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PREINDUSTRIAL FRONTIERS AND INTERACTION SPHERES:

ASPECTS OF THE HUMAN ECOLOGY OF ROMAN

FRONTIER REGIONS IN NORTHWEST EUROPE

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WILLIAM S. COOTER

Norman, Oklahoma

1976

PREINDUSTRIAL FRONTIERS AND INTERACTION SPHERES:
ASPECTS OF THE HUMAN ECOLOGY OF ROMAN
FRONTIER REGIONS IN NORTHWEST EUROPE

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TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	v
 Chapter	
I. INTRODUCTION	1
II. TEMPERATE FOREST ECOSYSTEMS	10
III. SERES, PLAGIOSERES, AND AGROSERES	29
IV. BUREAUCRATIZATION AND SOCIAL MALADAPTATION	60
V. INTERACTION SPHERES	73
VI. IRON AGE BASELINES AND THE ROMAN ADVENT	87
VII. THE PARAMETERS OF RESILIENCY	114
VIII. ROMAN PROVINCIALS, ROMAN FRONTIERSMEN, AND ROMAN BARBARIANS	160
IX. CONCLUSIONS	210
NOTES	215
BIBLIOGRAPHY	293

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CHAPTER I

INTRODUCTION

While the term frontier may arouse little controversy when used descriptively in narrowly defined contexts, the use of the term in any sort of general sense raises a host of problems. The differences between a Roman frontier and an American Western frontier are, at face value, so great that the search for common dimensions may seem misguided. This, it is hoped, will not prove to be the case, but a reasonable course would be to approach the matter of the universal features of frontiers only after careful consideration of the systemic characteristics of a number of frontiers or frontier types. In the following chapters, an attempt will be made to describe and analyze an example of one possible frontier type and to frame, on the basis of such an analysis, a set of tentative hypotheses which may prove useful in developing more generalized models for the analysis of other types of frontiers.

The following study will constantly deal with the problem of achieving a balance between description and generalizations at various levels of abstraction, a problem well exemplified, for

instance, in the case of the American West and the so-called Turner Thesis. While Frederick Jackson Turner may have initially conceived of frontiers in broader comparative terms, his later formulations relegated the concept to the level of historical particularism, the frontier forming part of America's unique legacy.¹ This extreme particularism on the part of the putative father of frontier studies is a major reason why the development of more general frameworks of analysis for frontier phenomena is still in its infancy.²

In the chapters that follow, careful attention will be given to a number of Roman frontier regions in Northwest Europe. From a study of these specific contexts, a set of hypotheses will be developed which further testing by the present author or by other scholars may show to have more general applicability.³ It is felt that some of the hypotheses developed from a study of Roman frontiers may be applicable to nearly all types of frontier phenomena. Other hypotheses may prove more useful in exploring more limited types of frontiers showing especially strong similarities to those of the Roman Empire. Both as orientation to the general features of Roman frontiers and as a suggestion as to how further testing of the hypotheses advanced below might proceed, a useful exercise would be to develop a tentative typology of frontier types. Such a typology, encompassing three broad categories of frontiers, will be briefly outlined below, Roman frontiers forming an example within one of these types.

In ordinary usage, one important use of the term frontier relates to the margins or hinterlands of a more highly developed region. An obvious way of subdividing frontiers is by reference to the nature of the economic and technological sophistication of the more highly developed core regions. The industrial revolution is one conspicuous line of demarcation, with important chronological, as well as taxonomical, implications.⁴ Heavily capitalized economies capable of sustained economic growth have had notable impact on the societies of highly developed core regions, and, in many areas outside of Europe that were able to share in the industrialization process, there often developed distinctive types of hinterlands that I shall refer to as industrial frontiers.

Industrial frontiers would include examples such as the American West, Canada, Australia, New Zealand, South Africa, and possibly certain contemporary colonization programs in places like Bolivia. Industrial frontiers might well be equated with the features that economists and economic historians have associated with so-called regions of recent settlement.⁵ Such frontiers commonly take shape following an influx of pioneer settlers into a region hertofore unpopulated or into a region that has been substantially cleared of its aboriginal population. From an early point in their evolutions, such frontiers have pervasive ties, especially economic ties, with highly developed industrialized societies from which the pioneer settlers are often drawn. Industrial frontiers are heavily dependent for their survival and well being on a variety of market,

credit, and trade ties with developed external areas, capital from these larger societies being attracted in turn to the frontiers as sources of profitable investments. Pioneer groups may be motivated by factors of probable economic advancement, although other factors, social, political, or religious, are also of significance.

Highly developed nation states may view frontier development as a way to bolster regional economies, expand sources of food supplies for urban centers, boost supplies of raw materials for budding industries, or facilitate other types of socially and politically desired changes. Population groups in areas of recent settlement may also view as desirable their eventual integration with national level institutions. Such integration assures the more ready provision of valuable social overhead costs involving transportational, communicational, educational, and financial services. Through such external agencies, credit and working capital can be obtained, and goods and services can be acquired whose production would be awkward or impossible given the technological and organizational potentials of local artisans, firms, and industries. Much of the burden of providing roads, canals, railroads, or schools can be shifted onto or shared with outside public or private agencies. Local production activities within industrial frontiers may then be specialized and adapted within the framework of larger national economies. Pioneer production units may have to make do with a degree of homespun self-sufficiency unnecessary in more highly developed or urbanized regions, but many local cash crops and products, staples, as they

are usually styled in the literature, will be complementary to the needs of non-local market outlets. Effective use of these extra-regional ties allows for progressive economic diversification beyond a narrow staple base, with the possibility of eventual integration, including political integration, with the larger societies.

Economic diversification and political integration can also be thwarted or arrested, and the fairly equitable outcomes of industrial frontier development may be preceded by a lengthy period of less than equitable contacts with the core regions of industrialized societies. Where pronounced obstacles to progressive integration exist, a different type of frontier situation suggests itself. Where economic flows do not allow reinvestment and diversification and where external linkages do not contribute to, or even debilitate, local social infrastructures, one is squarely within the domain of colonial phenomena.⁶ Colonialism has been a ubiquitous, perhaps an integral feature of industrial times, and colonial phenomena may well predate the emergence of self-sustaining capitalistic economies.⁷ Capitalism of one form or another can be discerned in early modern and medieval Europe as well as in other preindustrial contexts, and where transportation systems, usually involving seaborne commerce, were sufficiently sophisticated, even preindustrial capitalism could foster colonial developments.⁸

Quite possibly a category of colonial frontiers could be elaborated, which would bridge the demarcation between preindustrial and industrial societies. Examples could be drawn from contexts as

varied as the ante-bellum South, colonial West Africa, medieval Venetian enclaves on Crete or Cyprus, or Roman Sicily. The distinguishing characteristic of colonial frontiers would be the importance of economic flows of an extractive sort mediated by mercantile capitalists and centered on a highly restricted range of staples or raw materials leaving little scope for progressive economic diversification and development in the colonial hinterlands.

