE ATLANTIC AND ITS EFFECTS ARE EVIDENT 200 MILES OUT INTO THE OCEAN. THE RIVER ITSELF IS EFFECTED BY THE OCEAN TIDES AS FAR INLAND AS OBIDOS, 567 MILES INLAND. OCEAN FAUNA, INCLUDING SHARK, TARPON, SAWFISH AS WELL AS MANATEE AND PORPOISES, ARE FOUND 2,000 MILES UP THE MAIN RIVER. DURING PEAK LUNAR TIDAL CONDITIONS HUGE WAVES CALLED "POROROCA" SURGE UPSTREAM AT SPEEDS OF 30 TO 40 MILES PER HOUR SWEEPING WITH IT HUGE TREES AND DEBRIS. THE ROAR OF THE 10 TO 15 FOOT HIGH WAVES CAN BE HEARD MILES AWAY.

THE AXIAL RIVER TOGETHER WITH ITS TRIBUTARIES OFFER OVER 25,000 MILES OF NAVIGABLE WATER FOR LARGE VESSELS. DURING THE FLOOD PERIOD THE INTERIOR FOREST CAN BE PENETRATED FOR HUNDREDS OF MILES FROM THE MAIN TRIBUTARIES BY LAUNCH AND CANOE. WHEN THE FLOODS HAVE RECEDED MOST OF THE STREAMS BECOME INTERMITTENT AND SLUGGISH; CHOKED WITH FALLEN TREES AND AQUATIC PLANT LIFE. MANY OF THE STREAMS DRY UP ENTIRELY. IT IS TO BE NOTED THAT NAVIGATION CAPABILITIES DOES NOT

REFER TO CANOES OR SMALL CRAFTS. ALL WATERWAYS CAN BE NEGOTIATED BY THESE SMALLER CRAFT AND ABOVE THE RAPIDS THERE ARE LONG STRETCHES WHERE RIVER CRAFT OF CONSIDERABLE SIZE ARE USED. THE FREIGHT IS TRANSFERRED OVERLAND AROUND THE RAPIDS TO ANOTHER VESSEL. MANY INSTANCES WILL OCCUR REQUIRING PORTAGE DUE TO FALLS, RAPIDS, OR LOG AND MUD CHOKED CONDITIONS BUT ONCE A STREAM IS REACHED EVERY EFFORT SHOULD BE MADE TO FOLLOW IT TO ITS CONFLUENCE WITH A LARGER OR MAIN STREAM.

THE MAIN RIVER IS CAPABLE OF HANDLING OCEAN GOING SHIPS OF UP TO FOURTEEN FOOT DRAUGHT FOR 2,000 MILES UPSTREAM AS FAR AS IQUITOS. BEYOND IQUITOS, LAUNCHES PLY THE RIVER WITH REGULARITY AS FAR AS THE PONGO DE MANSERICHE, THE LAST "GATEWAY" DESCENDING FROM THE ANDES.

OF THE MAJOR TRIBUTARIES, THE MADEIRA HAS THE LONGEST NAVIGABLE DISTANCE BEING CAPABLE OF HANDLING SHIPS OF UP TO 6,000 TONS AS FAR AS PORTO VELHO IN ACRE TERRITORY. ABOVE PORTO VELHO 200 MILES OF RAPIDS EFFECTIVELY INTERRUPT COMMUNICATION BEFORE THE LONG NAVIGABLE STRETCHES OF THE MARMORE RIVER IN BOLIVIA ARE REACHED. MOST OF THE OTHER TRIBUTARIES ARE NAVIGABLE BY LARGER VESSELS ONLY FOR A RELATIVELY SHORT DISTANCE FROM THEIR CONFLUENCE WITH THE AXIAL RIVER. THE FALLS AND RAPIDS CLEARLY MARK THE LEVELS OF THE ASCENDING HIGHLANDS RIMMING THE BASIN. THE RAPIDS OF THE TAPAJOS, THE XINGU, AND THE TOCANTINS ARE REACHED WITHIN 100 TO 200 MILES FROM THE AMAZON.

SEVERAL OF THE RIVERS CAN BE TRAVELED BY LAUNCH TYPE RIVER CRAFT FOR SEVERAL HUNDRED MILES. THE PURUS AND THE JURUA CAN BE NAVIGATED BY SUCH SMALLER CRAFT AS FAR AS THE TERRITORY OF ACRE AND THE UCAYALI AND THE HUALLAGA CAN HANDLE SUCH CRAFT TO THE FOOT OF THE ANDES. THE NORTHERN TRIBUTARIES HAVE EVEN LESS NAVIGATION CAPABILITIES FOR LARGER VESSELS THAN THE TRIBUTARIES ENTERING THE SOUTH BANK OF THE

AMAZON. THE OUTCROPPING OF THE UNDERLYING ROCK EXTENDING FROM THE ANDES CREATE FALLS AND RAPIDS IN THE SOUTHEASTERLY FLOWING STREAMS FOR DISTANCES OF UP TO 600 MILES. THIS IS PARTICULARLY TRUE OF THE PUTUMAYO-ICA RIVER AND THE NAPO. THE JAPURA, AFTER LEAVING THE LINE OF DESCENT, PARALLELS THE MAIN RIVER FOR A CONSIDERABLE DISTANCE ALONG THE LOWER ELEVATION AND IS TRAFFICABLE TO GOOD SIZED RIVER STREAMERS. THE RIO NEGRO IS CAPABLE OF HANDLING RIVER STREAMERS AS FAR NORTH AS THE MASSURABI RAPIDS (66°W). BEYOND THIS POINT MOTOR LAUNCHES CAN NAVIGATE THE RIVER TO THE CASIQUIARE CHANNEL WHICH CONNECTS THE AMAZON RIVER SYSTEM WITH THE ORINOCO RIVER BASIN. THE RIO BRANCO CAN BE NAVIGATED FOR APPROXIMATELY 250 MILES BEYOND ITS CONFLUENCE WITH THE RIO NEGRO BUT MOST STREAMS FLOWING FROM THE GUIANA HIGHLAND HAVE RAPIDS OR FALLS WITHIN 100 MILES OF THE AMAZON.

TRAFFICABILITY

LAND. AS MAY BE INFERRED FROM THE FOREGOING DESCRIPTIONS, OVERLAND TRAVEL THROUGH THE TROPICAL RAIN FOREST HAS MANY SERIOUS OBSTACLES. EVEN UNDER THE BEST CONDITIONS--THAT IS, IN THE WELL-DRAINED UPLAND PRIMARY FOREST, DIRECT LINE TRAVEL CAN BE SUSTAINED FOR ONLY SHORT PERIODS. FALLEN TREES, SPORADIC STANDS OF LUSH GROUND VEGETATION WHERE THE SUN HAS PENETRATED THE FOREST CROWN, AND EVEN THE DENSITY OF THE TREES THEMSELVES WILL FORCE ROUTE DEVIATION.

IN THE AREAS OF INUNDATION TRAVEL BECOMES FURTHER COMPLICATED BY THE IRREGULAR OCCURRENCE OF SWAMPS OF THE VARZEA AND CONTINUOUS SWAMP AND MUD OF THE IGAPO. THE UNDERBRUSH BECOMES INCREASINGLY DENSE AND FLYING INSECTS ARE MORE PREVALENT.

IN TRAVELING THROUGH THE UPLAND FOREST AND THE AREAS OF INUN-

DATION, THE TRAVELER IS ADVISED TO BY-PASS EXTENSIVE SWAMPS AND ISOLATED BUT EXTENSIVE STANDS OF DENSE UNDERBRUSH RATHER THAN ATTEMPTING TO FORCE A WAY THROUGH. REASONS FOR THIS ARE SEVERAL: (1) TO CONSERVE ENERGY, (2) THERE IS NOTHING DEFINITE ABOUT THE TERRAIN TO INDICATE AN IMMEDIATE OBJECTIVE BEYOND THE OBSTACLE, (3) THE INCREASED OCCURRENCE OF SNAKES, INSECTS, AND TOXIC PLANTS, AS WELL AS INCREASED OCCASION FOR INJURY, (4) TIME SPENT IN HACKING, OR MUCKING THROUGH SUCH OBSTACLES IS OF SUCH UNCERTAIN SUCCESS THAT A LESS HAZARDOUS AND LESS ARDUOUS ROUTE ASSUMES ADDED VALUE. (THIS IS NOT INTENDED TO EXCLUDE PARTIAL PENETRATION AND DELAY IN TRAVEL TO FORAGE IN THESE AREAS FOR FOOD.)

WHEN THE MARGINAL STRIPS OF LAND BORDERING THE RIVERS AND STREAMS ARE REACHED, THE INDIVIDUAL HAS NO RECOURSE BUT TO HACK A WAY THROUGH THE ENTANGLED MASS OF VEGETATION TO REACH THE WATERWAY. UNLESS THERE IS A SPECIFIC REASON PECULIAR TO A PARTICULAR SURVIVAL SITUATION--, FOR EXAMPLE, A KNOWN SOURCE OF REFUGE WITH THE DIRECTION THERETO AS WELL AS THE DISTANCE WITHIN THE CAPABILITIES OF THE INDIVIDUAL--THE IMMEDIATE OBJECTIVE OF THE SURVIVOR IS A NAVIGABLE WATERWAY.

THERE ARE NO RELIABLE NATURAL AIDS TO NAVIGATION WITHIN THE RAIN FORESTS EXCEPT THE DIRECTION OF FLOW OF THE RIVERS AND STREAMS. BECAUSE OF THE CONCAVE FORMATION OF THE LAND ALL THE WATERWAYS IN THE AMAZON BASIN FLOW TOWARD THE AMAZON. IN THE GUIANAS DIRECTION OF FLOW IS DEPENDENT UPON INCLINE AND IS VARIABLE. MANY OF THE SMALLER TRIBUTARIES WILL REFLECT A DIRECTION OF FLOW COMPLETELY OPPOSITE THE RIVER INTO WHICH IT EMPTIES SUCH AS THE TACUTU WHICH FLOWS NORTH FOR A CONSIDERABLE DISTANCE BEFORE FLOWING WEST TO JOIN THE SOUTH FLOWING

Rio Branco. The incline toward the axial river is too slight and irregular to distinguish a fall line by land except on the Andean slopes and the higher extensions of the basin in the Guiana Highlands and the Brazilian Plateau.

Celestial navigation is nearly impossible because of the lack of visibility through the forest canopy. The continuity of the forest canopy, the height and unbranched trunk of the trees, the ubiquitousness of the voracious red fire ants, and the drain on energy from climbing makes it extremely hazardous to obtain sightings above the forest. Nevertheless, this may occasionally be a necessary expedient. A compass would be a valuable item of equipment to have even though its application is restricted. While it may not be feasible to maintain a straight line course it is possible with a compass and related techniques to maintain a constant direction of travel. This is a primary requirement in forest travel--maintaining a constant direction.

River. The position taken here is that the survival situation requires the construction of a suitable craft at the initial proximity of contact with a waterway. Several factors will govern the structural characteristic such as size, strength, and materials. The first choice of design would be a simple raft. The most suitable material would be any of the several species of balsa (Ochroma, various species) which are found throughout the rain forest and in close proximity to the waterways. Numerous fiber plants and hardwoods are available for making lashings and crossbars. As a refinement, the prow of the raft can be shaped to a projecting V point for easier control. For poling the raft any number of suitable semi-

FLEXIBLE POLES CAN BE ACQUIRED FROM THE NUMEROUS BAMBOOS THAT FRINGE THE RIVER.

A RATHER POOR SECOND CHOICE TO THE RAFT WOULD ENTAIL MAKING A DUGOUT FROM AN APPROPRIATE MEDIUM HARDWOOD. THIS WOULD BE BOTH TIME AND ENERGY CONSUMING. IT MAY BE WORTH THE EFFORT TO SEARCH THE RIVER BANKS FOR AN INDIAN DUGOUT, HOWEVER, THESE ARE USUALLY LARGE AND DIFFICULT FOR ONE MAN TO HANDLE. MOST DUGOUTS, ESPECIALLY ONE CRUDELY MADE, HAVE A PRECARIOUS BALANCE AND WILL ADD TO THE EXISTING HAZARDS OF THE RIVERS.

AS TO STRENGTH AND ENDURANCE OF THE CRAFT--THIS WILL DEPEND UPON THE TYPE OF FLOW OF THE WATER AND THE ESTIMATED DURATION OF USE. ABOVE AND WITHIN THE STRETCHES OF SWIFT FLOWING WATER WHERE RAPIDS AND FALLS MAY BE ENCOUNTERED, THE CRAFT WILL NEED TO BE STRONG BUT PERHAPS ONLY LARGE ENOUGH TO MAINTAIN BOUYANCY. THIS WILL MAKE IT LIGHT ENOUGH TO PERMIT PORTAGE OR IF IT MUST BE ABANDONED LESS WASTE EFFORT WILL HAVE BEEN INVOLVED. ON THE SMALL, SLOW,MEANDERING STREAMS IN WHICH THERE IS A LIKELIHOOD OF LOG JAMS, AGAIN THE CRAFT SHOULD ENTAIL ONLY THE MINIMUM EFFORT TO MAKE IT SAFE. ON THE LARGE STREAMS, ESPECIALLY AT THE LOWEST LEVEL OF FALL, THE CRAFT MAY BE MORE ELABORATE BOTH IN SIZE AND SAFETY FEATURES SUCH AS ADDITIONAL CROSSBARS, LASHINGS, TIE DOWNS FOR ACQUIRED GEAR, AND SUCH CONVENIENCES AS MAY OCCUR TO THE TRAVELER. IT MAY VERY WELL BE THE CRAFT UPON WHICH HE WILL MAKE FIRST CONTACT WITH CIVILIZATION.

SO FAR ONLY THE BROAD ASPECTS OF THE AMAZON RIVER SYSTEM HAS BEEN CONSIDERED. FOR THE NAVIGATION OF THE HUNDREDS OF RIVERS AND STREAMS COMPRISING THIS SYSTEM, IT PRESENTS A NUMBER OF HAZARDS AS WELL AS BENEFITS.

THE MOST EXACTING OF THE NAVIGATIONAL HAZARDS ARE THE FALLS AND RAPIDS OCCASIONED BY THE AFOREMENTIONED SERIES OF STEP-LIKE ELEVATIONS OF THE BASIN'S PERIMETER DOWN WHICH THE RIVERS AND STREAMS COURSE ENROUTE TO THE AXIAL RIVER. PREVIOUS MENTION ALSO HAS BEEN MADE OF THE HIGH-WALLED CANYONS CALLED PONGOS WHICH CHARACTERIZE THE LAST HUNDRED OR SO MILES MILES PLUNGE OF THE UPPER MARANON FROM THE ANDES. THIS STRETCH OF THE AMAZON CONTAINS SOME OF THE MOST SPECTACULAR AND DANGEROUS CATARACTS, RAPIDS, AND WHIRLPOOLS IN THE WORLD. TO A SOMEWHAT LESSER DEGREE, THOUGH NO LESS DANGEROUS, MOST OF THE SWIFT FLOWING WATERWAYS EXHIBIT SIMILAR STRETCHES OF FALLS AND RAPIDS BEFORE REACHING THE BROAD PLAINS WHERE THE INNER VALLEY OF THE AMAZON BEGINS.

UNDER SUCH CIRCUMSTANCES THE TRAVELER IS FORCED TO MAKE A NUMBER OF PORTAGES AROUND THE DANGER AREAS. FEW NARRATIVES OF EXPLOITS ON THE AMAZON OR ITS TRIBUTARIES FAIL TO REPORT IN SOME DETAIL EXCITING EXPERIENCES OF "SHOOTING" THE RAPIDS. USUALLY THE EXPERIENCE RESULTED FROM A "MISUNDERSTANDING" BETWEEN THE AUTHORS AND THEIR INDIAN RIVER BOATMEN (BALSEROS). THE ACCOUNTS NEVER FAIL TO EXTOLL THE FANTASTIC SKILL OF THE INDIAN RIVER BOATMEN IN NEGOTIATING THE TREACHEROUS RAPIDS. THEODORE ROOSEVELT GIVES A MORE REALISTIC, IF LESS THRILLING, ACCOUNT OF THE GRUELING DESCENT OF SUCH A STRETCH OF RAPIDS AND FALLS AND HIS PARTY INCLUDED THE FAMOUS BRAZILIAN EXPLORER AND INDIAN BENEFACTOR, MARSHAL CANDIDO MARIANO DA SILIA RONDON. IN GENERAL, "SHOOTING" THE RAPIDS IS NOT CONSIDERED AS A NECESSARY EXPEDIENCY OF SURVIVAL, WITH OR WITHOUT THE INDIAN BALSEROS IF THERE ARE OTHER MEANS OF NEGOTIATING THE HAZARD.

NEARLY ALL OTHER HAZARDS TO NAVIGATION ARE SITUATIONS OF THE

MOMENT RATHER THAN FIXED HAZARDS. FOR EXAMPLE, FLOATING LOGS SOMETIMES WHOLLY OR PARTIALLY SUBMERGED MUST BE GUARDED AGAINST ESPECIALLY DURING HIGH-WATER PERIODS WHEN THE SWIRLING WATERS HAVE UNDERCUT THE BANKS AND TOPPLED MANY TREES. DURING PERIODS WHEN THE WATERS HAVE RECEDED, THE STREAMS ARE FREQUENTLY CHOKED WITH FALLEN TREES. THE LOG JAMS ARE PILED WITH NUMEROUS DEBRIS CAUSING ACCUMULATION OF SILT AND MUD SO THAT THE STREAM BECOMES IMPASSABLE FOR EXTENDED DISTANCES. THIS CONDITION WOULD ENTAIL PARALLELING THE STREAMS BY LAND OR CLAMBERING OVER THE LOG JAMS. EITHER DECISION ENTAILS RISKS, THE FORMER OF BECOMING LOST IN THE FOREST AND LOSING THE STREAM; THE LATTER, POSSIBLE INCURRANCE OF A SPRAIN OR BROKEN BONE.

THE MEANDERING CHARACTERISTIC OF THE STREAMS UPON REACHING THE VALLEY FLOOR CAUSE NUMEROUS "FALSE" CHANNELS TO OCCUR. MOST OF THESE POUR INTO BACKWATER SWAMPS OR ELSE DISAPPEAR INTO THE FOREST UNDERBRUSH. THIS NECESSITATES BACK-TRACKING AND PROBING FOR THE PRIMARY CHANNEL. IN CONNECTION WITH THE SLUGGISHNESS OF THE STREAMS, MUD FLATS, SPITS, AND SAND BARS ARE VERY PREVALENT. FOR A RAFT THERE IS ONLY THE PROBLEM OF SHOVING OFF THE OBSTACLE, HOWEVER, A DUGOUT MAY BE EASILY CAPSIZED. FOR THIS REASON A RAFT IS MUCH MORE SUITABLE IN THAT THERE IS NOTHING MORE REQUIRED THAN SHOVING OFF FROM THE OBSTACLE. WITH A DUGOUT, HOWEVER, THE BALANCE IS SO PRECARIOUS THAT ONE WHO IS UNSKILLED IN THEIR USE WILL EASILY CAPSIZE. ALSO, THEY ARE EXTREMELY HEAVY AND CUMBERSOME.

THE NUMEROUS PLANTS AND TREES EXTENDING OVER THE RIVER ALONG THE BANK PRESENT CONTINUOUS THREATS. MANY OF THE PLANTS, ESPECIALLY SOME PALMS, HAVE REALLY DANGEROUS THORNS. THERE ARE LOOPING VINES THAT COULD DRAG AN INDIVIDUAL FROM THE CRAFT. FINALLY, THERE ARE THE

NUMEROUS WASPS AND OTHER BITING, STINGING INSECTS THAT INFEST THE OVERHANGING VEGETATION. THESE ARE IN THE NATURE OF DISTRACTIONS THAT CAN EITHER OCCUR AT A CRITICAL TIME OR BY THEIR OCCURRENCE CREATE A CRITICAL SITUATION.

THERE ARE THE "USUAL" HAZARDS ASSOCIATED WITH THE DANGEROUS FAUNA THAT INHABIT THE WATERWAYS AND THE LITTORAL. THESE ARE DISCUSSED INDIVIDUALLY UNDER HEALTH AND HAZARDS. MANY SITUATIONS WILL PROBABLY ARISE REQUIRING ENTERING THE WATER. AS A RULE, THE DANGERS FROM THE RIVER DENIZEN ARE MINIMAL. NEVERTHELESS, SOME PRECAUTIONS CAN BE EXERCISED SUCH AS A VISUAL CHECK FOR CAIMAN, PIRANHAS, ELECTRIC EELS, AND STING RAYS. THERE IS LITTLE POINT IN TEMPTING PROVIDENCE BY TRAILING ONE'S DIGITAL EXTREMITIES IN THE WATER AS UNINTENDED BAIT FOR THE PIRANHAS.

THE FOREGOING DOES NOT EXHAUST THE POTENTIAL HAZARDS OF THE RIVER SYSTEM BUT IT DOES EXAMINE THE MORE BASIC CONSIDERATIONS. THE BENEFITS ASSOCIATED WITH RIVER TRAVEL ARE FAIRLY OBVIOUS SUCH AS: (1) FIXING THE COURSE OF ACTION, (2) ESTABLISHING A FIXED TERRAIN FEATURE, (3) LESS ARDUOUS TRAVEL, (4) PRESENTING A CONSTANT SOURCE OF FOOD, AND (5) INCREASES POSSIBILITIES OF CHANCE ENCOUNTERS WITH NATIVES USING THE WATERWAYS.

CHAPTER II

REGIONAL TOPOGRAPHY

Guiana Highlands

The massif forming the territory of the Guianas, British, Surinam (Dutch), and French, includes the southern area of Venezuela east of the Orinoco, most of the area of Brazil north of the Amazon, and the triangular tip of southeastern Colombia. Topographically, the entire area consists of an elevated plateau averaging from 1,200 to 1,600 feet above sea level. Over the surface of the plateau are a number of low, rounded hills which become more prominent where the Brazil-Guianas borders adjoin. In the area where Brazil, Venezuela, and Guiana meet, the terrain is distinctly mountainous reaching elevations over 8,000 feet (Mount Roraima--8,540 feet).

The mountain ranges, called sierras or cerros, form the watershed of the various rivers in the region effecting the directional flow. The first important mountain range on the north is the Sierra Amacuro which forms the watershed for the northeast flowing rivers, Amacuro, Arature, Aguirre, Imataca, and Surinama, into the Orinoco and the Rio Barima flowing south and east into British Guiana. A western arm of the Sierra Amacuro extends southward through the high plateau intersection, the major Cuyuni-Caroni watershed, and continues south to Mount Roraima. The headwaters of Rio Cuyuni are found between the Sierras de Imataca on the north and Sierra Rincote

ON THE SOUTH SO THAT IT FLOWS TO THE NORTH AND EAST INTO BRITISH GUIANA. THE SIERRAS PACARIMA, PARIMA, AND SIERRA DE CURUPITA EXTENDING ALONG THE BORDER OF VENEZUELA AND BRAZIL FORM THE DIVIDING WATERSHED BETWEEN NORTH AND NORTHWEST FLOWING TRIBUTARIES OF THE ORINOCO AND THE SOUTH FLOWING TRIBUTARIES OF THE AMAZON. SPECIFICALLY, THE HEADWATERS OF THE ORINOCO ARE FORMED ON THE WESTERN SLOPES OF SIERRA PARIMA FROM WHERE THE RIVER FLOWS NORTHWEST. THE HEADWATERS OF THE RIO CAURA (SOMETIMES CALLED RIO MAREVARI), AND THE RIO CARONI ARE FORMED ON THE NORTHERN SLOPES OF THE SIERRA PACARIMA AND FLOW ALMOST DUE NORTH. BOTH RIVERS ARE OF MAJOR PROPORTIONS HAVING EXTENSIVE TRIBUTARIES NOTABLY THE RIO PARAGUA WHICH PARALLELS THE CARONI FOR OVER 200 MILES BEFORE JOINING IT AT APPROXIMATELY 7° NORTH. WHERE THE ORINOCO, THE RIO NEGRO, AND THE TRIBUTARIES OF THE CASIQUIARE ARE FORMED, THE ALMOST INDISTINGUISHABLE VARIATIONS IN THE SLOPE OF THE TERRAIN FREQUENTLY CAUSE THE WATERS OF THE TWO WATER SYSTEMS TO BACK UP INTO EACH OTHER TO THE EXTENT THAT THE TRUE DIRECTION OF FLOW IS SOMETIMES REVERSED DURING PERIODS OF OVERFLOW OF ONE OR THE OTHER OF THE WATERWAYS.

THE ORINOCO RIVER RECEIVES ALL OF THE FLOW FROM THE NORTHWESTERN SLOPES OF THE GUIANAS AS WELL AS THE FLOW OF NUMEROUS LARGE RIVERS FLOWING FROM SOUTHWEST, WEST, AND NORTH. THE VOLUME OF WATER AS WELL AS ITS OVERALL LENGTH AND WIDTH CLASSES IT AMONG THE LARGEST RIVERS IN THE WORLD. GEOLOGICALLY IT IS PART OF THE GUIANA MASSIF. HOWEVER, THE INTERRELATIONSHIP BETWEEN THE ORINOCO RIVER AND THE GREAT ORINOCO PLAINS OR <u>LLANOS</u> FOR MOST OF THEIR LENGTH IN VENEZUELA MAKE IT FUNCTIONALLY OF GREATER SIGNIFICANCE TO THE <u>LLANOS</u>. ALL OF THE UPPER ORINOCO RIVER COURSES THROUGH AREAS TYPICALLY TROPICAL RAIN

FOREST IN CHARACTER. FROM THE RIGHT BANK (FACING NORTH), THE RAIN FOREST EXTENDS CONTINUOUSLY INTO THE AMAZON RAIN FOREST BROKEN ONLY OCCASIONALLY BY THE SAVANNAS. THE LEFT BANK FOR APPROXIMATELY TWO-THIRDS OF ITS LENGTH IS MORE CHARACTERISTIC OF THE GALLERY FORESTS OF THE SAVANNAS AND IN MANY AREAS THE RIVER OPENS ENTIRELY ON TO THE PLAINS. THE CHARACTERISTICS OF THE ORINOCO BASIN AND THE ORINOCO RIVER ARE DISCUSSED IN DETAIL UNDER SAVANNAS OF SOUTH AMERICA.

MOVING EASTERLY INTO BRITISH GUIANA AND THE BRAZILIAN PORTION OF THE GUIANAS, MOUNT RORAIMA OVERLOOKS THE SOUTHERN WATERSHED FORMED BY THE CHAIN OF SIERRAS NAMED ABOVE. THE HEADWATERS OF THE SOUTH FLOWING RIO BRANCO, CHARACTERIZED BY NUMEROUS CATARACTS AND FALLS IN ITS UPPER PORTION, GIVE WAY TO A PLACID SMOOTH FLOWING RIVER IN ITS MIDDLE AND LOWER COURSE. AN EASTERN TRIBUTARY OF THE RIO BRANCO, THE RIO TACUTU, FLOWS NORTH FOR A CONSIDERABLE DISTANCE BEFORE TURNING WEST TO ITS JUNCTION WITH THE RIO BRANCO. WITH THE EXCEPTION OF THE IRENG WHICH FLOWS SOUTHWARD BEFORE JOINING THE TACUTU WHERE IT TURNS WEST, NEARLY ALL OF THE RIVERS AND STREAMS IN BRITISH GUIANA EVENTUALLY EMPTY INTO THE ATLANTIC. ON THE NORTHWEST THE BARIMA, THE BARAMA, AND THE WAINI RIVERS FLOW EAST AND THEN NORTH FROM THE EASTERN SLOPES OF THE SIERRA AMACURO. THEY EMPTY INTO THE COASTAL LOWLAND SWAMPS WHICH ARE A COMBINATION OF MUCK AND SLIME AND DENSE MANGROVE STANDS. OCCASIONAL ELEVATIONS RISE THIRTY TO FORTY FEET ABOVE THE MORASS. HERE STANDS OF RAIN FOREST VEGETATION BESIDE THE MANGROVES ARE FOUND ALONG WITH THE CHARACTERISTIC FAUNA. THE CUYUNI FLOWS ALMOST DUE EAST BEFORE JOINING THE ESSEQUIBO. SOUTH OF THE CUYUNI, THE MAZARUNI FLOWS TO THE NORTH AND THEN WINDS FIRST SOUTHEAST AND FINALLY NORTHEAST BEFORE JOINING THE ESSEQUIBO. THE

WATERSHED FOR THE MAZARUNI, AS WELL AS SEVERAL SMALLER TRIBUTARIES OF THE ESSEQUIBO, IS THE EASTWARD SLOPING FACE OF THE PACARIMAS RANGE.

THE ESSEQUIBO, WHICH NEARLY BISECTS BRITISH GUIANA, IS PARALLELED BY ANOTHER OF ITS TRIBUTARIES, THE RUPUNUNI, FOR A CONSIDERABLE DISTANCE BEGINNING AT THEIR HEADWATERS. WITHIN A RELATIVELY SHORT DISTANCE OF EACH OTHER THE HEADWATERS OF THE RIO TACUTU WHICH FLOWS INTO THE RIO BRANCO AND THE HEADWATERS OF SEVERAL TRIBUTARIES OF THE ESSEQUIBO, INCLUDING THE RUPUNUNI, ARE FORMED ON THE NORTHERN INCLINE OF THE RANGE OF SIERRAS RUNNING IN AN EAST AND WEST ARC COMPRISING THE KAMOA AND ACARAI SIERRAS. THE SOUTHERN INCLINE OF THE SAME RANGE FORMS THE WATERSHED OF THE SOUTH FLOWING STREAMS WHICH FLOW INTO THE AMAZON.

OF PARTICULAR NOTE IN THIS AREA IS THE FAIRLY EXTENSIVE RUPUNUNI SAVANNA WHICH IS BISECTED BY THE RIO RUPUNUNI FROM SOUTH TO NORTH AND BISECTED AGAIN FROM EAST TO WEST BY THE KANUKU MOUNTAIN. THE ENTIRE AREA COVERS NEARLY 5,500 SQUARE MILES.

THE ESSEQUIBO IS THE MOST PROMINENT RIVER IN THE BRITISH GUIANA. IN ITS UPPER REACHES IT FLOWS THROUGH RAIN FOREST CONTIGUOUS WITH THAT OF THE AMAZON. IT HAS A VERY GRADUAL DESCENT FROM ITS SOURCE AT ABOUT 1,000 FEET IN ELEVATION TO THE MOUTH WHERE IT EMPTIES INTO THE ATLANTIC THROUGH THE FAN OF CHANNELS AND SWAMPS WHICH MAKE UP THE COASTAL STRIP. THE RIVER IS SUBJECT TO FLOODING; THE BANKS NOT BEING HIGH ENOUGH TO CONFINE THEM DURING THE RAINY SEASON. TO THE EAST THE RIO BERBICE PARALLELS THE NORTH FLOW OF THE RIO ESSEQUIBO. THE RIO BERBICE, BEFORE FANNING OUT INTO THE COASTAL SWAMP FOREST, COURSES THROUGH ANOTHER FAIRLY EXTENSIVE SAVANNA BEARING THE SAME

NAME AS THE RIVER. THE RIO COURANTYNE, FLOWING NORTH, FORMS A NATURAL BOUNDARY BETWEEN THE TWO POLITICAL TERRITORIES OF BRITISH GUIANA AND SURINAM (DUTCH GUIANA). THE TUMUC-HUMAC MOUNTAIN RANGE FORMS THE CONTINUING DIVIDE BETWEEN THE NORTH FLOWING WATERS OF THE GUIANAS AND THOSE FLOWING SOUTH OR SOUTHEAST INTO THE AMAZON. A LARGE INTERIOR REGION OF LOW MOUNTAINS NAMED WILHELMINA MOUNTAINS REACH A HEIGHT OF 4,120 FEET. THESE MOUNTAINS EXTEND TO THE NORTH WHERE THEY GRADUALLY DISAPPEAR INTO AN INAPPROPRIATELY TERMED "SAVANNA" BELT WHICH IN TURN MERGES WITH THE COASTAL PLAIN. TO THE EAST THE INCLINE IS INTERRUPTED ONLY BY OCCASIONAL NORTHERN EXTENSIONS OF THE TUMUC-HUMAC RANGE SO THAT THE DRAINAGE OF MOST OF THE STREAMS OR RIVERS FAN OUT SOMEWHAT LIKE THE VEINS OF A LEAF FLOWING TO THE NORTH AND NORTHEAST INTO THE COAST OR EAST AND SOUTHEAST INTO THE AMAZON.

EXCEPT FOR THE OCCASIONAL SAVANNAS, SOME OF WHICH ARE OF CONSIDERABLE SIZE, THE FOREST AREAS OF THE INTERIOR OF THE GUIANAS IS CONTIGUOUS WITH AND OF THE SAME VEGETAL CHARACTER AS THE AMAZON RAIN FOREST. THE RIVERINE VEGETATION IS DENSE; COMPOSED OF THORNY BRUSH, PALMS WITH LONG SPINES PROTRUDING IN EVERY DIRECTION, ESPECIALLY DOWNWARD; ENTANGLING VINES, CLIMBERS AND EPIPHYTES, STIFF CANE, SMALL TREES AND THE USUAL TOWERING TREES, BUTTRESSED WITH ROOT KNEES PROTRUDING ABOVE GROUND TO ADD TO THE ENTANGLEMENT UNDERFOOT. IN BACK OF THE RIVER BANKS THE FOREST LIFE ASCENDS TO THE HIGH CROWN OF THE FOREST WHERE THE THICKNESS OF THE VEGETATION FILTERS THE SUNLIGHT LEAVING THE FOREST FLOOR IN PERPETUAL TWILIGHT DURING THE DAYLIGHT HOURS.

THE ANIMAL LIFE IN ALL OF ITS FORMS EXHIBITS NO APPRECIABLE VARIATION EITHER IN SPECIES, HABITS, OR ECOLOGICAL SIGNIFICANCE FROM

THAT OF THE AMAZON BASIN. THIS IS PARTICULARLY TRUE INSOFAR AS ITS UTILIZATION AS A SOURCE OF FOOD BY THE INHABITANTS OF THE REGION.

THROUGHOUT THE HIGHLANDS THE MAJOR VARIATIONS IN DAILY TEMPERATURE ARE CAUSED BY CHANGES IN ELEVATION BECOMING COOLER AT HIGHER ELEVATIONS OR EXPOSURE TO SEA BREEZES. IN THE INTERIOR BEYOND THE LOWEST LEVEL OF RIVER FALLS SEASONAL DISTINCTIONS ARE NEGLIGIBLE AND THE HUMIDITY IS VERY OPPRESSIVE. THIS IS ESPECIALLY TRUE IN THE EASTERN PORTION WHERE THE TRADEWINDS ARE RELATIVELY UNCHECKED BOTH FROM THE NORTHEAST AND SOUTHEAST. ALTHOUGH THEY BRING IN A HIGH MOISTURE CONTENT, THEY DO NOT PRODUCE THE COOLING EFFECT AT THESE LOWER LEVELS. THE TWO CLEARLY MARKED WET SEASONS OCCUR DURING DECEMBER AND JANUARY AND FROM APRIL TO NOVEMBER. THERE ARE EXTREME LOCAL VARIATIONS IN THE AMOUNT AND PERIODICITY OF RAINFALL--AGAIN DETERMINED BY ELEVATION AND EXPOSURE TO PREVAILING WINDS.

MAGDALENA AND CAUCA RIVER VALLEYS

THE RIO MAGDALENA AND THE RIO CAUCA VALLEYS OF THE NORTHERN ANDES BEGIN IN THE MOUNTAIN MASS IN SOUTHERN COLOMBIA IN THE PASTO-POPAYAN AREA CALLED THE PASTO KNOT. THEY EXTEND ALMOST DIRECTLY NORTH ON A PARALLEL BEFORE MERGING NEAR THE NORTHERN COAST. ON THE EASTERN SLOPES OF THIS SAME MASS THE PUTUMAYO (ICA) AND THE JAPURA ARE ALSO FORMED FLOWING SOUTHEAST WHERE THEY JOIN THE AMAZON RIVER.

FROM THIS REGION THE MOUNTAINS FAN OUT TO FORM THE WESTERN, CENTRAL, AND EASTERN CORDILLERAS. THE EASTERN CORDILLERA CONTINUES AS A SERIES OF MOUNTAIN RIDGES WHICH EVENTUALLY BRANCH FORMING THE WATERSHED FOR THE SOUTHERN DRAINAGE OF LAKE MARACAIBO AS WELL AS FOR THE EASTERLY FLOWING RIO APURE, RIO META, AND RIO GUAVIARE WHICH CROSS THE LARGE ORINOCO SAVANNAS BEFORE EMPTYING INTO THE ORINOCO RIVER.

The Magdalene Valley separates the Eastern and Central Cordillera and receives water flow from both. The river in its earlier stages is confined to a series of swift flowing rapids and falls which are difficult to navigate even by raft. After a precipitous series of rapids, which plunges down about 300 feet, the river deepens to about 10 feet and is navigable to larger boats for fairly long stretches. While still above 6,000 feet, the river receives the waters of several tributaries including the Rio Bogota and the Rio Fusagasuga. These rivers descend through a number of falls. On the Rio Bogota, the Tequendama Falls is several times the size and grandeur of the Niagara Falls. Some indication of the plunging character of the Rio Bogota is that in its last series of rapids over a distance of 60 miles it has a total incline of nearly 6,000 feet.

Below its confluence with the Rio Bogota, the Rio Magdalena fall is uniform until it reaches Honda where it begins a succession of dangerous rapids and falls for approximately 15 miles. This stretch separates the middle valley from the upper valley. Beyond the Honda rapids the river continues to be swift and somewhat dangerous as it passes through a number of high walled gorges. During the flood period the waters may reach a depth of 100 feet and the current is torrential. Beyond the gorge, called the "Nare," the river enters a valley up to 50 miles wide in some areas. Here the character of the river changes. It develops a number of channels as it broadens creating forested islands and flooded lagoons on either bank. The lowland aspects together with periodic inundation causes frequent changes in the river bed so that navigation for

LARGER VESSELS IN THIS PORTION OF THE RIVER IS A CONSTANT DANGER. IN ADDITION TO THE SAND BARS AND SPITS, THERE ARE NUMEROUS SNAGS, AND SUNKEN AND FLOATING TIMBERS TO CONTEND WITH.

AMONG THE TRIBUTARIES FLOWING INTO THE RIO MAGDALENA IS THE RIO SOGAMOSO WHICH IN TURN HAS SEVERAL TRIBUTARIES OF ITS OWN. TWO OF THE MORE IMPORTANT ARE THE RIO CHICANOCHA AND THE RIO SARAVITA. THE RIO CHICAMOCHA RISES IN THE EASTERN CORDILLERA OVERLOOKING THE LLANOS. IT FORCES ITS WAY WESTWARD THROUGH THE ANDEAN CHAIN THROUGH GORGES HUNDREDS OF FEET DEEP AND DURING PERIODS OF HEAVY RAINS SENDS A TERRIFIC VOLUME OF WATER PLUNGING THROUGH THE STEEP WALLS. THE RIO SARAVITA, WHILE NOT AS LONG AS THE RIO CHICAMOCHA, IS MUCH MORE SAVAGE IN ITS CHARACTER. IN ONE STRETCH IT PLUNGES DOWN THROUGH A NARROW GORGE 2,300 FEET IN 3 MILES. THE RIO SOGAMOSA IS ONE OF THE MORE POPULATED RIVERS IN THE VALLEY REGION DESPITE LACK OF NAVIGATION EXCEPT FOR ITS LOWER COURSE.

THE RIO CAUCA, WHICH RISES WEST OF THE RIO MAGDALENA IN THE SAME UPLAND REGION, FOLLOWS A PARALLEL SERIES OF LEVELS SIMILAR IN CHARACTER TO THE RIO MAGDALENA WITH ONE MAJOR EXCEPTION. INSTEAD OF THE MORE ABRUPT FALLS, THE RIO CAUCA DESCENDS THROUGH A SERIES OF RAPIDS EXTENDING OVER LONG STRETCHES OF THE RIVER. IN ONE STRETCH OF NEARLY 400 MILES, THE RIVER FALLS 2,700 FEET WITHOUT A SINGLE WATERFALL.

THE VALLEY OF THE RIO CAUCA IS ONE OF THE MOST POPULATED AREAS OF COLOMBIA ESPECIALLY BY WHITE POPULATIONS. THERE IS AN EXTENSIVE BELT OF UNFORESTED, WELL DRAINED LAND ALONG THE GREATER PART OF ITS LENGTH BEFORE IT OPENS ONTO THE FLOOD PLAINS WITH THE RIO MAGDALENA. THE MAGDALENA VALLEY ALSO HAS UNFORESTED PLAINS IN ITS MIDDLE COURSE.

THESE ARE SWAMPY FLOOD PLAINS AND PLAGUES OF FEVER BEARING MOSQUITOES MAKES HABITATION PROHIBITED.

AT THE BASE OF THE NORTHERN END OF THE CENTRAL CORDILLERA, THE MAGDALENA MERGES WITH THE CAUCA RIVER VALLEY. HERE THE TWO RIVERS FORM A WIDE, POORLY DRAINED FLOOD PLAIN. ALONG THE BANKS AND BETWEEN BOTH RIVERS, NUMEROUS CHANNELS, LAGOONS, SWAMPS, MUD FLATS AND OVERFLOW LAKES ARE FORMED BY THE FLOOD WATERS. A NORTHERN EXTENSION OF THIS PLAIN IS THE ZAPATOSO LAKE BASIN THROUGH WHICH THE RIO CEZAR FLOWS FROM NORTH TO SOUTH INTO THE RIO MAGDALENA. THE WATERSHED FOR THE ZAPATOSO IS THE SIERRA NEVADA DE SANTA MARTA ON THE NORTH AND THE SIERRA DE PERIJA ON THE WEST. THE SIERRA DE PERIJA SEPARATES THE COLOMBIAN FLOOD PLAIN FROM THE MARACAIBO BASIN.

THE WESTERN PORTION OF THE MAGDALENA-CAUCA DELTA CONTAINS THE SMALLER RIVER VALLEYS OF THE RIO SINU AND THE RIO SAN JORGE WHICH DRAIN THE EASTERN SLOPES OF THE WESTERN CORDILLERA.

THE CLIMATE OF THE MAGDALENA-CAUCA VALLEYS ARE REPRESENTATIVE OF THE ENTIRE TROPICAL ANDEAN MOUNTAIN RANGE. THE VARIATIONS IN TEMPERATURE ARE MOST EFFECTED BY ELEVATION. IN THE LOWER PORTION OF THE VALLEY THE ANNUAL MEAN TEMPERATURES RANGE FROM 80° TO 86°F. ASCENDING THE MOUNTAINS, THE TEMPERATURE RANGES THROUGH EVERY GRADATION FROM 80°F TO A LOW OF 41°F AT THE 11,000 FOOT LEVEL. THE PERPETUAL SNOWS COVER THE PEAKS AT THE HIGHER ELEVATIONS.

THE VALLEYS ARE SUBJECT TO TWO DISTINCTLY WET SEASONS, HOWEVER, BECAUSE OF THE MOUNTAINOUS ASPECTS OF THE REGION THE RAINFALL TENDS TO BE UNPREDICTABLE IN TERMS OF DAILY ACTIVITY. MORE SPECIFICALLY, THE AMOUNT OF RAINFALL EFFECTS THE ZONES OF VEGETATION. WHERE THERE IS ADEQUATE RAINFALL THE OCCURRENCE OF TROPICAL FOREST PRE-

DOMINATES. THE LOWER VALLEYS AND MOUNTAIN SLOPES EXHIBIT DENSE TROPICAL RAIN FOREST VEGETATION UP TO ABOUT 5,000 TO 6,000 FEET. ABOVE THIS ELEVATION THE VEGETATION TENDS TO MORE TEMPERATE IN CHARACTER FINALLY GIVING WAY TO BUSH AND GRASS COVERED PLATEAUS. THE FOREST AT THE HIGHER LEVEL IS MUCH MORE OPEN BUT THE TERRAIN IS EXTREMELY DIFFICULT TO TRAVEL BECAUSE OF THE STEEP INCLINE, NUMEROUS CREVASSES AND RAVINES, AND THE ROCKY COVERED GROUND.

THE ATRATO RIVER VALLEY

THE RIO ATRATO HAS BEEN DESCRIBED AS A MOVING SWAMP RATHER THAN A RIVER. IT RISES ON THE PACIFIC SLOPE OF THE WESTERN CORDILLERA BUT ALMOST IMMEDIATELY LOSES ITS MOUNTAIN, TORRENTIAL CHARACTER UPON ENTERING THE VALLEY FORMED BY THE CORDILLERA AND THE COASTAL RANGE. HERE IT TURNS NORTH AND FOR THE REST OF ITS COURSE IT IS NAVIGABLE FOR FAIRLY LARGE RIVER CRAFT AND DURING PERIODS OF FLOOD CAN BE NAVIGATED BY STEAMERS. BESIDES THE WATER FROM THE RIO SUCIO, THE RIO ATRATO IS CONTINUALLY RECEIVING THE RUN-OFF OF THE TORRENTIAL RAINS ON THE ASCENDING SLOPES OF THE TWO MOUNTAIN RANGES BY WHICH IT IS CONFINED.

"WALLED" IN BY THE COASTAL RANGE AND THE WESTERN CORDILLERA, THE VALLEY IS ONE OF THE HOTTEST, MOST HUMID, AND WETTEST AREAS IN THE WORLD. BESIDES RECEIVING AN ANNUAL RAINFALL SOMETIMES IN EXCESS OF 400 INCHES, THE DESCENT OF THE RIVER THROUGH MOST OF ITS COURSE IS LESS THAN A FOOT FOR EVERY 2 MILES. IN ITS UPPER REACHES THE CURRENT FLOWS IN LONG SWEEPING CURVES THROUGH INUNDATED AREAS OF MARSHES, LAGOONS, AND CHANNELS. IN ITS LOWER COURSE IT BRANCHES INTO NUMEROUS CHANNELS FORMING AN ALLUVIAL DELTA SOMEWHAT CHARACTERISTIC OF THE ORINOCO AND AMAZON DELTAS ALTHOUGH TO A MUCH LESSER DEGREE.

THE SILTED MOUTH OF THE RIVER PREVENTS EFFECTIVE NAVIGATION OF LARGE OCEAN GOING VESSELS. ALTHOUGH THIS CONDITION CAN BE REMEDIED, THERE HAS BEEN NOTHING SO FAR EXPLOITABLE IN THE ATRATO VALLEY TO MAKE SUCH AN UNDERTAKING WORTHWHILE. BECAUSE OF THE DANK, HUMID CLIMATE, AND THE PREVALENCE OF MALARIA FROM THE MOSQUITO INFESTED SWAMPS THE REGION IS ALMOST DEVOID OF CIVILIZED HABITATION.

THE RIO SAN JUAN, WHICH FLOWS SOUTH AND WEST INTO THE PACIFIC, ALSO RISES ON THE PACIFIC SLOPE OF THE WESTERN CORDILLERA AND GEOGRAPHICALLY IS A SEPARATE RIVER BASIN. IT HAS MUCH THE SAME PHYSICAL CHARACTERISTIC AS THE ATRATO PARTICULARLY IN ITS CLIMATIC RELATIONSHIP. THE RIO SAN JUAN WHICH IS ONLY 170 MILES IN LENGTH WINDS THROUGH SWAMPY, DENSELY FORESTED COASTAL VALLEY TERRAIN VERY SIMILAR TO THAT DESCRIBED ALONG THE COURSE OF THE RIO ATRATO. ITS MORE IMPORTANT SIGNIFICANCE IS RELATED TO THE PORT OF BUENAVENTURA AT ITS MOUTH. A RAILROAD EXTENDS FROM BUENAVENTURA THROUGH THE CRESTO DE GALLO MOUNTAIN PASS TO THE TOWN OF CALI ON THE RIO CAUCA.

LAKE MARACAIBO BASIN

THE BASIN OF LAKE MARACAIBO IS FORMED BY THE DEPRESSION BETWEEN THE CORDILLERA DE MERIDA, WHICH IS A NORTHEASTERLY BRANCH OF THE EASTERN CORDILLERA; AND THE SIERRA DE PERIJA, THE BRANCH OF THE ANDEAN RANGE WHICH CONTINUES ALMOST DUE NORTH. ONLY THE SOUTHERN PORTION OF THE BASIN EXHIBITS THE TROPICAL FOREST CHARACTER; THE REMAINING PORTIONS BEING SANDY, DUNE-COVERED WASTELANDS ON THE PENNINSULA OF GUAJIRA; AND SEMI-ARID PLAINS OF GNARLED DWARF TREES, CACTUS, AND GRASSY SAVANNAS, AND OPEN LIGHTLY FORESTED AREAS.

FORMING A CRESCENT FROM THE SOUTHWEST TO THE SOUTHEAST OF THE

LAKE BETWEEN 8°-9°N, THE NUMEROUS STREAMS AND RIVERS RISING ON THE SURROUNDING ANDEAN SLOPES EMPTY INTO A LOW, SWAMPY REGION. THIS LOWLAND IS ALMOST A CONTINUOUS, MARSHY FLOOD PLAIN OF STAGNANT POOLS AND MEANDERING STREAMS EXTENDING FROM SIXTY TO EIGHTY MILES FROM THE SHORELINE TO THE FOOTHILLS OF THE MOUNTAINS. AS THE TERRAIN ASCENDS IT BECOMES HILLY AND INTERSECTED BY NUMEROUS RAVINES, HOGBACKS, AND STREAM BEDS, MANY OF THEM STILL EXHIBITING A MEANDERING DESCENT TO THE LOWLAND. THE HOGBACKS AND DEEP RAVINES CUT BY THE NUMEROUS STREAMS FROM THE MOUNTAINS BECOME SHARPLY DEFINED HILLS WITH PLUNGING FLANKS AND DEEP VALLEYS AT THE HIGHER ELEVATION AND FINALLY BECOME TRUE MOUNTAIN SLOPES.

THE NUMEROUS RIVERS AND STREAMS DESCENDING THE SOUTHERN ARC OF THE SIERRA DE PERIJA ARE TYPICAL MOUNTAIN STREAMS. SWIFT FLOWING WATERS, NUMEROUS SHORT TRIBUTARIES PLUNGING THROUGH NARROW GORGES AND RAPIDS IN THEIR UPPER COURSES BECOME SLUGGISH, MEANDERING, DEVIATING IN THEIR CHANNELS AND FULL OF SANDBARS IN THE LOWLANDS. IN THE RAINY SEASON THEY SWELL AND OVERFLOW THEIR BANKS ADDING TO THE ALREADY SWAMPY CHARACTER OF THE ADJOINING LAND.

THE AREA LYING BETWEEN THE RIO LORA ($9^{o}3''$N-73° TO 72°W) AND THE RIO ESCALANTE (8°N-73° TO 72°W) INCLUDE NUMEROUS MOUNTAIN STREAMS WHICH DRY UP DURING THE DRY SEASON. THE MAJOR RIVERS INCLUDE THE RIO CATATUMBO, RIO DE ORO, AND RIO SOCUAVO EACH OF WHICH HAVE A NETWORK OF TRIBUTARIES.

TOWARD THE MOUNTAIN RANGE WEST AND SOUTHWEST, THE LAND RISES IN A SERIES OF FOOTHILLS OR <u>CERROS</u> OF WHICH THE MOST PROMINENT IS CALLED THE RIO TARA RANGE. THE HIGHEST <u>CERRO</u> OF THE RANGE IS ABOUT 1,000 FEET ABOVE THE LEVEL OF THE PLAIN. THE ENTIRE AREA IS DENSELY

FORESTED EXHIBITING TYPICAL RAIN FOREST TYPE OF VEGETATION SIMILAR TO THE THREE TYPES ASSOCIATED WITH THE TERRA FIRMA, VARZEA, AND IGAPO OF THE AMAZON BASIN.

PERHAPS THE MOST SIGNIFICANT ASPECT OF THIS ENTIRE REGION IS THAT IT IS THE HOME OF THE HOSTILE MOTILONE INDIANS WHO HAVE SUCCESSFULLY DENIED ACCESS AND DETAILED EXPLORATION OF THIS TERRITORY SINCE THE TIME OF THE SPANISH CONQUEST.

THE AREA LYING SOUTHEAST OF LAKE MARACAIBO IS A MIXTURE OF SWAMPY RAIN FOREST TYPE OF VEGETATION IMMEDIATELY ADJACENT TO THE LAKE GIVING AWAY TO MIXED SAVANNA AND OPEN FOREST TYPE VEGETATION TOWARD THE SOUTH, SOUTHEAST, AND EAST. NUMEROUS STREAMS DESCENDING THE WESTERN SLOPE OF THE SIERRA DE MERIDA FORM THE TRIBUTARIES OF ABOUT TEN RIVERS FLOWING NORTHWEST OR WEST INTO THE LAKE. THE MORE PROMINENT OF THESE RIVERS ARE RIOS POCO, BUENA VISTA, CAUS, MOTOTAN, JIMENEZ, CASTAN, AND MONAY.

THE SOUTHERN PORTION OF THE MARACAIBO BASIN IS IN AN AREA SUBJECT TO TWO WET SEASONS OF WHICH THE MOST PROLONGED IS FROM JANUARY TO JUNE. THE HIGHER ELEVATIONS RECEIVE A MORE EVEN DISTRIBUTION OF RAINFALL THAN DOES THE LOWER REGION. THE TEMPERATURE AT THE LOWER ELEVATIONS ARE HOT, THE ANNUAL MEANS RANGING FROM 80°F TO 86°F. THE TEMPERATURES BECOME COOLER AT THE HIGHER ELEVATIONS AND ARE SUBJECT TO A GREATER RANGE IN VARIATION ESPECIALLY DURING THE DAY AT THE HIGHER ELEVATIONS.

THE ORINOCO DELTA

EXTENDING FOR APPROXIMATELY 375 MILES SOUTHEAST ALONG THE ATLANTIC COAST FROM THE GULF OF PARIA AND INLAND FROM 50 TO 60 MILES, THE DELTA OF THE ORINOCO EMBRACES NEARLY 20,000 SQUARE MILES. IT IS

ONE OF THE LEAST INHABITED AND UNEXPLORED AREAS IN SOUTH AMERICA. BESIDES RECEIVING ALL OF THE WATER FROM THE MAIN RIVER, NUMEROUS SMALLER RIVERS EMPTY DIRECTLY INTO THE MAZE OF WATERWAYS THAT INUNDATE THE ENTIRE REGION. THESE RIVERS FLOW FROM THE LONG INCLINE OF THE ANDEAN RANGE ON THE NORTHWEST AND FROM THE SIERRA DE IMATACA ON THE SOUTHEAST.

THE WIDE-BRANCHING CHANNELS EXTENDING NORTH TO EAST IN A HUGE FAN SHAPED TRIANGLE HAS ITS APEX IN THE VICINITY OF BARANCAS ($62^{\circ}10'$W-$8^{\circ}50'$N). HUGE DEPOSITS OF SILT BEING CONTINUALLY WASHED INTO THE DELTA BY THE RIVERS HAVE FORMED A NETWORK OF WATERWAYS. THE MAIN CHANNELS HAVE A PERSISTENT FLOW BUT ARE MUCH MORE SHALLOW THAN THE CONNECTING CHANNELS WHICH ARE RELATIVELY FREE OF SILT. BESIDES THE SILT FROM THE INTERIOR WATERWAYS, THE OCEAN TIDE IS EFFECTIVE AS FAR INLAND AS 35 MILES CAUSING FURTHER SILTING. THE DEPTHS OF THE CHANNELS AVERAGE 60 FEET IN THE MAIN CHANNELS AND UP TO 130 FEET IN THE CONNECTING CHANNELS. WIDTHS MAY EXTEND UP TO A MILE OR MORE. THE SILT BEARING MAIN CHANNELS ARE A DIRTY BROWN COLOR. THE CONNECTING CHANNELS EXHIBIT A DARK, ALMOST BLACK COLOR RESULTING FROM VEGETATION RESIDUES.

THROUGHOUT THE ENTIRE REGION ONLY OCCASIONAL AREAS OF HIGH AND "DRY" GROUND IS TO BE FOUND. THESE SMALL PATCHES USUALLY LESS THAN ONE SQUARE MILE IN SIZE ARE COVERED WITH DENSE RAIN FOREST TYPE VEGETATION CHARACTERISTIC OF THAT FOUND ALONG THE RIVERS OF THE AMAZON BASIN. THE GREATER PART OF THE REGION IS TYPICAL OF THE RAIN FOREST OF THE AMAZON IGAPO. NEAR THE COAST WHERE THE TIDAL INFLUENCE IS EFFECTIVE, MANGROVE TYPE OF VEGETATION WITH ITS PECULIAR CONCENTRIC ROOT SYSTEM IS PREDOMINANT. INTERSPERSED AMONG THE MANGROVES ARE

VARIOUS SPECIES OF PALMS, BAMBOOS, AND ABUNDANCE OF REEDS. ONE HAZARD TO NAVIGATING THE OTHERWISE PLACID WATERS OF THE REGION IS THE OCCASIONAL LARGE "ISLANDS" OF FLOATING AQUATIC PLANTS WHICH HAVE ACCUMULATED INLAND FREQUENTLY WASHED DOWN ON THE RIO ORINOCO. THE VEGETATION EXTENDS FROM ONE TO THIRTY FEET BELOW THE WATER TO SINK ROOTS. MOST OF THE AREA IS CONTINUALLY UNDER WATER ALTHOUGH HUNDREDS OF TINY MUD-PLAT ISLANDS ARE CONTINUALLY BEING BUILT UP AND WASHED AWAY BY THE COMBINED ACTION OF THE SILT DEPOSITS AND WATER CURRENTS.

THROUGHOUT THE DELTA REGION THERE IS AN ABUNDANCE OF RAINFALL WHICH OCCURS USUALLY IN THE EARLY AFTERNOON. MORNINGS AND NIGHT TEND TO BE COOL. GREAT SWARMS OF MOSQUITOES INFEST THE ENTIRE AREA ESPECIALLY IN THE PROXIMITY OF THE CHANNEL BANKS AND MALARIA IS VERY PREVALENT. AS IN MOST AREAS WHERE MOSQUITOES AND OTHER SWARMING PESTS ABOUND, DRAWING AWAY FROM THE BANKS HELP EASE THE SITUATION ESPECIALLY IF IT IS POSSIBLE TO GET INTO A CURRENT OF BREEZE.

ONLY A FEW GAURAUNO INDIANS EKE OUT A MISERABLE EXISTENCE IN THE NORTHERN AND LEAST WET PART OF THE DELTA. THEY LIVE IN PALM HUTS BUILT ON TREES ABOVE THE HIGH WATER LEVEL. THEY SUBSIST MAINLY ON FISH, WHICH IS SPEARED, AND THE PRODUCTS OF THE NUMEROUS PALM TREES.

CHAPTER III

INDIANS OF THE TROPICAL FOREST

History and Distribution

THE UNRELENTING MARCH OF WESTERN CIVILIZATION OPERATING UNDER THE MANTLE OF ECONOMIC DEVELOPMENT, SOCIAL ENLIGHTENMENT, AND POLITICAL EXPEDIENCY IS MAKING SWIFT INROADS INTO THE PHYSICAL AND CULTURAL ENVIRONMENT OF THE INDIANS OF THE TROPICAL FOREST OF SOUTH AMERICA. IT IS NOT WITHIN THE PROVINCE OF THIS STUDY TO CONTEMPLATE THE QUALITIES OF GOODNESS OR BADNESS OF THIS SOCIAL INTERCOURSE ON THE SOCIOLOGICAL FATE OF THE INDIAN. THERE ARE, HOWEVER, CERTAIN IMPLICATIONS, GOOD AND BAD, AFFECTING THE SURVIVAL CONDUCT OF THE INDIVIDUAL IN HIS RELATIONSHIP WITH THE INDIANS WITH WHOM CONTACT MAY BE MADE.

MUCH OF WHAT IS DEPICTED CONCERNING THE ORIGIN, MIGRATIONS, CULTURAL DEVELOPMENT, AND EVEN PRESENT DAY CONDITIONS OF THE TROPICAL FOREST TRIBES IS CONJECTURAL AND TRANSITIONAL. DATA ARE BASED ON MEAGER ARCHEOLOGICAL FINDINGS, HISTORICAL DOCUMENTS DATING SINCE THE TIME OF DISCOVERY BY COLUMBUS, ACCOUNTS BY EXPLORERS, SCIENTISTS, TREASURE HUNTERS, COMMERCIAL AGENTS, AND MISSIONARIES; ALL OF VARYING DEGREES OF RELIABILITY. IN EFFECT MOST OF THE MATERIAL REGARDING THE INDIANS OF THE TROPICAL FOREST IS DESCRIPTIVE IN NATURE. ANY GENERALIZATIONS MADE REGARDING SOCIAL RELATIONSHIPS ARE SUBJECT TO EXCEPTIONS NOT ONLY AMONG TRIBES WITHIN A GIVEN REGION BUT ALSO AMONG TRIBES OF THE SAME ETHNIC FAMILY AND EVEN INDIVIDUAL GROUPS

OF THE SAME TRIBE.

THE INHABITANTS OF THE NORTHERN TWO-THIRDS OF SOUTH AMERICA, EXCEPT THE ANCIENT INCA EMPIRE DISCUSSED UNDER DESERT REGIONS, MAY BE DIVIDED INTO FOUR MAIN GROUPS BASED UPON LINGUISTIC FAMILIES. THEY ARE THE TUPI-GUARANI, THE CARIB, THE ARAWAK, AND THE NUMEROUS ISOLATED TRIBES WHICH ARE INTERSPERSED THROUGHOUT THE AMAZON REGION ABOUT WHOM THE ETHNOLOGICAL DATA ARE EXTREMELY COMPLICATED.

THE TUPI-GUARANI FAMILY SUPPOSEDLY BEGAN A NORTHWARD MIGRATION FROM THE LA PLATA-PARANA REGION AND WHAT IS NOW URUGUAY. THEIR ADVANCE TO THE NORTH FOLLOWED THREE MAIN AVENUES OF APPROACH. ONE APPROACH WAS VIA THE EAST COAST AS FAR AS THE AMAZON RIVER. THIS SOUTHEASTERN AREA OF BRAZIL BECAME THE LARGEST AREA OF SETTLEMENT FOR THE TUPI-GUARANI AND PARTICULARLY THE TUPINAMBA, ONE OF THE MOST PROMINENT TRIBES OF THIS ETHNIC GROUPING. A SECOND APPROACH WAS UP THE SOUTHERN TRIBUTARIES OF THE AMAZON; MAINLY, THE TAPAJOS AND THE MADEIRA RIVERS. THE THIRD COURSE FOLLOWED THE EASTERN SLOPES OF THE ANDES; THE WESTERNMOST TRIBES REACHING AS FAR NORTH AS ECUADOR. SPREADING NORTHWARD THEY ACQUIRED FOR THEMSELVES THE COASTAL REGIONS AND BETTER RIVER VALLEYS DRIVING THE WEAKER TRIBES INTO THE LESS DESIREABLE AND INACCESSABLE FOREST AREAS AND EFFECTIVELY ISOLATING THEM FROM EACH OTHER. THESE ISOLATED GROUPS ARE GENERALLY CLASSIFIED AS TAPUYA OR GE-SPEAKING TRIBES.

THE CARIBS ALSO APPEAR TO HAVE MOVED IN A NORTHERLY DIRECTION, PROBABLY FROM THE PROVINCE OF MATO GROSSO WHERE CARIB TRIBES ARE STILL LIVING. AT THE TIME OF COLUMBUS THEY HAD SPREAD NORTH OF THE AMAZON INTO GUIANA AND VENEZUELA AND MADE NUMEROUS CONQUESTS IN THE ANTILLES WHERE THEIR DESCENDANTS ARE STILL TO BE FOUND. OF THE TRIBES

WHO REFUSED TO COMPROMISE WITH THE ENCROACHING EUROPEAN CIVILIZATION, THE CARIBS HAVE MOST AGGRESSIVELY RESISTED THE ATTEMPTED ADVANCE INTO THEIR TERRITORIES. PERHAPS INAPTLY THE NAME "CANNIBAL" IS ASSOCIATED WITH THE CARIBS. WHILE THEY DID PRACTICE CANNIBALISM, IT WAS MUCH MORE WIDESPREAD AND CULTURALLY ENTRENCHED AMONG THE TUPI-GUARANI AND IT IS POSSIBLE THAT THE CARIBS ACQUIRED THE CUSTOM BY ASSOCIATION. MOST OF THE CARIB TRIBES ARE FOUND IN MODERN VENEZUELA AND SCATTERED THROUGH THE GUIANAS. THE MORE HOSTILE OF THE PRESENT DAY CARIBS ARE FOUND IN THE REGION OF THE UPPER ORINOCO ESPECIALLY NEAR ITS SOURCE.

THE ARAWAK FAMILY AT THE TIME OF DISCOVERY OCCUPIED THE GREATER ANTILLES AND THE BAHAMAS AND THE NORTHERN COAST FROM COLOMBIA TO THE MOUTHS OF THE AMAZON. FROM THIS POSITION THEY HAVE BEEN INFILTRATED AND FREQUENTLY DISPERSED BY THE CARIBS, THOUGH THEY ARE STILL NUMEROUS IN THE GUIANAS. THEY ALSO OCCUPIED A GREAT TRACT IN THE INTERIOR OF THE CONTINENT FROM THE UPPER ORINOCO TO THE EAST OF BOLIVIA WHERE THE MOXO ARE AN IMPORTANT TRIBE. WEST OF THE ARAWAK ARE NUMEROUS SMALLER GROUPS AND THE ETHNOLOGY OF THE WHOLE REGION EAST OF THE ANDES AS FAR SOUTH AS THE GRAN CHACO IS COMPLICATED TO AN EXTRAORDINARY DEGREE. AMONG THE MORE IMPORTANT TRIBES OF THIS LINGUISTIC FAMILY MAY BE MENTIONED THE GUARANO OR WARRAU, THE OTOMACO OF THE RIO META, A PRIMITIVE TRIBE AT THE MOUTH OF THE ORINOCO ONCE LIVING IN PILE-DWELLINGS IN THE SWAMPS, THE TUCANS OF R. UAUPES, THE JIVARO OF EASTERN ECUADOR, THE ZAPARO IMMEDIATELY SOUTH OF THE JIVARO ON THE UPPER AMAZON, THE PANO (INCLUDING THE CONIBO) OF THE UPPER UCAYALI RIVER, THE CHIQUITO, AND THE PALE-SKINNED URUCARES OF EASTERN BOLIVIA.

THERE ARE STILL TRIBES LIVING IN THE MOST INACCESSIBLE PARTS

OF THE INTERIOR WITH WHOM NO DIRECT CONTACT HAS BEEN MADE. ALTHOUGH SOME "MODERN" TOOLS HAVE FILTERED THROUGH TO THEM VIA BARTER OR WARFARE WITH THE LESS REMOTE INDIANS, THEY STILL ADHERE TO WHAT IS CONSIDERED A STONE AGE CULTURE. THE FACT THAT THESE INDIANS SEEK AND PREFER ISOLATION IS SOMEWHAT INDICATIVE OF THEIR GENERAL ATTITUDE NOT ONLY TOWARD WHITE INTRUDERS BUT ALL STRANGERS TO THEIR TERRITORIES. BUT--SUCH ISOLATED GROUPS ARE BECOMING MORE RARE AS TIME GOES BY.

DRESS AND ORNAMENTATION

THROUGHOUT THE TROPICAL AREA CLOTHING IS REDUCED TO A MINIMUM, THOUGH ABSOLUTE NAKEDNESS IS SELDOM FOUND. THE MOST CHARACTERISTIC ITEMS OF "APPAREL" THROUGHOUT THE FOREST AREAS IS THE CONICAL SHEATH OF VARIOUS PLIABLE MATERIALS USUALLY LEAVES WORN ON THE PENIS AND FREQUENTLY JUST COVERING THE PREPUCE; AND A SMALL PUBIC APRON WORN BY THE WOMEN. THESE ITEMS ARE USUALLY FUNCTIONAL AND/OR DECORATIVE. THERE ARE FREQUENTLY SOCIAL SANCTIONS OR TABOOS ASSOCIATED WITH THESE ITEMS HAVING NO CONNECTION WITH MORALITY OR SHAME IN THE SAME SENSE THAT WE USE CONCEALING GARMENTS. ALTHOUGH CLOTHING TENDS TO BE MINIMIZED, THE INDIANS MAKE EXTENSIVE USE OF BODY DECORATIONS. USUALLY THESE ADORNMENTS ARE WORN IN CONNECTION WITH SPECIAL SOCIAL AND RELIGIOUS FUNCTIONS OF THE TRIBES AND DETAILS AS TO MATERIALS USED, DESIGN, COLORS, PARTS OF THE BODY INVOLVED AND WHO MAY WEAR THEM HAVE A GREAT SIGNIFICANCE FOR THE TRIBE. SPECIAL SPIRITURAL ATTACHMENT IS ACCORDED CERTAIN FLOWING CAPES AND HEADRESSES MADE OF PLUMES AND FEATHERS. A GREAT VARIETY OF ORNAMENTS--NECKLACES, BRACELETS, DIADEMS, ANKLETS, EARRINGS, LABRETS, LIGATURES--ARE CREATED FROM THE MORE COLORFUL AND IMPRESSIVE PROFUSION OF MATERIALS AVAILABLE FROM THE FOREST. THEY INCLUDE VARIOUS WOODS, HUMAN AND ANIMAL TEETH, ES-

PECIALLY JAGUAR AND CAIMAN TEETH, BRILLIANTLY COLORED FEATHERS, BONE, SHELL, STONE, BEETLE WINGS, FRUIT SHELLS, JAGUAR CLAWS, WOVEN CLOTH AND BAST FIBERS. MUTILATION, SCARIFICATION AND TATOOING IS WIDESPREAD. THE UPPER EDGE AND LOBE OF THE EAR, AS WELL AS THE SEPTUM OF THE NOSE, IS OFTEN PERFORATED TO RECEIVE FEATHERS AND OTHER ORNAMENTS. MANY TRIBES WEAR A THORN OR A PEG OF METAL, STONE, OR OTHER MATERIAL IN THE LOWER LIP. SOME OF THE MORE PRIMITIVE EASTERN TRIBES WORE LARGE WOODEN PLUGS, LIKE THOSE KNOWN IN EAST AFRICA, NOT ONLY IN THE EAR LOBE BUT IN THE LIPS AS WELL; THE NAME BOTOCUDO IS DERIVED FROM THE PORTUGUESE WORD BOTOQUE, A PLUG. TRIBES ON THE UPPER TOCANTINS AND ARAGUAYA RIVERS ARE IN THE HABIT OF DISTENDING THE EAR LOBE UNTIL IT HANGS DOWN TO THE SHOULDERS. TATOOING BY PUNCTURE IS FREELY PRACTICED BY MANY TRIBES, THE INSTRUMENTS USED BEING THORNS, OR THE SHARP RIBS OF PALM LEAVES. WOMEN OF SOME TRIBES ARE MORE TATOOED THAN MEN, AND THE FACES OF SOME OF THE WOMEN OF THE CENTRAL TRIBES ARE COVERED WITH ELABORATE PATTERNS. PAINTING OF THE BODY USUALLY WITH VEGETABLE SUBSTANCES IS COMMON IN THE NORTHERN PART OF THE REGION.

SUBSISTENCE ACTIVITIES

ALMOST ALL OF THE INDIAN TRIBES OF THE TROPICAL FOREST ENGAGE IN THE CULTIVATION OF A LARGE VARIETY OF PLANTS. THEIR TECHNIQUES ARE RELATIVELY PRIMITIVE AND ARE INCAPABLE OF PRODUCING SUFFICIENT CROPS TO MEET THE DEMANDS. AS A RESULT, HUNTING, FISHING, AND GATHERING OF WILD FRUITS, NUTS, AND OTHER FOOD PLANTS AS WELL AS COLLECTING FRESH WATER SHELL FISH, TURTLE EGGS, CROCODILE AND CAIMAN EGGS ALONG THE RIVER BANK CONSTITUTE AN IMPORTANT PART OF THEIR FOOD-GETTING ACTIVITIES.

AGRICULTURE. OF PRIMARY IMPORTANCE ARE THE ROOT CROPS OF WHICH BITTER AND SWEET MANIOC ARE THE MOST WIDESPREAD STAPLE CROPS WITH SWEETPOTATO, CARA, AND ARROWROOT ALSO WIDELY GROWN. IN ADDITION TO ROOT CROPS, THE INDIANS CULTIVATE MAIZE IN ITS VARIOUS FORMS, NUMEROUS BEAN CROPS INCLUDING PEANUTS, VARIOUS TYPES OF SQUASH, PUMPKIN, CUCUMBER AND GOURD-TYPE VEGETABLES; NUMEROUS FRUITS INCLUDING GUAVA, PINEAPPLE, BANANAS, AVOCADO, AND VARIOUS BERRIES. NON-FOOD CROPS CONSIST OF TOBACCO, CALABASHES, AND OTHER GOURD-TYPE PLANTS, A BERRY CALLED URUCU USED FOR DYE, SPECIAL REED PLANTS USED FOR ARROWS; COTTON, AND A VARIETY OF POISON PLANTS WHICH ARE USED FOR DRUGGING THE FISHING STREAMS. ALTHOUGH THE FISH-DRUGGING PLANTS HAVE MANY REGIONAL OR TRIBAL NAMES, THE MORE COMMON ONES ARE BARBASCO AND TIMBO.

FIELDS ARE LOCATED IN THE VICINITY OF THE SETTLEMENT OFTEN IN THE SURROUNDING FORESTS WHERE SOIL AND DRAINAGE CONDITIONS ARE SUITABLE. THEY VARY IN SIZES FROM TINY FIELDS OF LESS THAN 100 SQUARE YARDS UP TO SEVERAL ACRES SUCH AS ARE FOUND IN THE GUIANAS. CLEARINGS ARE MADE BY FELLING THE TREES USING COMBINATION OF CHOPPING AND BURNING TECHNIQUES. THE AREA IS ALLOWED TO DRY AND IS THEN BURNED OFF. CROPS ARE PLANTED AMONG THE CHARRED STEMPS. COMMONLY CALLED THE SLASH AND BURN TECHNIQUE, IT IS USED BY PRIMITIVE AGRICULTURISTS THROUGHOUT THE WORLD.

THE SOILS OF THE TROPICAL FORESTS ARE QUICKLY EXHAUSTED AND REQUIRED THE RELOCATION OF THE INDIAN SETTLEMENTS PERIODICALLY FROM TWO TO FIVE YEARS. CONSEQUENTLY, THE INDIANS LEAD A SEMI-SEDENTARY EXISTENCES. THEY ARE RESTRICTED IN THEIR MOBILITY, HOWEVER, BY VARIOUS FACTORS BOTH ECONOMIC AND SOCIAL. TRIBAL BOUNDARIES ARE FAIRLY WELL ESTABLISHED AND ADHERED TO BUT ALSO IMPORTANT IS THE

NECESSITY OF RETAINING ACCESS TO THE VACATED FIELDS SO AS TO HARVEST THE CROPS WHICH CONTINUE TO GROW. IT IS CUSTOMARY AMONG MANY TRIBES TO SELECT, CLEAR, AND PLANT A NEW SITE SEVERAL MONTHS PRIOR TO RE-SETTLEMENT. ABANDONED FIELDS ARE NOT REPLANTED BUT ARE REVISITED UNTIL THE WILD VEGETATION MAKES THE HARVESTING OF CULTIVATED CROPS NO LONGER WORTHWHILE.

ABANDONED AREAS WILL BE RECOGNIZED BY THE DENSE ENTANGLEMENT OF THE UNDERBRUSH, THE GREATER AMOUNT OF SUNLIGHT, THE RELATIVE ABSENCE OF A THICK OVERHEAD CANOPY, AND THE OCCURRENCE OF NUMEROUS SMALL SAPLINGS AND BRUSH-TYPE VEGETATION--ALL OF THESE FEATURES ARE CHARACTERISTIC OF SECONDARY GROWTH. EVEN THOUGH THE CULTIVATED CROPS ARE NO LONGER TO BE FOUND IN ABUNDANCE, THERE WILL BE MANY OTHER WILD EDIBLE PLANTS GROWING. THE ANIMAL LIFE WILL ALSO HAVE INCREASED COMMENSURATELY. IF, HOWEVER, VEGETATION IS STILL VERY LOW AND SHOWS SIGNS OF HUMAN ACTIVITY SUCH AS PATHS, TREE SCARS, OR IF THE CHARRING OF STUMPS AND TREES IS STILL VERY MUCH IN EVIDENCE THERE IS NOT ONLY A PROBABLE SOURCE OF FOOD BUT ALSO DANGER OF VIOLATING THE PROPERTY RIGHTS OF THE "OWNERS" WHICH COULD HAVE SERIOUS COMPLICATIONS. WHERE SIGNS INDICATE RECENT ABANDONMENT THE SURVIVOR IS CONFRONTED WITH SEVERAL ALTERNATIVES:

1. IF THERE IS NO INTENTION OF CONTACTING THE INDIANS THE FOOD MAY BE TAKEN AS SURREPTIOUSLY AS POSSIBLE. EVEN THOUGH INDIANS HAVE REMARKABLE ABILITY TO DETECT UNNATURAL DISTURBANCES, THE IRREGULARITY WITH WHICH THE ABANDONED PLOT IS VISITED INCREASES THE ODDS OF NOT BEING DETECTED.
2. IF CONTACT WITH THE INDIANS IS DESIRED, THE SURVIVOR MUST DECIDE WHETHER TO TAKE THE FOOD AND POSSIBLY INCUR

THE HOSTILITY OF THE OWNERS OR TO CONTACT THE INDIANS FIRST. THE INDIANS HAVE VERY POSITIVE IDEAS ABOUT PROPERTY RIGHTS, EVEN OF ABANDONED PLOTS.

3. CONTACTING THE INDIANS ENTAILS GOING IN SEARCH OF THEIR NEW LOCATION OR WAITING FOR THEM TO RETURN TO THE AREA. IF THE ABANDONMENT IS RECENT, THERE WILL BE PATHS LEADING AWAY FROM THE PLOT TO THE NEW SITE ALTHOUGH A GREAT DEAL OF SEARCHING MAY BE NECESSARY TO FIND THEM. THE CONDITION OF THE PATHS WILL GIVE SOME INDICATION OF THE FREQUENCY OF THE VISITS BY THE INDIANS. IF THE DECISION IS TO GO IN SEARCH OF THE NEW LOCATION IT WILL HELP TO CONSIDER THE SETTLEMENT PATTERNS AND THE BASES FOR VILLAGE SITE SELECTION. IN OLDER AREAS OF ABANDONMENT, RETURN TO THE AREAS WILL BE IRREGULAR WITH LONG INTERVALS BETWEEN VISITS. UNDER SUCH CONDITIONS THE SURVIVOR MAY ELECT TO REMAIN IN THE AREA AND FULLY EXPLOIT THE FOOD SOURCES BEFORE CONTACTING THE INDIANS ASSUMING THE INDIANS WILL RECOGNIZE THE MITIGATING CIRCUMSTANCES--MOST PARTICULARLY THE PERIOD OF ABANDONMENT.

HUNTING. ALL OF THE TECHNIQUES ASSOCIATED WITH HUNTING ARE EMPLOYED IN ONE FORM OR ANOTHER IN THE FOREST AREAS. FEW OF THE GREAT VARIETY OF BIRDS AND ANIMALS ARE EXCEPTED AS A SOURCE OF FOOD. IN MANY INSTANCES VARIOUS TRIBES ATTACH SUPERNATURAL SANCTIONS OR TABOOS TO CERTAIN SPECIES WHICH EITHER RESTRICT OR PRECLUDE THEIR BEING EATEN. THESE TABOOS HAVE NOTHING TO DO WITH EDIBILITY.

THE SKILL AND TECHNIQUES OF THE HUNTER IS BASED UPON HIS EMPIRICAL KNOWLEDGE OF THE ENVIRONMENT. THE ABILITY OF THE INDIAN TO

READ TRACKS, TO ANTICIPATE GAME ACTIVITIES, TO EFFECTIVELY USE TRAPS, SNARES AND PITS, OR TO FLUSH THEM FROM THEIR HIDING PLACES IS HIGHLY DEVELOPED. THESE ASPECTS OF HUNTING ARE LEARNED FROM CHILDHOOD. THE INDIANS ARE NOT ONLY SKILLFUL IN IMITATING THE CALLS AND CRIES OF THE BIRDS AND ANIMALS BUT THEY KNOW WHICH OF THE VARIATIONS OF CALLS ARE MOST EFFECTIVE UNDER SPECIFIC CONDITIONS. THE VARIOUS TECHNIQUES INCLUDE STALKING, THE USE OF BLINDS EITHER IN A TREE OR ON THE GROUND NEAR ANIMAL RUNS, DECOYS, DEADFALLS, AND NETS. COLLECTIVE HUNTING TECHNIQUES INCLUDE ENCIRCLING AND DRIVING THE GAME INTO PREPARED PITS OR TO WAITING HUNTERS, FIRING OF BRUSH AND GRASS, OR BEATING THE BRUSH AND MAKING LOUD NOISES TO FLUSH THE GAME.

DESPITE THE VARIETY OF GAME, HUNTING IS MORE TIME CONSUMING AND LESS REWARDING IN THE RAIN FOREST THAN IN MANY OTHER REGIONS WHERE HUNTING IS NECESSARY. THERE ARE FEW LARGE ANIMALS WHICH ARE GOOD MEAT PRODUCERS ALTHOUGH THERE IS HARDLY ANY PART OF THE ANIMAL THAT IS NOT EATEN. EXCEPT FOR THE TAPIR, THE MANATEE WHICH ARE FOUND IN THE LARGER RIVERS, THE DEER WHICH ARE QUITE SMALL IN COMPARISON TO MOST NORTH AMERICAN SPECIES, AND THE PECCARY NEARLY ALL GAME IS VERY SMALL. THE ABUNDANT VEGETATION ALONG THE RIVER MARGINS OR ALONG THE EDGES OF THE FOREST WHERE IT MERGES WITH SAVANNAS AND OTHER CLEARINGS PROVIDE THE MOST LIKELY AREAS OF HABITATION FOR GAME. HOWEVER, THE DENSE AND THORNY ENTANGLEMENT OFFER THE GREATER ADVANTAGE TO THE ANIMALS MAKING THEIR CAPTURE MORE DIFFICULT.

FORMIDABLE AS THEY ARE, THE CAIMAN AND CROCODILES ARE NOT OVERLOOKED AS A SOURCE OF FOOD. VARIOUS METHODS OF CAPTURE AND KILLING ARE USED. SPECIAL CARE IS EXERCISED TO AVOID THE CRUSHING JAWS AND LASHING TAIL OF THESE GREAT REPTILES. THEY ARE SHOT THROUGH

THE EYES WITH A FIREARM IF AVAILABLE OR WITH POISONED ARROWS. THEY ARE CAPTURED BY LOOPING A STRONG LASSO MADE OF VINES AROUND THE SNOUT AND DRAGGED TO SHORE WHERE THEY ARE BEATEN TO DEATH WITH CLUBS, SPEARED, OR DRAGGED INTO PREPARED PITS WHERE SHARPENED STAKES, SOMETIMES POISONED, PIERCE THE SOFT UNDERBELLY. TURTLES ARE SHOT WITH ARROWS OR CAUGHT ASHORE WHERE THEY ARE FLIPPED HELPLESSLY UPON THEIR BACK. IGUANOS ARE SHOT WITH DARTS OR ARROWS AND CAUGHT WITH SLIP-NOOSE SNARES. THE EGGS OF THE CAIMANS, CROCODILES AND TURTLES ARE ALSO MUCH SOUGHT AFTER.

THE MOST WIDELY USED HUNTING WEAPONS ARE THE BOW AND ARROW AND THE BLOWGUN. IN HUNTING THE LARGER GAME SUCH AS THE TAPIR AND THE JAGUAR (USUALLY HUNTED FOR SPORT OR HONOR AND GLORY RATHER THAN FOOD), THE SPEAR IS FREQUENTLY USED. THE BLOWGUN MAY CONSIST OF TWO COMPLETE TUBES, ONE WITHIN THE OTHER; OR OF AN INNER TUBE WITHIN A CASE OF TWO SPLIT HALVES; OR OF A SINGLE TUBE COMPOSED OF TWO SPLIT HALVES EACH CAREFULLY GROOVED AND TIGHTLY STRAPPED TOGETHER. THE LENGTH MAY BE ANYWHERE FROM EIGHT TO TEN FEET OR EVEN SIXTEEN FEET. A SUDDEN PUFF OF BREATH APPLIED TO A SMALL TRUNCATE MOUTHPIECE FORCES OUT THE DART, WHICH IS USUALLY OF PALMWOOD THE THICKNESS OF A KNITTING NEEDLE, FROM NINE TO SIXTEEN INCHES IN LENGTH, AND TIPPED WITH THE POISON. THE POISON IS THE DEADLY CURARE WHICH EFFECTS THE VICTIM WITHIN SECONDS OR VERY FEW MINUTES DEPENDING UPON ITS SIZE.

THE BOWS ARE MADE FROM SEVERAL TYPES OF WOOD, ESPECIALLY PALMWOODS. THEY ARE UNUSUALLY LONG; IN THE GUIANAS THEY ARE FREQUENTLY LONGER THAN THE USER IS TALL. BOWSTRINGS ARE MADE FROM THE NUMEROUS WILD PLANT FIBERS. ARROWS ARE MADE FROM THE CANES AND HAVE DIFFERENT TYPE HEADS FOR DIFFERENT USES.

SPEARS ARE MADE FROM VARIOUS HARDWOODS INCLUDING PALMS. THEY ARE TAPERED AT THE BUTT AND SCRAPED SMOOTH WITH THE FILE-LIKE JAWS OF OF PIRANHA FISH AND ROUGH SANDPAPER-LIKE LEAVES. THE TIPS ARE MADE OF IRON WHEN SUCH METAL IS AVAILABLE, HOWEVER, RAZOR EDGED BAMBOO IS FREQUENTLY BOUND SEPARATELY TO THE SHAFT. POISON IS OCCASIONALLY USED PARTICULARLY WITH BAMBOO TIPS.

THE HUNTING TECHNIQUES USED BY THE INDIANS ARE PRIMITIVE AND ARE NO DIFFERENT THAN THEY WERE HUNDREDS OF YEARS AGO, OR EVEN THOUSANDS OF YEARS AGO IN THAT THE ADVENT OF THE BOW AND ARROW AND THE BLOWGUN MERELY INCREASED THE RANGE AND EFFECTIVENESS OF KILL CAPABILITIES. EVEN THE MAKING OF THE HUNTING AND FISHING TOOLS ARE DIFFERENT ONLY IN RELATION TO THE REGIONAL MATERIALS USED. THE REFINEMENTS WHICH ACCOUNTS FOR THE SKILL OF THE INDIAN IS BASED UPON KNOWING THE BEST MATERIALS AVAILABLE TO HIM, A THOROUGH KNOWLEDGE OF THE GAME HE PURSUES AND FINALLY AN INTIMATE KNOWLEDGE OF HIS OWN TERRITORY. SURPRISINGLY, OUT OF HIS OWN AREA, THE INDIAN IS AS LIABLE TO STARVE AS JOHN DOE USAF. THE SURVIVOR WITH A GOOD KNOWLEDGE OF BASIC HUNTING, TRAPPING AND FISHING TECHNIQUES MIGHT EVEN BE BETTER OFF. THE INDIANS' RELIGION CONCERNS NEARLY EVERY ASPECT OF HUNTING AND WHEN IN A STRANGE AREA HE IS OFTEN BESET WITH TERRORS AND FEARS FROM THE "SPIRITS" OVER WHICH HE HAS NO CONTROL IN THIS UNKNOWN FOREST. FREQUENTLY, HE WILL IGNORE OBVIOUS FOODS EITHER BECAUSE OF TABOOS OR AS IN MANY OTHER SOCIETIES, HE DOES NOT RECOGNIZE THEM AS FOOD. THE INDIAN HAS NO CONCEPT OF CONSERVATION--HE WILL GORGE HIMSELF WHEN THE FOOD IS AVAILABLE WITH NO THOUGHT TO THE NEXT DAY; OR EVEN THE NEXT MEAL. DESPITE THE SEEMINGLY SELF-SUFFICIENCY OF THE INDIAN, WHEN HE HAS EXHAUSTED HIS FOOD, LOST HIS GEAR, AND GENERALLY INCAPACITATED

HIMSELF HE MAY SIMPLY GIVE UP ASSUMING THAT HE IS BEWITCHED.

THE SURVIVOR MAY ALSO BE SUBJECT TO FEARS AND APPREHENSION OF THE STRANGE AND UNKNOWN BUT THESE ARE ASPECTS WITH WHICH HE CAN DEAL RATIONALLY. WITH A KNOWLEDGE OF HUNTING TECHNIQUES HE ALSO KNOWS THAT MOST ANIMALS HAVE SIMILAR PATTERNS OF BEHAVIOR THE WORLD OVER--THEY MUST COME TO WATER TO DRINK, THEY NEST, BURROW, HOLE-UP, OR HABITATE IN SOME FASHION; THEY LAY EGGS, HAVE YOUNG AND OFTEN LEAVE THEM. WHEN ONE IS HUNTING A PARTICULAR ANIMAL IT HELPS TO KNOW THE HABITS OF THAT ONE ANIMAL. WHEN ONE IS HUNTING ANIMALS, WITH NO RESTRICTION ON KIND, IT IS BEST TO THINK IN TERMS OF PATTERNS OF BEHAVIOR. THIS IS ONE OF THE KEYS TO SURVIVAL--THE ABILITY TO DEVELOP AND RELATE KNOWN METHODS OF LIVING OFF THE LAND TO THE PARTICULAR SITUATION AND TO IMPROVISE THE MEANS OF CARRYING THEM OUT.

FISHING. ALONG MANY RIVERS OF THE TROPICAL FOREST, FISHING IS OF CONSIDERABLE IMPORTANCE TO ALMOST ALL TRIBES. IN GENERAL, THE METHODS MAY BE CLASSIFIED AS FOLLOWS: (1) HOOK AND LINE; (2) POISONING; (3) TRAPS; (4) NETS; (5) KILLING WITH ARROWS OR SPEARS OF VARIOUS TYPES; AND (6) MISCELLANEOUS METHODS. IN MODERN TIMES METAL HOOKS HAVE BECOME UBIQUITOUS THROUGH TRADE, BUT THE ABORIGINAL HOOKS WERE MADE OF SUCH MATERIALS AS THORN, BONE, HARDWOOD, AND SHELL. THEY ARE BAITED AND USED ON A THROW LINE, DROP LINE, ROD, SPRING LINE OF SEVERAL TYPES, OR ON A SET LINE, ALTHOUGH THE LAST MAY BE A RECENT INTRODUCTION. POISONING IS USUALLY DONE IN RELATIVELY QUIET WATER AND NECESSITATES BUILDING A FENCE ACROSS THE STREAM AGAINST WHICH THE DEAD OR STUPIFIED VICTIMS MAY BE CAUGHT. THE COMMONEST POISEN THROUGHOUT THE TROPICAL FOREST IS DERIVED FROM THE ROOTS AND VINES OF VARIOUS SPECIES OF PLANTS AND ARE USED EITHER TO POISON THE WATER OR TO POISON THE FISH DIRECTLY

WHEN THEY SWALLOW THE POISON IN THE FORM OF BAIT.

IN ADDITION TO SPRING LINES AND SET HOOKS, THE INDIANS CATCH FISH IN A VARIETY OF ENCLOSING AND HOLDING TRAPS, SUCH AS FENCE WEIRS, ENCLOSING BASKETS, AND CONE-SHAPED WICKER BASKETS WHICH ARE USUALLY USED WITH FENCES ALTHOUGH OCCASIONALLY THEY ARE RIGGED INTO A SPRING TRAP WHICH HOISTS THE BASKET OUT OF THE WATER AFTER THE FISH AS ENTERED IT. DIP NETS OF VARIOUS FIBERS ARE USED. HARPOON ARROWS AND THROWING SPEARS, OFTEN WITH MULTIPLE HEADS, ARE A SECONDARY METHOD EMPLOYED USUALLY IN CLEAR WATER. MISCELLANEOUS METHODS INCLUDE THE USE OF BAIT, SUCH AS INSECTS, CAST ON THE WATER TO ENTICE FISH TO THE SURFACE, WHERE THEY CAN BE CLUBBED OR KILLED WITH MACHETES OR CATCHING BY HAND; THE BUILDING OF DAMS, THE IMPOUNDING WATER OF WHICH IS BAILED OUT AND THE FISH CAPTURED; AND THE MUDDYING OF THE WATER TO FORCE THE FISH TO THE SURFACE.

THE TECHNIQUES ASSOCIATED WITH THE USE OF POISON FOR FISHING HAVE CERTAIN BASIC FEATURES WHICH ARE REQUISITE TO THEIR EFFECTIVENESS. FIRST, THE STREAM WHERE THE POISON IS USED MUST BE LIMITED IN SIZE, SPEED OF FLOW, AND HAVE A WARM ENOUGH TEMPERATURE IN ORDER FOR THE DRUG TO ATTAIN ITS HIGHEST DENSITY. WHERE THE OTHER TWO FACTORS ARE SUITABLE, TEMPERATURE WILL PROBABLY BE SUITABLE IN THIS CLIMATE. UNDERSTANDABLY, THE RUSHING STREAMS AT THE HIGHER ALTITUDES ARE GENERALLY NOT ADAPTABLE TO THIS PROCESS. SECONDLY, MOST FISHING METHODS WHERE POISON PLANTS ARE USED REQUIRE COOPERATIVE ACTION WITH MOST OF THE TRIBE PARTICIPATING. THE MEMBERS OF THE TRIBE ARE DIVIDED, THE POISON HANDLERS GOING UPSTREAM TO INTRODUCE THE POISON INTO THE WATER, AND THE COLLECTORS GOING DOWNSTREAM TO A PREPARED WEIR-TYPE DAM TO GATHER AND DISPATCH THE FISH AS THEY RISE STUPIFIED

TO THE SURFACE. THE POISON IS EXTRACTED FROM THE PLANT BY CUTTING THEM INTO SEGMENTS AND ARRANGING THEM IN BUNDLES OF SEVERAL INCHES IN THICKNESS. THE BUNDLES ARE THEN PLACED AGAINST A ROCK OR LOG IN THE WATER AND BEATEN WITH A HEAVY CLUB. THE PLANT IS DIPPED FREQUENTLY IN THE WATER SO THAT THE SAP MAY BE ABSORBED. ONE WIDELY USED REFINEMENT OF THIS TECHNIQUE CONSISTS OF MASHING THE PLANTS IN A LARGE CONTAINER, USUALLY A DUGOUT, DILUTED WITH WATER AND ALLOWED TO SOAK FOR A PERIOD OF TIME. THE MASS OF POISON IS THEN POURED OR DUMPED INTO THE WATER WHERE IT SPREADS RAPIDLY. STILL ANOTHER METHOD OF INTRODUCING THE DRUG INTO THE WATER CONSISTS OF PLACING THE "MASH" INTO A SIEVE LIKE CONTAINER USUALLY MADE OF PLAITED FIBERS AND BASTS. THE CONTAINER IS LOWERED INTO THE STREAM WHERE THE CURRENT FLUSHES THE DRUG THROUGH THE CONTAINER. THIS METHOD, THOUGH EFFICIENT, REQUIRES A HIGHLY TOXIC PLANT AND A VERY SMALL AREA. IT IS ALSO THE MOST ADAPTABLE TO INDIVIDUAL APPLICATION. THE INDIAN IS FAMILAR WITH THE USES OF PLANTS IN HIS PARTICULAR AREA OR BY HIS PARTICULAR TRIBE. AS STATED ELSEWHERE, THROUGHOUT THE FOREST REGIONS MORE THAN 100 KNOWN PLANTS ARE USED. A LARGE NUMBER OF THEM ARE VINE-TYPE PLANTS WITH MILKY SAP. THE SURVIVOR IS ADVISED TO EXPERIMENT WITH SEVERAL WHEN POSSIBLE SO THAT IN ANY GIVEN AREA HE INCREASES THE PROBABILITY OF FINDING AT LEAST ONE IDENTIFIABLE PLANT.

PREPARATION OF FOOD AND DRINK. THE PREPARATION OF MANIOC OR CASSAVA (MANIHOT UTILISSIMA) IS PROBABLY THE MOST UNIVERSALLY DISTRIBUTED CULTURE TRAIT COMMON TO THE TROPICAL FOREST PEOPLES. IT IS ALSO THE MOST FREQUENTLY DESCRIBED. TO PREPARE BITTER MANIOC, THE TUBER IS PEELED, WASHED, AND GRATED ON A BOARD SET WITH SPINES OR STONES, AND MORE RECENTLY, NAILS, THE RESULTING PULP BEING TYPICALLY

CRAMMED BY HANDFULS INTO A CYLINDRICAL BASKETRY PRESS (TIPITI) WITH AN UPPER AND A LOWER LOOP. THE UPPER LOOP IS HUNG FROM A PROJECTING BEAM, WHILE A STRONG POLE IS PASSED THROUGH THE LOWER LOOP AND BALANCED ON A FULCRUM. A WOMAN, USUALLY, SITS ON THE FREE END OF THE POLE, THUS EXTENDING THE CONTAINER AND DIMINISHING ITS DIAMETER. THE POISONOUS PRUSSIC ACID THUS SQUEEZED OUT THROUGH THE INTERSTICES OF THE BASKETWORK IS ALLOWED TO DRIP INTO A VESSEL. THE PURGED PASTY MASS IS SHAKEN OUT AS A SNOW-WHITE, NEARLY DRY MASS, WHICH IS POUNDED IN A MORTAR AND PASSED THROUGH A SIFTER, FALLING ON A MAT. THE RESULTANT STARCHY WHITISH POWDER IS EITHER BAKED ON A CLAY GRID INTO THIN FLAT CAKES, BEIJU, OR PREVENTED FROM CONSOLIDATION BY STIRRING, THUS YIELDING AN ACCUMULATION OF SMALL, DRY CRUMBS, FARINHA PELLETS, LIKE THOSE OF WHITE BREAD. WELL-BAKED AND DRIED, THE BEIJU WILL KEEP FOR A LONG TIME, AS WILL THE PEA-SIZED PELLETS, SO THAT BOTH PRODUCTS PROVIDE SERVICEABLE TRAVELING FARE.

THE PROCESSES VARY SOMEWHAT LOCALLY. THE BASKETRY PRESS OBVIOUSLY PRESUPPOSES EARLIER DEVELOPMENTAL STAGES, SUCH AS ARE NOTED AMONG THE WITOTO AND ON THE UPPER PURUS RIVER, WHERE MUSCULAR EFFORT IS REQUIRED TO WRING THE POISON BY HAND OUT OF A PLAITED SACK. IT SHOULD BE NOTED, HOWEVER, THAT BOILING IS PROBABLY SUFFICIENT TO DRIVE OFF THE PRUSSIC ACID.

AFTER THE STARCHY SEDIMENT OF THE EXPRESSED MANIOC JUICE HAS SETTLED, THE WATER IS POURED OFF AND BOILED FOR SEVERAL HOURS WITH PEPPERS AND THICKENED INTO CASSARIP. THIS SOMEWHAT ACID BROTH MAY RECEIVE ADDITIONS SUCH AS MEAT, SMALL FISH, OR EVEN ANTS. ALL ANIMAL FOOD IS BOILED WITH WATER OR CASSARIP, YIELDING A CHARACTERISTIC "PEPPER POT," MEAT BEING THUS BOILED DAILY BY WAY OF PRESERVING IT.

THIS "PEPPER POT" OR "HUNTER'S STEW" IS FREQUENTLY A COMMUNITY POT AND INDIVIDUALS MAY BE SEEN DIPPING INTO IT ANY TIME OF THE DAY. ALTHOUGH THE SURVIVOR MAY WONDER ABOUT THE CONTENTS OF THE STEW, OF ONE THING HE MAY BE CERTAIN--THEY ARE USUALLY WELL COOKED AND RID OF PARASITIC ORGANISMS. ACTUALLY IT IS RATHER TASTY AS WELL AS HIGHLY NOURISHING.

ANOTHER KIND OF FLOUR ("WATER FLOUR") IS MADE FROM TUBERS WHICH HAS BEEN SOAKED IN RUNNING WATER FOR MANY DAYS UNTIL THEY BEGIN TO DECAY. THEY ARE THEN CRUSHED BY HAND, STRAINED IN THE TIPITI AND PASSED THROUGH A SIEVE. THE PULP IS BAKED AS BEFORE. A FLOUR CALLED CARIMA IS OBTAINED FROM TUBERS THAT ARE ROTTED, SOAKED IN WATER, SMOKED ON A BABRICOT (A RECTANGULAR FOUR-LEGGED GRILL OR PLATFORM MADE OF STICKS, UNDER WHICH A SLOW FIRE BURNED), POUNDED IN A WOODEN MORTAR AND CAREFULLY SIFTED. A COMBINATION OF "WATER FLOUR" AND CARIMA IS BAKED FOR A LONG TIME UNTIL DRIED AND WELL ROASTED. THIS FLOUR, WHICH KEEPS FOR MORE THAN A YEAR, IS CARRIED BY TRAVELERS AND WARRIORS IN WATERPROOF SATCHELS PLAITED OF PALM LEAVES.

AYPI, OR SWEET MANIOC, CAN BE EATEN DIRECTLY AFTER BOILING OR ROASTING, BUT IS CULTIVATED MAINLY FOR BREWING VARIOUS TYPES OF FERMENTED OR ALCHOLIC BEVERAGES. IT IS ALSO MADE INTO VARIOUS KINDS OF FLOUR. THE JUICE OF BOTH SPECIES OF MANIOC, IF LEFT IN THE SUN FOR AWHILE, LEAVES A STARCH DEPOSIT WHICH IS BAKED AND EATEN. OTHER TUBERS, SUCH AS SWEET POTATOES, CARA, MANGARA, AND TAIA, REQUIRING A LESS ELABORATE TREATMENT ARE EITHER BOILED OR ROASTED. MAIZE, MAINLY CONSUMED IN THE FORM OF FLOUR, IS ALSO ROASTED OR BOILED. PEANUTS ARE BROILED AND ROASTED. THE NAME MINGAO DESIGNATED ANY MUSH MADE OF MANIOC OR OTHER FLOUR.

MEAT AND FISH ARE ROASTED OR BOILED. THE BROTH IS OFTEN MIXED WITH MANIOC FLOUR. SMALL FISH, WRAPPED IN LEAVES, ARE COOKED UNDER ASHES. ANY SURPLUS OF GAME OR FISH IS DRIED AND SMOKED FOR ABOUT TWENTY-FOUR HOURS ON THE BABRIÇOT. ANOTHER METHOD FOR PRESERVING MEAT AND FISH IS TO POUND IT INTO A SORT OF PEMMICAN OR FLOUR.

CONDIMENTS COMPRISED MAINLY SEVERAL SPECIES OF PEPPER AND OCCASIONALLY A GRASS CALLED NHAMBY. SALT IS OBTAINED THROUGH TRADE AND BY BOILING LYE MADE OF PALM-WOOD ASHES. SALT AND GROUND PEPPER ARE GENERALLY MIXED AND MORSELS OF FOOD IS DIPPED IN THIS POWDER BEFORE BEING EATEN.

ALL SOCIAL EVENTS INCLUDING RELIGIOUS CEREMONIES ARE OCCASIONS FOR DRINKING BOUTS AT WHICH GREAT QUANTITIES OF ALCHOLIC BEVERAGES ARE CONSUMED. THE PREPARATION OF FERMENTED BEVERAGES IS MAINLY THE TASK OF WOMEN. LIQUORS ARE MADE FROM VARIOUS PLANTS: SWEET MANIOC, MAIZE, SWEET POTATOES, CASHEW, PINEAPPLES, BANANAS, AND OTHER FRUITS. MANIOC BEER, A FAVORITE AND WIDESPREAD DRINK, IS PREPARED IN VARIOUS WAYS, HOWEVER, THE FOLLOWING DESCRIPTION OF A PROCESS USED BY ONE TRIBE IS SOMEWHAT TYPICAL: ROOTS, CUT INTO THIN SLICES, ARE FIRST BOILED, THEN SQUEEZED AND PARTLY CHEWED BY THE WOMEN. THE MASS, IMPREGNATED WITH SALIVA, IS MIXED WITH WATER AND HEATED AGAIN OVER THE FIRE. THE LIQUID IS AFTERWARD POURED INTO HUGE JARS, HALF BURIED IN THE GROUND, COVERED WITH LEAVES, AND LEFT TWO OR THREE DAYS TO FERMENT. A FIRE IS BUILT AROUND THE JARS TO WARM THE BEVERAGE BEFORE SERVING IT. EACH EXTENDED FAMILY MANUFACTURES ITS OWN LIQUOR. WHEN A DRINKING PARTY IS ORGANIZED, DRINKERS GO SUCCESSIVELY TO EACH HUT, EXHAUSTING THE AVAILABLE SUPPLY. THE WOMEN SERVE THE LIQUORS IN HUGE CALABASHES. OLD MEN AND GUESTS OF HONOR ARE SERVED FIRST BY THE HOST'S CLOSEST

FEMALE RELATIVES. DRINKING IS ALWAYS THE OCCASION FOR RIOTOUS MERRY-MAKING. MEN AND WOMEN PAINT AND COVER THEMSELVES WITH THEIR MORE SHOWY ORNAMENTS. THEY DANCE, SHOUT, WHISTLE, PLAY MUSICAL INSTRUMENTS, TALK EXCESSIVELY, AND BRAWL. THESE ORGIES LAST FOR THREE OR FOUR DAYS, DURING WHICH NOBODY EATS OR SLEEPS MUCH.

FOREST PRODUCTS AND MANUFACTURES. EXCEPT FOR THE FEW MODERN TOOLS AND WEAPONS WHICH FILTER THROUGH THE FOREST TRIBES BY TRADING, RAIDING, OR SUCH OTHER MEANS, THE INDIAN IS ENTIRELY DEPENDENT UPON THE FOREST FLORA AND FAUNA FOR ALL NECESSITIES AND WHATEVER "LUXURIES" THEY OBTAIN. AN OUTSTANDING EXAMPLE OF PLANT UTILIZATION IS THE MANY PRODUCTS AND MANUFACTURES DERIVED FROM THE BURITI PALM WHICH MIGHT BE COMPARED TO THE "COUNTRY STORE."

ASIDE FROM FOOD PLANTS, FEW HAVE SUCH PRIMARY IMPORTANCE AS THE VARIOUS FIBER PLANTS. LITTLE IMAGINATION IS NEEDED TO REALIZE THE MANY USES TO WHICH THE CORDING FROM THESE PLANTS ARE PUT: BOW STRINGS, BINDINGS FOR BLOWGUNS, CROSSPIECES OF SHELTERS, COOKING PLATFORMS (BABRICOTS), TRAPS, AND SNARES; FISHING LINES, THREADS AND PLAITING MATERIELS FOR BASKETRY, HAMMOCKS, NETS, MANIOC TIPITIS; CLIMBING ROPES, SUSPENSION BRIDGES, CARRYING DEVICES, ETC.

LIKE THE FIBER PLANTS, THE LIST OF WOOD MANUFACTURES FROM THE VARIOUS TREES IS ALMOST INTERMINABLE. THE MANUFACTURE OF WEAPONS HAS BEEN DISCUSSED. IN ADDITION THERE ARE VARIOUS FORMS OF SHELTER FOR WHICH THE BROAD LEAVES OF THE TREES, PARTICULARLY THE PALMS, ARE USED AS THE COVERING OVER THE FRAME OF WOOD. ONE OF THE MORE SIGNIFICANT WOOD MANUFACTURES IS BOAT MAKING. THE USE OF BARK FOR LIGHT CANOES AND BALSA FOR RAFTS IS UTILIZED REGIONALLY. HOWEVER, THE DUGOUT IS KNOWN THROUGHOUT THE RIVER SYSTEMS AND THE SIMILARITY OF THE PROCESS

OF MANUFACTURE IS INDICATIVE OF THE MANY OTHER CULTURE TRAITS COMMON TO THE FOREST TRIBES. AS STATED IN THE SECTION DEALING WITH RIVER NAVIGATION, THE MAKING OF A DUGOUT IS A LONG AND LABORIOUS PROCESS IN WHICH HOLLOWING IS ACCOMPLISHED BY GOUGING AND BURNING AFTER WHICH WIDENING INVOLVES VARYING TECHNIQUES OF SOAKING, WEDGING, FILLING WITH SAND, AMONG OTHERS. THE DUGOUT IS LARGE, THIRTY TO FORTY FEET, AND ARE QUITE CUMBERSOME. THE BARK CANOES SHOW LITTLE OF THE REFINEMENT FOR WHICH THE NORTH AMERICAN INDIANS WERE NOTED. USUALLY THEY ARE FRAGILE, ALMOST MAKE-SHIFT IN APPEARANCE, AND VERY TRICKY TO HANDLE. OTHER WIDELY USED PRODUCTS OF VARIOUS TREES ARE BASTS FOR MAKING CLOTH ITEMS, DYES, OILS FROM THE VARIOUS PALM NUTS, RESINS, GUMS, GLUES, LATEX, AND DRUGS. BAMBOOS, WHICH ARE GRASSES RATHER THAN TREES, ARE VERY IMPORTANT IN VARIOUS MANUFACTURES PERHAPS THE MOST IMPORTANT BEING AS TIPS OF ARROWS AND SPEARS. THE INDIANS USE THEM AS KNIVES ACTUALLY ATTAINING THE SHARPNESS OF A RAZOR FOR WHICH THEY ARE FREQUENTLY USED. THEY ARE USED AS CARRYING DEVICES, DRUMS, MUSICAL PIPES, DRILLS, PUNCHES, NEEDLES, AND FISHING POLES.

THE USE OF GOURDS AS DRINKING, DIPPING, AND STORAGE VESSELS IS ALMOST UNIVERSAL ALTHOUGH PRIMITIVE POTTERY MAKING IS ALSO EXTENSIVELY PRACTICED. SUCH ITEMS AS ARE MANUFACTURED ARE USUALLY DECORATED BY PAINTING AND RELIEF WITH DESIGNS DISTINCTIVE TO THE USING TRIBE.

FIREMAKING IS KNOWN THROUGHOUT THE FOREST. CONSIDERING THE GREAT LENGTHS TO WHICH THE INDIANS GO TO KEEP THEIR FIRES BURNING, EVEN CARRYING SMOLDERING TIMBER ON AN EARTHEN HEARTH DURING LONG BOAT TRIPS, THEY PROBABLY FIND THE PROCESS AS LABORIOUS AND TRYING AS THE YOUNG BOY SCOUT. FREQUENTLY, THE MAKING AND PRESERVATION OF A

FIRE HAS RELIGIOUS ASSOCIATIONS. FRICTION AND PERCUSSION METHODS ARE IN GENERAL USE. SEVERAL MATERIALS ARE AVAILABLE FOR TINDER SUCH AS MOSS, SHREDDED BARK, AND THE SILK FLUFF FROM KAPOK SEEDS. THE INDIAN IS FAMILIAR WITH THE BURNING PROPENSITIES OF OILS, GUMS, RESINS, ETC. AND FREQUENTLY USE THESE PRODUCTS IN CONNECTION WITH COOKING, LIGHTING, AND FIRE PRESERVATION.

BESIDES THE VEGETABLE PRODUCTS, THE INDIANS MAKE FULL UTILIZATION OF THE ANIMALS FOR OTHER THAN FOOD. SKINS ARE USED IN LEATHER MANUFACTURES INCLUDING CARRYING DEVICES, FOOT COVERINGS, SHIELDS, ORNAMENTAL AND CEREMONIAL GARMENTS, THONGS, DRUM HEADS, ETC. BONES ARE USED AS WORKING TOOLS, AS MUSICAL PIPES, AND ORNAMENTAL WEAR. TEETH ARE USED AS CUTTING AND DRILLING TOOLS--THE WHOLE JAW OF THE PIRANHA IS USED AS A FILE OR ABRASIVE--AND ORNAMENTS. THE SHELLS OF VARIOUS RIVERINE MOLLUSKS AS WELL AS TURTLES ARE USED AS CUTTING, SCRAPPING, AND DIGGING TOOLS AS WELL AS VESSELS. WHILE THE USE OF STONE IS NOT OVERLOOKED AS A TOOL MATERIAL IN MANY AREAS OF THE FOREST PARTICULARLY THE RAIN FOREST, STONE IS COMPLETELY ABSENT OR VERY RARE.

THE FOREGOING IS MERELY REPRESENTATIVE OF THE VARIOUS PRODUCTS AND MANUFACTURES OF THE FOREST INDIAN. ALTHOUGH SPECIFIC TECHNIQUES ARE INVOLVED INSOFAR AS THE INDIAN USAGE IS CONCERNED, THE PRODUCTS ARE ADAPTABLE TO SUCH IMPROVISATION AS THE IMAGINATION AND INGENUITY OF THE SURVIVOR PERMITS.

SETTLEMENT PATTERNS. THE RIVERINE ENVIRONMENT OF THE TROPICAL FOREST PRESENTS TWO BASIC CHOICES FOR VILLAGE LOCATION: AWAY FROM THE RIVER, OR ALONG THE SHORE. CONSIDERATIONS OF DEFENSE, ELEVATION, AND PROXIMITY TO FOOD SOURCES CONTRIBUTE TO THE SELECTION OF THE SITE. SOME TRIBES FEEL THAT IT IS PREFERABLE TO BE CLOSER TO FISHING GROUNDS

THAN TO GARDENS, AND BUILD ON A HIGH BANK OVERLOOKING THE RIVER. THIS LOCATION IS CHOSEN BY THE MURA, APIACA, AND TRIBES IN THE UAUPES AND MONTANA REGIONS. JIVARO SETTLEMENTS ARE ON A STEEP HILL AT THE HEAD OF A STREAM.

OTHER TRIBES WHO FAVOR THE DEPTHS OF THE FOREST ALSO DO SO FOR REASONS OF A SUBSISTENCE NATURE. SUCCESSFUL HUNTING REQUIRES A WIDE RANGE OF VIRGIN FOREST ON ALL SIDES, A TERRITORY IN WHICH THE HUNTERS ARE NOT HANDICAPPED BY COMPETITION FROM NEIGHBORING VILLAGERS OR PASSERSBY ON THE RIVER. FURTHERMORE, IT IS THE PRACTICE TO LOCATE CASSAVA FIELDS ON HILLS OR SLOPES IN ORDER TO FACILITATE DRAINAGE OF THE SOIL. SUITABLE FACILITIES FOR NATURAL DRAINAGE ARE MORE OFTEN FOUND AT SOME DISTANCE FROM THE RIVER. TRIBES WHO SHUN THE RIVER LOCATE THEIR VILLAGES SEVERAL MILES AWAY. A NEARBY CREEK PROVIDES THE DOMESTIC WATER SUPPLY AND A PATH GIVES ACCESS TO THE RIVER. LAND ABOVE FLOOD LEVEL IS ALMOST UNIVERSALLY CHOSEN, STILL SOME TRIBES OFTEN SETTLED ON ISLANDS, BEACHES, OR LOWLANDS LIKELY TO BE INUNDATED.

HOUSES ARE OF TWO FUNDAMENTAL TYPES, COMMUNAL AND SINGLE FAMILY, OF WHICH THE COMMUNAL TYPE IS PREDOMINANT. DETAILS OF CONSTRUCTION ALSO HAVE A WIDE RANGE INCLUDING CIRCULAR, RECTANGULAR, AND ELLIPTICAL FLOOR PLAN; CONICAL, GABLED OR ARCHED ROOF; THATCHED OR OPEN SIDES; THE INTERIOR UNPARTITIONED, OR DIVIDED BY MATS INTO FAMILY COMPARTMENTS. INDIVIDUAL FAMILY HOUSES WERE CHARACTERISTIC OF THE TUPI-CAWAHIB TRIBES OF THE GUIANAS AND THE MONTANA, AND THE ENCABELLO (SOMETIMES OCCUPIED BY TWO FAMILIES). PILE DWELLINGS ARE BUILT BY THE WARRAU AND TUCUNA WHEN ON INUNDATED SITES; OTHERWISE THE FLOOR IS OF PACKED EARTH.

VILLAGE COMPOSITION IS VARIABLE AND NOT COORDINATED WITH THE NATURE OF THE HOUSE, EXCEPT WHERE A SINGLE COMMUNAL HOUSE CONSTITUTES

THE VILLAGE, AS IS CHARACTERISTIC IN THE UPPER AMAZON. OTHERWISE BOTH TYPES MAY BE ARRANGED IN A CIRCLE AROUND A CENTRAL PLAZA, IN ROWS, OR HAPHAZARDLY SCATTERED IN THE CLEARING. THE DIMENSIONS OF THE CLEARING ARE VARIABLE DEPENDING MAINLY IN THE TYPE AND NUMBER OF DWELLINGS.

IN POPULATION THE TROPICAL FOREST VILLAGES RUN THE GAMUT FROM TWO OR THREE FAMILIES (CHIMANE) TO MORE THAN A THOUSAND INDIVIDUALS (TUPINAMBA). THE MAJORITY CONTAIN UNDER 200 PEOPLE HOUSES IN COMMUNAL DWELLINGS. THE AVERAGE POPULATION FOR VILLAGES WITH INDIVIDUAL FAMILY HOUSES IS SOMEWHAT LESS.

THE LENGTH OF TIME THAT VILLAGES CONTINUE TO BE OCCUPIED IS INVARIABLY SHORT. THE TUPINAMBA MOVE WHEN THE SOIL IN THE VICINITY IS EXHAUSTED OR THE THATCH ON THE HOUSE BEGINS TO DETERIORATE, THAT IS EVERY FOUR TO FIVE YEARS, AND THE NEW VILLAGE IS NEAR THE OLD ONE. MONTANA VILLAGES MOVE EVERY TWO TO THREE YEARS, THE JIVARO AT LEAST EVERY SIX YEARS, THE CUBEO EVERY THREE TO FIVE YEARS, THE TAPIRAPE EVERY FOUR TO FIVE YEARS. IN ADDITION TO SOIL EXHAUSTION, THE DECIMATION OF GAME ANIMALS OR THE DESTRUCTION OF NEARBY PALM TREES MAKES A CHANGE DESIRABLE. AMONG SOME GROUPS ABANDONMENT IS CUSTOMARY AT THE DEATH OF A MEMBER OF THE HOUSEHOLD.

SOCIAL AND POLITICAL ORGANIZATION

EACH INDIAN VILLAGE OR SETTLEMENT IS COMMONLY AUTONOMOUS BUT RECOGNIZES RELATIONSHIPS BETWEEN OTHER VILLAGES OF THE SAME TRIBE. THESE RELATIONSHIPS ARE MAINTAINED FOR PURPOSES OF MARRIAGE, BARTER, AND, SOMETIMES, RELIGIOUS TIES, BUT RARELY FOR POLITICAL AFFILIATIONS.

A TROPICAL FOREST VILLAGE IS TYPICALLY COMPOSED OF ONE OR MORE KIN GROUPS. IN THE GUIANAS, KINSHIP IS OFTEN TRACED THROUGH THE

FEMALE LINEAGE (MATRILINEAGE), BUT IN MOST OF THE REMAINDER OF THE FOREST AREAS THE KIN IS TRACED THROUGH THE MALE LINE (PATRILINEAL). TRIBES WHICH TRACE THEIR DESCENT THROUGH BOTH BLOOD KIN GROUPS ARE NOT UNCOMMON. CLOSELY ASSOCIATED WITH KINSHIP AND DESCENT IS THE CLAN ORGANIZATION. USUALLY, KINSHIP CAN BE TRACED BACK ONLY A FEW GENERATIONS TO A KNOWN ANCESTOR. CLANS, HOWEVER, ARE TRACED BACK TO A MYTHOLOGICAL FIGURE ASSOCIATED WITH THE ORIGIN OF THE CLAN. THE MYTH OF ORIGIN INVOLVES HEROIC FEATS, RELATIONS--USUALLY SEXUAL--WITH ANIMALS, THE SUN, MOON, STARS, BIRDS, EVEN INANIMATE OBJECTS SUCH AS STONES; FROM WHICH THE CLAN DERIVES ITS ANCESTRAL SYMBOL OR TOTEM. THESE TOTEMS SUCH AS JAGUARS, TURTLES, TAPIRS, CROCODILES, VARIOUS BIRDS, ETC. INVARIABLY HAVE TABOOS ASSOCIATED WITH THEM.

THE EFFECT OF THE DESCENT SYSTEM AND THE CLANS ARE VERY PERVASIVE. NEARLY ALL ASPECTS OF SOCIAL LIFE HAVE SOME RELATION TO THE KIN OR CLAN GROUPS. HOUSING PATTERNS WITHIN THE VILLAGE, PROPERTY OWNERSHIP AND INHERITANCE, RULES OF SELECTING MARRIAGE PARTNERS, STATUS OF THE INDIVIDUAL IN THE TRIBE, HUNTING AND FISHING RIGHTS, SOCIAL INTERCOURSE, EVEN THE IDENTITY AND POSSESSION OF "SPIRITS" ARE DETERMINED THROUGH THESE SYSTEMS.

POLITICALLY, THERE IS NO WELL DEFINED ORGANIZATION IN MOST INDIAN TRIBES NOR IS LEADERSHIP HIGHLY DEVELOPED. SUCH AUTHORITY WHICH HEADMEN OR CHIEFS EXERCISE USUALLY DERIVES FROM THEIR LINEAGE AND CLAN. HIS AUTHORITY IS LIMITED AND IS USUALLY CONFINED TO ORGANIZING COMMUNAL ENTERPRISES SUCH AS HUNTING AND FISHING ACTIVITIES, ARRANGING FESTIVITIES AND CEREMONIES AND ARBITRATING DISPUTES. HE MAY OR MAY NOT BE THE LEADER OF HIS TRIBE ON A RAIDING PARTY. IN TRIBAL RELATION WITH "FOREIGNERS," HE IS UNDOUBTEDLY INFLUENTIAL BUT

STILL SUBJECT TO COLLECTIVE DECISIONS OF THE TRIBE. WHEN A STRANGER ENTERS INTO SOCIAL CONTACT WITH THE TRIBE, THE CHIEF PERFORMS THE CEREMONIAL REPRESENTATION AND SUCH SUCCESS OR FAILURE WHICH THE STRANGER MAY ACHIEVE MIGHT WELL HINGE ON THE IMPRESSION OF THE CHIEF. USUALLY PARLEY IS WITH THE CHIEF AND WHERE GIFT GIVING IS A PART OF THE CONTACT HE IS GIVEN EITHER FIRST CHOICE OR THE OBVICUSLY BEST GIFT.

RELIGION, MAGIC AND MEDICINE

IT WOULD BE A LENGTHY AND TEDIOUS JOB TO IDENTIFY THE MANY "SPIRITUAL" BEINGS THAT COMPRISE THE SUPERNATURAL WORLD OF THE INDIAN. TO A CONSIDERABLE DEGREE IT IS POSSIBLE TO DESCRIBE THE RELATIONSHIP BETWEEN THESE SPIRITS AND THE TRIBES OR INDIVIDUALS WITH WHOM THEY IDENTIFY. TO DO SO, HOWEVER, WOULD NOT EXPLAIN THE EFFECT WHICH THESE RELATICNSHIPS HAVE ON THE CONSCICUSNESS, OR MENTAL DISPOSITION OF THE INDIAN, NOR WOULD IT SERVE AS AN ADEQUATE FRAME OF REFERENCE WITH REGARDS TO SOCIAL AND RELIGIOUS BEHAVIOR. FOR THIS REASON INSTEAD OF LISTING THESE "SPIRITS," IT WILL BE OF CONSIDERABLE MORE BENEFIT TO LEARN HOW THE INDIAN CONCEIVES THE SUPERNATURAL AND WHAT EFFECT IT HAS ON HIS DAILY LIFE.

IN THE MIND OF THE PRIMITIVE INDIAN, HE IS SO COMPLETELY A PART OF HIS NATURAL ENVIRONMENT THAT HE MAKES NO ABSTRACT DISTINCTION BETWEEN HUMANS AND ANY OTHER OBJECT OF THE ENVIRONMENT. HE FINDS IT NEITHER DIFFICULT NOR CONTRADICTORY THAT AN ANACONDA, A JAGUAR, OR A BIRD SHOULD HAVE A SOUL OR SPIRIT. NOT ONLY ANIMATE BUT ALSO INANIMATE OBJECTS SUCH AS PLANTS, TOOLS, ESPECIALLY WEAPONS, AND EVEN STONES HAVE SPIRITS OF THEIR OWN AND ARE INTRINSICALLY CAPABLE OF GOOD OR EVIL. IN FACT, WERE THE INDIAN NOT ABLE TO ASSIGN SPIRITS

TO HIS NATURAL WORLD, HIS FEAR OF THE MYSTERIOUS FORCES OF NATURE WOULD BE EVEN MORE TERRIFYING THAN THEY ARE. BUT, WHERE HE CAN ASSIGN SUPERNATURAL CAUSES TO THESE VARICUS FORCES HE THEN CAN CALL UPON THE TRADITIONAL MEANS OF HIS TRIBE TO NEUTRALIZE THE THREATS OR TO OBTAIN FAVOR FROM THE "SPIRIT" WORLD.

ANTHROPOLOGISTS USUALLY DESCRIBE THE PRIMITIVE CONCEPT OF THE SUPERNATURAL IN TERMS CALLED "ANIMISM" AND "TABOO" (TABU-MANA). ANIMISM IS THE BELIEF IN SPIRITS. THESE SPIRITS MOST NEARLY COMPARE WITH THE GHOSTS, GOBLINS, GENII, SOULS, ELVES, FAIRIES, DEMONS, DEVILS, ETC. KNOWN IN MODERN LITERATURE. IN THE SUPERNATURAL WORLD OF THE PRIMITIVE INDIAN, EVERY OBJECT HAS SUCH A SPIRIT AND UNDER VARYING CONDITIONS IS CAPABLE OF GOOD OR EVIL. MANY OF THE SPIRITS SUCH AS OF TREES, BUSHES AND RIVERS ASSUME THE SHAPE OF JAGUARS, CROCODILES, AND OTHER DANGEROUS ANIMALS. ILLNESS, DISEASE AND DEATH ARE USUALLY ACCREDITED TO SPIRITS OR GHOSTS OF OTHER PERSONS LIVING OR DEAD OR THEY COULD BE THE SPIRIT OF ANY OBJECT WHICH IN SOME WAY WAS OFFENDED. INDIANS WILL FREQUENTLY TALK TO THEIR HUNTING WEAPONS AND MAKE SPECIAL CEREMONIES TO THE SPIRITS OF THEIR CULTIVATED PLOTS TO INSURE GOOD CROPS AND IF FAILURE OCCURS WILL ASUME THAT THE SPIRITS WERE UNFAVORABLY DISPOSED FOR ANY NUMBER OF REASONS.

ANYTHING STRANGE OR DIFFERENT IS VIEWED WITH SUSPICION OR FEAR. THE INDIAN IS NOT CURIOUS IN THE SENSE THAT HE SEEKS RATIONAL CAUSES; BUT RATHER HE SEARCHES FOR A PRESCRIBED AND PROTECTIVE FORM OF BEHAVIOR AND FOR THIS HE RELIES ON THE TRADITIONS OF HIS TRIBE. THESE ARE THE "INSTITUTIONAL" ASPECTS OF HIS RELIGION; THE CEREMONIAL RITES OF PURIFICATION; THE USE OF SPECIAL ADORNMENTS; SEEKING THE INTERCESSION OF THE SHAMAN OR WITCH DOCTOR; SCARIFICATION AND MUTILATION;

DRINKING AND USE OF NARCOTICS. THESE ARE THE RELIGIOUS ACTIVITIES OF THE INDIAN AND ARE USUALLY DESIGNED TO MEET THE FORCES OF THE SUPERNATURAL.

TABOOS, ALTHOUGH ESSENTIALLY SUPERNATURAL, ARE NOT SPIRITS BUT ARE MORE LIKE FORCES WHICH TEND TO RESTRICT OR PROHIBIT CERTAIN ACTIVITIES IN RELATION TO A PARTICULAR OBJECT. THEY COULD PERHAPS BE COMPARED TO ELECTRICITY. THEY ARE NOT DEFINED OR ENUMERATED IN TERMS OF EFFECTS NOR ARE THERE ANY OBVIOUS PHYSICAL CHARACTERISTICS, BUT TO VIOLATE A TABOO IS TO INCUR THE EFFECTS OF THE FORCE WITH HARMFUL CONSEQUENCES SUCH AS LOSS OF PROPERTY, FAILURE IN THE HUNT, DEFEAT IN COMBAT, SICKNESS AND DEATH.

TABOOS ARE FREQUENTLY ASSOCIATED WITH TOTEMIC ANIMALS, VARIOUS CEREMONIAL ITEMS, SPECIALLY DESIGNATED AREAS IN TRIBAL TERRITORIES, WITH CERTAIN PERSONS IN THE TRIBE--ESPECIALLY YOUNG GIRLS DURING MENSTRUAL PERIODS AND YOUNG BOYS GOING THROUGH INITIATION RITES. ITEMS OF WEAR FREQUENTLY HAVE TABOOS ATTACHED, SUCH AS THE PUBIC APRON OR THE STRING WORN ABOUT THE HIPS OF THE FEMALES. BOTH MEN'S AND WOMEN'S CEREMONIAL ACTIVITIES AND ASSOCIATED CEREMONIAL ITEMS SUCH AS ROBES, HEADDRESSES, MASKS, SYMBOLIC IMAGES USUALLY HAVE TABOOS ATTACHED. BLOOD HAS VERY STRONG POWERS ATTACHED AND THE ASSOCIATIONS CAN BE EITHER SPIRITS OR TABOOS. IN SOME INSTANCES IT IS BELIEVED THAT A MAN'S SPIRIT IS IN THE BLOOD. OFTEN BLOOD IS CONSIDERED UNCLEAN. DURING MENSTRUAL PERIODS, WOMEN ARE GREATLY RESTRICTED IN EVERYTHING THEY DO, MOST ESPECIALLY IN CONTACT ACTIVITIES OR FOOD HANDLING. THE COLOR RED IS GIVEN SPECIAL ACCORD THROUGHOUT THE FOREST AREAS. THE USE OF RED DIES FOR SPECIAL CEREMONIAL PAINTING OF THE BODY AND ORNAMENTATION IS FREQUENTLY ASSOCIATED WITH

THE "MAGIC" PROPERTIES OF BLOOD. FOR THIS REASON, THE IMPROPER DISPLAY OF RED COLOR COULD HAVE SERIOUS IMPLICATIONS.

THE CENTRAL FIGURE IN THE RELIGIOUS LIFE OF THE INDIAN TRIBES IS THE SHAMAN. IN THE LITERATURE DEALING WITH NORTH AMERICAN INDIANS, THIS INDIVIDUAL IS REFERRED TO AS THE MEDICINE MAN WHICH IS PROBABLY MUCH MORE APPROPRIATE THAN COMPARING HIM WITH A PRIEST. HE IS NOT TO BE CONFUSED WITH THE "WITCH DOCTORS" OR SORCERERS WHO ALSO PRACTICE THEIR EVIL MAGIC. THE SHAMAN IS USUALLY THE ONLY ONE WHO CAN COUNTER THE EVIL POWERS OF THE SORCERERS, SPIRITS, AND SUCH OTHER SUPERNATURAL BEINGS.

THE FOLLOWING DESCRIPTION FROM ROBERT H. LOWIE'S INTRODUCTION TO THE TROPICAL FOREST TRIBES, HANDBOOK OF SOUTH AMERICAN INDIANS, VOLUME III, (PP. 48-50), IS IN MOST WAYS TYPICAL OF SHAMAN PRACTICES:

> THE SHAMAN USUALLY WORKS IN COMPLETE DARKNESS UNDER A MOSQUITO NET--THE EQUIVALENT OF A SPECIAL PALM-LEAF COMPARTMENT ANCIENTLY USED. PUTTING ON A FEATHER DIADEM, HE RISES, BIDS ALL PRESENT FAREWELL SINCE HIS SOUL IS ABOUT TO START ON ITS JOURNEY, AND CRAWLS UNDER THE NET, AN ASSISTANT PASSING IN TO HIM THE ANIMAL-SHAPED BENCH AND A BASKET HOLDING THE SHAMANISTIC PARAPHERNALIA. THE DOCTOR SITS DOWN, REMOVES FROM HIS BASKET THE DANCE RATTLE AND A ROOT WHOSE ODOR THE SPIRITS LIKE, FOR WHICH REASON HE GRATES AWAY PARTICLES OF IT AND SPRINKLES THEM ON HIS HAIR. THE ASSISTANT NEXT HANDS HIM A LIGHTED CIGAR. SOON GROANS, WHISTLING, AND SINGING BECOME AUDIBLE, THE GLOWING TIP OF THE CIGAR IS SEEN FLOATING DOWNWARD FROM THE CEILING OF THE MOSQUITO NET, AND A RESOUNDING FOOTSTEP SIGNALIZES THE ENTRANCE OF THE FIRST SPIRIT INTO THE MEDICINE MAN'S BODY. HIS OWN SOUL HAS LEFT TO SUMMON THE FRIENDLY SPIRITS, INCLUDING THOSE OF THE DEAD. EACH OF THESE SINGS HIS OWN CHANTS TO THE MUSIC OF THE RATTLE, ALL SPECTATORS JOINING. AFTER FIVE TO TEN MINUTES OF SINGING, THE SPIRIT CONVERSES WITH THE ASSISTANT. THOSE PRESENT QUESTION THE VISITANT ABOUT THEIR OWN AFFAIRS. AT LAST THERE ARRIVES ONE SPIRIT CONSIDERED EXPERT IN THE TREATMENT REQUIRED, AND HIM THE ASSISTANT CONSULTS. THIS CONTINUES FOR HOURS UNTIL THE LAST SPIRIT LEAVES, AS INDICATED BY THE SOARING CIGAR TIP. THE SHAMAN CRAWLS OUT OF HIS COMPARTMENT. ANOTHER PROCEDURE IS TO BRING THE PATIENT, TOO, UNDER THE NET. IN ACTUAL TREATMENT THE DOCTOR UNDRESSES THE SICK MAN, SHAKES HIS RATTLE ALL OVER THE BODY TILL HE STRIKES THE SEAT OF THE MALADY, THEN SUMMONS HIS PATRONS AGAINST THE CAUSES OF THE DISEASE, WHICH MAY PRECIPITATE

A NOISY CONFLICT. IF THE POWERS OF EVIL CONQUER, THE DOCTOR ADMITS HIS FAILURE AND CASTS ABOUT FOR A MORE COMPETENT COLLEAGUE. EXTRACTION OF THE DISEASE BY SUCTION IS ALSO REPORTED, BUT NOT RECKONED ESSENTIAL. A CURED PATIENT REGALES HIS SAVICR WITH A DANCE AND D DRINKING FESTIVAL, WHICH IS NATURALLY DIRECTED BY THE SUCCESSFUL DOCTOR.

SOME OF THESE TRAITS, EVEN APART FROM THE SUCKING TECHNIQUE, HAVE A WIDE DISTRIBUTION. THE INSISTENCE ON DARKNESS, FOR EXAMPLE, OCCURS AMONG THE POMEROON-ARAWAK AND CARIB. THE SIUSI SHAMAN MASSAGES OUT OF THE PATIENT FIVE STICKS AS THE AGENTS OF THE DISEASE AND NOT MERELY PUFFS A CIGAR, BUT BLOWS THE SMOKE ON THE PATIENT--A PREVALENT PRACTICE THROUGHOUT THE TROPICAL FORESTS--AND HIMSELF SWALLOWS THE SMOKE; AGAIN, THE TAULIPANG SHAMAN DRINKS TOBACCO JUICE TO EXPEDITE HIS SOUL TO THE SKY. VENTROLOQUISM SEEMS HIGHLY DEVELOPED BY THE TAULIPANG. A NORTHWEST BRAZILIAN SPECIALTY IS POURING CUPFULS OF AN AROMATIC INFUSION OVER THE PATIENT'S HEAD AND BODY. THE MONTANA AND NORTHWEST AMAZON DOCTOR EXTRACTS NEEDLES OR THORNS AS PATHOGENIC AGENTS.

THE NONMEDICAL DUTIES OF A SHAMAN ARE ILLUSTRATED DURING FESTIVALS WHEN HE CONSECRATES FEATHERS, DANCE RATTLES, AND CARVED SETTEES BY BLOWING SMOKE ON THEM, THEREBY CAUSING SPIRITS TO ENTER THESE OBJECTS, FROM WHERE THEY ARE EXPELLED AT THE CLOSE OF THE CEREMONY.

THE SHAMAN OFTEN SOCIALLY OVERSHADOWS THE CHIEF FOR THE SPIRIT WORLD IS MOST COMMONLY APPROACHED THROUGH HIM ONLY. FOR THIS REASON, THE SURVIVOR MUST EXERCISE SPECIAL CARE WHEN IN THE PRESENCE OF THE SHAMAN OF A TRIBE SO AS TO NOT ANTAGONIZE HIM AND PERHAPS BE IDENTIFIED WITH EVIL SPIRITUAL INFLUENCES. OCCASIONALLY, BUT RARELY AND PROBABLY ONLY IN SOME TRIBES, WOMEN PRACTICE. A SON OFTEN INHERITS HIS FATHER'S PROFESSION, BUT THIS IS BY NO MEANS A UNIVERSAL RULE. THE SHAMAN IS PRIMARILY A DOCTOR AND DETECTOR OF SORCERERS, BUT MAY ALSO ACT AS MASTER

OF CEREMONIES, COUNSELOR IN WARFARE, PROPHET, FINDER OF LOST GOODS, NAME GIVER, DEPOSITORY OF TRADITION, WEATHER MAKER, ETC. A PROSPECTIVE SHAMAN UNDERGOES A LONG PERICD OF TRAINING UNDER HIS FATHER OR TEACHER, DURING WHICH HE DIETS, IS INSTRUCTED, ACQUIRES FAMILIAR SPIRITS, AND RECEIVES IN HIS BODY VARIOUS MAGICAL SUBSTANCES OR OBJECTS REGARDED AS THE SOURCE OF HIS POWER AND, WHEN PROJECTED INTO VICTIMS, AS THE CAUSE OF DISEASE. HE IS ALSO GIVEN TOBACCO IN VARIOUS FORMS AND OTHER STIMULANTS, ESPECIALLY IN THE NORTHWEST AMAZON REGICN. IN SOME TRIBES THE SHAMAN RECEIVES HIS MAGICAL SUBSTANCE FROM A SPIRIT, IN OTHERS FROM HIS TUTOR. FOR A FEW TRIBES THE PRACTITIONER IS STATED TO CONTROL ONE OR MORE FAMILIAR SPIRITS. IN THE WESTERN AMAZON HE IS ASSOCIATED WITH THE JAGUAR.

THE MAGICAL SUBSTANCE IS USUALLY A QUARTZ CRYSTAL IN GUIANA, A "THORN" OR "ARROW" IN THE REGION OF THE WESTERN AMAZON AND UPPER XINGU. DURING HIS INITIATION THE NEOPHYTE GAINS IMMUNITY TO AND CONTROL CF THOSE BUSTANCES WHICH HE IS SUPPOSED TO TAKE INTO HIS BODY.

THE FOREMOST INSIGNIA OF THE SHAMAN--WIDESPREAD, THOUGH NOT UNIVERSAL--ARE THE GOURD RATTLE, THE CRYSTAL, A CARVED AND PAINTED BENCH, AND A DOLL WHOSE POSITION DURING TREATMENT INDICATES WHETHER A PATIENT IS TO RECOVER. THE DOLL IS REPORTED FROM PARTS OF GUIANA. THE TAULIPANG MEDICINE MAN SHAKES A BUNCH OF LEAVES INSTEAD OF THE RATTLE SO USED BY DOCTORS FROM GUIANA TO THE UAUPES RIVER. THE BENCH SEEMS MOST CHARACTERISTIC OF GUIANA. CRYSTALS TURN UP IN GUIANA, ON THE ORINOCO, AND IN THE UPPER RIO NEGRO REGION, WHERE THEY MAY HAVE BEEN IMPORTED FROM THE ORINOCO. ON THE GUAPORE RIVER THE SHAMAN'S INSIGNIA ARE A SNUFFING TUBE, A BOARD FOR MIXING SNUFF, AND A MYSTIC FEATHERED STICK. AMONG THE POWERS WIDELY CLAIMED BY SHAMANS IS THE ABILITY TO TRANSFORM THEM-

SELVES INTO JAGUARS. A CUBEO SHAMAN'S SOUL ENTERS A JAGUAR WHEN HE DIES, THUS SEPARATING ITSELF FROM OTHER PEOPLE'S SPIRITS WHICH JOIN THE CLAN ANCESTORS.

THE INDIAN ALSO HAS A CONCEPT OF A "SUPREME" BEING HAVING TO DO WITH CREATION ALTHOUGH IT IS OFTEN VAGUE. RELATIONSHIPS BETWEEN MAN, THE SKY, THE EARTH, AND SEVERAL OF THE MORE AWESOME ELEMENTS OF NATURE SUCH AS THE SUN, RAIN, THUNDER AND LIGHTNING HAVE A PERVASIVE SPIRITUAL SIGNIFICANCE AND MORE NEARLY RESEMBLES MODERN CONCEPTS OF RELIGION. SPECIAL MYTHS AND LEGENDS ARE ALMOST UNIVERSAL WITH REGULARIZED FORMS OF CEREMONY AND PRAYER EITHER TO OBTAIN BENEFITS OR TO PLACATE THE "ANGRY" GODS. THIS ASPECT OF RELIGION DOES NOT ABSORB THE INDIAN SO COMPLETELY AS THE INTIMATE SPIRITS OF HIS DAILY LIFE. HE IS FEARFUL OF STORM ACTIVITIES BUT THESE ARE FREQUENTLY BEYOND HIS RELIGIOUS "CONTROL." NIGHT HOLDS SPECIAL TERROR FOR HIM FOR THIS IS THE TIME WHEN THE SPIRITS ARE IN POSSESSION OF THE DOMAINE AND WHEN HIS DEFENSES ARE LEAST EFFECTIVE.

CONTACT WITH THE INDIANS

ALTHOUGH THE RELIGIOUS ASPECTS OF THE INDIAN LIFE HAS BEEN DEALT WITH AT SOME LENGTH, IT IS IN THIS AREA OF HIS SOCIAL BEHAVIOR THAT WE CAN BEST SEE THE SEEMINGLY IRRATIONAL AND UNPREDICTABILITY OF HIS NATURE. THESE ASSOCIATIONS AFFECT HIS ENTIRE MENTAL OUTLOOK AND DISPOSITION. IT CAN BE MORE READILY UNDERSTOOD WHEN SEEN IN THIS CONTEXT WHY SUSPICION AND HOSTILITY FREQUENTLY CHARACTERIZE THE SOCIAL CONTACT BETWEEN THE INDIAN AND ALL STRANGERS NOT JUST THE WHITE MAN.

A LARGE PART OF THE INDIANS' PSYCHOLOGY OR CODE OF WARFARE INVOLVES REVENGE. IN THIS CONNECTION THE INDIAN DOES NOT THINK IN TERMS OF INDIVIDUALS BUT ATTACHES RESPONSIBILITY TO THE GROUP OF THE INDIVIDUAL

AGAINST WHOM VENGEANCE IS SOUGHT. UNTIL COMPENSATION HAS BEEN EXACTED FROM THE GROUP THE "EVIL" WHICH WAS PERPETRATED IS STILL IN FORCE. THIS HAS SPECIAL IMPLICATION WITH REGARDS TO THE WHITE MAN-INDIAN RELATIONSHIP IN THAT THE INDIANS GENERALLY LOOK UPON ALL WHITE MEN AS BELONGING TO THE SAME "GROUP."

FREQUENTLY, REPORTS OCCUR IN VARIOUS MAGAZINES OR IN THE NEWSPAPERS REGARDING THE KILLING OF A WHITE MAN BY THE INDIANS. USUALLY, HOWEVER, KILLING OF WHITE MEN BY THE INDIAN RESULTS FROM PROLONGED PROVOCATION WHERE THE "CIVILIZED" POPULATION CONTINUE TO TREAT THE INDIAN AS A HUNTED ANIMAL, KILLING THEM, OR VIOLATING THEIR TERRITORIAL RIGHTS. TO THE INDIAN ANY WHITE MAN BECOMES AN OBJECT OF REVENGE REGARDLESS OF WHO COMMITTED THE INITIAL WRONGS.

THERE ARE SOME OPENLY HOSTILE INDIAN TRIBES SUCH AS THE MOTILONE LIVING IN THE FORESTS WEST AND SOUTHWEST OF THE LAKE MARACAIBO, THE AUCAS OF THE EASTERN SLOPES OF THE ANDES IN ECUADOR, AND PROBABLY SOME TRIBES OF THE CARIBS LIVING IN THE GUIANA HIGHLANDS IN THE VICINITY OF THE UPPER ORINOCO RIVER. THE CHAVANTE AND OTHER TRIBES OF THE UPPER XINGU ARE OFTEN CITED FOR THEIR HOSTILITY. HOWEVER, CONTINUOUS EFFORTS BEING MADE TO PACIFY THESE TRIBES ARE MEETING WITH PROGRESSIVE SUCCESS ESPECIALLY WITH THE TRIBES ON THE XINGU.

HUNDREDS OF CONTACTS ARE MADE ON A CONTINUING BASIS WITH THE INDIANS. DURING WORLD WAR II MANY TRIBES WHICH WERE ONCE REMOTE AND ISOLATED WERE CONTACTED AND UTILIZED IN THE GATHERING OF RUBBER--ALTHOUGH IN SOME INSTANCES THIS RESULTED IN UNFAVORABLE RELATIONS. FOR THE MOST PART, HOWEVER, CONTACT WITH THE INDIANS IS TO BE SOUGHT. AN EXCEPTION TO THIS IS UNDER CIRCUMSTANCES WHERE THERE IS OBVIOUS EVIDENCE OF INDIANS IN THE AREA SUCH AS NEW GARDENS, FRESH EVIDENCE OF

COOKING FIRES OR A VILLAGE SITE WHICH APPEARS TO BE INHABITED BUT NO INDIANS PRESENT THEMSELVES AND SEEM TO BE AVOIDING CONTACT. THERE IS A STRONG POSSIBILITY THAT THE INDIANS ARE EITHER HOSTILE OR SO WARY AND SUSPICIOUS THAT FORCING CONTACT MAY PROVOKE AN INCIDENT PRODUCING FATAL CONSEQUENCES.

MOST IMPORTANT ASPECTS OF BEHAVIOR IN MAKING CONTACT AND DURING THE PERIOD OF ASSOCIATION IS DISCRETION AND CIRCUMSPECTION. THE SURVIVOR MUST BE ON THE ALERT FOR CUES AS TO HIS CONDUCT. HE MUST NEVER RISK ANIMOSITY BY VIOLATING CUSTOMS AND TABOOS. GENERAL MEASURES ARE:

1. AVOIDING CONTACT WITH ANY OBVIOUSLY RELIGIOUS OBJECTS WHICH ARE USUALLY HIGHLY DECORATED OR PAINTED,
2. REFRAIN FROM CLOSE OR INTIMATE CONTACT WITH THE FEMALE MEMBERS OF THE TRIBE,
3. VERY SPECIAL CAUTION MUST BE EXERCISED IN THE PRESENCE OF PREGNANT WOMEN. IF THERE IS AN ADVENT OF CHILD BIRTH, SPECIAL CAUTION MUST BE EXERCISED IN THE PRESENCE OF THE FATHER FOR IT IS BELIEVED THAT HE IS THE POSSESSOR OR GUARDIAN OF THE CHILD'S SPIRIT AND ANY ACTIVITIES, ASSOCIATIONS OR EVENTS AFFECTING THE FATHER ALSO AFFECT THE CHILD. IF FOR SOME REASON THE CHILD BECOMES ILL OR DIES, ANY UNUSUAL OCCURRENCE MAY BE INTERPRETED AS AN EVIL INFLUENCE OR CAUSE,
4. DO NOT POINT AT ANY ONE WITH A SHARP OR POINTED STICK OR OBJECT--EVEN THE FINGER,
5. NEVER ENTER DWELLINGS UNLESS INVITED. AVOID HUTS OR DWELLINGS WHICH APPEAR TO BE OF CONCERN. THEY

MAY BE CEREMONIAL HUTS, PREGNANCY DWELLINGS SET OFF FOR CHILD BIRTH OR HUTS WHERE YOUNG GIRLS ARE ISOLATED DURING PERIODS OF MENSTRATION,

6. IF PARTICIPATING IN HUNTING ACTIVITIES, OBSERVE WHAT ANIMALS ARE OR ARE NOT KILLED (AND EATEN),
7. AVOID TOUCHING OR HANDLING THE WEAPONS OF THE INDIANS UNLESS INVITED TO DO SO,
8. DO NOT DISPLAY INORDINATE CURIOSITY OR TOUCH THE ADORNMENTS, SCARS OR OBJECTS INVOLVED IN BODILY DISFIGUREMENT,
9. DO NOT TAKE ANY FOOD FROM THE CULTIVATED PLOTS OR KILL ANY ANIMALS, BIRDS, OR FISH UNLESS INVITED TO DO SO,
10. DO NOT REFUSE PREPARED FOOD AND DRINK WHEN PROFFERED EVEN THOUGH IT MAY BE NAUSEATING TO THE SENSES--THIS MAY INVOLVE CONSIDERABLE WILL POWER OR "MIND OVER MATTER" ON THE PART OF THE SURVIVOR,
11. IN MANY AREAS, ESPECIALLY THE GUIANAS, IT IS CUSTOMARY TO MAKE MUCH NOISE WHEN APPROACHING VILLAGES SO AS TO INDICATE OPEN AND FRIENDLY INTENT AS DIFFERENT FROM AN ENEMY SNEAK RAID. IN ALL EVENTS IF CONTACT IS DESIRED, CALL FROM A DISTANCE AND GIVE INDICATION OF INTENT.

IT IS NOT FEASIBLE TO LIST ALL THE MANNERS, CUSTOMS, TABOOS, ETC. OF THE INDIAN TRIBES. FOR ONE THING, THEY ARE NOT ALL KNOWN AND EVEN WHEN IN GENERAL USE THEY HAVE SPECIFIC APPLICATION FROM TRIBE TO TRIBE. AS STATED EARLIER--THE SURVIVOR MUST EXERCISE DISCRETION AND KEEP ALERT FOR CLUES TO DETERMINE THE APPROPRIATE BEHAVIOR. DO NOT BE PROVOKED INTO

UNPREMEDITATED ACTS BY WHAT WILL FREQUENTLY SEEM BIZARRE AND STARTLING BEHAVIOR BY THE INDIANS. DO NOT INTERFERE IN THEIR SOCIAL RELATIONS EVEN WITH GOOD INTENTIONS.

BEFORE LEAVING THE FOREST INDIANS, SPECIAL MENTION SHOULD BE MADE OF THE NEGRO TRIBES MOSTLY INHABITING THE GUIANA HIGHLANDS. THESE FOREST TRIBES ARE DESCENDANTS OF THE AFRICAN SLAVES WHO WERE IMPORTED BY THE COLONIAL POWERS DURING THE 17TH, 18TH, AND 19TH CENTURIES. MANY OF THEM, MAKING THEIR ESCAPE INTO THE TROPICAL FOREST, RESUMED THE TRIBAL CUSTOMS AND HABITS OF THEIR NATIVE LAND. DURING THE PROLONGED PERIOD OF GROWTH AND DEVELOPMENT OF THESE TRIBES, THE RELATIONSHIP BETWEEN THEM AND THE COLONIAL SETTLERS HAS BEEN ONE OF TURMOIL AND HOSTILITY AT TIMES ASSUMING THE PROPORTIONS OF MILITARY CAMPAIGNS. HOWEVER, FOR THE PAST SEVERAL DECADES SINCE THE ABOLISHMENT OF SLAVERY, THE CONTACT HAS DEVELOPED INTO A LIMITED TRADE RELATIONSHIP BASED ON THE GATHERING OF FOREST PRODUCTS WHICH IS ENTIRELY PEACEFUL AND COOPERATIVE.

THE NEGROES MAINTAIN A TRIBAL, RIVERINE TYPE OF LIFE. THEIR VILLAGES LINE THE MAJOR RIVERS MAINLY IN SURINAM, SUCH AS THE RIO SURINAM. FOR THE MOST, THEY REFLECT A SOMEWHAT HIGHER DEVELOPMENT OF SOCIAL AND POLITICAL ORGANIZATION THAN THE INDIANS. THEIR RELIGION IS IN MANY WAYS SIMILAR TO THAT OF THE INDIAN BUT WITH DEITIES AND SPIRITS RELATED TO THEIR AFRICAN ANCESTRY. CUSTOMS, HABITS, AND TECHNIQUES OF AGRICULTURE, HUNTING AND FISHING ALSO REFLECT SOME ADAPTATION TO THE ENVIRONMENT FROM THAT OF AFRICAN ORIGIN. EXCEPT BY ALMOST DELIBERATE PROVOCATION ON THE PART OF THE "VISITOR," SOCIAL CONTACT IS OF A FRIENDLY AND COOPERATIVE NATURE.

CHAPTER IV

FOOD SOURCES

GENERAL

IN THE RAIN FORESTS OF SOUTH AMERICA AS ELSEWHERE PROCUREMENT OF FOOD ASSUMES MAJOR IMPORTANCE IN ANY PROLONGED SURVIVAL SITUATION AND VERY PROBABLY WILL BE THE DECIDING FACTOR FOR SUCCESS OR FAILURE. EVEN FAIRLY WELL ORGANIZED PARTIES THAT HAVE BEEN FORCED TO RELY ON COLLECTING, HUNTING, AND FISHING FOR SUSTENANCE HAVE SUFFERED SERIOUS LOSSES AND INCAPACITATION DUE TO STARVATION.

DESPITE THE FREQUENTLY MENTIONED ABUNDANCE OF WILD PLANTS AND GAME AS ACCEPTABLE OR RECOGNIZED SOURCES OF FOOD, THEIR OCCURRENCE IS IRREGULAR, SOMETIMES NON-EXISTENT, AND FREQUENTLY IMPOSSIBLE TO OBTAIN WHEN PRESENT. EVEN THE MORE PRIMITIVE INDIAN TRIBES RECOGNIZE THE IMPROVIDENCE OF RELYING SOLELY UPON THE MUNIFICENSE OF THE FOREST AND ENGAGE IN SUPPLEMENTARY AGRICULTURE. THE VAST MAJORITY OF THE INDIANS CONDUCT FULL TIME FARMING ECONOMY WITH HUNTING, FISHING, AND GATHERING AS A SUPPLEMENTAL SUBSISTENCE ACTIVITY. THESE SUBSISTENCE ACTIVITIES AS WELL AS TECHNIQUES OF FOOD PREPARATION ARE DISCUSSED AT GREATER LENGTH UNDER THE SECTION PERTAINING TO THE INDIANS.

IT MIGHT DO WELL TO CONSIDER HERE ONE ASPECT OF FOOD WITH WHICH MANY MILITARY PERSONNEL HAVE SOME AWARENESS BUT HAVE NOT

PERHAPS CONSIDERED IN TERMS OF SURVIVAL. OUR CONCERN HERE IS THE EDIBILITY OF FOOD AS DIFFERENT FROM PALATABILITY. THE CULTURALLY CONDITIONED DIETARY HABITS OF PEOPLES FREQUENTLY ARE VERY STRANGE TO OTHER PEOPLES OFTEN PROVOKING REVULSION AND NAUSEA. ONCE THE CULTURE BARRIER HAS BEEN BREACHED AN AMAZING NUMBER OF NOURISHING FOOD SOURCES BECOME AVAILABLE. THE READER CAN BE VERY CERTAIN THAT IF THE SURVIVAL SITUATION ENTAILS MORE THAN SIXTY HOURS SOME OF THESE SOURCES WILL HAVE ALREADY BEEN TRIED.

GENERALLY, ALL ORGANIC MATTER IN ONE WAY OR ANOTHER REQUIRES FOOD. IN TURN, THERE IS VERY LITTLE ORGANIC MATTER THAT CAN'T BE EATEN. DISCARDING THE PORTION OF PLANT LIFE THAT BECOME CELLULOSE AND LIGNIN, THAT IS, THE WOODY MATERIALS, AND THE FEATHERS, HAIR, NAILS, AND TEETH OF ANIMALS, NEARLY EVERYTHING ELSE IS EDIBLE. NOT EVEN THE BONE IS DISREGARDED AS A SOURCE OF NOURISHMENT. THE GLARING EXCEPTION TO THIS GENERALITY IS THE OCCURRENCE OF POISONS, ESPECIALLY POISONOUS PLANTS.

DIETS OF VARIOUS PEOPLES RANGE FROM THE STRICT VEGETARIAN TO THOSE WHOSE DIET CONSISTS WHOLLY OF MEAT; THE CLASSIC EXAMPLE OF THE LATTER BEING THE ESKIMOS. IN THE COURSE OF EVOLUTION, MAN HAS PROBABLY EATEN OR TRIED TO EAT SOME REPRESENTATIVE OF EVERY PLANT AND ANIMAL ON EARTH. A SURVEY OF THE WORLD'S DIETORY CONTENT TODAY WOULD PROBABLY REVEAL THAT HE STILL DOES.

THIS HAS BEEN A SOMEWHAT DEVIOUS INTRODUCTION TO THE SOURCES OF FOOD IN THE TROPICAL RAIN FOREST OF SOUTH AMERICA, HOWEVER, REPRESENTATIVES OF JUST ABOUT EVERY PLANT AND ANIMAL FAMILY EXIST THERE AND WITH INTELLIGENCE, APPLICATION, AND PRUDENT UTILIZATION OF THEM THE ODDS FOR SURVIVAL ARE GREATLY INCREASED. TECHNIQUES

APPLICABLE TO FISHING, HUNTING, AND BUTCHERING, AND PREPARATION OF GAME ARE UNIVERSALLY KNOWN. THIS REPORT WILL ELABORATE ONLY ON THOSE TECHNIQUES THAT ARE PECULIAR TO THE AREA UNDER DISCUSSION.

A VERY SIGNIFICANT AND NEARLY EXCLUSIVE FEATURE OF THE TROPICAL RAIN FOREST OF SOUTH AMERICA IS THE INCIDENCE OF SEVERAL ANIMALS WITH PREHENSILE TAILS. JUST AS THE PLANT LIFE OF THE PRIMARY RAIN FOREST HAS PRACTICALLY DESERTED THE FOREST FLOOR SO HAS THE VAST MAJORITY OF ITS ANIMAL LIFE. THE PRINCIPLES OF ECOLOGY PERTAINING TO THE INTERRELATIONSHIP OF ALL LIVING MATTER WITH AND WITHIN ITS ENVIRONMENT ARE NO LONGER ACADEMIC TO A MAN IN A SURVIVAL SITUATION. HE BECOMES A PARTICIPATING AND INTEGRATED COMPETITOR IN THE RAIN FOREST ENVIRONMENT DURING HIS INVOLUNTARY SOJOURN. AS QUICKLY AS HE BECOMES ASSIMILATED AS QUICKLY WILL HIS DOMINANCE OVER THE ENVIRONMENT AND ITS OTHER INHABITANTS BE ASSURED AND FROM THIS WILL HIS FOOD AND OTHER NEEDS BE DERIVED. FOR FOOD HE WILL HAVE TO GO WHERE IT IS OR DEVISE A MEANS OF BRINGING IT TO HIM.

THE RAIN FOREST CANOPY HAS ALREADY BEEN CITED AS CONTAINING AN ABUNDANT SOURCE OF PLANT AND ANIMAL LIFE. GETTING TO IT IS MORE THAN THE RATHER DIFFICULT PROCEDURE OF CLIMBING UP A TREE. FOR ONE THING, THE ORDEAL BY THE UBIQUITOUS FIRE ANT INFESTING TREE TRUNKS AND CLIMBERS IS BEYOND ENDURANCE. CUTTING TREES DOWN IS ONE METHOD OF BRINGING THE FOOD TO EARTH. BUT, BECAUSE OF THE FANTASTIC INTERLACING OF CLIMBERS AND EPIPHYTES IT MAY REQUIRE THE SEVERANCE OF SEVERAL TREES BEFORE THEY ARE SUFFICIENTLY WEAKENED TO FALL. THERE ARE METHODS OF CLIMBING THE TREES USING VINES AS CLIMBING LOOPS, AND THERE ARE TREES AND VINES FREE OF ANTS. THE CHIEF LIMITING FACTOR IN PROCURING FOOD FROM THE TREE TOPS IS FINDING IN COMBINATION THESE

CONDITIONS: AN EDIBLE PRODUCT, A PEST FREE AVENUE OF ASCENT AND A TECHNIQUE FOR ASCENDING.

A SECOND ZONE OF PLANT AND ANIMAL LIFE IS THE AREAS OF SECONDARY GROWTH WHERE THE FOREST FOR VARIOUS REASONS HAS SUFFICIENTLY THINNED TO PERMIT SUNLIGHT TO PENETRATE TO THE FLOOR. THESE STRIPS ARE FOUND WHERE THE FOREST AND CLEARINGS MERGE, ALONG THE BANKS OF THE STREAMS AND RIVERS, ON THE ASCENDING SLOPES OF THE ANDES, THE MONTANA, AND ALONG THE UPPER REACHES OF THE GUIANA HIGHLANDS. HERE IN THIS DENSE GROWTH DESCRIBED IN PRECEDING PAGES LIVES THE SEMI-ARBOREAL AND LAND-BOUND ANIMALS OF THE RAIN FOREST, EACH FAIR GAME TO THE OTHER AND EACH EXERCISING EVERY NATURAL INSTINCT FOR SURVIVAL. THIS IS THEIR NATURAL HABITAT AND IT REQUIRES REAL SKILL AND INGENUITY TO COMPETE SUCCESSFULLY. THEIR ELUSIVENESS IS THEIR BASIC DEFENSE.

THE THIRD ZONE OF IMPORTANCE IS CONFINED MAINLY TO THE VAST NETWORK OF THE AMAZON RIVER SYSTEM. HERE THE VARIETY OF ANIMAL LIFE THAT MAKES UP THE AQUATIC ZONE IS SEEMINGLY INFINITE. YET, THEY CAN BE CAPTURED ONLY BY THE USE OF APPLICABLE TECHNIQUES

INSECTS

INFESTING ALL THREE ZONES, INTERCOMMUNALLY, ARE THE INSECTS; THE INFINITE, THE UNRELENTING, AND OFTEN HIGHLY NUTRITIOUS INSECT. CONSIDERING THEIR PREVALENCE IT SEEMS APPROPRIATE TO BEGIN THE CATALOGUING OF FOOD SOURCES WITH THEM.

THE USE OF INSECTS AS HUMAN FOOD SHOULD NOT BE PARTICULARLY STRANGE CONSIDERING THAT THEY HAVE ALWAYS BEEN A HIGHLY PRIZED ITEM IN MAN'S DIET. YET, THE AVERAGE NORTH AMERICAN WILL GRIMACE WITH

REVULSION AT THE SUGGESTION THAT THEY ARE NOT ONLY EXTREMELY VALUABLE AS A SOURCE OF PROTEIN BUT IN MANY AREAS OF THE WORLD ARE CONSIDERED A DELICACY. THE SHORT SEASONAL AVAILABILITY AND THE "HARVESTING" DIFFICULTIES IN RELATION TO OTHER FOODS MAY EXPLAIN THE RELATIVE UNIMPORTANCE OF INSECTS TO THE DIET IN NORTHERN CLIMATES. IT DOES NOT, HOWEVER, EXPLAIN THE AVERSION.

IN THE TROPICAL CLIMATES AND SPECIFICALLY IN THE RAIN FOREST THE INSECTS ABOUND IN ALL SEASONS. THE PEOPLES, MOST ESPECIALLY THE PRIMITIVE PEOPLES, HAVE MUCH TOO GREAT A DEMAND ON THE RESOURCES OF NATURE TO OVERLOOK ANY SOURCE OF SUSTENANCE.

THERE ARE CERTAIN HARMFUL ASPECTS RELATED TO THE USE OF INSECTS AS FOOD THAT MUCH BE CONSIDERED. FIRST OF ALL, THERE ARE INSECTS WHICH ARE POISONOUS TO EAT AS WELL AS TO HANDLE. THE STINGING, BITING AND TOXIC INJECTIVE CAPABILITIES OF THE INSECTS ARE GENERALLY WELL KNOWN. IN ADDITION, NUMEROUS TYPES OF INSECTS EMIT EXTREMELY NOXIOUS AND MALODEROUS SECRETIONS. AMONG THE WORST OFFENDERS ARE THE BOMBARDIER BEETLE (CARABIDAE), MANY CATERPILLARS WHOSE HAIRS ARE ALSO FREQUENTLY TOXIC AND PRODUCE RASH AND IRRITATION, THE SOLDIER CLASS OF SEVERAL GENERA OF TERMITES AND THE COMMONLY KNOWN STINKBUG (PENTATOMIDAE) WHICH ARE ACTUALLY CONSIDERED DELICACIES BY MANY INDIANS. AS IN THE CASE OF POISON PLANTS, THERE ARE NO FIXED RULES FOR RECOGNIZING THE HARMFUL OR POISONOUS INSECTS. HOWEVER, AS MIGHT BE INFERRED, THESE UNPLEASANT DEVICES ARE BASICALLY DEFENSE MECHANISMS AND AMONG THEM IS THE USE OF WARNING COLORATION. THE MOST COMMON "DANGER" COLORS ARE BLACK, WHITE, YELLOW, ORANGE, AND RED PROMINENTLY DISPLAYED BY SHARPLY CONTRASTING PATTERNS. THIS DOES NOT MEAN THAT ALL INSECTS MARKED WITH BRIGHT OR CONTRASTING MARKINGS

ARE POISONOUS OR DANGEROUS BUT ENOUGH OF THEM ARE TO WARRANT CAUTION.

OF ALL THE EDIBLE INSECTS, THE ANTS ARE THE MOST REGULARLY "HARVESTED." THROUGHOUT THE RAIN FOREST AREA THE LARGE-HEADED SAUBA ANT (ATTA CEPHALOUS) BUILD THEIR HUGE HUMMOCK-LIKE NESTS TWENTY YARDS SQUARE AND ONE YARD HIGH. WHEN THEY MAKE THEIR SEASONAL EMERGENCES, THE INDIANS GATHER THEM IN HUGE QUANTITIES. THE FEMALE ABDOMEN, SWOLLEN WITH EGGS AND RICH IN FAT AND PROTEIN, IS BITTEN OFF IMMEDIATELY. THE REST OF THE SAUBAS ARE ROASTED AND EATEN LIKE PEANUTS.

THE TERMITE OF THE RAIN FOREST (TERMES FLAVICOLLE) ARE ALSO CONTINUALLY SOUGHT, PARTICULARLY IN THE UPPER AMAZON. WHEN A NEST IS FOUND, LONG STEMS OF GRASS CAN BE INSERTED INTO THE OPENING. THE WORKER CLASS WHICH ARE BITERS WILL SNAP ON TO THE STEM AND CAN BE WITHDRAWN A DOZEN OR SO AT A TIME. THE HEAD AND THORAX ARE ROASTED AS WELL AS EATEN ALIVE. THEY ARE SOMEWHAT BITTER TO THE TASTE.

THE ABDOMENS OF THE LEAF-CUTTING ANT (ATTA SEXDENS), THE HONEY-POT ANTS (MYRMECOCYSTUS) AND A LARGE WINGED ANT OF THE GUIANA ARE ALL HIGHLY NUTRITIOUS AND THE FEMALES WHEN FILLED WITH EGGS ARE PARTICULARLY GOOD TASTING IF ONE LIKES CONDENSED MILK. THE SEXUALS SWARM PERIODICALLY AND ARE CAPTURED AT THAT TIME. THE ABDOMENS ARE BOTH ROASTED AND EATEN RAW.

FOLLOWING THE ANTS IN PREVALENCE ARE THE NUMEROUS INSECTS IN THE LARVAL FORM. CATERPILLARS OF ALL SIZES AND CONSISTENCY ARE ROASTED, BOILED, EATEN RAW, AND SOMETIMES USED LIKE A BUTTER SPREAD. THE DECAYING TREES, BOTH STANDING AND FALLEN, ARE RICH WITH LARVAL WORMS AND BEETLE GRUBS WHICH ARE EATEN COOKED OR RAW.

THE HONEY BEE CONTRIBUTES BOTH ITSELF AND ITS PRODUCT TO THE SOURCES OF FOOD IN THE RAIN FOREST. HOWEVER, WITH AN ABUNDANCE OF

HONEY AVAILABLE THE FOOD SIGNIFICANCE OF THE BEE TENDS TO DIMINISH. ON THE OTHER HAND ONE MIGHT RECALL THAT CANDIED AND FRIED HONEY BEES ARE SOLD AT A VERY FANCY PRICE AT MANY OF THE MORE EXCLUSIVE PARTY AND BANQUET SUPPLIERS. THIS IS TRUE OF MANY OF THE OTHER INSECTS MENTIONED ABOVE; CHOCOLATE COVERED ANTS FOR INSTANCE. IN THE RAIN FOREST YOU HAVE NOT ONLY THE ANTS BUT THE CACAO BEAN TOO.