To the industrial and colonial frontier types suggested above, a preindustrial type can be added, including examples such as the Inner Asian frontiers of Imperial China,⁹ or the frontiers of the Roman Empire. Such frontiers have formed the hinterlands of state systems or empires themselves characterized by poorly integrated inter-regional economies and almost no tendencies toward sustained economic growth. Where institutional obstructions or poor communication or transportation facilities precluded the exploitation or utilization of hinterlands through the capitalistic mechanisms characteristic of colonial or industrial frontiers, not only the state systems but their frontiers can reasonably be labeled preindustrial. In such contexts, while economic variables cannot be ignored, political, military, demographic, and ecological factors often outweigh the importance of staple flows. For instance, it will be argued that one of the primary uses of Roman frontiers was as military dumping grounds to remove the burden of standing armies from the core provinces of the Mediterranean. This factor not only outweighed most economic considerations, it largely precluded

the additional weight of staple flows.

The non-economic strains put on preindustrial frontiers such as those of Rome in Northwest Europe are analogous to the exploitative situations met with in colonial frontiers, but the impact of these strains on preindustrial frontiers must frequently be gauged otherwise than by the familiar indices of biased capital flows or poor sectorial diversification and articulation. The economic arrangements made possible in industrial or colonial contexts often allow staple production to operate in apparent defiance of demographic pressures, social organizational factors, or ecological tolerances. The non-economic arrangements of preindustrial frontiers were often sufficient to encourage similar acts of defiance, but preindustrial societies were infinitely more vulnerable to acts of hybris against natural or social constraints. Attention to this larger range of socio-ecological variables will form a major focus in the following treatment of Rome's frontiers in Northwest Europe.

The preceding discussion has outlined three tentative frontier categories, industrial and colonial frontiers being defined by predominantly economic linkages and preindustrial frontiers by the greater prominence of other types of linkages not generally included in economic treatments. Much useful research could be devoted to medium range theories and hypotheses derived from studies of these or other suitably defined frontier types, and much of the following discussion of Roman frontier regions aims at nothing more than such middle range generalizations. On the other

hand, certain crucial facets of the Roman frontier experience suggest generalizations applicable to a broader comparative range of frontier problems.

In the following chapters, considerable attention will be given to medium range problems associated with the subsistence bases and ecological underpinnings of preindustrial societies, whether these societies be as centralized as states or as decentralized as tribes. Agrarian history has acquired a considerable popularity in this century, but more success has come from studies of the economics of farming than from studies of the basic agronomical principles underlying any preindustrial agrarian economy. This shortcoming has largely stemmed from an inattention on the part of most historians to the most rudimentary principles of ecology. Ecological constraints played a crucial role in the organizational dynamics of preindustrial states and even more so in the case of preindustrial tribes.¹⁰ Attention to the ecology of the regions in which Roman frontiers were set will form the basis for an analysis of the types of societies that predated the emergence of the Roman frontier system in Northwest Europe and for an appraisal of many of the impacts, social and ecological, of the transformations attending the Roman advent.

Many of the problems associated with the development of Roman frontiers direct attention to other factors that, while mediated by ecological constraints, are of a more abstract organizational nature. Frontiers, preindustrial or otherwise, often involve linkages between

fairly complex societies and pre-existing simpler societies, where complexity usually becomes a matter of the presence of bureaucratic organization, and simplicity its absence. In the process of frontier incorporation, simpler societies are placed at the mercy of the constraints and potentialities of bureaucratic systems. Bureaucratic organization often produces severe problems even for the core regions of states, nations, or empires. These problems are often magnified in frontier hinterlands. In the following chapters, various aspects of the linkages between a militarily and politically bureaucratized Rome and unbureaucratized tribal hierarchies or interaction spheres will be considered. Many of the concepts developed below will probably be limited in their scope to an elucidation of the features of pre-industrial societies and preindustrial frontiers. But through an exploration of some fundamental characteristics of bureaucratic organizations, it is hoped that explanatory hypotheses will emerge applicable not only to Roman frontiers in Northwest Europe but to the general features of other frontier phenomena.

CHAPTER II

TEMPERATE FOREST ECOSYSTEMS

Until modern times, the vast majority of the populations of all human societies have been caught up in what economists call primary production, i.e., pursuits largely concerned with agriculture. Agriculture in its turn rested on a variety of manipulations of natural ecosystems, and, in a very real sense, agricultural systems can themselves be viewed as types of simplified ecosystems centering around a limited range of humanly favored plant and animal species. Before modern times, ecosystems and agricultural systems supplied all but a small fraction of the energy sources that fed human populations and provided them with fuel, shelter, clothing, and the materials of their technologies. Modern man has vastly enlarged the energy sources at his disposal by tapping accumulated reserves of oil, coal, and nuclear fuels.¹ Preindustrial societies were seldom able to use even fossil fuel sources to any appreciable degree so that, except for wind and falling water, they had only the solar energy trapped and converted by green plants at their disposal.²

Fossil fuels and fissionable materials are, for all practical purposes, nonrenewable. The converted energy sources of ecosystems are annually renewed by the photosynthetic abilities of plants, but human exploitation of ecosystemic reserves can lead to dwindling rates of ecosystemic productivity.³ One of the major inroads made by man

on the productivity of natural plant communities is through agricultural activities. Ironically, in many cases the more intensive man's husbandry, the greater the inroads made on the total amount of ecosystemic capital as highly productive natural ecosystems are cleared and replaced by cultigens whose apparently high yields of desired grains, tubers, or fruits may mask significantly lower total productivities. Man's preindustrial history has been played out against an undercurrent of intentional and unintentional attempts to balance his appetites for energy and materials against the capacities of natural ecosystems and agricultural systems to supply them. With increases in social complexity, these efforts have commonly followed the course of expanding agricultural systems to the detriment of natural ecosystems. This strategy has usually been self-defeating over the long run and has played a significant, although not always easily discernable role, in the interplay of intervening political, military, economic, and social processes.

An appreciation of the ecological dimension underlying the history of Roman frontier regions in Northwest Europe will be a central feature of the following study, and to understand the dynamics of such linked socio-ecological systems, a convenient starting point is to grasp certain cardinal features of the natural ecosystems these hybrids replaced. In the context of Roman frontier regions in Northwest Europe, this means knowing something about the characteristics of temperate forest ecosystems.