THE WILD STINGLESS HONEY BEE (MELPONINAE) OF THE AMAZON PRODUCES A HONEY THAT IS HIGHLY PRIZED NOT ONLY BY THE INDIAN BUT ANYONE ELSE WHO CAN GET IT. IT IS VERY THIN IN ITS NATURAL FORM AND CAN BE DRUNK OR IT CAN BE BOILED AND ALLOWED TO SET TO ATTAIN A MORE SOLID CONSISTENCY FOR EASIER PRESERVATION AND CARRYING. IN THE CONCENTRATED FORM IT WILL KEEP FOR A FAIRLY LONG TIME. IN ITS LIQUID FORM IT MAY SOUR BUT CAN BE RESTORED TO SWEETNESS BY BOILING. BEE HONEY MAY OCCASSIONALLY BE TOXIC FROM THE POISONOUS FLOWERS THAT THE BEE DRAINS SO SOME CAUTION MUST BE EXERCISED.

THE AMOUNT OF HONEY IN ANY ONE NEST MAY RANGE FROM SEVERAL PINTS TO THIRTY OR FORTY GALLONS. GAINING ACCESS TO THE HONEY ENTAILS CLIMBING, IF THE FIRE ANTS PERMIT, CHOPPING THE TREE DOWN, OR CHOPPING FIRST THAT PORTION OF THE TREE OR BRANCH HOLDING THE NEST, OR DRAINING THE HONEY FROM THE NEST WHERE IT SETS. WHILE MOST HONEY BEES ARE STINGLESS, THEY WILL SWARM AND COMPLETELY COVER THE INTRUDER'S HEAD, CRAWLING IN THE EYES, MOUTH, AND NOSTRILS. THEY DO BITE; SOME OF THEIR BITES ARE TOXIC PRODUCING A RASH-LIKE APPEARANCE THAT MAY LAST SEVERAL DAYS.

MANY OF THE INDIAN TRIBES OF THE RAIN FOREST, IN FACT IN ALL OF SOUTH AMERICA, HAVE DEVELOPED A SEMI-APICULTURE. IN SOME CASES THE DIFFERENCES BETWEEN THE NATURAL HIVES AND THE ARTIFICIAL HIVES ARE

OBVIOUS. ALSO, THE SEARCH FOR HONEY BEARING HIVES IS SO EXTENSIVE AND INTENSIVE THAT THE PRESENCE OF ONE COULD VERY WELL SIGNIFY THE PRESENCE OF INDIANS IN THE VICINITY.

THE LIST OF INSECTS OF THE RAIN FOREST IS PRACTICALLY INFINITE AND THE ABOVE LISTING FAR FROM EXHAUSTS THE FOOD POTENTIAL BUT IT SUFFICES TO OPEN THE RESERVOIR OF NUTRITION THAT IS AVAILABLE FROM THIS SOURCE. PERHAPS THE BEST EXAMPLE TO EMPHASIZE THIS SOURCE OF FOOD IS THE NUTRITIVE VALUES OF THE TERMITE. ONE HUNDRED GRAMS, APPROXIMATELY 3½ OUNCES, OF FRIED TERMITES AFFORDS 508 CALORIES OF WHICH 13% IS MOISTURE, 36.2% IS FAT AND 45.6% IS PROTEINS, THE REMAINING 5% BEING ASH. A LIKE AMOUNT OF COOKED BEEF AFFORDS 127 CALORIES CONTAINING 75.2% MOISTURE, 6.6% FAT, 16.9% PROTEINS, WITH THE REMAINING 1.3% ASH; A RATHER REMARKABLE RECOMMENDATION FOR THE TERMITES.

MAMMALS

OF THE NUMEROUS ANIMALS INHABITING THE RAIN FOREST THE PREDOMINATING LIFE FORM RUNS TO THE SMALLER SIZE EVEN AMONG THE VERTEBRATES. TO THE NORTH AMERICAN WHOSE TASTE IN WILD GAME CONSISTS MAINLY OF COTTONTAILS, SQUIRRELS, AND VENISON THE EATING OF MICE, CATS, EVEN BIG ONES; ARMADILLOS, AND MONKEYS IS SOMEWHAT LESS THAN APPETIZING. THESE AND MANY OTHER EXOTIC MEMBERS OF THE ANIMAL WORLD ARE PRIZED ITEMS IN THE DIET OF THE SOUTH AMERICAN INDIAN, NOT ONLY FOR THEIR TASTE BUT ALSO BECAUSE THEY ARE HARD TO COME BY.

VERY PROMINENT, THOUGH NOT THE MOST ABUNDANT AMONG THE FOOD SOURCES, ARE THE SEVERAL SPECIES OF MONKEY (FAMILY CEBIDAE). THE MORE COMMONLY KNOWN SPECIES ARE THE CAPUCHIN (CEBUS), THE SPIDER

MONKEY (ATELES), THE WOOLY MONKEY (LAGOTHRIX) AND THE HOWLER MONKEY WITH THE IMPROBABLE SCIENTIFIC NAME ALOUATTA. THE UNEARTHLY SOUNDS EFFECTED BY THE EXTRAORDINARY VOCAL APPARATUS OF THE HOWLER IS ANYTHING BUT BIRD-LIKE WHICH ALOUATTA IMPLIES. BEING ARBOREAL, THE CAPTURE OF A MONKEY WITHOUT SOME TYPE OF LURE OR PROJECTILE DEVICE IS MOST UNLIKELY. IT IS REPORTED THAT THE CAPUCHIN CAN BE LURED INTO A TRAP BY MIMICRY. INDIANS USE THE BOW AND ARROW AND BLOWGUN WITH POISON DART. WEIGHING FROM SIX TO TWENTY POUNDS THE MEAT OF THE MONKEY IS OF RATHER INDIFFERENT TASTE. ONE GRUESOME ASPECT IS THAT A SKINNED MONKEY HAS A RATHER CLOSE RESEMBLANCE TO A HUMAN BABY OR SMALL CHILD.

SLOTHS, ARMADILLOS, AND ANTEATERS ARE ALL EXCLUSIVELY NEW WORLD TROPICAL ANIMALS. TREE SLOTHS (FAMILY BRADYPODIDAE) ARE OF THE TWO-TOED (CHOLOYUS) AND THREE-TOED (BRADYPUS) VARIETIES RANGING IN WEIGHT FROM FOUR TO TWENTY POUNDS. THEY ARE EXTREMELY SLUGGISH AND HANG SUSPENDED WITH ALL FOUR FEET WRAPPED ABOUT A TREE BRANCH FOR HOURS. THEY SLEEP IN THIS UPSIDE DOWN POSITION OR CROUCH IN THE FORK OF A TREE. IF THEY CAN BE REACHED THEY ARE EASILY CAPTURED AND MAKE AN EXCELLENT MEAT SOURCE. USUALLY THEY REMAIN FAIRLY HIGH IN THE TREE OUT OF REACH FROM THE GROUND SO THAT THEY ARE DIFFICULT TO CAPTURE. TO COMPLICATE MATTERS THEY FREQUENT A SPECIE OF TREE CALLED EMBAUBA (CRECOPIA) FOR WHICH THE RED FIRE ANT HAS A PARTICULAR AFFINITY. THE SLOTH, TOO, IS CAPABLE OF INFLICTING A PAINFUL BITE.

THE ARMADILLOS (FAMILY DASYPODIDAE) CONSIST OF SEVERAL SPECIE DISTINGUISHED BY SUCH CHARACTERISTIC NAMES AS: NINE-BANDED (DASYPUS), SIX-BANDED (EUPHRACTUS), HAIRY (CHAETOPHRACTUS), THREE-BANDED (TOLPEUTES), AND PYGMY (CHAMYPHORUS). THEY ARE A SOURCE OF TENDER

AND DELICIOUS MEAT. WHEN THEY DO NOT HAVE A CONVENIENT HOLE TO ESCAPE INTO THEY BURROW VERY RAPIDLY THOUGH NOT DEEPLY AND CAN BE CAPTURED FAIRLY EASILY. IF THEY ARE CAUGHT WHILE PLUNGING INTO A PREPARED HOLE AND IF ONLY THE TAIL HAS BEEN GRABBED, THE HUNTER IS IN FOR A REAL TUG-OF-WAR. THEY DO HAVE TEETH OF SORTS BUT ARE NOT DANGEROUS. AS A SECONDARY USE, THE SHELL OF THE ARMADILLO MAKES AN EXCELLENT CONTAINER.

THE ANTEATERS (FAMILY MYRMECOPHAGIDAE) ARE REPRESENTED BY THREE SPECIE: THE PYGMY OR SILKY (CYCLOPES), COMMON (TAMANDUA), AND THE GIANT (MYROMECOPHAGA). THIS WIERD ANIMAL IS NOT VERY MUCH SOUGHT AFTER AS FOOD ALTHOUGH NOT COMPLETELY IGNORED. THE GIANT ANTEATER CAN BE PARTICULARLY DANGEROUS STRIKING LATERALLY WITH POWERFUL HUGE-CLAWED FOREFEET.

THE RODENTS OF THE SOUTH AMERICAN RAIN FOREST CONSIST OF A LARGE NUMBER OF FAMILIES AND HUNDREDS OF SPECIES, MOST ALL OF THEM REPRESENTING A FOOD SOURCE. THE MAJORITY OF THEM CAN BE CAPTURED BY ANY TYPE OF WEAPON OR SNARE AND EVEN BY HAND. THEIR SMALL SIZE AND AFFINITY FOR THE DENSE UNDERBRUSH MAKE THEM VERY ELUSIVE. THE MORE COMMON AMONG THE RODENTS ARE:

RABBITS AND HARES (FAMILY LEPORIDAE)

PORCUPINES (FAMILY ERETHIZONTIDAE),

NUMEROUS SPECIES, EASILY CAPTURED AND TASTY.

BRISTLE AND SPINY RATS (FAMILY ECHIMYIDAE),

SEVERAL SPECIE THROUGHOUT THE AMAZON REGION; THE BRISTLE RAT, ABOUT THE SIZE OF A COMMON HOUSE RAT HAS

EXCELLENT WHITE MEAT. INHABITS THE DENSE UNDERBRUSH AND ARE QUITE NUMEROUS.

AGOUTIS (FAMILY DASYPROCTIDAE), EXCLUSIVELY AMERICAN TROPICAL IS EXTENSIVE THROUGHOUT THE RAIN FOREST; HIGHLY DEPENDABLE ALL-SEASON SOURCE OF MEAT TO MANY SOUTH AMERICAN INDIAN TRIBES; EASILY HUNTED OR CAPTURED WITH BOW AND ARROW OR IMPROVISED SPEAR, SNARE, OR BY HAND WHEN RUN TO GROUND; WEIGHS FOUR TO TEN POUNDS, DIURNAL HABITS AND VERY TASTY.

CAPYBARA (FAMILY CAVIIDAE), LARGEST OF THE RODENTS, WEIGHT 100 TO 175 POUNDS, COMMON THROUGHOUT RAIN FOREST; AQUATIC, GREGARIOUS AND AN EXCELLENT SOURCE OF GOOD MEAT. REQUIRES STRONG BOW AND ARROW OR PIT TRAP TO CAPTURE.

PACA (FAMILY CAVIIDAE), COMMON THROUGHOUT RAIN FOREST, WEIGHS UP TO TWENTY-FIVE POUNDS, ESPECIALLY DESIRED FOR ITS WHITE TASTY FLESH; HUNTED WITH BOW AND ARROW, SPEAR OR RUN TO GROUND.

SQUIRRELS (FAMILY SCIURIDAE), NUMEROUS BUT AS ARBOREALS ARE EXTREMELY DIFFICULT TO CAPTURE.

MOST OTHER REPRESENTATIVES OF THE ORDER OF RODENTS ARE THE REGULAR RATS AND MICE SUCH AS ARE KNOWN IN NORTH AMERICA. THEY ARE NUMEROUS AND EDIBLE. THEY ARE MOSTLY FOUND IN THE DENSE MARGINAL STRIPS OF THE RIVERS AND STREAMS.

THE CARNIVOROUS ANIMALS OF THE RAIN FOREST ARE AS VARIED AS THEY ARE ELUSIVE AND INCLUDE REPRESENTATIVES OF ALL THE FAMILIES OF CARNIVORES EXCEPT THE HYENA AND THE CIVETS. ALTHOUGH THEY CERTAINLY CONSTITUTE A SOURCE OF FOOD IN A SURVIVAL SITUATION, TO THE NATIVE POPULATION THEIR USE AS FOOD IS RATHER IRREGULAR AND LOCALIZED. SOME, FOR INSTANCES; THE COATIMUNDI (A RELATIVE OF THE NORTH AMERICAN RACCOON), KINKAJOUS, OTTERS, AND EVEN PUMAS, ARE RAISED AS PETS. MANY ARE USED FOR THEIR HIDES; OTHERS ARE HUNTED FOR EXCITEMENT AND TROPHYS, ESPECIALLY THE JAGUAR AND THE PUMA. TOTEMIC OR RELIGIOUS FIGURES ARE DERIVED MAINLY FROM AMONG THESE ANIMALS PARTICULARLY THE BIG CATS.

ONE OF THE MOST IMPORTANT SOURCES OF FOOD THROUGHOUT THE AMAZON-ORINOCO RIVER SYSTEM IS THE RIVER MAMMAL CALLED THE MANATEE (TRICHECHUS INUNGUIS). THE SIZE OF THIS ANIMAL, WHICH MAY EXCEED 2000 POUNDS, TENDS TO DISCOURAGE CAPTURE EXCEPT WITH ADEQUATE EQUIPMENT. THE INDIANS USED BOTH HARPOON AND NET TO CAPTURE IT.

OF THE UNGULATES, THE TAPIR (TAPIRUS AMERICANUS) IS PROBABLY THE MORE COMMON AND EXPLOITED. WEIGHING BETWEEN 400 TO 600 POUNDS, IT REQUIRES STRONG WEAPONS OR A GOOD SIZED PIT TO CAPTURE. IT TAKES READILY TO WATER AND CAN BE CHASED BY BOAT AND SPEARED. THE MEAT IS EXCELLENT AND THE HIDE SERVES MANY PURPOSES.

TWO TYPES OF WILD PIG (FAMILY DICOTYLIDAE) CALLED PECCARIES RANGE THROUGHOUT THE RAIN FOREST. BOTH ARE EXCELLENT SOURCES OF

MEAT AND THEIR HIDE TOO CAN BE PUT TO MANY USES. THE COLLARED PECCARY (TAYASSU TAJACU) ARE HUNTED WITH BOW AND ARROW, SPEAR, AND BLOW GUN. THEY FREQUENTLY ATTEMPT TO ESCAPE BY RUNNING INTO HOLLOW LOGS OR ARMADILLO BURROWS. ALSO, THEY MAKE VERY EFFECTIVE USE OF THE DENSE UNDERBRUSH HAVING NO PROBLEMS WHATSOEVER WITH THE THORNY ENTANGLEMENT. THIS SPECIE USUALLY TRAVELS IN SMALL HERDS OF FIVE TO TEN CROSSING LAND AND WATER WITH EQUAL FACILITY. IF THE HERD REACHES A WATER OBSTACLE AT NIGHTFALL THEY WILL DISPERSE ALONG THE BANK AND WAIT UNTIL EARLY DAWN TO CROSS. THEY ARE MOST EASILY CAPTURED IN THE WATER--EITHER HAULED ONTO A RAFT, INTO A BOAT, OR DRAGGED TO SHORE BEFORE BEING KILLED. BLOOD-LETTING IN THE WATER IS CERTAIN TO ATTRACT THE PIRANHA AND IN ALL PROBABILITY THE PECCARY WILL BE LOST.

THE SECOND SPECIES, THE WHITE-LIPPED PECCARY, IS ALSO AN EXCELLENT IF SOMEWHAT DANGEROUS SOURCE OF MEAT. THEY ARE CONSIDERABLY LARGER THAN THE COLLARED PECCARY AND THEIR MUSK GLAND IS MUCH STRONGER. BOTH SPECIES CAN BE EASILY DETECTED WHEN NEAR OR EVEN AFTER HAVING PASSED THROUGH AN AREA BY THE LINGERING SMELL. THE WHITE-LIPPED PECCARY TRAVEL IN MUCH LARGER HERDS UP TO NEARLY A HUNDRED AND ARE KNOWN TO BE VERY DANGEROUS WHEN ATTACKED.

THERE ARE SEVERAL SPECIE OF SMALL DEER THROUGHOUT THE RAIN FOREST. THEY ARE MOSTLY FOUND IN THE AREAS WHERE THE MARGINAL RIVER STRIPS THIN OUT OR WHERE THE FOREST AND CLEARINGS MERGE. THEY FULLY UTILIZE THE DENSE UNDERBRUSH TO EVADE CAPTURE AND ARE HIGHLY ADEPT AT NEGOTIATING THE THORNY TANGLED GROWTH. ALTHOUGH ELUSIVE THEY ARE HUNTED WITH BOW AND ARROW, BLOWGUN WITH POISON DART, OR ARE SNARED BOTH BY PIT AND SURFACE TRAPS.

Reptiles

This class includes (1) turtles and tortoises, (2) caiman crocodillian and true crocodiles, (3) lizards, and (4) snakes. The most important of these as a source of food are the turtles and tortoises. Both the flesh and eggs are highly nutritious and very palatable. The commonest land tortoise of the Guiana-Brazilia region is the galapago (*Testudo tabulata*). It is found in unflooded areas of the rain forest. Ranging in sizes of ten to eighteen inches they weigh up to thirty pounds.

The turtle has always been a mainstay in the diet of the rain forest dwellers. Not only man but seemingly every other form of animal life exploits the spawning habits of the "socially" spawning turtle (*Podocnemis expansa*). While predation persist throughout the year, during the period of low water (September on the upper Amazon to November on the lower) the spawning season gives rise to intense gathering of turtles and eggs by all the predators of the river environment. There are numerous descriptive and fascinating accounts of the spawning processes, the complex technology developed by the Indians related to this subsistence activity, and the seriousness of the depletion of the turtle population as a result of unrestrained and improvident exploitation of the turtle during this vulnerable period.

The socially spawning turtles assemble in vast numbers in the vicinity of selected sandy beaches during the time for spawning which last approximately two weeks. During this period each female will ascend the beach one night and deposit her eggs. She digs a hole 18 to 36 inches deep in which she deposits 100 to 150 eggs. Before dawn

SHE WILL HAVE RE-ENTERED THE RIVER. AT ANY GIVEN TIME DURING THE NIGHT HUNDREDS OF THESE FEMALES COVER THE SURFACE OF THE SPAWNING GROUND. ABOUT ONE MONTH LATER THE YOUNG TURTLES HATCH AND INSTINCTIVELY HEAD FOR THE WATER AFTER EMERGING FROM THEIR HOLES. THE MASS EXODUS, STARTING DURING THE NIGHT, USUALLY FINDS A LARGE PERCENT OF THE YOUNG STILL MAKING FOR THE RIVER AS DAYLIGHT APPEARS AND WITH THE DAY APPEAR ALSO THE SCORES OF PREDATORS. DESPITE USING THE COVER OF DARKNESS, BOTH FOR DEPOSITING THE EGGS BY THE FEMALE AND THE ESCAPE TO THE RIVER BY THE YOUNG, THE TOLL IS ENORMOUS. THE "HARVESTING" PROCESSES INCLUDE CAPTURE OF THE FEMALES DURING SPAWNING, DIGGING UP THE EGGS, AND FINALLY CAPTURING THE YOUNG TURTLES WHICH MANAGED TO ESCAPE THE INITIAL HARVESTING STAGE.

WHEN NOT SPAWNING THE TURTLES ARE SCATTERED THROUGHOUT THE FLOODED POOLS, CHANNELS, AND SWAMPS OF THE FOREST TOGETHER WITH MANY OTHER SPECIES. DURING THE DRY PERIODS WHEN THE WATER HAS RECEDED, THE TURTLES CONVERGE ON THE CONCENTRATIONS OF WATER AND ARE MORE EASILY CAPTURED IN GREATER NUMBERS. THE MOST EXPEDIENT METHOD OF CAPTURING A TURTLE IS TO FLIP IT ON ITS BACK AFTER WHICH THE METHOD OF KILLING IS CIRCUMSTANTIAL. THE FLESH OF THE TURTLE IS DELICIOUS. THE EGGS ARE DIFFICULT TO LOCATE BUT THEY TOO ARE VERY PALATABLE, RAW OR COOKED. THE EGG IS COVERED BY A STRONG, RUBBERY MEMBRANE WHICH MUST BE PIERCED. BOILING THE EGGS WHILE STILL IN THE "SHELL" IS A LONG PROCESS AND THEY ARE COOKED BETTER WHEN OUT OF THE SHELL.

THE DANGEROUS ASPECTS OF THE CAIMAN AND CROCODILE AND DISCUSSED UNDER HEALTH AND HAZARDS. AS FOOD SOURCES THE TAIL, CHEEK MUSCLES, AND THE EGGS ARE THE MOST EDIBLE.

There are two species of lizard, the tejus (Tupinambis) and the more commonly known iguana (Iguana iguana) that are highly prized as food throughout the Guiana-Brazilia region. The tejus, which attains lengths of four feet, are black with yellow or white bands along the back. The body and tail are covered with small square scales arranged in rings along the entire body and tail. They are very elusive being swift runners on the ground as well as arboreal. They are most frequently found where the clearings merge with the forest. Their flesh is tender and delicious.

The iguana is also arboreal. It is a large lizard frequently up to six feet in length. The tail is long and compressed. A crest of large spines extend from the head to tail along its back. The spines are flexible and tend to flop to either side. It is green-grey in color with large black bands extending along the body and tail. They bask for hours in the sun lying extended on tree branches and at such times are most easily captured. Their meat is tender and suggestive of chicken in taste. There are no poisonous lizards in South America.

The novelty of eating rattlesnake meat has been fairly well aired whenever exotic foods are discussed. Snakes are certainly an important source of food, however, considerable caution must be exercised in any forced contact.

Fish

The rivers and streams of the Amazon Basin teems with thousands of fish specie; nearly all of them edible. Accounts dealing with the food aspects of the regional fish usually stress the type of fishing techniques which are somewhat communal in

APPLICATION. IN SO DOING THEY TEND TO IDENTIFY SUCH FOOD FISH AS THE HUGE PIRARUCU WHICH WEIGHS OVER 200 POUNDS, THE PIRAIBA OF MORE THAN A 1000 POUNDS, OR THE SCHOOLS OF MULLET. ACTUALLY IT IS NOT FEASIBLE TO LIST ALL THE EDIBLE FISH. THE EXPLOITATION OF THE RIVERS FOR FOOD IS NOT SO MUCH "WHAT" AS "HOW." EVEN THE FLESH OF THE DREADED PIRANHA IS DELICIOUS AND BECAUSE OF ITS GREED IT IS ONE OF THE EASIEST FISH TO CATCH. ONCE THEY HAVE SUNK THEIR TEETH IN A SUITABLE BAIT THEY HANG ON SO THAT EVEN A HOOK IS NOT ALWAYS NECESSARY.

THE "CONVENTIONAL" HOOK AND LINE CAN BE CONSTRUCTED AND APPLIED WITH SOME IMPROVISATION AND INGENUITY USING FIBER PLANTS, THORNS, BONE, ETC. WITH A LITTLE PRACTICE ONE CAN BECOME QUITE PROFICIENT AT SPEARING. THE SKILL REQUIRED FOR THE USE OF THE BOW AND ARROW MAY BE TOO ADVANCED FOR THE TRANSIENT SURVIVOR, STILL IT IS ANOTHER TECHNIQUE. UNDOUBTEDLY, THE MOST EFFECTIVE AND REMUNERATIVE TECHNIQUE OF ALL WHEN PROPERLY APPLIED IS THE USE OF VARIOUS TOXIC PLANTS, USED EXTENSIVELY BY THE INDIANS. THE BASIC TECHNIQUES AND A DESCRIPTION OF THE DRUG PLANTS ARE DISCUSSED AT CONSIDERABLE LENGTH UNDER SUBSISTENCE ACTIVITIES OF THE INDIANS.

BIRDS

THE TROPICS OF SOUTH AMERICA AND PARTICULARLY THE TROPICAL RAIN FOREST CONTAINS THE RICHEST AND MOST EXOTIC BIRD FAUNA IN THE WORLD. SURPRISINGLY, FEW BIRDS ARE USED PRIMARILY AS FOOD BY THE INDIANS. HOWEVER, ALL BIRDS CONSTITUTE A SOURCE OF MEAT ALTHOUGH THEY ARE DIFFICULT TO CAPTURE IN THE DENSITY OF THE FOREST CANOPY. RAIDING THE NEST FOR EGGS AND YOUNG BIRDS IS THE MOST YIELDING FOR THE EFFORT. THE BRILLIANT COLORATION OF THE BIRDS WILL AID IN LO-

CATING THEIR NESTING PLACES. THE MOST COMMONLY IDENTIFIED BIRDS ARE:

HERONS, STORKS, AND FLAMINGOS WHICH ARE CONSPICIOUS FOR THEIR LARGE SIZE, LONG BILL AND LEGS, AND OFTEN BRILLIANT PLUMAGE. ALL THREE OF THESE BIRDS ARE SEMI-AQUATIC, HAVE FLOCKING HABITS IN NESTING AND FEEDING.

DUCK AND GEESE ARE PREVALENT THROUGHOUT THE RIVER SYSTEM OF THE AMAZON. THEIR GENERAL APPEARANCE AND HABITS CONFORM CLOSELY TO THE RELATED SPECIES OF NORTH AMERICA. GROUND NESTING HABITS MAKE THEM MORE SUSCEPTIBLE TO SNARES AND THEIR NEST MORE ACCESSIBLE AS A SOURCE OF EGGS AND YOUNG.

VULTURES, BUZZARDS, HAWKS, AND FALCONS ARE FOUND THROUGHOUT THE GUIANA-BRAZILIA REGION. ONE OF THE MOST CONSPICIOUS FOR ITS SIZE AND PREDATORY HABITS IS THE MONKEY EAGLE WHICH PREYS ON NEARLY ANY ANIMAL UP TO THE SIZE OF SMALL DEER. EVEN THOUGH THE MEAT OF THIS ORDER OF BIRDS IS GENERALLY OBJECTIONABLE TO THE TASTE THE NUTRITIONAL VALUE IS NOT TO BE OVERLOOKED. CAPTURE OF THESE BIRDS ARE DIFFICULT ENTAILING ELABORATE SNARES

AND TOXIC BAITS. THE INDIANS' PROFICIENCY WITH BOW AND ARROW, BLOWGUN WITH POISON DARTS, AND EXPERIENCED TRAPPING TECHNIQUES ARE GENERALLY REQUIRED AGAINST THEM.

CURASSOWS, GUANS, AND HOATZIN (STINKING TURKEY) ARE RELATED TO THE QUAIL AND PHEASANT. THE GUANS ARE FLOCKING, GROUSE-LIKE BIRDS WHICH ARE PREVALENT THROUGHOUT THE RAIN FOREST AND ARE VERY DELICIOUS. THEY ARE SHORT-WINGED, LONG-TAILED, AND ARE EITHER BLUISH OR REDDISH IN COLORATION. THE CURASSOWS, ALSO FLOCKING BIRDS, RESEMBLE TURKEYS BOTH IN SIZE AND TASTE. THE HOATZIN OR "STINKING TURKEY" IS ONE OF THE MOST PREVALENT BIRDS OF THE INUNDATED FOREST AREAS. IT IS CONSPICIOUS FOR ITS FLOCKING HABITS AS WELL AS OTHER PECULIARITIES SUCH AS HEAVY FLOPPING MOVEMENT THROUGH THE DENSE UNDERBRUSH, ITS HISSING AND CROAKING VOCALIZATION, AND METHOD OF "HAND-OVER-FOOT" CLIMBING OF THE VINES AND CLIMBERS OF THE FOREST. THE FLESH HAS A STRONG MUSKY SMELL AND HAS A REPULSIVE TASTE BUT IT IS NEVERTHELESS EDIBLE AND NOT AS DIFFICULT TO CAPTURE AS MANY OF THE OTHER BIRDS.

OIL BIRDS OF NORTHERN GUIANA-BRAZILIA ARE EXTREMELY VALUABLE AS A SOURCE OF FOOD. THESE BIRDS NEST IN LARGE COLONIES IN CAVES WHERE THE YOUNG WHICH ARE EXCESSIVELY FAT CAN BE GATHERED IN LARGE QUANTITIES.

PARROTS, PARAKEETS, MACAWS, AND TOUCANS ARE CONSPICIOUS THROUGHOUT THE GUIANA-BRAZILIA RAIN FOREST FOR THEIR BRILLIANT PLUMAGE, FLOCKING HABITS, RAUCOUS AND MIMICKING VOCALIZING AND OTHER RIDICULOUS ANTICS. ALTHOUGH MANY ARE VERY PALATABLE, THEY ARE MOSTLY CAPTURED FOR USE AS PETS OR FOR PLUMAGE WHICH IS USED FOR ORNAMENTATION.

WILD AND CULTIVATED PLANTS

THERE IS NOT ALWAYS A CLEAR DISTINCTION BETWEEN WILD AND CULTIVATED PLANTS AS UTILIZED BY THE TROPICAL RAIN FOREST INDIAN. MANY PLANTS WHICH GROW WILD ARE CULTIVATED AND INCLUDED AS STAPLE ITEMS OF FOOD IN ORDER TO INSURE AN ADEQUATE SUPPLY. THIS IS PARTICULARLY TRUE OF THE VARIOUS PALMS WHICH ARE SO IMPORTANT TO THE SUBSISTENCE NEEDS OF THE RAIN FOREST. MANY OTHER WILD PLANTS, WHILE NOT ACTUALLY CULTIVATED, ARE EXPLOITED BY TECHNIQUES WHICH ARE REGULARIZED AND INVOLVE MUCH MORE THAN MERE RANDOM COLLECTION.

FREQUENTLY, CULTIVATED PLANTS WILL CONTINUE TO FLOURISH IN AREAS LONG SINCE ABANDONED BY THE INDIAN BECAUSE THE SOIL HAS BECOME

INFERTILE. WHILE THIS IS AN OVER-ALL PLUS FACTOR IN A SURVIVAL SITUATION, SOME OF THE PLANTS CULTIVATED BY THE INDIANS REQUIRE SPECIAL PROCESSING IN ORDER TO ELIMINATE THEIR TOXIC EFFECTS. THE OUTSTANDING EXAMPLE OF THIS IS THE WIDESPREAD USE OF THE SEVERAL SPECIES OF MANIOC, MANDIOCA (MANIHOT UTILISSIMA), A HIGHLY TOXIC TUBEROUS ROOT.

IN VIEW OF THESE CIRCUMSTANCES THE INFORMATION COVERING WILD PLANTS IS BEING CONSIDERED IN GREATER DETAIL WHILE CULTIVATED PLANTS WILL BE DISCUSSED INCIDENTALLY WITH SPECIFIC COMMENTS RESERVED FOR THOSE REQUIRING SPECIAL PROCESSING.

THE PALMS ARE ONE OF THE MOST DEPENDABLE AND USEFUL PLANTS OF THE TROPICS THROUGHOUT THE WORLD. SOUTH AMERICA IS ESPECIALLY BLESSED WITH A FAIRLY LARGE NUMBER OF PALMS FROM WHICH THE INDIANS OBTAIN HOUSING MATERIALS, CLOTHING FIBERS, FISHING LINES (FIBERS), HAMMOCKS, WOOD FOR BOWS AND ARROWS, AND MATERIALS FOR WEAVING MATS, BASKETS, WEIRS FOR FISH TRAPS TO NAME JUST A FEW ASSOCIATED PRODUCTS. MORE IMPORTANT ARE THE NUMBER OF FOOD PRODUCING PALMS. THEY FURNISH STARCH (SAGO) FOR MAKING BREAD, SAP FOR MAKING WINE AND ABOVE ALL, FRUITS, NUTS, AND A PARTICULARLY DELICIOUS VEGETABLE CALLED A "PALM CABBAGE" OR PALMITO. EVEN THE DEAD PALMS OFFER UP LARGE EDIBLE LARVAE FROM ITS DECAYING TRUNK.

THE PALMS HAVE SEVERAL TYPES OF FRUITS. FROM SEVERAL THE SHELL OF THE FRUIT IS BROKEN AND THE EDIBLE PORTION IS THE INSIDE KERNAL. THE KERNAL OF THE BABASSU, "UAGUASSU," BAGUASSU" PALM (ARBIGNYA SPECIOSA) KNOWN AS THE PINDOBA NUT WHICH IS VERY RICH IN OIL. THIS PALM IS WIDELY DISTRIBUTED THROUGHOUT THE AMAZON UPLANDS. THE BACABA PALM (OENOCARPUS BACABA AND O. DISTICUS) WHICH IS ABUNDANT THROUGHOUT

THE RAIN FOREST SUPPLIES NUTS, COOKING OIL FROM THE NUT AND AN EXCELLENT DRINK FROM THE FRUIT PULP.

OTHER NUT BEARING PALMS LISTED HERE BY THEIR GENERIC GROUPINGS ARE: ACROCOMIA, ASTROCARYUM, ATTALEA, CATOBLASTUS, COCOS, COPERNICIA, AND MAXIMILIANA. THESE, TOO, ARE WIDELY DISTRIBUTED THROUGHOUT THE GUIANA-BRAZILIA REGION.

OTHER SPECIES OF PALM FRUIT ARE EATEN FOR THE FLESHY PORTION RATHER THAN THE KERNAL SUCH AS THE BURITI, "MURITI," "MIRITI,""ACHUA" (MAURITIA VINEFERA AND M. FLEXUOSA) WHICH ARE WIDESPREAD THROUGHOUT THE RAIN FOREST. IN ADDITION TO THE FRUIT THE PITH FROM INSIDE THE TRUNK OF THE PALM IS CUT OUT AND IS PROCESSED INTO STARCH BY SOAKING THE SHREDDED PITH AND EXTRACTING THE SEDIMENT. IT IS NUTRITIVE THOUGH TASTELESS FOOD CALLED "SAGO" OR "SAGU." THE TRUNKS OF THE BURITI ARE A SOURCE OF EDIBLE BEETLE LARVAE.

SEVERAL PALM FRUITS ARE USED AS A SOURCE OF FRUIT MASH AND FRUIT DRINK. AMONG THESE ARE THE ASSAI (EUTERPE OLERACEA, E. PRECATORIA), THE MANICOL (EUTERPE EDULIS), THE LU (OENOCARPUS SPECIOSO), PATUA (O. PATUA), THE KIKERIT OR ARRAJO (MAXIMILIANA REGIA), THE AWARRA (ASTROCARYUM TUCUMOIDES) AND THE MARAJA (BACTRIS MINOR). THE FRUIT OF THESE PALMS ARE SOAKED IN WARM WATER (BOILING WOULD HARDEN RATHER THAN SOFTEN THE FRUIT SHELL) AFTER WHICH THE PULP IS SEPARATED FROM THE KERNAL AND MADE INTO A THICK, OILY, FRAGRANT DRINK OF HIGH NUTRIENT VALUE.

THE PALM CABBAGE OR PALMITO IS THE TERMINAL BUD OF THE PLANT AND RESEMBLES A MASS OF IVORY. SEVERAL PALMS ARE NOTED FOR THIS VEGETABLE WHICH CAN BE EATEN RAW, BOILED, OR ROASTED. IT HAS A NUTTY FLAVOR AND IS VERY TASTY AND NUTRITICUS.

OTHER WILD PLANT FOODS INCLUDE TUBERS (ROOTS), FRUITS, NUTS, AND GREENS. THERE IS NO DEGREE OF REGULARITY IN THE OCCURRENCE OR DISTRIBUTION OF THE HUNDREDS OF SPECIES OF PLANTS INCLUDED AMONG THESE FOOD SOURCES:

TUBERS - SOURCES OF FOOD FROM THE SPECIFIC WILD PLANTS IS PRACTICALLY UNKNOWN. THE INDIANS HAVE ALMOST UNIVERSALLY DEVELOPED THE CULTIVATION OF SUCH ROOT CROPS AS THE MANIOC (MANIHOT UTILISSIMA), SWEET POTATO (IPOMOEA BATATAS), YAM (DIOSCOREA, SEVERAL SPECIES) AND ARROWROOT (MARANTA ARUNDINACEA). MANY PLANTS, ESPECIALLY ALONG THE BANKS OF THE RIVERS HAVE LENGTHY ROOT SYSTEMS WHICH CAN BE EXPERIMENTED WITH AS FOOD SOURCES.

NUTS AND SEEDS - BESIDE THE PALM NUTS, OTHERS HAVE A HIGH NUTRITIVE VALUE AND HAVE ALSO ATTAINED CONSIDERABLE ECONOMIC VALUE. THE BRAZIL NUT (BERTHOLLETIA EXCELSA). THE NUT COMES FROM ONE OF THE MORE COMMON AND IMPRESSIVE TREES IN THE RAIN FOREST (100 TO 175 FEET HIGH) WITH A STRAIGHT BRANCHLESS BOLE. IT IS MOSTLY FOUND IN THE MORE WELL-DRAINED UPLANDS BUT IS NOT UNCOMMON TO ANY AREA. TWELVE TO TWENTY SEEDS OR NUTS ARE ENCLOSED IN THE BOWL SHAPED LIGNEOUS FRUIT OF THE TREE. THE NUT HAS A HIGH NUTRITIVE OIL CONTENT. AN INCIDENTAL ASPECT IS THE DANGER OF BEING HIT BY ONE OF THE FALLING FRUITS. SERIOUS OR EVEN FATAL

INJURY CAN OCCUR BY A DIRECT HIT. THE SAPUCHAIA OR PARADISE NUT (LECYTHIS USITATA) IS OF THE SAME FAMILY AS THE BRAZIL NUT AND QUITE SIMILAR TO IT BOTH IN DISTRIBUTION AND IN APPEARANCE. OTHER NUTS OF FOOD VALUE ARE PIQUI (ALMENDRAS DEL BRAZIL), SAWARI (CARYOCAR, SEVERAL SPECIES), COMANDA-IBA (SOPHORA TOMENTOSU), COMANDA-ASSU (AUCUNA ALTISIMA), AND JATOBA OR LOCUST TREE (HYMENAEA COURBARIL). PEANUTS (ARACHIS, SEVERAL SPECIES) ARE CULTIVATED EXTENSIVELY THROUGHOUT SOUTH AMERICA WHERE CONDITIONS PERMIT. THEY GROW WILD IN THE MARGINAL AREAS OF THE RAIN FOREST PARTICULARLY IN THE SOUTHERN PART OF THE AMAZON REGION.

FRUITS - SOME OF THE MOST WIDELY DISTRIBUTED FRUITS ARE THOSE OF THE PINEAPPLE FAMILY, ANANAS, PINA, OR BACAXI (ANANAS COSMOSUS, A. SATIVUS). THESE FRUITS ARE FOUND IN THE WILD STATE AS WELL AS CULTIVATED. THE EDIBLE PORTION IS SWEET AND JUICY. SEVERAL SPECIES OF PAPAYA, KNOWN LOCALLY BY SUCH NAMES AS "GRANDADILLA," "MARACUJO," "PASSION FRUIT," (PASSIFLORA QUADRANGULARIS, P. ALATA, P. EDULIS) ARE FOUND WILD AND CULTIVATED. THESE FRUITS HAVE PULPY FLESH AND ARE GENERALLY SWEET AND RANGE IN SIZE FROM THAT OF SMALL PLUMS TO GOOD SIZED MELONS. SEVERAL SPECIES OF MANGOS (FAMILY ANACARDIACEAE) ARE FOUND THROUGHOUT THE GUIANA-BRAZILIA REGION. THE MOST WIDELY KNOWN IS THE CULTIVATED CASHEW

(A. OCCIDENTALE). THE SMALL FRUIT OF THE WILD SPECIES ARE OFTEN COLLECTED AFTER HAVING BEEN THROWN TO THE GROUND BY MONKEYS. THE ROOT OF THE UMBU (SPONDIOS TUBEROSA) ARE EDIBLE AS WELL AS THE FRUIT. THE MAJORITY OF THESE FRUITS ARE THE SIZE OF SMALL APPLES OR PLUMS WITH YELLOWISH, SOFT, PULPY FLESH. THEY ARE JUICY AND HAVE VARYING TASTES FROM TART TO SWEET. THE GUAVA, "GUAYABA," (PSIDIUM, SEVERAL SPECIES) IS FOUND CULTIVATED AND WILD. THE FRUIT IS COMMONLY YELLOW IN COLOR WITH THE SOFT PULPY FLESH OF VARYING SHADES FROM WHITE TO PINK. IT IS SWEET AND MUSKY AND VERY AROMATIC.

THIS IS A VERY SMALL REPRESENTATIVE LISTING OF THE HUNDREDS OF EDIBLE PLANTS FOUND ALONG THE RIVER BANKS AND AMONG THE VINES AND CLIMBERS THAT ENMESH THE FOREST CANOPY AS WELL AS ON THE TREES THEMSELVES. AS PREVIOUSLY STATED THERE IS A GREAT ABUNDANCE OF SPECIES THROUGHOUT THE RAIN FOREST BUT IT IS NOT ALWAYS LIKELY THAT ANY ONE RECOGNIZEABLE FRUIT OR EDIBLE PLANT WILL BE AVAILABLE.

THE PLANTS CULTIVATED BY THE INDIANS ARE ONLY PARTIALLY KNOWN. THEY CONSIST OF: (1) THE UNMODIFIED WILD SPECIES WHICH ARE PLANTED FOR CONVENIENCE OF HARVESTING, AND FOR ASSURANCE OF THEIR OCCURRENCE BY INCREASING THE PRODUCING UNITS, PROTECTING WILD STANDS, AND BY PLANTING IN AREAS WHERE THEY DID NOT OCCUR ORIGINALLY, (2) PARTIALLY DOMESTICATED PLANTS WHERE ONLY THE MODIFIED MUTANTS OR HYBRIDS ARE GROWN AND UTILIZED, AND THE CULTIGENS WHICH ARE CULTIVATED PLANTS WHICH ARE LOST FROM THE WILD ANCESTRAL PLANTS AND ARE ENTIRELY DEPENDENT UPON CULTIVATION TO EXIST. THE PRIMARY EXAMPLES OF THE LATTER ARE MANIOC, MAIZE, AND THE

VARICUS SWEET POTATOES AND YAMS. THE MAJOR FOOD PLANTS UNDER CULTIVATION ARE:

MAIZE (ZEA MAYS) - A STAPLE THROUGHOUT THE RAIN FOREST AREA CONSISTING OF NUMEROUS VARIETIES.

BEANS (PHASEOLUS) - A LARGE FAMILY OF LEGUMES INCLUDING PEANUT (ARACHIS HYPOGAEA), KIDNEY BEAN (PHASEOLUS VULGARIS), LIMA BEAN (P. LUNATUS), AND JACK BEAN (CANAVALIA ENSIFORMIS), COMMON THROUGHOUT THE GUIANA-AMAZON REGION.

TUBERS (MANIOC, SWEET POTATOES, YAMS) - THESE HAVE BEEN DISCUSSED AT LENGTH.

FRUITS AND NUTS - IN ADDITION TO THE PALMS AND FRUITS PREVIOUSLY MENTIONED ARE: THE BANANA PLANT (MUSACEAE). THESE ARE USUALLY DIVIDED INTO TWO SUBDIVISIONS: THE PLANTAIN (L. PARADISIACA NORMALIS) WHICH IS NEARLY ALWAYS PICKED IN THE GREEN STATE AND COOKED IN VARIOUS WAYS; AND THE BANANA (M. PARADISIACA SAPIENTUM) WHICH IS THE FRUIT MOST FAMILIAR TO NORTH AMERICANS AND EATEN RAW--ALTHOUGH IT ALSO IS EXCELLENT WHEN COOKED WHILE STILL GREEN.

AVOCADO (PERSEA AMERICANA) - FOUND MOSTLY IN THE GUIANAS AND EASTERN PERU.

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CHAPTER V

HEALTH AND HAZARDS

Tropical Diseases

Presumably every member of our armed forces enjoys good health at all times except when officially undergoing medical treatment. Presumably, too, he will have maintained his shot record up-to-date as well as having taken the shots indicated for specific geographical areas. Most particularly he will have shots for cholera, small pox, yellow fiver, typhoid, typhus, and tetanus. Being thus fortified we can examine the gruesome aspects of tropical diseases with the certain reassurance of having countered the threat of many of the more sericus diseases associated with the tropics.

It may be of further assurance to note that a great number of the diseases and affections frequently designated as "tropical" are not confined to tropical regions and the preventative measures, particularly good hygiene, practiced in other climates are just as effective in the tropics. The conventional habit of listing as tropical such affections resulting from heat, helminths, funguses, bacteria, and virus as well as bites from venomous reptiles and insects, malnutrition and psychological disturbances are based upon prevalence rather than endemism. Prevalence of diseases in tropical areas results from a number of factors not the least of which are those of the cultural rather than physical environment. The vast

MAJORITY OF THE POPULATION IS POVERTY STRICKEN AND UNEDUCATED; TWO UNIVERSAL CONDITIONS CONDUCIVE TO THE PERPETUATION OF DISEASE. FOR ONE, THE DIET OF THE PEOPLE IS USUALLY DEFICIENT IN NUTRITIVE REQUIREMENTS WHICH IN TURN RENDERS THEM LESS RESISTANT TO THE ONSLAUGHT OF ANY DISEASE; AND SECONDLY, EFFECTIVE HYGIENIC PRACTICES REQUIRES CONTINUAL PUBLIC EDUCATION. AS A LOOK THROUGH ANY OF THE COPIOUSLY ILLUSTRATED MANNUALS ON TROPICAL DISEASES WILL REVEAL, MANY OF THE RATHER NAUSEATING EXAMPLES ARE OF THE POORER CLASS. THROUGH IGNORANCE, SUPERSTITION, OR UNFORTUNATE LACK OF MEDICAL FACILITIES AND PERSONNEL, THE DISEASES ARE SPREAD AND REACH EXTREME DEVELOPMENT.

IT IS SOMEWHAT IN THE NATURE OF THE TROPICS TO BE PROLIFIC IN ALL FORMS OF LIFE, PARTICULARLY LIFE FORMS WHICH HAVE NO FORMIDABLE COMPETITION. UNFORTUNATELY, THE VAST MAJORITY OF THE DISEASES ARE ORGANIC IN ORIGIN. BACTERIA AND VIRUSES ENTER THE ENVIRONMENTAL SPHERE OF COMPETITION AS PARASITES WITH A FANTASTIC POTENTIAL FOR TTAINING SUPERIORITY. UNFORTUNATELY, TOO, THE VECTORS FOR MANY OF IESE ORGANIC DISEASES ARE THE INSECTS AND THE HELMINTHS WHICH ARE PREVALENT IN THE TROPICS. AUTHORITIES CONTEND THAT THE MAIN ORT OF ANY EFFECTIVE PROGRAM TO ELIMINATE DISEASE FROM AMONG PICAL INHABITANTS WOULD INVOLVE EFFECTIVE ANTI-PARASITIC AND ANTI-INTHIC CONTROL MEASURES.

GIVEN THIS SITUATION THEN, THE BASIC HEALTH PROBLEM OF THE IDUAL IN AREAS REMOTE FROM HUMAN HABITATION INVOLVES:

1. SUBSISTENCE ACTIVITIES TO SUSTAIN PHYSICAL ENDURANCE AND MENTAL EQUILIBRIUM,
2. APPROPRIATE ADAPTATION TO CLIMATIC STRESSES

THROUGH MECHANICAL MEANS AND INTAKE OF ADEQUATE LIQUIDS,

3. PRECAUTIONARY TACTICS DESIGNED TO REDUCE THE THREAT OF PHYSICAL IMPAIRMENT FROM NATURAL ENVIRONMENTAL HAZARDS,

4. PRECAUTIONARY TACTICS DESIGNED TO EITHER OBTAIN ASSISTANCE OR REDUCE THE THREAT OF INJURY OR DEATH FROM INDIANS OF UNKNOWN ATTITUDE,

5. PREVENTATIVE FIELD HYGIENE TO REDUCE THE THREAT OF PHYSICAL IMPAIRMENT FROM INFECTION,

6. ORIENTATION TO THE PSYCHOLOGICAL STRESSES INHERENT IN THE OVERALL SURVIVAL SITUATION.

STARVATION

MANUALS DEALING WITH TROPICAL DISEASES DEVOTE CONSIDERABLE PACE TO THE DIETARY DEFICIENCES. AS A RESULT MANY OF THE DISORDERS MALNUTRITION ARE ERRONEOUSLY EQUATED WITH TROPICAL CLIMATES. ALSO, E MATERIAL PRESENTED IS MOSTLY CLINICAL IN NATURE AND RELATES TO ONIC MALNUTRITION.

FOR OUR PURPOSES THE TERM "STARVATION" HAS A MORE SPECIFIC OTATION EXPRESSING THE FUNDAMENTAL BIOLOGICAL AND PSYCHOLOGICAL S AND IMPAIRMENT. WHILE MALNUTRITION WILL UNDOUBTEDLY OCCUR INTLY, THE IMMEDIATE PHYSICAL DEBILITY AND IRRATIONAL BEHAVIOR IATED WITH STARVATION ARE THE MORE SERIOUS AFFECTS OF THE MO- THERE ARE A NUMBER OF INTERRELATED PSYCHO-PHYSOLOGICAL FACTORS VED IN STARVATION THAT MAKE IT DIFFICULT IN CERTAIN ASPECTS TO

DISTINGUISH THE PURELY PHYSICAL FROM THE PSYCHOLOGICAL. IN DES-
CRIBING THE PROGRESSIVE EFFECTS OF STARVATION, THE READER CAN
APPRECIATE THIS LACK OF CLEAR DISTINCTION. THE CONDITIONS OF STRESS
INHERENT IN STARVATION ARE FURTHER COMPLICATED AND MAGNIFIED BY THE
URGENCY AND THREAT INHERENT IN THE SURVIVAL SITUATION.

THE FIRST NOTICEABLE EFFECTS RESULTING FROM THE LACK OF FOOD
ARE KNOWN AS HUNGER PANGS. COMMENCING WITH A GENERAL FEELING OF
RESTLESSNESS, THE INDIVIDUAL PROGRESSIVELY EXPERIENCES TENSENESS IN
THE ABDOMINAL REGION GIVING WAY FINALLY TO GNAWING AND ACHING SEN-
SATIONS ACCOMPANIED BY SPASMOTIC, OFTEN PAINFUL, CONTRACTIONS IN THE
EPIGASTRIC AREA. IN COMPLETE STARVATION, THESE HUNGER PANGS SUBSIDE.
IN PARTIAL OR SEMI-STARVATION, THE HUNGER PANGS ARE PERSISTENT. THE
EMOTIONAL STRESS ACCOMPANYING HUNGER PANGS MAY BE SUCH AS TO BLUNT
THE ALERTNESS OF THE INDIVIDUAL AND IN HIS ANXIETY TO OBTAIN FOOD
MAKE HIM OBLIVIOUS TO THE PHYSICAL DANGERS OF THE ENVIRONMENT.

AS THE SHORTAGE OF FOOD CONTINUES, THE PHYSICAL EFFECTS BECOME
ORE PRONOUNCED; LOSS OF STRENGTH AND ENDURANCE, DIZZINESS, AND LACK
TACTILE COORDINATION. DEPRESSION SETS IN ACCOMPANIED BY IRRI-
BILITY, NERVOUSNESS, AND A DEGREE OF APATHY WHICH TENDS TO MAKE THE
IVIDUAL MORE EASILY DISCOURAGED IN THE FACE OF DISAPPOINTMENT OR
URE. PROGRESSIVELY, THE STARVING INDIVIDUAL BECOMES SUBJECT TO
STINAL MALFUNCTION EXHIBITED BY DIARRHEA AND DYSENTARY, ABDOMINAL
S AND BLOATING, AND THE FORMATION OF GASES.

EXCEPT IN THE MORE ADVANCED STAGES THE SENSES ARE THE LEAST
TED BY STARVATION. A CERTAIN DEGREE OF NIGHT BLINDNESS MAY
AND THERE IS AN INCREASED SENSITIVITY TO COOL TEMPERATURES
N GENERAL THE SENSES FUNCTION NORMALLY OR MAY EVEN BECOME MORE

ACUTE, ESPECIALLY HEARING. WHILE INTELLIGENCE IS NOT EFFECTED, MENTAL BEHAVIOR IS. CONCENTRATION BECOMES INCREASINGLY MORE DIFFICULT, LAPSES OF MEMORY BECOMES MORE FREQUENT AND OF LONGER DURATION AND RESPONSES TO VARIOUS STIMULI BECOMES SLOWER AND INEFFECTIVE. IN CONCERT, THESE CONDITIONS LEAD TO CONFUSION AND ABERRANT BEHAVIOR. SIGNIFICANTLY, THE INSTINCT FOR SURVIVAL IS SUCH THAT EVEN WHEN THE HUNGER PANGS CEASE AND THE OBSESSION FOR FOOD IS NO LONGER COMPELLING, MAN WILL CONTINUE HIS QUEST FOR FOOD. TIME AND AGAIN THIS FACT IS BORNE OUT IN THE ACCOUNTS OF MEN EXPOSED TO SURVIVAL EXPERIENCES IN CONNECTION WITH SHIP AND PLANE WRECKS, EXPEDITIONS, AND EXPLORATIONS IN THE ARTICS AND TROPICS. THE TENACITY WITH WHICH MAN HOLDS ON TO LIFE EXHIBITED BY THE ORDEALS, ESPECIALLY STARVATION, OF MEN AND WOMEN EXPOSED TO CRUELTIES OF PRISONER OF WAR CAMPS AND THE MORE NOTORIOUS NAZI CONCENTRATION CAMPS ARE ALMOST BEYOND BELIEF.

HEAT AND THIRST

THE "HOT HOUSE" ATMOSPHERE OF THE TROPICAL RAIN FOREST REFERRED TO UNDER CLIMATE CAN SERIOUSLY IMPAIR THE PHYSICAL WELL-BEING OF THE INDIVIDUAL. FORTUNATELY, PREVENTATIVE MEASURES TO AVERT ANY INJURIOUS EFFECTS ARE WELL WITHIN THE CAPABILITIES OF THE INDIVIDUAL.

THE NATURE OF THE POTENTIAL DANGER INVOLVES THE METABOLIC PROCESSES OF NORMAL HEAT PRODUCTION. BODY TEMPERATURE OF 98.6° IS MAINTAINED BY BALANCING THE LOSS OR GAIN OF BODY HEAT. THE MAIN SOURCES OF BODY HEAT ARE PHYSICAL EXERCISE AND AIR TEMPERATURE HIGHER THAN BODY TEMPERATURE.

ONE OF THE MORE IMPORTANT METHODS OF HEAT CONTROL ENTAILS LOSS OF EXCESSIVE BODY HEAT THROUGH EVAPORATION, THIS IS PARTICULARLY TRUE WHEN AIR TEMPERATURES AND BODY TEMPERATURES ARE NEARLY EQUAL. WHERE

THE AIR IS DRY AND MOVING THE BODY SWEAT TENDS TO EVAPORATE QUICKLY, HOWEVER, UNDER EXTREME HUMID CONDITIONS AS ARE FOUND IN THE RAIN FOREST THE SWEAT CLINGS TO THE BODY AND ONE IS SOON LITERALLY DRIPPING WITH IT. PHYSICAL LABOR, LIKE HACKING ONE'S WAY THROUGH THE UNDERBRUSH, GENERATES EXCESSIVE HEAT AND INDUCES PROFUSE SWEATING. IN ITSELF THIS SWEATING IS DESIREABLE AND ITS COOLING EFFECT SHOULD BE MAXIMIZED BY ALLOWING THE AIR TO CIRCULATE AS FREELY AS POSSIBLE OVER THE SURFACES OF THE BODY. THE NATIVES OF THE FOREST WITH UNASSUMING PRACTICALITY RECOGNIZE THE CONDITIONS BY WEARING LITTLE OR NO CLOTHING. FOR VARIOUS REASONS, NOT THE LEAST OF WHICH IS THE PRESENCE OF THE INFINITE INSECT, THE SURVIVOR IS NOT ADVISED TO SHED HIS CLOTHING. HOWEVER, COMMENSURATE WITH PROTECTIVE NEEDS AGAINST THE FLORA AND FAUNA, CLOTHING SHOULD BE AS LIGHT WEIGHT AS POSSIBLE WITH ALL VENTS OPENED TO PERMIT THE GREATER AMOUNT OF AIR FLOW.

UNDER CONDITIONS CONDUCIVE TO INTENSE SWEATING THE BODY MAY LOSE IN EXCESS OF TWO QUARTS OF FLUID PER HOUR. OBVIOUSLY THIS LOSS MUST BE REPLACED IF THE HEAT CONTROL MECHANISM OF THE BODY IS TO REMAIN FUNCTIONAL.

A SECONDARY AFFECT OF EXCESSIVE SWEATING IS THE DEPLETION OF SALT IN THE BODY. USUALLY THE BODY ADJUSTS TO THIS SALT DEPLETION BY REDUCING THE AMOUNT OF SALT IN THE SWEAT BUT A PERIOD OF ACCLIMATIZATION IS NECESSARY. SOMETIMES THIS ADJUSTMENT IS ALMOST IMMEDIATE.

PHYSICAL DEFICIENCES ASSOCIATED WITH MALFUNCTION OF THE BODY TEMPERATURE CONTROL ARE RECOGNIZED AS THREE DISTINCT CONDITIONS. FIRST IS HEAT CRAMPS WHICH IS CAUSED BY RAPID AND EXCESSIVE SALT LOSS. MUSCULAR CRAMPS OF THE ARMS AND LEGS GRADUALLY INCREASES IN INTENSITY AND EXTENDS TO THE OTHER PARTS OF THE BODY, PARTICULARLY THE ABDOMEN.

REMEDIAL ACTION ENTAILS IMMEDIATE INTAKE OF SALT AND WATER.

A SECOND SYMPTOM OF HEAT CONTROL DEFICIENCY IS CALLED HEAT EXHAUSTION AND IS CAUSED BY POOR CIRCULATION FROM PROLONGED EXPOSURE TO HIGH TEMPERATURES. THIS IS MORE A PROBLEM OF THE DRY DESERT ENVIRONMENT RATHER THAN THE HUMID FORESTS.

THE THIRD AND MOST SIGNIFICANT TYPE OF DEFICIENCY IS CALLED HEAT STROKE. HERE THE FAILURE OF THE HEAT CONTROL MECHANISM IS USUALLY CAUSED BY PROLONGED EXERTION AND SWEATING IN A HOT, AIRLESS, HUMID ENVIRONMENT. THE FIRST INDICATION OF HEAT STROKE MAY BE (THOUGH NOT ALWAYS) THE CESSATION OF SWEATING. SUBSEQUENT REACTIONS ARE VOMITING, MUSCULAR SPASMS, RESPIRATORY AND CARDIAC DISTRESS, RAPID RISE IN TEMPERATURE, DELIRIUM AND FAINTING. REDUCTION OF HIGH TEMPERATURES BY WATER INTAKE, AND "SPONGING" THE BODY WITH WATER IS THE MOST IMMEDIATELY EFFECTIVE TREATMENT.

IN THE RAIN FOREST WATER IS AVAILABLE FROM NUMEROUS SOURCES AND ITS ACQUISITION DOES NOT CONSTITUTE A SERIOUS PROBLEM. HOWEVER, WATER NEEDS MAY EXCEED THIRST. THIS FREQUENTLY HAPPENS WHEN THE INDIVIDUAL IS ENGAGED IN A FORM OF LABOR REQUIRING CONCENTRATION. WATER SHOULD BE REPLACED REGULARLY; IDEALLY HOUR BY HOUR. POSTPONEMENT OF WATER REPLENISHMENT CAN CAUSE DIZZINESS AND EVEN FAINTING BEFORE THE INDIVIDUAL IS AWARE OF THE CONDITION. IT CAN ALSO RESULT IN MILDLY ABERRANT BEHAVIOR. UNDER SECURE ENVIRONMENTAL CONDITIONS SUCH AN EXPERIENCE WOULD NOT BE PARTICULARLY SERIOUS. IN THE UNFAMILIAR ENVIRONMENT OF THE RAIN FOREST IT COULD BE FATAL.

SNAKES

BEFORE DESCRIBING THE CHARACTERISTICS OF THE DANGEROUS SNAKES OF THE TROPICAL RAIN FOREST IT SEEMS ADVISEABLE TO REVIEW SOME GENERAL

INFORMATION AND PREVENTATIVE MEASURES APPLICABLE TO ALL SNAKES.

CLINICAL INVESTIGATION AND REPORTS FROM COMPETENT FIELD OBSERVERS EASILY BELIE MOST OF THE FICTION SURROUNDING THE SNAKE WORLD. SOME OF THE MORE PERTINENT FACTS WHICH HAVE BEEN DEVELOPED ARE:

1. THE OVERWHELMING MAJORITY OF THE SNAKE WORLD IS MADE UP OF NON-POISONOUS SPECIES.
2. SNAKES ARE NOT AGGRESSIVE. THIS IS PARTICULARLY TRUE OF SNAKES IN THE WESTERN HEMESPHERE. SNAKE BITE INVARIABLY OCCURS THROUGH INADVERTENCY OR AGGRESSION ON THE PART OF MAN RATHER THAN THE SNAKE.
3. THE RELATIVELY SLOW SPEED OF LOCOMOTION OF A THREE MILE PER HOUR MAXIMUM UNDER THE MOST FAVORABLE CONDITIONS. IN CONNECTION WITH LOCOMOTION, SNAKES CAN CRAWL, CLIMB, AND SWIM ONLY.
4. VENOM IS EXUDED BY THE SNAKES ONLY THROUGH THEIR FANGS ADAPTED TO THAT PURPOSE. THERE ARE NO SNAKES IN THE WESTERN HEMISPHERE CAPABLE OF PROJECTING VENOM THROUGH SPACE SUCH AS THE OLD WORLD "SPITTING" COBRAS; NOR IS THE TONGUE OR A "STINGER" INVOLVED IN THE PROJECTION OF THE TOXIN.

5. SNAKES DO NOT HAVE MYSTIC HYPNOTIC CAPABILITIES, AT LEAST INSOFAR AS HUMANS ARE CONCERNED. PERSONS MAY BECOME TRANSFIXED FROM THE POWERFUL FEAR BUILT UP IN THEIR OWN MIND. IF SO, LACK OF MOVEMENT MAY PROVE TO BE THE UNINTENTIONAL MEANS OF SAVING THEIR LIFE.

6. THE ODDS ARE SEVERAL TO ONE IN FAVOR OF RECOVERY FROM POISONOUS SNAKE BITE EVEN WHEN CLINICAL TREATMENT IS UNAVAILABLE. FREQUENTLY FATALITIES OCCUR NOT FROM THE TOXIC EFFECTS ALONE BUT RATHER THE COMBINED EFFECTS OF THE TOXINS AND THE GREAT FEAR WHICH INDUCES SHOCK AND HELPLESSNESS IN THE VICTIM.

PERTAINING TO PREVENTATIVE MEASURES THE ONE OVERRIDING RULE CAN BE CITED IN ONE WORD: "AVOIDANCE." DESPITE THE OPTIMISTIC VIEWS EXPRESSED BY TRAINED OBSERVERS AND THE WISHFUL EXPRESSIONS OF SOME WRITERS THAT MANKIND ADOPT A MORE BENEVOLENT ATTITUDE TOWARD THIS ALLEGEDLY MUCH MALIGNED CREATURE, PROSPECTS FOR SURVIVAL IN THE FIELD ADVISE COMPLETE AVOIDANCE EXCEPT WHERE THE MAN IS THE AGGRESSOR AND HE HAS COMPLETE CONTROL OF THE SITUATION. SUCH A SITUATION MAY ARISE BECAUSE OF THE NEED FOR FOOD OF WHICH SNAKES ARE AN EXCELLENT SOURCE. FORTUNATELY, AVOIDANCE CONSTITUTES THE MAJOR ASPECT OF THE SNAKE'S SURVIVAL TECHNIQUES. IT IS THIS CHARACTERISTIC WHICH IS SO FREQUENTLY

CITED AS A REASON FOR THE RELATIVELY RARE SIGHTING OF SNAKES IN THE RAIN FOREST. ON THE OTHER HAND, IT IS THE SNAKE THAT YOU DO NOT SEE THAT BITES YOU. CONSIDER THE MOST LIKELY PLACES IN WHICH A SNAKE CAN HIDE; UNDER LOGS, ROCKS, BRUSH PILES; IN HOLES ANIMAL BURROWS; IN HOLLOW TREES OR RESTING AMONG BRANCHES AND CLIMBERS; UNDER OVERHANGING RIVER BANKS, IN HOLES IN THE RIVER BED, ON AND UNDER LOGS LYING SUBMERGED OR PARTIALLY SUBMERGED ALONG THE RIVER BANKS--THESE ARE A FEW EXAMPLES OF POSSIBLE HIDING PLACES. THE INDIVIDUAL MUST BE CONSTANTLY ALERT TO THESE SOURCES OF DANGER. THE USE OF A FORKED OR CURVED STICK OF APPROPRIATE LENGTH IS MOST USEFUL IN HOLDING BACK OR PUSHING ASIDE BRANCHES AND FOLIAGE WHILE MAKING PENETRATION OF DENSE UNDERBRUSH. THIS TECHNIQUE IS EFFECTIVELY USED IN CONJUNCTION WITH A MACHETE OR OTHER CUTTING INSTRUMENT. NOT ONLY SNAKES ARE KEPT AT A DISTANCE BUT BITING AND STINGING INSECTS WHICH INFEST THE PLANT LIFE ARE ALSO WARDED OFF. AVOID TRAVELING BY NIGHT IF POSSIBLE. CAREFULLY INSPECT THE AREA IN WHICH A NIGHT STOP IS BEING MADE WHILE THERE IS STILL SUFFICIENT DAYLIGHT. WHEN FURTHER MOVEMENT IS NECESSARY AFTER DARK, EVEN AROUND THE IMMEDIATE CAMPSITE, USE A TORCH OR FLASHLIGHT TO CHECK THE GROUND. LIKE SO MANY OF THE RAIN FOREST DENIZEN, THE SNAKE IS A NIGHT HUNTER. THIS IS ONE OF THE SEVERAL GOOD REASONS FOR CONTRIVING AN OFF-THE-GROUND SLEEPING ARRANGEMENT--SUCH AS HAMMOCKS.

GENERALLY, SNAKES DO NOT STALK THEIR FOOD BUT INSTEAD LIE IN WAITING ALONG THE GAME TRAIL FOR PREY. JUDGING EITHER BY SMELL, HEARING, OR HEAT RADIATION, IT DETERMINES THE SIZE, FOOD PROSPECTS, AND POTENTIAL FOR SUCCESS. WITH REGARDS TO SIZE OF FOOD SOURCES, ONE OF THE REMARKABLE FACTS ABOUT SNAKES IS THEIR ABILITY TO SWALLOW

RELATIVELY LARGE OBJECTS. THROUGH AN INGENIOUS SYSTEM OF LOOSELY CONNECTED BONES OF THE JAWS, AN ELASTIC SKIN AND FORMATION OF TEETH, THE SNAKE LITERALLY PULLS ITSELF AROUND THE OBJECT OF PREY IN A WALKING-LIKE MOVEMENT IN THE MANNER OF PULLING A PILLOW CASE OVER A PILLOW. THEY SUBSIST FOR A CONSIDERABLE PERIOD ON ONE MEAL IF IT IS OF GOOD SIZE. SNAKE BITE COULD RESULT FROM THE LETHARGIC STATE OF THE GORGED REPTILE. LYING IN A STATE OF STUPOR, UNABLE TO CRAWL AWAY FROM AN APPROACHING AND USUALLY UNWARY VICTIM, THE SNAKES STRIKE DEFENSIVELY. WEAR FOOT GEAR AT ALL TIMES; BOOTS IF AVAILABLE. TROUSER LEGS ARE BEST LEFT HANGING OR TUCKED INTO TOP OF BOOTS IF WORN AND ALLOWED TO BAG ESPECIALLY WHEN TRAVELING IN DENSE UNDER-BRUSH WHICH MAY CONCEAL SNAKES AND ARE SURE TO BE INFESTED WITH NUMEROUS INSECTS.

THE POISONOUS SNAKES OF THE RAIN FOREST ARE RARELY ENCOUNTERED. THE BUSHMASTER (LACHESIS MUTA), A SILENT RELATIVE OF THE NORTH AMERICAN RATTLER, IS PROBABLY THE MOST FEARED OF THE POISONOUS SNAKES. IT IS THE LARGEST OF THE PIT VIPERS RANGING UP TO TWELVE FEET IN LENGTH. IT INJECTS A VENOM WHICH IS BOTH HEMATOXIC AND NEUROTOXIC IN CONSIDERABLE QUANTITY WHICH MAKES IT ESPECIALLY DANGEROUS. THE BUSHMASTER IS KNOWN BY SEVERAL NAMES IN SOUTH AMERICA, THE MORE COMMON BEING SURUCUCU, VEKA, AND MAPEPIRE. THE IDENTIFYING CHARACTERISTICS ARE: SLITTED CAT-LIKE EYES, A DARK BROWN OR BLACK STREAK SLANTING FROM THE EYE TO THE HINGE OF THE MOUTH, DEEP PITS HALF-WAY BETWEEN THE NOSTRIL AND EYES, A HALF INCH BONY PLATE EXTENDING OVER EACH EYE, EXTREMELY ROUGH SCALATION SOMEWHAT RESEMBLING A PINEAPPLE, AND A LONG THIN SPINY TAIL. THE GROUND COLOR OF THE BODY IS TAN OR ORANGE-YELLOW WITH DARK PATCHES

ON THE BACK NARROWING TOWARD THE UNDERBELLY. THE FANGS OF THE BUSHMASTER ARE CURVED AND FUNCTION IN MUCH THE SAME WAY AS A HYPODERMIC NEEDLE. THEY MAY REACH TWO INCHES IN LENGTH.

IT IS ESTIMATED THAT APPROXIMATELY TWO WEEKS ARE REQUIRED TO RESTORE THE FULL QUANTITY OF A BUSHMASTER'S VENOM ONCE IT HAS BEEN COMPLETELY EXPENDED. THUS WHEN SNAKE BITE DOES OCCUR IT MAY BE POSSIBLE TO DETERMINE THE POTENCY OF THE VENOM BY EXAMINING THE CONTENTS OF THE SNAKE'S STOMACH FOR SIZE AND RECENCY OF INGESTION.

PERHAPS MORE DANGEROUS THOUGH OF LESSER REPUTATION IS ANOTHER PIT VIPER, THE FER-DE-LANCE (BOTHROPS ATROX). KNOWN LOCALLY BY SEVERAL NAMES, THE MORE POPULAR ARE JARARACA AND BARBA AMARILLA. THIS UBIQUITOUS MEMBER OF THE VIPER FAMILY IS AT HOME IN THE FOREST, SAVANNA, AND EVEN IN AREAS UNDER CULTIVATION AND HAS PROBABLY BITTEN MORE PEOPLE IN SOUTH AMERICA THAN ALL OTHER POISONOUS SNAKES TOGETHER. THE DART SHAPED HEAD SET ON A SLENDER NECK GIVES IT THE APPEARANCE OF A LANCE FROM WHICH IT DERIVES ITS NAME. IT AVERAGES ABOUT FIVE TO SIX FEET IN LENGTH BUT MAY RANGE UP TO NINE FEET. IT HAS A GROUND COLOR OF BROWN TO DARK OLIVE. THE PATTERN OF LEMON-YELLOW XS ALONG THE BACK CONTRAST SHARPLY WITH DARK COLORED TRIANGULAR PATTERNS ALONG THE SIDES. THE LEMON-YELLOW SCALES AT THE THROAT GIVE RISE TO THE NAME BARBA AMARILLO.

ONE ASPECT WHICH INCREASES THE DANGER OF THE FER-DE-LANCE IS THAT THE SNAKE IS CAPABLE OF INFLICTING A HIGHLY CONCENTRATED TOXIC POISON IMMEDIATELY AFTER HATCHING. IT IS UNLIKELY THAT A MORE LETHAL NATURAL ENVIRONMENT COULD BE FOUND THAN THE IMMEDIATE VICINITY OF FIFTY TO SEVENTY-FIVE BABY FER-DE-LANCES, WHICH IS THE AVERAGE LITTER, HIGHLY EXCITEABLE, STRIKING AT ANY DISTURBANCE. THE YOUNG CLIMB ALONG

THE LOW-HANGING VINES AND BRUSH LOOKING FOR INSECTS AND SMALL LIZARDS. THIS EXPLAINS WHY THE HIGH PERCENTAGE OF BITES (OVER 40%) OCCUR ON THE HANDS AND ARMS.

LIKE THE BUSHMASTER, THE FER-DE-LANCE GORGES ITSELF TO THE POINT OF IMMOBILITY AND THUS STRIKES DEFENSIVELY AT ANY THREAT TO ITS SAFETY. UNDER NORMAL CONDITIONS IT WILL EVADE A MAN BUT WHEN CORNERED OR COME UPON UNEXPECTEDLY IT IS HIGHLY DANGEROUS.

RELATED TO THE FER-DE-LANCE BUT NOT AS FRE UENTLY ENCOUNTERED IS THE POISONOUS TREE VIPER OR HORNED VIPER AS IT IS SOMETIMES CALLED. IT HAS BONY SCALES WHICH CURVE UPWARDS OVER EACH EYE AND SMALLER "HORNS" STICKING UP ON EACH SIDE OF ITS SNOUT GIVING THE HEART SHAPED HEAD A PARTICULARLY VICIOUS, SPINY APPEARANCE. THIS VIPER IS A SLENDER BODIED SNAKE ABOUT TWO FEET IN LENGTH WITH A STUBBY PREHENSILE TAIL, AN ASPECT OF ITS ARBOREAL PURSUITS. IT IS OF TWO COMBINATIONS OF COLORS, ONE A YELLOW-GREEN WITH BLACK SPECKS AND THE OTHER GREEN WITH BLOTCHES OF DARK OLIVE OR BLACK, PINK, OR ORANGE. SPECIES OF THE TREE VIPERS ARE FOUND AT ELEVATIONS UP TO 6000 FEET IN THE MONTANA.

THE CORAL SNAKE (SEVERAL SPECIES OF THE GENUS MICRURUS) IS RELATED TO THE COBRA OF THE OLD WORLD. ITS VENOM IS AS HIGHLY POISONOUS AS THE VIPERS DESCRIBED ABOVE. HOWEVER, THERE ARE SEVERAL CHARACTERISTICS PECULIAR TO THE CORAL WHICH MAKES IT A LESSER THREAT THAN THE OTHERS. FOR ONE, THE FANGS OF THE CORAL ARE SHORT AND PITCHED BACKWARDS SO THAT EVEN CLOTH EFFECTIVELY PREVENTS PENETRATION. BESIDES HAVING A RELATIVELY "PEACEFUL" DISPOSITION THEY TEND TO BURROW UNDERGROUND OR BENEATH OBJECTS THUS ARE LESS APT TO BE ENCOUNTERED. THE CORAL SNAKE HAS A CYLINDRICALLY SHAPED BODY ABOUT EIGHTEEN TO THIRTY-SIX INCHES IN LENGTH WITH A SMALL STUB-SNOUTED HEAD. THE BODY IS

COLORED BY ALTERNATING BANDS OF RED AND BLACK SEPARATED BY BANDS OF YELLOW AND WHITE. THE RED BANDS ARE ABOUT THREE TIMES THE WIDTH OF THE BLACK BANDS.

FREQUENT REFERENCE IS MADE TO THE HARMLESS "FALSE" CORALS WHICH HAVE A SIMILAR PATTERN OF COLORED BANDS; THE MAIN DIFFERENCE BEING IN THE ORDER OF THE BANDS. UNLESS ONE IS THOROUGHLY VERSED IN THE SKILL OF IDENTIFYING SNAKES, THE BEST RULE IN THE TROPICAL RAIN FOREST IS TO AVOID ALL SNAKES IF POSSIBLE. IF FOOD REQUIREMENTS MAKE CAPTURE OF SNAKES A NECESSITY, USE THE UTMOST CAUTION EVEN WHEN THEY ARE DEAD. A REFLEX ACTION OR THE ACCIDENTAL MIXTURE OF THE VARIOUS TOXIC POISONS WITH THE BODY FLUIDS THROUGH CONTACT WITH SORES, CUTS, ETC. CAN PRODUCE HARMFUL AND PERHAPS FATAL EFFECTS.

HAVING DISCUSSED THE POISONOUS SNAKES, IT WOULD BE A DISSERVICE TO BOTH THE READER AND THE REPTILE IF THE MOST FABULOUS OF THE SOUTH AMERICAN SNAKES WERE NOT INCLUDED, NAMELY; THE ANACONDA OR WATER BOA (EUNECTES MURINUS). IT CAN BE ASSERTED WITHOUT FEAR OF CONTRADICTION THAT THE ANACONDA, COMMONLY CALLED "SUCURI" IN SOUTH AMERICA, IS THE LARGEST OF THE NEW WORLD SNAKES. FROM THERE ON, REFERENCES AS TO ITS SIZE AND DANGER TO MAN ARE IN THE COMPANY OF THE "FISH STORIES." IT PROBABLY AVERAGES LESS THAN TWENTY FEET IN LENGTH AND ALTHOUGH BRAZILIAN AUTHORITIES ACKNOWLEDGE A RECORD THIRTY-SEVEN AND ONE-HALF FEET, SIGHTINGS OF OVER TWENTY FEET ARE RARE. THE SECOND-HAND REPORTS OF SIGHTINGS OF SIXTY TO NINETY FOOT MONSTERS ARE TOO INCREDIBLE. A VERY SIGNIFICANT ASPECT OF THEIR DIMENSIONS IS THEIR UNUSUALLY LARGE GIRTH SOMETIMES IN EXCESS OF THREE FEET. THEY ALSO ATTAIN WEIGHTS OF UP TO 300 POUNDS. SUCH DIMENSIONS SHOULD IN THEMSELVES PROVOKE CAUTION. AS TO THEIR DISPOSITION, AGAIN, THE

SECOND-HAND REPORTS REGARDING THEIR ATTACKS ON HUMANS BECOME SOMEWHAT DISTORTED IN THE TELLING. THE ANACONDA IS ALWAYS FOUND IN CLOSE ASSOCIATION WITH ALL THE MAJOR RIVER SYSTEMS EAST OF THE ANDES. IT FREQUENTLY INSINUATES ITSELF AMONG THE LOW HANGING BRANCHES OF THE TREES ALONG THE RIVER ENGAGING ANY SUITABLE PREY WHICH MAY BE ANYTHING FROM A SMALL RODENT UP TO A SMALL DEER OR CAPYBARA. THERE IS NO DOUBT THAT THEY CAN KILL A FULL-GROWN MAN BY CRUSHING OR DROWNING BUT THERE IS LITTLE SUBSTANTIATION TO THE REPORTS THAT THEY DO.

THE SNAKES DISCUSSED ARE THE MORE "NOTORIOUS" OF THOSE INHABITING THE RAIN FOREST AREAS OF SOUTH AMERICA. THERE ARE NO KNOWN SPECIES OF POISONOUS WATERSNAKES SUCH AS THE WATER MOCCASIN OF NORTH AMERICA. HOWEVER, ALL SNAKES CAN SWIM TO SOME DEGREE AND DURING PERIODS OF FLOOD MANY LAND SNAKES MAY BE FOUND IN THE WATER IN TRANSIT TO DRY LAND. IT IS VERY PROBABLE THAT THERE ARE OTHER SPECIES WHICH HAVE NOT BEEN REPORTED OR EVEN DISCOVERED. UNDER THE CIRCUMSTANCES THE ADVICE ADVANCED AT THE BEGINNING OF THIS SECTION IS REITERATED: AVOID UNNECESSARY CONTACT WITH ALL SNAKES.

ARTHROPODS: INSECTS AND ARACHNIDS

PREVIOUS REFERENCE HAS BEEN MADE TO THE FOOD POTENTIAL OF INSECTS AND CRUSTACEANS, WHICH ALSO BELONG TO THIS LARGEST OF PHYLUMS. IN THIS SECTION, ONLY THE TWO CLASSES LISTED ABOVE ARE BEING EXPLORED PRIMARILY IN RELATION TO THEIR CAPACITY AS VECTORS OF DISEASE AND MISERY.

CITING FIGURES IN RELATION TO SPECIES AND POPULATION OF THE INSECT WORLD IS SOMEWHAT LIKE QUOTING STATISTICS RELATING TO ASTRONOMY WHICH DEALS IN MILLIONS AND TRILLIONS OF LIGHT YEARS AND AN

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EQUALLY INCOMPREHENSIBLE NUMBER OF ASTRAL BODIES. IT HELPS LITTLE TO STATE THAT COMPARATIVELY FEW OF THE SPECIES ARE DIRECTLY INVOLVED IN THE ILL HEALTH OF MAN. IT TAKES ONLY ONE ANOPHELES MOSQUITO TO START AN EPIDEMIC OF MALARIA. NOR DOES IT TAKE MANY OF THE EXTREMELY PAINFUL STINGS OF THE TINY RED FIRE ANTS, HORMIGA DE FUEGOS, TO DETERMINE THE LIMITS OF ONE'S ENDURANCE FOR PHYSICAL PAIN. IN TERMS OF LETHALNESS, THE INSECT HAS MOST CERTAINLY TAKEN HIS TOLL OF LIVES THROUGH THE TRANSMISSION OF DISEASES. BUT, TO THE INDIVIDUAL INVOLVED IN A SURVIVAL SITUATION THE INSECT IS CHIEFLY A MISERY-DEALING, PATIENCE-TRYING, INFERNAL PEST.

DIPTERA (MOSQUITOS, FLIES, ETC.) THIS ORDER OF TWO-WINGED INSECTS IS BY FAR THE MOST NOTORIOUS IN PRACTICALLY ALL ASPECTS OF DEALING MISERY. ON TOP OF THE LIST IN TERMS OF NOTORIETY ARE THE SEVERAL SPECIES OF ANOPHELES MOSQUITO WHICH TRANSMITS MALARIA, AND THE AEDES AEGYPTI WHICH TRANSMITS YELLOW FEVER. OF THE OTHER MOSQUITO-BORNE DISEASES, THE SEVERAL FORMS OF FILARIASIS IS THE ONLY ONE THAT RANKS COMPARATIVELY IN PREVALENCE WITH MALARIA AND YELLOW FEVER. ASIDE FROM VECTORING DISEASES, THE CAPACITIES OF ALL MOSQUITOS FOR INFLICTING SUFFERING STEMS FROM THEIR UBIQUITOUSNESS, SWARMING HABITS AND UNERRING INSTINCT FOR HOMING IN ON VULNERABLE TARGETS.

CAPABLE OF INFLECTING GREATER TORMENT AT THE MOMENT BUT LESS FREQUENTLY ENCOUNTERED ARE THE VARIOUS SPECIE OF PHLEBOTOMUS FLY. OF THE DISEASES TRANSMITTED BY THE PHLEBOTOMUS FLY, THE TWO MOST NOTORIOUS ARE CARRION'S DISEASE (OROYA FEVER) AND THE SEVERAL FORMS OF LEISHMANIASIS. THE VECTORS OF THE LATTER DISEASES ARE SMALL SAND FLIES COMMON THROUGHOUT THE RAIN FOREST AREA.

THE EXPRESSIVE POTENTIAL OF THE ERSTWHILE MULESKINNER'S INVEC-

TIVE WOULD BE OF CONSIDERABLE ADVANTAGE IN DESCRIBING THE CHARACTERISTICS OF THE NUMEROUS TINY FLIES KNOWN VARIOUSLY AS "GNATS," "MIDGES," "PIUMS," "BORACHUDAS," "MERIHUIS," ETC. UNDER THEIR SCIENTIFIC CLASSIFICATIONS THEY FALL MOSTLY WITHIN THE GENERAL CHIRONOMIDAE, CERATOPOGONIDAE, AND SIMULIDAE. THESE FLIES USUALLY APPEAR IN DENSE SWARMS ALONG THE STREAMS, PARTICULARLY IN THE FOOTHILLS OF THE HIGHLANDS SURROUNDING THE AMAZON-ORINOCO BASINS. THEY ARE EXCEEDINGLY VORACIOUS AND THEIR TOXIC BITES RENDERS LIFE PRACTICALLY UNENDURABLE IN INFESTED AREAS. A MOST SERIOUS ASPECT OF THEIR BITING IS THE INABILITY OF THE VICTIM TO CONCENTRATE ON THE TASK AT HAND. FREQUENT REFERENCES ARE MADE TO THE DISASTEROUS OR NEARLY DISASTEROUS CONSEQUENCES OF THESE DISTRACTIONS.

AMONG THE MORE PAINFUL BITERS OF THE FLIES ARE THE HORSEFLIES, "MUTUCAS" OR "TABANOS," WHICH ARE THE LARGE AND EXTREMELY VICIOUS BLOOD SUCKERS. THEY OCCUR THROUGHOUT SOUTH AMERICA.

PROBABLY THE MOST LOATHSOME OF THE FLIES IS THE HUMAN BOTFLY KNOWN SCIENTIFICALLY AS DERMATOBIA HOMINIS. THE BOTFLY DEPOSITS ITS EGGS ON THE ABDOMEN OF A FEMALE MOSQUITO CAUGHT IN FLIGHT. AFTER A FEW DAYS OF DEVELOPMENT TO THE LARVAL STAGE THE LARVA IS DEPOSITED ON THE SKIN OF SOME UNWARY VICTIM SERVING AS A SOURCE OF FOOD FOR THE MOSQUITO. THE LARVA THUS DEPOSITED PENETRATES THE SKIN, USUALLY THROUGH A HAIR FOLLICLE AND BEGINS ITS LIFE-STAGE AS AN ENDOPARASITE. THE INCIPIENT STAGES OF THE INFECTION IS A SMALL BUMP ON THE SKIN WHICH SOON FESTERS INTO A BOIL-LIKE SORE. INSIDE THE SORE THE LARVA HAS DEVELOPED INTO A CARROT SHAPED WORM WITH SHARP BLACK SPINES AT THE LARGER END--THE BETTER TO TORMENT YOU WITH--WHICH PROBABLY ASSISTS THE LARVA IN RETAINING ITS "SQUATTERS RIGHTS." OF THE

SEVERAL METHODS SUGGESTED FOR ELIMINATING THIS PARASITE THE MOST EFFICACIOUS CONSISTS OF SMOTHERING BY APPLYING TAPE OR GUM (FROM ONE OF THE MANY TREES AVAILABLE) OVER THE BREATHER HOLE IN THE SKIN AND SQUEEZING OUT THE DEAD LARVA; USUALLY ABOUT TWENTY-FOUR HOURS ARE SUFFICIENT TO KILL THE LARVA.

ARACHNIDS (SPIDERS AND SCORPIONS) OF THE ARACHNIDS THE MOST INJURIOUS, BUT RARELY DEADLY, ARE THE SPIDERS COMMONLY CALLED TARANTULA (*AVICULARUDAE*), THE NOTORIOUS BLACK WIDOW (*LACTRODECTUS MACTANS*), AND THE SCORPIONS. THE TARANTULA IS CAPABLE OF PRODUCING MILD AND TEMPORARY SYSTEMIC DISCOMFORT BUT IT IS MORE FEROCIOUS LOOKING WITH ITS LARGE THICK FRIZZY BODY THAN IT IS HARMFUL.

THE BLACK WIDOW SPIDER CAN BE MORE SERIOUS ESPECIALLY IF THE VICTIM IS IN AN ALREADY WEAKENED CONDITION. THE VENOM OF THE BLACK WIDOW PRODUCES SYSTEMIC DISORDERS, ACUTE ABDOMINAL CRAMPS, AND HEART AND RESPIRATORY IRREGULARITIES. FEVER AND CHILLS AND MARKED PAIN IN VARIOUS PARTS OF THE BODY MAY OCCUR. THE SYMPTOMATIC CONDITIONS OCCUR ABOUT THIRTY MINUTES AFTER THE BITE.

AS IN THE CASE OF THE BLACK WIDOW, SCORPION BITES ARE DANGEROUS ONLY TO THE VERY YOUNG OR THE VERY WEAK (EXCEPTING INDIVIDUAL IDIOSYNCROCIES). THE SCORPIONS OF THE RAIN FOREST AREA ARE PARTICULARLY VICIOUS LOOKING ATTAINING SIZES UP TO SEVEN AND EIGHT INCHES IN LENGTH. THE VENOM OF THE SCORPION IS INJECTED BY MEANS OF A STINGER LOCATED IN THE LAST SEGMENT OF THE SPINE CURVED VENTRALLY SO THAT THE STINGER POINTS FORWARD. ALTHOUGH PAINFUL THE VENOM IS RARELY FATAL. THE POISON EFFECTS BEGIN WITH BURNING PAINS FOLLOWED BY NAUSEA AND VOMITING, PROFUSE SWEATING, RAPID BREATHING AND PULSE, AND MUSCULAR SPASMS.

HYMENOPTERA (BEES, WASPS, AND ANTS) BEES, "ABILHAS," "ABEJAS," ETC. ARE DISCUSSED UNDER FOOD SOURCES. LITTLE DIFFERENCE IS NOTED BETWEEN THOSE OF NORTH AND SOUTH AMERICA INSOFAR AS THEY ARE CAPABLE OF DOING HARM.

THE VENOM OF THE BEE CONTAINS BOTH FORMIC ACID AS WELL AS A NEUROTOXIN (PERHAPS RELATED TO THE VENOM OF THE RATTLESNAKE). USUALLY THE EFFECTS OF A BEE STING IS LOCAL, HOWEVER, SOME INDIVIDUALS REACT STRONGLY SHOWING SYMPTOMS OF FEVER, DIZZINESS, PAINFUL BREATHING, AND RASH. WHEN THE BEE STINGS THE STINGER IS USUALLY LEFT IN THE WOUND AND THE VENOM CONTINUES TO EJECT THROUGH THE MUSCULAR ACTION.

WASPS HAVE AMONG THE SOUTH AMERICAN SPECIES SEVERAL THAT ARE LARGE AND DANGEROUS. THEY ARE KNOWN REGIONALLY BY SEVERAL NAMES, SUCH AS "MARIMBONDOS," "VESPIDEOS," AND"AVISPAS." THE STINGING APPARATUS OF THE WASP IS USUALLY LEFT IN THE WOUND. THE STINGER SHOULD BE REMOVED IMMEDIATELY BY A KNIFE, NEEDLE, OR SHARP THORN OR ELSE THE VENOM OF THE WASP WILL CONTINUE TO PUMP INTO THE BODY FROM THE POISON RESERVOIR. A PERSON SUBJECTED TO MANY WASP STINGS MAY DEVELOP SYSTEMIC SHOCK. DEATH CAN OCCUR FROM EITHER RESPIRATORY OR CARDIAC INJURY OR MORE LIFELY BOTH TOGETHER.

ANTS OF THE RAIN FOREST NUMBER SCORES OF SPECIES, AND OFTEN THE COLONIES ARE NUMEROUS AND EACH CONTAINS THOUSANDS OF INDIVIDUALS. A FEW SPECIES CAN STING WITH A VIOLENTLY POISONOUS EFFECT, AND CAN BE VERITABLE SCOURGES AND CAUSE THE ABANDOMENT OF HUMAN HABITATIONS.

THE "TUCANDEIROS," OR "HORMIGA CONGAS" (PARAPONERA, GRANDIPONERA), ARE CONSPICUOUS BY THEIR HUGE SIZE (THREE-QUARTERS OF AN INCH), BLACK COLOR, AND HIGHLY VIRULENT POISON. THEY ARE GREATLY RESPECTED AND FEARED AND PROBABLY ARE USED AS AGENTS IN ENDURANCE

TESTS AT INITIATION RITES. FORTUNATELY, THE INDIVIDUALS ARE SEMI-SOLITARY AND THE COLONIES ARE SMALL.

FIRE ANTS, "FORMIGAS DO FOGO," "HORMIGAS DE FUEGO" (WASMANNIA, PSEUDOMYRMA, ETC.), ARE SMALL, REDDISH ANTS WITH A TERRIFIC STING. SOME SPECIES FORM COLONIES IN TREES, SOME IN THE GROUND, AND ONE SPECIES ACTUALLY CAUSED THE ABANDOMENT OF THE VILLAGE OF ALVEIROS ON THE TAPAJOS RIVER NEAR THE AMAZON, BRAZIL. PROBABLY, NATIVE VILLAGES SUFFER IN A SIMILAR WAY. FIRE ANTS ARE ALSO UTILIZED AS TORTURE AGENTS IN INITIATION CEREMONIES. THE TOXICITY OF THE VENOM FROM THE ABDOMINAL STING IS SO GREAT THAT EVEN THE MINUTE QUANTITY INJECTED BY A SINGLE INDIVIDUAL CAN PRODUCE POWERFUL ILL EFFECTS.

ARMY ANTS (ECITON) OF THE RAIN FOREST ARE SMALL, COLONIAL, NOMADIC, AND OF SIMILAR POISONOUS POTENTIALITY AND USE AS FIRE ANTS, BUT ARE MORE IMPRESSIVE IN THEIR SOCIAL ORGANIZATION. THEIR NOMADISM CAUSES HORDES TO MOVE THROUGH THE JUNGLE IN MILITARY FASHION CAUSING EVERY LIVING ORGANISM, INCLUDING MAN, TO MOVE FROM THE LINE OF MARCH.

THE FAMOUS LEAF-CUTTER ANTS, "SAUVA" (ATTA), ARE FOUND THROUGHOUT GUIANA-BRAZILIA, CENTRAL AMERICA, AND THE ANTILLES, WHERE THEY DAMAGE AND SOMETIMES DEVASTATE PLANTATIONS. THERE IS PROBABLY NO CULTIVATED PLANT, EXCEPT SOME WITH MILKY SAP, AS MANDIOC, PAPAIA, LONCHOCARPUS, ETC., THAT THEY WILL NOT ATTACK. THE VEGETATION THAT IS CUT AND CARRIED TO THE NEST IS NOT EATEN, BUT IS USED AS A CULTURE MEDIUM FOR A FUNGUS WHICH FORMS THE FOOD OF THE ANT. THE ATTA ANTS ARE STINGLESS, LARGE, COLONIAL, AND THEIR HUGE UNDERGROUND NESTS IN THE WOODS ARE EASILY IDENTIFIED BY THE FRESHLY

EXCAVATED EARTH AND ELEVATED PROFILE, SURROUNDING DEFOLIATION, AND THE GREAT NUMBERS OF CONVERGENT, SMALL, CLEAN TRAILS. THE SOLDIER CASTE OF THE FAMOUS LEAF-CUTTER ANT, COMMONLY CALLED "SAUVA," OR "SAUBA" (ATTA), IS LARGE WITH HUGE, OPPOSING, SICKLE-SHAPED MANDIBLES WHICH ARE USED BY CERTAIN INDIAN TRIBES TO CLOSE WOUNDS. THE ANT TENACIOUSLY HANGS ON AFTER BITING THROUGH BOTH SIDES OF AN APPRESSED INCISION, THE HEAD IS SEVERED, LEAVING IT AND THE CLOSED MANDIBLES ATTACHED AS A SUTURE. THE ATTA IS PRIMARILY AN AGRICULTURAL SCOURGE.

FISH

OF THE GREAT NUMBER OF FISH WHICH INHABIT THE GREAT RIVERS AND THOUSANDS OF STREAMS OF THE RAIN FOREST, ONLY THE STING RAY INJECTS A POISON INTO THE WOUND IT MAKES. THE FRESH WATER STING RAY, "ARAIAS," "RAYOS," OF THE AMAZON AND ORINOCO HAVE A ROUND BODY WITH A WHIP-LIKE TAIL TWELVE TO SIXTEEN INCHES LONG. THE UPPER SIDE OF THE TAIL IS ARMED WITH A BARBED SPINE CONNECTED TO A POISON APPARATUS. A FURTHER COMPLICATION MAY OCCUR FROM THE INOCULATION OF TETANUS BACILLI (WHICH IS NOT A PROBLEM IF TETANUS SHOTS ARE UP-TO-DATE).

STING RAYS FREQUENTLY FEED IN SHALLOW WATER, PARTICULARLY AROUND SUNDOWN. THEY LIE CONCEALED IN THE SAND OR MUD AND THUS BECOME A MENACE TO A WADING PERSON. FOR THIS REASON, WHERE THERE IS ANY REASON TO SUSPECT THE PRESENCE OF THE RAYS, OR EVEN IF NOT SUSPECTED, IT IS BEST TO SLIDE ONE'S FEET ONE AFTER THE OTHER. USUALLY THE STING RAY WILL MOVE AWAY FROM APPROACHING OBJECTS BUT IF IT DECENDS UNSUSPECTINGLY UPON IT, THE RAY WILL INSTINCTIVELY USE ITS BARBED TAIL AS A MEANS OF DEFENSE.

WHILE STING RAYS ARE A CONTINUING SOURCE OF CONCERN NEITHER

IT NOR ANY OTHER FRESH WATER FISH (AND POSSIBLY SALT WATER FISH) CAN MATCH THE LETHAL POTENTIAL, REAL OR FANCIED, OF THE NOTORIOUS PIRANHAS. KNOWN REGIONALLY ALSO AS "CARIBS" AND "PIRAI," IT OCCURS THROUGHOUT THE DRAINAGE SYSTEMS OF THE AMAZON, THE ORINOCO, AND THE PARAGUAY. THE TALES OF THEIR FEROCITY BORDERS ON THE APOCRYPHAL. IT IS NOT POSSIBLE TO ARRIVE AT ANY FIGURE EVEN APPROXIMATING THE HUMAN FATALITIES ATTRIBUTABLE TO THESE RIVER FURIES.

THERE IS NO DOUBT THAT ATTACKING PIRANHAS CAN REDUCE A MAN OR LARGE ANIMAL TO A SKELETON IN A FEW HOURS. NOR IS THERE ANY DOUBT OF THE SINGLE MINDED FEROCITY OF THEIR BEHAVIOR WHEN AROUSES RENDERING THEM COMPLETELY OBLIVOUS TO COUNTERACTION DESTRUCTIVE TO THE FISH ITSELF. WHERE OPINIONS TEND TO VARY LIES IN THE UNPREDICTABILITY OF THE FISH WITH REGARDS TO ITS RANGING HABITS AND CONDITIONS PROVOKING ATTACK. THERE IS CONCENSUS THAT PRESENCE OF BLOOD AND OPEN WOUNDS OR SORES IS AN INVITATION TO THE FEAST. THERE IS A DECIDED PREFERENCE FOR CLEAR WATER STREAMS RATHER THAN MUDDY OR STAGNANT WATERS. INSTANCES HAVE BEEN REPORTED WHERE INDIVIDUALS HAVE BEEN ATTACKED WITHOUT THE USUALLY ACCEPTED PROVOCATION (BLOOD SCENT) IN AREAS WHERE SUPPOSEDLY NO PIRANHAS WERE PRESENT. FOR THE MOST PART, HOWEVER, INHABITANTS OF THE REGION TREAT THE ENTIRE SITUATION QUITE CASUALLY.

THE ELECTRIC EEL, "PURAQUE," OR "TEMBLADOR" (ELECTROPHORUS ELECTRIOUS), OF THE AMAZON AND ORINOCO DRAINAGES, IS LARGE (UP TO 9 FEET; AVERAGE 3 TO 5 FEET), AND IS CAPABLE OF EMITTING RAPIDLY PULSATING ELECTRIC SHOCKS UP TO 500 VOLTS (AVERAGE 300) LASTING ONLY 2/1000 SECOND, AT FREQUENCIES OF 400 PER SECOND, AND WITH AN AVERAGE WATTAGE OF 40. THIS DISCHARGE CAN UPSET A HORSE OR RENDER UN-

CONSCIOUS A MAN IN THE WATER, AND THE EEL IS GREATLY FEARED BY SWIMMERS, BATHERS, AND WADING FISHERMAN. THE EEL APPARENTLY BREEDS IN SHALLOW CLEAR WATER ON INUNDATED LANDS IN THE RAINY SEASON. THE ELECTRIC ORGANS LIE IN THE POSTERIOR THREE-FIFTHS OF THE BODY, AND ARE ANALOGOUS TO A STORAGE BATTERY, THE CURRENT PASSING FROM HEAD TO TAIL. THE EYES ARE APPARENTLY USELESS BECAUSE OF CATARACTS, WHICH MAY BE THE RESULT OF A FISH'S OWN ELECTRIC DISCHARGES OR OF THOSE OF ITS NEIGHBORS. THE EEL HUNTS BY UNDERWATER "RADAR," WHICH IS EFFECTED BY SHORT IMPULSES OF ABOUT FIFTY VOLTS AT FREQUENCIES OF FIFTY PER SECOND; THESE REBOUND FROM THE PREY AND ARE RECEIVED BY A SERIES OF SPECIALIZED PITS ON THE HEAD.

THE CATFISH OF THE AMAZON-ORINOCO DRAINAGE SYSTEM ARE REPRESENTED BY AN, AS YET, UNCOUNTED NUMBER OF SPECIES. TWO OF THE MORE NOTORIOUS ARE CONSPICIOUS FOR THEIR SIZE EXHIBITING AS IT WERE THE LARGE AND THE SMALL OF THE CATFISH FAMILY. THE LARGEST, THE PIRAIBA, HAS PROBABLY BEEN UNJUSTLY ACCUSED BECAUSE OF ITS ENORMITY, RANGING UP TO THIRTEEN AND FOURTEEN FEET IN LENGTH AND WEIGHING WELL OVER 1000 POUNDS. SUPPOSEDLY, THIS HUGE FISH SURGES UP FROM THE BOTTOM OF THE AMAZON WHERE IT LURKS AWAITING SOME HAPLESS SWIMMER WHOM IT IMMEDIATELY SWALLOWS WHOLE. WHILE THIS IS POSSIBLE IF THE PERSON WERE SMALL (IT HAS A LARGE ENOUGH MOUTH) THE ACCOUNTS OF SUCH OCCURRENCES ARE QUITE DUBIOUS.

CROCODILLIANS: CAIMAN AND CROCODILES

THERE ARE NO TRUE ALLIGATORS IN SOUTH AMERICA. THE CAIMAN (CAYMAN), "JACARE," HAS A BROAD SNOUT LIKE THE ALLIGATOR WHICH IS ONE OF THE PRINCIPAL FEATURES DISTINGUISHING IT FROM THE CROCODILES

INHABITING THE SAME AREAS. THERE ARE SEVERAL SPECIES OF CAIMAN PREVAILING THROUGHOUT THE AMAZON-ORINOCO-PARAGUAY RIVER SYSTEMS. OF THE SPECIES, THE BLACK CAIMAN (MELANOSUCHUS NIGER) IS THE MOST FORMIDABLE ATTAINING LENGTHS OF OVER NINE FEET AND IS GENERALLY CONSIDERED DANGEROUS. WHETHER THEY WILL ACTUALLY PURSUE AN INDIVIDUAL OTHER THAN WHEN THREATENED IN QUESTIONABLE. THEY WILL, HOWEVER, AGGRESSIVELY DEFEND THEIR POSITION. WHEN LURKING UNDER THE RIVER BANKS OR HIDDEN AMONG THE AQUATIC VEGETATION WAITING FOR SOME UNSUSPECTING PREY, AN EXTENDED LEG, ARM, OR HEAD MIGHT WELL BE CONSIDERED SUITABLE. THE SEVERAL OTHER SPECIE ARE GENERALLY SMALLER THAN THE BLACK CAIMAN AND DO NOT HAVE SUCH A VICIOUS REPUTATION. NEVERTHELESS, THEY ARE TREATED RESPECTFULLY EVEN WHEN BEING HUNTED FOR FOOD.

THE CROCODILES LIKE THE CAIMAN ARE FOUND THROUGHOUT THE MAJOR RIVER SYSTEMS BUT ARE MORE PREVALENT IN THE UPPER AMAZON AND IN THE ORINOCO RIVER. THEY ARE DISTINGUISHED FROM THE CAIMAN MOSTLY BY THEIR RELATIVELY NARROW SNOUT. IN GENERAL, THEY ARE CONSIDERED MORE DANGEROUS THAN CAIMAN--EXCEPT THE BLACK CAIMAN--AND ARE TREATED ACCORDINGLY. THEY ARE SURPRISINGLY QUICK ON LAND THOUGH APPEARING AWKWARD, AND WHILE THEY USUALLY SLITHER ALONG ON THEIR BELLIES THEY CAN RAISE THEMSELVES ON THEIR LEGS AND CHARGE FOR SHORT DISTANCES.

THE CAIMAN AND CROCODILES ARE AMPHIBIAN AND THOUGH THEY CAN REMAIN SUBMERGED FOR LONG PERIODS THEY ARE LUNG BREATHERS AND MUST RISE TO THE SURFACE FOR AIR. TWO ASPECTS OF SURFACING ADD ANOTHER HAZARDOUS DIMENSION. FOR ONE, THEIR NOSTRILS ARE AT THE VERY TIP OF THE NOSE SO THAT ONLY A SMALL PORTION NEED BE EXPOSED; SECONDLY, THE EYES ARE ENCLOSED IN PROJECTIONS ABOVE THE HEAD SO THAT EXCEPT FOR THESE FEATURES IT IS ENTIRELY HIDDEN UNDER THE WATER. IN THE WATER

THEY ARE VERY SWIFT AND CAN EASILY OVERTAKE ANY LAND ANIMAL WHERE DISTANCE PERMITS. WHEN ON LAND IF ATTACKED OR ATTACKING BOTH REPTILES USE THEIR TAIL AND SNAPPING JAWS WITH TERRIFIC FORCE. THE VICTIM OR ADVERSARY WILL BE DRAGGED INTO THE WATER. THE CAIMAN AND CROCODILES FREQUENTLY BUILD LAIRS UNDER OR INTO THE BANKS OF THE RIVERS AND STREAMS FOR SEVERAL YARDS WITH THE ENTRANCE SUBMERGED AND THE REAR OPENING INTO A DRY CAVE. HERE IS WHERE THE VICTIM MAY BE DRAGGED. THEY CONCEAL THEMSELVES ALONG THE RIVER BANKS USUALLY SUBMERGED WITH JUST THE EYES PROTRUDING. AS AN ANIMAL COMES TO DRINK THEY MOVE WITH GREAT SPEED SNAPPING AT WHATEVER AREA OF THE VICTIM IS EXPOSED. IT IS THEN DRAGGED INTO THE WATER FOR FINISHING.

THE FEMALES LAY THEIR EGGS ON DRY LAND USUALLY SEEKING AN AREA NEAR SHALLOW WATER. SEVERAL DOZEN GOOSE SIZED EGGS, WHICH ARE MUCH SOUGHT AFTER AS A SOURCE OF FOOD, ARE DEPOSITED IN A HOLE AFTER WHICH THE FEMALE WILL GO TO CONSIDERABLE LENGTH TO COVER AND CONCEAL THE NEST. DURING THIS PERIOD THEY ARE EXTREMELY DANGEROUS AND WILL RUSH ANYONE OR ANYTHING WHICH MAY APPROACH THE NESTING PLACE.

DURING THE DRY SEASON--PARTICULARLY IN THE ORINOCO WHEN THE WATER RECEDES, THE CAIMAN AND CROCODILES TEND TO COLLECT IN THE RESIDUAL WATER. AS THIS TOO DRIES UP THEY BURY THEMSELVES BENEATH THE MUD AND REMAIN IN A STATE OF SEMI-HIBERNATION UNTIL THE RAINS COME.

DESPITE THE POTENTIAL DANGER OF THE CAIMAN AND CROCODILES, INSTANCES OF ATTACKS ON MAN ARE VERY UNUSUAL EXCEPT UNDER PROVOCATION. NEVERTHELESS, WHERE PROXIMITY IS UNAVOIDABLE, CARE AND CAUTION ARE ADVISED.

MAMMALS

THE MOST FORMIDABLE OF THE LAND ANIMALS OF THE RAIN FOREST IS THE SPECIES OF CAT KNOWN TO NORTH AMERICANS AS THE JAGUAR. IN SOUTH AMERICA IT IS CALLED THE "TIGRE," "ONCA PINTADO," OR SIMPLY "ONCA." THEY ARE EITHER OF THE MORE COMMON SPOTTED VARIETY OR THE BLACK AND RATHER SINISTER LOOKING CAT. WEIGHING FROM 125 TO 200 POUNDS ON THE AVERAGE, SOME HAVE BEEN REPORTED AS WEIGHING WELL OVER 250 POUNDS. THEY ARE GREATLY RESPECTED BY THE INDIANS AND THOUGH NOT GENERALLY FEARED AS A COMMON PREDATOR OF MAN IT IS RECOGNIZED THAT THERE ARE CERTAIN CONDITIONS UNDER WHICH THEY MAY ATTACK WITHOUT PROVOCATION ON THE PART OF MAN. EXAMPLES OF SITUATIONS IN WHICH THERE IS DANGER OF ATTACK USUALLY INVOLVE SUCH CONDITIONS AS (1) A MOTHER WITH CUB, (2) OLD OR PHYSICALLY DISABLED JAGUARS; THESE ATTACKS USUALLY INVOLVE ATTACK ON A CHILD OR LONE INDIVIDUAL, (3) ABNORMAL SCARCITY OF NATURAL FOOD, (4) CIRCUMSTANCES WHERE THE CAT IS CORNERED, AND (5) CIRCUMSTANCES WHERE THE BIG CAT IS THE PREY AND TURNS UPON THE HUNTER.

NUMEROUS INCIDENTS ARE CITED CONCERNING THE NOCTURNAL VISITS OF THE JAGUAR INTO AREAS OF HABITATION, OR EVEN TEMPORARY ENCAMPMENT. THEY WILL FREQUENTLY KILL LIVESTOCK OR AS IN ONE INSTANCE CITED MERELY MEANDER INTO AND OUT OF THE CAMP SITE. MOST EPISODES WHERE THE FORMIDABLE CHARACTER OF THE ANIMAL IS CITED AS A THREAT TO MAN ARE THOSE OF THE HUNT IN WHICH THE JAGUAR IS THE QUARRY. UNDER THESE CONDITIONS NOT ONLY WILL HE ATTACK BUT WILL ENTICE THE HUNTER INTO AN AREA OF ITS CHOICE BEFORE DOING SO. IN OPEN AREAS THEY WILL USUALLY BREAK AND RUN BUT ONCE IN DENSE FOREST OF SECONDARY GROWTH HE MAY ATTACK EITHER FROM HIGH BRUSH ON THE GROUND OR FROM A WELL

CONCEALED OVER-HANGING BRANCH. UNDER THESE CONDITIONS HIS STEATH AND NATURAL CAMOUFLAGE MAKE HIM A MEAN ADVERSARY. THEY ATTACK QUICKLY WITH NO PERCEPTIBLE WARNING. SPRINGING FROM A BELLY-TO-THE-GROUND POSITION BY WHICH IT HAS ADVANCED, IT WILL ATTEMPT TO HIT THE BACK, BITING THE NECK AND SHOULDERS.

THE JAGUAR IS A NIGHT HUNTER BUT IS FREQUENTLY ABOUT DURING THE DAY. THEIR NOISY ROARS DURING THE EARLY EVENING AND THE MORE SINISTER RASPING COUGH INDICATING PROXIMITY ADD TO THE ALREADY TERRIFYING NIGHT SOUNDS OF THE FOREST. IT IS AN EXCELLENT SWIMMER AND IS USUALLY FOUND IN CLOSE PROXIMITY TO RIVERS AND STREAMS. IT IS ALSO AN EXCELLENT CLIMBER. DURING PERIODS OF FLOOD, THE JAGUAR WILL SPEND MUCH OF HIS TIME IN THE TREES OF THE RIVERINE AREAS WHERE THE LOWER STORY OF THE FOREST ATTRACTS NUMEROUS OTHER ANIMALS. FROM THIS POSITION ABOVE THE GROUND, HE MAINTAINS A SURVEILLANCE OF THE ANIMAL PATHS BELOW AND CAN ATTACK WITH EASE ANY SUITABLE PREY--INCLUDING A MAN.

THEY ARE INDISCRIMINATE FEEDERS BUT AS A RULE WILL RETURN TO FINISH ANY GAME LEFT OVER FROM A PREVIOUS KILL. THEY EAT PRACTICALLY ALL THE ANIMALS AND ANIMAL PRODUCTS LISTED UNDER FOOD SOURCES.

THE JAGUAR IS POTENTIALLY DANGEROUS AT ALL TIMES BUT PARTICULARLY AFTER HAVING CUBBED. AS MOST ALL OTHER FOREST ANIMALS, IT RARELY ATTACKS MAN AND IS IN FACT NOT OFTEN SEEN BY THE SHORT-TIME VISITOR. A PROFESSIONAL JAGUAR HUNTER OF CONSIDERABLE REPUTATION, SACHA SIEMEL, KNOWN AS "TIGERMAN," HAS KILLED OVER 300 JAGUARS, MANY OF THEM WITH A SPEAR. HIS TECHNIQUES, HOWEVER, ARE BASED UPON KNOWLEDGE GAINED OVER THREE DECADES OR MORE OF PROFESSIONAL HUNTING. HE PROPOSES THAT A GOOD STURDY SPEAR IS PROBABLY THE BEST DEFENSIVE

WEAPON AGAINST THE JAGUAR. WHILE THE NEOPHYTE MAY FIND THIS QUESTIONABLE, IF ONE DOES NOT HAVE AN ADEQUATE FIREARM THE SPEAR COMES HIGHLY RECOMMENDED.

THE PUMA, CALLED "COUGAR" AND "MOUNTAIN LION" IN THE SOUTHWESTERN PART OF NORTH AMERICA, HAS SEVERAL REGIONAL NAMES IN SOUTH AMERICA, THE MORE COMMON BEING "ONCA SUSSUARANA" AND "LEON." THESE CATS, GENERALLY SMALLER THAN THE JAGUAR, WEIGH FROM 100 TO 165 POUNDS. IT IS A TAWNY-BROWN COLOR, UNMARKED, SHADING TO LIGHT CREAM UNDER THE CHEST, BELLY, AND FLANKS, AND AROUND THE MOUTH. IT IS CONSIDERED EVEN MORE EVASIVE THAN THE JAGUAR AND INSTANCES WHERE ONE HAS ATTACKED MAN ARE VERY EXCEPTIONAL.

THE WHITE-LIPPED PECCARY WHICH FREQUENTLY CONGREGATE IN LARGE HERDS CAN BE COLLECTIVELY DANGEROUS WHEN AROUSED. THEIR BEHAVIOR IS UNPREDICTABLE. AS A RULE THEY ATTACK IN GROUPS GRUNTING AND SQUEALING, CLACKING THEIR TUSKS, AND EMITTING OFFENSIVE GLANDULAR SECRETION FROM A LUMBAR GLAND. WHILE THEY COULD, AND PROBABLY WOULD, KILL A FALLEN MAN, THE CHIEF DANGER LIES IN THE SERIOUS WOUNDS THEY CAN INFLICT WITH THEIR HOOVES AND VICIOUS TUSKS. IN CONCERT, THEY CAN AND DO KILL JAGUARS AND PUMAS WHICH PREY ON THEM. UPON HAVING TREED AN ADVERSARY, THEY WILL WAIT HIM OUT UNTIL SOMETHING FINALLY COMES TO DISTRACT THEM OR FINALLY THEIR OWN HUNGER AND THIRST PULLS THEM AWAY.

THE VAMPIRE BAT, "VAMPIROS" (DESMODUS ROTUNDUS, DIAEMUS YOUNGI, DIPHYLLA ECAUDATA) OF THE TROPICAL SOUTH AMERICA AND CENTRAL AMERICA ARE THE ONLY BLOOD DRINKING BATS IN THE WORLD. THEY ARE SMALL, TWO TO FOUR INCHES; WINGSPREAD EIGHT TO TWELVE INCHES, WITH SMALL EARS AND LONG THUMBS. EACH UPPER CENTRAL INCISOR IS LANCE-LIKE

WITH AN ACUTE POINT AND A RAZOR-SHARP SLOPING LATERAL EDGE; EACH UPPER CANINE IS LONG, SHARP, AND WITH A REAR CUTTING EDGE; THE OTHER TEETH ARE VESTIGIAL. VAMPIRE BATS CAN CRAWL ACTIVELY ON WALLS OF THEIR CAVE HOMES, ALONG THE GROUND, OR ON THEIR INTENDED VICTIMS. THE SKIN OF THE VICTIM IS OPENED BY THE CUTTING INCISOR AND THE FLOWING BLOOD, SUSTAINED BY AN ANTI-COAGULANT IN THE SALIVA OF THE BAT, IS LAPPED UNTIL THE BAT IS FILLED TO THE POINT THAT IT FALLS FROM THE VICTIM FROM THE SURFEIT OF BLOOD. BESIDE THE GENERALLY REPELLENT ASPECTS OF IT FEEDING HABITS THE BAT MAY BE A RABIES CARRIER.

CHAPTER VI

SUMMARY

IN ASSEMBLING THE DATA PERTINENT TO SURVIVAL IN THE TROPICAL FORESTS OF SOUTH AMERICA, THE FOLLOWING BASIC CONDITIONS ARE ASSUMED:

1. THE SURVIVAL SITUATION WAS PRECIPITATED BY BAIL-OUT OVER THE FOREST AREA. THIS CONCURS WITH THE CONSENSUS THAT ANY ATTEMPT TO RIDE THE PLANE DOWN IS UNFEASIBLE. THERE ARE "LONG ODDS" OF FINDING A CLEARING OR A SMALL SAVANNA AT THE TIME OF THE MALFUNCTION BUT THEY ARE VERY LONG INDEED.
2. BECAUSE OF THE MOTION, TIME, AND SPACE FACTORS THE CREW MEMBERS WILL BE SEPARATED IN DESCENT.
3. BECAUSE OF THE EXTREME DENSITY OF FOREST VEGETATION THERE IS STRONG LIKELIHOOD THAT THE CREW WILL REMAIN INDIVIDUALLY ISOLATED DURING THE SURVIVAL PERIOD (ALTHOUGH IMMEDIATE EFFORTS SHOULD BE MADE TO EFFECT ANY REGROUPING POSSIBLE. THE COMBINED EFFORTS OF MORE THAN ONE GREATLY INCREASES THE SURVIVAL PROSPECTS.)

4. MATERIELS REQUIRED FOR SUSTAINED SURVIVAL ACTIVITIES WILL BE LIMITED TO WHAT THE INDIVIDUAL HAS ON HIS PERSON UPON REACHING THE GROUND AND THAT WHICH HE CAN MANUFACTURE FROM THE PHYSICAL ENVIRONMENT.

5. RESCUE OPERATIONS WILL BE SERIOUSLY AFFECTED BY:

   A. WHETHER OR NOT THERE WAS AN OPPORTUNITY TO RADIO THE SIGNIFICANT DETAILS OF THE SITUATION PRIOR TO ABORT.

   B. ACCURACY OF DETAILS SENT AND RECEIVED.

   C. PROXIMITY AND COMPOSITION OF RESCUE FACILITIES.

   D. RESTRICTED OR NO VISIBILITY BECAUSE OF DENSITY OF FOREST COVER.

   E. LIMITED TRANSMISSION CAPABILITIES OF RADIO (IF AVAILABLE) UNDER THE DENSE FOREST COVER.

   F. ACCESSABILITY TO SURVIVAL AREA.

6. THE SURVIVOR IS PHYSICALLY CAPABLE OF NEGOTIATING THE ENVIRONMENTAL CONDITIONS AND THAT ANY INJURY SUSTAINED DURING THE INITIAL CATASTROPHE CAN BE EFFECTIVELY OVERCOME.

LACK OF FAMILIARITY WITH THE RAIN FOREST ENVIRONMENT HAS THE USUAL EFFECT OF CREATING FEAR AND APPREHENSION IN THE MINDS OF AVERAGE INDIVIDUAL. INCREASED FAMILIARITY SERVES TO ELIMINATE FEAR AND MAY RELIEVE THE APPREHENSION. AMONG THOSE INDIVIDUALS HAVE MADE THE TROPICAL FOREST OF SOUTH AMERICA A SIGNIFICANT PART THEIR LIVES, EVEN THE MORE INTREPID RECOGNIZE ITS INHERENT AD-RSITIES AND REACT TO THEM WITH RESPECT AND CIRCUMSPECTION.

THE MOST SERIOUS THREAT TO THE INDIVIDUAL LOST IN THE FOREST ILDERNESS LIES IN THE VASTNESS OF ITS COMPLICATED PHYSIOGRAPHY. HOUSANDS OF SQUARE MILES ARE UNINHABITED AND UNEXPLORED. TO SOME EXTENT THIS CONDITION IS MITIGATED BY THE MECHANICS OF FLIGHT-ROUTE SCHEDULING WHICH DIVIDES THE DISTANCE INTO INCREMENTS EACH TERMINATING IN A FIXED TERRAIN CHECK POINT. EVEN SO, THE PERIOD OF TRAVEL MAY BE EXTENDED TO SEVERAL WEEKS BECAUSE OF THE NATURAL OBSTACLES AS WELL AS THE PHYSICAL CONDITION OF THE INDIVIDUAL. BECAUSE OF THIS PARTICULAR ASPECT THE INDIVIDUAL MUST MAKE A CAREFUL AND DELIBERATE APPRAISAL AT THE INITIAL STAGE OF THE SURVIVAL SITUATION. THIS "STOCK-TAKING" SHOULD BE SYSTEMATIC CONSISTING OF:

1. A MENTAL REVIEW OF EVENTS LEADING UP TO THE SITUATION TO INCLUDE:
   - A. LAST KNOWN POSITION IN RELATION TO PRESENT POSITION.
   - B. ANY RIVERS OR STREAMS MOST RECENTLY SEEN AND RELATION TO PRESENT POSITION.
   - C. LAST ACKNOWLEDGED RADIO COMMUNICATION AND SIGNIFICANCE FOR THE IMMEDIATE SITUATION.

2. A MENTAL REVIEW OF ALL RECOLLECTED DATA PERTAINING TO THE GEOGRAPHY AND THE SURVIVAL ASPECTS RELATED THERETO.
3. A MENTAL REVIEW OF ALL RECOLLECTED DATA PERTAINING TO THE HELPFUL AND THE HARMFUL ASPECTS OF THE IMMEDIATE ENVIRONMENT.
4. AN APPRAISAL OF PHYSICAL MATERIELS ON HAND, AND ITS APPLICATION TO THE SURVIVAL SITUATION.
5. A SELECTIVE PROCESS OF DECISIONS REGARDING THE COURSE OF ACTION BASED UPON ALL KNOWN FACTORS AND CONSIDERED RISKS OF UNKNOWN FACTORS.
6. AN EXAMINATION, AS OBJECTIVE AS IS POSSIBLE, OF THE IMMEDIATE MENTAL, EMOTIONAL, AND PHYSICAL STATE AND A COURSE OF ACTION DESIGNED TO ACHIEVE AND SUSTAIN ALL THREE AT THE HIGHEST POSSIBLE LEVEL OF EFFICIENCY.

IMPLICIT IN THIS ANALYSIS OF THE SITUATION IS THE ACCEPTANCE OF THE POSSIBILITY OF AN EXTENDED PERIOD OF LIVING WITHIN THE ENVIRONMENT AND THE NECESSARY ADJUSTMENT TO ITS DEMANDS. THE IMMEDIATE OBJECTIVE OF THE SURVIVOR IS TO REACH A NAVIGABLE WATERWAY. HAVING DONE SO, HE CAN THEN CONTEND WITH THE NUMEROUS HAZARDS OF THE RIVER SYSTEM--THE FOREMOST BEING THE RAPIDS AND FALLS OF THE HIGHER ELEVATIONS. VARIOUS MATERIALS ARE AVAILABLE FOR CONSTRUCTION OF A SUIT-

ABLE WATER CRAFT. THE MOST EFFICIENT CRAFTS ARE SIMPLE RAFTS MADE OF BALSA.

TRAVEL BY LAND IS EXTREMELY SLOW EVEN WHERE THE FOREST FLOOR IS RELATIVELY FREE OF DENSE UNDERBRUSH AS IN THE PRIMARY UPLAND FORESTS. THE SWAMPY AREAS OF THE VARZEA AND THE IGAPO ARE TO BE AVOIDED AS MUCH AS POSSIBLE ALTHOUGH THEY MAY HAVE TO BE NEGOTIATED IF THERE ARE INDICATIONS OF A RIVER BEYOND. SUCH INDICATIONS ARE THE OCCURRENCE OF EXTENSIVE, DENSE UNDERGROWTH, LESS DENSITY IN THE OVERHEAD CANOPY, A GENERAL LOWERING OF THE CROWNS OF THE TREES AND AN INCREASE IN ANIMAL ACTIVITY BOTH IN THE CANOPY AND ON THE GROUND.

THE EXTREMELY LUSH NEARLY SOLID WALL OF GREEN PLANTS THAT BORDER THE RIVERS AND STREAMS WILL ENTAIL A GREATER CONCENTRATED EFFORT TO PENETRATE THAN ANY OTHER FOREST AREA. THE EFFORT IS SUSTAINED, HOWEVER, BY THE KNOWLEDGE OF THE RIVER'S PROXIMITY PLUS MANY OTHER FACTORS CONTRIBUTING TO THE FURTHERANCE OF THE SURVIVAL EFFORT.

HAZARDS ASSOCIATED WITH THE TROPICAL FORESTS OF SOUTH AMERICA ARE MANY AND VARIED BUT LIKE SO MUCH OF THE CHARACTER OF THE REGION NUMERICAL UNITS ARE SWALLOWED UP IN ITS VASTNESS. POISONOUS SNAKES AND JAGUARS ARE RARELY SEEN. THE ALLIGATOR-LIKE CAIMAN, STING RAYS, ELECTRIC EELS ARE THERE BUT GENERALLY AVOID MAN. THE DREAD PIRANHA IS FOR THE MOST PART A CASUAL INCIDENT TO THE PEOPLE OF THE AMAZON. TROPICAL DISEASES, EVEN MALARIA, ARE MAINLY A CHRONIC CONDITION OF THE SOCIAL ENVIRONMENT OF SOUTH AMERICA RATHER THAN THE PHYSICAL ENVIRONMENT. OF ALL THE HAZARDS THAT DO EXIST THE ONE WHICH CANNOT BE WRITTEN OFF CASUALLY IS THE HIGH RATE OF INCIDENCE OF THE INSUFFERABLE BITING AND STINGING INSECTS--EVEN THESE, HOWEVER, ARE MAINLY PESTS RATHER THAN LETHAL THREATS.

A THREAT OF REAL IMPORTANCE IS STARVATION. THERE ARE
ERALLY THOUSANDS OF EDIBLE SPECIES OF PLANTS INCLUDING FRUITS,
ENS, ROOTS, LEGUMES, ETC. YET THERE IS NEVER ANY ASSURANCE THAT
SE PLANTS ARE ALWAYS PRESENT IN ANY GIVEN AREA IN SUFFICIENT NUM-
S TO AFFORD SUSTENANCE. THE MOST CONSPICUOUS FEATURE OF THE
MARY RAIN FOREST IS THAT MORE THAN 90% OF ITS GREEN LIFE AS WELL
ITS ANIMAL LIFE EXIST HIGH AMONG THE FOREST CROWNS AND GETTING
THE AREA OF LIFE REQUIRES CONSIDERABLE TECHNIQUE AND RISK.

LIFE ABOUNDS IN THE RIVERS AND ALONG THE LITTORAL BUT AGAIN
HE OBTAINING OF FOOD FROM THESE SOURCES REQUIRE TECHNIQUES APPRO-
PRIATE TO HUNTING, TRAPPING, AND FISHING MOST PROBABLY WITH PRIMITIVE
EQUIPMENT. GAME FOOD CONSIST OF FISH, TURTLES (AND TURTLE EGGS),
DEER, TAPIRS, PECCARIES, PACAS, AGOUTI, MONKEYS, WATER FOWL, LAND
FOWL, ETC. IN ADDITION TO THE GAME FOODS, THERE ARE INSECTS, INSECT
LARVAE AND VARIOUS REPTILES.

FOR THE MOST PART THE INDIANS OF THE FOREST CONSTITUTE A
SOURCE OF AID, PARTICULARLY IN MATTERS OF FOOD AND GUIDANCE TO
AREAS OF CIVILIZATION. NEVERTHELESS, CIRCUMSPECTION IS ADVISED IN
ALL MATTERS OF SOCIAL CONTACT. THE ONE TRIBE OF INDIANS KNOWN TO BE
STILL HOSTILE TO THE WHITE MAN IS THE MOTILONE TRIBE IN THE REGION
SOUTH OF LAKE MARACAIBO. THE DISPOSITION OF MANY OTHER TRIBES IS
NOT KNOWN OR THEY MAY BE UNDERGOING A TEMPORARY PERIOD OF HOSTILITY
FOR REASONS PECULIAR TO A GIVEN SITUATION.

IN ASSEMBLING AND PREPARING THE FOREGOING MATERIAL IT WAS NOT
INTENDED THAT THE ADVERSE CONDITIONS OF THE FOREST AREAS OF SOUTH
AMERICA BE OVER-EMPHASIZED. HOWEVER, THIS IS OFTEN THE RESULT WHEN
SUCH DATA AS THESE ARE PRESENTED IN A COLLECTED FORM. ON THE OTHER

HAND, IT IS NOT INTENDED TO MINIMIZE THE THREATS TO LIFE AND HEALTH THAT THESE TROPICAL FORESTS CONTAIN. INDEED, THE NUMBER OF MEN WHO HAVE FALLEN VICTIM TO THE EXISTING DANGERS ARE TOO SIGNIFICANT TO IGNORE. EVEN THE INDIANS WHO MAKE THE FOREST THEIR HOME CONTRIBUTE THEIR SHARE OF VICTIMS. RATHER IT IS THE INTENT TO PRESENT NOT ONLY THE HAZARDS IN A PROPER PERSPECTIVE; BUT ALSO TO DEVELOP CONFIDENCE BASED UPON FAMILIARITY AND THE KNOWLEDGE THAT THE FORESTS OFFER MUCH GREATER PROSPECTS FOR SURVIVAL WHEN ONE IS NOT RESIGNED TO HELPLESS OR HOPELESS FAILURE. IN MANY INSTANCES THE ADVERSITIES, WHETHER REAL OR IMAGINED, ARE REDUCED OR EVEN UTILIZED TO AN ADVANTAGE. SURVIVAL IN THE "JUNGLE" IS NOT A MATTER OF CHANCE AND ANYONE WHO DELIVERS HIMSELF UP TO SUCH A NOTICE HAS STACKED THE ODDS AGAINST HIMSELF AT THE START. SURVIVAL IS A MATTER OF APPLICATION OF KNOWLEDGE AND TECHNIQUES APPROPRIATE TO THE PHYSICAL AND CULTURAL ENVIRONMENT. SPECIFICALLY, THE INTENT HERE HAS BEEN TO PRESENT THE SINGULAR CHARACTERISTICS OF THE TROPICAL FOREST ENVIRONMENT WHICH WILL FACILITATE OR DETER ULTIMATE SURVIVAL.

PART II

SAVANNAS OF SOUTH AMERICA

CHAPTER VII

THE PHYSICAL ENVIRONMENT

DISTRIBUTION

THE TERM "SAVANNA" HAS BEEN USED SOMEWHAT FLEXIBLY TO INCLUDE VARIOUS TYPES OF TROPICAL GRASSLANDS. PERHAPS NOT SURPRISINGLY, THE GEOGRAPHIC REGION MOST FREQUENTLY DESCRIBED IS NOT THE SAVANNAS OF SOUTH AMERICA FROM WHERE THE TERM APPARENTLY ORIGINATED BUT THE MORE WELL-KNOWN PLAINS OF SUB-SAHARAN AFRICA TO WHICH THE TERM HAS BEEN ADAPTED. THE VAST GRASSLANDS OF SOUTH AMERICA ARE KNOWN ONLY PARTIALLY AND THE DESCRIPTIVE LITERATURE, FOR THE MOST PART, IS SKETCHY DEALING WITH SCIENTIFIC DATA, OR DATA DERIVED FROM VARIOUS TYPES OF EXPLORATORY, HUNTING, AND ADVENTURE EXPEDITIONS USUALLY APPLICABLE TO SPECIFIC LOCALES.

AS USED IN THIS MONOGRAPH, SAVANNAS ARE TROPICAL, OPEN GRASSLANDS IN WHICH SCATTERED TREES, SHRUBS, AND OTHER HERBACIOUS PLANTS OCCUR SINGLY, IN ISOLATED STANDS, OR AS EXTENSIONS OF PERIPHERAL FORESTS. THE DOMINANT PLANT LIFE IS OF THE SORT CAPABLE OF WITHSTANDING LONG PERIODS OF DROUGHT AND IN MANY INSTANCES IS ALSO FIRE-RESISTANT. FOR PURPOSES OF CONGRUENCY, REGIONAL DESCRIPTIONS WILL INCLUDE FRINGE OR GALLERY FORESTS EXTENDING INTO THE SAVANNAS FROM THE PRIMARY RAIN FORESTS OR OCCURRING AS ISOLATED STANDS ALONG THE PERMANENT RIVERS COURSING THROUGH THE SAVANNAS.

THERE ARE FOUR MAJOR SAVANNA REGIONS OF SOUTH AMERICA. NORTH OF THE AMAZON, THE <u>LLANOS</u> OF THE ORINOCO BASIN ARE THE MOST EXTENSIVE,

STRETCHING FROM THE ORINOCO DELTA (64°-66°W, 8°-10°N), WEST TO THE COASTAL RANGE AND EXTENDING SOUTH INTO COLOMBIA AS FAR AS THE RIO GUAVIARE (68°-76°W, 2°-4°N). THE OTHER NORTHERN SAVANNA REGION OF CONSIDERABLE IMPORTANCE IS THE RUPUNUNI-RIO BRANCO SAVANNAS LOCATED IN THE BORDER AREA BETWEEN BRAZIL AND BRITISH GUIANA (58°-61°W, 2°-4°N). SOUTH OF THE AMAZON, THE SAVANNA AREAS CONSIST OF THE VAST CAMPOS OR GRASSLANDS OF THE BRAZILIAN PLATEAU WHICH INCLUDES THE MATO GROSSO AND MUCH OF THE EASTERN STATES OF BRAZIL. ALSO WITHIN THE USED DEFINITION IS INCLUDED THE GRAN CHACO OF NORTHWESTERN PARAGUAY AND SOUTHEASTERN BOLIVIA.

CHARACTERISTICS

AMONG THE SEVERAL INTERRELATED FIELDS OF SCIENCE, CONSIDERABLE CONTROVERSY ENSUES WHENEVER CAUSAL THEORIES ARE PROPOSED REGARDING THE ORIGIN OF SAVANNAS. ALTHOUGH THE VALIDITY OF THESE THEORIES IS NOT THE CONCERN HEREIN, THE PHYSIOGRAPHIC FACTORS UPON WHICH THE THEORIES ARE BASED DO OCCUR WITH SUCH CONSISTENCY AND IN VARYING DEGREES OF EFFECT UPON THE ENVIRONMENT THAT THEY FORM THE BROAD OUTLINE WITHIN WHICH THE NATURAL CHARACTERISTICS OF THE SAVANNAS CAN BE DESCRIBED. ESSENTIALLY THE MAIN FACTORS ARE:

1. CLIMATE - ALTERNATING WET AND DRY SEASON WITH PROLONGED PERIODS OF MOISTURE DEFICIENCY.
2. SOIL CONDITIONS - VARYING SOIL CONDITIONS INCLUDING:
   A. CHEMICAL DEFICIENCIES DUE TO CONSTANT LEACHING,

B. FLATLAND TOPOGRAPHY RESULTING IN POOR DRAINAGE AND A PERMEABLE TOP LAYER OF SOIL SUBJECT TO RAPID DRYING,

C. UNDERLYING GEOLOGIC FORMATIONS CREATING IMPERMEABLE SUB-SOIL STRATA CONDUCIVE TO RAPID RUNOFF OF MOISTURE AND PROHIBITING ACCUMULATION.

3. BIOTIC - FIRE MAKING ACTIVITIES OF MAN CAUSING THE INITIAL DESTRUCTION OF THE FOREST AND SUBSEQUENT CONSTANT FIRING RESTRICTING REGROWTH.

THE RELATIONSHIP OF THESE FACTORS TO EACH OTHER ARE OF LESS IMPORTANCE TO THE SURVIVOR THAN IS THE SPECIFIC NATURE OF THE FACTORS AND THEIR AFFECTS UPON THE SURVIVOR. IN GENERAL THEY DO OCCUR THROUGHOUT ALL OF THE SAVANNA REGIONS OF SOUTH AMERICA IN VARYING DEGREES OF COMPLEMENTATION.

CLIMATE

THE SAVANNAS ARE SUBJECT TO A FAIRLY WIDE RANGE OF LOCALIZED AND DAILY METEOROLOGICAL VARIATIONS WITHIN A GIVEN REGION AS WELL AS BETWEEN REGIONS. THE ONE ASPECT OF CLIMATE WHICH TENDS TO REFLECT ANY RELATIVE CONSISTENCY IS THAT THERE ARE ALTERNATING WET AND DRY SEASONS. THE WET MONTHS IN SOUTH AMERICA ARE DESIGNATED AS THE WINTER SEASON, CALLED INVIERNO, AND THE DRY MONTHS ARE THE VERANO OR SUMMER. IN BRAZIL, WHERE PORTUGUESE IS SPOKEN, THESE BECOME INVERNO AND VERAO.

SIGNIFICANTLY, THESE TERMS ARE DESCRIPTIVE OF THE METEOROLOGICAL ASPECTS OF THE CLIMATE RATHER THAN BEING COINCIDENT WITH THE SOLAR RELATIONSHIP. THERE IS NO GREAT SEASONAL VARIATION IN TEMPERATURES. THEY AVERAGE 65° TO 85°F THROUGHOUT THE SAVANNAS. NEVERTHELESS, THERE ARE REGIONAL VARIATIONS WHICH TEND TO INCREASE OR REDUCE THE IMMEDIATE EFFECTS OF THE TEMPERATURE. THE ANNUAL STATISTICS DO NOT REFLECT THE RELATIVELY WIDE RANGE OF DAILY TEMPERATURE FLUCTUATIONS. FOR EXAMPLE, THERE IS FREQUENTLY A DAILY RANGE OF MORE THAN 40°F IN THE BRAZILIAN PLATEAU. IN THE LLANOS THE DAILY RANGE IS AS HIGH AS 25°F. ANOTHER ASPECT OF THE TEMPERATURE READINGS IS THAT THEY ARE TAKEN IN THE SHADE AND UNFORTUNATELY THE MAIN CHARACTERISTIC OF THE SAVANNA IS THE LACK OF SHADE. THUS, IN DIRECT SUNLIGHT THE TEMPERATURES WILL FREQUENTLY REACH WELL ABOVE 100°F ESPECIALLY IN THE INTERIOR OF THE LLANOS, THE GRAN CHACO, AND THE RUPUNUNI SAVANNAS.

WHEN DISCUSSING THE WINTER-SUMMER SEASONS IN THE SAVANNAS--OR IN NEARLY ALL OF TROPICAL SOUTH AMERICA FOR THAT MATTER--THE MOST IMPORTANT SEASONAL ASPECT IS THAT OF RAINFALL RATHER THAN TEMPERATURE. THE REGIONAL DIFFERENCES IN RAINFALL IN THE SAVANNAS IS CONSIDERABLE, BOTH IN AMOUNTS OF RAINFALL AS WELL AS PERIODICITY. IN THE VENEZUELAN SAVANNAS THE ANNUAL RAINFALL AVERAGES FORTY TO FORTY-FIVE INCHES WITH AS MUCH AS SEVEN MONTHS OF DROUGHT. IN THE MATO GROSSO, THE RAINFALL OFTEN REACHES A TOTAL OF SIXTY-EIGHT INCHES WITH NO MONTHS OF ACTUAL DROUGHT BUT RATHER A RELATIVELY LESSER AMOUNT OF RAIN DURING SUMMER MONTHS. SPECIFIC DETAILS OF CLIMATE WILL BE DISCUSSED UNDER THE REGIONAL DESCRIPTION.

RELIEF AND DRAINAGE

WHEREAS SAVANNA CLIMATES SHOW CONSIDERABLE VARIATION, THE

TOPOGRAPHY IS PREDOMINANTLY CHARACTERIZED BY PLAINS OR PLATEAUS. THE LAND FORM IS GENERALLY LEVEL OR GENTLY ROLLING BROKEN ONLY BY THE RIVER INCISED VALLEYS, AND STREAM BEDS, SCATTERED STANDS OF TREES OR SINGLE TREES, BRUSH, AND THE CONSPICUOUS TERMITE MOUNDS WHICH ARE A FREQUENT OCCURRENCE IN THE SAVANNAS. SAVANNAS, FOR THE MOST PART, COVER WHAT IS KNOWN GEOLOGICALLY AS "SENILE" TOPOGRAPHY. THESE ARE AREAS OF GEOLOGIC STABILITY THE AGE OF WHICH IS RECKONED IN MILLIONS OF YEARS SOME BEING ANCIENT ALLUVIAL PLAINS OR OLD AGE HIGHLANDS. THE BRAZILIAN PLATEAU, ONE OF THE WORLD'S LARGEST UPLAND MASSES, IT IS ALSO ONE OF THE OLDEST, POSSIBLY HAVING BEEN UNSUBMERGED SINCE THE EARLIEST KNOWN GEOLOGIC PERIOD.

THE SIGNIFICANCE OF THE FLATNESS OF THE LAND LIES IN ITS GENERALLY POOR DRAINAGE, THE TYPE OF SOILS RESULTING FROM EROSION, SLOW RUN-OFF WATER, AND THE EFFECTS OF THESE FACTORS ON THE SAVANNA VEGETATION. THE SCIENTIFIC TREATMENT OF THE NATURE OF THE SAVANNA SOIL CONDITION TENDS TO BE COMPLEX AND LENGTHY. ESSENTIALLY, THE SANDY TOP SOILS ARE OVER-LYING VARYING TYPES OF HARDPAN STRATA OF CLAY, ROCK, OR EQUALLY IMPERMEABLE SOIL. DURING THE RAINY SEASON THE TOP SOIL BECOMES WATER-LOGGED AND THE IMPERMEABLE SUB-STRATA TOGETHER WITH THE FLATNESS OF THE LAND CAUSES THE WATER TO SPREAD AND STAND FOR LONG PERIODS OF TIME. THIS RESULTS IN INTERMITTENT STAGNATING BOGS, MARSHES, AND SWAMPS. THE IMPERMEABLE SUB-STRATA PREVENT A WATER TABLE FROM FORMING SO THAT WHEN THE DRY SEASONS OCCUR THE STANDING WATER EVAPORATES AND THE SANDY TOP SOIL IS QUICKLY DRIED OUT BY THE COMBINING INFLUENCES OF WIND AND SUN.

BIOTIC FACTORS

THESE FACTORS INVOLVE THE VARIOUS WAYS IN WHICH MAN AND

ANIMAL EFFECT THE NATURAL DEVELOPMENT OF THE ENVIRONMENT. THE MORE SIGNIFICANT FEATURE OF THE SOUTH AMERICAN SAVANNAS IN THIS RESPECT IS THAT MAN HAS BEEN THE MOST INFLUENTIAL ELEMENT FOR CHANGE OR STABILITY. THERE ARE NO NATURALLY OCCURRING LARGE HERDS OF GRAZING ANIMALS WITH THE ATTENDENT PREDATORY ANIMALS SUCH AS EXIST IN AFRICA. NEARLY ALL OF THE ANIMALS OF SOUTH AMERICA ARE FOREST ANIMALS OF WHICH ONLY A FEW MAKE FORAYS INTO THE SAVANNAS PERIODICALLY. THE TRUE SAVANNA INHABITANTS ARE THE INSECTS, ANTEATERS WHICH LIVE OFF THE ABOUNDING TERMITES AND ANTS; THE SMALL RODENTS, LIZARDS, AND SNAKES. ONE SNAKE, THE CASCABEL OR RATTLESNAKE (CROTALUS DURISSUS TERRIFICUS), IS ESPECIALLY DANGEROUS. HOWEVER, THE MOST ABUNDANT LIFE FORM OF ALL, ESPECIALLY DURING THE RAINY SEASON, IS THE UBIQUITOUS AND INESCAPABLE FLYING INSECTS--BOTH FLIES AND MOSQUITOS.

MAN HAS ALWAYS PLAYED A DOMINANT ROLE IN EFFECTING CHANGE IN HIS IMMEDIATE ENVIRONMENT. AT THE PRIMITIVE OR NON-TECHNICAL LEVEL THE CHANGE MAY BE CONTEMPORARY WITH THE RESIDENCE AND SUBSISTENCE ACTIVITIES OF THE PEOPLES WHO ARE LIVING WITHIN A SPECIFIC ENVIRONMENT. HOWEVER, THERE ARE INSTANCES WHERE THE EFFECTS MAY BE MORE LASTING. THE INDIANS OF SOUTH AMERICA HAVE BEEN BURNING OFF THE LAND APPARENTLY SINCE EARLIEST DAYS OF OCCUPATION. USUALLY THE GRASS IS FIRED FOR THE PURPOSE OF SCARING UP GAME. MORE RECENTLY IT IS FIRED AS A MEANS OF IMPROVING PASTURAGE. IN SOME INSTANCES IT IS A TRADITIONAL METHOD OF MAINTAINING OPEN AND UNRESTRICTED AREAS AND WHEN PASSING THROUGH AREAS OF FAIRLY MATURE DEVELOPMENT THE LOCAL INHABITANTS FIRE THE GRASSES AS A MATTER OF COURSE. THE EFFECTS OF SUCH BURNING IS BELIEVED BY MANY AUTHORITIES TO BE ONE OF THE IMPORTANT CAUSAL FACTORS IN THE ORIGIN AND STABILITY OF SAVANNA-TYPE CLIMAXES.

THE CONSTANT BURNING OF LARGE TRACTS OF LAND HAS RESULTED IN THE DEVELOPMENT OF A VARIETY OF PLANTS IN WHICH THE FIRE-RESISTENT CAPABILITIES ARE A SIGNIFICANT ASPECT OF THE SAVANNA VEGETATION. AGAIN, THE TECHNICAL DISCUSSIONS REGARDING CAUSALITY IS BEYOND THE SCOPE OF THE MONOGRAPH. NEVERTHELESS, THE FREQUENT OCCURRENCE OF FIRES, EITHER MAN-MADE, OR FROM NATURAL CAUSES SUCH AS LIGHTNING, DOES PRESENT POTENTIAL PROBLEMS FOR SURVIVAL BOTH DIRECTLY AND INDIRECTLY. THE MOST IMMEDIATE EFFECTS OF COURSE ARE THOSE RESULTING FROM ENCOUNTERING A FIRE IN PROGRESS OR OF RECENT OCCURRENCE. THE DANGER FROM A FIRE IN PROGRESS IS PERHAPS OBVIOUS THOUGH NOT SO DANGEROUS AS IT MAY APPEAR CONSIDERING THE FREQUENT AND DELIBERATE FIRING BY THE INHABITANTS. NEVERTHELESS, SHOULD ONE BE CAUGHT IN FRONT OF AN ADVANCING FIRE ESPECIALLY WHEN THERE IS A HIGH WIND, IMMEDIATE EVASIVE ACTION WILL PROBABLY BE NECESSARY. IN THAT THE FIRING OF THE SAVANNAS USUALLY COINCIDES WITH THE PERIOD OF DROUGHT, THERE IS LITTLE LIKELIHOOD OF SWAMP WATER BEING CONVENIENTLY AVAILABLE. VERY PROBABLY THE STREAMS WILL ALSO BE DRY ALTHOUGH EVERY ADVANTAGE SHOULD BE TAKEN OF SUCH STREAMS OR SWAMPS. WHERE THERE IS NO AVENUE OF ESCAPE OR PLACE OF IMMEDIATE REFUGE, THE MOST APPROPRIATE ACTION WILL BE THAT OF BACK-FIRING WHICH SHOULD BE IMMEDIATE AND AS WIDE AND AS DEEP AN AREA SHOULD BE BURNED AS TIME PERMITS.

DURING THE BURNING, THE CLOUDS OF SMOKE ATTRACT BIRDS FOR MILES AROUND WHICH, SEEMINGLY OBLIVIOUS TO THE SMOKE AND FLAMES, DART ABOUT WILDLY GORGING ON THE EXPOSED RODENTS AND INSECTS WHICH ARE ALREADY DEAD OR FLEEING FROM THE FIRE. LAND BOUND ANIMALS WHICH NORMALLY PREY UPON EACH OTHER BECOME OBLIVIOUS TO THE USUAL THREATS IN THE FACE OF A COMMON DANGER. NEVERTHELESS, IN THE PANIC THE

NORMALLY EVASIVE ANIMALS, ESPECIALLY THE SNAKES, PRESENT POTENTIAL IF UNPREDICTABLE SOURCE OF DANGER. WHERE THE LAND HAS BEEN RECENTLY BURNED, WITHIN A PERIOD OF SEVERAL DAYS, THE ANIMAL LIFE IS PRACTICALLY NIL. HOWEVER, AS SOON AS THE NEW GROWTH OF TENDER GREEN SHOOTS BEGINS THE ANIMAL LIFE BECOMES TEMPORARILY INTENSE AS THE INSECTS AND HERBIVAROUS ANIMALS SUCH AS DEER ARE ATTRACTED TO THE GOOD GRAZE. THE HERBIVAROUS ANIMALS IN TURN ATTRACT THEIR CARNIVOROUS PREDATORS SO THAT, FOR THE TIME, THE AREA ASSUMES A COMPLETELY DIFFERENT ECOLOGICAL RELATIONSHIP.

INDIRECTLY, THE AFFECTS ARE PROBABLY EVEN MORE IMPORTANT IF NOT SO OBVIOUS. ON THE ONE HAND, THE EDIBLE PORTIONS OF THE PLANT LIFE ARE VERY FREQUENTLY FOUND UNDERGROUND THUS BEING AVAILABLE EVEN IMMEDIATELY FOLLOWING A FIRE; ON THE OTHER HAND, THE WILD GAME IS BEING CONTINUALLY DEPLETED AND THE COMPARATIVE DESCRIPTION BETWEEN THE ABUNDANCE OF GAME SIGHTED DURING EXPLORATIONS OF THE 18TH AND 19TH CENTURY AND THE SCARCITY OF SUCH GAME TODAY IS VERY NOTABLE.

WITH THE EUROPEAN INFLUENCE IN SOUTH AMERICA, CONTINUOUS EFFORTS HAVE BEEN MADE TO INTRODUCE CATTLE RAISING TO THE VARIOUS SAVANNA REGIONS. SO FAR, THESE EFFORTS HAVE MET WITH RATHER INDIFFERENT SUCCESS FOR REASONS BOTH SOCIAL AND ECOLOGICAL. MANY OF THE CATTLE HAVE TURNED WILD, AND EVEN WHERE HERDING CONTROL IS EXERCISED THE CATTLE ARE NOTED FOR THEIR "SPOOKINESS" AND CAN BE DANGEROUS. AT ANY RATE, THEY DO NOT EXIST IN SUCH NUMBERS AS TO BE A SERIOUS INFLUENCE ON THE CHARACTER OF THE VEGETATION. THEY DO CONSTITUTE A POSSIBLE SOURCE OF FOOD FOR THE SURVIVOR IF A MEANS OF CAPTURE CAN BE DEVISED. MORE SIGNIFICANTLY THEIR APPEARANCE IN NUMBER INDICATE PROBABLE HABITATION NEARBY.

Savanna Vegetation

The predominance of grasslands has already been cited as one of the defining characteristics of the savannas. Considering the varying conditions to which such widely dispersed areas may be subjected, it is not surprising that there are varying types of savanna grasslands. The nature of these variations are due mainly to the amount of moisture available to a specific area together with the duration of the periods of drought. In South America the grasslands most widely encountered are those of a bunch-grass type especially that which is called "tall" bunch-grass. The grasses (Graminaceae) which constitutes 90% or more of the savanna vegetation are typical of drought-resistant, or xeromorphic plants. More than forty species of grasses have been identified in the llanos of Venezuela alone. However, there are only six to eight species which predominate throughout all of the savannas. In the swampy and river areas several species of sedges (Cyperaceae) occur. The difference between the varieties of grass, even in appearance, are usually distinguishable only to the trained observor. The leaves are stiff, narrow and coarse and are frequently sharp-edged appearing more like spikes. If allowed to mature they frequently reach an average height of five feet. During the dry periods the average height of the vegetation is seldom greater than fourteen to twenty inches. However, there are patches throughout the savanna regions where the growth is shoulder high and in areas of the Rupununi will grow more than six feet high. In areas where there is a prevalence of water such as in the bogs or swamps, the shorter grass-like sedge plant (Cyperaceae) develops which has spiked leaves with edges that

ARE OFTEN RAZOR-SHARP AND ARE ACTUALLY USED FOR CUTTING INSTRUMENTS.

THE PLANTS WHICH MAKE UP THE REMAINDER OF THE VEGETATION CONSISTS MAINLY OF TREES AND SHRUBS. THE TREES ARE USUALLY SMALL AND WELL SPACED EXCEPT WHERE THEY LINE THE PERMANENT FLOWING STREAMS AND RIVER BANKS, OR MORE PERMANENT SWAMP AREAS. THE VARIETY OF TREES IS RELATIVELY LIMITED. THE MOST IMPORTANT FOR SURVIVAL PURPOSES ARE THE VARIOUS PALM TREES WHICH OCCUR THROUGHOUT THE SAVANNA AND THE POD-BEARING ALGARROBA TREES OF THE GRAN CHACO. THE SHRUBS ARE OF THREE GENERAL TYPES: (1) THOSE THAT HUG THE GROUND USUALLY CONSISTING OF STIFF, LARGE LEAVES; THE MAIN PART OF THE PLANT BEING THE WOODY STEM LYING UNDERGROUND; (2) SHRUBS WHICH ALSO HAVE THE UNDERGROUND, WOODY, STEM-ROOT SYSTEM BUT AFTER A FIRE SENDS UP SHOOTS TWO OR THREE FEET HIGH FORMING A THICKET SEVERAL FEET IN DIAMETER; AND (3) SINGLE-STEMMED SHRUBS SOMEWHAT RESEMBLING A SMALL TREE TWO OR THREE FEET IN HEIGHT. THE TREES, OTHER THAN THOSE OF THE GALLERY FORESTS, ARE USUALLY LOW-BRANCHING AND VERY GNARLED AND TWISTED. THE WOOD IS HARD AND BRITTLE WHILE THE BARK IS THICK, CORK-LIKE, AND EASILY FLAKED AWAY. THE CROWNS OF THE TREES ARE THIN AND SOMEWHAT UMBRELLA-LIKE IN SHAPE. THE LEAVES ARE STIFF AND LARGE, EITHER FELT-LIKE IN TEXTURE OR ROUGH AND WAXY AND DROOP SO THAT THEY AFFORD LITTLE SHADE FROM THE SUN. LIKE MUCH OF THE SAVANNA VEGETATION THEY ARE FIRE-RESISTANT. THE MOST COMMON SPECIES OF TREES ARE CURATELLA AMERICANA, BOWDICHIA VIRGILIODES, AND BYRSONIMA CROSSIFOLIA. WHERE THE TREES ARE IN CONSIDERABLE DENSITY, ALTHOUGH RARELY CLOSER THAN TEN TO TWENTY YARDS APART ON THE AVERAGE, THEY ARE REFERRED TO AS CHAPPARAL. THIS IS NOT THE SAME AS THE CHAPPARAL AS IT IS KNOWN IN THE SOUTHWESTERN PART OF THE UNITED STATES OR NORTHERN MEXICO. SUCH CONCEN-

TRATIONS ARE ORCHARD-LIKE OR PARK-LIKE IN APPEARANCE.

IN THE BRAZILIAN PLATEAU OR "PLAN ALTO" AREAS THERE ARE FAIRLY EXTENSIVE OPEN "WOODLANDS." THE REGIONAL TERM FOR THESE AREAS IS CAMPO CERRADO WHICH MEANS "CLOSE, DENSE OPEN COUNTRY." THE CONTRADICTION LIES IN THE LACK OF DENSE FOLIAGE OR SHADE BUT THE RATHER CLOSE PROXIMITY OF THE SCRUB TREES WHICH COMPRISE THE "WOODLAND." THE OVERALL LANDSCAPE OF THE INTERIOR OF THE BRAZILIAN PLATEAU TENDS TO PRESENT AN UNENDING, MONOTONOUS VIEW. THE DETAILS OF THE VEGETATION IS SOMEWHAT LOST IN THE SEEMINGLY ENDLESS EXPANSE. THE VEGETATION OF THE PLATEAU FALLS INTO FOUR GENERAL CLASSIFICATIONS: TREELESS SAVANNAS CALLED "CAMPOS LIMPOS," TREE SAVANNAS CALLED "CAMPOS CERRADOES," SCATTERED PALMS, AND FORESTS. WITHIN THESE GENERAL CLASSIFICATIONS ARE GRADATIONS WHICH ARE SIGNIFICANT FOR SURVIVAL. IT WILL BE NOTED THAT THE TERM "CAMPO" INCLUDES NOT ONLY GRASSLANDS BUT ALSO PREDOMINATING TREE FORMATIONS. IN THIS CONNECTION THE CAMPOS COINCIDES PARTICULARLY WELL WITH THE DESCRIPTIVE CHARACTERISTICS OF THE SAVANNA AS THEY HAVE BEEN DESCRIBED IN THIS MONOGRAPH. IN DETAILS THE DESCRIPTIVE ASPECTS OF THE CAMPOS ARE:

1. TREELESS SAVANNAS. THIS CLASSIFICATION INCLUDES TWO SUB-CLASSIFICATIONS: CAMPOS LIMPOS OR "CLEAN" SAVANNAS AND CAMPOS SUJOS OR "DIRTY" SAVANNAS. OBVIOUSLY, THE "CLEAN" SAVANNAS ARE ALMOST PURE GRASSLANDS. THE ONLY VARIATION IN SCENERY IS AN OCCASIONAL SINGLE FILE OF MORICHE OR BURITI PALMS LINING A STREAM. THE CAMPOS LIMPOS OFFER THE LEAST IN FOOD SOURCES EITHER VEGETABLE OR ANIMAL.

THE MOST CONSPICUOUS FEATURE TO BE SEEN ARE THE TERMITE MOUNDS. IN THE CAMPOS SUJOS, LOW HERBACIOUS SHRUBS DOMINATE THE LANDSCAPE. IN CONTRAST TO THE DRAB GRAYNESS OF THE CAMPOS LIMPOS, THE SHRUB-COVERED AREA IS GREEN. THE ROOT SYSTEMS OF THESE SHRUBS ARE FREQUENTLY TUBEROUS AND EDIBLE. THERE IS ALSO A GREATER VARIETY OF WILD LIFE, IF SOMEWHAT DIFFICULT TO CATCH, IN THE DENSITY OF THE SHRUBBERY. WARNING IS CITED REGARDING PRESENCE OF SNAKES, SPECIFICALLY THE RATTLE SNAKE CALLED "CASCAVEL," AND THE FER-DE-LANCE.

2. TREE-SAVANNA. EXTENSIVE AREAS ARE COVERED BY THE DROUGHT-RESISTANT SAVANNA TREES (CURATELLA AMERICUS, BOWDICIA VIRGILIOIDES, BYRSONIMA CRASSIFOLIA, ETC.). THERE ARE TWO GRADATIONS OF TREE-SAVANNAS; "CAMPO CERRADO" AND "CAMPO CERRADAO" (THE SUFFIX AO IN PORTUGUESE DENOTES THE SECOND DEGREE OF COMPARISON INDICATING A GREATER DEGREE OF A QUALITY.) THE CAMPO CERRADO IS THE SECOND MOST EXTENSIVE SAVANNA FORMATION IN THE PLATEAU; THE GRASSY PLAINS BEING THE MOST EXTENSIVE. THE TREES WHICH MAKE UP THE CERRADO ARE THE CHARACTERISTIC DROUGHT-RESISTANT, GNARLED AND CROOKED TREES OF THE

SAME FAMILIES OCCURRING IN THE NORTHERN SAVANNAS OF THE CONTINENT. IN ADDITION, THERE ARE VARIOUS SPECIES OF MIMOSA, ACACIA AND THORN TREE PRESENT.

THE TREES OF THE CERRADOS GROW TO AN AVERAGE HEIGHT OF FIFTEEN FEET. THE DENSITY IS CONSIDERABLY GREATER THAN THE ORCHARD FORMATIONS OF THE LLANOS BUT PERMIT EASY PASSAGE THE FLOOR OF THE CERRADO IS MOSTLY BARREN OR SUSTAINS A SPARSE UNDERGROWTH OF LOW SHRUB AND WIDELY SPACED, TUFTED GRASS. THE TREE SPACING, TOGETHER WITH THE DROOPING LEAVES, OFFER LITTLE SHADE. CONSEQUENTLY, NO RESPITE IS GAINED FROM THE HEAT OF THE SUN. IN FACT, THE CERRADO IS MORE EFFECTIVE AS A WIND SCREEN--A FEATURE HAVING BOTH GOOD AND BAD AFFECTS. WHILE THE BREEZE IS A COOLING AGENT DURING THE DAY IT IS ALSO FREQUENTLY QUITE STRONG AND CONSTANT AND AT NIGHT CAN BE VERY CHILLING.

A MORE BENEFICIAL ASPECT OF THE CERRADO IS THE INCREASE IN ANIMAL LIFE, PARTICULARLY PECCARY, ARMADILLOS, DEER, AGOUTI, AND COUNTLESS SPECIES OF BIRDS. THE MAJORITY OF THESE ANIMALS ARE TRANSIENTS FROM THE GREATER FOREST AREAS. AMONG THE MORE SINISTER VISITORS TO THE CERRADO ARE THE JAGUAR AND PUMA. THOUGH THESE BIG CATS GENERALLY AVOID MAN, THEY ARE

SOMETIMES UNPREDICTABLE. MANY SMALL FORMS OF ANIMAL LIFE ABOUND IN THE CERRADO AMONG THEM ARE THE RODENTS, VARIOUS REPTILES, AND AN INFINITE NUMBER OF INSECTS.

THE CAMPO CERRADAO DIFFERS FROM THE CERRADO MAINLY IN THE SIZE AND INTENSITY OF THE VEGETATION. THE DIFFERENCE IS DUE TO THE SUPPLY OF MOISTURE. WHERE CERRADOS ARE FOUND IN SEEMINGLY UNDIFFERENTIATED AREAS OF RAINFALL AND GROUND WATER IN RELATION TO THE GRASSLANDS, THE CERRADOES SHOW A MARKED PREFERENCE FOR AREAS OF GREATER WATER SUPPLY. CONSEQUENTLY, THEY ARE FOUND ALONG THE LOWER SLOPES OF THE RIVER VALLEYS OR QUITE FREQUENTLY AS AN INTERMEDIATE STAGE BETWEEN SAVANNA AND EVERGREEN FOREST. THE CERRADAO CONTAINS A TALLER (FIFTEEN TO THIRTY FEET) AND GREATER VARIETY OF TREES, AMONG THEM SEVERAL HARDWOODS. MORE IMPORTANT TO THE SURVIVAL SITUATION IS THE OCCURRENCE OF SEVERAL TYPES OF FRUIT AND NUT TREES. ANIMAL LIFE, TOO, TENDS TO REFLECT A GREATER INTENSITY AND INCLUDE SOME WHICH ARE FOUND IN THE RAIN FOREST BUT DO NOT VENTURE INTO THE OPEN SAVANNAS.

COMPARED TO THE RAIN FOREST, THE OVERHEAD FOLIAGE IS THIN, NOT MUCH GREATER THAN THE CERRADO, AND WITH THE ADDED MOISTURE AND

SUNLIGHT THE UNDERGROWTH BECOMES QUITE DENSE. PASSAGE THROUGH SUCH AREAS CAN BE DIFFICULT TO AN EXTENT THAT A MACHETE OR SIMILAR CUTTING PLADE WOULD BE VERY USEFUL. IN FACT, DENSITY OF THE CAMPO CERRADAO MAY BE SUCH AS TO FORCE A DETOUR AROUND ITS PERIMETER. NEVERTHELESS, IT IS AN AREA OF "BOUNTY" AND FULL ADVANTAGE SHOULD BE TAKEN OF ITS RESOURCES--KEEPING IN MIND TRAVEL DISTANCE BEFORE ANOTHER SUCH AREA OCCURS.

ONE ASPECT OF THE CERRADAO IS THE VALUE THAT THE REGIONAL INHABITANTS PLACE ON THE FERTILITY OF SUCH FORMATIONS. AS THE "FRONTIER" IS PROGRESSIVELY SETTLED, CERRADOES ARE AMONG THE FIRST AREAS TO BE SELECTED FOR CLEARING AND CULTIVATION.

3. SCATTERED PALMS. AS IN THE SAVANNAS OF THE NORTHERN REGIONS OF SOUTH AMERICA, THE PALMS ARE WIDELY DISTRIBUTED AND HIGHLY PRIZED AS A FOOD SOURCE. ALTHOUGH NOT AS DIVERSE IN EITHER VEGETATION OR ANIMAL LIFE BUT PERHAPS EVEN MORE IMPORTANT IN TERMS OF FOOD POTENTIAL IN RELATION TO SURROUNDING SPARSENESS OF THE LAND IS THE SCATTERED GROVES OF MORICHE PALMS (MAURITIA FLEXUOSA) AND SAVANNA PALMETOS (COPERNICIA CERIFERA). THE MORICHE PALMS, ALSO CALLED "AEDA," "MIRITI," AND "ITE," ARE

MOST USUALLY REFERRED TO IN THE LLANOS AS "MORICHALES." THE MORICHE PALM IS A MAINSTAY IN THE FOOD SUPPLY OF THE MATO GROSSO AND CHACO INDIANS AND TO THE INDIANS WHO RESIDE IN THE FOREST AREAS SURROUNDING THE LLANOS OF VENEZUELA AND COLOMBIA. THE SAVANNA PALMETO IS A STUNTED (SIX TO EIGHT FEET), FRIZZY PALM WHICH IS LOCATED THROUGHOUT ALL OF THE SAVANNAS OF SOUTH AMERICA.

AS IN THE NORTHERN SAVANNAS, THERE IS VERY LITTLE VARIATION EITHER IN SPECIES, ENVIRONMENTAL RELATIONSHIP, OR UTILIZATION. THE ONE EXCEPTION IS A COUSIN OF THE NORTHERN SAVANNA PALMETO (COPERNICIA TEXTUOSA). IN THE PLATEAU SAVANNAS, ESPECIALLY IN THE SOUTHERN MATO GROSSO AREA, THE PALMETO OR "CANDARAY" IS THE SPECIES COPERNICIA CERIFERA. THE CABBAGE OF THIS PALM HAS ALWAYS BEEN A STAPLE OF THE INDIAN DIET, NOT ONLY IN THE MATO GROSSO BUT IN THE GRAN CHACO AS WELL. LIKE ITS NORTHERN KIN IT IS ESSENTIALLY A DROUGHT-RESISTANT MEMBER OF THE PALM FAMILY; MOST OF THE OTHERS USUALLY BEING ASSOCIATED WITH AN ABUNDANCE OF WATER. IN ADDITION TO THESE PALMS MANY OF THE PALMS LISTED UNDER TROPICAL FOREST ARE FOUND IN ASSOCIATION WITH THE GALLERY FORESTS.

4. FORESTS. OF PRIMARY INTEREST IN THIS CLASS ARE THE EXTENSIVE GALLERY FORESTS EXTENDING FAR UP THE BROAD VALLEYS OF THE AMAZON'S GREAT TRIBUTARIES. THESE FORESTS REACH TOWARD THE OPEN SAVANNAS LIKE GREAT ARMS LYING BETWEEN THE LIMITING HEIGHTS OF THE CHAPADOES. WHERE LESSER TRIBUTARIES FAN OUT FROM A MAIN TRIBUTARY, THE GALLERY FOREST SHOOT OUT LIKE FINGERS ALONG THE BANKS OF THE STREAMS GRADUALLY TAPERING IN WIDTH AS THE WATER BECOMES INSUFFICIENT.

THE LOWER STRETCHES OF THE GALLERY FORESTS OFTEN REACH A WIDTH OF MORE THAN TWENTY-FIVE MILES. THE ENVIRONMENTAL ASSOCIATIONS ARE SUFFICIENTLY DISTRIBUTED AS TO MAINTAIN A RAIN FOREST STATE OF EQUILIBRIUM. THE PROBLEMS OF SUBSISTENCE ARE SIMILAR, FOR EXAMPLE: THE RELATIVE ABSENCE OF ANIMAL LIFE AT THE GROUND LEVEL IN THE PRIMARY ZONE; AND THE RICH ANIMAL LIFE BUT THE DIFFICULT PASSAGE ALONG THE LITTORAL.