Temperate forest ecosystems are found primarily in regions possessing continental or marine west coast climates.⁴ In Europe, temperate forest ecosystems are usually associated with what pedologists call brown earth soils. The climatic regimes in question are characterized by mild summers and winters with no more than three months of sub-freezing temperatures. Rainfall is evenly distributed, perhaps with small autumnal maximums, but with no pronounced drought seasons.⁵ In the United States, such climates are found in a belt south of the Great Lakes and in the Pacific Northwest. That climate in itself is not the absolute determinant of the brown earth soil type is readily apparent from a comparison of these two similar American climatic regimes. The woodlands south of the Great Lakes boast natural vegetation dominated by trees such as oak, beech, maple, and hickory and have soils similar to the brown earths of Europe while the Pacific Northwest has mainly non-deciduous species such as pines, firs, or spruce as well as soil types markedly different from brown earths.⁶

These differences in vegetation types and their associated soils are a product of glacial times.⁷ The Eastern United States is relatively flat and offered few impediments to the migration of trees to the north and south as ice sheets retreated or advanced. The Western United States straddles the Rockies, and this obstacle eliminated species that either were not fast growing or were very inefficient in the production or dispersal of seeds. This eliminated most of the deciduous species, and the decimation was sealed since

the arid Great Plains effectively prevented the migration of tree species from the eastern woodlands. The post-glacial recolonization of the Pacific Northwest was accomplished without deciduous species, and as a result, the soils formed were significantly different from those of the eastern hardwood forests.⁸ This non-correlation of soil type with climate can be circumvented by terminological slight of hand, say, by calling the brown earths an azonal type.⁹ The crux of the problem is that while climatic regimes can be determined by noting temperature and rainfall patterns alone, soils are products of a more complex series of interactions involving climate, the types of biotic communities present, geomorphology, parent materials, and time.¹⁰ All these factors can effect each other. Climatic variables are more nearly autonomous, e.g., all the other variables had to bow before the glaciers of the ice ages, but even certain types of gross climatic features may be tempered by other variables and, hence, may produce important differences in resultant soil types. For instance, deep valleys commonly have one side that receives more sunlight than the other, and this can have a great impact on the plant cover and the soil types present. Geomorphology can influence the rates of wind and water erosion, and the subsequent redeposition of this transported material can influence soil types. Where erosion is not impeded, soil types may become determined by their positions in a sloping landscape, forming a catena with deeper alluvial soils on valley bottoms and thin, immature soils on steep slopes.¹¹ Similar transfer processes acting on older depositional

patterns dating back, say, to glacial times may have a similar effect, producing what is called a land system.¹² Complicated processes of aggradation, degradation, and hydrology in a river delta or flood plain may produce a palimpsest of varying soil types best classified as a soil complex.¹³

The types of plant and animal communities present may also influence soil forming factors. A closed canopy forest or a good turf of perennial grasses can reduce wind or rain erosion to imperceptible levels. A forest in particular can create its own micro-environments by damping out seasonal extremes of heat beneath its canopy and leveling out minor fluctuations in rainfall and watershed runoff by holding water back in trunks, roots, and surface litter. Where plant communities are able to form continuous, closed mantles, an appreciable number of climatic variables can be screened out or controlled. Under such conditions, the interactions between plants and soil may be so pervasive that it is worthwhile to redefine the frame of reference by lumping certain variables and components into appreciably distinct types of entities called ecosystems.¹⁴

Ecosystems have both living and non-living components.¹⁵ Obviously, ecosystems involve various plants and animals and relations among these defining food chains and trophic levels. These biotic communities are also dependent on relationships with non-living components. Animals and plants respire, necessitating exchanges of gases with the atmosphere. Animals are ultimately dependent for their sustenance on the complex, high energy molecules

synthesized by green plants. Photosynthesis involves catalytic pigments, carbon dioxide, and water. Photosynthesis also involves various simpler inorganic substances, substances which are of even greater importance for the varied metabolic processes of plants and animals. Some of these materials can be taken from rainfall or from the air, but most of them are ultimately derived from the soil.¹⁶ Geochemical cycles in the soil are a vital aspect of ecosystem dynamics since biotic communities can exercise more control over variables influencing geochemical cycles than over climatic variables or factors affecting hydrology or solar radiation. A plant community must adapt to its location vis-a-vis the equator or the poles. A plant community can also do little to control the hydrology of a desert, and a plant community situated on a bare cliff face must adapt to the drought prone geomorphology. Where the impact of climatic or geomorphological variables is extreme, plant communities may be unable to exercise much control over non-living components, and, in a very real sense, it is then unrealistic to speak of ecosystems and possibly even of communities of organisms. For instance, in the American Southwest, ecologists themselves speak of biotic communities rather than of ecosystems,¹⁷ and in the most arid regions of the Southwest, even the relationships between plants and animals pale before the ability of each individual organism to fend for itself.¹⁸ Under such adverse conditions, organisms will adapt not to relations with other organisms but to local edaphic variables involving rainfall patterns, runoff rates, and the occurrence of frosts; variables which are all

externally controlled by climate, geology, and physical weathering.

Where external controls are not so extreme, it is possible for biotic communities to exercise considerable control over non-living components, the degree of such control generally increasing over time. Ecosystems usually change from immature, pioneer types to systems with higher degrees of diversity, complexity, and maturity until a condition known as the climatic climax is attained.¹⁹ Transformations toward climax conditions are known as seres²⁰ and represent progressively more efficient adaptations on the part of biotic communities. Unlike species evolution, seral progression is not necessarily based on genetic alterations but can build on changes in the relations among existing populations of organisms and aspects of the non-living environment.²¹ Over time, successful community adaptations within a given ecosystem make possible the inclusion of additional species, usually drawn from adjacent areas. Ultimately, an equilibrium state will be attained. Such mature ecosystems are then adapted as wholes to their environments. Component species of mature ecosystems, e.g., trees in a forest ecosystem, can exercise a degree of control over environmental factors themselves, but this control in turn depends on the presence of other ecosystem components. A temperate forest ecosystem could not exist without its trees. It could also not exist for long without its soils or decomposer organisms such as earthworms, bacteria, and fungi. By creating micro-environments beneath its canopy suitable for other organisms, a forest community dramatically enhances the ability of the total ecosystem to control

environmental factors. The range of relationships between organisms and between organisms and non-living components is enormously increased and, in the process, both the number of species and the populations within individual species are also increased. The total amount of living material or biomass in such mature, diverse ecosystems is increased and as a result, so is the ecosystem's productivity, i.e., the rate at which new living material is produced.

While the evolution of a mature ecosystem may involve a hundred years or more, the pace of ecosystem evolution easily outstrips that of species evolution. In fact, since the emergence of biotic communities, species evolution has often been a matter of coevolution within the hedge of the control mechanisms provided by ecosystems.²² A completely untempered natural environment, as is met with in the deserts of the American Southwest, puts appreciable strains on the random ingenuity of species evolution. A more equitable natural environment allows ecosystems to create an augmented set of habitats and niches, whose relative stability encourages the survival of finely tuned genetic adaptations, whose success in turn creates niche space for further coevolution.

The control capacity of mature ecosystems is not unlimited however, and ecosystems often have strategic weaknesses. With temperate forest ecosystems in Northwest Europe, the weakness centers on the continued availability of inorganic nutrients for the dominant tree species in the face of leaching processes that, if unchecked, would quickly lower the levels of such nutrients below the points needed

for the growth of hardwood species such as oak or beech. Brown earth soils are a convenient index as to which way the balance is tipping. The presence of brown earths indicates that ecosystem control is adequate. Their absence or degradation is a sign of control failure.