IN THE UPPER STRETCHES THE GALLERY FORESTS ASSUME CERTAIN DISTINCTIVE FEATURES. THE CANOPY BECOMES SINGLE RATHER THAN THREE-STORIED, THE OVERHEAD FOLIAGE BECOMES LESS DENSE; EPIPHYTES GIVE WAY TO LIANES; LIFE IN GENERAL MOVES CLOSER TO THE GROUND AND SEEMS TO BE MORE INTENSE. THE UNDERGROWTH IS NOT CONFINED TO THE LITTORAL AS IN THE LOWER STRETCHES BUT INCREASES IN HEIGHT

AND DENSITY. IN MOST RESPECTS THE UPPER STRETCHES MORE NEARLY RESEMBLE THE "JUNGLE" OF POPULAR CONCEPTION. IN THE FINAL STAGES, THE TREES PETER OUT, SOMETIMES TO A SINGLE ROW OF BURITI PALMS (MAURITIA VINIFERA), OR MORICHE PALMS.

ONE OF THE MOST IMPORTANT FEATURES OF THE SAVANNAS IS THE DEGREE OF FREQUENCY WITH WHICH GALLERY FORESTS OCCUR IN THE SAVANNA AREAS. WHERE THERE IS SUFFICIENCY OF RAINFALL OR WHERE THERE ARE A NUMBER OF PERMANENT FLOWING RIVERS THESE FORESTS ARE FAIRLY EXTENSIVE. SUCH ARE THE CONDITIONS IN THE LLANOS OF THE RIOS APURE-GUAVIARE AREA. NEAR THE MOUNTAINS. THESE CONDITIONS ARE PREVAIL IN THE MATO GROSSO WHERE THE RIOS XINGU-TAPAJOS REGION MERGES INTO THE SOUTHERN FRINGES OF THE AMAZON RAIN FOREST ALONG THE RIO ARAGUAIA AND IN THE EASTERN PORTION OF THE BASIN OF THE RIO PARAGUAY. WHERE THESE GALLERY FORESTS ATTAIN A CONSIDERABLE WIDTH--SEVERAL HUNDRED FEET TO SEVERAL MILES--THE LIFE FORMS ARE AS INTENSIVE AND DIVERSE AS THOSE OF THE RAIN FOREST. THE VEGETATION AS WELL AS THE ANIMAL LIFE OF THE RIVER AND FOREST ARE FOR THE MOST PART A CONTINUATION OF THE RAIN FOREST.

IN SUMMARY, THE PLANT FORMATION OF THE SAVANNAS IS CHARACTERIZED BY THE PREDOMINENCE OF PERENNIAL BUNCH-GRASS AND SEDGES INTERSPERSED WITH OTHER HERBACIOUS PLANTS ESPECIALLY LOW SHRUBS OF TWO TO THREE FEET IN HEIGHT. THE CHARACTERISTIC SAVANNA TREES, LOW, CROOKED, AND GNARLED WITH THIN UMBRELLA-SHAPED CROWNS AND THICK, CORKY BARK, OCCUR SINGLE OR IN "ORCHARDS" BUT NEVER SO DENSE THAT PASSAGE THROUGH THEM IS SERIOUSLY HINDERED. NEARLY ALL PLANT LIFE IS ESSENTIALLY DROUGHT-RESISTANT AND IN MANY INSTANCES FIRE-RESISTANT.

MOST OF THE HERBS AND SHRUBS HAVE UNDERGROUND ROOT SYSTEMS SOME OF WHICH ARE TUBEROUS. SUCCULENTS, I.E., CACTUSES, OCCUR ONLY PERIPHERALLY MAINLY IN THE MOST ARID PORTIONS OF THE GRAN CHACO WHERE THORN FORESTS ALSO ARE FREQUENTLY PREVALENT. THE MOST IMPORTANT VEGETATION FOR SURVIVAL PURPOSES ARE THE PALMS, ALGARROBA TREES, AND THE TUBEROUS ROOT SYSTEMS OF SEVERAL OF THE SAVANNA HERBS.

FAUNA

THE ANIMALS FOUND IN THE SAVANNAS OF SOUTH AMERICA REPRESENT THREE DISTINCT ENVIRONMENTS: (1) THE TRUE INHABITANTS OF THE SAVANNAS, (2) THE FOREST ANIMALS THAT REGULARLY FORAGE IN THE SAVANNAS, AND (3) THE NUMEROUS LIFE FORMS THAT ARE ESSENTIALLY IN OR OF THE MAJOR RIVER SYSTEMS. CONSIDERING THE VAST AREA ENCOMPASSED BY THE THREE INTERRELATED ENVIRONMENTS, THERE IS SURPRISINGLY LITTLE SIGNIFICENT VARIATION IN THE FAUNA WITHIN EACH SEPARATE ENVIRONMENT. ALMOST ANY KIND OF ANIMAL FOUND IN THE FORESTS OF THE GUIANA HIGHLANDS WILL ALSO BE FOUND RANGING THROUGH THE FORESTS EXTENDING INTO THE MATO GROSSO. THE TENS OF THOUSANDS OF YEARS OF FLUVIAL INTERCHANGE BETWEEN THE MAJOR RIVER SYSTEMS HAVE PRODUCED A SIMILAR HOMOGENEITY IN THE AQUATIC LIFE. EVEN THE SAVANNAS WHICH ARE SEPARATED BY VAST EXPANSES OF FOREST SHOW LITTLE VARIATION IN THE COMPOSITION OF THE FAUNA THAT IS OBVIOUS TO ANY BUT THE TRAINED NATURALIST.

THE TRUE SAVANNA DWELLERS ARE FOUND AMONG THE INSECTS, SMALL RODENTS OF THE BURROWING VARIETIES, REPTILES, MOSTLY LIZARDS AND SNAKES; AND THE ANTEATERS, ONE OF THE LARGEST OF THE SOUTH AMERICAN ANIMALS. THE INSECTS ARE BY FAR THE PREDOMINANT FORM OF LIFE. MOST OF THEM ARE EQUALLY AT HOME IN OR IN ASSOCIATION WITH ALL THREE ENVIRONMENTS. SEVERAL OF THE INSECTS ARE IMPORTANT FOOD SOURCES

PARTICULARLY THE GRASSHOPPERS, LOCUSTS, BEES, FOR THEIR HONEY; GRUBS, BEETLES, AND THE ANTS, ESPECIALLY TERMITES. THE PESTS, SUCH AS THE MOSQUITOS, BLOODSUCKING FLIES, "PIUMS," "BORRACHUDAS," "MUTUCAS," WASPS, FLEAS, GNATS, ETC., HAVE BEEN DESCRIBED IN DETAIL IN THE SECTION DEALING WITH HEALTH AND HAZARDS OF THE TROPICAL FOREST. IN THE SAVANNAS MANY OF THESE INSECTS ARE FOUND CONCENTRATED ALONG THE RIVERS, STREAMS AND SWAMPY AREAS. THEY ARE PARTICULARLY OBNOXIOUS DURING THE LATE AFTERNOONS, PRECEDING A RAIN, AND DURING THE RAINY SEASON. IN ADDITION TO THE ABOVE PESTS, THE SAVANNAS CONTRIBUTE A HOST OF SPIDERS, MITES, AND FLEAS. BUT ONE REAL SCOURGE OF THE SAVANNAS ARE THE VARIOUS SPECIES OF TICKS (IXODIDAE) OR "GARRAPATOS." THEY ARE PARTICULARLY PREVALENT, LITERALLY BY THE MILLIONS, DURING THE DRY SEASON.

ONE OF THE MORE CONSPICUOUS AND CONSTANT FEATURE OF THE SAVANNAS THROUGHOUT SOUTH AMERICA ARE THE LARGE TERMITE MOUNDS. THE CONSTRUCTION AND MAINTENANCE OF THESE NESTS BY THE TERMITES OR WHITE ANTS (NASUTITERMES, SYNTERMES) ARE ONE OF THE OUTSTANDING FEATS OF NATURE. THE NESTS FURNISH BOTH A SOURCE OF FOOD AND A POSSIBLE SOURCE OF DANGER. USING SECRETIONS OF SALIVA MIXED WITH THE SANDY SOILS OF THE SAVANNAS, THE TERMITES CONSTRUCT A SHELL OF THE MOUND ALMOST AS HARD AND DURABLE AS CEMENT. THERE ARE GENERALLY TWO TYPES TO BE FOUND, THE ONE APPROXIMATELY TWO TO THREE FEET HIGH AND FIVE TO SIX FEET IN DIAMETER; THE OTHER IS IRREGULARLY SHAPED AND APPROXIMATELY TEN TO TWELVE FEET HIGH. AS A SOURCE OF FOOD THE PRIMARY ITEM IS THE TERMITES THEMSELVES. FREQUENTLY, OTHER INSECTS, LIZARDS, MICE, AND SNAKES MAKE USE OF THE SHELTER AFFORDED BY THE NESTS. WHEN EXPLORING THE FOOD POTENTIAL, SPECIAL CARE MUST BE EXERCISED--THE

CASCAVEL ARE ALSO OCCASIONAL BOARDERS.

OF THE SAVANNA MAMMALS, THE RODENTS ARE THE MOST NUMEROUS AND OF THESE THE MAJORITY ARE BY FAR THE BURROWING KIND. THEY ARE EXTREMELY ELUSIVE AND DIFFICULT TO CATCH AND EVEN THEIR BURROWS ARE QUITE DEEP. THE SAVANNA ANTEATER IS THE LARGEST OF THE SOUTH AMERICAN SPECIES WEIGHING NEARLY 100 POUNDS AND SOMETIMES RANGING UP TO 8 FEET IN LENGTH FROM NOSE TO THE TIP OF HIS LONG BANNER-LIKE TAIL. GENERALLY THE ANTEATER IS CONSIDERED A HARMLESS CREATURE BUT DEFENSIVELY THEY ARE VERY DANGEROUS. THEY REPORTEDLY CAN CRUSH A JAGUAR TO DEATH WITH THEIR POWERFUL ARMS. WHETHER THIS IS TRUE OR NOT THE FACT THAT THEY CAN BREAK OPEN THE SHELL OF A TERMITE NEST WITH A BLOW OF A PAW IS SUFFICIENT EVIDENCE OF THEIR STRENGTH. AMONG THE DEER OF SOUTH AMERICA ARE SEVERAL SPECIES CALLED "BROCKETS" OR "VEADO" IN BRAZIL. THE CAMPOS BROCKETS ARE SMALL, FLEET, ELUSIVE CREATURES TWO TO TWO AND ONE-HALF FEET HIGH. THEY ARE NOCTURNAL FEEDERS HOLING UP IN THE DAYTIME AMONG ROCK FORMATIONS OR IN DENSE THICKETS. WHEN PURSUED THEY COVER THE GROUND IN GREAT LEAPS. ALONG WITH THEIR COUSINS FROM THE FOREST THEY ARE THE OBJECTS OF INTENSIVE COLLECTIVE HUNTS BY THE INDIANS.

THE BIRDS COMPRISE A RATHER LARGE IF SOMEWHAT WARY PORTION OF THE SAVANNA FAUNA. MORE THAN 1500 SPECIES OF BIRDS HAVE BEEN IDENTIFIED IN SOUTH AMERICA OF WHICH MORE THAN 500 HAVE BEEN FURTHER IDENTIFIED IN THE CAMPOS OF BRAZIL. ALTHOUGH THERE ARE A NUMBER OF BIRDS SUCH AS QUAIL, PARTRIDGE, DOVE, TINAMOUS, PHEASANT, AND LARK WHICH ARE GENERALLY ASSOCIATED WITH OPEN AREAS, THE MAJORITY OF THE BIRDS FEED IN THE SAVANNAS BUT NEST IN THE FORESTS. HAWKS AND BUZZARDS ARE A COMMON SIGHT OVERHEAD. ONE OF THE MORE UNUSUAL BIRDS OF SOUTH

AMERICA IS THE RHEA, A FLIGHTLESS OSTRICH-LIKE BIRD OF THE PAMPAS, GRAN CHACO AND SOUTHERN AREAS OF THE CAMPOS. RANGING UP TO 100 POUNDS THE RHEA IS AN EXCELLENT SOURCE OF MEAT.

OF THE REPTILES OF SOUTH AMERICA, THE RATTLESNAKE (CROTALUS DURISSUS TERRIFICUS) CALLED "CASCAVEL" OR "CASCABEL" IS THE MOST DANGEROUS INHABITANT OF THE SAVANNAS. IT IS FOUND THROUGHOUT THE DRYER REGIONS EAST OF THE ANDES BUT RARELY UNDER NORMAL CONDITIONS IN THE RAIN FOREST OR IN WET MARSHY AREAS. ALTHOUGH CAPABLE OF SWIMMING, AS ARE MOST SNAKES, IT IS NOT OF AN AQUATIC NATURE. IN APPEARANCE THE CASCAVEL EXHIBITS THE CHARACTERISTIC DIAMOND-SHAPED PATTERNS OF MOST RATTLESNAKES. THESE ARE FORMED IN LIGHTER YELLOW COLORED SCALES FRAMING DARKER BROWN OR GRAY SOLID DIAMOND PATTERNS ALONG THE BACK AND SIDES. PARALLEL STRIPES EXTEND FROM THE HEAD AND THE CORNERS OF THE MOUTH BACK ALONG THE NECK FOR EIGHT TO TEN INCHES. THE CHARACTERISTIC "RATTLE" IS BOTH EVIDENT AND SOUND PRODUCING. IT RANGES IN LENGTH UP TO SIX FEET BUT AVERAGES LESS THAN FIVE FEET. THERE ARE SOME IN THE RUPUNUNI WHICH ARE SOMEWHAT SMALLER THAN THE AVERAGE AND ARE PROBABLY A DIFFERENT SUB-SPECIE. THERE IS SOME QUESTION ABOUT THE SOUNDING OF THEIR RATTLE. WHILE STILL CALLED A CASCAVEL IT IS DISTINGUISHED FROM THE LARGER SPECIE WHICH IS CALLED THE "BUSH" CASCAVEL.

BESIDES THE CASCAVEL ANOTHER DANGEROUS SNAKE IN THE SAVANNA IS THE FER-DE-LANCE CALLED THE "JARARACA." THE JARARACA IS PROBABLY THE MOST UBIQUITOUS OF THE SOUTH AMERICAN POISONOUS SNAKES AND IS FOUND IN THE FORESTS, SAVANNAS, AND CULTIVATED AREAS AS WELL. PARTICULAR CARE IS NECESSARY WHEN SEARCHING THE THICKETS AND BRUSH OR IN HOLES, ROCKS, BURROWS, AND ESPECIALLY TERMITE MOUNDS. OTHER

REPTILES INCLUDE NUMEROUS LIZARDS, TORTOISES, AND NON-POISONOUS SNAKES.

THE HABITS OF THE FOREST ANIMALS REFLECT THE SOMEWHAT TRANSIENT OR SECONDARY NATURE OF THEIR RELATIONSHIP WITH THE SAVANNA ENVIRONMENT. THE SEASONAL ASPECTS ARE ONE OF THE MAJOR INFLUENCES ON THE INTENSITY OF ACTIVITY. DURING THE RAINY SEASON THE ANIMALS REMAIN MOSTLY IN THE FOREST. FOLLOWING THE RAINY SEASON THE RIVERS AND STREAMS BEGIN TO RECEDE AND THE RIVERINE LIFE BECOMES CONCENTRATED IN RESIDUAL SWAMPS AND INTERMITTENT STREAMS. THE ANIMAL ACTIVITY INCREASES PROPORTIONATELY AMONG THE CARNIVOROUS ANIMALS ESPECIALLY THOSE THAT FEED ON THE RIVER ANIMALS. WHEN THE GRASSES, BERRIES, NUTS, AND OTHER SAVANNA VEGETATION BECOME EDIBLE, THE HERBIVORES AND INSECTIVORES INCREASE IN NUMBERS WHICH IN TURN AGAIN ATTRACTS THE PREDATORY CARNIVOROUS ANIMALS. AS THE SEASON OF DROUGHT REACHES ITS GREATEST INTENSITY MOST OF THE ANIMAL LIFE REVERTS TO THE FOREST LEAVING THE DEAD, OPEN GRASSLANDS, LIFELESS SCRUB TREES, BUSHES, AND PARCHED, BAKED EARTH TO THE INSECTS, LIZARDS, SNAKES, AND RODENTS THAT BURROW BENEATH IT, OR THE BIRDS THAT FLY ABOVE IT.

THE FOREST ANIMALS RARELY RANGE FAR FROM THE MARGINS OF THE FOREST. THIS IS ESPECIALLY TRUE IN THE CAMPOS AND THE LLANOS. IN THE RUPUNUNI WHICH IS NOT SO EXPANSIVE AND SUSTAINS A GREATER DENSITY OF TREES AND VEGETATION THE ANIMAL LIFE IS MORE ACTIVE. THE EXCEPTION TO THIS IS WHERE THE CATTLE RAISING ACTIVITIES TEND TO SCARE THE ANIMALS AWAY. IN THE CAMPOS WHERE THERE ARE EXTENSIVE AREAS OF CERADO OR CERADAO THE ANIMAL LIFE IS ALSO MORE ACTIVE.

THE MORE PESISTENT FORAGERS IN THE SAVANNAS ARE THE DEER AND ARMADILLOS THAT FREQUENTLY HOLE UP IN THE SAVANNA; CAVIES,

TAPIRS, AGOUTIS, PACA, PECCARY, AND THE BIG CATS, THE PUMAS AND JAGUARS. THESE ANIMALS ARE DESCRIBED AT LENGTH UNDER DATA PERTAINING TO FOOD AND HAZARDS OF THE TROPICAL FOREST. IN THE SAVANNAS THE INDIANS MOST USUALLY RESORT TO COLLECTIVE HUNTING TECHNIQUES FOR SUCH GAME BECAUSE OF THE DIFFICULTY OF STALKING IN THE OPEN AREAS. THE GAME IS DRIVEN TO WAITING HUNTERS OR INTO PREPARED TRAPS AND PITFALLS. ONE OF THE MORE COMMON METHODS OF DRIVING THE GAME IS BY FIRING THE GRASS. WHEN FIRING TAKES PLACE, USUALLY NEAR THE END OF THE DRY SEASON, THE HAZE FROM THE BURNING SAVANNAS ARE A COMMON SIGHT. THE INDIANS MOVE INTO THE BURNT OFF AREAS COLLECTING EVERY FORM OF LIFE THAT HAS BEEN "COOKED" BY THE FIRES. LITTLE IF ANYTHING IS CONSIDERED AS INEDIBLE.

ONE OUTSTANDING, AND FOR SURVIVAL PURPOSES, UNFORTUNATE ASPECT OF THE ANIMAL LIFE OF THE SAVANNAS IS THE ELUSIVE OR APPARENT ABSENCE OF IT. FOR ONE THING, THE OPEN NATURE OF THE TERRAIN AFFORDS THE ANIMALS A CONSIDERABLE ADVANTAGE. MOST OF THEM ARE BELOW THE LEVEL OF THE VEGETATION WHEREAS A MAN STANDING ABOVE IT IS EASILY SIGHTED. SECONDLY, ANIMAL ALARMS HAVE A CONTAGIOUS EFFECT SO THAT THE REACTION OF A BIRD OR EVEN A GRASSHOPPER IS SUFFICIENT TO WARN ALL THE OTHER ANIMALS IN THE VICINITY. ONE OF THE SHRILLEST AND ANNOYING SOUNDS OF THE CAMPOS IS MADE BY A PARTICULAR GRASSHOPPER. AS AN INDIVIDUAL MOVES IN AN AREA THE SILENCE IS PARTICULARLY NOTICEABLE BUT IF ONE REMAINS MOTIONLESS FOR A PERIOD THE "RACKET" PICKS UP AGAIN. THE HUNTING TECHNIQUES OF THE INDIANS, THE MANY HOURS SPENT IN HUNTING, OFTEN FROM MORNING TO NIGHTFALL, AND THE FREQUENT FAILURE TO FIND ANY SIZABLE GAME REFLECTS THE SCARCITY AND DIFFICULTY OF CAPTURING GAME. VERY FREQUENTLY THE EVENING MEAL OF AN INDIAN FAMILY WILL CONSIST OF

THE GRASSHOPPERS, BEETLES, GRUBS, BERRIES, FRUITS, AND NUTS THAT THE WOMAN HAS GATHERED WHILE HER HUSBAND WAS HUNTING.

THE TOTAL ENVIRONMENT COMPOSITION OF THE RIVERS, STREAMS, POOLS, PONDS, SWAMPS, AND BOGS OFFERS THE RICHEST AND MOST RELIABLE SOURCE OF SUSTENANCE WITHIN THE SAVANNAS. IT IS NECESSARY, HOWEVER, TO QUALIFY THE FOREGOING STATEMENT BY POINTING OUT THE EFFECTS OF CLIMATE AND TOPOGRAPHY ON THE DISPERSION OF THE WATERS AND THE DISTRIBUTION OF AQUATIC FAUNA AND LAND ANIMALS AND BIRDS WHICH FEED UPON THEM.

DURING THE RAINY SEASON THE RIVERS AND STREAMS OVERFLOW INUNDATING THE ADJACENT AREAS FOR MILES ON EITHER SIDE. THE ANIMAL LIFE TOO IS SPREAD OUT THROUGH THE FLOODED AREAS. AT SUCH TIMES CATCHING FISH AND OTHER WATER ANIMALS PRESENTS SEVERAL PROBLEMS. FOR ONE, THE FISH ARE WIDELY DISPERSED AND ARE AFFORDED AN ABUNDANT SOURCE OF FOOD FROM THE FLOOD LAND VEGETATION, MAKING THEM LESS SUSCEPTIBLE TO BAIT FISHING. ANOTHER PROBLEM IS THE PERIPHERAL MARSHY AREAS THROUGH WHICH ONE MUST WADE TO GET TO MOVING WATERS WHERE MOST OF THE FISH ARE. ALSO ASSOCIATED WITH THE PERIPHERAL MARSHES AND THE WADING IS THE DANGER FROM THE VARIOUS HARMFUL ANIMALS LISTED BELOW.

DURING THE PERIODS OF DROUGHT WHEN THE WATER OF THE RIVERS, STREAMS, AND SWAMPS BECOME GREATLY REDUCED IN VOLUME THEY BECOME CONCENTRATED WITHIN THEIR BEDS. DURING THE EARLY PERIODS AS THE STREAMS BEGIN TO DRY UP, THE UNDULATIONS OF THE LAND CAUSES INTERMITTENT STOPPAGE OF FLOW. THE FISH AND OTHER AQUATIC LIFE FORMS BECOME ISOLATED AND TRAPPED IN THE DIMINISHING NON-FLOWING POCKETS OF WATER. AT SUCH TIMES THE WATER TEEMS WITH ACTIVITY UNTIL THE GREATER PART OF THE FAUNA FINALLY DIE. FISH ARE FOUND BY THE THOUSANDS LYING ON

THE MUD FLATS ALONG THE RIVERS AND STREAMS OR SURROUNDING THE SWAMPS. THE LIFE STILL REMAINING CONTINUE TO PREY UPON EACH OTHER. ALSO, THE LAND ANIMALS AND BIRDS CONGREGATE IN GREATER NUMBERS IN THE VICINITY OF THE RECEDING WATER, TAKING ADVANTAGE OF THE EASY ACCESS TO FOOD.

AT SUCH TIMES, ALTHOUGH THE FOOD-GETTING PROSPECTS ARE GREATLY INCREASED, THERE IS ALSO AN EVER INCREASING THREAT FROM THE CONCENTRATION OF THE MORE DANGEROUS TYPE OF RIVER INHABITANTS, NAMELY; THE CAIMAN AND CROCODILES, THE PIRANHA WHICH BECOME ESPECIALLY VICIOUS IN CONCENTRATED AREAS, STING RAYS AND ELECTRIC EELS; JAGUARS WHICH ARE PREYING UPON THE LESSER PREDATORS, AND POISON SNAKES WHICH REMAIN ON THE PERIPHERY ALSO TAKING ADVANTAGE OF THE CONCENTRATED FOOD PROSPECTS. AGAIN, THE DANGER INVOLVED IS NOT SO MUCH THAT OF BEING DELIBERATELY ATTACKED AS THAT OF COMING UNEXPECTEDLY UPON SUCH ANIMALS WHICH IN TURN REACTS DEFENSIVELY.

AS THE PERIOD OF DROUGHT REACHES THE STAGE OF EQUILIBRIUM, THE ANIMAL LIFE SURROUNDING THE WATER SOURCES BECOMES MORE SCARCE. THE TURTLE AND CAIMAN FREQUENTLY BURROW DEEP INTO THE MUD AND REMAIN IN A TORPID STATE OF SEMI-HIBERNATION. OTHERWISE, THEY MIGRATE TO AREAS OF MORE PERMANENT WATER. THE FOREST ANIMALS RETREAT TO THE MORE ABUNDANT AREAS OF FOOD WITHIN THE FORESTS.

CHAPTER VIII

REGIONAL DESCRIPTION

THE LLANOS OF VENEZUELA AND COLOMBIA

DISTRIBUTION. THE MOST EXTENSIVE SAVANNA NORTH OF THE AMAZON ARE THE LLANOS OF VENEZUELA AND SOUTHEASTERN COLOMBIA. THE LLANOS FORM A GREAT ARC BOUNDED ON THE NORTH AND WEST BY THE COASTAL RANGE AND THE EASTERN CORDILLERA, ON THE EAST AND SOUTH BY THE ORINOCO DELTA AND THE WEST-EAST COURSE OF THE RIO ORINOCO AS IT FOLLOWS THE BASE OF THE GUIANA HIGHLANDS; AND THE NORTHEAST COURSE OF THE RIO GUAVIARE WHICH RISES IN THE ANDES AT APPROXIMATELY 75°W-2°N AND FLOWS NORTHEAST TO APPROXIMATELY 68°W-4°N WHERE IT JOINS THE RIO ORINOCO. IN ALL, IT ENCOMPASSES MORE THAN 200,000 SQUARE MILES. ALONG ITS ENTIRE SOUTHERN EXTREMITY IT MERGES WITH THE VAST GUIANA-AMAZON RAIN FOREST AND ON THE WEST THE ANDES DESCEND ABRUPTLY TO THE PLAINS WITH ONLY SLIGHT EVIDENCE OF FOOTHILLS.

RELIEF AND DRAINAGE. THE MAJOR PHYSIOGRAPHIC FEATURE OF THE ENTIRE LLANOS IS THE RIO ORINOCO ITSELF. EXCEPT FOR TWO RELATIVELY MINOR DRAINAGE SYSTEMS IN THE NORTHEASTERN PART OF THE REGION, THE RIO ORINOCO IS THE MAIN ARTERY OF THE ENTIRE DRAINAGE SYSTEM OF THE ORINOCO BASIN.

THE RIVER IS FREQUENTLY DESCRIBED IN TWO OR THREE DIVISIONS SOMEWHAT ARBITRARILY SEPARATED ACCORDING TO NAVIGATIONAL CAPABILITIES OR DIRECTION OF FLOW. ONLY THE TWO DIVISIONS, CALLED THE UPPER

ORINOCO AND LOWER ORINOCO, SERVE AS THE FRAME OF REFERENCE FOR THE DESCRIPTIVE DATA THAT FOLLOWS.

THE UPPER ORINOCO STRETCHES FROM APPROXIMATELY 62°W-2°N IN THE SIERRA DE PARIMA TO THE JUNCTION OF THE RIO META, A DISTANCE OF MORE THAN 400 MILES. IT RISES AS A TINY BROOK PERHAPS ONE STEP WIDE BUT SOON BECOMES A RUSHING MOUNTAIN STREAM FED BY NUMEROUS OTHER TINY MOUNTAIN STREAMS AND THE TORRENTIAL RAINS OF THE REGION. BETWEEN 66° TO 67°W AND 3° TO 4°N, THE RIVER ENTERS A RELATIVELY LEVEL REGION. WITHIN THIS STRETCH THE RIVER IS CONNECTED WITH THE AMAZON RIVER SYSTEM THROUGH THE CASIQUIARE CANAL INTO THE RIO NEGRO. DURING THE RAINY SEASON THERE ARE SEVERAL INTERCONNECTING WATERWAYS BUT ONLY THE CASIQUIARE IS PREDICTABLE AND CARRIES WATER DURING THE DRY SEASON. EVEN DURING THE DRY SEASON TRAVELERS FREQUENTLY PREFER TRAVELING OVER-LAND BECAUSE OF THE MEANDERING CHARACTER OF THE CANAL.

THE FIRST MAJOR TRIBUTARY OF THE RIO ORINOCO IS THE RIO VENTUARI FLOWING WESTWARD FROM THE GUIANA HIGHLANDS. AT THE CONFLUENCE OF THE TWO RIVERS, THE SURROUNDING AREA IS LOW AND SWAMPY AND IS CALLED THE VENTUARI DELTA. FROM THIS POINT THE RIO ORINOCO FLOWS WEST TO THE SMALL RIVER TOWN OF SAN FERNANDO DE ATABAPO ($67^{\circ}45'$W-$4^{\circ}10'$N) WHERE TWO MAJOR RIVERS ENTER THE GUAVIARE FLOWING NORTHEASTERLY FROM THE ANDES THROUGH THE <u>LLANOS</u>, AND THE ATABAPO FLOWING NORTH THROUGH THE TROPICAL RAIN FOREST EXTENDING FROM THE AMAZON. THE FOREST AREAS SUR-ROUNDING THE JUNCTION OF THE THREE RIVERS IS SUBJECT TO INTENSE FLOODING PERIODICALLY. DENSE TROPICAL FORESTS COVER THIS ENTIRE REGION IS THE SEVERAL SPECTACULAR GRANITE MASSES WHICH RISE ABRUPTLY FROM THE SURROUNDING FOREST. THE MORE PROMINENT OF THESE ARE THE CERRO DUIDA ($65^{\circ}35'$W-$3^{\circ}20'$N) AND THE CERRO MARAHUACA ($65^{\circ}25'$W-$3^{\circ}35'$N)

WHICH RISE TO HEIGHTS OF OVER 8,000 FEET.

FROM THE JUNCTION OF THE RIO GUAVIARE, THE RIO ORINOCO FLOWS DUE NORTH FOR MORE THAN 150 MILES TO THE CONFLUENCE OF THE RIO META. IN THE UPPER COURSE BETWEEN THE JUNCTION OF THE CASIQUIARE AND THE RIO SIPAPO ($67^{\circ}50'$W-$5^{\circ}15'$N) THE RIVER IS NAVIGABLE FOR PASSENGER AND CARGO LAUNCHES. MUCH OF THE TRAFFIC IN THIS PORTION OF THE RIVER COMES FROM THE AMAZON THROUGH THE RIO NEGRO-CASIQUIARE SYSTEM. BELOW THE RIO SIPAPO, A SERIES OF RAPIDS EFFECTIVELY BAR CONTINUOUS NAVIGATION. CARGO MUST BE RELAYED OVERLAND FOR TRANSSHIPPING ABOVE OR BELOW THE RAPIDS. PASSENGERS, UNLESS THEY DESIRE TO RISK THE HAZARDS OF "SHOOTING" THE RAPIDS BY DUGOUT, ALSO TRAVEL OVERLAND. THE FIRST OF THESE RAPIDS TO BE ENCOUNTERED ARE NAMED THE "MAIPURES," THE NAME OF AN INDIAN TRIBE OF THE REGION NOW MORE OR LESS EXTINCT. THE "RAUDAL DE MAIPURES" DESCEND OVER FOUR MILES THROUGH HIGH GRANITE CLIFFS, HUGE BOULDERS, DIVERSE CHANNELS, SUBMERGED REEFS AND SHELVES. BELOW THE MAIPURES, THE RIVER COURSES THROUGH A SERIES OF LESSER RAPIDS BEFORE REACHING THE "RAUDAL DE ATURE" ANOTHER EQUALLY TREACHEROUS STRETCH OF RAPIDS AND ALSO BEARING AN INDIAN NAME. ONCE THE ATURES HAVE BEEN BY-PASSED, NAVIGATION RESUMES ON THE ORINOCO WITH ONLY ONE SERIOUS INTERRUPTION IN ITS MIDDLE COURSE WHERE EL PASO DEL INFIERNA POSES A THREAT.

THE UPPER COURSE OF THE RIO ORINOCO RECEIVES THE FLOW OF SEVERAL LARGE RIVERS CROSSING THE LLANOS. THE RIOS GUAVIARE, VICHADA, TOMO, MESETA, AND GUARIPA ARE ALL PERMANENT FLOWING RIVERS.

THE REGION THROUGH WHICH THE MAIN RIVER FLOWS IS ALTERNATELY FORESTED OR HAS LLANOS ALONG ITS LEFT BANK WHILE THE RIGHT BANK IS ENGULFED BY DENSE RAIN FOREST EXTENDING INTO THE GUIANA HIGHLANDS.

During the rainy season the waters rise thirteen to fifteen feet flooding the surrounding areas.

The Lower Orinoco begins a short distance south of the confluence with the Rio Meta. Puerto Ayacucho ($67^{\circ}40'$W.-$5^{\circ}40'$N) is the main transfer point for overland transshipment of goods around the rapids dividing the upper and lower stretches of the river. This stretch of river from the confluence of the Rio Guaviari to the Rio Apure, another 150 miles north of the rapids, is frequently called the "middle" Orinoco. At the Rio Apure junction the main river swings to the east following the curviture of the Guiana Highlands. Dense rain forests extend along the entire length of the right bank of the river. Along the left bank, or west and north bank, the <u>llanos</u> predominate although strips of forest of varying density and compositions extend from several feet to several hundred feet into the lowland plains.

Between the Rio Meta and the Rio Apure, the Rio Orinoco is approximately 2,000 yards in width. The current though not sluggish is not so swift as in its upper course. Several larger streams and numerous small feeders continue to flow into the river from either side. At the confluence of the Rio Apure, the Rio Orinoco broadens approximately to 4,300 yards during the dry periods and to more than 12,000 yards during the rainy season. The volume becomes so great that the flow from the several fairly large rivers of the Guiana Highlands, namely; the Rios Cuchivero, Caura, and Caroni have little visible effect.

Numerous islands appear. Some are permanent; many are exposed only during the dry season. Channels are being continually created,

FLOODED AWAY, AND NEW ONES RECREATED BY THE FLUCTUATION OF THE WATER HIGHS AND LOWS CAUSED BY SEASONAL CHANGE. DURING THE DRY SEASON, MOST OF THE MEANDERING SIDE CHANNELS DRY UP SO THAT EVEN BOATS OF SHALLOW DRAFT CANNOT BE USED. DURING THE RAINY SEASON, THE CURRENT BECOMES QUITE SWIFT. MANY WHIRLPOOLS ARE CREATED, PARTICULARLY WHERE HIGH BANKS CONFINE THE RIVER TO ITS PERMANENT BED. ONE SUCH AREA OF ESPECIAL IMPORTANCE IS "EL PASO DE INFIERNO," LITERALLY "THE PASSAGE OF HELL," LOCATED SEVERAL MILES EAST OF MAPIRE ($64^{\circ}45'$W-$7^{\circ}50'$N). THE RIVER MAKES AN ACUTE ANGLE IN ITS COURSE AT THIS POINT AND ENTERS A NARROWING CHANNEL. THE FLOW IS FURTHER CONSTRICTED BY A LARGE ISLAND IN THE MIDDLE OF THE RIVER. THE BED OF THE RIVER IS FILLED WITH ROCKS CLOSE TO THE SURFACE. DURING THE RAINY SEASON, THE PASSAGE AROUND THE WEST SIDE OF THE ISLAND IS IMPASSABLE AND THE FLOW OF WATER IN THE EAST CHANNEL IS FROM TWELVE TO FIFTEEN MILES PER HOUR. AS A RESULT THE UPBOUND BOATS MUST OFTEN BE WINCHED THROUGH THE "INFIERNO" BY THE USE OF ROPES AND TREES ALONG THE BANKS.

CUIDAD BOLIVAR ($63^{\circ}40'$W-$8^{\circ}20'$N) IS THE MOST IMPORTANT CITY ON THE RIO ORINOCO. IT IS A TRANSSHIPPING POINT FOR GOODS THROUGHOUT THE ORINOCO RIVER SYSTEM AND MAINTAINS TRADE-ROUTE CONNECTION BOTH LAND AND WATER WITH BARCELONA ON THE NORTH COAST, BOGOTA THROUGH SAN FERNANDO DE APURE AND THE AMAZON THROUGH SAN FERNANDO DE ATABAPO AND THE CASIQUIARE-RIO NEGRO SYSTEM.

BELOW BARANCAS THE RIO ORINOCO SPREADS THROUGH MANY CHANNELS INTO THE ORINOCO DELTA. THE TIDES FROM THE ATLANTIC ARE FELT WELL ABOVE BARANCAS AND CONTRIBUTE TO THE CONSIDERABLE RISE OF FORTY TO FIFTY FEET AT CUIDAD BOLIVAR DURING THE RAINY SEASON (APRIL TO AUGUST

AND NOVEMBER). DURING THIS PERIOD MUCH OF THE LOW-LYING AREAS ARE FLOODED FOR SEVERAL MILES BEYOND THE MAIN RIVER CHANNEL. AT SUCH TIMES THE RIVER APPEARS TO BE A LARGE LAKE RATHER THAN A RIVER.

WITHIN THE PAST DECADE, TRAFFIC ON THE RIO ORINOCO AND ITS TRIBUTARIES PARTICULARLY THE RIO APURI AND THE RIO META HAS INCREASED TREMENDOUSLY. THE TWO MOST SIGNIFICANT CAUSES FOR THE INCREASE OF RIVER TRAFFIC IS THE DEVELOPMENT OF CATTLE RAISING INDUSTRY AND MINING. IRON ORE BOATS NOW MAKE REGULAR PASSAGE ON BOTH THE UPPER AND LOWER COURSES OF THE RIVER TRANSSHIPPING AROUND THE MAIPURE AND THE ATURES RAPIDS BY ROAD AND RAIL.

NORTH OF THE RIO APURE AND THE WEST-EAST COURSE OF THE RIO ORINOCO, THERE ARE THREE DISTINCT DRAINAGE SYSTEMS. IMMEDIATELY WEST OF THE ORINOCO DELTA THE STREAMS FLOW TO THE NORTHEAST DRAINING INTO THE DELTA CHANNELS OR DIRECTLY INTO THE GULF DE PARIA. THERE ARE SIX MAJOR STREAMS WITH NUMEROUS SMALL BRANCHES AND TRIBUTARIES OF WHICH FIVE ARE NAVIGABLE TO SMALL CRAFT BUT ONLY ONE OF WHICH SUSTAINS SOME COMMERCIAL TRAFFIC. THESE RIVERS ARE THE URACOA, MORICHAL, TIGRE, GUANIPA, AMANA AND THE GUARIPICHE. DURING THE DRY SEASON, THE WATER IN THESE STREAMS CONTINUE TO FLOW BUT IN SOME STRETCHES THE FLOW IS REDUCED TO A MERE TRICKLE. THEY ARE CHARACTERISTICALLY MEANDERING AND FILLED WITH SAND SPITS, SUBMERGED LOGS, AND NUMEROUS SHARP TURNS. ON THE EAST, THE LLANOS IN THIS AREA MERGE WITH THE SWAMP AREAS OF THE DELTA. TOWARD THE WEST THE LAND RISES GENTLY UNTIL IT REACHES AN ELEVATION OF ABOUT 600 TO 700 FEET. IN THE VICINITY 65°-66°W AND $8^{\circ}40'$N, THE LAND FORMS AN ALMOST IMPERCEPTIBLE DIVIDE BETWEEN THE THREE DRAINAGE SYSTEMS. THE RIO UNARE WITH ITS NUMEROUS TRIBUTARIES WHICH FLOWS NORTHWARD INTO THE CARIBBEAN SEA FORMS THE

SECOND DRAINAGE SYSTEM. THE MAIN TRIBUTARIES OF THE RIO UNARE ARE THE RIOS CHAPARRITO, TAMANACO, TUCUPIDO, IPIRE, GUANAPE, GUARIBE, AND ARAGUA WHICH IN TURN ARE FED BY NUMEROUS SMALL STREAMS. THEY ARE DRAINED BY THE RIO UNARE SYSTEM AND ARE SUBJECTED TO INTENSIVE FLOODING DURING THE RAINY SEASON. THE THIRD DRAINAGE SYSTEM IS THAT OF THE RIO ORINOCO. FROM THIS AREA ON TOWARD THE WEST AND THE SOUTH, ALL OF THE RIVERS AND STREAMS CROSSING THE LLANOS EVENTUALLY EMPTY INTO THE RIO ORINOCO.

THE LLANOS EXHIBIT A GENERAL UNIFORMITY OF ROLLING, OR UNDULATING PLAINS. IN THIS NORTHEASTERN PORTION THERE ARE EXTENSIVE, GRASSY TABLE LANDS WITH SHARPLY DEFINED, ESCARPED RIMS CALLED "MESAS." THESE MESAS, OCCURRING IRREGULARLY, DO NOT RISE MORE THAN SEVERAL FEET ABOVE THE LEVEL OF THE LAND BUT THEY ARE NOTABLE FOR THEIR EXTREME FLATNESS UNINTERRUPTED BY STREAMS AND NEAR ABSENCE OF TREES. IN CONSTRAST, THE LLANOS SURROUNDING THE MESAS ARE INCISED BY NUMEROUS "QUEBRADAS" OR DRIED-UP STREAM BEDS WHICH BECOME FILLED AND OVERFLOW DURING THE RAINY PERIODS INUNDATING THE AREAS BETWEEN THE MESAS. THIS AREA COMPRISES MOST OF THE STATE OF GUARICO IN VENEZUELA.

BETWEEN THE RIO PAO AND THE RIO APURE, THE DRAINAGE SYSTEM FORMS A HUGE FAN-SHAPED ARC FROM EAST TO WEST. THOSE ON THE EAST DRAIN SOUTHWARD INTO THE RIO ORINOCO. TOWARD THE WEST, THE RIVERS DRAIN SOUTHEASTERLY AND FINALLY DIRECTLY EAST FOLLOWING THE CURVITURE OF THE COASTAL RANGE AND EASTERN SLOPES OF THE ANDES FROM WHICH THEY FLOW. THE MAIN RIVERS ARE THE PAO, SUATA, IGUANA, MANAPIRE, GUARICO, GUANAUTA, AND THE PORTUGUESA, THE LATTER BEING A MAJOR TRIBUTARY OF THE RIO APURE. ALL OF THE ABOVE RIVERS HAVE AN EXTENSIVE NETWORK OF TRIBUTARIES, HOWEVER, ONLY THOSE NAMED SUSTAIN A

PERMANENT FLOW OF WATER AND EVEN THESE EXCEPT FOR THE RIO PORTUGUESA ARE QUITE LOW DURING THE DRY SEASON.

THE TERRAIN THROUGHOUT MOST OF THIS PORTION OF THE LLANOS IS FLAT, DRAB AND MONOTONOUS. IT IS SUBJECTED TO FLOODING DURING THE RAINS AND GREAT SHEETS OF WATER FILL THE DEPRESSIONS WHICH ARE CALLED "ESTEROS." THIS IS ONE OF THE POOR AREAS FOR CATTLE NOT ONLY BECAUSE OF THE INUNDATION BUT ALSO BECAUSE OF THE SCOURGE OF THE INSECTS, PARTICULARLY THE FLY WHICH DEPOSITS ITS EGGS UNDER THE SKIN OF THE CATTLE CAUSING EXTENSIVE INFECTIONS--THIS FLY IS NOT ADVERSE TO USING AN AVAILABLE HUMAN FOR THE SAME PURPOSE.

THE WESTERN-MOST PART OF THE LLANOS OF VENEZUELA ARE OFTEN REFERRED TO AS LLANOS ALTO (HIGH LLANOS) AS COMPARED TO THOSE TO THE EAST CALLED THE LLANOS BAJOS (LOW LLANOS). THEY ARE ALSO IDENTIFIED FREQUENTLY BY THE NAME OF THE STATE IN WHICH THEY ARE LOCATED, E.G., "LLANOS DE BARINAS." THEY LIE ALONG THE BASE OF THE COASTAL RANGE AND EASTERN SLOPE OF THE ANDES. THE RIVERS AND STREAMS DRAINING THE BARINAS LLANOS ARE ALL TRIBUTARIES OF THE RIO APURE. THE MAIN RIVERS, EACH HAVING A NETWORK OF TRIBUTARIES, ARE THE RIOS MASPARRO, PAGUEI, CANAGUA, SURIPA, CAPARO, AND URIBANTE.

THE RIO APURE VIES WITH THE RIO META FARTHER SOUTH AS THE MOST IMPORTANT TRIBUTARY OF THE RIO ORINOCO. WITH ITS EXTENSIVE DRAINAGE SYSTEM WHICH INCLUDES THE RIO PORTUGUESA, IT IS ONE OF THE MAJOR RIVERS OF SOUTH AMERICA. AS A WESTERN EXTENSION OF THE RIO ORINOCO, ITS NAVIGATIONAL POTENTIAL COULD BE A MAJOR AVENUE FOR COMMERCE BETWEEN THE LLANOS AND THE REGIONS TO THE WEST. IT DOES CONNECT WITH THE IMPORTANT PASSES OVER THE EASTERN CORDILLERA. DURING THE RAINY SEASON, THE TRIBUTARIES OF THE RIO APURE OVERFLOW AND EXTEND

OVER WIDE AREAS. THE BANKS OF THE RIVERS ARE CONTINUALLY CHANGING BEING CUT AWAY AND REFORMING WHERE NEW DEPOSITS ARE BUILT UP. THE RIO PORTUGUESA WHICH COULD BECOME A TRAFFICABLE RIVER MEANDERS SO THAT THE CHANNEL IS OFTEN COMPLETELY LOST IN THE WIDESPREAD FLOODING OF THE SURROUNDING AREA.

THE RIOS APURE, META, TOMA, VICHADA, AND GUAVIARE, ALL OF WHICH DRAIN THE EASTERN SLOPES OF THE ANDES, EACH HAVE AN EXTENSIVE NETWORK OF TRIBUTARIES. LIKE THE RIO APURE, THE RIO META HAS A POTENTIAL OF BECOMING ONE OF THE MORE IMPORTANT COMMERCIAL AVENUES OF SOUTH AMERICA. THE RIVERS HAVE EXTENSIVE FLOOD PLAINS OVER WHICH THEY SPREAD DURING THE RAINY SEASONS. THE FLOODING IS MORE WIDESPREAD AND LONGER LASTING IN THE LOWER COURSES--ESPECIALLY APPROACHING THE RIO ORINOCO.

THE LLANOS OF THE ABOVE RIVERS ARE LESS FLAT TOWARD THE WEST AND PRESENT SOME DIFFICULT TERRAIN TO TRAVEL. AMONG THE FEATURES OF THIS AREA ARE THE "SURALES," A PECULIAR NETWORK OF DITCHES, SURROUNDING RAISED MOUNDS SEVERAL FEET APART. USUALLY THE DITCHES ARE PARTIALLY FILLED WITH STAGNANT WATER CAUSING A THICK MUCK TO FORM. IN TRAVELING THROUGH SUCH AN AREA THE INDIVIDUAL EITHER WADES THROUGH THE DITCHES OR ATTEMPTS THE TIRING FEAT OF JUMPING FROM MOUND TO MOUND IF SPACING PERMITS.

ANOTHER FEATURE OF THE REGION IS THE "SERRANIAS," LITERALLY MOUNTAIN RIDGES. ACTUALLY, THEY HAVE NOT THE HEIGHT THAT THE NAME IMPLIES, HOWEVER, THEY DO EXHIBIT THE STEEP SLOPES AND "HOG BACKS" WITH THE INTERLYING VALLEYS FREQUENTLY INUNDATED. WITHIN THE VALLEYS, STANDS OF TREES, INCLUDING THE PALMS ARE FREQUENTLY FOUND. FARTHER TO THE EAST WHERE THE LLANOS BECOME FLAT AND MORE POORLY DRAINED

LARGE ESTEROS ARE FORMED IN THE BAJOS OR LOWLANDS.

CLIMATE. THE CLIMATE OF THE LLANOS IS DISTINCTLY TROPICAL WITH THE WET SEASON "INVIERNO" AND THE DRY SEASON "VERANO" CONTRASTING MOST SIGNIFICANTLY. THE ANNUAL TEMPERATURES SHOW LITTLE SEASONAL VARIATION, AVERAGING BETWEEN 75° TO 85°F. HOWEVER, THESE STATISTICS DO NOT REFLECT THE INTRA-REGIONAL VARIATION DUE TO LOCAL TOPOGRAPHY NOR DO THEY INDICATE THE CONSIDERABLE RANGE IN DAILY FLUCTUATIONS. FOR THE MOST PART, THE TEMPERATURE IS UNCOMFORTABLY HOT ESPECIALLY WHEN EXPOSED DIRECTLY TO THE SUN. DURING THE HOTTEST PART OF THE DAY, MOST ACTIVITY CEASES.

IN THE NORTHEASTERN PORTION OF THE LLANOS, THE TEMPERATURE AVERAGES 85°F. THE DAILY RANGE IS FROM THE LOW 70°S IN THE EARLY MORNING HOURS TO THE MIDDLE 90°S AT NOON. THE HIGHER TEMPERATURES PERSIST THROUGH MOST OF THE DAY WITH A COOLING PERIOD BECOMING NOTICEABLE FAIRLY LATE AT NIGHT. TO AN EXTENT THIS AREA IS INFLUENCED BY THE NORTHEAST TRADES TENDING TO REDUCE THE TEMPERATURES BUT ALSO CREATING A DRYING AFFECT WHICH QUICKLY EVAPORATES WHAT LITTLE RAIN FALLS DURING THE DROUGHT PERIOD.

FARTHER INLAND THE TEMPERATURES AVERAGE SOMEWHAT HIGHER (89°F), BEING LESS AFFECTED BY THE COOLING WINDS FROM THE COAST. THE DAILY RANGE OF TEMPERATURE IS APPROXIMATELY THE SAME BUT AT THE HIGHER AVERAGES. DUE TO THE LESSENING INFLUENCE OF THE TRADEWINDS, THE HUMIDITY IS CONSIDERABLY HIGHER AND ENERVATING. NOT SURPRISINGLY, THIS IS ONE OF THE LEAST DEVELOPED AREAS INSOFAR AS THE RAISING OF CATTLE AND IT IS MOST PESTIFEROUS.

IN THE BARINOS-SAN FERNANDO DE APURE AREA, THE TEMPERATURES AGAIN DROP TO AN AVERAGE OF 82°F WITH A SLIGHTLY WIDER RANGE OF

DAILY TEMPERATURES BECAUSE OF THE INFLUENCE OF THE ANDES AND THE RELATIVELY HIGHER ALTITUDE (600 TO 800 FEET). TO THE SOUTH, THE TEMPERATURES OF THE RIO META-GUAVIARE SAVANNAS REFLECT THE SAME GENERAL INFLUENCE OF THE MOUNTAINS TENDING TO BECOME HOTTER AS ONE TRAVELS FROM WEST TO EAST. ALSO, THE HUMIDITY BECOMES CONSIDERABLY HIGHER AS ONE APPROACHES THE RIO ORINOCO.

THE RAINY SEASON EXTENDS FROM APRIL THROUGH NOVEMBER REACHING ITS HIGHEST RATE OF PRECIPITATION DURING THE MONTHS OF APRIL, MAY, AND JUNE. THROUGHOUT THE REGION THE ANNUAL RAINFALL IS BETWEEN FORTY TO FORTY-FIVE INCHES WITH THE AREA IMMEDIATELY EAST OF THE ANDES RECEIVING AN AVERAGE OF TWO TO FOUR INCHES MORE THAN THE EASTERN AND NORTHEASTERN AREAS. DURING THE DROUGHT PERIOD, DECEMBER TO MARCH, THERE IS SOME PRECIPITATION, TWO TO FOUR INCHES PER MONTH, BUT THIS MOISTURE IS RAPIDLY EVAPORATED BY THE COMBINING INFLUENCES OF THE SANDY TOPSOIL, QUICK RUN-OFF OF THE WATER AND THE DRYING EFFECTS OF THE WINDS.

REGIONAL TRAVEL AND DESTINATIONS. ADVERSE CONDITIONS AFFECTING TRAVEL IN THE LLANOS ARE DIRECTLY ATTRIBUTABLE TO SEASONAL INFLUENCES. DURING THE WINTER RAINS (APRIL TO NOVEMBER), EXTENSIVE TRACTS OF LAND THROUGHOUT THE REGION ARE CONVERTED TO SWAMPS AND QUAGMIRE. AREAS LYING ABOVE THE DEPRESSIONS ARE IRREGULARLY SPACED AND OFTEN DISCONTINUOUS. TO SUSTAIN EVEN A GENERAL LINE OF MARCH FREQUENTLY ENTAILS TRAVERSING THE ESTEROS. DURING THIS SAME PERIOD SMALLER RIVERS AND STREAMS, MOST OF WHICH ARE NEARLY DRY OR COMPLETELY SO DURING THE SUMMER, SPREAD OVER THE COUNTRYSIDE. THEIR CHANNEL AND FLOW BECOME PRACTICALLY INDISTINGUISHABLE.

THE LARGER RIVERS ALSO OVERFLOW AND SPREAD FAR AND WIDE. IN

SO DOING, NOT ONLY IS THE FLOW IN THE MAIN CHANNEL OBSCURED BUT NUMEROUS FALSE CHANNELS ARE CREATED INTERLACED WITH THE CHARACTERISTIC OXBOWS OF THE MAIN RIVER. CONSEQUENTLY, ONE FINDS ONE'S SELF PURSUING AN ERRATIC AND INTERMINABLE COURSE, OFTEN THROUGH THE GALLERY FORESTS ASSOCIATED WITH THE RIVER. SUCH CONDITIONS ARE MOST APPLICABLE TO THE LARGE WEST TO EAST FLOWING RIVERS FROM THE RIO APURE SOUTHWARD.

IN THE DRY SUMMER MONTHS, ALL BUT THE LARGER RIVERS ARE REDUCED TO DRY BEDS OR MERE TRICKLES OF WATER SO THAT NAVIGABILITY IS IMPOSSIBLE. MANY OF THE ESTEROS MAINTAIN SEMI-PERMANENT POOLS OF STAGNANT WATER BUT THE FLOOD AREA SURROUNDING THE ESTEROS IS GREATLY DIMINISHED. NEAR THE CENTER THE LAND IS A THICK MORASS OF MUD AND SEDGE, BUT MOST OF THE LAND IS EASILY TRAVELED AND NO EXTENDED DEVIATION FROM THE GENERAL LINE OF MARCH IS NECESSARY.

TERMINAL AREAS OF RECOVERY, I.E., AREAS SUCH AS TOWNS, CITIES, RANCHES, ET. WHERE THE BASIC SURVIVAL SITUATION IS RESOLVED, IN THE LLANOS ARE BOTH SECTIONAL AND PERIPHERAL. FROM ANY ONE LOCATION THE SELECTED DIRECTION OF TRAVEL WILL BE DETERMINED BY THE SURVIVOR'S ORIENTATION TO PROXIMAL TERMINAL AREAS AND NO ONE GENERAL DIRECTION OBTAINS FOR THE ENTIRE REGION. THERE ARE VERY MANY INTERMEDIATE AREAS OF RECOVERY, SOME OF WHICH COULD BECOME TERMINAL AREAS. INTERMEDIATE AREAS OF RECOVERY ARE AREAS WHERE FOOD, WATER, AND REST ARE AVAILABLE BUT THE SURVIVAL SITUATION CONTINUES. SUCH AREAS MAY BE ISOLATED RANCHES, FARMS, VILLAGES, INCLUDING INDIAN VILLAGES, OR NATURAL HABITAT WHERE PLENTIFUL FOOD AND WATER IS AVAILABLE. THE MOST SIGNIFICANT ASPECT OF THE REGION WITH REGARDS TO RECOVERY IS THE FAST MOVING ECONOMIC DEVELOPMENT IN THE ENTIRE REGION.

Because of the sectional distribution of areas of recovery, the region is divided into two sections: North section comprising that portion of the llanos north of the west-east extension of the Rio Apure and the Rio Orinoco and a south section comprising that portion of the llanos south of the Rio Apure.

1. North Section. Using a central reference point of 66°W-9°S, five major terminal areas are located with a distance of 180 to 260 miles. A number of probable terminal areas and certain intermediate areas are located with the radius of the peripheral major terminal areas. Reading clockwise, Barcelona (64°45'W-10°15'N) is a distance of approximately 180 miles. Beside being a major port for the region, it connects by highway and rail to Maturin (63°10'W-9°45'N) a major terminal area and Ciudad Bolivar (63°40'W-8°20'N).

   Ciudad Bolivar, a distance of 260 miles, is the main river port city on the Rio Orinoco. A main highway connects with Caracas on almost a direct line northwest across the llanos.

   San Fernando de Apure (67°30'W-7°55'N), a distance of 250 miles, is the major port city on the Rio Apure and connects with Caracas on the north by highway, with Ciudad Bolivar down the Rio Apure and the Rio Orinoco, and serves as the main transshipment point between

THE LLANOS AND THE WESTERN SIDE OF THE ANDES.

CALABOZO-EL RASTRO, A DISTANCE OF 180 MILES, ARE OF IMPORTANCE BECAUSE OF THE GREAT IRRIGATION DAM WHICH HAS BEEN BUILT BETWEEN THE TWO CITIES. THE PROJECT HAS CREATED A DEVELOPING FARM AREA OF OVER 500 FARMS FOR SUBSISTENCE CROPS, BEEF, AND DAIRY CATTLE. BOTH CITIES CONNECT WITH CARACAS AND SAN FERNANDO DE APURE.

CARACAS, THE CAPITOL OF VENEZUELA, IS A DISTANCE OF 200 MILES.

2. SOUTH SECTION. THE LLANOS SOUTH OF THE RIO APURE ARE LESS DEVELOPED ECONOMICALLY THAN THE NORTH AND DO NOT OFFER THE SAME SELECTION OF TERMINAL AREAS. USING THE WEST-EAST EXTENSION OF THE RIO CASANARE AND THE RIO META TO MAKE A NORTH-SOUTH SUB-DIVISION, THE MAIN TERMINAL AREA NORTH OF THE RIVERS WOULD BE SAN FERNANDO DE APURE OR EAST ON THE RIO META TO PUENTO CARRENO AT THE JUNCTION OF THE RIO META AND THE RIO ORINOCO.

SOUTH OF THE DIVIDING RIVERS, THE MAIN EFFORT IS (1) TOWARD THE WEST TO BOGOTA THROUGH VILLAVICENCIA (73°W-$4^{\circ}5'$N), (2) EAST ON THE RIO META TO THE JUNCTION WITH THE ORINOCO AND THE RIVER PORT CITIES PUERTO CARRENO OR PUERTO PAEZ, OR (3) EAST ON THE RIO GUAVIARE TO SAN

FERNANDO DE ATABAPO AT THE JUNCTION OF THE RIO GUAVIARE AND THE RIO ORINOCO.

SELECTION OF DESTINATION WILL NOT NECESSARILY DEPEND UPON THE SHORTEST DISTANCE ALTHOUGH PROXIMITY IS A MAJOR CONSIDERATION. IF OVERLAND TRAVEL IS FEASIBLE AND THE DISTANCE IS SHORTER WESTWARD, TRAVEL IS FAVORED TOWARD VILLAVICENCIA OR THE HIGHWAY SKIRTING THE EASTERN FOOTHILLS OF THE ANDES ALONG WHICH THERE ARE NUMEROUS SMALL VILLAGES AND TOWNS. IF THE DISTANCE IS EQUAL, SHORTER TOWARD THE ORINOCO, OR UNKNOWN, OR WHERE THERE IS RELATIVE PROXIMITY TO A MAJOR NAVIGABLE EAST FLOWING RIVER THE CHOICE MAY FAVOR THE RIVER ROUTE. THIS, OF COURSE, ENTAILS THE CONSTRUCTION OF A RAFT (OR OTHER AVAILABLE CRAFT). THE AVAILABILITY OF FOOD AND WATER PLUS THE LESS FATIGUING MODE OF TRAVEL WEIGHS STRONGLY FOR THE RIVER. BETWEEN THE RIO META AND THE RIO GUAVIARE, THE EASTERN PORTION OF THE <u>LLANOS</u> ARE INTENSELY INUNDATED AND THE RAIN FOREST EXTENDS A CONSIDERABLE DISTANCE WEST FROM THE RIO ORINOCO.

WITH REFERENCE TO DIRECTIONAL ORIENTATION, OTHER THAN THE SUN, THE DIRECTION OF FLOW OF THE RIVERS IS MAINLY SOUTH AND SOUTHEAST ABOVE THE RIO APURE AND EAST BELOW THE RIO APURE.

<u>THE RUPUNUNI SAVANNAS</u>

<u>DISTRIBUTION</u>. THE SECOND LARGEST SAVANNA REGION (APPROXIMATELY

6000 SQUARE MILES) NORTH OF THE AMAZON, THE RUPUNUNI SAVANNA, IS LOCATED BETWEEN THE PAKARAIMA MOUNTAINS OF BRITISH GUIANA ON THE NORTH, THE ESSEQUIBO-AMAZON WATERSHED ON THE SOUTH, THE SOUTHWESTERN EXTENSION OF THE PAKARAIMA MOUNTAINS ON THE WEST AND THE DENSE TROPICAL RAIN FORESTS PARALLELING THE ESSEQUIBO ON THE EAST.

THE SAVANNA DOES NOT PRESENT THE MONOTONY OR UNIFORMITY OF THE LLANOS OR THE TREELESS EXPANSE OF THE BRAZILIAN CAMPOS. THERE IS HARDLY A PLACE WITHIN THE SAVANNA FROM WHERE TROPICAL FORESTS OR DENSE GROVES OF TREES ARE NOT VISIBLE.

RELIEF AND DRAINAGE. IN BRITISH GUIANA, THE KANUKU MOUNTAINS (59° TO 60°W-3°N) DIVIDE THE RUPUNUNI SAVANNA INTO TWO NEARLY EQUAL PARTS. THE NORTHERN PART IS THE MORE LEVEL AND EXHIBITS THE TYPICAL GRASSY PLAINS ASSOCIATED WITH SAVANNA AREAS. HOWEVER, THE AREA AS A WHOLE CONTAINS NUMEROUS LOW HILLS AND HOLLOWS, THE LATTER BECOMING SWAMPS OR SMALL LAKES DURING THE HEAVY RAINS.

IMMEDIATELY SOUTH OF THE KANUKU MOUNTAINS, THE TERRAIN IS RELATIVELY LEVEL. TO THE SOUTH AND EAST, THE LAND BECOMES INCREASINGLY IRREGULAR EXHIBITING A SERIES OF ROLLING HILLS AND VALLEYS. ABOVE THE GENERAL SURFACE, SEVERAL ISOLATED "MOUNTAINS" RISE ABRUPTLY TO A HEIGHT OF 500 TO 1,000 FEET. THE EASTERN HILLS ARE REGULARLY MARKED BY OUTCROPPINGS OF WEATHERED BLACK GRANITE.

IN THE RAINY SEASON, THE LOW DEPRESSIONS THROUGHOUT THE REGION ARE FILLED WITH WATER. SWAMPS, PONDS, AND LAKES, OFTEN FIVE TO SIX MILES ACROSS, CALLED "BAIXO," CORRESPOND TO THE ESTEROS OF THE LLANOS. IN THE DRY SEASON, WATER IN THE NUMEROUS TRIBUTARIES OF THE MAJOR REGIONAL RIVERS RECEDES AND THE FLOW LACKS CONTINUITY. THIS RESULTS IN MANY DISCONNECTED POOLS OF STAGNATING WATER THAT ATTRACTS A HOST

OF INSECTS AND WILDLIFE. THESE "WATER HOLES" ARE FREQUENTLY FIFTEEN TO TWENTY MILES APART, REQUIRING THAT A TRAVELER INSURES AGAINST THIRST BEFORE LEAVING A SOURCE OF WATER AT HAND.

THE FOUR MAIN REGIONAL RIVERS OF SIGNIFICANCE TO THE SURVIVAL SITUATION ARE:

1. THE RUPUNUNI, RISING IN THE MARUDI MOUNTAINS ($59^{\circ}30'$W-2°N), BISECTS THE SAVANNA REGION FROM SOUTH TO NORTH FOR NEARLY THE ENTIRE LENGTH OF BOTH THE REGION AND THE RIVER. AT APPROXIMATELY 4°N, THE RIO RUPUNUNI TURNS EAST EFFECTING A JUNCTION WITH THE ESSEQUIBO WITHIN A SHORT DISTANCE. THIS CONSTITUTES ONE OF THE MAJOR AVENUES FOR TRAFFIC BETWEEN GEORGETOWN TO THE NORTH ON THE ATLANTIC COAST AND THE SAVANNA AREA.
2. THE TAKUTU RISING ON THE NORTHWESTERN SLOPES OF THE ACARAI MOUNTAIN ($59^{\circ}50'$W-$1^{\circ}30'$N) THAT FORMS THE ESSEQUIBO-AMAZON WATERSHED. THE RIO TAKUTU, FLOWING NORTH, SKIRTS THE MAIN SAVANNA ALONG THE WESTERN EDGE TO $3^{\circ}30'$N(APPROXIMATE) WHERE IT EFFECTS A JUNCTION WITH THE SOUTH-FLOWING RIO IRENG. BOTH RIVERS TURN SOUTHWESTERLY AND FLOW INTO THE RIO BRANCO. THIS RIVER SYSTEM (TAKUTU-IRENG-BRANCO) FORMS THE MAIN AVENUE FOR TRAFFIC BETWEEN THE ESSEQUIBO RIVER SYSTEM AND THE AMAZON RIVER SYSTEM.
3. THE IRENG, RISING IN THE PAKARAIMA MOUNTAINS ($60^{\circ}20'$W-5°N), FOLLOWS A MEANDERING COURSE SOUTH

GENERALLY ALONG THE 60° W PARALLEL SOMEWHAT IN EXTENSION OF THE RIO TAKUTU.

4. THE ESSEQUIBO, THOUGH NOT PHYSICALLY A FEATURE OF THE SAVANNA, DOES PARALLEL THE ENTIRE EASTERN FLANKS OF THE REGION AND CONSTITUTES THE MAIN AVENUE OF COMMUNICATION BETWEEN THE NORTH COAST AND THE ENTIRE REGION INCLUDING THE FOREST AREAS.

CLIMATE. THE AVERAGE RAINFALL IN THE RUPUNUNI SAVANNA IS HIGHER THAN IN THE OTHER SAVANNA REGIONS OF SOUTH AMERICA. PROBABLY THIS FACTOR ACCOUNTS FOR THE GREATER FREQUENCY AND DENSITY OF TREES IN THE RUPUNUNI. THE ANNUAL RAINFALL AVERAGES SIXTY TO SEVENTY INCHES MOSTLY CONCENTRATED DURING THE MONTHS OF MAY THROUGH AUGUST AND AGAIN IN DECEMBER AND JANUARY.

TEMPERATURES ARE RELATIVELY HIGH AVERAGING 85° TO 88°F WITH LITTLE SEASONAL VARIATION. THE DAILY TEMPERATURES REFLECT A GREATER RANGE VARYING FROM 68° TO 75°F IN THE EARLY MORNING, TO 90° TO 96°F IN MID-AFTERNOON, TO 75° TO 80°F IN THE LATE EVENING. DURING DECEMBER, JANUARY, AND FEBRUARY EXCEPTIONALLY LOW TEMPERATURES OF 58° AND 60°F HAVE RESULTED FROM COMBINED RAIN AND WIND CONDITIONS BUT SUCH COOLNESS IS RARE.

NORTH OF THE KANUKU MOUNTAINS THE HEAT IS PARTIALLY ALLEVIATED BY THE NORTHEASTERLY TRADEWINDS. IN THE SOUTHERN PART OF THE RUPUNUNI THE WEATHER BECOMES PARTICULARLY HOT AND HUMID.

REGIONAL TRAVEL AND DESTINATION. THERE ARE NO SERIOUS DETERRENTS TO EGRESS FROM THE RUPUNUNI SAVANNAS. THE CHARACTERISTIC FLOODED SWAMPS ARE A TEMPORARY HINDERANCE DURING THE RAINY SEASON PRESENTING THE USUAL DIFFICULTIES IN TRAVERSING. THE KANUKU MOUNTAINS,

WHICH LIE ACROSS THE REGION AT MID POINT CAN BE NEGOTIATED BY RIVER (MAY-AUGUST, DECEMBER-JANUARY), OR BY-PASSED ON THE WEST DURING THE DRY SEASON. IN THE RAINY PERIODS MOTOR LAUNCHES AND CARGO BARGES CAN NAVIGATE THE ENTIRE INTER-CONNECTING RIVER SYSTEMS. RIO ESSEQUIBO TRAFFIC REACHES ABOUT MIDWAY INTO THE SOUTH HALF OF THE SAVANNA. THE MAIN AVENUE OF EVACUATION FROM THE RUPUNUNI IS THE NORTH-FLOWING RIO RUPUNUNI AND THE RIO ESSEQUIBO. DURING THE DRY SEASON RIVER TRAFFIC IS LIMITED TO ANNAI (59°W-4°N), A SMALL VILLAGE ON THE RUPUNUNI RIVER, AT THE NORTHEAST CORNER OF THE REGION. EVEN A CANOE CANNOT TRAVEL CONTINUALLY ABOVE THIS POINT. ALTHOUGH MANAUS ON THE AMAZON CAN BE REACHED THROUGH THE IRENG-TAKUTU-RIO BRANCO RIVER SYSTEM, THIS MEANS OF EXIT IS A SECONDARY SELECTION.

ANOTHER MEANS OF EGRESS FROM THE RUPUNUNI SAVANNA IS BY WAY OF THE BERBICE CATTLE TRAIL. THE TRAIL IS USED DURING THE DRY SEASON TO MOVE CATTLE FROM THE RUPUNUNI TO THE NORTH COASTAL REGIONS. ALTHOUGH TRAVEL ON THE RIVER IS PREFERABLE BEING FASTER AND LESS EXPOSED TO ENVIRONMENTAL INFLUENCES, THE CATTLE TRAIL DOES EXIST AS AN ALTERNATIVE.

THE RUPUNUNI SAVANNAS IS ONE OF THE MOST POPULATED INTERIOR REGIONS OF BRITISH GUIANA BECAUSE OF THE CATTLE INDUSTRY AND SEVERAL RANCHES ARE LOCATED IN THEM. BESIDES ANNAI, THE MOST IMPORTANT RECOVERY AREA IS THE GOVERNMENT STATION AT LETHEM ($59^{\circ}45'$W-$3^{\circ}30'$N). BOTH LETHEM AND ANNAI HAVE AIRSTRIPS THAT CAN HANDLE PLANES UP TO THE SIZE OF A DC3.

THE CAMPOS OF BRAZIL

DISTRIBUTION. SOUTH OF THE AMAZON THE VAST SAVANNAS OF BRAZIL LIE IN THE SOUTH PORTION OF THE STATE OF PARA, ALL OF THE STATES OF

MATO GROSSO AND GOIAS, AND IN WESTERN PORTIONS OF THE STATES OF BAHIA AND MINAS GERAIS. CONTAINED WITHIN THE INTERIOR OF THE BRAZILIAN PLATEAU, THE REGION EMBRACES NEARLY A MILLION SQUARE MILES. ALTHOUGH FORESTS OF VARYING COMPOSITION DOT THE LANDSCAPE, SOME BEING GALLERY FORESTS, OTHERS DROUGHT-RESISTING CAMPO FORESTS, MORE THAN TWO-THIRDS OF THE LAND IS PREDOMINATELY SAVANNA GRASSLANDS.

THE REGION IS BOUNDED ON THE NORTH BY AMAZON RAIN FOREST EXTENDING NORTHEAST FROM THE CERROS DOS PARECIS, IN THE STATE OF GUAPORE, TO THE STATE OF MARANHAO IN NORTHEASTERN BRAZIL; ON THE WEST THE MARSHLANDS AND RAIN FOREST ENGULFING THE WATERSHED OF THE MARMORE RIVER SYSTEM OF NORTHEASTERN BOLIVIA; ON THE SOUTH THE RIO PARAGUAY RISES ON THE SOUTHERN WATERSHED DIVIDING THE NORTH-FLOWING AMAZON TRIBUTARIES AND THE SOUTH-FLOWING RIO PARAGUAY. HERE THE MATO GROSSO SAVANNAS MERGE INTO GREAT MARSHLANDS OF THE UPPER PARAGUAY. CALLED "EL PANTANAL," THESE "SWAMP-SAVANNAS" EXTEND APPROXIMATELY 400 MILES TO THE SOUTH AND MAINTAIN A WIDTH OF 50 TO 150 MILES; ON THE EAST THE REGION IS BOUNDED BY THE CHAIN OF LOW MOUNTAINS, OR "SERRAS," EXTENDING NORTHEAST BY SOUTHWEST. THESE SERRAS END ABRUPTLY ALONG THE GREAT ESCARPMENT WHICH RISES ABOVE THE ENTIRE EASTERN COASTLINE FROM 6°S TO 30°S.

RELIEF AND DRAINAGE. THE BRAZILIAN PLATEAU HAS REMAINED STRUCTURALLY UNCHANGED FOR PERHAPS SIXTY MILLION YEARS OR MORE. DURING THIS PERIOD, THE EROSIVE EFFECTS OF WIND AND WATER AND CLIMATE HAVE PRODUCED A REMARKABLE SURFACE UNIFORMITY THROUGHOUT THE REGION. THE PLATEAU SUSTAINS A GRADUAL SLOPE TO THE NORTH-NORTHWEST FROM AN ELEVATION OF ABOUT 3,000 FEET ALONG THE EASTERN ESCARPMENT TO GENERAL LEVEL OF ABOUT 1,500 FEET. MOST OF THE RIVERS DRAIN TO THE NORTH AS

MAIN TRIBUTARIES OF THE AMAZON.

THE MAIN WATERSHED BETWEEN THE NORTH-FLOWING RIVER SYSTEMS OF THE LARGER AMAZON RIVER SYSTEM, AND THE MAJOR RIVER SYSTEMS OF SOUTHERN BRAZIL AND THE PARAGUAY RIVER BASIN CONSIST OF AN EXTENSIVE CHAIN OF SERRAS. STARTING FROM THE SOUTHEASTERN HIGHLANDS OF THE STATE OF GOIAS, THE CHAIN EXTENDS NORTHWEST TO THE 56°W-14°S PARALLELS THEN SWINGS TO THE SOUTHWEST. THE UPPER BASIN OF THE RIO PARAGUAY WITH ITS GREAT MARSHY TRACT OCCUPIES THE CONCAVITY FORMED BY THE SOUTH DRAINING SLOPES OF THE SERRAS. NEARLY ALL OF THE PANTANAL, EXCEPT FOR THE PERIPHERAL OVERFLOW, LIES WITHIN THE SOUTHWESTERN SECTION OF THE MATO GROSSO. ON THE WEST THE MARSHLANDS MERGE WITH THE GRAN CHACO OF SOUTHEASTERN BOLIVIA AND NORTHERN PARAGUAY.

THE RIVERS OF THE PLATEAU WITH EONS OF TIME TO WORK HAVE CUT DEEPLY INTO THE SURFACE OF THE LAND CREATING BROAD NORTH-SOUTH VALLEYS WITH REGULAR, GENTLE SLOPES ASCENDING ON EITHER SIDE. THE TABLELANDS LYING BETWEEN THE MAJOR RIVER VALLEYS ARE CALLED "CHAPADOES" (PLURAL FOR CHAPADAO). THE ELEVATIONS BETWEEN THE LESSER STREAMS WITHIN A MAJOR PLATEAU ARE CALLED "CHAPADAS." THE CHAPADAS ARE THE MORE OBVIOUS FEATURE OF THE TOPOGRAPHY AND ARE DISTINGUISHED BY SHARP BLUFFS OUT BY THE STREAMS. THE MAJOR CONFIGURATION TENDS TO BE OBSCURED BY THE VASTNESS OF THE DISTANCES INVOLVED.

THE MAJOR RIVERS DRAINING NORTH FROM THE PLATEAU ARE, FROM EAST TO WEST:

1. THE TOCANTINS WHICH RISES IN THE CENTER OF THE STATE OF GOIAS (50°W-15°N). IT FLOWS THROUGH A WIDE, DEEP VALLEY AND IN THE EARLY STAGES OF ITS COURSE RECEIVES THE FLOW OF NUMEROUS TRIBUTARIES THAT DRAIN THE SLOPES OF THE HIGHLANDS

ON EITHER SIDE. AT 49°W-5°S (APPROXIMATE), THE RIO TOCANTINS RECEIVES THE FULL FLOW OF THE RIO ARAGUAIA. FROM THIS JUNCTION, THE RIO TOCANTINS, ALMOST AS GRAND AS THE AMAZON, CONTINUES NORTH TO THE AMAZON DELTA WHERE IT RAMIFIES INTO NUMEROUS CHANNELS BEFORE ENTERING THE MAIN CHANNEL BETWEEN BELEM AND THE ISLAND OF MARANHAO;

2. THE RIO ARAGUAIA WHICH RISES IN THE SERRO DO VERDINHO (55°W-18°S (APPROXIMATE) AND FLOWS DUE NORTH FORMING A NATURAL BOUNDARY BETWEEN THE STATE OF GOIAS AND THE STATES OF MATO GROSSO AND PARA ON THE WEST BEFORE JOINING THE RIO TOCANTINS. A MAJOR TRIBUTARY OF THE RIO ARAGUAIA IS THE RIO DAS MORTES WHICH RISES TO THE WEST (55°W-14°S) AND FLOWS EAST FOR APPROXIMATELY 200 MILES AND THEN NORTH PARALLELING THE RIO ARAGUAIA FOR AN ADDITIONAL 250 MILES BEFORE EFFECTING A JUNCTION;

3. THE XINGU RISES IN EASTERN MATO GROSSO. AN INTRICATE NETWORK OF FEEDERS EFFECTS A FAN-SHAPED DRAINAGE PATTERN BETWEEN THE PARALLELS 52° TO 55°W AND 11° TO 14°S. THE DIRECTION OF FLOW OF THE MAIN RIVER IS GENERALLY DUE NORTH;

4. THE RIO TAPAJOS IS FORMED FROM A NUMBER OF SIZEABLE TRIBUTARIES, TWO OF WHICH ARE MAJOR RIVERS DESCENDING THE PLATEAU BEFORE MERGING AS THE RIO TAPAJOS AT THE JUNCTION OF THE

POLITICAL BOUNDARIES OF THE STATES MATO GROSSO, PARA, AND AMAZONAS (58°W-$7^{\circ}20'$S). THE TRIBUTARIES ARE THE RIO TELES PIRES WHICH RISES 55°W-15°S, AND THE RIO JURUENA WHICH RISES 59°W-$14^{\circ}30'$S. BOTH OF THESE RIVERS HAVE THE CHARACTERISTIC NETWORK OF FEEDERS DRAINING THE SLOPES OF THE ELEVATED CHAPADOES BETWEEN THE MAJOR RIVER VALLEYS.

CLIMATE. BECAUSE OF THE ELEVATION AND THE VAST AREA INCLUDED, THERE ARE SOME LATITUDINAL VARIATIONS. IN MANY RESPECTS THE GENERAL CLIMATE IS MORE NEARLY TEMPERATE RATHER THAN TROPICAL. WHILE SEASONAL VARIATIONS ARE RELATIVELY MINOR, THE DAILY RANGE IS OFTEN BETWEEN 40° AND 50°F DURING THE DRY WINTER MONTHS, JUNE THROUGH AUGUST. THIS IS DUE IN PART TO THE CLEARNESS OF THE ATMOSPHERE AT THIS ELEVATION. DURING DAYLIGHT HOURS MAXIMUM INSOLATION PERMITS RAPID HEATING AND BY MID-AFTERNOON THE TEMPERATURES MAY REACH A GROUND READING OF OVER 100°F AND AT NIGHT DROP TO 50° TO 55°F DUE TO RADIATION. ANOTHER PHENOMENON OCCURRING DURING THIS PERIOD IS THE FRIAGEM, A COLD SOUTH WIND PRODUCED BY THE NORTHWARD PRESSURE OF COLD ANTARTIC AIR. WHEN THE FRIAGEMS ARE BLOWING, TEMPERATURES MAY DROP TO FREEZING. THE HOTTEST AND MOST HUMID MONTHS OCCUR DURING THE RAINY SEASON. THE DAILY TEMPERATURES TEND TO BECOME STABLE AS THE NORTHERN LIMITS OF THE PLAINS ARE REACHED AND THE RAIN FOREST BEGINS TO PREDOMINATE.

THE RAINY SEASON BEGINS IN SEPTEMBER ACCOMPANIED BY VIOLENT THUNDER AND LIGHTNING STORMS. THE RAINS REACH THEIR PEAK DURING NOVEMBER AND BEGIN TAPERING OFF AT THE END OF MARCH IN THE WESTERN AREAS AND IN APRIL IN THE EAST. FROM MAY THROUGH AUGUST, PRECIPI-

TATION IS PRACTICALLY ZERO. ANNUAL RAINFALL AVERAGES SIXTY TO SEVENTY INCHES FOR THE ENTIRE REGION BUT GOIAS ON THE EAST WILL AVERAGE SIXTY-EIGHT TO SEVENTY INCHES, WHEREAS CORUMBA ON THE RIO PARAGUAY AVERAGES LESS THAN FIFTY INCHES. NEARING THE SOUTHERN LIMITS OF THE AMAZON RAIN FOREST, THE RAINFALL LOSES THE SEASONAL DISTINCTION ALTHOUGH NOT ATTAINING ANY GREATER INTENSITY.

REGIONAL TRAVEL AND DESTINATIONS. FIRST OF ALL--TRAVELING AWAY FROM THE SITE OF THE DOWNED PLANE IS IN THE NATURE OF A "LAST RESORT" AND BECOMES A PRIMARY CONSIDERATION ONLY WHEN THERE IS LITTLE OR NO CHANCE OF BEING FOUND THROUGH ORGANIZED SEARCH AND RESCUE OPERATIONS. WHILE THIS IS TRUE OF ALL THE SAVANNA REGIONS IT IS ESPECIALLY TRUE OF THE CAMPOS BECAUSE OF THE VAST DISTANCES INVOLVED. IN THE LLANOS OF THE ORINOCO AND IN THE RUPUNUNI, PROBABLE TERMINAL AREAS ARE GENERALLY RECKONED IN DISTANCES OF 50 TO 150 MILES. IN THE CAMPOS, DISTANCES MAY BE SEVERAL HUNDRED MILES. TOPOGRAPHICALLY, THE REGION PRESENTS NO INSURMOUNTABLE BARRIER TO THE MORE POPULATED SOUTH AND SOUTHEASTERN STATES BEGINNING WITH THE "FRONTIER" STATE OF GOIAS AND THE UPPER PARAGUAY BASIN. THE OBVIOUS ADVANTAGES OF "CIVILIZATION" NEED NOT BE CITED. HOWEVER, THESE AREAS OF HABITATION ARE ALSO THE MOST NATURALLY ACCESSIBLE AREA OF SAFETY FROM THE INTERIOR REGIONS. THE AVENUES OF APPROACH FROM THE PLATEAU ARE THE LEAST ARDUOUS AND HAZARDOUS AND GENERALLY EXPOSED NATURE OF THE TERRAIN OFFER GREATER CHANCES OF BEING SPOTTED BY SEARCH PARTIES.

THE GENERAL LINE OF MARCH FROM ALMOST ANY LOCATION IN THE CAMPOS IS SOUTH OR EAST. DEVIATION FROM THIS GENERAL DIRECTION WOULD BE BASED PRINCIPALLY UPON THE SURVIVOR'S ORIENTATION TO PROXIMAL AREAS INHABITED BY THE KNOWN HOSTILE INDIANS ALONG THE EASTERN BANKS OF THE

RIO TAPAJOS AND THE HEADWATERS OF THE RIO XINGU.

NORTH OF THE 15°S PARALLEL AND WEST OF THE RIO ARAGUAIA TERMINAL AREAS ARE UNCERTAIN. CHANCE DISCOVERY OF A BRAZILIAN AIR FORCE INSTALLATION MIGHT PROVIDE A MEANS OF EXIT FROM THE REGION BUT THE TRANSITORY NATURE OF SUCH INSTALLATIONS RENDER THEM HIGHLY UNDEPENDABLE. POSSIBLE TERMINAL AREAS ARE NUMEROUS BUT ARE FOR THE MOST PART FORTUITOUSLY ENCOUNTERED. THE DEVELOPMENT OF THE CATTLE INDUSTRY AND THE SLOW PUSH TOWARD THE FRONTIER REGION HAS RESULTED IN A NUMBER OF ISOLATED RANCHES AND FARMS. THESE ARE GENERALLY LOCATED NEAR RIVER VALLEY AREAS AND PREDOMINATING CERRADOES AND FORESTED AREAS.