Brown earths are subjected to a process known as podzolization which, given free rein, leads to the formation soils called podzols.²³ Podzols are climatically dictated where winters are long and cold, where summers are brief, with highs of only fifteen to nineteen degrees Centigrade, and where evapotranspiration leaves an appreciable water surplus.²⁴ Under such cool, humid conditions, nutrients are carried from the upper layers of the soil and deposited in lower subsoil layers, producing pronounced soil horizons. In mature podzols, the steady downward percolation of water has carried away many free nutrients. Iron and aluminum ions are mobilized and transported, and deficiencies of these substances cause most of the available phosphorus to precipitate in insoluble forms not readily utilizable by plants.²⁵ Even clay aggregates may be broken up or deflocculated to be deposited in lower soil horizons along with chemically altered forms of the iron, aluminum, and phosphorus. In many cases, a water-impervious iron crust or pan may form along the juncture between the upper or eluvial horizon from which materials have been removed and the lower or illuvial horizon where the transported materials have been redeposited.²⁶ A mature podzol shows a sandy, bleached, nutrient poor eluvial horizon and a noticeably darker illuvial horizon colored by the redeposited iron compounds and

clays. The intervening iron pan impedes drainage and root growth and encourages periodic waterlogging of the upper horizons.

With the loss of free ions such as calcium, the soil solution of a podzol becomes markedly acidic. The increased acidity may be lethal for many bacteria, insects, and other organisms such as earthworms. These decomposer organisms are important in the breakdown of plant litter, first into smaller humus molecules²⁷ and then into even simpler onorganic nutrients that can be reused by plants. Certain bacterial organisms are also important in fixing atmospheric nitrogen into the more complex ammonium and nitrate forms needed by higher plants.²⁸ At the levels of acidity associated with podzols, many of these decomposer organisms and nitrogen fixing bacteria are eliminated, and, hence, the rate at which litter is re-incorporated into the soil is reduced. As a result, a surface layer of raw humus may accumulate above a humus-deficient soil, itself deficient in many nutrients. In a well developed podzol, deciduous trees have little chance of surviving since softwoods such as pines can out-compete them on the nutrient starved soils.

Where the climatic dictates are not so tightly drawn, the type of dominant vegetation plays a critical role in determining the type of soil present. Pine trees would encourage the degradation of even the best brown earth soils. Pine trees are shallow rooted, tapping only a restricted depth of topsoil.²⁹ Adapted to higher latitudes, their cuticle-like needles are resistant to freezing but are also immune to decomposition by all but the most persistent fungi. Pine litter contains high concentrations of polyphenol compounds that in-

hibit microbial activity.³⁰ Pine needles are also high in lignin and cellulose, compounds that have very high carbon to nitrogen ratios. Unfortunately, soil decomposer organisms most readily attack nitrogen rich compounds such as protein. Pine litter is deficient in protein, and polyphenols have the additional disadvantage of altering protein chains so that they cannot be easily metabolized by decomposer organisms. The proteins from pine litter are almost literally tanned.³¹ The predominating carbon-rich compounds are only slowly decomposed, if at all, leading to a build up of surface litter which chokes out herbaceous vegetation. In addition to its deficiencies in available proteins, pine litter is deficient in nutrients such as phosphorus, potassium, and, most particularly, calcium.³² In addition to its role as a plant nutrient, calcium is a vital buffering agent in the soil, replacing hydrogen ions from chemically active clay and humus colloids.³³ As raw humus builds up on the surface, the concentrations of hydrogen ions increase throughout the soil. Low calcium levels mean that hydrogen ions are free to displace vital plant nutrients from soil colloids. These nutrients are dissolved in the soil solution and then leached away to lower soil horizons or transported by runoff into streams and rivers. In time, the leaching process will advance beyond the level of the pine tree roots, and no new nutrients will be taken up by the trees to be redeposited in the litter. Pine litter, then, becomes progressively more nutrient impoverished.

In contrast, deciduous trees such as oak can take an active role in creating what, next to chernozems, are the richest soils on earth. The root systems of oak trees are extensive and deep, some

roots being deep enough to penetrate to subsoil layers or even to parent material and bedrock.³⁴ Oaks and other deciduous species are more demanding than pines and softwoods in their nutrient requirements.³⁵ As a result, their litter has higher concentrations of these same nutrients. Their litter is also less resistant to decomposition than pine litter. The soil flora and fauna of temperate forests can easily metabolize a whole year's litter fall with no accumulation of raw humus.³⁶ While the leaves and bark of oak and beech trees contain appreciable amounts of polyphenols, these chemicals are more readily leached out than with pine litter. In any event, while earthworms may prefer the more succulent leaves of the shade tolerant elm or ash, they will eat oak and beech leaves.³⁷ Fallen oak leaves also have the ability, as yet poorly understood, to absorb large amounts of nitrogen from the air.³⁸ By the time oak litter is ingested by earthworms, it is still rich in nitrogen, making it attractive to soil micro-organisms as it passes through decomposer foodchains in the process of being reduced to humus. As a result, the litter in temperate forests is rapidly broken down into humic material, and much of this material is then broken down into inorganic nutrients which can then be recycled by the higher plants.

Efficient recycling is also characteristic of tropical rain forests. Tropical rainforests have developed the art of recycling to such a pitch that they can exist on soils almost devoid of nutrients, the nutrients being tied up almost entirely in their biomass.³⁹ Temperate forest ecosystems have lower and less rapid recycling rates.⁴⁰ An appreciable proportion of their litter is reduced to its inorganic

constituents and recycled into their biomass, but an appreciable surplus humic materials and some free nutrients remain.⁴¹ Much of the humic material is composed of carbon and nitrogen which, since they are derived from the atmosphere, represent no real drain of the soil's stock of nutrients derived from physical and chemical weathering. Other types of nutrients are rendered unavailable too however, becoming tied up in humic molecules so distorted by the action of polyphenols that they are relatively impervious to microbial enzymes.⁴²

Tropical rain forests could probably not afford such extravagance, but the lower leaching rates of temperate forest ecosystems allow this humus surplus to be turned to advantage. As a result of this humus surplus, temperate forest ecosystems are able to augment the nutrient statuses of their soils over time, building up a mobile nutrient reserve⁴³ that, in contrast to the barren soils of the tropics, may dwarf by an order of magnitude the amounts of nutrients bound up in the living biomass. The presence of this mobile nutrient reserve is the cardinal feature of the brown earths and is an index of an ecosystem's resistance to the process of podzolization.

Mobile nutrients are those ions, e.g., cations of calcium, potassium, etc., which are readily dissolvable in the soil solution, where they can either be taken up by plants through their root systems or leached away. This is in contrast to immobile reserves bound up in mineralized form, in nonsoluble chemical compounds, in inaccessible spaces within crystals, large molecules, or soil pores, or in subsoil regions beyond the reach of roots. Most soils lack appreciable mobile nutrient reserves. In deserts, this may be due to

the lack of water or due to salinization. In many tropical regions and in high latitude regions characterized by mature podzols, most nutrients may have been removed by intense leaching.⁴⁴ Only brown earths, chernozems, and their near relatives have mobile nutrient reserves. Chernozems and other similar soils formed in semi-arid regions under perennial grasses are given assistance by the climate since seasonal droughts inhibit leaching and, hence, the development of the illuvial and eluvial horizons that plague podzols. As a result, nutrient rich topsoils a yard or more in depth are readily produced.⁴⁵ The brown earths are associated with climates with water surpluses and, hence, with the problem of podzolization. Under such conditions, free ions can be dissolved in the soil solution, especially if this is acid in reaction, and leached away. Brown earths do not become podzols because weak ionic attractive forces by microscopic colloidal particles of clay or humus are able to keep large amounts of mobile nutrients loosely bonded to their surfaces.⁴⁶ Equilibrium conditions are attained so that nutrients can be released into the soil solution to be picked up by plant roots or micro-organisms when concentrations in the soil solution fall below a certain level. Likewise, nutrients can be picked up again by the colloids when excess quantities accumulate. As a result, most free nutrients are tied up either in organisms or on the surfaces of colloids. Few nutrients stay in the soil solution long enough to be leached away. Colloids can be added almost ad infinitum to the topsoil, and as colloids accumulate, so do mobile nutrient re-

serves. Over hundreds of years, the size of these reserves can reach astonishing proportions. A rich, brown topsoil is produced, as deep as plant roots or soil micro-organisms can penetrate.

Soil colloids are predominated numerically by clay particles produced through various chemical and physical weathering processes acting on soil and subsoil minerals. Colloids can also be produced when humus particles are reduced to microscopic size. Under ideal conditions, clay colloids are much more stable than humus colloids, with humus colloids generally degenerating after a few years or decades.⁴⁷ Humus colloids, however, have a much higher base exchange capacity, i.e., they can hold many more ions on their surfaces than can clay colloids.⁴⁸ Humus colloids and other humus materials lacking colloidal properties can also work to enhance the stability and base exchange capacities of the clay colloids.

Individual clay particles are so small that they can be washed down through minute soil pore spaces. Clay particles are also easily carried away by wind or water erosion. Clay particles are much more stable if they form clumps, i.e., if they are flocculated. At the levels of acidity characteristic of brown earths, flocculation occurs readily. Flocculated clay particles are even more stable if they can be loosely massed together to form larger macroscopic bodies called peds or crumbs.⁵⁰ In addition to texture, i.e., the blend of particles of different sizes, e.g., sand, silt, loam, and clay, good soils have a quality known as structure. For instance, a spadeful of a brown earth will readily break up into

loose clods. Each clod can then be readily broken into smaller clods, and these into even smaller crumbs. If large clods cannot be readily broken down into smaller clods and crumbs (as is the case with many heavy clay soils) or if clods and crumbs are absent (as is the case with very sandy soils), the soil structure is said to be defective. If the soil is packed into brick-like massive aggregates or layers, soil pore space is reduced, and the amount of air needed for respiration by plant roots and soil organisms may be affected.⁵¹ Such massive soils, as they are called, also have diminished water retention and absorption characteristics. Being able to hold less water, such soils may also be subject to erosion during heavy rains.⁵² Even during minor droughts, massive soils may dry out below the so-called wilting point, meaning that plant roots will not be able to draw water from soil pores and particle surfaces and, hence, will die. Sandy soils with no structure are subject to a different but equally deleterious set of handicaps.⁵³ Good soil structure, so-called crumb structure being the best as far as plants are concerned, results when bacteria attack dead or dying root hairs, producing as a byproduct chain-like polysaccharide gums that help bind together and stabilize macroscopic structural bodies.⁵⁴ Deep-rooted deciduous trees produce ample quantities of root hairs, thus spreading crumbs throughout the topsoil as a result of their underground litter production.

Through a variety of inter-related processes then, temperate forest ecosystems are in a position to conserve existing colloids

and, hence, existing nutrient reserves. The store of colloids may also be augmented from a variety of sources. Small amounts of nutrients will be added and conserved from rainfall or from wind-borne dust.⁵⁵ Major additions will come from clay particles and nutrients released from minerals in the body of the soil as the result of chemical and physical weathering.⁵⁶ The good structure of brown earths and their great depth provide an enormous surface area for the action of the soil solution and the enzymes and chemicals secreted by micro-organisms. New clay colloids produced by weathering will be quickly stabilized, and free nutrients will be taken up on colloidal surfaces. Minor additions are also made by the deepest roots of trees such as the oak, whose roots can penetrate below the main body of the soil into subsoil layers or parent material. Nutrients from these depths will subsequently be deposited in the litter production and add to the soil's stock of nutrients.

Temperate deciduous forests are relatively unique among forest ecosystems in being able to create mobile nutrient reserves. Most other forest ecosystems exist on soils where nutrients are largely immobilized or where eons of weathering and leaching have mined the soils of most of their potential supplies of nutrients. Forests on impoverished soils must either evolve strategies to live on few nutrients, as in the case of high latitude pine forests, or else must evolve strategies such as those met with in tropical forests where nutrients are recycled almost instantaneously. After tens of thousands of years, such strategies might also become incumbent on temper-

ate forests as their soils would be slowly weathered clean of nutrients.⁵⁷ Major climatic shifts accelerating leaching rates would speed this process. In such eventualities, new strategies would have to be evolved after the manner of the pine or of the tropical forests.⁵⁸ On a less geological scale of time, however, or in the face of less drastic or permanent climatic shifts, the stability of temperate forests would not be impaired. Even if short-lived climatic fluctuations were to accelerate leaching rates, accumulated mobile nutrient reserves would allow the forest communities to survive for a considerable period. If the climate were ameliorated before podzols had developed, reserves might be relatively exhausted, but the forest would remain to commence a new cycle of nutrient accumulation. This is an example of almost unparalleled control.⁵⁹

Temperate forest ecosystems would also have great resilience in the face of natural catastrophes that attacked the dominant tree species. Even if a large scale fire were to reduce tree biomass to ash and carry this away by wind and water erosion, so long as viable seeds remained, the mobile nutrient reserves in the soil would allow the forest to regenerate itself in a few decades, enormously shortening the time that would be necessary were seral progression to be pushed back to a few lichens on sterile bedrock or mineral overburden. Considered as wholes then, temperate forest ecosystems have an amazing resiliency extending to both their living and non-living components.

Of all soils associated with mature ecosystems, the brown earths are perhaps the most desirable for human agricultural purposes.

Chernozems may have larger mobile nutrient reserves, but chernozems occur in regions subject to seasonal droughts, regions deficient in water and lacking in timber for fuel and construction purposes. The agricultural colonization of the chernozems is basically a product of industrial times. For preindustrial societies, brown earths and temperate forests were much to be preferred. Temperate forests could compensate for most of the natural calamities that might befall them. Calamities induced by man were a different matter. The forests eventually bowed before man, but with the demise of the forests, the degradation of the brown earths was only a matter of time. The death of temperate forest ecosystems might, on a human scale, be a prolonged affair, a process that might even be missed within the lifetime of an individual or even several generations. This process would eventually make itself felt.