SOUTH OF THE 15°S PARALLEL THE UPPER PARAGUAY BASIN CONTAINS A MAJOR CONCENTRATION OF POPULATION OF THIS REGION. CUIABA (56°W-15°40'S) IS A FOCAL POINT FOR THE ENTIRE AREA DRAINED BY THE HEADWATERS OF THE RIO TAPAJOS AND RIO XINGU. FROM CUIABA, A RAILWAY RUNS ALL THE WAY TO RIO DE JANEIRO AND SAO PAULO. ON THE RIO PARAGUAY, CORUMBA (57°30'W-19°S) SERVES AS A COMMUNICATION CENTER LINKED WITH SANTA CRUZ IN BOLIVIA BY HIGHWAY, WITH SAO PAULO BY A RAILWAY, WITH LA PAZ BY RAILWAY, AND WITH CUIABA ON THE NORTH AND BUENAS AIRES ON THE SOUTH BY RIVER.

FOR THE AREA BETWEEN THE RIO ARAGUAIA AND THE RIO TOCANTINS AND SOUTH OF THE 10°S PARALLEL, THE FOCAL POINT OF TRAVEL IS THE GENERAL AREA OF SOUTHEASTERN GOIAS WHERE THE CITIES OF BRAZILIA, THE COUNTRY'S NEW CAPITOL, GOIANA AND ANAPOLIS ALL REPRESENT TERMINAL AREAS. ABOVE THE 10°S PARALLEL AND EAST OF THE RIO TOCANTINS RIVER BASIN, THE GENERAL ORIENTATION IS TO THE NORTHEAST ALONG THE AXIS OF THE RIO PARNAIBA.

TRAVEL IN THE CAMPOS IS ALMOST ENTIRELY OVERLAND. ABOVE THE LINE OF RAPIDS ON THE PLATEAU THE CURRENT IS NOT SO SWIFT THAT HEADWAY CANNOT BE MADE IF A SUITABLE CRAFT CAN BE OBTAINED. HOWEVER, THE CONSTANT BRANCHING OF THE STREAMS, THE IRREGULARITY OF DEPTH AND THE MEANDERING CHARACTERISTIC TEND TO DISSUADE THE USE OF THE RIVERS FOR TRAVEL. THE MAJOR EXCEPTION TO THIS IS IN THE PANTANAL WHERE A BOAT IS DESIREABLE NOT ONLY TO SUSTAIN DIRECTION OF TRAVEL BUT TO NEGOTIATE THE FLOODED LAND.

THE MOST DESIREABLE TRAVEL CONDITIONS ARE THOSE PERMITTING THE PARALLELING OF A RIVER AND GALLERY FOREST USING THE HIGH GROUND. UNFORTUNATELY, THE RIVERS SNAKE BACK AND FORTH FOR MILES. BECAUSE OF THE RELATIVE FLATNESS OF THE TERRAIN, THIRTY OR FORTY MILES OF RIVER MAY BE ENCOMPASSED IN A TEN MILE DISTANCE (AS THE CROW FLIES). THIS MEANDERING PROJECTS THE ACCOMPANYING GALLERY FORESTS SO THAT THE TRAVELER IS CONSTANTLY CONFRONTED WITH EXTENDED STRETCHES WHICH MUST BE CIRCUMVENTED OR PASSED THROUGH. DESPITE THE TIME INVOLVED, A DETOUR IN MOST CASES IS PREFERABLE TO PENETRATION OF THE FOREST ESPECIALLY WHEN THE DISTANCE OF PASSAGE CANNOT BE DETERMINED.

THE GRAN CHACO

DISTRIBUTION. THE GRAN CHACO (GREAT HUNTING GROUND) EXTENDS FROM APPROXIMATELY 17°30'S TO THE NORTHERN EXTENSION OF THE ARGENTINE PAMPA, A DISTANCE OF MORE THAN 1,000 MILES. IT IS BOUND ON THE NORTH BY THE NORTHWEST-SOUTHEAST EXTENSION OF THE DIVIDING WATERSHED BETWEEN THE AMAZON RIVER BASIN AND THE PARAGUAY RIVER BASIN, ON THE WEST BY THE LOW RANGE OF HILLS ASCENDING THE EASTERN SLOPES OF THE ANDES, ON THE SOUTH BY SIERRAS DE CORDOBA AND GUAYASAN AND ON THE EAST BY THE RIO PARAGUAY FLOWING FROM THE NORTH AND THE RIO PARANA FLOWING FROM

THE NORTH AND THE RIO PARANA FLOWING FROM THE SOUTH OR NEARLY A DIRECT NORTH-SOUTH COURSE. IT ENCOMPASSES APPROXIMATELY 400,000 SQUARE MILES OF RELATIVELY FLAT, POORLY DRAINED LAND ALMOST ENTIRELY DESOLATED BY THE GENERAL HOSTILITY OF ITS PHYSIOGRAPHY. THE AREA NORTH OF THE RIO PILCOMAYO IS ONE OF THE LAST STRONGHOLDS OF THE "UNTAMED" INDIANS AGAINST THE INCURSIONS OF CIVILIZATION.

THE CHACO IS PROBABLY THE LEAST KNOWN AND EXPLORED REGIONS OF SOUTH AMERICA. THIS IS PARTICULARLY TRUE OF THE CENTRAL AREA LYING WITHIN THE TRIANGLE FORMED BY THE RIO PILCOMAYO AND THE RIO PARAGUAY. EVEN THE INDIANS WHO INHABIT THE NORTHERN CHACO MAKE ADEQUATE PREPARATIONS WHEN MAKING FORAYS INTO THE PLAINS DURING THE DRY SEASON. THEY, OF COURSE, KNOW THE LOCATIONS OF NATURAL RESERVOIRS BUT THEY ALSO MAINTAIN A SYSTEM OF ARTIFICIAL WELLS.

RELIEF AND DRAINAGE. THE REGION SLOPES GENTLY TO THE EAST AND SOUTHEAST. IN THE NORTH, THE RIO PARAPITI DRAINS NORTHWARD INTO AN EXTENSIVE SWAMP WHICH IN TURN DRAINS INTO A TRIBUTARY OF THE AMAZON. ALL THE OTHER CHACO RIVERS DRAIN TO THE EAST. NUMEROUS RIVERS AND STREAMS RISE IN THE ANDES BUT ONLY THE RIOS PILCOMAYO, BERMEJO, AND SALADO REACH THE RIO PARAGUAY OR THE RIO PARANA--THE MAIN RECIPIENT RIVERS. THE OTHER RIVERS BECOME LOST IN THE SANDY SOIL OR MARSHES (ESTEROS) FILLING THE EXTENSIVE DEPRESSIONS THROUGHOUT THE REGION. THE RIO PILCOMAYO IS THE ONLY MAJOR RIVER CROSSING THE CHACO THAT FLOWS ABOVE THE 24°S PARALLEL AND THIS IS ONLY IN ITS UPPER COURSE. ALONG THIS PORTION THE RIVER IS PARALLELED BY DRY RIVERBEDS AND RAVINES OR "CANADAS" WHICH RECEIVED THE OVERFLOW OF THE PILCOMAYO DURING THE FLOOD PERIODS. IN ITS MIDDLE COURSE, THE BANKS OF THE RIVER DISSOLVE COMPLETELY INTO A GREAT MARSH NAMED ESTERO PATINA (59°-60°W AND

24°-$24^{\circ}30'$S). BEYOND THE ESTERO, THE RIVER HAS A NORTH BRANCH AND SOUTH BRANCH THROUGH WHICH IT DRAINS INTO THE RIO PARAGUAY. THROUGHOUT THE ENTIRE COURSE OF THE RIVER THE ADJACENT LAND IS FLOODED FOR MANY MILES IN EACH DIRECTION. THESE FLOODED TRACTS OF SWAMPS, LAGOONS, AND CANADAS ARE THE MOST CHARACTERISTIC FEATURE OF THE ENTIRE LANDSCAPE DURING THE WET SEASON. SOME OF THE DEEPER AND MORE EXTENSIVE FLOODED LOWLANDS RETAIN WATER EVEN DURING THE DRY SEASON, HOWEVER, THE WATER IS STAGNANT AND OFTEN FILLED WITH RESIDUES OF DEAD LAND ANIMALS AND RIVER LIFE; THE FORMER TRAPPED BY THE INITIAL FLOODING AND THE LATTER BY THE RECEDING WATERS. WHERE EVAPORATION EFFECTS THE PROCESS OF DRYING, LARGE AREAS OF SALT INCRUSTED DEPRESSIONS RESULT.

CLIMATE. THE CHACO PRESENTS GREATER EXTREMES OF TEMPERATURE THAN ANY OTHER REGION EAST OF THE ANDES. ESSENTIALLY, IT IS AN EXTENSION OF THE BRAZILIAN PLATEAU CLIMATIC BELT, BUT, WHERE FROSTS ARE RARE IN THE MATO GROSSO, THEY OCCUR WITH CONSIDERABLE FREQUENCY ESPECIALLY IN THE NORTHERN CHACO. THE HIGHEST TEMPERATURES IN SOUTH AMERICA ALSO OCCUR IN THE CHACO WHERE READINGS OF 120°F ARE NOT UNUSUAL DURING THE SUMMER. THE MOST STRIKING ASPECT OF THE CHACO CLIMATE IS ITS SOMEWHAT VIOLENT DAILY FLUCTUATION, DROPPING AS MUCH AS SIXTY DEGREES OR MORE IN A MATTER OF HOURS. THIS OCCURS MOST GENERALLY DURING THE WINTER MONTHS, JUNE THROUGH AUGUST. THIS IS THE PERIOD OF THE COLD SOUTHWINDS CALLED FRIAGEMS, WHICH ARE THE NORTHERN EXTREMES OF AN ANARTIC CLIMATIC PHENOMENON.

THE RAINY SEASON IN THE CHACO IS FROM NOVEMBER THROUGH MAY. IN THE EAST, THE RAINFALL IS HEAVIER AVERAGING FIFTY INCHES ANNUALLY. TO THE WEST, THE RAINFALL IS REDUCED TO ABOUT TWENTY-FIVE INCHES AND ENDS IN APRIL. THE HUMIDITY IS CONSIDERABLY LESS THAN THAT EXPERIENCED

IN MOST OF THE TROPICAL LATITUDES AND DURING THE DRY PERIOD MORE NEARLY APPROXIMATES A DESERT DRYNESS.

REGIONAL TRAVEL AND DESTINATION. IN THE GRAN CHACO, ASIDE FROM HEAT, THIRST, AND POSSIBLY HOSTILE INDIANS, THE MAJOR DETERRENT TO TRAVEL IS THE EXTENSIVE AREAS OF INUNDATION. THE PERIOD OF INUNDATION IS FROM NOVEMBER TO MAY, THE RAINY SEASON, AND THE PERIOD OF THIRST IS FOR THE REMAINDER OF THE YEAR WHEN WATER SOURCES ARE FEW AND FAR BETWEEN AND GENERALLY KNOWN ONLY TO THE RELATIVELY UNPREDICTABLE INDIANS, THE TOBA AND MATACO TRIBES, INHABITING THE RIO PILCOMAYO AREA.

THE MAJOR, AND PRACTICALLY THE ONLY, TERMINAL AREA OF RECOVERY IN THE NORTHERN PART OF THE REGION IS SANTA CRUZ (63°W-$17^{\circ}40'$S) LYING IN THE FOOTHILLS OF THE ANDES AND CORUMBA, A MAJOR RIVER PORT ON THE RIO PARAGUAY. A MAIN HIGHWAY CONNECTS SANTA CRUZ WITH CORUMBA. ON THE WEST A NUMBER OF TINY VILLAGES ARE LOCATED AT THE BASE OF THE ANDES AND A MAIN HIGHWAY SKIRTS THE BASE OF THE MOUNTAIN SOUTHWARD FROM 23°S PASSING THROUGH A NUMBER OF TOWNS AND CONNECTING WITH A MAJOR CITY, TUCUMAN, IN ARGENTINA.

THE RIO PARAGUAY EXTENDS ALONG THE ENTIRE EASTERN BOUNDARY OF THE GRAN CHACO CARRYING A FAIRLY CONSTANT FLOW OF TRAFFIC. THE RIVER IS THE MAIN AXIS OF COMMUNICATION INTO THE INTERIOR CONNECTING WITH CUIABA, THE CAPITOL OF MATO GROSSO AT ITS HEADWATERS.

CHAPTER IX

SURVIVAL FACTORS

General

THE PROCEDURES INVOLVING EMERGENCY SITUATIONS INCLUDING CRASH LANDING, BAIL OUT PROCEDURES, CREW FUNCTIONS, DISPOSITION OF SURVIVAL GEAR AND SUCH OTHER DETAILS ARE PROPERLY MATTERS OF AIR FORCE OPERATING PROCEDURES AND NOT WITHIN THE SCOPE OF THIS MONOGRAPH. IN THIS CONNECTION IT IS RECOMMENDED THAT THE READER REVIEW AIR FORCE MANUAL 64-3, ESPECIALLY CHAPTERS I, III, AND IV. OF SPECIFIC APPLICATION IN THE SAVANNAS IS THE ADVISABILITY OF REMAINING WITH THE AIRCRAFT AND CONDITIONS UNDER WHICH TRAVEL MIGHT BE UNDERTAKEN.

BECAUSE OF THE VAST DISTANCES INVOLVED IN SUCH AREAS AS THE CAMPOS OF BRAZIL, OR THE EXPANSES OF RAIN FORESTS THAT LIE BETWEEN THE SAVANNAS AND AREAS OF HABITATION SUCH AS IN THE RUPUNUNI, THE ADVANTAGES OF REMAINING IN THE VICINITY OF THE PLANE ARE INCREASED CONSIDERABLY. CERTAIN UNDERLYING ASSUMPTIONS ARE BEING MADE (1) THAT THE PLANE IS INTACT AFTER CRASH LANDING, OR (2) THAT AFTER BAIL OUT THE CREW (OR SINGLE PILOT) IS ABLE TO GET TO THE CRASHED PLANE, OR (3) THAT IF THE CRASHED PLANE IS NOT ACCESSIBLE THE CREW (OR PILOT) WILL ESTABLISH A CAMP IN THE VICINITY OF BAIL OUT UTILIZING HIS CHUTE AND SUCH OTHER IMPROVISATIONS SUGGESTED BY THE NATURAL SURROUNDINGS.

IT IS HOPED THAT THE INITIAL CIRCUMSTANCES OF THE EMERGENCY ENABLES THE SURVIVOR(S) TO UTILIZE WHATEVER SURVIVAL GEAR WAS CARRIED

ON THE PLANE, OR THAT THE PLANE ITSELF CAN BE UTILIZED FOR MAKING THE IMPLEMENTS NECESSARY FOR SURVIVAL. THE MOST IMPORTANT REQUIREMENTS ARE SUCH ITEMS AS GUNS AND AMMUNITION, KNIVES, AXES, MACHETES, MATCHES, FISH HOOKS, AND COOKING UTENSILS. NEARLY ALL OF THESE, IF NOT ON HAND, WILL HAVE TO BE MANUFACTURED FROM THE AVAILABLE MATERIALS OR AN ADEQUATE SUBSTITUTE DEVISED. THIS IS PARTICULARLY TRUE OF THE GUN AND AMMUNITION. ALTHOUGH TRAPS AND SNARES SHOULD BE USED AS MUCH AS POSSIBLE, THERE ARE NUMEROUS OCCASIONS WHEN A PROJECTILE IS REQUIRED. THESE CAN BE IN THE FORMS OF SLING SHOTS, SPEARS, BOW AND ARROWS IF TIME AND PROFICIENCY WARRANT THEM; OR EVEN A SUPPLY OF SUITABLE SIZED STONES FOR THROWING. HOW MUCH THE MATERIALS OF THE PLANE AND SUCH GEAR AS THE PARACHUTE CAN BE UTILIZED IS MOSTLY A MATTER OF IMAGINATION AND RESOURCEFULNESS.

THE MATTER OF OBTAINING FOOD AND WATER ESPECIALLY SHOULD BE OF IMMEDIATE CONCERN EVEN THOUGH THERE MAY BE EMERGENCY SURVIVAL RATIONS AVAILABLE. TO OBTAIN THESE ITEMS THERE MAY BE A NEED FOR TRAVELING SOME DISTANCE FROM THE ESTABLISHED CAMP SITE. PRECAUTIONS MUST BE TAKEN FOR FINDING THE WAY BACK TO THE CAMP. IF ONLY ONE SURVIVOR IS INVOLVED A MESSAGE MUST BE LEFT AT THE CAMP SITE SHOWING DIRECTION TAKEN, TIME OF DEPARTURE AND EXPECTED TIME OF RETURN. HUNTING AND FORAGING ACTIVITIES SHOULD BE PLANNED SO THAT ALL INDIVIDUALS ARE BACK AT THE CAMP BEFORE DARKNESS EACH DAY. BECAUSE OF THE GENERAL LACK OF FOOD AND WATER DURING CERTAIN SEASONS IN THE SAVANNAS IT MAY BE ADVISABLE TO MOVE THE CAMP NEAR TO A SOURCE OF FOOD AND WATER SUCH AS A GALLERY FOREST. IF A CONSIDERABLE DISTANCE IS INVOLVED, MESSAGES SHOULD BE LEFT AT THE SITE OF THE DOWNED PLANE GIVING ADEQUATE INSTRUCTIONS ON WHERE TO LOCATE THE CAMP SITE.

THE DATA CONTAINED IN THIS MONOGRAPH IS NOT PRIMARILY CONCERNED WITH TECHNIQUES. IN FACT, IT NECESSARILY REQUIRES THAT THE INDIVIDUAL WILL HAVE RECEIVED THE MINIMUM SURVIVAL TRAINING TO RECOGNIZE THE NATURE AND CONDITIONS OF THE ENVIRONMENT TO INCLUDE THE HABITS OF ITS POPULATION AS DESCRIBED AND TO BE FAMILIAR WITH THOSE TECHNIQUES APPLICABLE TO ANY GIVEN CONDITION OR INCIDENT ARISING IN THE SURVIVAL SITUATION. WHEN A MEMBER OF A TECHNOLOGICALLY ADVANCED SOCIETY IS REDUCED TO THE PRIMITIVE LEVEL OF SUBSISTENCE MORE THAN JUST THE BASIC TECHNIQUES OF HUNTING AND GATHERING AND SELF PRESERVATION ARE NECESSARY FOR SURVIVAL. JUST AS IMPORTANT, IF NOT MORE SO, IS THE PSYCHOLOGICAL ADJUSTMENT NECESSARY TO ACCEPT ANY EDIBLE SOURCE OF NOURISHMENT. IN THE RAIN FORESTS WHERE THERE IS A GREATER VARIETY OF GAME AND VEGETATION IT IS DIFFICULT ENOUGH TO OBTAIN FOOD OF A MORE ACCEPTABLE PALATABILITY. IN THE SAVANNAS, EVEN MARGINAL TO THE FORESTS, THE SCARCITY OF GAME SERIOUSLY LIMITS ANY SELECTIVITY. AS IS OFTEN THE SITUATION EVEN WITH THE INDIANS, THE SURVIVOR WILL BE FORCED TO ACCEPT A DIET OF INSECTS, REPTILES, RODENTS, ROOTS, NUTS, BERRIES; WHATEVER HE IS ABLE TO GATHER.

INHABITANTS OF THE SAVANNAS

SURPRISINGLY, THE MAJORITY OF INHABITANTS IN THE SAVANNAS ARE NOT INDIANS--OR AT LEAST NOT INDIANS IN THEIR ABORGINAL STATE. THE FACT IS, THE INDIAN VERY PROBABLY HAS NEVER BEEN A TRUE INHABITANT OF THE SAVANNAS. LIKE MUCH OF THE FAUNA SEEN IN THE SAVANNA, THE INDIAN IS ESSENTIALLY ORIENTED TO THE FORESTS. HE FORAGES IN THE SAVANNA ACCORDING TO SEASONAL RIPENING OF CERTAIN FRUITS AND NUTS OR FOR COMMUNAL HUNTS WHEN THE GRASS IS BURNED TO DRIVE THE GAME OR TO COLLECT THE SMALL RODENTS, LIZARDS, INSECTS, ETC. KILLED BY THE FLAMES.

IN THE LLANOS THE INHABITANTS, IN THE MORE REMOTE AREAS, ARE THE RANCHEROS AND LLANEROS--RANCHERS AND COWBOYS--ENGAGED IN CATTLE RAISING. THE LLANEROS ARE MOSTLY MESTIZOS OR INDIANS WHO HAVE BECOME "WESTERNIZED." THERE ARE CONFLICTING REPORTS REGARDING THE DISPOSITION OF THE LLANERO--RANGING FROM THAT OF BEING HIGHLY SUSPICIOUS, DISTRUSTFUL, UNTRUSTWORTHY (BUT NOT DANGEROUS), TO BEING A MOST GENEROUS AND TRUSTWORTHY "COMPANERO." AS WITH MOST PEOPLE HE IS PROBABLY A COMBINATION OF MOODS DEPENDING UPON THE SITUATION.

A VERY PROGRESSIVE PROGRAM OF AGRICULTURAL, PETROLEUM, AND MINING HAS BEEN UNDER WAY IN THE LLANOS AND UPPER ORINOCO FOR AT LEAST A DECADE. AT THE PRESENT TIME APPROXIMATELY 30% OF THE EXPORTS OF VENEZUELA COME FROM THE PROVINCES OF ANZOATEQUI AND MATURIN AND RECENT DISCOVERIES INDICATE THAT EVEN LARGER OIL RESOURCES ARE LOCATED IN THE LLANOS OF THE RIO APURE. A LARGE AREA, MORE THAN 5,000 SQUARE MILES HAVE BEEN BROUGHT UNDER CULTIVATION IN THE WESTERN AREAS OF THE LLANOS AS A RESULT OF AN EXTENSIVE IRRIGATION PROJECT COMPLETED IN 1957. THE MINING ACTIVITIES OF THE UPPER ORINOCO HAVE RESULTED IN AN INCREASE OF TRAFFIC AND ROAD BUILDING BETWEEN THE RIO ORINOCO AND THE WESTERN AND COASTAL URBAN AREAS. MANY EUROPEAN IMMIGRANTS, DISPLACED SINCE WORLD WAR II, HAVE TAKEN UP RESIDENCE IN THIS REGION. THE CONSEQUENCE OF ALL THIS ACTIVITY IS THAT THE LLANOS ARE BECOMING LESS AND LESS A VAST AND ISOLATED REGION.

IN THE RUPUNUNI SAVANNA, THE INDIVIDUAL MOST LIKELY TO BE ENCOUNTERED IS ALSO THE INDIAN COWBOY. THERE ARE SEVERAL FOREST TRIBES OF THE ARAWAK AND CARIB FAMILIES INHABITING THE PERIPHERAL FORESTS OF THE REGION. NONE OF THESE ARE KNOWN TO BE HOSTILE AND DIRECTLY OR INDIRECTLY ARE ACQUAINTED WITH WESTERN MAN. AMONG THE INDIAN TRIBES ARE

THE WAI WAI AND THE WAPISIANA WHO HAVE ON VARIOUS OCCASIONS FURNISHED GUIDES, HUNTERS, AND BOATMEN FOR ARCHAEOLOGICAL AND EXPLORING PARTIES IN THE RUPUNUNI REGION.

SOUTH OF THE AMAZON THE MAJOR PORTION OF THE BRAZIL PLATEAU CAMPOS ARE VIRTUALLY DEVOID OF ANY INHABITANTS--INCLUDING INDIANS. IN THE AREAS OF THE HEADWATERS OF THE MAJOR RIVER VALLEYS, NUMEROUS INDIAN TRIBES, MEMBERS OF THE GE-LANGUAGE FAMILIES, ENGAGE IN BASICALLY TROPICAL FOREST SUBSISTENCE ACTIVITIES WHICH THEY SUPPLEMENT BY FORAGING IN THE SAVANNAS. ETHNOGRAPHERS GENERALLY CLASSIFY THESE TRIBES AS "MARGINAL TRIBES." AMONG THESE ARE SEVERAL TRIBES WHO HAVE, IN THE RECENT PAST, BEEN NOTORIOUS FOR THEIR FEROCITY AND HOSTILITY TOWARD ANY AND ALL STRANGERS, WHITES, AND OTHER INDIANS INCLUDED. THEY ARE THE KAIOPO (ALSO SPELLED KAYOPO AND CAYOPO), THE TAPAYUNA, THE TUPI-CAWAHIB, AND THE NAMBIKUARA WHO INHABIT THE EAST BANK OF THE RIO TAPAJOS, AND THE CHAVANTE (SHAVANTE, XAVANTE) WHO OCCUPY THE REGION BETWEEN THE HEADWATERS OF THE RIO DAS MORTES AND THE RIO XINGU. THE KAIOPOS HAVE CAUSED MOST OF THE SETTLERS ON THE UPPER TAPAJOS TO EVACUATE THE AREA BECAUSE OF THEIR RAIDING ACTIVITIES.

LITTLE IS KNOWN ABOUT THE ABOVE NAMED TRIBES ON THE TAPAJOS, HOWEVER, THE CHAVANTE HAVE BEEN THE OBJECT OF AN INTENSE PACIFICATION PROGRAM ON THE PART OF THE INDIAN COMMISSION OF THE BRAZILIAN GOVERNMENT. THEY HAVE BEEN CITED ON A NUMBER OF OCCASIONS IN CONNECTION WITH THE KILLING OF VARIOUS INTRUDERS INTO THEIR TERRITORY INCLUDING SOME MEMBERS OF THE PACIFICATION TEAM. WITHIN THE PAST SEVERAL YEARS THE EFFORTS OF THE INDIAN PROTECTION SERVICE HAVE MET WITH CONSIDERABLE SUCCESS. MANY INDIVIDUAL INDIANS OF THE CHAVANTE HAVE BEEN ENGAGED IN BUILDING GOVERNMENT AIR STRIPS AND ARE IN CASUAL CONTACT WITH

"OUTSIDERS." THE BRAZILIAN AIR FORCE HAVE RECRUITED A NUMBER OF THE CHAVANTE AS SCOUTS, GUIDES, AND INTERPRETERS; ONE EVEN HOLDS THE RANK OF SERGEANT. VOLUNTARY ACCESS TO THE CHAVANTE AREA IS STILL CONTROLLED BY THE INDIAN PROTECTION SERVICE AND THERE IS STILL A DEGREE OF CAUTION AND UNPREDICTABILITY INVOLVED IN CONTACT WITH THE CHAVANTE.

WITH REGARDS TO THE SOCIAL, POLITICAL, AND RELIGIOUS ORGANIZATIONS AND ACTIVITIES OF THE MARGINAL INDIAN TRIBES, THERE IS LITTLE APPARENT DIFFERENCES BETWEEN THEM AND THE TROPICAL FOREST TRIBES. IN THAT THEY DO FORAGE IN THE SAVANNAS DURING THE PERIODS OF SEASONAL RIPENING OF THE PALM FRUITS AND OTHER VEGETABLE SOURCES, THIS ASPECT OF THEIR CULTURE PRESENTS A POSSIBLE CONTACT SITUATION. UNDER MOST CONDITIONS THE BEHAVIOR OF THE SURVIVOR IS THE SAME AS WITH THE TROPICAL FOREST INDIANS. WHAT MIGHT CONSTITUTE "OTHER" CONDITIONS IS UNPREDICTABLE AND THE SURVIVOR CAN ONLY BE ADVISED TO ATTEMPT TO INITIATE A FRIENDLY EXCHANGE; ACT CALMLY AND RATIONALLY; REFRAIN FROM PROVOCATIVE ACTS OR GESTURES AND BE ALERT FOR POSSIBLE CLUES AS TO A COURSE OF ACTION.

FOOD SOURCES

VEGETATION. SAVANNA VEGETATION OFFERS LITTLE IN THE WAY OF RELIABLE SOURCES OF FOOD. THE MAJOR EXCEPTION TO THIS IS THE OCCURRENCE OF PALM TREES THAT ARE FOUND ALONG THE STREAMS AND RIVERS OR IN FAIRLY PERMANENT AREAS OF MOISTURE SUCH AS SWAMPLANDS. OCCASIONALLY, SINGLE PALM TREES ARE SEEN STANDING OUT CONSPICUOUSLY AGAINST AN OTHERWISE EMPTY LANDSCAPE. THE MORICHE PALM, "MIRITI" OR "ITE" (MAURITIA FLEXUOSA), IS THE MOST COMMON TO THE SAVANNAS AND IS PARTICULARLY IMPORTANT TO THE INDIAN DIET. THE ORANGE COLORED FRUIT

PULP IS HIGHLY NUTRITIOUS. THE SMALL PALMETO OR "CANDARAY" PRODUCES A TERMINAL SHOOT OR CABBAGE WHICH IS BEST TASTING WHEN COOKED ALTHOUGH IT CAN BE EATEN RAW.

FOLLOWING THE PALMS, THE MORE PERSISTENT VEGETABLE OF ANY VALUE ARE THE TUBEROUS ROOTS OF THE SAVANNA HERBS. DUE TO THE CONSTANT FIRES AND DROUGHT THE SAVANNA VEGETATION DEVELOPS EXTENSIVE UNDER-GROUND ROOT SYSTEMS. MOST OF THESE TEND TO BE FIBEROUS AND TOUGH ES-PECIALLY THE OLDER PLANTS. NEVERTHELESS, THEY CAN BE SOAKED, POUNDED INTO A PULP, AND BOILED. INSECTS, MEAT FROM THE SMALL RODENTS, OR PORTIONS OF MEAT THAT ARE GENERALLY CONSIDERED REPELLENT, SUCH AS ENTRAILS, HEADS, EYES, ETC. MAY BE MADE MORE PALATABLE BY STEWING WITH ROOTS OR TUBERS. THIS SORT OF "DISGUISE" CAN ALSO BE EFFECTED BY COOKING WITH NUTS, BERRIES, OR ANY TYPE OF EDIBLE "GREENS" THAT CAN BE FOUND. IN CONNECTION WITH BOILING OF FOODS, THE LACK OF A SUITABLE COOKING POT THAT CAN BE PLACED DIRECTLY OVER A FIRE COULD BE A SERIOUS PROBLEM. IF ANY STURDY CONTAINER CAN BE IMPROVISED, THE SURVIVOR IS REMINDED OF THE METHOD OF HEATING ROCKS AND PLACING THEM IN THE FOOD "POT" INSTEAD OF PLACING IT OVER THE FLAME. AS TO CONTAINERS, THERE ARE GOURDS, PALM FRUIT SHELLS, SHELLS OF THE TURTLES, HOLLOWED OUT WOOD WHICH CAN BE HARDENED BY FIRE, AND METAL UTILIZED FROM THE PLANE.

BERRIES, FRUITS, AND GREENS BLOOM AND RIPEN QUICKLY IN THE SAVANNAS. ON OCCASIONS, THE DULL, LIFELESS APPEARANCE IS CHANGED AL-MOST IN HOURS AFTER THE OCCURRENCE OF A PROLONGED RAIN. USUALLY, HOWEVER, THE HARVEST IS SEASONAL AND SHORT. IN THE GRAN CHACO, THE MAJORITY OF THE VEGETABLE SOURCES ARE OBTAINED FROM THE BUSH TYPE VEGETATION SUCH AS THE PODS FROM THE ALGARROBA IS USUALLY GROUND INTO A MEAL FROM WHICH IT IS PREPARED IN DIFFERENT FORMS OF FOOD AS WELL

AS BEING FERMENTED FOR BEVERAGES. OTHER FRUITS OF THIS SORT IN THE GRAN CHACO ARE TUCAS (ACACIA, SEVERAL SPECIES), CHANAR (GOURLIEA DECORTICAN), MISTAL (ZYZYPHUS MISTAL), AND VARIOUS CACTUS FRUITS. THESE FRUITS ARE HARVESTED FROM NOVEMBER TO FEBRUARY.

MOST FRUIT TREES ARE FOUND IN CLOSE ASSOCIATION WITH THE GALLERY FORESTS OR NOT TOO DISTANT FROM MORE PERSISTENT AREAS OF MOISTURE. AMONG THE REGULARLY SOUGHT AFTER FRUITS ARE THE PEACH-LIKE FRUCTO DO LOBO, THE WILD PINEAPPLE AND THE MANGABARA. IN MANY OF THE SWAMPY AREAS ESPECIALLY IN THE PANTANAL, WILD RICE IS FOUND IN CONSIDERABLE ABUNDANCE. ANY CULTIVATED FOOD PLOTS, EITHER CURRENTLY USED OR ABANDONED ARE FOUND ONLY IN THE FORESTED AREAS INCLUDING THE GALLERY FORESTS. IN THE RUPUNUNI SAVANNAS, THERE IS A CONSIDERABLY GREATER INTENSITY OF FRUIT AND NUT TREES AND BERRY BUSHES BUT AGAIN THEY ARE SEASONAL, RIPENING SOON AFTER THE RAINY SEASONS DURING SEPTEMBER AND OCTOBER OR MARCH, APRIL AND MAY. GROVES OF PALM TREES OCCUR WITH CONSIDERABLE FREQUENCY IN THIS REGION.

SIGNIFICANTLY, THE SEASONAL "NOMADIC" FORAGING IN THE SAVANNAS BY THE MARGINAL INDIAN TRIBES IS NEITHER HAPHAZARD NOR RANDOM. THEY ARE THOROUGHLY FAMILIAR WITH THE AREAS OF CONCENTRATION AND RIPENING HABITS OF THE VEGETATION, AS WELL AS THE HUNTING AND FORAGING HABITS OF THE FAUNA THAT MAKE UP THE ENTIRE ECOLOGICAL COMPLEX OF THE SAVANNA ENVIRONMENT. THEY TRAVEL FROM ONE AREA OF ABUNDANCE TO ANOTHER EXHAUSTING EACH IN TURN UNTIL THE SEASON ENDS RETURNING FINALLY TO THE MORE PERMANENT TROPICAL FOREST ENVIRONMENT DURING THE RAINY SEASON OR WHEN THE SAVANNAS ARE IN THE FINAL AND LIFELESS STAGES OF DROUGHT. EVEN KNOWING THE NATURE AND DISTRIBUTION OF SAVANNA FOOD PLANTS, THE INDIANS CARRY SUPPLIES OF MANIOC MEAL HELD IN RESERVE FROM THEIR CUL-

TIVATED PLOTS FOR THIS SEASONAL TREK. THE LONG SEASONAL MARCHES ARE BECOMING LESS AND LESS A MEANS OF SUBSISTENCE AS THE INCREASING AVAILABILITY OF METAL AXES AND OTHER MORE "MODERN" TOOLS ALLOW THE INDIANS TO CLEAR LARGER AREAS OF THE FORESTS FOR CULTIVATION WITH CONSIDERABLY LESS ENERGY. THE SAVANNAS ARE STILL HARVESTED BUT MUCH MORE AS SUPPLEMENTAL RESOURCES THAN FORMERLY.

ANIMALS. HUNTING OR STALKING ANIMALS IN THE SAVANNAS IS TO A CONSIDERABLE EXTENT A MATTER OF LEARNING THEIR MOVEMENT PATTERNS. AS CREATURES OF HABIT THEY FOLLOW A SOMEWHAT PREDICTABLE ROUTINE. FOR EXAMPLE, THE NOCTURNAL FEEDERS HOLE UP DURING THE DAY. THE SURVIVOR SHOULD BE ALERT TO ANY INDICATION OF A BURROW, NEST, CREVICE, HOLE, HOLLOW TREE, OR ANY SUCH HABITABLE PLACE WHERE THE NIGHT FEEDERS MAY BE. EVEN EMPTY HABITATIONS CAN BE RIGGED WITH TRAPS OR SNARES IN THAT MANY ANIMALS UTILIZE SUCH PLACES SOMEWHAT INDISCRIMINATELY. THE ANIMALS THAT ARE ACTIVE DURING THE DAY USUALLY REGULATE THEIR MOVEMENTS ACCORDING TO THE INTENSITY OF THE SUN'S HEAT. MOST ACTIVITY OCCURS DURING THE EARLY MORNING OR LATE EVENING HOURS. IN THE HEAT OF THE MIDDAY SUN, THE LAND IS GIVEN OVER TO THE GRASSHOPPERS AND LOCUSTS. AT SUCH TIMES THE SAVANNA INHABITANTS FIND RESPITE IN THEIR BURROWS, UNDER OR BEHIND CLUMPS OF GRASS, OR DEEP AMONG THE THICKETS AND BUSHES. THE FOREST ANIMALS RETREAT TO THE COOLER SHADE OF THE FOREST.

AS IN THE FOREST, THERE SEEMS TO BE CONTINUOUS NIGHT LIFE GOING ON IN THE SAVANNAS. NIGHT SOUNDS CARRY A CONSIDERABLE DISTANCE AND UNLESS ONE IS EXPERIENCED IT IS DIFFICULT TO DETERMINE HOW FAR AWAY THE ANIMALS ARE OR WHAT THE SOUNDS SIGNIFY. IN THE EARLY MORNING HOURS WHILE THE DEW IS STILL ON THE GROUND THE PATTERN OF TRACKS MOVING OUT OF THE FORESTS SHOW UP QUITE WELL WHERE GRASS COVER IS DENSE AND STILL

SHORT. HOWEVER, IN THE TALLER BUNCH-GRASS THE SOIL IS MORE EXPOSED AND THE TELLTALE DEW TRAILS ARE LESS EVIDENT. THEN THE HUNTER MUST RELY ON KNOWN GAME HABITS AND MOVEMENTS. GAME TRAILS IN AND OUT OF THE SAVANNAS GENERALLY FOLLOW TWO DIFFERENT PATTERNS. IF THERE ARE INTERMEDIATE AREAS OF FOOD SOURCES WITHIN A GIVEN EXPANSE OF OPEN TERRAIN THE TRAILS LEAVE THE FOREST EDGE AT THE POINT CLOSEST TO INTERMEDIATE AREAS. INTERMEDIATE AREAS IN THIS CASE REFER TO GROVES OF PALMS, OR OTHER TREE COVERED AREAS, AREAS OF EXTENSIVE BUSH GROWTH, CERRADOS, SWAMPS, ESTEROS, OR OTHER ISOLATED BODIES OF WATER. IN OTHER WORDS, ANY AREA WHERE THERE IS AN INCREASE OF VEGETATION OR ANIMAL LIFE IN COMPARISON TO THE SURROUNDING AREA. WHERE THERE ARE NO INTERMEDIATE AREAS, THE TRACKS REFLECT A MEANDERING PATTERN OF FORAGING--CIRCLING AMONG THE CLUMPS OF TALL GRASSES, SCATTERED BUSHES, TERMITE MOUNDS, BURROWS, ETC. THESE FORAGING TRIPS ARE NEVER A GREAT DISTANCE FROM THE FRINGES OF THE FORESTS. WHERE THE MARGIN OF THE FOREST ENCIRCLES A FAIRLY EXTENSIVE OPEN AREA, RARELY WILL THE MAJORITY OF THE ANIMALS CUT ACROSS THE EXPANSE USUALLY PREFERRING TO FOLLOW THE EDGE OF THE FOREST. THIS IS NOT ALWAYS SO. THE JAGUAR APPARENTLY HAS LITTLE TO FEAR AND OCCASIONALLY HERDS OF PECCARY WILL ROOT THEIR WAY ACROSS SUCH AREAS. THE LITTLE RED CAMPOS BROCKETS, TRAVELING IN HERDS OF TEN OR MORE, ARE CONSTANTLY ON THE ALERT FREQUENTLY LEAPING UP TO SCAN THE HORIZON.

THE SURVIVOR IS REMINDED THAT IN THE SAVANNAS HE IS THE TALLEST ANIMAL OF ALL. THERE ARE CERTAIN AREAS AND TIMES OF THE YEAR WHEN THE GRASSES ARE AS TALL AS A MAN. NEVERTHELESS, ABOUT 99% OF THE FAUNA, OTHER THAN INSECTS, FUNCTION BELOW THE HEIGHT OF THE VEGETATION OR WHEN SENSING DANGER CAN EASILY BLEND OR MERGE WITH THE TERRAIN BECOMING

QUITE INVISIBLE. UNDER THESE CONDITIONS THE HUNTER, OR SURVIVOR IN THIS INSTANCE, MUST UTILIZE ALL THE CUNNING AND IMAGINATION HE POSSESSES. WHATEVER HIS WEAPONS THEY ARE VALUELESS IF THE GAME CANNOT BE BROUGHT WITHIN EFFECTIVE RANGE. THE INDIAN IS OF COURSE UNRIVALED IN ALL THE LORE OF THE REGIONAL FAUNA. IT IS UNLIKELY THAT THE SURVIVOR CAN ACQUIRE THE SAME PROFICIENCY IN SO SHORT A TIME. HOWEVER, A REVIEW OF THE BASIC PRINCIPLES OF INDIVIDUAL CAMOUFLAGE MIGHT BE HELPFUL. USE THE NATURAL VEGETATION TO MAKE A SCREEN OR AMBUSH ALONG TRAILS, FEEDING, OR WATERING PLACES. IF STALKING, USE BUSH TYPE VEGETATION TO BREAK UP ONE'S SILHOUETTE. THE INDIANS TIE THE BUSH BRANCHES ALL ABOUT THEMSELVES LEAVING THE ARMS FREE FOR ACTION. ONLY MOVE WHEN THE GAME IS OBVIOUSLY UNAWARE AND DISTRACTED BY FEEDING OR SUCH OTHER ACTIVITY. A WORD OF CAUTION--IF A PARTICULAR ANIMAL IS BEING STALKED, REMEMBER TO SCRUTINIZE THE AREA OF APPROACH FOR OTHER ANIMALS WHICH MAY EITHER REACT AND SOUND AN ALARM OR PRESENT A BETTER SOURCE OF FOOD AND OPPORTUNITY OF CAPTURE.

AS A SOURCE OF FOOD FEW ANIMALS CAN EQUAL THE ARMADILLO. WHILE NOT ABUNDANT IT IS PROBABLY MORE COMMON IN THE SAVANNAS THAN MOST OF THE OTHER ANIMALS WHICH ARE USUALLY ASSOCIATED WITH THE FORESTS. THE ARMADILLO IS A BURROWER AND WHEN THE OCCASION DEMANDS A VERY SWIFT ONE DISAPPEARING IN AN AMAZINGLY SHORT TIME WHEN ATTEMPTING TO ESCAPE CAPTURE. THEY DO NOT BURROW DEEPLY AND CAN BE DUG OUT OR FORCED OUT BY PRODDING WITH A SHARP POINTED STICK OR SMOKE.

ONCE THE OTHER BURROWING ANIMALS SUCH AS SMALL FIELD MICE AND SHREWS DISAPPEAR INTO THEIR UNDERGROUND NETWORK OF RUNWAYS, THEY ARE ALMOST IMPOSSIBLE TO GET OUT. THESE MUST BE SNARED OR TRAPPED IN VARIOUS WAYS, BURNED TO DEATH BEFORE THEY CAN GET TO THEIR HOLES (BY

GRASS FIRES) OR CLUBBED OR STONED--FEATS REQUIRING BOTH ALACRITY AND ACCURACY. RABBITS AND HARES OCCUR SOMEWHAT IRREGULARLY. THEY APPEAR TO BE MORE ABUNDANT IN THE RUPUNUNI SAVANNAS THAN IN THE CAMPOS OR THE LLANOS. CAPTURE BY TRAPPING, SNARING, OR BY HAND WHEN THEY CAN BE FORCED OUT OF A BURROW OR CREVICE ARE THE MORE USUAL METHODS OF HUNTING THESE ANIMALS. THEIR SMALL SIZE AND ELUSIVENESS MAKE THEM A SOMEWHAT DOUBTFUL CHOICE FOR EXPENDITURE OF CRITICAL AMMUNITION EXCEPT IN MORE EXTREME CONDITIONS OF SCARCITY OF LARGER GAME--AND HUNGER.

THE PECCARIES, AGOUTIS, DEER, FOXES, TAPIR, PACAS, OPPOSSUM, ANTEATERS, AND MONKEYS ARE ALL REMUNERATIVE GAME FOR EXPENDITURE OF AMMUNITION. IF AMMUNITION IS A CRITICAL FACTOR, THE SURVIVOR MUST UTILIZE THE GREATEST SKILL AND PATIENCE TO BE ASSURED OF A SUCCESSFUL SHOT. WHERE THERE IS ALREADY SOME MEAT ON HAND THE SURVIVOR MUST ALSO CONSIDER THE ADVISABILITY OF USING AMMUNITION ON TARGETS OF OPPORTUNITY. EVEN THOUGH THE MEAT CAN BE CUT, DRIED AND/OR SMOKED, IT CANNOT BE PRESERVED FOR VERY LONG. IT IS NEARLY IMPOSSIBLE TO KEEP FLIES AWAY FROM MEAT BEING PREPARED FOR PRESERVATION ESPECIALLY IF THE STRIPS OF MEAT ARE BEING SUN DRIED. THE LARVAE OF THE FLIES AND OTHER INSECTS GET INTO THE MEAT AND IN A SHORT TIME PRODUCE PUTRIFYING ACTION EVEN IN THE HARD, DRIED STRIPS. STILL, THE CHRONIC SCARCITY OF SUCH PRIZED GAME MUST BE CONSIDERED. UNDER THESE CONDITIONS THE SURVIVOR MAY ATTEMPT SOME OF THE ALTERNATE IF LESS RELIABLE MEANS OF CAPTURE AND SAVE THE AMMUNITION FOR A MORE CRITICAL TIME. ALTHOUGH THE JAGUAR AND PUMA ARE FOOD SOURCES, STALKING AND KILLING THESE ANIMALS WITHOUT PREVIOUS EXPERIENCE POSES A SERIOUS RISK, EVEN WITH A GUN.

BIRDS. THERE ARE MANY EXCELLENT GAME BIRDS ASSOCIATED WITH

THE SAVANNAS ALTHOUGH QUITE A NUMBER ONLY FEED IN THE SAVANNAS AND NEST IN THE SURROUNDING FORESTS. THE CURASSOWS AND GUANS DESCRIBED UNDER TROPICAL FORESTS ARE ALSO FOUND IN THE GALLERY FORESTS PENETRATING INTO THE SAVANNAS BUT ARE RARELY FOUND IN THE OPEN AREAS. THIS IS TRUE OF MANY OF THE RAIN FOREST BIRDS. SOME OF THE BIRDS WHICH ARE MORE SPECIFICALLY OF THE SAVANNA ARE IN MANY RESPECTS SIMILAR TO THE PRAIRIE BIRDS OF NORTH AMERICA. THE HUNTING TECHNIQUES ARE ALSO MUCH THE SAME IF ONE HAS THE PROPER GEAR, THAT IS; SHOTGUN, BIRD DOGS, BIRD CALLS; AND IF ONE USES THE PROPER TACTICS, THAT IS; STALKING, CAMOUFLAGE, COVER, ETC. WHETHER ANY TYPE OF GUN IS AVAILABLE IS A MATTER OF CIRCUMSTANCES AS INDICATED ABOVE. WHETHER ANY OTHER TYPE OF WEAPON IS AVAILABLE IS VERY MUCH A MATTER OF IMAGINATION AND RESOURCEFULNESS ON THE PART OF THE INDIVIDUAL. IT IS UNLIKELY THAT THE SURVIVOR CAN LEARN TO LURE THE BIRDS IN CLOSE WITH CALLS AS DO THE INDIANS. HOWEVER, HE CAN LEARN TO USE THE STALKING TECHNIQUES IN ORDER TO BRING HIS WEAPONS INTO PLAY.

IN THE SURVIVAL SITUATION ANY KIND OF BIRD THAT CAN BE CAPTURED BY SNARING, SHOOTING, STONING, CLUBBING IN ANY WAY IS A PRIZE. THE FOLLOWING IS A LIST OF SOME OF THE MORE COMMON BIRDS ASSOCIATED WITH THE SAVANNA:

RHEA ALSO "EMU"(RHEA AMERICANA)--KNOWN LOCALLY AS "AVESTRUZ" OR "NANDU." THESE OSTRICH-LIKE BIRDS RANGE IN THE SOUTHERN CAMPOS OF BRAZIL, IN THE GRAN CHACO, AND THE PAMPAS OF ARGENTINA. THEY WEIGH UP TO 100 POUNDS, ARE FLIGHTLESS BUT VERY SWIFT RUNNERS AND ARE PARTICULARLY ADEPT AT WEAVING ERRATICALLY THROUGH THE CLUMPS OF TALL GRASS, THORN BUSHES AND

THORN TREES. THEY ARE OF VARIOUS COLORS RANGING FROM DIRTY MOTTLED GREY TO DARK BROWN AND IN APPEARANCE CANNOT BE MISTAKEN FOR ANY OTHER SOUTH AMERICAN BIRD. BREEDING SEASONS VARY WITH THE LOCAL. THEY USUALLY BUILD THEIR NESTS, A SHALLOW HOLE THIRTY-SIX TO FORTY INCHES IN DIAMETER, ON LOOSE SANDY SOIL AMONG THE TALLER GRASSES, THICKETS, OR COPSE OF SAVANNA TREES. THE NUMBER OF EGGS VARY. ON ONE OCCASION FORTY-THREE WERE FOUND IN ONE NEST. THE EGGS ARE LARGE AND GOOD TASTING. USUALLY WHEN A NEST IS FOUND THE MALE WILL BE IN THE VICINITY. HE WILL ATTEMPT TO DISTRACT ATTENTION FROM THE NEST BY RUNNING ABOUT ERRATICALLY WITH OUTSTRETCHED WING BUT WILL NOT ATTACK. THE INDIANS CONSIDER ALL PARTS OF THE RHEA AS EDIBLE ALTHOUGH THE WINGS ARE THE MORE DESIREABLE. THE CALL OF THE RHEA HAS A DISTINCTIVE BOOMING SOUND.

TINAMOUS (TINAMIDAE)--THERE ARE NUMEROUS SPECIES OF THIS REPRESENTATIVE OF THE QUAIL THROUGHOUT SOUTH AMERICA. THEIR BODY COLORING AND MARKINGS ARE AS VARIED AS THE SPECIES. LIKE THEIR NORTH AMERICAN COUSINS, THEY ARE USUALLY OPEN AREA BIRDS SPENDING ALL OF THEIR TIME ON THE GROUND. ONLY WHEN FLUSHED BY AN ENEMY DO THEY TAKE FLIGHT. RISING IN A WHIRR OF WINGS ABOUT TEN TO FIFTEEN FEET, THEY HEAD DIRECTLY FOR THE NEAREST RISE, NEVER FAR ABOVE GROUND, AND DISAPPEAR BEHIND THE SCREEN AFFORDED

BY THE TERRAIN. THEIR PATTERN OF FLIGHT IS A SERIES OF STROKES AND GLIDES FOLLOWING THE CONTOURS OF THE TERRAIN.

THEY ARE MUCH THE SAME SIZE AS THE NORTH AMERICAN QUAIL ALTHOUGH ONE SPECIE, THE "GREY" TINAMOUS, WEIGHS UP TO THREE AND FOUR POUNDS. NESTS CONSIST OF SMALL HOLLOWS IN THE CLUMPS OF THE GRASSES OR THICKETS. THEIR BREEDING AND NESTING HABITS ARE AS VARYING AS THE SPECIES AND LOCALES IN WHICH THEY ARE FOUND. THEY RANGE THROUGHOUT THE SAVANNAS AND GRASSLANDS OF SOUTH AMERICA INCLUDING THE GRAN CHACO. THERE ARE SOME SPECIES FOUND IN A LOOSE ASSOCIATION WITH OPEN WOODLANDS AND MARSHY AREAS BUT THE MAJORITY ARE MORE COMMONLY FOUND IN THE OPEN AREAS. MOST OF THE TINAMOUS HAVE A MELODIOUS SERIES OF CALLS INCLUDING A SERIES OF LOW PIPING WHISTLES, TERMINAL TRILLS AFTER A SERIES OF SINGLE NOTES, ASCENDING NOTES WITH TERMINAL TRILLS, OR ALTERNATING NOTES AND TRILLS. THE WHISTLING EFFECT IS PREVALENT AMONG NEARLY ALL OF THE TINAMOUS.

FINCHES (FUNGILLIDAE)--THERE ARE MANY SPECIES OF THIS BIRD FAMILY RANGING THROUGHOUT SOUTH AMERICA. MANY OF THEM ARE CONSIDERED FOREST BIRDS BUT THEY ARE AMONG THOSE WHICH FEED SOMEWHAT INDISCRIMINATELY IN BOTH FOREST AND SAVANNA ENVIRONMENT. THERE IS A DECIDED PREFERENCE FOR AREAS OF EXTENSIVE BUSH OR

TREE-COVERED AREAS ESPECIALLY IN THE CERRADOS AND THE GRAN CHACO. THEY USUALLY PERCH AMONG THE SMALL TREES OR IN THE THICKETS DARTING AFTER FLYING INSECTS OR DROPPING TO THE GROUND FOR FOOD AND RETURNING TO THE THICKETS OR TREES. SEVERAL SPECIES OF THE MATO GROSSO DO FEED ON THE GROUND ESPECIALLY DURING THE BREEDING SEASON. THESE ARE FOUND IN SMALL STREAMS OR MARSHES. THEIR NESTS ARE FOUND IN CLUMPS OF GRASS SEVERAL INCHES ABOVE THE GROUND. THE EGGS, USUALLY FOUR TO SIX IN A NEST, ARE MOTTLED GREY GREEN AND BROWN AND ARE VERY THIN SHELLED. THEIR CALLS ARE THOSE OF A SONGBIRD, INTRICATE AND MELODIOUS. THEY ARE SMALL, QUICK, EXCITABLE, AND DIFFICULT TO KILL IN FLIGHT. SNARING APPEARS TO BE THE BEST MEANS OF CAPTURE.

CUCKOO (CUCULIDAE)--NUMEROUS SPECIES INCLUDE LOCAL OR INDIAN NAMES OF ANI OR ANO-I, GUIRA, PIRIRI (GUARANI, INDIAN NAME) AND PIRINCHO. THESE BIRDS RANGE THROUGHOUT THE SAVANNAS, THE CHACO AND PAMPAS. THEY ARE GREGARIOUS, FLOCKING IN NUMBERS UP TO TWENTY OR MORE. THEY FEED ON THE GROUND BUT MAINTAIN A MEMBER OR GUARD PERCHED WHERE IT CAN SURVEY THE COUNTRYSIDE. THEY ARE FREQUENTLY ATTRACTED BY RECENTLY BURNED AREAS. THEY RESEMBLE THE MAGPIES OR JAYS. THE CALLS ARE USUALLY A DISCORDANT SERIES OF NOTES, WHICH SOUND LIKE A PERSON FORCING AIR OVER A LEAF COMPRESSED BETWEEN THE TONGUE AND THE

ROOF OF THE MOUTH (AS MOST BOYS LEARN TO DO). THEIR ALARM SOUNDS LIKE THE CRACKLING NOISE OF A BRUSH FIRE, OR WALKING THROUGH DRY LEAVES. FLIGHT IS SLOW AND WEAK USUALLY ENDING AT THE NEAREST TREE WHERE THE ENTIRE FLOCK WILL ROOST. ON COOL MORNINGS THEY GATHER IN A SUNNY SPOT WITH WINGS AND TAILS DROOPING AND FEATHERS FLUFFED. THEY HAVE A STRONG AND DISAGREEABLE ODOR AND THE MEAT THOUGH EDIBLE BECOMES MORE PALATABLE WHEN THOROUGHLY BOILED (A RECOMMENED TREATMENT FOR MOST OFFENSIVE MEATS). THEY FORAGE AMONG THE CLUMPS OF GRASS, IN DENSE THICKETS, BUSH, OR TREES.

PIGEONS (COLUMBIDAE)--THESE BIRDS, OF WHICH THERE ARE NUMEROUS SPECIES, ARE MUCH LIKE THE QUAIL IN HABITS. THEY ARE FOUND THROUGHOUT THE SAVANNAS SHOWING A PREFERENCE FOR LOW BRUSH OR TREE COVERED AREAS. THEY REMAIN ON THE GROUND FREQUENTLY FEEDING IN OPEN AREAS FREE OF UNDERBRUSH, WALKING ABOUT WITH BOBBING HEADS. WHEN ALARMED THEY WILL EITHER FREEZE IN POSITION OR FLUSH RAPIDLY WITH QUICK DARTING FLIGHTS ACCOMPANIED BY WHIRRING SOUNDS OF WINGS AND A SHRILL WHISTLING. THEY MAY FLY TO THE NEAREST DENSE COVER OR TO THE NEAREST TREE WHERE THERE IS SOME COVER--EVEN THOUGH THE TREE MAY BE A FEW YARDS AWAY. THEY ARE VERY GREGARIOUS, ESPECIALLY WHERE FOOD IS ABUNDANT, WITH FLOCKS OF UP TO TWENTY-FIVE OR THIRTY NOT UNUSUAL. NESTING HABITS ARE VARIED, SOME IN TREES, THICKETS,

SINGLE BUSHES OR IN CLUMPS OF TALL GRASS.

THE FOREGOING ARE JUST A FEW OF THE MANY BIRDS THAT FREQUENT THE SAVANNA REGIONS OR THE WOODS IN CLOSE ASSOCIATION WITH THE SAVANNAS. OTHER FAMILIES OF BIRDS REPRESENTED ARE PLOVERS, WOODPECKERS, PARROTS, SNIPES, MINERS, HUMMINGBIRDS, LARKS, ORICLES, BLACKBIRDS--THE LIST GOES ON ALMOST INTERMINABLY.

BESIDE THE "LAND" BIRDS, THERE ARE MANY AQUATIC OR SEMI-AQUATIC BIRDS WHICH ARE FOUND IN ASSOCIATION WITH ALL OF THE RIVER SYSTEM AS WELL AS THE MARSHLANDS AND SWAMPS. AMONG THESE ARE HERONS, TERNS, SANDPIPERS, IBIS, GEESE, DUCKS, ETC., ETC. PROBABLY THE MORE IMPORTANT OF THESE ARE THE SEVERAL SPECIES OF DUCKS AND GEESE THAT ARE COMMON ALONG MOST OF THE WATERWAYS THROUGHOUT SOUTH AMERICA. THE NON-MIGRATORY ORINOCO GOOSE NESTS IN PAIRS ALONG MOST OF THE TRIBUTARIES OF THE RIO ORINOCO, IN THE SAVANNAS AND GALLERY FORESTS. THEY ARE PARTICULARLY ABUNDANT IN THE RIO APURE-PORTUGUESE AREA WHERE THEY ARE COMMONLY SEEN FEEDING OR RESTING IN HOLLOW TREES. THEY ARE RELATIVELY TAME, AND CAN BE APPROACHED QUITE EASILY. THE BREEDING PERIOD IS FROM APRIL TO AUGUST. EGGS ARE VERY PALATABLE. MOST OTHER GEESE OF THE RIVER SYSTEMS ARE MIGRATORY BIRDS. OF THE DUCKS, PROBABLY THE MOST COMMONLY KNOWN IS THE MUSCOVY DUCK. ALTHOUGH FOUND IN THE GRAN CHACO OF PARAGUAY, THEY ARE NOT COMMON IN THE OTHER SAVANNA AREAS BEING MORE ASSOCIATED WITH THE FOREST. THERE ARE, HOWEVER, SEVERAL OTHER SPECIES OF DUCK WHICH ARE TO BE FOUND IN THE SWAMPS, RIVERS AND STREAMS. THESE ARE THE WHITE-BILLED AND RED-BILLED WHISTLING DUCKS WHICH ARE FOUND IN THE MARSHES AND SWAMPS AS WELL AS THE RIVERS AND STREAMS. THEY NEST IN THE TALL REEDS OR GRASSES ALONG THE MARGINS OF THE WATER OR IN HOLLOW TREES. THEY ARE GREGARIOUS AND NOISY CONGREGATING IN

FLOCKS, USUALLY BREEDING DURING THE RAINY SEASONS WHEN THEY LAY UP TO TWELVE TO FIFTEEN EGGS PER NEST. THEY FEED AT NIGHT, ARE QUITE TAME, AND EASILY APPROACHED. THE PINTAIL IS ANOTHER SPECIE OF DUCK WHOSE APPEARANCE USUALLY COINCIDES WITH THE PERIODS OF FLOOD. DURING THE PERIODS OF ARRIVAL IN THE FEEDING AREAS OR TERMINAL AREAS ALONG ROUTES OF MIGRATION, THESE BIRDS SHOW LITTLE FEAR OR AWARENESS OF DANGER FROM HUMANS. AT SUCH TIMES CONTINUOUS FLIGHTS OF MORE THAN 20,000 INDIVIDUAL DUCKS MAY ARRIVE IN ONE AREA OF FLOODED LAND. BESIDES THE ABOVE, OTHER SPECIES OF DUCK INCLUDE THE YELLOW-BILLED OR TREE TEAL, BRAZILIAN TEAL, CINNAMON TEAL, GREY TEAL, ROSY-BILLED DUCK, BLACK-HEADED DUCK, AND THE RUDDY DUCK MOST OF WHICH ARE FOUND IN THE MARSHES, LAGOONS, OR OTHER WATERWAYS.

REPTILES. THE MORE IMPORTANT FOOD SOURCES AMONG THE REPTILES OF THE SAVANNA ARE THE TURTLES AND TORTOISES. THESE ARE MOST USUALLY FOUND IN ASSOCIATION WITH AREAS OF MORE PERMANENT WATER EITHER THE RIVERS AND STREAMS OR THE SWAMPS AND MARSHES. LIKE THE OTHER AQUATIC OR SEMI-AQUATIC REPTILES, PARTICULARLY THE CROCODILES AND CAIMAN, THE TURTLES DISPERSE OVER THE FLOODED AREAS ADJACENT TO THE RIVERS AND STREAMS DURING THE RAINY SEASONS. DURING PERIODS OF RECESSION AND DROUGHT, THEY ARE FREQUENTLY TRAPPED IN ISOLATED BODIES OF WATER. ALSO LIKE THE CAIMAN, AT SUCH TIMES THEY MAY BURROW INTO THE MUD AND REMAIN IN SEMI-HIBERNATION UNTIL THE RAINS "REDISTRIBUTE" THEM. FOR THE MOST PART, HOWEVER, THEY FOLLOW THE RECEDING WATERS BACK TO THE FLOWING RIVERS.

RIVER ANIMALS. AS DESCRIBED UNDER FOOD SOURCES OF THE TROPICAL FORESTS, THE SPECIES OF FOOD FISH OF THE SOUTH AMERICAN RIVER SYSTEMS NUMBER IN THE THOUSANDS AND THE NUMBER OF FISH IN THE

MILLIONS, THE MAJORITY OF WHICH ARE EDIBLE. IN ADDITION TO THE FISH, THERE ARE THE ABOVE MENTIONED CROCODILES AND CAIMAN, MANATEES ESPECIALLY IN THE ORINOCO RIVER SYSTEM, DOLPHIN, OTTERS, AND OTHER WATER ANIMALS. NOT TO BE OVERLOOKED ARE THE VARIOUS AMPHIBIANS SUCH AS FROGS, TADPOLES, NEWTS, AND SALAMANDERS. TWO SPECIES ARE BEST AVOIDED: ONE IS THE GIANT TOAD, "SAPAO" OR "SAPO," WHICH WEIGHS UP TO FIVE POUNDS AND HAS HUGE EXTERNAL GLANDS ON ITS BACK THAT EXUDE A HIGHLY TOXIC SECRETION WHICH AFFECTS THE DIGESTIVE TRACT; THE OTHER IS A SMALL, BRILLIANTLY COLORED FROG WHICH HAS A SKIN SECRETION WHICH WHEN FRESH IS HIGHLY TOXIC TO THE DIGESTIVE TRACT AND WHEN DRY AFFECTS THE BLOOD STREAM. THE DRIED SECRETION IS USED AS A POISON FOR BLOWGUN DARTS. OTHER SOURCES OF ANIMAL FOOD ALONG THE RIVERS, SWAMPS AND MARSHES ARE THE EGGS FROM TURTLES, CROCODILES, CAIMAN, AND AQUATIC BIRDS; VARIOUS TYPES OF FRESH-WATER SNAILS, MOLLUSKS, CRABS, AND OTHER TYPES OF SHELLFISH WHICH ARE ALL EASILY GATHERED.

IN THE SAVANNAS ONE OF THE MORE SERIOUS CONSIDERATIONS AFFECTING THE UTILIZATION OF AQUATIC ANIMAL LIFE IS THE SEASONAL VARIATIONS. THIS HAS BEEN DISCUSSED BRIEFLY ABOVE. DURING PERIODS OF DROUGHT MOST OF THE STREAMS AS WELL AS THE SWAMPS ARE DRIED UP AND ONLY THE MAJOR TRIBUTARIES MAINTAIN A PERSISTENT FLOW OF WATER AND ANIMAL LIFE. CONVERSELY, DURING THE RAINY SEASONS THE ADJACENT LANDS ARE THOROUGHLY INUNDATED AND THE ANIMAL LIFE IS WIDELY DISTRIBUTED OVER THE FLOODED AREAS MAKING THE NORMAL TECHNIQUES OF FISHING FROM THE BANKS (WHICH IS VERY ARID ESPECIALLY IN THE REGION NORTH OF THE RIO PILCOMAYO, THE PERIODS OF FLOOD WERE PARTICULARLY IMPORTANT TO HE INDIANS BECAUSE OF THE SEASONAL RUN OF FISH WHICH WERE LEFT TO IE BY THE THOUSANDS AS THE WATERS RECEDED.

INSECTS. THE TERMITE HAS BEEN MENTIONED SEVERAL TIMES, VARIOUS SPECIES BEING FOUND BOTH IN THE FORESTS AND SAVANNAS. THE MOUNDS OF THE TERMITES SEEM TO FILL A SPECIFIC ECOLOGICAL NICHE IN THE SAVANNAS. NOT ONLY DO OTHER ANIMALS SUCH AS INSECTS, LIZARDS, SNAKES, AND RODENTS UTILIZE THE MOUNDS AS SHELTERS BUT FREQUENTLY THE ONLY CONSPICUOUS VEGETATION IN AN AREA WILL BE CONCENTRATED AROUND THE MOUND. THE SURVIVOR CAN USE THE OCCUPANTS OF THE MOUND AS A SOURCE OF FOOD AND THE MATERIAL OF THE MOUND ITSELF CAN BE BURNED AND USED AS FUEL (IT CAN ALSO SERVE AS A SIGNAL FIRE FOR SEARCHING PARTIES).

GRASSHOPPERS AND LOCUSTS ARE A PARTICULARLY NUTRITIOUS SOURCE OF FOOD AND HAVE BEEN UTILIZED AS SUCH BY PEOPLES THE WORLD OVER. THE MORE USUAL METHOD OF PREPARING THEM IS BY ROASTING BUT THEY CAN BE MASHED INTO A PASTE OR BOILED WITH OTHER FOODS, ESPECIALLY VEGETABLES. A NOTE OF CAUTION IS INTRODUCED CONCERNING THE NECESSITY OF REMOVING THE LEGS--THIS APPLIES TO MOST EDIBLE INSECTS BUT PARTICULARLY THE GRASSHOPPERS, LOCUSTS, AND ANTS. THE LEGS ARE NOT ONLY INDIGESTIBLE BUT ALSO CAUSE IRRITATION TO THE THROAT AND STOMACH.

THE VALUE OF THE HONEYBEE WAS DISCUSSED AT LENGTH IN THE TROPICAL FOREST DATA. THEY ARE PARTICULARLY PREVALENT IN THE CERRADOS OF THE CAMPOS AND THE WESTERN LLANOS AREAS. AS PREVIOUSLY MENTIONED--THE HONEYBEES OF SOUTH AMERICA ARE STINGLESS BUT THEY DO BITE. SOME SEEM TO HAVE A PARTICULAR AFINITY FOR HUMAN SWEAT AND WILL LITERALLY BLANKET A PERSON'S FACE OR EXPOSED AREAS. SOME ARE ALSO ATTRACTED TO THE EYES APPARENTLY AND IN THE CAMPOS ARE CALLED "LAMBE ALHOS" OR EYE LICKERS. THE HONEYBEES THEMSELVES ARE AN EXCELLENT FOOD. THE WASPS ARE ALSO QUITE PREVALENT AND WHILE THE COMBS AND LARVAE OF SOME

ARE AN EXCELLENT SOURCE OF FOOD THE DANGER FROM THE WASPS THEMSELVES IS QUITE FORMIDABLE. MOST OF THE OTHER INSECTS OF FOOD VALUE ARE ASSOCIATED WITH THE FORESTS. THIS IS TRUE OF THE VARIOUS GRUBS AND BEETLE LARVAE FOUND IN THE DEAD OR DYING TREES.

HEALTH AND HAZARDS

IN THE SAVANNAS ONE OF THE MORE SERIOUS CONSIDERATIONS OF SURVIVAL IS THE PROCUREMENT OF WATER DURING THE PERIODS OF DROUGHT. AFTER THE INITIAL PROBLEMS OF ORGANIZATION HAVE BEEN DEALT WITH, IMMEDIATE ATTENTION SHOULD BE GIVEN TO FINDING AN ADEQUATE SOURCE OF WATER. THIS IS BEST ACCOMPLISHED WHILE THE INDIVIDUAL OR INDIVIDUALS ARE STILL STRONG AND ABLE. ONCE THE DEBILITATING EFFECTS OF MOISTURE DEFICIENCY SET IN THE LESS ENERGY CAN BE AFFORDED, OR EVEN GENERATED, IN SEARCH. WHERE THERE ARE SEVERAL IN THE SURVIVAL PARTY, AREAS CAN BE APPORTIONED SO THAT THE SEARCH PARTIES ARE OPERATING SIMULTANEOUSLY. WHEN A SEARCH PARTY DOES LEAVE THE CRASH OR BASE AREA, EVERY PRECAUTION MUST BE TAKEN TO INSURE THEIR SAFE RETURN. DIRECTION MAINTENANCE TECHNIQUES SHOULD BE USED, TRAILS BLAZED WHERE NECESSARY, AND DISTINCTIVE CHECK POINTS CLEARLY IDENTIFIED. TO THE EXTENT POSSIBLE, EACH PARTY SHOULD BE EQUIPPED WITH WEAPONS, COMPASS, SIGNAL MIRROR, MATCHES, KNIVES, AXE OR MACHETE, FOOD, WATER, INSECT REPELLENT, AND ANTI-VENOM FOR SNAKE BITE. THE PARTY SHOULD BE PREPARED AS IF IT WERE AN INDEPENDENT SURVIVAL UNIT WHILE IT IS SEPARATED FROM THE BASE AREA. IT IS RECOGNIZED THAT THE ABOVE MEASURES ASSUME OPTIMUM CONDITIONS PREVAIL. VERY PROBABLY THE REVERSE WILL BE TRUE. NEVERTHELESS, PRIMARY EFFORT SHOULD BE EXPENDED AND SUPPORTED TO THE ENDS THAT ADEQUATE WATER IS AVAILABLE TO MEET CONTINUED NEEDS. OBVIOUSLY, PERHAPS THE SEARCH FOR FOOD SHOULD NOT BE OVERLOOKED ALTHOUGH IT MAY BE OF

SECONDARY IMPORTANCE UNTIL WATER IS FOUND.

PRIMARY SOURCES OF WATER ARE THE RIVERS, STREAMS, AND RESIDUAL SWAMPS BUT AS WAS POINTED OUT ONLY THE MAIN RIVERS SUSTAIN A RELIABLE FLOW OF WATER DURING THE DRY SEASON. THE MOST CONSPICUOUS LANDMARKS INDICATING THE PRESENCE OF WATER ARE THE PALM TREES, ESPECIALLY THOSE OCCURRING IN GROVES OR IN ROWS. EVEN IF THE STREAM ALONG WHICH THE TREES ARE ALIGNED IS DRIED UP THE PALM FRUIT CONTAINS CONSIDERABLE JUICE. ALSO, IT IS POSSIBLE THAT WATER CAN BE STRUCK AT A DEPTH THAT CAN BE REACHED WITH LITTLE DIGGING. WHEN SUCH A TREE FORMATION IS FOUND AND WATER IS NOT IMMEDIATELY AVAILABLE, THE STREAM BED SHOULD BE FOLLOWED DOWNSTREAM IN SEARCH OF POOLS OR SIGNS OF SUB-SURFACE MOISTURE.

IN SWAMP OR FLOODED AREAS THAT HAVE DRIED UP, THE DEEPEST PORTIONS OF THE DEPRESSION SHOULD BE PROBED FOR SEEPAGE. ALTHOUGH THE WATER WILL BE MUDDY AND STAGNANT, IT CAN BE STRAINED THROUGH PARACHUTE CLOTH OR OTHER MATERIAL AND BOILED. CAUTION IS ADVISED WHEN MOVING THROUGH SUCH AREAS WITH REGARDS TO CROCODILES OR CAIMAN THAT MAY BE SUBMERGED IN THE MUD--ALSO WATCH FOR TURTLES.

UNDERGROUND ROOTS AND TUBERS DO NOT YIELD MUCH MOISTURE NOR ARE THERE SUCCULENTS SUCH AS CACTUSES EXCEPT IN THE GRAN CHACO AREA. EVEN THERE THEY ARE NOT ABUNDANT. OCCASIONALLY, WELLS DUG BY THE INDIANS ARE ENCOUNTERED IN THE GRAN CHACO BUT THESE TOO ARE FREQUENTLY DRY.

IN SURVEYING THE LAY OF THE LAND FOR PROBABLE AREAS OF WATER, THE <u>LLANOS</u> AND THE RUPUNUNI FOR THE MOST PART DO NOT HAVE "HIDDEN" VALLEYS OR DEEP DEPRESSIONS THAT WOULD OBSCURE THE INDICATION OF WATER FROM THE OBSERVER. IN THE <u>CAMPOS</u>, HOWEVER, THE VALLEYS MAY BE

WELL BELOW THE HORIZON IF ONE IS IN THE CENTER OF A CHAPADAO OR TABLELAND BETWEEN THE RIVER VALLEYS. REMEMBER THAT THE VALLEYS RUN NORTH-SOUTH AND TO REACH ONE ENTAILS TRAVELING EAST OR WEST.

HEAT IS CERTAINLY A FACTOR IN THIRST AND THE SURVIVOR SHOULD AVAIL HIMSELF OF ANY MEANS TO REDUCE THE EFFECTS OF THE SUN. ENERGY WILL NEED TO BE EXPENDED BUT NOT WASTED. CLOTHING SHOULD BE WORN SO AS TO GIVE THE MAXIMUM VENTILATION. FASHION SOME SORT OF HEAD COVERING; IF POSSIBLE ONE THAT HAS A BRIM.

FOR CONCENTRATED DANGER PROBABLY THE TWO MOST SERIOUS THREATS ARE THE CASCAVEL AND THE FER-DE-LANCE. THE FER-DE-LANCE HAS BEEN DESCRIBED AT SOME LENGTH UNDER HAZARDS OF THE TROPICAL FOREST WHERE IT IS EQUALLY AT HOME. THE CASCAVEL, HOWEVER, IS ESSENTIALLY A DRY LAND SNAKE. BY NATURE AS WELL AS TOXITY OF ITS VENOM IT IS PROBABLY THE MOST DANGEROUS OF THE SOUTH AMERICAN SNAKES AND ACCORDING TO AVAILABLE RECORDS IT HAS CAUSED MORE DEATHS THAN ANY OTHER SNAKE IN BRAZIL. LIKE MOST OTHER SNAKES, IT IS NOT GIVEN TO UNPROVOKED ATTACKS ON HUMANS, HOWEVER, IT DOES HAVE A GENERALLY VICIOUS DEFENSIVE DISPOSITION USUALLY STANDING ITS GROUND WHEN APPROACHED OR ATTACKED. THE VENOM OF THE CASCAVEL HAS A RELATIVELY HIGH PERCENTAGE OF NEUROTOXIN. THE EFFECTS ARE RAPID AND EVEN WHEN NOT FATAL FREQUENTLY RESULT IN LONG AND SOMETIMES PERMANENT IMPAIRMENT, MOST PARTICULARLY OF THE EYES. THE SYMPTOMS OF A BITE IS PARTIAL OR COMPLETE BLINDNESS FROM PARALYSIS OF THE EYEBALLS AND EYELIDS. THE MUSCLES THROUGHOUT THE BODY BUT ESPECIALLY IN THE NECK AND SHOULDERS BECOME FLACCID AND INCAPABLE OF HOLDING UP THE HEAD AND ARMS. THESE SYMPTOMS ARE FOLLOWED BY PARALYSIS OF THE MUSCLES AND RESPIRATORY FUNCTIONS BECOME IMPAIRED TO THE POINT OF SUFFOCATION. OTHER EFFECTS ARE DIZZINESS, SHORTNESS

OF BREATH, PALPITATIONS OF THE HEART AND SEVERE HEAD PAINS.

THE JAGUAR AS A FAIRLY COMMON PREDATOR IN THE SAVANNAS CERTAINLY POSES A THREAT, HOWEVER, THEY GENERALLY ARE NOT KNOWN FOR ATTACKING A MAN ESPECIALLY IN THE OPEN.

THE MOST PERSISTANT THOUGH NOT LETHAL PROBLEM IN THE SAVANNAS IS PRESENTED BY THE SWARMS OF INSECTS. FOR THE MOST PART THESE HAVE BEEN QUITE ADEQUATELY COVERED IN SEVERAL PORTIONS OF THIS MONOGRAPH. ONE SPECIAL SOURCE OF MISERY IN THE SAVANNAS COMES FROM THE VARIOUS SPECIES OF TICKS THAT ARE PREVALENT IN ALL OF THE SAVANNAS BY THE MILLIONS. WORKING WITH GREAT SPEED THE TICK SINKS ITS HEAD INTO THE SKIN OF THE VICTIM. ON RIDDING ONE'S SELF OF TICKS, THE HEAD SHOULD NOT BE SEVERED FROM THE BODY AND LEFT TO FESTER UNDER THE SKIN. ONE TRICK OF REMOVAL IS BASICALLY THAT OF MAKING THE TICK REMOVE ITS OWN HEAD BY APPLYING AN IRRITANT SUCH AS HEAT OR CHEMICAL TO ITS BODY. ANOTHER METHOD CONSISTS OF PRESSING THE BODY BETWEEN THE FINGER AND A SHARP POINTED BLADE AND DRAWING THE HEAD OUT SLOWLY AND IN LINE WITH THE BODY. THIS REQUIRES A DELICATE TOUCH THAT CAN BE ACQUIRED WITH LITTLE PRACTICE. THESE TINY MONSTERS TOGETHER WITH THE FLIES ARE THE WORST SCOURGES AND DETERRENTS TO THE DEVELOPMENT OF THE CATTLE RAISING INDUSTRY IN THE SAVANNAS.

THERE ARE NUMEROUS SPIDERS AND SCORPIONS SOME OF WHICH ARE UNDOUBTEDLY POISONOUS. HOWEVER, STINGS OR BITES OF THESE INSECTS THOUGH FREQUENTLY CAUSING ILL EFFECTS ARE NOT GENERALLY DANGEROUS. A MORE SERIOUS BUT OF VERY SPORADIC PREVALENCE IS THE OCCURRENCE OF MALARIA CARRYING ANOPHELES MOSQUITOS. THESE ARE RARELY FOUND WITHIN THE SAVANNAS BUT RATHER IN THE AREAS OF RIVERINE SETTLEMENTS ALONG THE MAJOR RIVERS.

DANGER FROM THE INDIANS IS ALMOST ENTIRELY RESTRICTED TO THE MARGINAL FOREST AREAS ALONG THE EAST BANK OF THE RIO TAPAJOS AND THE HEADWATERS OF THE RIO DAS MORTES AND THE RIO XINGU. HOW REALLY SERIOUS A THREAT THESE INDIANS POSE SEEM TO BE TRANSITIONAL AND UNPREDICTABLE. PERSONS OF COMPETENCY AND RELIABILITY REPORT CONFLICTING EXPERIENCES--WITH ONE, DURING A PERIOD OF TIME THE RELATIONS WERE EXCELLENT, WITH ANOTHER AT A LATER PERIOD, THE SITUATION WAS EXTREMELY TOUCHY OR ABSOLUTELY SUICIDAL. THERE ARE SOME MEMBERS OF THE INDIAN PROTECTION SERVICE WHO HAVE ALMOST UNRESTRICTED FREEDOM AMONG THE REPORTEDLY MOST HOSTILE INDIANS. SIGNIFICANTLY, THERE IS NO PREDICTABLE MODE OF BEHAVIOR THAT WILL ASSURE IMMUNITY FROM ATTACK IF THE SITUATION IS SUCH THAT THE INDIANS FEEL SO COMMITTED. ON THE OTHER HAND, ANY ACT OF HOSTILITY ON THE PART OF THE SURVIVOR IN CONFRONTATION WITH ANY GROUP OF INDIANS MAY PROVOKE AN ATTACK EVEN WHEN SUCH WAS NOT INITIALLY INTENDED. MORE OFTEN THAN NOT, IT IS JUST THIS SORT OF ACTION THAT HAS PROVOKED ALTERCATIONS BETWEEN THE INDIANS AND OTHERS WHO HAVE COME IN CONTACT WITH THEM. THE INDIAN PROTECTION SERVICE CONSIDERS THE ENTIRE REGION BETWEEN THE HEADWATERS OF THE RIO TAPAJOS AND THE RIO XINGU AS POTENTIALLY DANGEROUS AND CONTACT WITH THE INDIANS AS GENERALLY UNDESIREABLE. IF FORCED DOWN IN THE AREA, NO CONTACT SHOULD BE INITIATED BY THE SURVIVOR. IF THERE ARE INDICATIONS OF INDIANS IN THE VICINITY AND NO ATTEMPT IS MADE BY THEM TO MAKE CONTACT ANY ATTEMPT TO DO SO BY THE SURVIVOR WILL PROBABLY BE DANGEROUS.

TRAVEL AND NAVIGATION

THE DECISION OF THE PARTY TO REMAIN WITH THE PLANE OR TO STRIKE OUT FOR AID INVOLVES A NUMBER OF "FIRST THINGS FIRST" SORT OF

CONSIDERATIONS, SOME OF WHICH WILL BE INFLUENCED ON ACTION PRECEDING THE INCIDENCE OF SURVIVAL; SOME DEVELOPING DURING THE COURSE OF THE INCIDENCE. HERE ARE A FEW, CERTAINLY NOT ALL, OF SUCH CONSIDERATIONS:

1. QUALITY AND RECENCY OF RADIO COMMUNICATION WITH REGIONAL AIR CONTROL PRIOR TO INCIDENCE.
2. QUALITY, RECENCY, AND COMPREHENSION BETWEEN RADIO CORRESPONDENTS TO THE EFFECT THAT;
   A. PLANE WAS MALFUNCTIONING BUT NOT ABORTIVE LANDING CONTEMPLATED, OR,
   B. PLANE WAS MALFUNCTIONING AND ABORTIVE LANDING WAS IMMINENT, OR,
   C. PLANE WAS IN PROCESS OF AN ABORTIVE LANDING, OR,
   D. PARTY WAS BAILING OUT.
3. TRANSMISSION CAPABILITY OF RADIO AFTER LANDING.
4. NUMBER OF PERSONS IN THE PARTY.
5. PHYSICAL CONDITION OF THE PARTY FOLLOWING THE LANDING.
6. RECENCY OF EATING AND DRINKING PRIOR TO INCIDENCE.
7. SUPPLY OF FOOD AND WATER AT TIME OF INCIDENCE.
8. CONDITION OF SURVIVAL GEAR OR OTHER USABLE EQUIPMENT AFTER LANDING.
9. TIME OF DAY.
10. PROXIMITY OF AREAS OF HABITATION OR SUSTENANCE AS DETERMINING DURING FLIGHT OR BY VISIBILITY FROM THE GROUND.

SOME OF THE FOREGOING CONSIDERATIONS ARE STANDARD PROCEDURE. OTHERS WILL BE INFLUENCED BY CIRCUMSTANCES INHERENT IN THE INCIDENCE ITSELF OR BY THE LOCALE. SEVERAL OF THEM ARE INTERRELATED AND ARE RECIPROCAL IN EFFECT.