CHAPTER III

SERES, PLAGIOSERES, AND AGROSERES

Ecosystems ordinarily undergo transformations through time until a condition of steady state equilibrium or homeostasis¹ is reached called the climax. The entire series of seral stages is itself a homeostatic process, with ecosystems operating, as it were, to maximize their life chances at each stage.² In immature, pioneer stages, homeostasis is largely a matter of maintaining any sort of systemic organization at all.³ The mechanisms provided by pioneer ecosystems provide only a limited degree of control over environmental factors, so that organisms themselves must often cope with all the variations, predictable or unpredictable, of untempered natural environments. As a result, pioneer ecosystems often accommodate a mere handful of hardy species. Maturity is attained as ecosystems come to exercise more control as wholes over predictable environmental fluctuations, leveling these out so that organisms can begin to adapt to the more predictable environments of the systems of which they are parts.⁴ Maturity also involves tempering the intensity of ecosystem inter-relationships so that calamities affecting one species or one set of relationships do not reverberate through the whole system. If relationships are too interdependent, ecosystems can be said to be coherent.⁵ To handle such coherence, a whole set of centralized control mechanisms would have to exist

capable of monitoring variations, capable of assigning priorities to variations affecting different relationships, and capable of initiating quick and efficient remedial responses.⁶

In individual organisms, the problems of coherence are tackled by coordinating hormone systems or specialized central nervous systems. Ecosystems lack such obviously centralized monitoring systems and, therefore, must limit the amount of coherence in order to obtain maximal survival potential. This is accomplished by evolving relatively discrete and autonomous subsystems that react more intensely with themselves than with other subsystems. As a result, the system as a whole is buffered against fluctuations in any given subsystems. For instance, as was seen in the last chapter, perturbations such as increased leaching rates can debilitate the soils and decomposer organisms in mature temperate forests without necessarily debilitating the trees. Likewise, perturbations affecting the trees might not immediately disturb soils and decomposer organisms. In addition, ecosystemic relationships within and between subsystems are usually redundant. Given the high species diversities of mature ecosystems, many alternative or mutually reinforcing subsystems and subsystem linkages are possible, so that the failure of one link in the ecosystemic web does not necessarily entail the collapse of the entire system.⁷

In pioneer communities, there is room for increased maturity because existing systemic relations and species potentials can be improved upon by the addition of new species or new types of relation-

ships among species and their environments. Such innovations can occur because of suitable genetic mutations: in fact, one factor that can put an end to seral progression is that the range of available species variety has been temporarily exhausted. More commonly, new species will invade pioneer communities from neighboring ecosystems. The pioneer communities create opportunities that species or whole groups of species from adjacent ecosystems can utilize more efficiently. Usually, this process represents a transformation toward greater maturity, diversity, and stability.

Such transformative processes may also prove unsuccessful or deviate from the normal course of progressive maturity. Sometimes the trajectory of seral progression is a twisted one, with many branches, many seemingly repetitious cycles, and many dead ends. Deflected or arrested seral progressions are called plagioseres. The term plagiosere has increasingly come to be associated with deflections in some way attributable to human influences, but the term was originally devised to describe a wider range of deflections with natural as well as anthropogenic causes.⁸ Natural plagioseres can be found where major climatic regimes grade into each other abruptly or where environmental differences are created by more localized geomorphological features. In such locations, ecosystems well adapted to major climatic regimes or the predominant environmental features of a region might experience difficulties, and these stresses would be further magnified if climatic variables were subject to short term fluctuations.⁹

Under such conditions, ecosystemic resilience is reduced, and relatively minor initial fluctuations can trigger plagioseres.¹⁰ Such fluctuations could come from inside or outside an ecosystem or could involve a combination of internal and external factors. For instance, an oak and beech forest might become dominated by oaks alone. The oak trees would not provide a dense, closed canopy by themselves, and an understorey of low nutrient herbaceous plants and shrubs would develop. This understorey would increase the podzolization of upper soil layers, and an impervious hardpan might develop. Mature, deep-rooted oak trees would survive, but their seedlings and those of other deciduous trees would not. Eventually, a seemingly stable, mature oak and beech forest might be replaced by a moor of bracken and heath.

A similar situation could develop if an oak and beech forest were to become dominated by beech trees. Beech trees form a good, closed canopy, but they are relatively shallow rooted, and their litter contains higher quantities of polyphenols than other deciduous trees. Without accompanying oak trees, a forest of beech would begin to exhaust the nutrients in the topsoil. Mature beech trees would survive, but seedlings would not. As mature beech trees died, the canopy would open, and an understorey of bracken and heath species would develop. Eventually, only a treeless moor might be left. In the cases outlined above, however, an oak and beech forest could re-emerge were a dense understorey of bracken to develop. This would provide an ideal nursery for seedlings of hazel or birch. Birch trees

in particular can break up subsurface hardpans and increase nutrient turnover rates. The area might then be recolonized by oak and beech trees, and the original climax community might reappear at the end of a convoluted plagiosere.¹¹

Other types of plagioseral deflections might seriously hamper the ability of ecosystems to reattain some initial seral stage. For instance, if the types of disturbances of oak and beech forests described above were to take place in a region subject to extreme podzolization or if climatic shifts were to increase leaching rates after the spread of low nutrient understoreys had commenced, an ecosystem might experience a sort of seral progression in reverse. The original forest community might be replaced by a heath community.¹² Even such a simplified community might not be able to maintain itself, especially if the development of ironpans were to result in seriously impeded drainage with periodic waterlogging of the topsoil. Bracken and woody heath species would then be replaced by various low nutrient grasses, rushes, sedges, and mosses. If waterlogging were severe, these grass heaths would be further simplified so that only mosses and tussocky molina and cotton tail grasses might remain. If the high leaching rates and poor drainage were to continue, communities dominated by pioneer mosses would become the plagioseral climax. Degrees of podzolization less severe might still leave a plagioseral grass or heather moor. None of these disclimaxes would favor the re-establishment of forest communities.

All the plagioseres discussed above could involve natural perturbations alone. In all cases, the more simplified seral stages

would be poorly equipped to conserve, much less amass, nutrient reserves.¹² In all cases, the more simplified communities would be less suitable for agricultural practices than the nutrient rich communities they replaced. Ironically though, agricultural practices almost invariably entail some degree of ecosystem simplification, thus increasing the possibility that anthropogenically induced plagiosere communities will develop. To counter the liabilities of such trends, man has developed the variegated practices of husbandry and agronomy. Usually, however, the more sophisticated and intensive the agricultural practices, the greater have been the ecological liabilities, and, hence, the more sophisticated or desperate have been man's efforts at husbandry.

Man can put stress on both the living and non-living components of ecosystems. He diverts a portion, perhaps a large portion of the biomass for his own use. This may play havoc with an ecosystem's ability to maintain balances between existing populations of plants and animals and their environments. Man may also prove highly inefficient in recycling the remains of his harvests, resulting in waste, especially of plant nutrients. Man's technological abilities give him the power to manipulate biotic communities and soils in ways that equal or exceed the most destructive powers of nature.¹⁴ With axes, fires, or grazing animals, he can clear whole stands of trees, exposing soils to the dangers of increased leaching and erosion. With digging sticks, harrows, and ploughs, man can even do what nature cannot: he can attack the very body of the soil.¹⁵

Ploughs in particular can devastate soils.¹⁶ Inverted furrow slices bury nutrient-rich topsoil and humus, they impede drainage by destroying soil pores and capillaries, and they expose nutrient deficient subsoil layers. Repeated ploughing may leave a compacted ploughsole nearly as impervious as the ironpans in a mature podzol. The cutting surfaces of ploughs and other implements exert pressures sufficient to create massive, brick-like soil bodies completely lacking in structure. Even when structure is not immediately impaired, a furrow slice or even a turned spadefull tends to dry to hard chunks and clods.¹⁷ When wetted, clods turn into a sticky, plastic mud. When dried again, the material has been substantially robbed of structure. Continuous cultivation with implements such as ploughs precludes closed communities of perennial plants. This reduces the amount of root growth and humus production. The supply of humic colloids and soil binding gums is reduced. As colloids are lost, base exchange capacity decreases, and nutrient reserves are lost. Eventually, the soil will not yield crops, and if soil degradation has been severe enough, the regeneration of natural vegetation will not define a normal sere, but a plagiosere. To coin a phrase, agricultural practices encourage the development of agro-seres.

To lessen the ecological liabilities of his agricultural activities, man has developed husbandry. However, the technology at his disposal is never as complex and subtle as the natural processes of stable, mature ecosystems. Only by meddling with small areas, and these at appropriate intervals, can man co-exist with and still tap

the full productivity of climax communities.¹⁸ On the criterion of ecological integrity, the ideal subsistence adaptation would be hunting and gathering. Indeed, for over ninety percent of man's history as a species, this was the case, and far from being a grim, unrelenting struggle against imminent starvation, hunting and gathering was often a nutritional paradise, where the desultory labor of a single man could usually support five of his fellows.¹⁹ Since Neolithic times, the food quest has usually proved less productive for preindustrial societies,²⁰ and, more importantly, it has had to come to grips with a whole gambit of potential ecological hazards induced or aggravated by agricultural practices.

The reasons man abandoned hunting and gathering for the more problematical life of agriculture are the subject of considerable debate, largely because the onset of Neolithic life has been shown to have been less a decisive revolution than a gradual transition, with its roots extending well back into the post-glacial period of the Mesolithic.²¹ An adequate definition of agriculture still eludes us, the possibility being that agriculture consists not of any rigid collection of traits but of flexible combinations of various types of tendencies and processes.²² Southwest Asia was probably the first center of agriculture, where it developed from intensive hunting and gathering strategies focussing on specific ecological zones called ecotones.²³

Ecotones are transition areas separating different types of seral communities adapted to significantly different climatic or

edaphic conditions.²⁴ In Southwest Asia, such an ecotone or series of ecotones stretched along the so-called hilly flanks of the Zagros Mountains, which separated oak and pistachio woodlands from lower lying grass Steppes.²⁵ Ecotones contain species from neighboring ecosystems, but environmental tensions do not give clear competitive advantages to any given community types. As a result, species from one ecosystem do not crowd out species from other ecosystems within the ecotone. This often creates greater species diversities within an ecotone than in adjacent ecosystems. The competitive stand-off between species from neighboring ecosystems also provides combinations of habitats and niches seldom met with outside the ecotone. The ecotone, then, may boast species adapted to niches not found in adjacent ecosystems.

A region such as Southwest Asia is subject to cyclical drought phases spanning several decades, a situation also met with in the United States in the ecotones separating forests from prairies.²⁶ Drought cycles can cause considerable fluctuations in the boundaries separating trees from areas more suitable for grasses. Species adapted to special ecotone niches must also be able to adapt to these migratory pulsations. In Southwest Asia, this gave a competitive edge to swiftly propagating annual cereals which were the wild ancestors of wheat and barley.

Cereals possess weedy qualities, meaning that they are adept at colonizing disturbed habitats, e.g., rocky slopes or ploughed fields.²⁷ Cereals are generally pioneer species, and, outside ecotones,

they would only be found in immature ecosystems. As outlined above, immature ecosystems have lower biomasses and, hence, have lower total productivities than more mature ecosystems.²⁸ However, low total biomass means that the yearly growth in excess of that needed merely to replace or maintain existing biomass may comprise an appreciable percentage of total biomass. Annual cereals in particular squander an incredible portion of their production in ways that do little to conserve existing biomass. Their strategy is to produce enough seeds to insure the survival of the species, and once seeds have been produced, the whole plant, leaves, tillers, and roots, dies. Cereals are prodigal in their waste of unrecycled nutrients, but in immature communities, survival of the species has priority over conservation of ecosystem capital. As long as they are not outpaced by more mature and more conservative ecosystems, cereals can survive. The tensions and spatial volatility of ecotones guaranteed the survival of cereals in Southwest Asia even though ecotones were not necessarily disturbed, weedy habitats.²⁹

Mature ecosystems carefully invest their productivity in a dispersed array of leaves, stems, trunks, and roots that help them control their environments. Weedy cereals concentrate their productivity in highly nutritive seeds. Ecotones would have obvious attractions for hunters and gatherers, and the first steps toward plant domestication involved a gravitation by hunters and gatherers toward ecotones and a narrowing pattern of plant collection centering on emmer, einkorn, and barley. Concentration on cereals encouraged the develop-

ment of storage facilities to accommodate the seasonally fixed harvests. Baskets, pottery, storage pits, pounding mallets, and grinding stones, not to mention tons of grain, reduced the mobility of hunters and gatherers.³⁰ A heavy dependence on cereals predisposed such groups to a sedentary, proto-Neolithic existence. Within ecotones, this did not compromise ecological stability,³¹ so that in Southwest Asia, incipient agriculturalists lived for thousands of years in virtual equilibrium with their environments.³²

Eventually, sedentary groups with their grain centered economies began to expand to neighboring ecosystems. In such environments, cereals and various domesticated animals such as cattle, sheep, and goats could be accommodated only at the expense of drastic alterations in local ecologies. Perennial grasses, legumes, and trees were pushed back to make room for cereals. Natural game was crowded back to provide pasture for domesticated livestock. Several thousand years of such activities reduced vast stretches of the steppe regions above the Tigris and Euphrates to an inhospitable desert.³³ In the meantime, human selective pressures had eliminated self-propagating cereals in favor of non-self-propagating varieties that were easier to reap since seed could not detach itself from the rachis.³⁴ These genetic freaks had to be planted by man and could not survive without his constant attention. His animals, too, were turned into parasites, with selective breeding and perhaps poor feeding producing dwarfed, poor toothed, and often hornless specimens, well suited for the farmyard but helpless in the wild.³⁵ In time, man and his domesticated

animals and plants were forced into the larger river valleys, which, constantly renewed by seasonal floods, were more resistant to the ecological liabilities of these weedy plants and domesticated animals.³⁶

From this early center in Southwest Asia, Neolithic life spread into the Mediterranean and up the Danube into temperate Europe.³⁷ Man learned relatively little about husbandry in the Mediterranean, where his impact on the environment often resulted in the fairly rapid replacement of closed canopies of evergreen oaks protecting rich brown soils with erosion carved catenae.³⁸ He was saved here by the olive, the vine, and the coppiced oak, species that could grow, almost literally, on bare rock while grain was harvested from sheltered valleys above the silt charged plains.³⁹ The impact of human agricultural practices was ultimately little better in temperate Europe, but here the vine and the olive would not grow, and irrigation is useless in climates where getting rid of water was often the real problem. Here man had to learn a modicum of husbandry, or his ecosystems would perish and so might he. Little was learned during the initial phases of the Neolithic, which one archaeologist has not unjustly characterized as a joy ride on the post-glacial forests.⁴⁰ By the Bronze Age at the latest, though, the broad lessons of husbandry in temperate forests and on brown earths were taking shape, and, at least into the late Iron Age, some of the results were not so ecologically unsound.