IN THE CASE OF 1. AND 2.A., CONSIDERABLE TIME MIGHT ELAPSE BEFORE A SEARCH WAS INSTITUTED. UNDER THESE CONDITIONS THE PARTY MIGHT DECIDE TO STRIKE OUT IMMEDIATELY FOR WATER AND FOOD; ALL OTHER CONDITIONS ALLOWING UNFETTERED TRAVEL. IN THE CASE OF 2.C. AND 3., HOWEVER, IF A FIX HAS BEEN OR CAN BE ESTABLISHED IT WOULD BE FOOLHARDY TO LEAVE THE PLANE.

WITH REGARDS TO THE TIME OF DAY, IT IS DESIREABLE TO TAKE FULL ADVANTAGE OF DAYLIGHT HOURS FOR ALL ACTIVITY--TEMPERATURES BEING FAVORABLE--WHEN GOOD VISIBILITY DEFINES THE TERRAIN FEATURES AS AIDS IN NAVIGATION, AS POSSIBLE SOURCES OF PHYSICAL DANGER OR SOURCES OF FOOD, WATER, AND OTHER ASSISTANCE. IF THE INCIDENCE OCCURS LATE IN THE AFTERNOON OR EVENING IT WOULD BE GENERALLY ADVISABLE TO REMAIN WITH THE PLANE.

WHEN THE ISSUE HAS BEEN RESOLVED AND THE DECISION IS GO, THE NEXT DECISION MUST BE "WITH WHAT GEAR," AND "IN WHAT DIRECTION." INSOFAR AS GEAR IS CONCERNED REFERENCE IS AGAIN MADE TO AIR FORCE MANUAL 64-3. AS TO DIRECTION; THE MOST DIRECT LINE TO KNOWN OR PROBABLE AREA OF HABITATION SEEMS A RATHER OBVIOUS STATEMENT; HOWEVER, THERE ARE SOME GENERAL RULES THAT APPLY.

THERE MAY DEVELOP REASONS FOR LEAVING THE CRASH SITE OR ATTEMPTING TO "WALK OUT." WHATEVER THE DIRECTION CHOSEN MAY BE OR THE ULTIMATE DESTINATION SELECTED, THE SURVIVOR MUST RECKON ON INTERMEDIATE AREAS OF FOOD AND WATER SUPPLY AS WELL AS POSSIBLE SOURCES

OF AID OF A MORE TERMINAL NATURE. TO CITE AN EXAMPLE: THREE MEN WERE DOWNED IN A LIGHT PLANE IN THE MATO GROSSO. NO OFFICIAL FLIGHT PLAN HAD BEEN FILED AND BECAUSE OF CIRCUMSTANCES THEY WERE NOT MISSED. AS A RESULT NO SEARCH WAS ORGANIZED UNTIL SEVERAL WEEKS LATER. FROM THE DIARIES THEY MAINTAINED IT WAS LEARNED THAT ONE BECAUSE OF A BROKEN LEG REMAINED WITH THE PLANE--HE LIVED FOR FORTY DAYS. THE OTHER TWO ATTEMPTED TO WALK OUT AND HEADED DIRECTLY SOUTH. THEY TOO LASTED APPROXIMATELY FORTY DAYS. WHAT WAS UNFORTUNATE ABOUT THE ENTIRE EPISODE IS THAT THE TWO TRAVELERS PARALLELED A FIRST CLASS ROAD WHICH WAS AT TIMES LESS THAN FIVE MILES FROM THEIR DIRECTION OF MARCH.

CERTAINLY, RECONNAISSANCE IS AN IMPORTANT PART OF TRAVEL. EVERY EFFORT SHOULD BE MADE TO RETAIN THE FLIGHT MAPS AND TO KEEP THE MAP ORIENTED WITH THE TERRAIN. THE MAPS OFTEN CONTAIN USEFUL INFORMATION BUT WHICH IS OF NO VALUE UNLESS THE INDIVIDUAL KNOWS HOW TO USE IT.

THE PRIMARY AIDS TO NAVIGATION ARE THE SOUTHERN ASTRAL CONSTELLATIONS OF WHICH THE SOUTHERN CROSS IS THE MOST CONSPICIOUS. DURING THE DAY, THE SUN, OF COURSE, IS THE PRIMARY REFERENCE. THE TERRAIN FEATURES WHICH ARE MOST SIGNIFICANT ARE THE RIVERS AND STREAMS; SPECIFICALLY THEIR DIRECTION OF FLOW.

THE MOST DELAYING TERRAIN FEATURES TO TRAVEL IN THE SAVANNAS ARE THE GREAT MEANDERING OXBOWS OF THE RIVERS TOGETHER WITH THE STRETCHES OF GALLERY FORESTS THAT ARE OFTEN ASSOCIATED WITH THEM. THESE RIVERS LOOP BACK AND FORTH ACROSS THE TERRAIN OFTEN TWENTY OR MORE MILES, SOMETIMES ONE BOW OF THE RIVER DOUBLING BACK ABOVE THE PRECEDING BOW. DURING THE RAINY SEASON ALL THE BOWS BECOME CONNECTED BY A SINGLE FLOW WITH THE RESULTS THAT THE RIVER WILL ATTAIN WIDTHS

OF TWENTY OR THIRTY MILES. THIS REQUIRES THAT TO THE EXTENT POSSIBLE THE TRAVELER MUST STICK TO THE HIGH GROUND MAKING LONG DETOURS AROUND THE FORESTS OR BODIES OF WATER.

CHAPTER X

SUMMARY

THE PREVAILING CONDITIONS THROUGHOUT THE SAVANNA REGIONS SHOW A MARKED UNIFORMITY. THE MOST SIGNIFICANT ASPECTS OF THE ENVIRONMENT HAVING DIRECT BEARING ON THE SURVIVAL SITUATION ARE:

1. TOPOGRAPHY. ALL THE SAVANNA REGIONS PRESENT A LEVEL OR GENTLY ROLLING SURFACE. DURING PERIODS OF DROUGHT, MOST STREAMS DRY UP AND RIVERS BECOME SLUGGISH, MEANDERING, AND SHALLOW. DURING RAINY SEASONS, LARGE AREAS ARE INUNDATED BY OVER-FLOWING RIVERS AND COLLECTION OF WATERS IN EXTENSIVE DEPRESSED AREAS. GALLERY FOREST OF VARYING WIDTH LINE THE PERMANENT FLOWING RIVERS AND STREAMS. CLUMPS OR ROWS OF PALMS ARE LOCATED IN SWAMP AREAS OR ALONG FLOWING STREAMS. CITIES AND TOWNS ARE MAINLY PERIPHERAL WITH ONLY THE LLANOS OF VENEZUELA REFLECTING AN INTERIOR DEVELOPMENT. THE MOST SERIOUS FACTOR AFFECTING SURVIVAL IS THE VAST DISTANCES INVOLVED IN THE BRAZILIAN PLATEAU CAMPOS.
2. CLIMATE. CONSIDERABLE VARIATION OCCURS WITHIN REGIONS AS WELL AS BETWEEN REGIONS. THE DISTINGUISHING FEATURE OF THE SAVANNA CLIMATE IS

THE CONTRAST BETWEEN THE WET AND DRY SEASON. HEAVY RAINFALL OCCURS FOR FIVE TO SEVEN MONTHS FOLLOWED BY THE REMAINING MONTHS OF LITTLE OR NO RAINFALL.

HEAT CAN BE EXCESSIVE ESPECIALLY IN THE GRAN CHACO OR IN AREAS OF CONSTANT EXPOSURE TO SUN BUT CUT OFF FROM COASTAL WINDS. THE MOST SERIOUS FACTOR OF THE HEAT IS THE LOSS OF BODY FLUIDS IN RELATION TO A RELATIVE SCARCITY OF WATER SUPPLY.

3. VEGETATION. THERE IS A MARKED SCARCITY OF VARIETIES. TALL BUNCH GRASS PREDOMINATES WITH LOW SHRUBS AND LOW, CROOKED, SHADELESS TREES, SCATTERED IN CLUMPS OR SINGLY. SAVANNA VEGETATION IS PREDOMINATELY XEROMORPHIC AND FIRE-RESISTANT. MORICHE PALMS LINE STREAMS AND SWAMPS AFFORDING A VALUABLE SOURCE OF FOOD. MOST VEGETAL FOOD SOURCES ARE CONTAINED IN THE GALLERY FORESTS OR PERIPHERAL FOREST. IN THE CAMPOS OF BRAZIL, LOW-GROWING, TREE-COVERED AREAS CALLED CERRADOS OFFER ONE OF THE BEST SOURCES OF VEGETAL AND ANIMAL FOODS. PRINCIPAL FOOD SOURCE IN THE GRAN CHACO IS THE ALGARROBO TREE PODS AND FROM THE RIVERLINE LIFE.

4. FAUNA. SAVANNA FAUNA IS RESTRICTED TO SMALL REPTILES, RODENTS, INSECTS ESPECIALLY TERMITES, AND ANTEATERS. MOST OTHER FORMS OF ANIMAL LIFE

ARE FOREST AND RIVER INHABITANTS. THE MOST DANGEROUS SNAKE ENDEMIC TO THE SAVANNA IS THE CASCAVEL DELIVERING A HIGHLY TOXIC VENOM.

5. TRAVEL. NO SERIOUS BARRIERS TO AREAS OF RECOVERY EXIST IN ANY OF THE REGION. ADVERSE CONDITIONS ARE MAINLY SEASONAL, THAT IS; EXTENSIVELY INUNDATED AREAS DURING THE RAINY SEASON. DURING THE DRY SEASON, RIVER AND STREAMS ARE FREQUENTLY UNSUITABLE FOR TRAVEL. A BASIC PROBLEM OF LAND TRAVEL IS AVOIDANCE OF PENETRATION OF RAIN FOREST BEYOND FRINGE (FOR FOOD AND WATER). DIRECTION OF FLOW OF RIVERS AND STREAMS, AND OPEN TERRAIN FACILITATE NAVIGATION.

6. FOOD AND WATER. MOST FOOD AND WATER SOURCES ARE LOCATED IN THE GALLERY FORESTS, PERIPHERAL FORESTS, RIVERS, AND STREAMS CROSSING THE SAVANNAS. SAVANNAS THEMSELVES OFFER LITTLE OF FOOD VALUE EXCEPT INSECTS, RODENTS, LIZARDS, AND SNAKES. WATER IS THE MOST SERIOUS PROBLEM OF THE SAVANNAS DURING THE DROUGHT PERIOD. IN THE GRAN CHACO, WATER SOURCES ARE SEPARATED BY TWENTY-FIVE TO FIFTY MILES, IN OTHER REGIONS THE DISTANCES ARE NEARLY AS GREAT. PRESENCE OF PALM TREES, EITHER IN GALLERY FORMATION OR GROVES, GENERALLY DENOTES WATER SOURCE.

7. INHABITANTS OF THE SAVANNAS. IN GENERAL, THE SAVANNAS ARE SPARCELY POPULATED EVEN BY INDIANS.

THE LLANOS OF VENEZUELA ARE BECOMING MORE DENSELY POPULATED DUE TO ECONOMIC PROGRAMS BEING INITIATED. MOST INHABITANTS ARE FARMERS, RANCHERS, AND COWBOYS ASSOCIATED WITH CATTLE RAISING. THERE ARE THREE AREAS INHABITED BY POSSIBLE HOSTILE INDIANS: THE EAST BANK OF THE TAPAJOS, THE AREA BETWEEN THE HEADWATERS OF THE RIO DAS MORTES AND RIO XINGU, INHABITED BY THE CHAVANTE, AND THE GRAN CHACO NORTH OF THE RIO PILCOMAYO INHABITED BY THE TOBAS AND MATOCO INDIAN.

PART III

DESERTS OF SOUTH AMERICA

CHAPTER XI

PHYSICAL ENVIRONMENT

Distribution and General Description

No other area in the world presents such an extreme of vertical thrust within a defined horizontal distances as is exhibited along the entire west coast of South America. From the crest of the Andean Cordillera averaging 13,000 feet in height with peaks ascending to nearly 23,000 feet, the land plunges to a depth below the sea of over 25,000 feet; all within a distance of 175 miles. More than three-fourths of the descent occurs within a distance of 75 miles. The entire region is undergoing adjustment representing form and up-lift of geologically "recent" activity. This region of extreme topographical contrast contains the desert area of South America.

When compared with those of other continents the desert area of South America is small. It is a ribbon of land twenty to eighty miles wide between the Pacific Ocean on the west and the Andes on the east extending from northern Peru (approximately 5°S) to northern Chile (approximately 26°S); a distance of 2,000 miles. Within this desert area lie two of the most absolute deserts in the world; the Sechura Desert of northern Peru and the Atacama Desert of northern Chile comprising the provinces of Tarapaca, Antofagasta and Atacama.

Authoritative sources become almost lyrical in their attempts

TO ADEQUATELY DESCRIBE THE FEATURES OF THE WEST COAST DESERTS WHICH ARE THE ULTIMATE IN THOSE CHARACTERISTICS DEFINITIVE OF TRUE DESERTS. MOST RECURRENT AMONG THE CHARACTERISTICS DESCRIBED ARE: BARRENNESS, DESOLATION, ARIDITY, VAST STRETCHES OF EXPOSED ROCK, GRAVEL AND SAND, EROSION, ABSENCE OF PLANT LIFE, ETC., INVARIABLY EXPRESSED IN THE MOST STARK TERMS. THE REGION CONSISTS OF A VARIETY OF RELIEF FEATURES AND SOILS COMMENCING WITH A LOW COASTAL PLAIN NORTH OF TRUJILLO WHEREIN LIES THE SECHURA DESERT. SOUTH OF TRUJILLO, SPURS OF THE ANDES JUT INTO THE SEA CREATING RUGGED HEADLAND INTERLACED BY DEEP NARROW ALLUVIAL PLAINS AND DELTA FLATS. BETWEEN PISCO AND SAN JUAN A DESERT PLAIN EXTENDS INLAND FROM TWENTY TO FORTY MILES. CONTINUING SOUTH THE COASTAL RANGES, BROKEN BY DEEP VALLEYS LEADING FROM THE ANDES, FORM THE WESTERN BORDER OF AN EXTENSIVELY STREAM-CUT PLATEAU THIRTY TO FORTY MILES WIDE EXTENDING AS DESERT PLAINS TO THE ANDES. THE LONGITUDINAL DEPRESSION IS MORE EVIDENT TOWARD THE SOUTH IN THE CHILEAN DESERT WHERE THE COASTAL RANGE ATTAINS HEIGHTS OF 2,000 TO 8,000 FEET.

MARINE TERRACES RANGING FROM ONE TO FIVE MILES WIDE ARE CHARACTERISTIC OF THE ENTIRE COASTLINE. THEY EXTEND FROM SEA LEVEL TO HEIGHTS OF 1,500 FEET. ALONG THE INNER BORDER THE TERRACES ARE STRAIGHT OR CURVE IN BROAD REGULAR LINES GRADING EVENLY INTO THE COAST RANGE. THE TOPS ARE SMOOTHLY PLANED RELATIVELY FREE OF ROCK UPCROPPINGS AND DISSECTIONS. TWO GEOLOGICAL PERIODS OF UP-LIFT ARE REPRESENTED BY THE MARINE TERRACES. ALLUVIAL DEPOSITS AT THE BASE OF THE COASTAL RANGE WERE PLANED BY THE SEA. AFTER MATURE DEVELOPMENT THE WELL GRADED TERRACES WERE RAISED AND SUBJECT TO NUMEROUS DISSECTION OF VARYING DEPTH BY CROSSING STREAMS FROM THE COASTAL

RANGE. THE PROCESS OF DISSECTION CONTINUED UNTIL ANOTHER PERIOD OF SUBSIDENCE AND DEPOSITION OCCURRED DURING THE PLIOCENE OR EARLY PLEISTOCENE. EXTENSIVE DEPOSITS OF SANDS, GRAVELS, AND CLAY FILLED THE VALLEYS WHOLLY OR PARTIALLY UNTIL THE TERRACE WAS LEVELED AND GRADED INTO BROAD STRETCHES OF LAND. A FINAL UP-LIFT OCCURRING IN THE "RECENT" PERIOD ESTABLISHED THE PRESENT TERRACES WITH CROSS STREAMS ACTIVELY RENEWING THE PROCESS OF DISSECTION.

THE PRESENT APPEARANCE OF THE IMMEDIATE COASTAL BELT IS ONE OF EXTREMELY BARREN, WIND-SWEPT STRIPS OF DRIFTING SANDS, GRAVEL, AND EXPOSED SMOOTH BASAL ROCK. BEGINNING AT THE WAVE-CUT LOW LITTORAL TERRACE THE LAND RAPIDLY ASCENDS THE COASTAL RANGE IN BROAD SWEEPING SLOPES. EXCEPTIONS TO THIS CHARACTERISTIC APPEARANCE OCCURS WHERE THE SPURS OF THE ANDES EXTEND TO THE SEA BETWEEN SALAVERRY ($8^{\circ}5'$ S) AND LIMA (12°S).

FIFTY-TWO TRASVERSE RIVER VALLEYS DISSECT THE COASTAL DESERT OF PERU. FORMED BY STREAMS FROM MELTING SNOWS AND RAINS DESCENDING THE WESTERN SLOPES OF THE ANDES, THE VALLEYS CONSTITUTE THE ONLY SOURCE OF IRRIGABLE LAND IN THE WEST COAST DESERT. THE PHYSICAL RELATIONSHIP BETWEEN THE PHYSIOGRAPHIC COMPONENTS OF THE VALLEYS AND DESERT PLAINS IS ESSENTIALLY THE SAME FOR MOST OF THE COASTAL AREA. HOWEVER, WHERE THE SPURS OF THE ANDES IMPINGE UPON THE LITTORAL, THE RIVERS ARE CONFINED BY STEEP, ROCKY SLOPES. THE AMOUNT OF IRRIGABLE LAND IS LIMITED TO THE FLOOD PLAINS AND DELTAS BETWEEN THE SPURS AND RESTRICTED BY THE CONTOUR OF THE MOUNTAIN. THE VALLEYS, WHICH AVERAGE TWENTY-FIVE TO THIRTY MILES APART, SEEM INSIGNIFICANT IN RELATION TO THE EXPANSES OF DESERT THAT SEPARATE THEM. THEY CONSTITUTE A LITTLE MORE THAN 3% OF THE ENTIRE COASTAL STRIP WEST OF THE ANDES

YET CONTAIN A SIXTH OF THE ACREAGE UNDER PRODUCTION IN PERU AND PRODUCE ANNUAL CROPS EQUAL IN VALUE TO ALL OTHER AGRICULTURAL AREAS COMBINED. THE INTENSIVELY IRRIGATED OASES PROVIDED BY THE NUMEROUS STREAMS HAVE PROVIDED RICH FERTILE LANDS WHICH HAVE SUSTAINED MAN FOR THOUSANDS OF YEARS.

CLIMATE

PHYSICAL FACTORS. THE COASTAL AREA OF PERU AND NORTHERN CHILE MAY BE DIVIDED INTO FOUR PARALLEL ZONES: (1) THE COASTAL SHELF ZONE WITH RAIN OCCURRING IRREGULARLY EVERY FEW YEARS; (2) THE CLOUDY ZONE EXTENDING INTO AND ABOVE THE COASTAL RANGE WITH RAIN OCCURRING AT INTERVALS OF FIVE TO TEN YEARS BUT WHICH DERIVE MOISTURE FROM THE BANKS OF FOG; (3) THE DESERT PLAINS, LYING BETWEEN THE COASTAL RANGE AND THE ANDES WITH RAIN INTERVALS OF MANY YEARS; AND (4) THE VALLEY ZONE ASCENDING THE FOOTHILLS OF THE ANDES WITH ANNUAL RAINS.

THE MOST VISIBLE, THOUGH NOT NECESSARILY THE MOST IMPORTANT FEATURE AFFECTING THE CLIMATIC CONDITIONS OF THE PACIFIC COAST, IS THE HIGH WALL OF THE ANDES WHICH ACTS AS A BARRIER TO THE TRADE WINDS BLOWING ACROSS THE CONTINENT FROM THE WARM EQUATORIAL WATERS OF THE ATLANTIC. MOST OF THE MOISTURE AND RAIN-MAKING PROCESSES OF THE TRADE WINDS ARE EXPENDED BEFORE AND UPON REACHING THE EASTERN SLOPES OF THE ANDES. AS THE WIND DESCENDS THE WESTERN SLOPES THE AIR IS COMPRESSED BY THE PROGRESSIVELY HIGHER ATMOSPHERIC PRESSURES. THE ENERGY EXPENDED IN THE PROCESS OF COMPRESSION IS EXPRESSED IN THE AIR AS HEAT WHICH IN TURN CREATES A GREATER CAPACITY FOR WATER ABSORPTION. THEREFORE, THE WINDS THAT DO CROSS THE CORDILLERA FROM THE EAST BECOME DRYING WINDS WHICH CONTRIBUTE TO THE ARIDITY OF THE WESTERN LOWLANDS IN THE LEE OF THE MOUNTAINS.

Paralleling the coast of South America from northern Chile to Point Parinas in northern Peru a cold upwelling ocean current is a major contributing factor to the aridity and cool temperatures that characterizes the coast from Valparaiso, Chile, north to the Gulf of Guayaquil. Named the Peru Current it was at one time called the Humbolt Current after the reknowned explorer who first measured its temperature. It is composed of two separate elements, (1) the oceanic current which flows at an irregular distance from the shore, and (2) the coastal current which is colder and flows more swiftly at a fairly regular distance closer to the shore. The coastal current 50 to 100 miles wide maintains an average temperature ranging between 58° and 64°.

Because of the permanent high pressure area over the Pacific between the twentieth and fortieth parallels, the prevailing wind of the west coast is southerly or southeasterly. On its way toward the land it crosses the cool Peru Current where it picks up the superincumbent air of reduced vapor content resulting from the low temperature of the water. Approaching the land the saturated air is forced upwards several thousand feet by the steep Coastal Range and adiabatic cooling creates a combination of fog, cloud, mist, and occasionally rain on the seaward slopes. During the winter months (June to October in South America) the conditions are most conducive to condensation and although very little rain actually falls the fogs and mist which are called "<u>garua</u>" in Peru and "<u>camanchaca</u>" in Chile are most prevalent.

<u>Temperatures, Precipitation and Humidity</u>. Records for the period 1941-1950 at Arica reflect a precipitation mean of two-hundredths

OF AN INCH WITH THE HIGHEST ANNUAL TOTAL IN 1942 OF 0.1 OF AN INCH AND SOME YEARS OF NO RAIN AT ALL. BEHIND THE COASTAL RANGE THE INTERIOR DESERT BASIN RECEIVES A NORMAL AVERAGE RAINFALL OF LESS THAN .04 INCHES PER YEAR. AT LIMA DURING THE SAME PERIOD THE PRECIPITATION MEAN WAS APPROXIMATELY 1.3 INCHES WITH THE HIGHEST ANNUAL TOTAL OF 2.2 INCHES. FARTHER NORTH, CHICLAYO'S INCOMPLETED RECORDS SHOW TWO YEARS-ANNUAL RAINFALL OF JUST OVER FIVE-TENTHS OF AN INCH EACH. TO REACH THE ZONE OF ANNUAL RAINFALL AT THIS LATITUDE (7°S) ONE MUST ASCEND THE ANDES TO AN ELEVATION OF 3,000 FEET. AT LIMA (12°S) THE ZONE OF ANNUAL RAINFALL IS 5,000 FEET AND AT PISCO (14°S) IT IS 7,000 FEET.

TEMPERATURES AND HUMIDITY OF THE WEST COAST ARE STRONGLY AFFECTED BY THE SEA BREEZE AND THE COOL OCEAN CURRENT. DESPITE THE DESERT CHARACTER OF THE WEST COAST, THE TEMPERATURES ARE REMARKABLY COOL AND HAVE A RELATIVELY SMALL RANGE OF VARIATION. BECAUSE OF THE HIGH DEGREE OF INSOLATION AND THE CLEARNESS OF THE ATMOSPHERE, THE PLAINS BEHIND THE COASTAL RANGE REFLECT HIGHER TEMPERATURES DURING THE DAY AS WELL AS COLDER TEMPERATURES AT NIGHT. HOWEVER, EVEN DURING THE SUMMER MONTHS THE TEMPERATURES OF THE PLAINS RANGE BETWEEN 75°F AND 85°F AND ONLY OCCASIONALLY EXCEED 90°F. THE YEARLY AVERAGE FOR THE ATACAMA DESERT REMAINS FAIRLY CONSTANT AT 65°F. COASTAL TEMPERATURES SHOW COMPARATIVELY LITTLE VARIATION FROM SUMMER TO WINTER. IN GENERAL, THERE IS A GRADUAL DECREASE FROM NORTH TO SOUTH AS INDICATED IN THE TABLE OF TEMPERATURES AND PRECIPITATIONS.

Approximate Latitude S.	Place	Average Temp. (Degrees Fahr.)	Average Yearly Precipitation MM
5°	Piura (Paita)	74.8°	30 (1.2")
8°	Trujillo	68.5°	30 (1.2")
12°	El Callao	66°	30 (1.2")
17°	Mollendo	64.5°	20 (.8")
19°	Arica	65°	0
20°	Iquique	64°	0
24°	Antofagasta	64.9°	6 (.24")

Humidity is affected by the sea breeze because of the immediate condensation on the Coastal Range. There is considerably higher humidity along the littoral than on the plains. At the most extreme, however, the humidity is not nearly so intense as the tropical humidity of interior regions east of the Andes.

Winds. The intrinsic character of the prevalent winds have not been discussed as much as their geophysical affects. The "Virazon" as the sea breeze is called has very marked characteristics which have a considerable regulatory affect on human activity as well as plant and animal life. The wind exhibits both diurnal and seasonal periodicity in force and persistence. During the summer months (October to March) the winds are most forceful due to the greater relative difference between land and sea temperatures. Along the immediate coast the morning winds blow fitfully in strong often violent gusts until approximately noon at which time they become steady, stiff, and stifling with dust. Commencing about 2:00 PM the winds begin to subside and settle to a comfortable dust-free breeze. By nightfall the winds calm and remain quiet until the following morning when they repeat the cycle. During the noon "gale" the temperatures reach their

MAXIMUM AND MOST ACTIVITY IS SUSPENDED WHILE THE PEOPLE TAKE A MOST PRACTICAL SIESTA.

ON THE PLAINS, PARTICULARLY THE NITRATE PLAINS OF CHILE, THE APPROACH OF THE GALE-FORCE WINDS ARE FREQUENTLY PRECEDED BY AN OMINOUS ROARING SOUND FOR AS LONG AS AN HOUR BEFORE THE WINDS REACH THE AREA. WHILE THESE GALE-FORCE WINDS ARE BLOWING, DUST AND LIGHTER SANDS FILL THE AIR AND THE HEAVIER SANDS FORMING THE DUNES MOVE IMPERCEPTIBLY ALONG THE GROUND. DURING THE SUMMER MONTHS RECORDED FIGURES FOR THE WIND FORCE SHOW THAT 95% OF THE WINDS BLOW WITH STRENGTHS OF OVER TEN MILES PER HOUR FROM A SOUTHERLY DIRECTION. THE WINTER MONTHS REFLECT A SIMILAR PATTERN OF WIND ACTIVITY BUT WITH A LESSER DEGREE OF FORCE AND PERSISTENCE.

FOG AND MIST. THE FOG AND MIST DESCRIBED ABOVE ARE OF SUCH SINGULAR IMPORTANCE AS TO WARRANT SPECIAL MENTION. THE GREY OVERCAST SKIES ARE OFTEN SURPRISING TO THE ARRIVING STRANGERS. THIS IS ESPECIALLY TRUE BECAUSE OF THE EXTREME ARIDITY WHICH PERSISTS DESPITE THE SEEMINGLY FAVORABLE RAIN CONDITIONS. HOWEVER, WHERE THE HEAVY FOG LIES ON THE LAND THEY PROVIDE A PENETRATING MOISTURE GIVING RISE TO DENSE GROWTH OF RAPIDLY MATURING VEGETATION. THESE AREAS, KNOWN AS LOMAS, PROVIDE VALUABLE PASTURAGE FOR ANIMALS FROM JUNE TO OCTOBER.

THERE IS CONSIDERABLE VARIATION IN THE CHARACTER OF THE FOG ALONG THE COAST FROM PLACE TO PLACE. THE LIMITS OF THE RANGE OF ELEVATION (FROM 2,000 TO 4,000 FEET) TEND TO EXPAND FROM NORTH TO SOUTH, HOWEVER, THE INTENSITY OF CONDENSATION TENDS TO DECREASE WITH A DIMINUTION OF MOISTURE CONTENT OCCURRING AS THE RANGE EXPANDS. IN CHILE THE CAMANCHACA IS MORE OF A MIST RATHER THAN A PRONOUNCED FOG. CONTRARY TO THE FOREGOING GENERALITY, TRUJILLO AT A LATITUDE OF 10°S

HAS LITTLE FOG OR OVERCAST AS COMPARED TO LIMA AT A LATITUDE OF 12° S WHERE THE FOG IS PERSISTENT AND INTENSE. HERE THE ZONE OF LOMAS EXTEND FROM 2,600 FEET TO 4,600 FEET. ALSO, AT ANTOFAGASTA DURING THE WINTER SEASON FOG IS CHARACTERISTIC WHILE AT IQUIQUE APPROXIMATELY 225 MILES NORTH THE OCCURRENCE OF FOG IS VERY INFREQUENT. GENERALLY, WHERE THE COASTAL RANGE IS OF CONSIDERABLE HEIGHT OR THERE IS A CONVERGENCE OF THE SLOPES TOWARD A FOCAL POINT THE FOG TENDS TOWARD A GREATER CONDENSATION, EVEN TO THE POINT OF PRODUCING ENOUGH RAINFALL AS TO GIVE RISE TO HERDING SETTLEMENTS MOSTLY IN THE COASTAL MOUNTAIN RANGE OF PERU.

EL NINO. THERE IS A PHENOMENON OCCURRING AT INTERVALS WHICH DESPITE THE INFREQUENCY HAS A CONSIDERABLE AFFECT ON COASTAL LIFE. EACH YEAR A WARM OCEAN CURRENT FLOWS SOUTHWARD ALONG THE COAST FROM THE EQUATOR. APPEARING DURING THE MONTHS OF JANUARY, FEBRUARY, AND MARCH IT IS CALLED "EL NINO," THE CHRIST CHILD, IN THAT IT ARRIVES NEAR CHRISTMAS SEASON. WHERE THE PERU CURRENT DEVIATES TO THE WEST NEAR THE CONTINENTAL BULGE THE WARM CURRENT INSINUATES ITSELF BETWEEN THE COLD CURRENT AND THE LAND. USUALLY IT IS QUICKLY DISSIPATED AND RARELY PENETRATES FARTHER SOUTH THAN CHIMBOTE (9° S). HOWEVER, AT INTERVALS AND FOR REASONS UNKNOWN, THE WARM OCEAN CURRENT PENETRATES ALL THE WAY SOUTH TO NORTHERN CHILE. THE ENTIRE EQUILIBRIUM OF THE ATMOSPHERE IS UNBALANCED AND FOR THE MOST PART DISASTER RESULTS. HUMIDITY IS GREATLY INCREASED. TEMPERATURES RISE AS MUCH AS 20° OR MORE. RAPIDLY RISING WARM AIR PRODUCES TOWERING CUMULUS CLOUDS WHICH IN TURN RELEASE TORRENTIAL RAINS FOR SEVERAL DAYS AT A TIME. THE ENSUING FLOODS DESTROY IRRIGATION SYSTEMS, WASH AWAY ROADS AND BRIDGES, MELT THE ADOBE HOUSES AND COVER THE CULTIVATED AREAS WITH TOP SOIL OF

GRAVEL WASHED DOWN FROM THE SLOPES. SANITATION IS DISRUPTED AND SWARMS OF INSECTS ADD TO THE DISCOMFORT.

REGIONAL DESCRIPTION

THE DESERT REGION OF PERU. IT WAS STATED ABOVE THAT THE TRANSVERSE VALLEYS OF THE COASTAL DESERT OF PERU CONSTITUTE THE ONLY SOURCE OF IRRIGABLE LAND. IN TERMS OF SURVIVAL THEY REPRESENT PRIMARY SOURCES OF AID AND COMFORT. OTHER SOURCES OF REFUGE--WHICH MAY BE CALLED "INTERMEDIATE AREAS OF REFUGE"--EXIST AND UNDER CIRCUMSTANCES PECULIAR TO THE INCIDENCE OF SURVIVAL WILL IN MANY CASES BE THE MOST IMMEDIATE AND PRACTICAL SOURCE OF AID. EXAMPLES OF SUCH REFUGES OF OPPORTUNITY ARE: (1) THE SEASHORE WHERE AN ABUNDANCE OF MARINE LIFE OFFERS IMMEDIATE FOOD AND MOISTURE. ALSO, THE CONSIDERABLE ACTIVITY ASSOCIATED WITH THE SEASHORE SUCH AS FISHING, TRANSPORTATION, OR EVEN RECREATION MAY BE IN EVIDENCE AND OF IMMEDIATE AID; (2) WELL TRAVELED ROADS MAY PROVIDE QUICK AID FROM A PASSING MOTORIST OR LOCAL RESIDENT TRAVELING BY BURRO OR AFOOT--THE MOST OBVIOUS OF THESE ROADS IS THE PAN AMERICAN HIGHWAY WHICH TRAVERSES THE ENTIRE LENGTH OF THE REGION; (3) PROXIMITY TO THE MOUNTAINS MAY PROVIDE QUICK ACCESS TO THE NUMEROUS SMALL MONTANE-PIEDMONT VILLAGES WHICH EXIST AT ELEVATIONS OF 2,000 TO 8,000 FEET AND ABOVE; AND (4) VISIBLE LOMAS SITES WHERE HERDING ACTIVITIES MAY PROVIDE IMMEDIATE AID.

EXAMINATION OF THE LISTED EXAMPLES OF INTERMEDIATE AREAS OF REFUGE REVEAL THAT THEY ARE ALMOST ENTIRELY MARGINAL TO THE DESERT WASTELAND AREAS OF THE COASTAL REGION. FOR INSTANCE, THE PAN AMERICAN HIGHWAY TENDS TO AVOID THE DESERT PLAINS, BY-PASSING THE SECHURA DESERT COMPLETELY AS IT SKIRTS ALONG ITS EASTERN BORDER. TO THE GREATEST DEGREE POSSIBLE IT HUGS THE SHORE LINE ALONG ITS ENTIRE EXTENSION.

WITHIN THE INTERDICTORY DESERT PLAINS EITHER NOTHING OF SUSTENANCE VALUE EXISTS OR ITS EXISTENCE IS SO SPORADIC AND UNCERTAIN THAT IT MAKES THE TIME SPENT IN SEARCHING PROHIBITIVE. ULTIMATELY, THE COASTAL VALLEYS OR THE SEA PORTS SERVING THE COASTAL VALLEYS REMAIN THE FINAL DESTINATION OF THE SURVIVAL PARTY DURING THE INCIDENCE OF SURVIVAL.

USING THE REGIONAL TOPOGRAPHIC VARIATION OF THE COASTAL BELT AS A BASIS FOR COMPARISON THE PERU COASTAL DESERT OF PERU CAN BE DIVIDED INTO THREE ZONES: (1) FROM PIURA (5°S) TO SALAVERRY ($8^{o}5'$S); (2) FROM SALAVERRY TO LIMA (12°S); AND (3) FROM LIMA TO ARICA, CHILE ($18^{o}30'$S).

FROM PIURA TO SALAVERRY (ZONE ONE) THE TERRAIN IS FAIRLY UNIFORM IN APPEARANCE. THE DESERT PLAINS BEGIN AT THE WAVE-CUT LITTORAL AND EXTEND TO THE ANDEAN PIEDMONT WHICH STANDS FIFTY TO SEVENTY-FIVE MILES BACK FROM THE SHORELINE. NUMEROUS SMALL RESIDUAL MASSES OF METAMORPHIC ROCK AND ANCIENT LAVAS, REMANENTS OF THE FORMER MOUNTAINS, BREAK UP THE OTHERWISE LEVEL APPEARANCE OF THE LOW LYING PLAINS. AT THE NORTHERN END OF THE REGION IN THE VICINITY OF PIURA THE RIO PIURA AFFORDS CONSIDERABLY LARGE AREAS OF IRRIGABLE LAND. FROM THE PIURA THE SECHURA DESERT, FIFTY TO SIXTY-FIVE MILES WIDE IN THE CENTRAL PORTION, EXTENDS SOUTHWARD ALONG THE COAST A DISTANCE OF NINETY MILES. THE GENERAL FEATURES OF THIS ARID DESERT ARE: SPARCELY SCATTERED LOW SHRUBS, DRIED-UP SHALLOW LAKE BEDS, BOTH LARGE CRESCENT SAND DUNES (MEDANOS) AND IRREGULAR SAND DRIFTS; COARSE GRAVELS AND DESERT "PAVEMENT" WHICH CONSISTS OF WIND AND SAND BUFFED PEBBLES. THERE IS NO ON-GOING HUMAN ACTIVITY IN THE SECHURA DESERT OFFERING AREAS OF REFUGE SUCH AS OCCURS IN THE ATACAMA DESERT.

IN THE SECHURA DESERT, THE MAIN SURVIVAL EFFORT IS TOWARD THE

PERIPHERAL SOURCES OF REFUGE, SPECIFICALLY, THE IRRIGATED VALLEYS TO THE NORTH AND SOUTH, THE SEA SHORE ON THE WEST, OR THE MOUNTAIN RANGE AND THE PAN AMERICAN HIGHWAY IN THE EAST. THE PROXIMITY TO THE PERIPHERY WILL DETERMINE THE DIRECTION OF TRAVEL.

TEMPERATURES IN THE SECHURA DESERT TEND TO BE HIGHER DURING THE DAY THAN THE DESERT REGIONS TO THE SOUTH. CONTRARY TO RECOMMENDATION FOR THE MORE SOUTHERN DESERT AREAS, TRAVEL MAY BE RESTRICTED TO EARLY MORNING, LATE AFTERNOON AND EVENING, OR EVEN AT NIGHT. ALTHOUGH TERRAIN DOES NOT PRESENT THE DANGEROUS FISSURES AND QUEBRADAS THAT OCCUR IN THE ATACAMA DESERT, THERE ARE NUMEROUS ROCK UP-CROPPING, LOOSE ROCK AND GRAVEL AND OCCASIONAL PRECIPITOUS DECLIVITIES. NIGHT TRAVEL WOULD REQUIRE CAUTIOUS MOVEMENT AT ALL TIMES. BETWEEN THE SECHURA DESERT AND SALAVERRY, A DISTANCE OF 125 MILES, THE COASTAL STRIP NARROWS TO AN AVERAGE WIDTH OF 25 MILES. FIVE EXTENSIVELY IRRIGATED RIVER VALLEYS RANGING FROM 15 TO 25 MILES APART DISSECT THE DESERT PLAINS WHICH REFLECT THE SAME CHARACTERISTICS AS THE SECHURA DESERT EXCEPT FOR THE ABSENCE OF THE SCATTERED LOW SHRUBS. THE RELATIVELY SHORT DISTANCES TEND TO GREATLY MINIMIZE THE PROBLEMS OF SURVIVAL.

BETWEEN SALAVERRY AND LIMA (ZONE TWO) SPURS OF THE ANDES SURGE WESTWARD TO THE SHORE CREATING RUGGED HEADLANDS COMPRISING HUGE TOWERS OF TILTED AND FAULTED STRATIFIED ROCK. MASSES OF SAND ARE BLOWN MORE THAN A THOUSAND FEET UP THE DEEPLY CREVICED CLIFFS AND SLOPES. THE NARROW LOWLANDS ARE CHARACTERIZED BY MASSES OF DRIFTING SAND FORMING RIPPLES AND DUNES.

THERE ARE SIXTEEN IRRIGATED VALLEYS IN THIS COASTAL STRIP. THOSE FORMED BY THE RIVERS WITHIN THE MOUNTAIN SPURS ARE EXCEEDINGLY DIFFICULT TO REACH EXCEPT BY THE APPROACH FROM THE SEA. THE WALLS ON

EITHER SIDE OF THE VERY NARROW VALLEYS RISE HUNDREDS OF FEET AS SHEER PRECIPITOUS SLOPES AND CLIFFS.

EXCEPT FOR THE AREAS IMMEDIATELY SOUTH OF SALAVERRY, THE TERRAIN GENERALLY FAVORS TRAVEL TOWARD THE SEASHORE AND THEN FOLLOWING THE SHORE TO A SOURCE OF AID. THE RUGGEDNESS OF THE TERRAIN MAKES NIGHT TRAVEL ALMOST PROHIBITIVE. HOWEVER, THE TEMPERATURES ARE RELATIVELY MODERATE AND THE FOG, GARUA, WHICH IS CHARACTERISTIC--PERMITS DAYTIME TRAVEL WITHOUT DANGER OF PHYSICAL IMPAIRMENT FROM EXCESSIVE HEAT AND PERSPIRATION. THE MOUNTAINOUS TERRAIN PRESENTS AN ADDITIONAL HAZARD. EXTREME CAUTION MUST BE EXERCISED CONTINUALLY AND A KNOWLEDGE OF THE APPLICATION OF MOUNTAIN CLIMBING TECHNIQUES WOULD BE MOST VALUABLE.

THE REGION BETWEEN LIMA AND ARICA (ZONE THREE) PRESENTS A VARIETY OF TERRAIN FEATURES AMONG WHICH THE MORE PROMINENT ARE THE ACCENTUATION OF THE COASTAL RANGE, THE INTRICATELY DISSECTED SURFACE OF THE HIGH DESERT PLAINS, AND THE NARROW LITTORAL SHELF FROM WHICH THE COASTAL RANGE ABRUPTLY RISES IN VERTICAL CLIFFS AND SLOPES TO HEIGHTS OF 1,500 TO 4,000 FEET.

SOUTH OF LIMA THE ANDES WITHDRAW FROM THE SHORE LINE AND GRADUALLY EXPOSE ARID SANDY PLAINS WHICH ATTAIN WIDTHS OF THIRTY TO FORTY MILES. THE PLAINS CONSIST OF THE CHARACTERISTIC DRIFTING CRESCENT SAND DUNES AND IRREGULAR DRIFTS, COARSE GRAVELS OF VARYING COMPOSITION AND SMOOTH EXPANSES OF CRUSTED, FINELY TEXTURED TOP SOILS.

CONTINUING SOUTHWARD THE COASTAL RANGE BECOMES INCREASINGLY EVIDENT BEGINNING WHAT IS TO BECOME THE WESTERN CONTAINING BORDER OF THE LONGTITUDINAL DEPRESSION WHICH PARALLELS THE COAST FOR HUNDREDS OF MILES TO THE SOUTH. THE RISING COASTAL RANGE GRADUALLY REDUCES

THE COASTAL PLAIN TO A NARROW WAVE-CUT SHELF FROM WHICH THE STEEP GRANITE ESCARPMENTS RISE TO ELEVATIONS OF 2,500 FEET.

THE REGIONS BETWEEN 15°S AND 18°S FORMS A GEOLOGIC AND PHYSIOGRAPHIC UNIT. THE ESCARPMENT RISE TO THE EDGE OF ELEVATED TABLE LANDS CALLED PAMPAS OF ARGENTINA.

THESE PAMPAS, ONCE A CONTINUOUS DESERT PLAIN, ARE SEPARATED BY SEVERAL RIVERS DESCENDING FROM THE ANDES WHICH HAVE CUT STEEP-WALLED CANYONS 1,000 TO 4,000 FEET DEEP. THE SEAWARD SLOPING PAMPAS EXHIBIT SURFACE COMBINATIONS OF EXPOSED MINUTELY DISSECTED ROCK, DRIFTING SANDS FORMING IRREGULAR DRIFTS AND SMALL CRESCENT DUNES, COARSE GRAVELS, AND SMOOTH FINELY TEXTURED EXPANSES OF LAVA FLOW.

TOWARD THE EAST IN THE VICINITY OF AREQUIPA THREE PROMINENT VOLCANIC MASSES DOMINATE THE ANDEAN SKYLINE; CHACHANI, EL MISTI, AND PICHU-PICHU. AT THE BASE OF THE ANDEAN CORDILLERA IN THIS VICINITY THE LAVA PLATEAU MERGES WITH THE PAMPAS. HERE AND THERE TONGUES OF LAVA FLOWS PROJECT WELL INTO THE DESERT. AREQUIPA, A THRIVING AGRICULTURAL CENTER AT THE FOOT OF EL MISTI, FORMS THE NUCLEUS FOR THE EXTENSIVELY IRRIGATED VALLEY WATERED BY THE RIO CHILI. THE LARGE RIVER VALLEYS ARE PRODUCTS OF MILLENIUMS OF EROSION BY THE SNOW FED STREAMS DESCENDING THE CORDILLERA. ACCUMULATIONS OF WASTE FROM THE EROSION HAVE DEVELOPED EXTENSIVE FLATS PROVIDING THE IRRIGABLE LAND ON THE FLOORS OF THE VALLEYS.

ALONG WITH THE VALLEYS CUT BY THE THROUGH-FLOWING STREAMS ARE A NUMBER OF "DRY" VALLEYS WHICH JOIN THE IRRIGATED VALLEYS AT IRREGULAR INTERVALS. THESE DRY VALLEYS, USUALLY SAND CHOKED, ARE THE RESULTS OF THE INFREQUENT RAINS. GENERALLY, THE DRY VALLEYS CAN BE FOLLOWED IN THEIR MEANDERING DESCENT WESTWARD TO THE IRRIGATED VALLEYS.

PRIMARY AREAS OF REFUGE CONTINUE TO BE THE CULTIVATED VALLEYS. UPON THE DESERT PAMPAS NO DEPENDABLE VEGETATION EXISTS. AT THE HIGHER ELEVATIONS OF THE LAVA PLATEAU ABOVE THE DESERT PAMPAS LIES THE "COUNTRY OF THE SHEPHERDS." THE PASTURE LANDS LIE AT THE ASTOUNDING ELEVATIONS OF 10,000 TO OVER 17,000 FEET, THE HIGHEST PERMANENT HABITATION IN THE WORLD. THE SIGNIFICANCE OF THESE AREAS FOR PURPOSES OF SURVIVAL IS THE HABITS OF THE SEMI-NOMADIC HERDSMEN AND SHEPHERDS WHO SCOUR THIS THINLY POPULATED BELT MOVING THEIR HERDS OF LLAMAS AND SHEEP IN SEARCH OF GOOD GRAZE. BECAUSE OF THE EXTREME WIND WHICH INTENSIFIES THE COLD AT THESE HEIGHTS, NUMEROUS SMALL HUTS HAVE BEEN BUILT AS A PROTECTION FOR THE HERDSMEN. ASIDE FROM THE HELP TO BE OBTAINED FROM THE POSSIBLE ENCOUNTER WITH HERDSMEN, THE HUTS OFFER TEMPORARY EMERGENCY RELIEF FROM SEVERE WEATHER. COMPLEMENTARY TO HERDING, EVERY ADVANTAGEOUS PIECE OF LAND IS UTILIZED FOR GROWING POTATOES (AN EXCEEDINGLY HARDY THOUGH BITTER VARIETY DESCRIBED BELOW UNDER SUBSISTENCE ACTIVITIES), WHEAT, BARLEY, AND ALFALFA. THE HIGH PASTURE NOMADS TEND TO BE SUSPICIOUS AND WARY--NOT HOSTILE BUT STILL NOT AS RECEPTIVE AS THE DESERT VALLEY PEOPLES. PROXIMITY AT TIME OF SURVIVAL WILL ULTIMATELY DECIDE THE DIRECTION OF TRAVEL, HOWEVER, IN TERMS OF ACTIVITY, WEATHER CONDITIONS AND SPEED OF PROCESSING, THE SEASHORE (OR THE NEAREST RIVER VALLEY) IS GENERALLY MORE FAVORABLE. EXCEPTIONS TO THIS WOULD BE THE PROXIMITY TO SUCH OBVIOUS TERRAIN POINTS OF REFERENCE SUCH AS EL MISTI WITH THE KNOWN CITY OF AREQUIPA.

THE ATACAMA DESERT. BETWEEN ARICA, CHILE (18°30"S) AND THE RIO COPIAPO (26°20"S) A DISTANCE OF SIXTY MILES, LIES THE ATACAMA DESERT. HERE BEGINS THE LONGITUDINAL DEPRESSION WHICH EXTENDS SEVERAL HUNDRED MILES SOUTH ALMOST TO SANTIAGO, CHILE. AT WIDTHS OF UP TO

FIFTY MILES, THE ATACAMA DESERT HAS BEEN VARIOUSLY DESCRIBED AS ONE OF THE DRIEST, MOST DESOLATE STRETCHES OF STERILE LAND ANYWHERE ON EARTH. ONLY ONE RIVER, THE RIO LOA, TRAVERSES THE DESERT FROM THE ANDES TO THE OCEAN FOR A DISTANCE OF 252 MILES ON A MEANDERING COURSE. PLANT LIFE IS EXTREMELY RARE OCCURRING ONLY AT THE OASES, OR IN THE IRRIGATED VALLEY OASES BETWEEN TACNA AND ARICA WHICH ARE A CONTINUANCE OF THE VALLEY AGRICULTURE ALONG THE ENTIRE PERUVIAN COAST.

THE WEST BOUNDARY OF THE LONGITUDINAL VALLEY IS THE GEOLOGICALLY ANCIENT COASTAL RANGE WHICH GRADUALLY ASCENDS FROM NORTH TO SOUTH TO ELEVATIONS BETWEEN 2,000 TO 4,000 FEET. RISING DIRECTLY FROM THE SEA A WALL OF PINK GRANITE ESCARPMENT FORMS THE SEAWARD SIDE OF THE COASTAL RANGE. ON THE EASTERN SIDE THE SMOOTHLY ROUNDED "HILLS" MERGE GRADUALLY INTO THE DESERT PAMPAS, A GENTLY ROLLING SURFACE COMPOSED OF SANDS, GRAVELS, PEBBLE "PAVEMENT," DRIED-UP SALT LAKE BEDS, AND BARE WIND-SWEPT ROCK EXTENDING TO THE ANDEAN PIEDMONT.

SOUTH OF ARICA THE CANYONS ARE DEEPER AND WIDER THAN WILL BE FOUND FARTHER SOUTH. THE PITTED SURFACE CLEARLY SHOWS THE EVIDENCE OF THE FORMER SALT LAKES. THE TERRAIN IS FLAT AND COURSED WITH MEANDERING DRIED-UP STREAM BEDS (QUEBRADAS). THE QUEBRADAS CUT THE FLAT LAND INTO MESAS WHICH ARE ONLY OCCASIONALLY DISRUPTED BY FAULTED SCARPS OR SAND HILLS. NO DEPENDABLE WATER IS AVAILABLE FOR IRRIGATION IN THE SEVERAL QUEBRADAS CUTTING THROUGH THIS REGION.

SOUTH OF IQUIQUE THE BROAD EXPANSE OF THE SALAR DE PINTADOES MERGES WITH AN EXTENSIVE NET OF COALESCING ALLUVIAL FANS OF COARSE GRAVEL EXTENDING UP THE ANDES. THROUGHOUT THIS REGION ENCOMPASSING THE EXTENSIVE PAMPA DEL TAMARUGAL ARE EXTENSIVE DRIED-UP SALT LAKES WHICH TYPIFY THIS ENTIRE NORTHERN DESERT OF CHILE. WITHIN THIS AREA

(70 MILES SOUTH OF IQUIQUE) THE SURFACE OF THE PAMPAS DISPLAY UNUSUALLY WIDE FISSURING, DIKES OF IGNEOUS ROCK, AND EXTRUDED MINERAL VEINS. LARGE NITRATE DEPOSITS ARE LOCATED HERE ON THE LOWER EASTERN SLOPES OF THE COASTAL RANGE. GRAVELS OF THE ALLUVIAL FANS CARRY FRESH WATER FROM THE ANDES A CONSIDERABLE DISTANCE WESTWARD INTO THE DESERT PERMITTING WATER TO BE FOUND AT SHALLOW DEPTHS IN WELLS. SOME ATTEMPTS AT CULTIVATION ARE MADE.

BETWEEN TOCOPILLA AND ANTOFAGASTA THE DESERT LOSES NONE OF ITS CHARACTERISTIC ARIDITY, NOR DOES THE TOPOGRAPHY ASSUME A MORE ENHANCING VIEW. THE DRAINAGE BASIN REFLECTS THE SAME DESERT "PAVEMENT," SAND, SALT, AND WIND-SWEPT EXPOSED ROCK. THE PROCESS OF CONTINUED FAULTING IS PARTICULARLY EVIDENT ALONG THE COASTAL ESCARPMENT AND THE COASTAL RANGE IN THE VICINITY OF SIERRA ANGLA NORTH AND EAST OF ANTOFAGASTA. PLANT LIFE CONTINUES TO BE NON-EXISTANT EXCEPT IN THE RIO LOA OASES OR DURING A RARE SUMMER SHOWER. IN ITS NATURAL STATE THE CONDITIONS REMAIN AS ADVERSE TO HUMAN SETTLEMENT AS ANY DESERT REGION. BEYOND THE OASES THERE IS NOTHING UPON WHICH MAN CAN SUBSIST AND ANIMAL PASTURAGE IS RESTRICTED TO SPARSE MOUNTAIN GRASSES TO WHICH ACCESS IS DEPENDENT UPON SHORT SEASONAL PERIODS. THE RIO LOA RISES HIGH IN THE ANDES IN BOLIVIA JUST EAST OF THE CHILEAN BORDER. DURING ITS COURSE, WHILE STILL HIGH ON THE LAVA PLATEAU AND AS IT DESCENDS TO THE INDUSTRIAL AREA OF CHUQUICAMATA, IT IS INTERSECTED BY A NUMBER OF TRIBUTARIES WHICH CONTRIBUTE TO ITS VOLUME OF FLOW. AT THIS LEVEL WHERE THE WATERS ARE POTABLE, THEY ARE PIPED AND SIPHONED OFF FOR THE COMMUNITY NEEDS THROUGHOUT THE ATACAMA DESERT AREA TO INCLUDE ANTOFAGASTA AND TOCAPILLA ON THE COAST.

AT VARIOUS INTERVALS SUCH AS AT CHIUCHIU, CALAMA, AND SANTA

BARBARA, THE LOA OR ITS CONFLUENTS SUCH AS THE RIO SALADA OR THE SAN PEDRO PROVIDE WATERS FOR GOOD SIZED CULTIVATED AREAS. CALAMA IS THE LARGEST AREA UNDER CULTIVATION IN NORTHERN CHILE AMOUNTING TO OVER 4,500 ACRES.

THE AREAS OF IRRIGATION DRAIN OFF MUCH OF THE FLOW OF THE RIO LOA AND FROM CALAMA ON TO THE MOUTH OF THE RIVER AT THE OCEAN MUCH OF THE WATER IS LOST THROUGH SEEPAGE. IT IS OFTEN REPORTED THAT THE WATERS DRY UP DURING CERTAIN SEASONS. ACTUALLY, THIS IS IN ERROR. DURING CERTAIN HOURS OF THE DAY, THE WATERS ARE EMPOUNDED IN THE RESERVOIRS OR DRAINED OFF FOR IRRIGATION AT THE HIGHER LEVELS. EVEN IN SEASONS WHEN THE WESTERN SLOPES OF THE CORDILLERA WERE DEVOID OF SNOW, THE RIO LOA CONTINUED TO FLOW WITH NO APPARENT CHANGE IN VOLUME.

MORE SERIOUSLY IN TERMS OF SURVIVAL IS THE POTABILITY OF THE WATER. THE WATER OF THE RIO LOA IS EXTREMELY BRACKISH AND THE SALINITY INCREASES ALONG ITS ENTIRE COURSE. BELOW THE AREA OF CULTIVATION WHERE THE RIVER ENTERS UPON THE DESERT FLOOR, THE WATER VERY NEARLY RESEMBLES THE OCEAN WATERS. RAINY SEASONS INCREASE THE SALT CONTENT BY DISSOLVING THE SALINE EFFLORESCENCES FROM THE SOIL IN THE UPPER BASIN AREA. EVEN ABOVE THE CALAMA AREA SOME OF THE WATERS HAVE MILD PURGATIVE EFFECTS. BELOW THE AREA OF EXTENSIVE IRRIGATION, THE WATER IS NOT USED FOR DRINKING EXCEPT WHERE EVAPORATORS HAVE BEEN INSTALLED.

DESPITE THE SEEMINGLY ADVERSE CONDITIONS WITH REGARD TO HUMAN HABITATION, THE MINERAL WEALTH CONTAINED WITHIN THIS REGION MAKES IT ONE OF THE BUSIEST DESERT AREAS IN THE WORLD. WITHIN THIS 10,000 SQUARE MILE DRAINAGE BASIN IS CONTAINED NUMEROUS NITRATE OFICINAS AND THE WORLD'S LARGEST BODY OF COPPER IS LOCATED AT CHUQUICAMATA. THERE

HAS BEEN A STEADY DECLINE IN NITRATE PRODUCTION WITH A CORRESPONDING DECLINE IN THE SIZE AND ACTIVITY OF THE VILLAGES AND COMMUNITIES DIRECTLY CONNECTED WITH THEM. HOWEVER, THE SULPHUR INDUSTRY HAS INCREASED CONSIDERABLY. THE SULPHUR MINES ARE EXTENDED SOUTHWARD ALONG THE WESTERN ANDES FOR ABOUT 600 MILES BEGINNING AT THE NORTHERN TIP OF CHILE. ALTHOUGH LOCATED HIGH IN THE ANDES AT ELEVATIONS OF 14,000 TO 20,000 FEET THE INDUSTRY HAS CONTRIBUTED GREATLY TO THE INCREASING POPULATION OF THE COASTAL REGION AND ENCOURAGED THE EXPANSION OF TRANSPORTATION AND ROAD FACILITIES. THE POPULATION HAS BEEN INCREASING STEADILY IN THE PAST TWO DECADES AND WITH THE INCREASED POPULATION HAS OCCURRED CONTINUED MODERNIZATION. EVEN IN THE PERIPHERAL OASES, ONCE CALLED "OUT-OF-THE-WORLD-VILLAGES," CONTACT BY ROAD HAS BEEN OR IS BEING ESTABLISHED AND THE INFLUENCE OF MODERNIZATION IS BEING FELT. THE INDUSTRIAL CENTER CHUQUICAMATA IS RAPIDLY BECOMING A "MODERN" CITY AND THE SURROUNDING COMMUNITIES REFLECT A CORRESPONDING GROWTH AND DEVELOPMENT.

MORE SIGNIFICANTLY FOR THE ASPECTS OF SURVIVAL IS THE EXPANSION OF TRANSPORTATION FACILITIES AND THE INCREASED TRAFFIC BETWEEN THE INTERIOR COMMUNITIES AND THE SHIPPING PORTS OF ANTOFAGASTA AND TOCOPILLA. FOR ALL PRACTICAL PURPOSES ANIMAL PORTAGE EXCEPT IN THE HIGH MOUNTAIN RETREATS HAVE BEEN RELEGATED TO THE PAST. MOTOR CARS, TRUCKS, AND BUSES (FLOTAS) PLY THE ROADS WITH REGULARITY THROUGHOUT THE DAY, THE MONTH, AND THE YEAR. REGULAR DAILY BUS SERVICE IN BOTH DIRECTIONS CONNECT CHUQUICAMATA WITH TOCOPILLA AND ANTOFAGASTA AS WELL AS WITH SAN PEDRO DE ATACAMA. THE ROADS ARE IN VARIOUS STAGES OF DEVELOPMENT. MANY OF THEM ARE MERELY SINGLE LANES FROM WHICH THE LOOSE DESERT MATERIALS HAVE BEEN SCRAPED AND A LAYER OF PACKED GRAVEL AND ROCK ADDED.

THE MORE IMPORTANT ROADS ARE SURFACED WITH ASPHALT OR PAVEMENT. SOME INDICATION OF THE AMOUNT OF TRAFFIC INVOLVED IS THE MORE THAN 1,500 MILES OF ROADS WHICH HAVE BEEN DEVELOPED JUST ON THE MOUNTAIN SLOPES TO HEIGHTS OF 19,000 FEET IN CONNECTION WITH THE FUEL (YARETA) AND SULPHUR MINING INDUSTRIES. IN ADDITION TO THE NETWORK OF HIGHWAYS A RAIL NET REGULARLY SERVICES THE DEVELOPING INDUSTRIAL CENTERS TO MEET THE INCREASING DEMANDS OF AN EXPANDING URBAN SOCIETY.

BECAUSE OF THE GROWING POPULATION ATTENDING THE INDUSTRIAL EXPANSION, THE PROVISION OF WATER AND FOOD IS STILL THE MOST SERIOUS PROBLEM OF THE REGION. FOR EXAMPLE, ANTOFAGASTA PIPES WATER 250 MILES FROM THE BOLIVIAN ANDES. OTHER COMMUNITIES ARE CONFRONTED WITH THE SAME PROBLEM; PIPING OF WATER FROM AVAILABLE SOURCES SOME OF WHICH REQUIRE PROCESSING TO REMOVE THE HIGH MINERAL CONTENT.

DESERT VEGETATION

ALTHOUGH NO STUDY EXISTS OF THE COASTWISE DESERT PROVINCE AS A WHOLE, IT WOULD SEEM TO BE DIVISIBLE INTO THREE DISTRICTS: THE DESERT DISTRICT, THE CARDONAL DISTRICT AND THE XEROPHIL WOODLAND DISTRICT.

THE DESERT DISTRICT ALMOST WITHOUT VEGETATION, RUNS FROM LATITUDE 6°S TO ABOUT 31°S, FLANKED ON ONE SIDE BY THE SEA, ON THE OTHER EITHER BY TRUE DESERT OR BY CARDONALES. THE ALMOST COMPLETE LACK OF RAIN HINDERS THE DEVELOPMENT OF VEGETATION EXCEPT ALONG THE BANKS OF THE STREAMS AND--VERY PRECARIOUSLY--ON SLOPES BLANKETED IN MIST OR MOISTENED BY DRIZZLE DURING THE WINTER. THE VEGETATION CONSISTS OF A NUMBER OF SHORT ROOTED, HERBACEOUS ANNUALS WITH AN ULTRA SHORT VEGETATIVE CYCLE AND SPECIES WITH PERENIAL ORGANS BELOW THE SOIL. THESE PLANTS ARE REFERRED TO AS LOMAS ASSOCIATIONS AND ARE ENTIRELY DEPENDENT

UPON THE COASTAL FOGS AND MISTS.

LITTLE IS KNOWN OF THE PLANT LIFE OF THE CARDONAL DISTRICT. IT LIES ALONG THE WESTERN ANDEAN SLOPES BETWEEN 5,000 AND 14,000 FEET ABOVE THE DESERT ZONE. THE VEGETATION CONSISTS OF SEVERAL SPECIES OF THE SPINY, COLUMNAR CACTUSES, BROMELIACEOUS PLANTS CHARACTERIZED BY STIFF OR SPIKED LEAVES AND BRILLIANTLY COLORED, OR WHITE FLOWERS, AND VARIOUS TYPES OF STUNTED SHRUBS AND TREES. THE CACTUSES RANGE IN HEIGHTS OF FROM THREE TO THIRTY FEET.

THE XEROPHILE WOODLAND DISTRICT COMPRISES THE WOODED AREAS CHIEFLY OF SOUTHERN PERU AND NORTHERN CHILE. THEY ARE NOT EXTENSIVE AND ARE IN DANGER OF BECOMING EVEN LESS SO BECAUSE OF DEPLETION AS SOURCES OF FUEL EXCEPT WHERE DELIBERATE CONSERVATION EFFORTS ARE BEING MADE.

THE MAIN SPECIES OF TREES ARE:

ALGARROBO (PROSOPIS CHILENSIS) LIVES ON DRY SANDY SOILS IN THE NORTH OF CHILE AND OCCURS AT ALTITUDES AS HIGH AS 5,000 FEET. ITS WOOD IS HARD AND ROT-RESISTANT AND IS USED FOR CHARCOAL BURNING, AS FIREWOOD, AND IN BUILDING. THE SEEDS WHICH GROW IN PODS ARE PRIZED AS SOURCES OF MEAL WHICH IS USED BOTH FOR VARIOUS TYPES OF FOOD ITEMS, SUCH AS MEAL CAKES AND GRUEL. IT IS ALSO USED AS A SOURCE OF FERMENTED DRINK.

TAMARUGO (PROSOPIS TAMARUGO) IS NATIVE TO THE PAMPA DEL TAMARUGAL, IN TARAPACA, AND FORMERLY WAS EXTREMELY PLENTIFUL. IT GROWS TO A HEIGHT OF THIRTY TO THIRTY-FIVE FEET AND THE TRUNK REACHES A DIAMETER OF TEN TO TWELVE INCHES. IT GROWS VERY SLOWLY AND ITS WOOD,

USED FOR FIREWOOD AND CHARCOAL, IS EXTREMELY HARD. IT IS BECOMING EXTINCT.

IN THE PAMPA DEL TAMARUGAL ANOTHER ALGARROBO IS GROWN, THE SEEDS OF WHICH APPEAR TO HAVE BEEN BROUGHT FROM ARGENTINA BY THE HARVESTING GANGS. IT IS GROWN MAINLY FOR ITS SWEET FRUIT, FOR USE AS FORAGE, FOR ITS WOOD, WHICH IS BOTH GOOD FUEL AND GOOD BUILDING MATERIAL AND FOR THE TANNIN IN ITS BARK.

ALGARROBILLA (BALSAMOCARPON BREVILFOLIUM) IS A SHRUB STANDING TEN TO TWELVE FEET HIGH, FOUND IN ATACAMA AND COQUIMBO, LIVING ON DRY HILLSIDES UP TO ABOUT 7,000 FEET ALTITUDE. IT APPEARS TO BE VERY DIFFICULT TO GROW. ITS WOOD IS USED IN VEHICLE BUILDING AND FOR FUEL. IT APPEARS TO BE BECOMING EXTINCT.

CARBON (CORDIA DECANDRA) IS A SHRUB TEN TO TWELVE FEET IN HEIGHT, FOUND IN ATACAMA AND COQUIMBO. IT YIELDS FIREWOOD, TIMBER, ETC.

GUAYACAN (PORLIERIA HYGROMETRICA) GROWS TO A HEIGHT OF EIGHTEEN TO TWENTY FEET AND IS USED FOR FUEL AND FOR MAKING SPOONS, COMBS, BOWLS, ETC.

ESPINO (ACACIA CAVENIA) MAY REACH THIRTY-FIVE FEET IN HEIGHT.

MAITON (MAYTENUS BOARIA) ALSO GROWS TO A HEIGHT OF THIRTY-FIVE FEET. ITS LEAVES ARE USED FOR FORAGE.

CHAPTER XII

DESERT CULTURE

HISTORY

OUR KNOWLEDGE CONCERNING THE DEVELOPMENTAL STAGE OF THE AMERICAN INDIAN IS MUCH TOO INADEQUATE TO DO MORE THAN THEORIZE. WHILE THERE ARE NUMEROUS THEORIES OF ABSORBING INTEREST AND OF VARYING DEGREES OF PLAUSIBILITY, THEY ARE NOT GERMANE TO THIS STUDY. AN EMERGENCE OF ANTHROPOLOGICAL INTEREST, PARTICULARLY IN ARCHEOLOGY IN THE ANDES IS ONLY BEGINNING TO DEVELOP THE PRE-HISTORICAL CULTURES OF THE WEST COAST OF SOUTH AMERICA. AT LEAST IN THIS INSTANCE THE ARIDITY OF THE DESERT HAS PROVEN A BOON. THE ARID CONDITIONS HAVE CONTRIBUTED TO THE EXCELLENT PRESERVATION OF ARCHEOLOGICAL MATERIALS INCLUDING MUMMIES, CLOTH, FOOD ITEMS, AND WOOD ALONG WITH THE MORE DURABLE MINERAL OBJECTS.

ALTHOUGH THERE WERE CERTAINLY MUCH EARLIER CULTURES THE EARLIEST EXTENSIVE ANDEAN CULTURE TO WHICH A PERIOD HAS BEEN ASCRIBED IS THE CHAVIN DATING FROM THE 3RD TO THE 8TH CENTURY WHICH EXTENDED ALONG THE ENTIRE COAST FROM PIURA IN THE NORTH TO PISCO IN THE SOUTH. DURING THE 7TH AND 8TH CENTURY THERE EMERGED IN THE NORTH CENTRAL VALLEYS OF THE PACIFIC COAST THE NASCA-PARACAS CULTURE AND IN THE NORTH THE MOCHICA CULTURE. TOWARDS THE END OF THE 11TH CENTURY THE INCA, WHOSE ORIGINS ARE SOMEWHAT OBSCURE, BEGAN TO EMERGE IN THE CUSCO BASIN. BY THE TIME SPANIARDS ARRIVED IN 1532 THE INCAS HAD EXTENDED THEIR CONTROL OVER THE

ENTIRE NORTHERN ANDES FROM THE PRESENT PROVINCE OF HUANCAVILCA OF NORTHERNMOST PERU TO THE RIO MAULE IN CHILE. NUMEROUS REFERENCES ARE AVAILABLE REGARDING THE EXTRAORDINARY EFFICIENCY OF THE INCA ADMINISTRATION. SUFFICE TO SAY HERE THAT IN ONE SHORT CENTURY OF INCA RULE THE HISTORY OF THE ANDEAN CULTURE WAS COMPLETELY CHANGED EVEN TO THE EXTENT OF ESTABLISHING AN OFFICIAL LANGUAGE, QUECHUA, OVER THE ENTIRE AREA CAUSING THE DISAPPEARANCE OF THE OTHER REGIONAL LANGUAGES AND PLACE NAMES EXCEPT THAT OF THE AYMARA WHICH WAS ACCORDED SPECIAL PRIVILEGES BY THE INCA.

THE DISCOVERY AND CONQUEST OF PERU AND CHILE EARLY IN THE 16TH CENTURY BY THE SPANISH EXPLORERS FRANCISCO PIZARRO AND DIEGO DE ALMAGRO WAS ATTENDED BY MAGNIFICENT FEATS OF ENDURANCE AND COURAGE AS WELL AS ACTS OF UTMOST CRUELTY AND DEPRAVITY AGAINST THE INDIAN POPULATION. THE APHORISM "MEN NEVER DO EVIL SO COMPLETELY AND CHEERFULLY AS WHEN THEY DO SO FROM RELIGIOUS CONVICTION" HOLDS ESPECIAL SIGNIFICANCE WHEN APPLIED TO THE PERIOD OF CONQUEST AND COLONIZATION. THE LUST FOR GOLD AND POWER ABETTED BY THE PROPAGATION OF CHRISTIANITY GAVE RISE TO MURDER, PILLAGE, AND DEPREDATION ON THE PART OF THE CONQUERORS. DISSENTION AND INTERNECINE WARFARE AMONG THE INDIAN, INSTIGATED BY THE SPANISH, WAS A MAJOR FACTOR IN THE SUCCESS OF THE CONQUEST.

THE NEXT 300 YEARS IS A STORY OF ABSOLUTE DOMINATION BY THE SPANISH UNDER A SYSTEM OF VICE-REGENCIES WITH CHAPTER AFTER CHAPTER DEPICTING RUTHLESS SUBJECTION AND EXPLOITATION OF THE NATIVE POPULATION PUNCTUATED BY SPORADIC, DESPERATE AND ILL-FATED UPRISINGS BY THE INDIANS--USUALLY RESULTING IN EVEN MORE SEVERE SUBJECTION.

THE EARLY 19TH CENTURY SAW THE BEGINNING OF COORDINATED MOVEMENTS AGAINST THE "MOTHER COUNTRY" NOT ONLY BY THE INDIANS BUT ALSO

BY DISSIDENT SPANISH GROUPS CALLED CREOLES WHO WERE SPANISH PEOPLE BORN IN THE NEW WORLD AND WHO RESENTED THEIR INFERIOR SOCIAL STATUS AS WELL AS BEING UNHAPPY WITH THEIR UNFAVORABLE ECONOMIC AND POLITICAL STATUS. IN SUCH CONDITIONS OF DISSENTION AND DISCONTENT WERE NURTURED THE SEEDS OF DISAFFECTION AND REBELLION. THE DISSOLUTION OF SPAIN'S POWER AT THE HANDS OF THE COLONISTS (WITH SOME OUTSIDE HELP) UNDER THE LEADERSHIP OF RISING NATIONAL HEROES SUCH AS JOSE DE SAN MARTIN AND SIMON BOLIVAR WAS CLIMAXED IN 1824 AT THE BATTLES OF JUNIN AND AYACUCHO.

THE SUCCEEDING YEARS FOR THE WEST COAST REPUBLICS OF SOUTH AMERICA WERE PERIODS OF STRIFE AND TURBULENCE; SPAIN'S LEGACY TO HER REBORN CHILD OF A PREGNANCY CONCEIVED IN VIOLENCE, NURTURED ON GREED AND AVARICE AND DELIVERED IN BLOOD AND REVOLUTION. DICTATOR FOLLOWED DICTATOR EACH BEING EITHER DEPOSED OR KILLED IN TURN. REVOLUTIONS WERE POLITICALLY DE RIGUEUR AND BOUNDARY DISPUTES BETWEEN THE ANDEAN REPUBLICS BROUGHT ABOUT INTER-REPUBLIC WARS WHICH STILL INCITE CHAUVINISTIC ACCUSATIONS AND RECRIMINATIONS AMONG THEM.

THE PEOPLE

ONE OF THE MOST SIGNIFICANT FEATURES OF THE POPULATION OF THE WEST COAST--AS IS TRUE OF NEARLY ALL OF SOUTH AMERICA--IS THE RACIAL MIXING WHICH BEGAN FROM THE OUTSET OF THE EUROPEAN CONQUEST AND WHICH HAS CONTINUED UNABATED WITH LITTLE OR NO RESTRICTION OR TABOOS. THIS INTERCOURSE, HOWEVER, DID NOT EXTEND TO THE CULTURES. NOT ONLY DO EUROPEAN AND INDIAN CULTURES REMAIN DISTINCTIVE BUT THEY ARE TO A LARGE EXTENT INCOMPATIBLE AND ARE TODAY A SOURCE OF MANY OF THE SOCIAL PROBLEMS CONFRONTING ALL THE SOUTH AMERICAN NATIONS. THE PRESENT

POPULATION OF THE WEST COAST OF PERU IS PREDOMINATELY MESTIZO (MIXTURE OF WHITE AND INDIAN) WHO PROVIDE THE LABOR FOR THE AGRICULTURE IN THE IRRIGATED VALLEYS AND THE LOCAL INDUSTRIES.

CENSUS FIGURES ATTEMPT TO DISTINGUISH BETWEEN "PURE" INDIAN AND THE MESTIZO OR "CHOLO." ACTUALLY NO ELABORATE BIOLOGICAL CRITERIA ARE USED TO DISTINGUISH THE ONE FROM THE OTHER. GENERALLY THE DECISION IS LEFT TO THE CENSUS TAKER WHO USES SUCH SUBJECTIVE FACTORS AS PERSONAL PREFERENCE OR SUCH ARBITRARY DISTINCTIONS AS LINGUISTIC ABILITY, OCCUPATION, AND EDUCATION. THERE IS LITTLE DIFFERENCE IN THE CULTURAL ELEMENTS OF THE COASTAL POPULATION OTHER THAN THE EUROPEANS. ANY SEGMENT OF THE POPULATION CURVE WILL CONTAIN GROUPS REPRESENTING VARYING DEGREES OF INDIAN AND MESTIZO STATUS.

THE NEARLY ONE AND A QUARTER MILLION WHITES OF PERU LIVE MOSTLY IN THE LARGER COASTAL CITIES CONSTITUTING THE UPPER SOCIAL STRATA CONTROLLING THE ECONOMY AND GOVERNMENT. IN NORTHERN CHILE THERE WAS UNTIL RECENTLY A LARGER PROPORTION OF "PURE" INDIANS FOR VARIOUS REASONS--NOT THE LEAST OF WHICH IS THE HARSHNESS OF THE DESERT ENVIRONMENT. THIS IS CHARACTERISTIC OF THE ENTIRE REGION, THAT IS, WHERE ENVIRONMENT IS MORE SEVERE AND SUBSISTENCE MORE PRECARIOUS THE POPULATION REFLECTS A LARGER PROPORTION OF INDIANS.

THE INDIAN-MESTIZO PORTION OF THE POPULATION REFLECT TWO MAIN ACCULTURATIONAL TRENDS: (1) INDIVIDUALS AND CLASSES OF INDIVIDUALS HAVE BEEN DETACHED FROM THE CONTEXT OF NATIVE LIFE AND ASSIMILATED QUITE RAPIDLY INTO THE NATIONAL, HISPANIC-AMERICAN CULTURE; (2) COMPARATIVELY STABLE NATIVE COMMUNITIES HAVE EXPERIENCED MORE GRADUAL ACCULTURATION.

LARGE NUMBERS OF INDIVIDUALS HAVE LEFT THEIR NATIVE COMMUNITIES TO BECOME A SOMEWHAT MOBILE NATIONAL LABORING CLASS THAT IS INTE-

GRATED WITH THE EUROPEANS IN A CONDITION OF ECONOMIC AND SOCIAL INTER-DEPENDENCE. THEIR DISLODGEMENT FROM THE NATIVE COMMUNITIES HAS SEVERAL CAUSES; WORK AS SERVANTS TO THE HIGHER CLASS, MINE LABOR, SERVICE IN THE ARMY, THE REWARDS OF VARIOUS NEW TYPES OF PRODUCTION IN THE URBAN CENTERS, AND THE LOSS OF THEIR OWN LANDS. THE LAST, AND PERHAPS THE MOST IMPORTANT, FACTOR WAS BROUGHT ABOUT BY: THE EARLY WARS, NEW TYPES OF LAND USE, ESPECIALLY CATTLE RAISING, WHICH CROWDED OUT PART OF THE DENSE FARMING POPULATION, COMPLICATION OF LEGAL TITLES TO LAND, INCREASE OF THE NATIVE POPULATION, AND THE INTRODUCTION OF INDIVIDUALIZED LAND OWNERSHIP AND CASH CROPS, WHICH FREQUENTLY LED TO LAND SALES. SOME OF THE DETACHED PERSONS BECAME FARM WORKERS (COLONOS) ON THE HACIENDAS AND EITHER WERE RAPIDLY HISPANICIZED THROUGH THE EFFORTS OF THE LANDLORDS, OR SIMPLY LOST THEIR INDIAN TRAITS WITHOUT COMMENSURATE GAIN. INCREASING NUMBERS, HOWEVER, HAVE BECOME URBANIZED AND, THOUGH RETAINING SOME INDIAN CULTURE, THEY WEAR EUROPEAN DRESS, WORK FOR WAGES, CAN READ AND WRITE, AND ARE GEARED TO THE NATIONAL SOCIOECONOMIC SYSTEM THROUGH A NATIONAL CONSCIOUSNESS AND A SENSE OF SOLIDARITY.

THE MAIN RESERVOIR OF INDIAN LIFE IN THE MODERN COASTAL REGION IS THE COMMUNITY (COMMUNIDAD OR AYLLU), WHICH HAS REMAINED RELATIVELY INTACT, EXCEPT THAT DURING THE COLONIAL PERIOD ITS SIZE WAS INCREASED THROUGH THE SYSTEM OF CONCENTRATING POPULATIONS (REDUCCIONES) TO FACILITATE ADMINISTRATIVE CONTROL AND RELIGIOUS PROSELYTIZATION OF THE OF THE INDIAN. IN PERU AND BOLIVIA AND NORTHERN CHILE THERE ARE 3,000 SUCH COMMUNITIES TODAY EACH WITH ABOUT 500 PERSONS. THEIR PATTERNS, DESPITE A CONSIDERABLE CONTENT OF SPANISH ELEMENTS, RETAIN MANY OF THE PRINCIPAL CHARACTERISTICS OF THE NATIVE FOLK CULTURE: PRODUCTION

MAINLY FOR LOCAL USE, THOUGH ALWAYS SOME SURPLUS CROPS FOR SALE; NATIVE METHODS OF CULTIVATION; EXCHANGE OF LABOR WITH COMMUNITY MEMBERS (AINE); INDIAN GARMENTS, HOUSES, AND OTHER MATERIAL ITEMS; QUECHUA OR AYMARA SPEECH, THOUGH MUCH BILINGUALISM; INABILITY TO READ; LOCAL CONTROL OF MATTERS NOT OF NATIONAL CONCERN; THE EXTENDED FAMILY AS THE PRINCIPAL SOCIOLOGICAL UNIT; COMMUNITY SOLIDARITY EXPRESSED THROUGH VILLAGE ENDOGAMY, LOCAL CEREMONIES, SHRINE (HUACA) WORSHIP OF LOCAL DEITIES, ESPECIALLY THOSE OF MOUNTAINS, PRACTICE OF SHAMANISM AND MAGIC, AND EXCHANGE OF GOODS AT PERIODIC MARKETS.

AS THE NATIONAL ECONOMY EXPANDS, AS EDUCATION IS EXTENDED, AND AS TRANSPORTATION BRINGS THE REMOTER RURAL AREAS INTO CONTACT WITH THE MORE ADVANCED CENTERS, THE INDIAN COMMUNITIES ARE BEING GRADUALLY TRANSFORMED. ALMOST ALL LAND IS NOW INDIVIDUALLY OWNED FACILITATING ITS LOSS THROUGH SALE. THE SALE OF LAND TOGETHER WITH LIMITED LIVING SPACE IS BREAKING DOWN THE PATRILINEAL EXTENDED FAMILY BECAUSE NEW GENERATIONS TEND TO BUD OFF AND BECOME INDEPENDENT. THIS IN TURN WEAKENS THE COMMUNITY. CASH CROPS ARE INTRODUCING A MONEY ECONOMY AND GREATER USE OF MANUFACTURED GOODS. SPECIAL INDUSTRIES ALSO AUGMENT COMMUNITY INCOME AND PROMOTE URBANIZATION. MANY NON-INDIAN COMMUNITIES ARE INCORPORATED AND HAVE PRODUCERS' AND CONSUMERS' COOPERATIVES. BILINGUALISM IS INCREASING. FORMAL EDUCATION IS INTRODUCING THE NATIONAL CULTURE AND A NATIONAL CONSCIOUSNESS.

SUBSISTENCE ACTIVITIES

THE WEST COASTAL REGION OF SOUTH AMERICA IS BASICALLY AGRICULTURAL. TO A CONSIDERABLE DEGREE HERDING IS RELATED TO THE EXTENSIVENESS OF TILLABLE LAND. HERDING AS A PRIMARY ACTIVITY IS RELEGATED

TO THE HIGHLAND PLATEAUS WHERE THE LAND IS LITTLE SUITED TO CULTIVATION AND IS COMPLEMENTARY TO HERDING ONLY TO THE EXTENT THAT IT IS PRACTICABLE. IN THE MIDDLE ALTITUDES A MORE BALANCED INTEGRATION OF THE TWO ACTIVITIES, ONE COMPLEMENTING THE OTHER, EVEN THOUGH GRAZING HERE CAN BE CONSIDERED TO PLAY THE SUBORDINATE ROLE.

PRACTICALLY EVERYWHERE IN THE ANDES THE VALLEYS PRODUCE A SURPLUS FOR A MARKET AND PARTICIPATE TO SOME EXTENT IN A MONEY ECONOMY. TRADE, BOTH OF PRODUCE AND HANDICRAFT ARTICLES, IS HIGHLY DEVELOPED AND WITH THE IMPROVEMENT OF ROADS AND MEANS OF TRANSPORTATION DURING THE PAST FEW YEARS AGRICULTURAL PRODUCTION IS BECOMING EVER MORE GEARED TO THE REQUIREMENTS AND DEMANDS OF OUTSIDE CONSUMPTION.

TYPICALLY, AGRICULTURE IS CHARACTERIZED BY ADHERENCE TO A SIMPLE TRADITIONAL TECHNOLOGY AND TO AN INTRICATE DIVISION OF LABOR, QUITE AS MUCH A SURVIVAL AS THE TECHNOLOGY. DRAFT ANIMALS ARE USED WHEN AVAILABLE. MECHANIZATION IS BECOMING MORE COMMON IN THE MORE EXTENSIVELY IRRIGATED VALLEYS. ALTHOUGH THE PRIMITIVE DIGGING STICK WITH IRON BLADE IS IN EVIDENCE IT IS GIVING WAY TO THE SINGLE-HANDLED ONE-WAY METAL WALKING PLOW STILL SEEN IN MANY RURAL AREAS OF THE SOUTHERN STATES OF NORTH AMERICA.

THE MAJORITY OF THE COASTAL COMMUNITIES HAVE BEEN ABSORBED INTO LARGE HACIENDAS WHICH DEPENDS UPON THE LOCAL POPULATION FOR LABOR. IN THE MAJORITY OF HACIENDAS OF THE ANDES, AGRICULTURAL METHODS DIFFER LITTLE FROM THOSE FOUND IN THE INDIAN VILLAGES. HERE, MORE OFTEN THAN NOT, THE COLONOS AND YANACONAS ARE LEFT TO THEIR OWN DEVICES BY THE OWNER OR THE HACIENDADO SO LONG AS THEY ABIDE BY THEIR CONTRACTS, GIVE THEIR LABOR, AND DELIVER TO THE HACIENDADO HIS PROPER SHARE OF THE TOTAL PRODUCE HARVESTED. THE TYPICAL COASTAL HACIENDA IS CAREFULLY

MANAGED IN DISTINCTION TO THAT OF THE SIERRA. PRIVATE CCAPITAL AND GOVERNMENT ASSISTANCE ARE MADE AVAILABLE TO THEM. A PATRONIZING POLICY TOWARD FARM LABOR HAS CREATED AN EFFECTIVE, RELATIVELY HEALTHY FORCE OF MESTIZO AND QUECHUA WAGE-LABORERS WHOSE STANDARD OF LIVING IS CONSIDERABLY SUPERIOR TO THAT OF THE FREE CULTIVATORS AND SHARE-CROPPERS OF THE SIERRA. FINALLY, THE COASTAL HACIENDAS PRODUCE CROPS--COTTON, FLAX, SUGARCANE--ALMOST EXCLUSIVELY FOR A WORLD MARKET. PRICES TRANSLATED INTO LOCAL TERMS SIGNIFY TANGIBLE PROFITS OVER THE COST OF PRODUCTION.

ARABLE LAND IS DIVIDED INTO TWO LARGE CLASSES: (1) THE IRRIGATED LANDS, USUALLY IN THE VALLEYS AND IN THE HIGHLAND STRETCHES BORDERING STREAMS, AND (2) THE NON-IRRIGATED, SO-CALLED DRY LANDS ON THE HILLSIDES AND FLAT PLAINS OF THE ALTIPLANO. IRRIGATION IS RATHER SIMPLE. GENERALLY, EACH COMMUNITY WHICH HAS ACCESS TO WATER WILL CUT SOME NARROW DITCHES FROM THE RIVER. THESE DISAPPEAR AFTER A SHORT TIME AND MUST BE REDUG. THE BATTLE FOR WATER RIGHTS GOES ON INCESSANTLY IN ALL PARTS OF THE COAST. OCCASIONALLY, CONFLICTS DEVELOP BETWEEN ONE COMMUNITY AND ANOTHER, RARELY BETWEEN INDIVIDUALS OF THE SAME COMMUNITY. THE CLASSIC CASE, HOWEVER, IS COMMUNITY VERSUS HACIENDA, AND THE HACIENDA IS GENERALLY VICTORIOUS. WATER IS DRAWN OFF BY THE HACIENDA IN AMOUNTS THAT LEAVE LITTLE FOR THE COMMUNITY, OR THE COURSE OF THE RIVER MAY EVEN BE CHANGED ALTOGETHER.

ROTATION OF CROPS IS PRACTICED EVERYWHERE. IN SOME OF THE BEST LANDS OF CUZCO, PUNO, AND CENTRAL PERU, ROTATION PROCEEDS ACCORDING TO A THREE-CROP SYSTEM WITH A REVERSION TO THE FIRST CROP IN THE FOURTH YEAR. CONTINUOUS CULTIVATION OF THIS SORT IS RATHER UNCOMMON. THE USUAL PICTURE OF CROP ROTATION INCLUDES SEVERAL FALLOW YEARS AFTER THE

PLANTING OF A THIRD CROP. IN VARIOUS PARTS OF THE DEPARTMENT OF CUZCO THE FOLLOWING ROTATION HAS BEEN NOTED: FIRST YEAR, POTATOES; SECOND YEAR, OCAS OR LISES; THIRD YEAR, BARLEY. THE LAND IS THEN ALLOWED TO LIE FALLOW FOR THREE YEARS, AFTER WHICH POTATOES ARE SOWN AGAIN. ON THE MOUNTAIN SLOPES AND HILLSIDES THERE IS USUALLY ONE CROP, POTATOES, WITH FIVE TO TEN YEARS OF SOIL REST. ARABLE LAND WHICH IS LYING FALLOW IS GENERALLY USED FOR PASTURE.

ALTHOUGH ALFALFA, SORGHUM, MAIZE, LENTILS, BEANS, AND YUCA ARE THE PRINCIPAL AND LARGEST FIELD CROPS, MANY OTHERS (SEE APPENDIX A) ARE ALSO PLANTED AND GROWN IN FIELDS AS WELL AS IN GARDEN ORCHARDS AND FIELD BORDERS. EVERY HOUSE IN THE IRRIGATED COUNTRYSIDE IS SURROUNDED BY A GARDEN (HUERTA) AND MOST HOUSES IN THE PUEBLO MAKE AN ATTEMPT AT ONE IN THE BACK YARD. THESE ARE USUALLY RELATIVELY SMALL AREAS CONTAINING A GREAT VARIETY OF FRUIT TREES, BUSHES, AND SMALL PLOTS OF DECORATIVE FLOWERS AND KITCHEN VEGETABLES. IN THE VEGETABLE PLOTS IT IS NOT UNUSUAL TO SEE ONIONS, CABBAGE, LETTUCE, AZAFRAN, AND RADISHES, FOR EXAMPLE, ALL GROWING IN ONE PLOT, EITHER IN ALTERNATE ROWS OR MIXED UP TOGETHER MORE OR LESS INDISCRIMINATELY. USUALLY THE SMALL VEGETABLE PLOTS ARE SURROUNDED BY A FENCE OF CANE TO KEEP OUT POULTRY AND DOGS. THE FRUIT TREES AND BUSHES PROVIDE SHADE AND PROTECTION FROM THE WIND AS WELL AS EDIBLE PRODUCTS.

THE FIELD BORDERS ARE USUALLY THREE TO SIX FEET WIDE, USUALLY DEPENDING UPON THE EXTENT TO WHICH THEY ARE UTILIZED FOR THE PLANTING OF OTHER THAN FIELD CROPS, AND FOLLOW THE LINE OF THE ENCIRCLING FENCE OF THE PROPERTY. THE FIELD CROPS MENTIONED ABOVE ARE SELDOM GROWN IN ANY QUANTITY IN HUERTAS AND FIELD BORDERS BUT PRACTICALLY ALL OTHER TYPES OF DOMESTICATED OR USEFUL PLANTS ARE TO BE FOUND IN BOTH HUERTAS

AND BORDERS AND OFTEN IN FIELDS THEMSELVES.

DOMESTIC ANIMALS AND STOCKRAISING. DURING THE PAST TWO DECADES A GROWING EMPHASIS ON DAIRY AND MEAT PRODUCTS HAS PRODUCED A CORRESPONDING INCREASE IN THE NUMBER OF CATTLE AS WELL AS ALLOCATION OF LAND FOR PASTURAGE. THE BULK OF THE PRODUCE IS FOR URBAN MARKETS. ALTHOUGH SOME CATTLE ARE RAISED FOR BEEF THE EMPHASIS IN THE VALLEY AREAS IS MAINLY ON MILK AS A CASH MONEY PRODUCT.

IN ADDITION TO CATTLE, WHICH ARE OF IMPORTANCE FOR MILK, MEAT, AND TRACTION FOR PLOWS (OXEN), THE OTHER MOST IMPORTANT DOMESTIC ANIMALS IN COASTAL VALLEYS ARE DONKEYS OR BURROS. THESE SMALL AND PATIENT BEASTS ARE BY ALL ODDS THE PRINCIPAL MEANS OF TRANSPORTATION OF CARGO AND ONLY RECENTLY HAVE BEEN RELEGATED TO SECOND PLACE BY THE DEVELOPMENT OF BUS TRANSPORTATION FOR THE TRANSPORT OF PERSONS TO URBAN CENTERS.

SHEEP, LLAMA, AND ALPACA HERDS ARE WIDESPREAD, THOUGH IT IS ONLY IN THE HIGHER ALTITUDES THAT HERDING BECOMES A PRIMARY ACTIVITY. IN SOUTHERN PERU, SHEEP WOOL AND ALPACA WOOL ARE PRODUCED IN LARGE QUANTITIES TO ENTER THE WORLD MARKET. THE QUECHUA, FURTHERMORE, RECEIVES A CONSIDERABLE INCOME FROM URBAN MEAT DEALERS. THE INDIAN HIMSELF USES LITTLE OF HIS HERD TO PROVIDE FOOD FOR HIMSELF. IN MOST PARTS OF PERU THE NORMAL DIET TENDS TO BE DEFICIENT IN PROTEINS FOR THIS REASON. A THIRD VALUE WHICH THE INDIAN OBTAINS FROM HIS DOMESTICATED HERDS, PRIMARILY HIS LLAMAS, IS THEIR USE AS BEASTS OF BURDEN. CATTLE ARE KEPT IN MANY PLACES BUT IN SMALL NUMBERS. THE MANURE OF ALL DOMESTICATED ANIMALS IS USED AS FERTILIZER AND FUEL.

THE TYPE OF STOCK THAT ONE ORDINARILY FINDS IN INDIAN HERDS IS NOT OF THE BEST. THE SHEEP ARE SMALL AND SCRAWNY AND THE WOOL

SECOND RATE. THE INDIAN LLAMAS AND ALPACAS ARE NOT COMPARABLE TO THE WELL-KEPT HACIENDA HERDS. THE REASONS ARE TWO: LACK OF GOOD PASTURAGE, AND APART FROM SOME MINOR EXCEPTIONS, INDISCRIMINATE BREEDING. IN MOST OF PERU NATURAL PASTURAGE IS USED. A LITTLE BARLEY AND EMERGENCY FODDER MAY BE GIVEN TO THE HERDS PERIODICALLY, BUT SPECIAL CULTIVATION OF GRAINS FOR FODDER IS SELDOM PRACTICED.

PRACTICALLY EVERY HOUSEHOLD, WHETHER IN TOWN OR IN THE COUNTRY, KEEPS POULTRY--CHICKENS, DUCKS, AND/OR TURKEYS. EGGS ARE A COMMON ARTICLE OF DIET AMONG THE INDIANS, AND POULTRY FLESH ALSO IS CONSUMED, ALTHOUGH NOT SO FREQUENTLY. BOTH PRODUCTS ARE ALSO SOLD. POULTRY IS FREQUENTLY KEPT IN SMALL HOUSES IN THE YARD, MADE EITHER OF TOTORA MATTING (ESTERAS) OR OF CANA BRAVA. SOMETIMES HOUSES OF THE LATTER ARE BUILT ON SMALL PLATFORMS FOUR TO FIVE FEET OFF THE GROUND AS A PROTECTION FROM WEASELS AND DOGS. THE BIRDS ROOST IN THESE SHELTERS AT NIGHT, BUT USUALLY HAVE THEIR LAYING NESTS EITHER IN CORNERS OF THE HUMAN DWELLING OR ABOUT THE HUERTA.

SWINE AND SHEEP ARE RAISED IN ALL COMMUNITIES BUT WITH CONSIDERABLE DIFFERENCES IN NUMBERS USUALLY DEPENDING UPON SOCIAL OUTLOOK, ECONOMIC RETURN, AND AMOUNT OF PASTURAGE FOR SHEEP. GOATS ARE RAISED EVEN LESS FREQUENTLY THAN SHEEP, AND THEY ALSO ARE MAINTAINED ON THE NATURAL GRAZING GROUNDS NEAR THE RIVERS. BOTH OF THESE ANIMALS ARE RAISED MAINLY FOR MEAT RATHER THAN FOR WOOL OR HAIR. ALTHOUGH KID, AND TO A LESSER EXTENT MUTTON, IS A FAVORITE FOOD THE MAJOR PART OF THE MEAT IS BOUGHT IN THE URBAN MARKETS. THE LACK OF EMPHASIS UPON SHEEP AND GOAT RAISING IS EXPLAINED BY THE FACT THAT PASTURE SUITABLE FOR THESE ANIMALS IS SCARCE AND THAT MAINTAINING THEM ON THE ALFALFA PASTURES WOULD BE UNECONOMICAL.

DOGS ARE THE ONLY OTHER REGULARLY KEPT DOMESTIC ANIMALS. THESE ARE NUMEROUS, AND EACH HOUSEHOLD IS GUARDED BY TWO OR THREE AT LEAST. THEY SEEM TO BE MONGRELS, WITH HOUNDLIKE SMOOTH-HAIRED VARIETIES IN THE MAJORITY, ALTHOUGH LARGE HAIRY BRUTES DERIVED FROM SOMETHING LIKE AN ENGLISH SHEPHERD DOG ARE NOT UNCOMMON.

HUNTING AND FISHING. HUNTING HAS PRACTICALLY DISAPPEARED EXCEPT AS A SPORT. OCCASIONAL FORAYS ARE MADE INTO THE MOUNTAINS BUT VERY FEW NATIVES HAVE GUNS. ANCIENT METHODS OF HUNTING WITH THE BOW AND ARROW AND OTHER ARCHAIC WEAPONS HAVE LONG SINCE BEEN DISCARDED. OPOSSUMS, WEASELS, AND RODENTS ARE TRAPPED IN BOX TRAPS WITH FIGURE-4 TRIGGERS OF WOOD AND A DROP ENTRANCE DOOR, A EUROPEAN OR NORTH AMERICAN PATTERN. THE ONLY ANIMALS EXTENSIVELY TRAPPED FOR FOOD ARE THE SMALL LIZARDS (CANANES). THESE ARE USUALLY HUNTED BY SMALL BOYS WHO KILL THEM ON THE RUN WITH STICKS. THE CANANES ARE FOUND IN CLOSE ASSOCIATION WITH THE ALGARROBA TREE IN THAT THEIR DIET CONSISTS MAINLY OF THE ALGARROBA SEED. THERE ARE MANY OTHER SMALL LIZARDS CALLED LARGARTIJAS WHICH ARE NOT CONSIDERED AS FOOD SOURCES AS ARE THE CANANES.

DURING THE MOIST WINTER SEASON OCCASIONAL EXPEDITIONS ARE MADE TO THE NEARBY MOUNTAINS TO THE EAST TO GATHER LARGE GROUND SNAILS, WHICH APPEAR THERE AT THAT SEASON. THEY ARE STEAMED AND EATEN.

THE AMOUNT OF FISHING AND THE TECHNIQUES INVOLVED VARY ACCORDING TO THE PROXIMITY TO THE SEASHORE OR THE QUANTITY OF FISH IN THE RIVERS SUPPORTING THE VALLEY COMMUNITIES. THE GOVERNMENTS OF PERU AND CHILI HAVE EXPERIMENTED WITH STOCKING OF THE VALLEY RIVERS WITH FISH, ESPECIALLY TROUT. THE RIO LOA AND THE RIO SAN PEDRO, A TRIBUTARY, WERE ONCE WELL STOCKED. HOWEVER, THE HIGH SALINITY OF THE WATER AND THE GENERAL LACK OF SUFFICIENT FOOD FOR THE FISH HAVE RE-

SULTED IN A DEPRECIATION IN NUMBER PLUS A METAMORPHIC CHANGE. THE TROUT WHICH IN OTHER STREAMS ARE OF NORMAL THICKNESS OF BODY HAVE BECOME THIN AND ALMOST EEL-LIKE IN THE RIO LOA. METHODS OF FISHING INCLUDE THE USE OF HOOK AND LINE AND VARIOUS TYPES OF NETS, WEIRS, AND SEINES IN THE RIVERS. ON THE SEASHORE, FISHING IS DONE BOTH FROM BOATS AND FROM THE SHORE AGAIN USING VARIOUS TYPES OF THROW-NETS, AND HOOKS AND LINES.

MARINE LIFE IS VERY RICH ALONG THE COAST. IT INCLUDES MANY TYPES OF FISH WHICH CAN BE CAUGHT FROM THE SHORE, AS WELL AS NUMEROUS TYPES OF SHELL FISH, CRABS, SEA URCHINS, SEA-SQUIRTS, SQUID, SNAILS, SHRIMP, AND CRAWFISH WHICH CAN BE COLLECTED ON THE SANDS, UNDER AND BEHIND ROCKS, AND IN HOLES AND CREVICES FORMED BY ROCKS. A WORD OF CAUTION IS MADE CONCERNING THE PREVALENCE OF SHARKS IN THE COASTAL WATERS SHOULD ONE BE TEMPTED TO VENTURE TOO FAR FROM THE SHORE. NOT TO BE OVERLOOKED ALONG THE SHORE ARE THE SEAWEEDS, MANY OF WHICH FORM A CUSTOMARY PART OF THE DIET OF THE COASTAL PEOPLE.

EXCEPT FOR FISHING AND HUNTING OF THE SMALL GAME WHICH INHABIT THE AREAS OF HUMAN CULTIVATION--THAT IS, THE AREAS OF VEGETATION AND WATER--THE DESERT OFFERS NOTHING OF A SUBSISTENCE QUALITY TO THE INDIVIDUAL. THE WILD ALPACA, VICUNA, AND GUANACO ALTHOUGH PROTECTED BY LAW ARE HIGH COUNTRY ANIMALS WHICH HAVE RETREATED EVEN FARTHER INTO THE MOUNTAIN RETREATS. THE SAME APPLIES TO THE RHEA (AN OSTRICH-LIKE BIRD), THE VIZCACHA WHICH RESEMBLES A RABBIT, AND THE CHINCHILLA (EXCEPT WHERE IT IS RAISED COMMERCIALLY ON FARMS). FOXES ARE FOUND WHEREVER MAN HAS CREATED SOME TYPE OF FORAGE.

IN THE RIVER VALLEYS AND ESPECIALLY ALONG THE LOA IN NORTHERN CHILE, PARTRIDGES, DOVES, AND FLAMINGOS ARE IN FIELDS ADJACENT TO OR

IRRIGATED BY THE RIVER. IN ADDITION, THE AQUATIC FOWL SUCH AS THE MUSCOVY DUCK, WHICH IS BOTH DOMESTICATED AND WILD, IS FOUND IN CONSIDERABLE ABUNDANCE.

FOOD AND DRINK. TO A NORTH AMERICAN THE THREE MORE OUTSTANDING FEATURES OF SOUTH AMERICAN FOOD, ASIDE FROM DETAILS OF VARIOUS RECIPES, WOULD PROBABLY BE: (1) THE PICANTE; (2) THE DISHES MADE IN VARIOUS WAYS FROM RAW FISH; AND (3) THE CHICHA, OR MAIZE BEER. THE FIRST AND SECOND OF THESE ITEMS IN ONE FORM OR ANOTHER ARE CHARACTERISTIC OF THE WHOLE OF PERU, AND DISHES PREPARED FROM RAW FISH ARE FOUND THROUGHOUT THE COAST.

PICANTE IS A GENERAL TERM REFERRING TO WHAT MIGHT BE CALLED "HOT SEASONING." IT APPEARS IN VARIOUS FORMS, BUT ITS PRINCIPAL INGREDIENTS ARE RED AND YELLOW PEPPERS (THE RED ARE THE HOTTEST), SALT (BOUGHT IN THE STORES IN THE FORM OF ROCK SALT), BLACK PEPPER (THE BERRIES ARE BOUGHT IN THE SHOPS AND GROUND AT HOME), ONIONS, GARLIC, PARSELY, AZAFRAN, AND CITRUS FRUIT JUICES, ESPECIALLY LIME JUICE. OF ALL THESE, THE RED AND YELLOW PEPPERS (AJI COLORADO AND AJI AMARILLO) ARE THE MOST IMPORTANT SINCE THEY APPEAR IN PRACTICALLY ALL FOOD PREPARATION, AND RAW FISH (SEVICHE) IS "COOKED" IN CITRUS FRUIT JUICE AND EATEN WITH PEPPER. A SMALL SIDE DISH OR GOURD OF PICANTE SAUCE USUALLY STANDS ON THE TABLE IN CASE ONE IS NOT SATISFIED WITH THE FLAVORING OF THE DISHES SET BEFORE HIM.

RAW FISH IS SERVED IN THE FORM OF SEVICHES; IN THIS THE FISH IS FIRST "COOKED" IN LIME JUICE, THEN COVERED WITH COLD PICANTE SAUCE, AND SERVED WITH CORN ON THE COB, YUCA, SWEETPOTATO AND OFTEN OTHER VEGETABLES, THE WHOLE GARNISHED WITH LEAVES OF LETTUCE. CRABS AND SHRIMPS ARE ALSO EATEN RAW AFTER SIMILAR TREATMENT AS WELL AS BEING

STEAMED OR BOILED.

THE WORD CHICHA IS IN GENERAL USE FOR FERMENTED DRINKS IN ALL PARTS OF RURAL SPANISH AMERICA, AND IT DOES NOT SEEM TO BE A TERM NATIVE TO PERU. THE QUECHUA TERMS ARE "ACCA," "AKA," "ASUHA," "KUSHA," "AQHA." CHICHA MAY BE MADE FROM A VARIETY OF GRAINS OR KERNELS, OTHER THAN MAIZE INCLUDING PEANUTS, BARLEY, AND WHEAT. ALTHOUGH THERE ARE MINOR VARIATIONS IN TECHNIQUES THE DRINK IS ESSENTIALLY BREWED. FRESH CHICHA "FRESCA" WITH LITTLE OR NO ALCOHOLIC CONTENT IS USED, IF AVAILABLE, AS A THIRST QUENCHER AT BREAKFAST AND TO BE CARRIED IN BOTTLES TO THE FIELDS, ETC. THIS FRESH DRINK IS MERELY THE REGULAR PRODUCT BEFORE IT HAS FERMENTED. JUDGING BY ITS EFFECTS, WELL-MATURED CHICA MUST HAVE AN ALCOHOLIC CONTENT CLOSE TO THAT OF A HEAVY ALE, PERHAPS TWELVE TO FOURTEEN PER CENT BY VOLUME.

EXCEPT FOR THE PROBABLE EXCESSIVE CONSUMPTION OF ALCOHOL WHICH IT INDUCES, CHICHA IN ITSELF WOULD SEEM TO BE A COMPARATIVELY HEALTHFUL BEVERAGE. IT IS NOT CHEWED UP AND SPIT OUT AS IS DONE IN THE MANUFACTURE OF CERTAIN BEERS IN THE JUNGLE PORTIONS OF SOUTH AMERICA. IT IS, HOWEVER, IN THE ETIQUETTE OF DRINKING THAT ALL ATTENTION TO MODERN RULES OF CLEANLINESS DISAPPEARS. THE BREW IS STORED IN BOTIJAS (LARGE JARS) AND LADLED OUT WITH A SMALL GOURD CALLED A COJODITO ("LITTLE LAME ONE") INTO A LARGE GOURD CALLED A POTO. THEN THE SINGLE COJODITO SERVES AS THE DRINKING VESSEL FOR ALL WHO MAY BE PRESENT. THE AFFECTATION OF SERVING THE DRINK IN GLASS TUMBLERS SERVES ONLY TO RENDER VISIBLE THE SLIME LEFT BY MANY MOUTHS ON THE RIM.

MODERN COMMUNICATIONS AND TRANSPORTATION HAS RESULTED IN THE EXPANDING USE OF COMMERCIALLY PROCESSED FOODS EVEN IN SOME OF THE REMOTER VILLAGES. NEVERTHELESS, THE AGE OLD METHODS OF FOOD PREPARATION

ARE SUFFICIENTLY PREVALENT AS TO BE ENCOUNTERED AS A COMMON DAILY FARE, ESPECIALLY IN THE SMALL PIEDMONT VILLAGES. CHUNU, DEHYDRATED POTATOES, IS A STAPLE IN THE INDIAN DIET. THERE ARE TWO MAIN VARIETIES, THE BLACK CHUNU, AND THE WHITE, AND MANY LOCAL VARIETIES KNOWN BY LOCAL NAMES. CHUNU NEGRO IS MADE OF SPECIALLY SELECTED POTATOES THAT HAVE BEEN LEFT TO FREEZE ON SOME OPEN HIGH GROUND. WHILE THE POTATOES ARE IN THE PROCESS OF FREEZING THEY ARE SPRAYED WITH WATER PERIODICALLY, CARE BEING TAKEN THAT THEY ARE NOT EXPOSED TO THE SUN. WHEN THE FREEZING TREATMENT IS FINISHED, THE POTATOES ARE TRAMPLED TO EXTRACT WHATEVER WATER IS LEFT. THE WHITE CHUNU IS MADE OF A BITTER POTATO WHICH HAS BEEN LEFT IN A LAKE OR RIVER FOR SEVERAL WEEKS UNTIL THE COLOR HAS BECOME ALMOST WHITE. THEN, AFTER THE WATER HAS BEEN EXTRACTED, THE POTATOES ARE PUT OUT FOR THE FROST TO WORK UPON THEM. OFTEN THEY ARE PRESSED DOWN WITH ROCKS. AFTER A FEW DAYS, THE POTATOES HAVE BEEN ALMOST ENTIRELY DEHYDRATED, THE FINISHED PRODUCT BEING A WHITE CHALKY SUBSTANCE.

DRIED POTATOES ARE MADE BY FIRST COOKING, THEN CLEANING AND EXPOSING THEM TO THE ACTION OF THE FROST. MAIZE, WHEAT, OCAS, BARLEY, ULLUCOS, AND MASHUAS ARE PRESERVED IN THE SAME WAY.

MEAT IS PRESERVED BY SALTING AND DRYING IN THE SUN (CHARQUI). ALONG THE COAST LITTLE PRESERVATION IS DONE EXCEPT BY THE COMMERCIAL ESTABLISHMENTS. THE FISH ARE SALTED AND SOLD IN THE DAILY MARKET.

CHUNU, POTATOES, AND THE POTATO SEED ARE STORED IN LLAMA-WOOL SACKS, IN HUTS ADJOINING THE LIVING QUARTERS, OR IN THE HOUSEHOLD. GRAIN IS STORED IN THE SAME WAY OR IS LEFT SPREAD OUT ON THE FLOOR OF THE STORAGE PLACE.

EXCEPT AT FIESTA TIMES, THE QUECHUA ORDINARILY EAT TWO MEALS A DAY--AT DAWN AND IN THE EARLY EVENING. DURING PLOWING AND HARVESTING SEASONS, THE WORKERS ARE ACCUSTOMED TO RECEIVING A MIDDAY LUNCH. USUALLY WOMEN DO THE COOKING, ALTHOUGH MEN ALSO COOK AT TIMES. POTATOES, CHUNU, AND GRAINS ARE BOILED AND SERVED IN STEWS (SANCOCHADO, CHUPE, ETC.). MEATS ARE ROASTED ON SPITS OR FRIED. IN THE HIGHLANDS, FOOD IS FREQUENTLY COOKED OVER FIRES MADE OF MANURE. WOOD FIRES ARE MORE COMMON IN THE LOWER ALTITUDES.

BREAD IS A STAPLE ONLY IN RESTRICTED AREAS OR IS EATEN ON SPECIAL OCCASIONS. CHEESE, OF COW'S, EWE'S, AND GOAT'S MILK, IS MADE IN MOST COMMUNITIES. IN MANY PLACES IT IS AN ESSENTIAL PART OF THE DIET.

BUTCHERING TECHNIQUES ARE NEARLY THE SAME THROUGHOUT THE COASTAL REGION. BASICALLY, SLAUGHTERING IS ACCOMPLISHED BY SLITTING THE ANIMAL'S THROAT. CARCASSES ARE IMMEDIATELY SKINNED AND HUNG UP. THE MEAT NOT NEEDED IN THE OWNER'S HOUSEHOLD IS SOLD TO THE LOCAL MEAT SHOPS (CARNECERIAS) AND TO VENDORS IN THE MARKETS. IN BOTH CASES IT IS DISPLAYED, HUNG FROM HOOKS OVERHEAD, OR LAID OUT ON WOODEN TABLES.

NOTHING IS THROWN AWAY. EVEN THE INTESTINES ARE SOLD FOR SOUP AND MEAT (MONDONGO). THE INTESTINES ARE FREQUENTLY CUT INTO THIN SLICES OR SHREDS AND FRIED, SOMEWHAT AFTER THE MANNER OF MAKING CHITTERLINGS. BEEF PENIS AND TESTICLES ARE FREQUENTLY USED IN THE MAKING OF A PEPPER POT STEW CALLED SANCOCHADO.

THERE IS LITTLE ATTENTION GIVEN TO BUTCHER'S CUTS OF MEAT. IT GENERALLY IS CUT OR HACKED INTO HUNKS, REGARLESS OF THE PART OF THE CARCASS FROM WHICH IT IS TAKEN. CHOPS OR CUTLETS ARE UNKNOWN. LOMO IS PRACTICALLY THE ONLY RECOGNIZED "CUT," BUT IT IS ONLY A FLAT PIECE

OF MEAT WHICH CAN BE FRIED OR BROILED LIKE A BEEFSTEAK. IT MAY BE TAKEN FROM ANY PART OF THE ANIMAL, FROM THE RUMP TO THE SHOULDERS, AND IT MAY REPRESENT EITHER A CUT ACROSS THE FIBERS OR ALONG THEM. MOST MEAT IS PREPARED EITHER "GUIZADO" OR "SANCOCHADO." BOTH PROCESSES MAKE USE OF HUNKS OR CUBES OF MEAT REGARDLESS OF CUT. THIN SLICES OF MEAT (CARNE MECHADA) ARE CUT FROM BOILED JOINTS AND SERVED COLD IN SANDWICHES.

RELIGION

INDIAN OR RURAL RELIGION TODAY IS ESSENTIALLY A SPECIAL FORM OF CATHOLICISM. THE CATHOLIC RITUAL AND THEOLOGY HAS PENETRATED TO THE MOST ISOLATED COMMUNITIES. MOST OF THE SURVIVING NON-CATHOLIC ELEMENTS ARE COATED OVER WITH A CATHOLIC SURFACE.

JUST AS IN PEASANT EUROPE, CATHOLICISM WAS COMBINED WITH LOCAL PAGAN WORSHIP SO THE PRE-COLUMBIAN RELIGIOUS FORMS THROUGHOUT THE AMERICAS WERE FREQUENTLY ABSORBED IN LOCAL CHURCH PRACTICE. THE PROBLEM IS COMPLICATED HERE IN THAT ALREADY SPECIALIZED BRANDS OF CATHOLICISM BORN IN THE PEASANT DISTRICTS OF SPAIN WERE FURTHER MODIFIED AND AMPLIFIED BY THE LOCAL RELIGIONS IN THE NEW WORLD AND BY INTERNAL HISTORIC CHANGES. TO DISENTANGLE THE VARIOUS ELEMENTS AND TO PLACE EACH HISTORICALLY AND GEOGRAPHICALLY REQUIRES CONTROL OF BOTH THE AMERICAN AND SPANISH SOURCES.

IT HAS BEEN POINTED OUT THAT THE MODERN INDIANS HAVE NOT DEVELOPED A HIGHLY INTEGRATED RELIGION. THE ELEMENTS OFTEN DO NOT JIBE; THERE IS NO ATTEMPT TO RELATE ONE ELEMENT TO ANOTHER. FOR THE MOST PART, RELIGION APPEARS TO BE A LOOSE JUMBLE OF BELIEFS, IDEAS, AND PRACTICES DISCONNECTED AND UNSYSTEMATIZED.

HOWEVER, IT IS NOT A NEGLIGIBLE FACTOR IN THE LIFE OF THE COMMUNITY. THE SUPERNATURAL BEINGS ARE CLOSELY INVOLVED IN THE ECONOMIC AND SOCIAL LIFE OF THE INHABITANTS. RITUAL AND CEREMONIALISM ARE ALLIED TO THE MOST PRACTICAL AND SERIOUS OBJECTIVES OF MEN AND WOMEN. THE PUBLIC CEREMONIALS ARE PIVOTS AND HIGH POINTS OF COMMUNAL LIFE. MAGIC AND CURING ENTER INTO THE WHOLE FIELD OF HUMAN RELATIONS. MOREOVER, OUTSIDE OF GOVERNMENT THE CHURCH IS THE ONLY OTHER GREAT CONSTANT WHOSE PRESSURE IS FELT IN EVERY COMMUNITY.

INTRICATELY BOUND UP IN THE RELIGIOUS AND SOCIAL LIFE OF THE WEST COAST COMMUNITY IS THE FIESTA COMPLEX--AS IN ALL OF LATIN AMERICA. THE FIESTAS ARE A RATHER STRANGE AND WONDERFUL ADMIXTURE OF ROMAN CATHOLIC AND PAGANISTIC RITES AND CEREMONIES WITH A GENEROUR PROPORTION OF SATURNALIA ADDED. THE FIESTA IS A TIME OF GAIETY, RELIEF FROM THE TEDIUM OF DAILY LABOR, AND TO A GREAT EXTENT A TIME OF FORGETFULNESS AND DISREGARD FOR THE DRUDGERY AND IMPOVERISHMENT THAT SO MUCH CHARACTERIZES THE LIFE OF THE SOUTH AMERICAN INDIAN OR MESTIZO.

THE SUPERFICIAL CARNIVAL ATMOSPHERE BELIES THE UNDERLYING FUNCTIONAL CHARACTER OF THE FIESTA IN RELATION TO THE CULTURAL OR SOCIOLOGICAL ASPECTS OF NATIONAL AS WELL AS COMMUNITY LIFE. IN PERU, FOR EXAMPLE, THERE ARE TWENTY OFFICIAL HOLIDAYS MOST OF WHICH ARE RELIGIOUS, WHICH ARE OCCASIONS FOR FIESTAS FOR THEIR PATRON SAINTS DAYS, PLANTING (FERTILITY RITES), HARVESTS, CHILDRENS' FIRST HOLY COMMUNION, AND MANY OTHERS.

THE FORM OF THE FIESTAS IS HIGHLY INSTITUTIONALIZED. IT SERVES NOT ONLY TO REINFORCE THE IDENTITY AND COHESION OF THE COMMUNITY BUT ALSO IDENTIFIES THE INTERRELATED ROLES OF THE MEMBERS OF THE COMMUNITY BY DESIGNATING THE ROLE ASSUMED DURING THE FIESTA ACCORDING TO THE

REAL LIFE ROLE IN THE COMMUNITY. FIESTA TIME CALLS FOR MUCH REVELRY, CONSIDERABLE BEHAVIORAL LICENSE WHICH MIGHT TEND TO RAISE A FEW EYE BROWS AS WELL AS BLOOD PRESSURES OF THE MOST PURITANICAL, AND A NATION-WIDE HANGOVER. NEVERTHELESS, THE SOCIAL IMPORTANCE OF THE FIESTA CANNOT BE DISMISSED AS A TRANSITORY OCCURRENCE. IT IS A VERY SIGNIFICANT PART OF THE LIFE OF THE INDIVIDUAL AND COMMUNITY.

MEDICAL PRACTICES AND CURATIVES

NO OTHER ASPECT OF THE NATIVE CULTURE OF THE COASTAL PEOPLE INCORPORATES SO MUCH OF THE PRIMITIVE ELEMENT IN ITS APPLICATION AS DO THE PRACTICES ASSOCIATED WITH ILLNESS OF ANY SORT. IN OUR WESTERN WORLD OF HYGIENICS, MANUFACTURED DRUGS AND CURATIVES, STAINLESS STEEL SURGERY AND SPECIALISTS FOR EVERY ILL, THE BELIEF IN WITCHCRAFT, SORCERY, BLACK MAGIC, INCANTATIONS AND WITCHES BREWS TEND TO BE SOMEWHAT UNSETTLING. IN SOUTH AMERICA THEY COMPRISE A GOOD PORTION OF THE MEDICAL FIELD.

THE MAJORITY OF THE WEST COASTAL PEOPLE ARE AWARE OF AND IN MANY INSTANCES HAVE AVAILED THEMSELVES OF MODERN MEDICAL TECHNIQUES AND MEDICINES. YET THE "BRUJOS" (WITCHES) AND "CURANDEROS" (CURERS) NOT ONLY PRESCRIBE FOR THE "CUSTOMARY" ILLS BUT IN TIMES OF CRISES ARE CALLED UPON IN PREFERENCE TO THE "MEDICOS" OR MODERN PRACTIONERS.

TO DEVELOP THE MATERIAL PERTAINING TO NATURE AND EFFICACY OF THESE PRACTICES WOULD REQUIRE SEVERAL VOLUMES. SUFFICE TO SAY THAT THEY ARE A COMPOUND OF SUPERSTITION, PRACTICAL EXPERIENCE WITH REGARDS TO TECHNIQUES AND REMEDIES, FOLKLORE, "PRIMITIVE" PSYCHOLOGY, AND INCREASING USE OF PREPARED DRUGS FROM THE NEAREST "BOTICA" (DRUG STORE).

Summary of Social Aspects

Except for the truly urban centers such as Lima, the majority of the communities of the coast have a basic rural orientation. Some of the industrialized areas which depend almost entirely on outside sources for daily necessities show a more rapid trend toward modernization. However, even in the remote "out-of-the-world" villages there is a growing familiarity with the "wonders" of modern machinery, communications, and recognition of different ways of life.

The visitor is no longer quite the rarity he once was. The advent of the motor bus and car together with the increase in road building has resulted in many remote villages being frequently visited by tourists, social scientists searching for residual elements of passing cultures or attempting to gauge and evaluate the dynamics of acculturation, government officials (including tax collectors) dispensing the benefits of bureaucracy, etc.

For the most part, the rural inhabitants display a rather disinterested kindness and politeness. There have been various references to the docile and abject character of the Indian and to considerable extent the *mestizo* personality; a consequence of generations of servitude and impoverishment. This condition, an inheritance of the colonial *encomiendo*, is contemporarily retained in the hacienda absentee landlord system. It concentrates the land holding in hands of a few wealthy land owners. The Indian "peasant" is reduced to the meager returns of a share-cropper's existence.

There is a growing awareness of the need for social reforms. There is, too, the not so faint stirring of unrest among the large lower class "comuneros," an increasing demand for political and social

RECOGNITION, AN INCREASE IN LITERACY; IN ESSENCE A GROWING REALIZATION THAT THE DESIRE FOR THE HUMAN DIGNITY NEED NOT BE DENIED THEM. THE INDIAN AND MESTIZO CONSTITUTE MORE THAN EIGHTY PER CENT OF THE POPULATION AND PRESENT A FORMIDABLE SOCIAL PROBLEM OF IMMEDIATE CONCERN.

WHILE THIS SOCIAL AWARENESS HAS IN SOME INSTANCES GIVEN RISE TO A COLLECTIVE ANIMOSITY TOWARD THE WEALTHY CLASS OR GOVERNING FACTION THE INATE POLITENESS OF THE INDIVIDUAL TOWARD THE INDIVIDUAL PERSISTS. LOCAL CUSTOMS AND HABITS ARE TOO MANY AND TOO VARIED FOR THE MOMENTARY VISITOR TO LEARN. HOWEVER, A THREE CENTURY HISTORY OF CONTINUOUS CONTACT BETWEEN PEOPLES OF EUROPEAN EXTRACTION AND THE INDIAN HAS CREATED AN ACCOMMODATING IF NOT ALWAYS COMPATIBLE MODE OF LIFE. IN GENERAL THE VISITOR IS RECEIVED CORDIALLY. IN THE EXTREMELY REMOTE MOUNTAIN VILLAGES THERE MAY BE SOME MISTRUST PERHAPS AN APPEARANCE OF SULLENNESS BUT NO ACTUAL HOSTILITY IS DISPLAYED. THE SHORTAGE OF FOOD ON OCCASION MAY CAUSE THE PEOPLE TO APPEAR INHOSPITABLE BUT AGAIN IF FOOD IS AVAILABLE AND THERE IS NEED FOOD WILL BE GIVEN. IN GENERAL, IT IS SOCIALLY CORRECT TO OFFER TO PAY FOR THE FOOD AND SERVICES RENDERED. COURTESY AND KINDNESS ARE UNIVERSALLY RECOGNIZED AND RECIPROCATED.

CHAPTER XIII

SURVIVAL FACTORS

AFTER HAVING BELABORED THE AWESOME CHARACTERISTICS OF THE COASTAL DESERT REGION OF SOUTH AMERICA, IT MAY SEEM RATHER PARADOXICAL TO SUGGEST THAT IN TERMS OF SURVIVAL IN ITS ENTIRETY IT IS PROBABLY THE MOST ACCOMMODATING OF ALL DESERTS. AT THIS POINT THE READER MAY HAVE ALREADY REACHED THIS CONCLUSION.

PERHAPS THE FEATURE WHICH MOST FAVORS THE CHANGE FOR SURVIVAL IS THE PHYSIOGRAPHIC ATTENUATION OF THE REGION ITSELF. FOR ALL OF ITS 100,000 SQUARE MILES THE ODDS ARE EXCEEDINGLY SLIM THAT A PARTY WOULD BE MORE THAN TWENTY-FOUR HOURS FROM AID AND COMFORT. SOME OF THE MORE OBVIOUS TERRAIN FEATURES WHICH CONTRIBUTE TO THIS UNLIKELIHOOD ARE: (1) THE RELATIVELY SHORT DISTANCE IN WIDTH OF THE ENTIRE REGION, (2) THE RATHER NUMEROUS AND EVENLY SPACED TRANSVERSE RIVER VALLEYS ALONG THE COAST, (3) THE CONSIDERABLE AMOUNT OF INDUSTRIAL ACTIVITY IN THE ATACAMA DESERT REGION WITH THE CORRESPONDING GROUND TRANSPORTATION NETWORK, (4) THE PAN AMERICAN HIGHWAY WHICH EXTENDS THE ENTIRE LENGTH OF THE COAST WITH ITS CONSIDERABLE TRAFFIC, AND (5) THE PROXIMITY OF THE ANDES WITH NUMEROUS PIEDMONT VILLAGE OASES AND IMMEDIATE SOURCE OF VEGETATION AND WATER THEY OFFER.

ANOTHER FEATURE WHICH GREATLY FAVORS THE PARTY IS THE CLIMATE. DESPITE THE DRYNESS, THE RELATIVE COOLNESS BY DAY REDUCES THE EVAPORATION FACTOR CONSIDERABLY WHICH IN TURN REDUCES THE WATER LOSS TO THE

BODY--INDEED A CRITICAL FACTOR. PERHAPS THE MOST IMPORTANT ASPECT OF THIS FEATURE IS THAT IT PERMITS TRAVEL DURING DAYLIGHT HOURS WHEN THE IMPORTANT TERRAIN FEATURES ARE VISIBLE AS NAVIGATION AIDS. IT ALSO REDUCES THE POSSIBILITY OF SERIOUS ACCIDENTS WHICH COULD OCCUR FROM THE NUMEROUS AND OFTEN DEEP GULLIES AND FISSURES ON THE DESERT PAMPAS.

WHILE THESE FEATURES IN THEIR BROADER CONFIGURATION TEND TO FAVOR THE SURVIVAL PARTY, IN THEIR DETAILED COMPOSITION THEY PRESENT A NUMBER OF ADVERSE CONDITIONS WHICH WILL SERIOUSLY AFFECT THE DECISIONS OF THE PARTY FROM THE INCEPTION OF THE INCIDENCE OF SURVIVAL TO RECOVERY TO INCLUDE PERSONNEL AND EQUIPMENT. THESE DETAILS ARE CONSIDERED MORE INTENTLY. BEFORE DOING SO, HOWEVER, THE OPPORTUNITY IS TAKEN HERE TO EMPHASIZE THE IMPORTANCE OF BECOMING FAMILIAR WITH THE SURVIVAL TECHNIQUES DETAILED IN AIR FORCE MANUAL 64-3. TO A GREATER OR LESSER DEGREE ALL OF THE INSTRUCTIONS PERTAINING TO DESERT SURVIVAL ARE APPLICABLE TO THE DESERTS OF SOUTH AMERICA.

TERRAIN

THE FOREMOST TERRAIN FEATURE IS THE ANDEAN MOUNTAIN RANGE. IT IS PROBABLY THE MOST IMPORTANT SINGLE FEATURE AFFECTING NEARLY ALL OF THE SURVIVAL FACTORS WITH WHICH THE PARTY MUST BE CONCERNED. ITS CONNECTION WITH EACH FACTOR WILL BE CONSIDERED INDEPENDENTLY.

AS A TERRAIN OBSTACLE WITHIN THE DESERT PROPER IT IS ONLY WHERE THE ANDES EXTEND WEST IN THE FORM OF SPURS AND RUGGED HEADLANDS TO THE OCEAN THAT THEY ACT ACT AS A BARRIER TO NORTH-SOUTH MOVEMENT EXCEPT ALONG THE LITTORAL. THEY COMPRISE THE COASTAL TERRAIN FROM 8°S TO 13°S, A DISTANCE OF APPROXIMATELY 400 MILES. ANY DECISION REGARDING SAFETY OF PERSONNEL IN THE EVENT OF TECHNICAL MALFUNCTION MUST INCLUDE

BAIL-OUT IF THE PLANE IS INCAPABLE OF SUSTAINING FLIGHT BEYOND THE MOUNTAIN AREA ITSELF EITHER TO THE SEA OR TO THE COASTAL PLAINS TO THE NORTH AND SOUTH OF THE AREA. THE COASTAL VALLEYS THAT DISSECT THE HEADLANDS ARE SHARPLY DEFINED BY NARROW AND PRECIPITOUS SLOPES; THEY ARE THICKLY POPULATED; AND THEY ARE INTENSELY TERRACED. EXCEPT AT DESIGNATED AIRPORT FACILITIES SUCH AS AT AREQUIPA, LIMA, AND TRUJILLO THE TERRAIN DOES NOT LEND ITSELF TO THE SAFE LANDING OF A HIGH-EFFICIENCY AIRPLANE.

THE PAMPAS FOR THE MOST PART OFFER A WIDER LATITUDE AS TO THE POSSIBILITY OF A SAFE LANDING. AGAIN THERE ARE FACTORS THAT MUST BE CONSIDERED. ON THE SALARES OR DRY SALT-LAKE BEDS THE SURFACE IS SUFFICIENTLY HARD AS TO PERMIT WHEELS-DOWN LANDING. HOWEVER, THERE IS THE FREQUENCY OF DRIFTING SAND AND DUNES WHICH COULD WREAK HAVOC WITH THE MACHINE IF HIT. ANOTHER CONCERN IS THE ABOVE MENTIONED GULLIES AND FISSURES CUTTING THE SURFACES.

THE HIGHWAYS AND BETTER ROADS OF THE DESERT GENERALLY FAVOR A WHEELS-DOWN LANDING BUT EVEN THESE ARE FREQUENTLY CROSS-CUT BY DRIFTING SANDS AND EROSION CAUSED BY SUDDEN SHOWERS.

CERTAIN OF THE PLAINS, SPECIFICALLY THE PAMPAS OF SOUTHERN PERU IN THE VICINITY BETWEEN MOLLENDA AND AREQUIPA, ARE EXTREMELY DISSECTED, RUGGED, AND INTERSPERSED WITH SAND DUNES, IRREGULAR DRIFTS, EXPOSED ROCK, AND TALUS.

THE LITTORAL HAS A RATHER EVEN DISTRIBUTION OF "GOOD" AND BAD LANDING POSSIBILITIES. UNFORTUNATELY, THE FREQUENT CLOUD COVER MAY PREVENT SUFFICIENT VISIBILITY SO AS TO ALLOW MUCH SELECTIVITY. THE ALTERNATIVE OF A WATER LANDING ENTAILS SERIOUS CONSIDERATION OF THE DANGER OF SHARKS WHICH RANGE CLOSE TO SHORE ESPECIALLY DURING THE MONTHS OF

OCTOBER TO MAY. THIS IS MADE POSSIBLE BY THE SHARP DROP OF THE LAND CREATING DEEP WATER IMMEDIATELY OFFSHORE; ANOTHER FACTOR WHICH THE PARTY MUST CONSIDER.

CLIMATE

AS PREVIOUSLY INDICATED THE TEMPERATURES ARE QUITE MODERATE AND FOR THE MOST PART CREATE NO SERIOUS PHYSICAL PROBLEM. THE FLIGHT CLOTHING WORN FOR THE GENERAL AREA TOGETHER WITH THE WARMTH PROVIDED BY THE PARACHUTE WILL PROVE MOST ADEQUATE. ONE SERIOUS EXCEPTION TO THIS, HOWEVER, IS THE REGION OF THE PUNA DE ATACAMA, THE HIGH MOUNTAIN PLATEAU, DISCUSSED ABOVE. THE EXTREME WIND AND COLD CONDITIONS DURING THE WINTER MONTHS REQUIRE GREATER EMPHASIS ON THE NEED FOR ADEQUATE SHELTER AND CONSERVATION OF ENERGY AND WILL SERIOUSLY INFLUENCE THE DECISION TO REMAIN WITH OR ABANDON THE PLANE.

THE USE OF SUNGLASSES, HEAD COVER, ANTI-DUST CLOTHS, COMPLETE BODY COVERING, ETC., AS COVERED IN AIR FORCE MANUAL 64-3 APPLY.

WATER

AS IN ANY DESERT ENVIRONMENT, THE NEED FOR CONSERVATION OF WATER PREVAILS, HOWEVER, NOT TO THE EXTENT OF CAUSING DEBILITY. FORTUNATELY, THE CLIMATIC FACTORS CAUSING BODILY MOISTURE DEPRECIATION ARE NOT AS SEVERE AS IN MANY DESERT AREAS. THIS IS OFFSET SOMEWHAT BY THE MORE EXTREME ARIDITY WHICH CHARACTERIZES SOUTH AMERICA'S DESERTS. EXCEPT AT THE OASES OR THE THROUGH-FLOWING RIVERS, THE PROBABILITY OF FINDING POTABLE WATER IS MOST UNLIKELY.

BECAUSE OF THE PROBABLE PROXIMITY OF THE OASES AND AREAS OF HUMAN HABITATION TO THE LOCATION OF DESCENT, TIME SHOULD BE SPENT IN DIRECT-LINE TRAVEL TO NEAREST INDICATED WATER OR OASES RATHER THAN

SEARCHING FOR FORTUITOUS SOURCES OF WATER.

THE MOST LIKELY SOURCES OF WATER OTHER THAN THE RIVERS AND OASES ARE CONDENSATION RESULTING FROM THE GARUA OR CAMANCHACA, THE COOLING OF NIGHT TEMPERATURES, AND THE RATHER DUBIOUS MOISTURE TO BE EXTRACTED FROM SOME OF THE VARIOUS TYPES OF CACTUS PLANTS. WITH REGARDS TO CONDENSATION ALL FLAT SURFACES, FOR EXAMPLE, THE SMOOTH SURFACES OF THE PLANE'S WINGS, SPREAD-OUT PAPER, TIGHTLY WOVEN FABRICS ESPECIALLY PLASTICS, ETC., SHOULD BE FULLY UTILIZED.

FOOD

AT THE RISK OF CITING THE OBVIOUS, IT IS RECOMMENDED THAT TIME SHOULD NOT BE WASTED ON THE SEARCH FOR WILD GAME OR EDIBLE WILD PLANTS. THE IMMEDIATE NEED FOR FOOD IS NOT QUITE SO CRITICAL AS IS THE NEED FOR WATER. EXCEPT FOR THE DISCOMFORT BROUGHT ON BY THE HUNGER PANGS OF A BODY USED TO THREE MEALS A DAY A MAN CAN ENDURE FOR A SURPRISINGLY LONG TIME ON AN EMPTY BELLY. IN THIS CASE CERTAINLY LONG ENOUGH TO REACH AREAS OF HUMAN HABITATION. WHEN GAME CAN BE OBTAINED OR PLANTS OF RECOGNIZED FOOD VALUE ARE ENCOUNTERED THEY SHOULD BE UTILIZED AGAINST CONTINGENCIES. HOWEVER, AS IN THE CASE OF WATER, WHERE ANIMALS CAN ABIDE IN THE DESERT SO USUALLY CAN HUMANS.

TRAVEL AND NAVIGATION

CONDITIONS AFFECTING THE DECISION TO REMAIN WITH THE DOWNED AIRCRAFT OR TO ATTEMPT A "WALK-OUT" ARE TO A CONSIDERABLE DEGREE MUCH LIKE THOSE DISCUSSED IN THE DATA PERTAINING TO THE SAVANNAS. THE FACTOR THAT WOULD MOST LIKELY INFLUENCE A DECISION TO MOVE OUT INDEPENDENTLY ARE: (1) THE PROXIMITY OF HABITATION, ESPECIALLY THE IRRIGATED VALLEYS, AND (2) THE NEED FOR IMMEDIATE HELP BECAUSE OF INJURY

OF A MEMBER OF THE PARTY TOGETHER WITH A KNOWN AREA OF AID WITHIN A DISTANCE THAT CAN BE COVERED IN A SHORT PERIOD.

IT CAN BE READILY SEEN FROM A GLANCE AT THE MAP OF THE WEST COASTAL DESERT THAT EVEN AT RELATIVELY LOW ALTITUDES (1,000 TO 5,000 FEET) THERE IS HARDLY ANY AREA IN WHICH THE SEASHORE OR ONE OF THE TRANSVERSE VALLEYS ARE NOT VISIBLE. THE AREAS WHERE THERE IS A POSSIBILITY OF THIS NOT BEING SO ARE THE SECHURA DESERT OR THE ATACAMA DESERT. THE ATACAMA HAS A CONSIDERABLE AMOUNT OF CROSS-REGIONAL TRAFFIC BECAUSE OF THE MINING DEVELOPMENTS WITHIN THE DESERT AND ALONG THE WESTERN FLANKS OF THE ANDES. EVEN SO, SHOULD THE DESCENT IN EITHER OF THESE TWO AREAS OCCUR MANY HOURS MAY ELAPSE BEFORE AN AREA OF HELP IS REACHED.

IN CONSIDERING THE ADVANTAGES OR DISADVANTAGES OF WALKING OUT OR OBTAINING AID INDEPENDENTLY OF ORGANIZED SEARCH AND RESCUE OPERATIONS, THERE ARE A NUMBER OF INFLUENCING FACTORS SOME OF WHICH WILL BE INHERENT IN THE CIRCUMSTANCES PERTAINING TO SPECIFIC SURVIVAL SITUATIONS.

IF THERE ARE MORE THAN ONE PERSON IN THE PARTY, THE DECISION MUST BE MADE WHETHER OR NOT TO REMAIN TOGETHER, TO SEND OUT ONE OR TWO, OR FOR ALL TO TRAVEL TOGETHER. IF THERE ARE INJURED MEMBERS OF THE PARTY, TRAVEL MAY BE FATAL. IT MAY BE ADVISABLE THAT ONE OR TWO GO FOR AID IN SUCH AN EVENT WHILE THE OTHER MEMBERS REAMIN WITH THE INJURED. PERHAPS THE MOST DIFFICULT DECISION OF ALL WOULD ENTAIL A PARTY OF TWO OF WHOM ONE WAS INJURED. TO REMAIN WITH THE INJURED MEMBER OR TO GO FOR AID WILL CERTAINLY TRY ONE'S CAPACITY TO WEIGH THE VARIOUS FACTORS OBJECTIVELY. IN THE FINAL ANALYSIS THIS IS THE MOST IMPORTANT OF THE HUMAN FACTORS INVOLVED--THE ABILITY TO OBJECTIVELY EVALUATE THE VARIOUS FACTORS AND ACT ACCORDING TO BEST POSSIBLE CONCLUSIONS. MANY

OF THE PROCEDURES DETAILED IN AIR FORCE MANUAL 64-3 SHOULD BE REVIEWED FOR PERTINENT STANDING PROCEDURES.

IF THE DECISION TO GO HAS BEEN MADE, A GENERAL ORIENTATION TO THE TERRAIN IS NECESSARY. THE ANDES CONSTITUTE A CONSTANT GUIDE. TO REACH ONE OF THE COASTAL VALLEYS TRAVEL PARALLEL TO THE MOUNTAINS. FACING NORTHWARD, THEY ARE TO THE RIGHT OF THE INDIVIDUAL. WHETHER ONE IS ATTEMPTING TO REACH THE MOUNTAINS OR THE SEASHORE MAY BE A MATTER OF THE MOMENT; THEY BOTH OFFER ABOUT EQUAL ADVANTAGES AS AREAS OF PROBABLE HABITATION ALONG THE PERUVIAN COAST. IN THE ATACAMA DESERT BETWEEN ARICA AND TOCOPILLA, THE DIRECTION TENDS TO FAVOR THE SEASHORE BECAUSE THE PAN AMERICAN HIGHWAY AND THE RAILWAYS HUG THE COAST IN THIS REGION. BETWEEN TOCOPILLA AND ANTOFAGASTA, THE ROAD NET SPREADS OUT TO ENGAGE THE NUMBER OF INDUSTRIAL TOWNS ALONG THE ANDEAN PIEDMONT. ONE FAIRLY CONSTANT RULE IS THAT ALL ROADS, UNIMPROVED THOUGH THEY MAY APPEAR, LEAD TO AREAS OF HUMAN ACTIVITY OR HABITATION. THERE IS ALSO THE RIO LOA OASES TO CONSIDER. THUS THE DIRECTION OF TRAVEL WILL DEPEND UPON THE PROXIMITY OF THESE FEATURES TO THE AREA OF DESCENT.

BESIDE THE SUN AND THE ASTRAL CONSTELLATIONS PECULIAR TO THE SOUTHERN HEMISPHERE OF SUPPLEMENTARY IMPORTANCE TO THE ANDES AS AIDS IN NAVIGATION ARE SEVERAL GENERAL PHYSIOGRAPHIC FEATURES AND SOME TOPOGRAPHIC FEATURES APPLICABLE TO SPECIFIC LOCALES. AMONG THE GENERAL FEATURES ARE:

1. THE COASTAL RANGE WHICH IN MOST INSTANCES APPEAR AS LOW-LYING SMOOTHLY CONTOURED HILLS ALWAYS OPPOSING THE LINE OF THE ANDEAN RANGE.

2. THE CLOUD OR FOG LAYER LYING OVER THE COASTAL RANGE ON THE SEASHORE--NOT TO BE CONFUSED WITH CLOUD BANKS FORMING OVER THE ANDEAN RANGE;

3. THE QUEBRADAS OF DRIED-UP STREAM BEDS WHICH THOUGH FREQUENTLY MEANDERING MAINTAIN A DEFINITE EAST-WEST COURSE;

4. THE WIND WHICH IS MOST CONSTANTLY BLOWING FROM THE WEST OR SOUTHWEST, CONSEQUENTLY FROM THE SEA.

THE MOST PROBABLE SOURCE OF DANGER LIES WITHIN THE PARTY ITSELF. CARELESSNESS OR INATTENTION STEMMING FROM WHATEVER CAUSE, FATIGUE, ANXIETY, LACK OF APPLICATION OF SAFETY RULES; THESE EITHER CREATE HAZARDS OR MAGNIFY EXISTING HAZARDS THAT COULD ORDINARILY BE OVERCOME.

ONE SUCH HAZARD IS THE NATURE OF THE TERRAIN. THE AREA OF DESCENT MIGHT ENTAIL BASIC MOUNTAIN CLIMBING PROCEDURES IN THE AREA WHERE THE ANDES PROJECT WESTWARD TO THE SEASHORE. WHENEVER POSSIBLE AVOID ASCENDING OR DESCENDING ESCARPMENTS OR SLOPES THAT CANNOT BE NEGOTIATED BY USE OF MOUNTAIN WALKING TECHNIQUES OR IN EXTREME CASES BALANCE CLIMBING TECHNIQUES. REMEMBER THAT THE TIME REQUIRED TO REACH SAFETY IN THIS DESERT REGION CAN USUALLY BE MEASURED IN HOURS, NOT DAYS. RATHER THAN RISK INJURY OR DEATH BY FALLING IT WOULD BE BETTER TO TRAVEL A MORE CIRCUITOUS ROUTE EVEN THOUGH IT MAY REQUIRE RETRACING PREVIOUSLY TRAVELED ROUTES.

TERRAIN FEATURES PREVIOUSLY MENTIONED ARE THE QUEBRADAS AND FISSURES. FIRST OF ALL THEY CONSTITUTE A SERIOUS THREAT TO A LANDING PLANE. AT GROUND LEVEL THEY ARE NOT VISIBLE UNTIL THE TRAVELER IS

UPON THEM. THEY CAN USUALLY BE NEGOTIATED WITH LITTLE DIFFICULTY DURING HOURS OF VISIBILITY. THE CHIEF DANGER LIES IN FALLING INTO THEM DURING HOURS OF DARKNESS. IN SOME CASES IT MAY BE NECESSARY TO TRAVEL PARALLEL TO THE DISSECTION UNTIL A NARROW OR SHALLOW PORTION IS REACHED.

NIGHT TRAVEL IS NOT GENERALLY RECOMMENDED. THIS IS IN THE NATURE OF A CONTRADICTION TO SURVIVAL PROCEDURES FOR MOST DESERT REGIONS. HOWEVER, ONE DOES NOT ENCOUNTER THE INTENSE HEAT OF DAY, AS IN THE SAHARA DESERT FOR EXAMPLE. ALSO, THE DISTANCES TOGETHER WITH THE CONSTANT AND DISTINCTIVE LANDMARKS GIVES ONE A DIRECT LINE OF MARCH TO PROBABLE SOURCES OF WATER AND FOOD SO THAT TIME AND ENERGY IS NOT DISSIPATED IN SEARCHING AIMLESSLY FOR THEM.

CHAPTER XVI

SUMMARY

BECAUSE OF THE VARIOUS FACTORS RELATING TO THE TOPOGRAPHIC AND CLIMATIC CONDITIONS OF THE DESERT REGION OF SOUTH AMERICA THERE IS NOT THE SERIOUS THREAT OR DANGER USUALLY ASSOCIATED WITH DESERT REGIONS.

1. TOPOGRAPHY. THE DESERT REGION OF SOUTH AMERICA TO THE WEST COAST FROM APPROXIMATELY 5°S TO 26°S BEGINNING WITH THE SECHURA DESERT OF NORTHERN PERU AND ENDING AT THE SOUTHERN EXTENSION OF THE ATACAMA DESERT IN CHILE, A DISTANCE OF NEARLY 2,000 MILES. AT ITS WIDEST THE SECHURA DESERT REACHES A DISTANCE OF APPROXIMATELY SIXTY-FIVE MILES BUT IN MOST INSTANCES DISTANCES ARE LESS THAN THIRTY TO FORTY MILES EITHER BETWEEN THE TRANSVERSE RIVER VALLEYS OR THE OCEAN AND THE MOUNTAINS. IN PERU, BETWEEN 8°S AND 13°S, THE ANDES EXTEND TO THE LITTORAL OF THE PACIFIC OCEAN EXHIBITING RUGGED, MOUNTAINOUS TERRAIN. THE COASTAL RANGE AND THE DESERT PLATEAU OR PAMPAS IN THE AREA APPROACHING THE BORDER WITH CHILE EXHIBIT NUMEROUS CREVASSES AND BARE, DEEPLY INCISED SLOPES WHICH ARE DIFFICULT TO TRAVERSE. THE PORTIONS OF THE DESERT EXPOSED

TO THE WESTERLY WINDS ARE CHARACTERIZED BY HUGE SAND DRIFTS AND CREEPING DUNES WHEREAS THOSE AREAS LYING BETWEEN THE ANDES AND COASTAL RANGE EXHIBIT SAND MIXED WITH HARD-PAN SURFACES, GRAVEL, EXPOSED ROCK, OCCASIONAL SALT FLATS, AND DEEP QUEBRADAS OR STREAM CUT RAVINES.

2. CLIMATE. ALTHOUGH ONE OF THE DRIEST AREAS IN THE WORLD WHERE RAIN OCCURS IRREGULARLY WITH INTERVALS OF MANY YEARS, THE TERRIBLE HEAT OF MOST DESERT REGIONS DOES NOT OCCUR. TEMPERATURES RARELY EXCEED 90°F. THROUGHOUT THE ENTIRE LENGTH OF THE DESERT THE TEMPERATURES AVERAGE 64°F TO 74°F. WINDS ARE CONSTANTLY WESTERLY AND OCCASIONALLY DEVELOP INTO ROARING GALES FILLING THE AIR WITH DUST AND SAND. A PRIMARY SOURCE OF MOISTURE ALONG THE COASTAL RANGE IS DERIVED FROM THE PERSISTENT FOG AND MISTS WHICH FORM OVER THEM.

3. VEGETATION. SUCH VEGETATION THAT EXHIBITS A DEGREE OF CONSTANCY IS FOUND EITHER IN THE LOMAS OR PASTURE LANDS PRODUCED WITH HELP FROM THE FOG AND MISTS ALONG THE COASTAL RANGE, OR IN THE IRRIGATED RIVER VALLEYS. IN THE DESERTS THEMSELVES THE VEGETATION IS PRACTICALLY NON-EXISTENT.

4. FAUNA. OTHER THAN THE DOMESTIC ANIMALS GRAZING ON THE SLOPES OF THE MOUNTAIN RANGES, THE ANIMALS FOUND IN ASSOCIATION WITH THE FEW MEAGER STREAMS NEAR THE ANDES, IN THE OASES OF THE ATACAMA, OR

SUBSISTING PERIPHALLY TO THE IRRIGATIONS PROCESSES OF THE RIVER VALLEYS, FAUNA, LIKE VEGETATION, IS PRACTICALLY NON-EXISTING.

5. FOOD AND WATER. THESE ITEMS ARE SO SCARCE AS TO MAKE RANDOM SEARCHING FOR THEM ALMOST PROHIBITIVE IN COMPARISON TO THE ALTERNATIVE OF HEADING DIRECTLY TOWARD A MORE DISTANT BUT PROBABLE SOURCE OF FOOD AND WATER. THESE SOURCES WOULD BE FOUND IN THE RIVER VALLEYS, THE OASES, AND TOWNS OF THE ATACAMA DESERT OR ALONG THE SHORE.

6. TRAVEL. IF CONDITIONS WARRANT TRAVEL RATHER THAN REMAINING IN THE AREA OF DESCENT, DAYTIME TRAVEL IS RECOMMENDED. MOST SERIOUS OBSTACLES ARE THE MOUNTAINOUS REGIONS CITED ABOVE (1. TOPOGRAPHY) AND THE DEEP FISSURES AND CREVASSES. AIDS TO NAVIGATION CONSIST OF THE ANDEAN AND COASTAL RANGES, THE FOG BANDS OVER THE CREST OF THE COASTAL RANGE, AND THE WESTERLY WINDS.

7. INHABITANTS. POPULATIONS ARE CONCENTRATED IN THE RIVER VALLEYS, IN THE PRINCIPAL TOWNS AND CITIES OF THE COAST, IN THE SMALL VILLAGES SITUATED ALONG THE SLOPES OF THE ANDES, OR IN THE TOWNS IN THE ATACAMA DESERT ASSOCIATED WITH THE MINING INDUSTRY. THE MAJORITY OF THE POPULATION ARE INDIAN OR MIXED INDIAN AND SPANISH <u>MESTIZO</u>. THEY CONSTITUTE WHAT IS GENERALLY CALLED A PEASANT SOCIETY. THEY ARE COURTEOUS AND HELPFUL EXCEPT IN SOME REMOTE VILLAGES

WHERE THERE IS SOME MISTRUST AND SUSPICION OF STRANGERS IN GENERAL.

CHAPTER XV

CONCLUSIONS

IN REVIEWING THIS STUDY FOR ITS ANTHROPOLOGICAL SIGNIFICANCE CERTAIN FACTORS SHOULD BE CONSIDERED. THE FIRST IS THAT THE STUDY IS CONSIDERED APPLIED ANTHROPOLOGY. THIS FACTOR GOVERNED THE TYPE OF DATA COLLECTED AS WELL AS THE MANNER IN WHICH THEY ARE PRESENTED. IN OTHER WORDS, THE NEEDS OF THE USERS OF THE DATA WERE SPECIFIED. WITHIN THIS RELATIONSHIP IT REPRESENTS ONE EXAMPLE OF THE MANY KINDS OF SERVICES THAT ANTHROPOLOGISTS ARE BEING CALLED UPON TO PERFORM FOR GOVERNMENTAL, PUBLIC, AND PRIVATE OFFICES. IT IS ALSO INDICATIVE OF THE VARIED AND WIDENING RANGE OF KNOWLEDGE HE IS BEING REQUIRED TO DEVELOP IN CONJUNCTION WITH HIS OWN SPECIAL FIELD. HOWEVER, IT IS BECAUSE OF THE SPECIAL KNOWLEDGE AND METHODS EMPLOYED BY ANTHROPOLOGISTS THAT SUCH AGENCIES AS THE ARTIC, DESERT, TROPIC INFORMATION CENTER OF THE UNITED STATES AIR FORCE HAVE FOUND THEM SINGULARLY QUALIFIED IN CARRYING OUT CERTAIN RESEARCH PROJECTS.

MUCH OF THE BASIC RESEARCH ON BEHAVIOR, LEADERSHIP, TENSIONS, ETC. AFFECTING INDIVIDUAL AND GROUP SURVIVAL HAS BEEN CARRIED OUT BY ANTHROPOLOGISTS FOR THE ARMED FORCES OVER A CONSIDERABLE NUMBER OF YEARS. TECHNIQUES DEVELOPING OUT OF SUCH RESEARCH ARE INCORPORATED INTO ARMED FORCES TRAINING PROGRAMS. INFORMATION AS IT PERTAINS TO SPECIFIC GEOGRAPHIC AREAS IS GENERALLY PRESENTED WITHIN THE FRAMEWORK OF THESE BASIC TECHNIQUES.

ONE OF THE HALLMARKS OF ANTHROPOLOGY IS THAT OF SYNTHESIZING DATA FROM RELATED FIELDS AS THEY APPLY TO MAN. ANTHROPOLOGICAL SOURCES OF DATA WERE USED EXTENSIVELY AS THEY APPLIED TO SUBSISTENCE ACTIVITIES AND SOCIAL CONTACT SITUATIONS. THESE DATA CAN BE GENERALLY RECOGNIZED WITHIN THE CONTEXT OF THE STUDY. MUCH OF THE DATA INCORPORATED IN THIS STUDY ARE DERIVED FROM SOURCES GENERALLY ASSOCIATED WITH THE NATURAL SCIENCES. HOWEVER, THESE DATA, EITHER EXPLICITLY OR IMPLICITLY, ANTICIPATE THE PHYSICAL AND PSYCHOLOGICAL BEHAVIORAL NEEDS OF AN INDIVIDUAL OR GROUP OF INDIVIDUALS IN SPECIFIC SITUATIONS.

FOR SUCH INDIVIDUALS KNOWLEDGE OF THE ENVIRONMENT PRESENTS THE MOST IMPORTANT PREREQUISITE FOR SURVIVAL. THIS IS TO SOME EXTENT AT VARIANCE WITH MOST ANTHROPOLOGICAL FIELD STUDIES WHERE THE PHYSICAL ENVIRONMENT RECEIVES ONLY MINIMAL TREATMENT IN DEFERENCE TO THE IMPORTANCE OF THE SOCIAL-STRUCTURAL ADAPTATIONS. RECENT TRENDS IN ANTHROPOLOGICAL LITERATURE REFLECT THE INCREASING AWARENESS OF THE BIOLOGICAL ASPECTS RELATING TO MAN'S CULTURAL DEVELOPMENT. THIS AWARENESS IS EVIDENT IN THE ANTHROPOLOGICAL LITERATURE TREATING WITH THE ECOLOGY OF MAN. THE ARCHEOLOGISTS HAVE PERHAPS SHOWN THE GREATEST PROGRESS IN THE USE OF ECOLOGICAL METHODOLOGY. HOWEVER, THE QUANTITATIVE AND QUALITATIVE SYNTHESIS INHERENT IN ECOLOGICAL METHODOLOGY IS PROVING TO BE OF INCREASING VALUE IN BRINGING TOGETHER THE CULTURAL AND BIOLOGICAL NATURE OF MAN.

ANOTHER FACTOR OF PARTICULAR RELEVANCE FOR THE STUDENT IS THE EXTENT TO WHICH SUCH AN UNDERTAKING AS THIS AFFORDS THE STUDENT THE OPPORTUNITY TO DEVELOP RESEARCH TECHNIQUES, TO GAIN FIELD EXPERIENCE, AND TO DO ANTHROPOLOGY. THE COMPETITION FOR FUNDS TO CARRY ON RESEARCH GREATLY RESTRICTS THE KINDS OF RESEARCH AS WELL AS THE TIME

THAT CAN BE EXPENDED AND DISTANCES COVERED TO AS WELL AS IN GEOGRAPHIC REGIONS SINGULARLY APPROPRIATE TO ANTHROPOLOGICAL STUDY. IT IS BECAUSE ANTHROPOLOGY DOES SEEK FOR KNOWLEDGE IN DISTANT AND REMOTE REGIONS THAT RESEARCH IS EXPENSIVE AND AT THE SAME TIME OF IMMEDIATE VALUE ONLY TO CERTAIN KINDS OF USERS. THIS IS ONE OF THOSE HAPPY OCCASIONS WHEN THE PRACTICAL NEEDS OF A USING AGENCY AND THE FINANCIAL NEEDS OF A GRADUATE STUDENT FOR SUPPORT OF FIELD RESEARCH WERE RECIPROCAL.

IT IS THE OPINION OF THE WRITER THAT THERE ARE MANY SUCH OPPORTUNITIES WHEREBY THE RESEARCH METHODS, GEOGRAPHIC AREAS OF INTEREST, AND TOPICAL AREAS OF INTEREST CONSIDERED TO BE SPECIFICALLY ANTHROPOLOGICAL AND ACTION-ORIENTED RESEARCH SUCH AS WOULD BE REQUIRED BY PUBLIC AND PRIVATE AGENCIES CAN BE MUTUALLY SUPPORTED. IT IS SUGGESTED THAT UNIVERSITIES MIGHT MAKE A SPECIAL EFFORT TO APPROACH THE FIELD OF PRIVATE AND PUBLIC ENTERPRISE FOR THE PURPOSE OF PROMOTING THIS TYPE OF RELATIONSHIP BETWEEN POTENTIAL CLIENTS AND GRADUATE DEPARTMENTS. THIS TYPE OF FINANCING WOULD BE IN ADDITION TO THOSE FUNDS PROVIDED BY NATIONALLY ESTABLISHED INSTITUTIONS SUCH AS THE NATIONAL SCIENCE FOUNDATION AND THE FORD FOUNDATION.

APPENDIX A

CROPS AND USEFUL PLANTS

THE FOLLOWING REPRESENTATIVE LIST OF DOMESTICATED OR SEMI-DOMESTICATED PLANTS IS NOT EXHAUSTIVE. LOCAL VARIATIONS OCCUR IN THE NAMES AND ALL WILL NOT BE FOUND THROUGHOUT THE COAST.

AJI (CHILI PEPPERS). SEVERAL VARIETIES, LARGE, SMALL, GREEN, BILLOW, AND RED; USUALLY PLANTED IN HUERTA.

ALGARROBA. WOOD OF THE TREE USED FOR SUPPORTS AND BEAMS IN HOUSES; SWEETISH, LARGE BEANLIKE FRUIT EATEN OR SUCKED. SEEDS ARE CRUSHED AND GROUND INTO MEAL USED FOR BREAD, GRUEL, AND OTHER MEAL TYPE FOODS. THE ALGARROBA TREE GROWS NATURALLY IN MANY SEMI-ARID REGIONS ESPECIALLY IN CLOSE PROXIMITY TO THE ANDES.

ALVAJA DE COMIDA (ALBAHACA SWEET BASIL). PLANT GROWN IN FENCED ENCLOSURES IN HUERTAS AND USED FOR MAKING SOUP AND FOR FLAVORING OTHER DISHES.

ALVERJAS (VETCHES). PLANTED EITHER IN FIELDS OR GARDENS; PLANTS LOOK LIKE THOSE OF COMMON SWEETPEA; PRODUCES SMALL, PODDED, PEALIKE FRUIT; SEVERAL VARIETIES.

AZAFRAN. USUALLY PLANTED IN FIELD BORDERS AND GARDEN ORCHARDS; PRODUCES A DARK ORANGE-RED FLOWER, WHICH IS DRIED AND TOASTED OVER THE FIRE, THEN RUBBED TO A POWDER BETWEEN THE HANDS. THE POWDER IS USED TO COLOR FOODS.

CACTUS. VARIOUS TYPES ARE FOUND RARELY IN THE COUNTRYSIDE, AND MOSTLY NEAR THE BORDERS OF IRRIGATION. CULTIVATION IS INTENSE ENOUGH TO KEEP MOST OF THE PLANTS ROOTED OUT OF THE FARMING AREA. THE MOST USEFUL IS PENCA WHICH IS A FLESHY, LOW CACTUS, PRODUCING A FRUIT CALLED TUNA, WHICH IS GATHERED AND EATEN. CACTUS PLANTS ARE NOT REGULARLY PLANTED AS FENCES OR ON TOP OF TAPIA FENCES AS IN CERTAIN OTHER LATIN AMERICAN COUNTRIES, SUCH AS PARTS OF MEXICO.

CAIGUA OF VARIOUS VARIETIES. A LOW, CREEPING PLANT PRODUCING A SOFT SQUASHLIKE FRUIT, WHICH IS EATEN AS A VEGETABLE AND ALSO STUFFED WITH MEAT TO MAKE ALBONDIGAS. USUALLY PLANTED IN FIELD BORDERS NEAR IRRIGATION DITCHES.

CAMOTES (SWEETPOTATOES). PLANTED SYSTEMATICALLY IN FIELDS. SEVERAL VARIETIES. THE FOLLOWING TYPES OF CAMOTES ARE GROWN: SANGRIENTO (BLOODY), COLORADO (RED), BOCA DE CHIZCO, ESPELINA, PIERNA DE LA VIUDA ("WIDOW'S LEG," LARGE, LONG, WHITE, AND BIG IN DIAMETER), NINO ("CHILD," LARGE AND WHITE AND ALSO PURPLE).

CAPULI. PLANTED IN FIELDS AND ELSEWHERE; LOW PLANT, FRUIT LOOKS LIKE NORTH AMERICAN "GROUNDCHERRY."

CEBOLLA (ONION). PLANTED IN GARDENS AND FIELDS; SOME RAISED FOR THE MARKET.

CULANTRO. PLANTED, USED AS FOOD SEASONING.

GARBANZO (CHICKPEA). PLANTED, USUALLY IN FIELD BORDERS.

LECHUGA (LETTUCE). PLANTED IN GARDENS ONLY.

INCHIS (PEANUTS). PLANTED IN FIELDS, BUT ON A SMALL SCALE EXCEPT WHERE GROWN COMMERCIALLY.

CHUNU (WHITE POTATOES). DESCRIBED AT LENGTH UNDER FOOD AND DRINK.

PLANTANO (BANANA). THE FOLLOWING TYPES ARE RECOGNIZED: RABANETE (LITERALLY "RADISHLIKE"), DE LA ISLA (ISLAND BANANA), ESPECIALLY FAVORED IN FRIED FORM, MANSANO ("APPLE BANANA"), SWEET AND EATEN RAW, NARANJO ("ORANGE"), ORANGE COLORED AND WITH A SLIGHTLY TART TASTE, DE SEDA ("SILKY"), GUINEO ("GUINEA BANANA"), LARGE YELLOW.

RABANA (RADISH). PLANTED IN GARDENS ONLY.

REPOLLO (CABBAGE). PLANTED IN FIELDS AND GARDENS.

SANDIA (WATERMELON). SEVERAL VARIETIES PLANTED, ALL STRIPED.

TOMATE. GARDEN TOMATOES; THERE IS ALSO SAID TO BE A WILD TOMATO WHICH GROWS IN THE FIELD BORDERS, PRODUCING A SMALL, TASTY FRUIT.

TUMBO. A CLIMBING VINE, PRODUCING AN EDIBLE FRUIT ABOUT THE SIZE OF A MUSKMELON, PLANTED AROUND HOUSES AS COVER FOR OUTDOOR ARBORS. IT IS SAID THAT EACH PLANT HAS A GUARDIAN SERPENT WHICH ATTACKS STRANGERS ATTEMPTING TO STEAL THE FRUIT OR HARM THE PLANT.

ZANAHORIA (CARROT). PLANTED IN GARDENS.

FRUIT TREES AND BUSHES PLANTED EITHER IN HUERTAS OR IN FIELD BORDERS INCLUDE THE FOLLOWING:

ALGODON PARDO (BROWN COTTON). A FEW PERSONS HAVE PLANTED BUSHES IN THEIR HUERTAS WHILE OTHER PLANTS ARE TO BE

FOUND GROWING UNTENDED BY ROADSIDES. THE BUSHES ASSUME A LARGE, SPREADING FORM, AS MUCH AS NINE FEET HIGH AND TWELVE FEET IN DIAMETER, AND ARE NOT TRIMMED. THEY ARE RARELY FOUND AS A DELIBERATELY CULTIVATED PLANT IN THE FIELDS.

BLANQUILLO. BUSH WITH EDIBLE FRUIT.

CALABAZO (GOURD TREE). THERE ARE APPARENTLY SEVERAL VARIETIES OF THESE BUSHES. THE PRODUCT VARIES IN SIZE AND SHAPE FROM A WIDE, SHALLOW, PLATE-LIKE CONTAINER UP TO FIFTEEN INCHES IN DIAMETER, TO SMALL CUPS THREE INCHES IN DIAMETER, AND LONG-NECKED CHICHA BOTTLES WITH GLOBULAR BODIES. THE BRANCHES OF THE PRODUCING BUSHES ARE SUPPORTED BY STICKS AND THE FRUITS THEMSELVES ARE BOUND WITH BANDAGES INTENDED TO CONTROL THEIR SHAPES. THE PLANTS, WHICH ARE ALL OF AN "OVER-SIZED" BUSH TYPE, ARE USUALLY PLANTED AND TENDED IN HUERTAS.

CEREZO (CHERRY).

CHIRIMOYO. FRUIT TREE IN HUERTAS.

CIRUELA. PLUM, PLANTED BOTH IN HUERTAS AND FIELD BORDERS.

HIGO (FIG). TREE VALUED FOR THE FRUIT AND ALSO FOR THE LARGE FIVE-POINTED LEAVES WHICH ARE USED TO FLAVOR THE DISH KNOWN AS SANCOCHADO.

LIMON AGRIO (COMMON LEMON).

LIMON REAL. LARGE, SWEETISH LEMON, SOME ARE ALMOST ORANGE IN COLOR.

LIMON SUTIL (LIME).

LUCUMO. FRUITS ARE PICKED, PLACED IN THE SUN FOR A DAY OR TWO AND WRAPPED IN RAGS OR STRAW TO RIPEN.

MAMEY. FRUIT TREE IN HUERTAS.

MANGO. FRUIT TREE IN HUERTAS.

MEMBRILLO. A WOODY BUSH BEARING A SMALL FRUIT.

NARANJO AGRIO. BITTER ORANGE, USUALLY GREEN WHEN "RIPE." SUCKED TO RELIEVE THIRST BUT MAINLY USED IN SEVICHES AND ESCAVICHES.

NARANGO DULCE. SWEET ORANGE.

PACAY (GUAVA).

PALTO (ALLIGATOR PEAR). USUALLY FOUND NEAR THE HOUSE.

PAPAYO (PAPAYA). HAS MALE AND FEMALE FORMS. MALE TREES HAVE YELLOW FLOWERS, AND THEIR FRUIT WHEN IT OCCURS IS SMALL. FEMALE TREES HAVE WHITE FLOWERS AND SMALLER LEAVES.

PEGOPEGO. A WEED SOMEWHAT LIKE A NETTLE WHICH GROWS ALONG THE SIDES OF THE IRRIGATION DITCHES AND IN FIELDS BORDERS. IT IS SAID THAT THE WILD DOVES (PALOMAS) BECOME ENTANGLED IN IT AND ARE EASILY CAUGHT.

UNA DE GAT (LITERALLY CAT'S CLAWS). GROWS ALONGSIDE OF TAPIEAS AND IRRIGATION DITCHES AND IS FREQUENTLY PLANTED TO SERVE AS A FENCE AND TO KEEP LIVESTOCK FROM WANDERING. IT IS COVERED WITH SPINES.

YERBA LUIZA. A GRASS, THE LEAF OF WHICH LOOKS MUCH LIKE THAT OF SORGHUM, BUT WHICH, WHEN RUBBED, IS AROMATIC. IT IS MUCH USED IN AN INFUSION TO MAKE A BEVERAGE, TAKEN EITHER HOT OR COLD. WHEN ONE SPEAKS OF "TEA" (TE), THE

REFERENCE IS PRACTICALLY ALWAYS TO THIS BEVERAGE OF YERBA LUIZA, RATHER THAN TO INDIA OR CHINA TEA.

YUYU. A LOW PLANT WHICH LOOKS SOMETHING LIKE RAGWEED, NOT USUALLY PLANTED, BUT LEAVES ARE COOKED AND EATEN AS GREENS.

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