Previously, it was noted that to co-exist with mature ecosystems, man must interfere only with small areas and with these infrequently. This can be accomplished by mobile hunting and gathering. It can

also be accomplished by shifting cultivation or swiddening. Swiddening may involve moving one's homestead every few years, but it may also be accomplished by the periodic relocation of cultivated plots. In either case, the accumulation of material culture can be considerable, but especially so when field sitings alone are obliged to move.⁴¹ Swiddening is often assumed to be primitive and inefficient. It is often taken to impose low population densities and dispersed settlement, thus hindering the development of intense social ties and the benefits of more complex cultural systems. While there is some truth in these generalizations, they are defective on a number of points as universal generalizations. Their cogency stems from an over narrow evidential base drawn from particularly unpropitious areas in the tropics and from equally unpropitious areas in Northern Europe involving severely degraded ecosystems.⁴³ In less foreboding or less misused environments, swiddening might produce substantial returns for modest labor outlays, support sizable population densities, and pose no threats to ecosystem stability. Such hypotheses find a strong measure of cross-cultural substantiation, and there is sufficient evidence from temperate Europe itself to demonstrate or at least give strong support for these propositions.

The agricultural history of Europe from the Iron Age on is usually portrayed as a halting but steadily progressive advance, with three field systems marvelously boosting the yields of older open field techniques and with the agricultural revolution of early modern times lifting agricultural productivity to unparalleled highs.⁴⁴

At best this scenario ends properly, but it begins in the gravest of error, and it winds out its tale of progress by overlooking the roots of the astounding nonproductiveness of the intervening stages. The agricultural revolution of early modern times accomplished the feat of raising cereal yields to levels approaching or exceeding 16:1.⁴⁵ The best the intervening stages could predictably muster was 5:1 or 6:1,⁴⁶ and often the yields fell to 3:1 or worse.⁴⁷ On the other hand, the supposedly primitive swidden techniques operating in temperate forests and on brown earths could easily give yields of from 16:1 to 20:1.⁴⁸ The triumph of early modern agronomy was merely to regain the levels attained by the swiddenists.

The reasons behind this apparent paradox are ecologically simple. Cereals, unlike many other weedy plants, have high nutrient uptake requirements, especially if one is after a crop of grain instead of a crop of straw. In fact, their nutrient requirements are approximately the same as those of the dominant tree species in a mature, temperate forest ecosystem.⁴⁹ In degraded forest ecosystems or in heath, moor grass, or pine dominated ecosystems, cereal crops cannot grow on the nutrients in the soil alone. Crops can be taken only if the plant cover is set afire so that the nutrients in the resulting ash can be mobilized by the cereals. The fertility of such soils would quickly decline, and then they might be so impoverished that ecosystem regeneration would be long delayed or permanently deflected along some even lower nutrient plagiosere.⁵⁰ In temperate forests on brown earths, the mobile nutrient reserves in the soil

alone might be sufficient for several crops. If cleared by fire, the seed bed would be further enriched by the ash of the high nutrient plant cover. If left alone before cereal yields had fallen drastically, the soil would still have sufficient reserves to ensure the rapid regeneration not of some inferior heath but of the original high nutrient forest, a forest that could then begin to replenish soil nutrients. If the soil were not exploited too severely, swiddenists could exist in temperate forest ecosystems with only minor long term damage to the natural ecosystems⁵¹ and with yields that would have satisfied even the reformers of the early modern agricultural revolution.

These yields from primitive swiddening were accomplished not so much by the sophistication of human technology or the intensity of human labor but by judicious adaptations to the self-sustaining productivity of natural ecosystems. Axes, shovels, hoes, and the traction of oxen to haul away half burned stumps and to clean and level seed beds would have sufficed preparatory to planting.⁵² After that, only a bit of weeding would have been necessary before the harvest. The harvest in, agricultural chores could cease with more than enough grain for seed and for food through the winter months.

Labor productivity is difficult to estimate for such prehistoric swiddening systems, but comparison with ethnographic examples of equally simple and equally productive systems can help fix some rough baselines. Perhaps the best quantitative data come from modern groups in Highland New Guinea, where it has been calculated that for each calorie of labor expended on agricultural tasks, close to

twenty calories of foodstuffs could be produced.⁵³ The New Guinean groups grow sweet potatoes, but even when allowance is made for the fact that tubers can produce some five to ten times the calories of seed crops per unit weight of harvest, this still means that cereal swiddening might possibly yield somewhere between two to four calories for each calorie of invested labor.⁵⁴ This may seem rather small, but the modern Iowa corn farmer gets back only five calories for each calorie of expended energy, and modern rice, potato, and sugar beet farming often operates at a trade-off of 1:1.⁵⁵ The latter systems are feasible only because modern man has cheap fossil fuels at his disposal to drive machinery. Primitive swiddenists in temperate forest ecosystems could do at least as well equipped only with their muscles.

To the returns from cereal crops should also be added the returns from animal husbandry and from subsidiary hunting and gathering.⁵⁶ It has already been remarked how productive hunting and gathering can be, and it is an accepted truism that animal husbandry is much less labor intensive than cereal growing. Man must tend, milk, or slaughter his herds, but the animals do most of their feeding unaided. Animals such as oxen can also be used in conjunction with tools in agricultural tasks, thus reducing the amounts of human labor inputs required. When these additional returns are taken into account, the productivity of temperate forest swiddenists begins to reapproach the New Guinean figures of better than fifteen calories in yield for each calorie of labor input.⁵⁷

Another intriguing set of statistics can be drawn by figuring the acreage required to feed an individual. In New Guinea, sweet potatoes yield eleven pounds per hectare per day, this weight of crop being perhaps fifty percent more than is needed to feed an adult man adequately.⁵⁸ Sweet potatoes are deficient in proteins and fats as compared to cereals such as barley or wheat, so that a figure of around five pounds per day of small grains is a reasonable equivalency. If the figure of five pounds of small grains per day per person is used and if cereal yields of the order of 16:1 were possible at sowing rates of three to five bushels per acre,⁵⁹ then the harvests from a little over a half acre of land would suffice to feed an adult male for a year. The acreage figures for the primitive swiddenists were probably much lower than these estimates based on cereals alone would indicate since the contribution from animal husbandry has been neglected. This could lower the acreage figures by better than twenty to forty percent. This means that a good sized village of five hundred men, women, and children could have been adequately fed on about a quarter section of cultivated land.⁶⁰

These figures are easier to grasp when expressed as population densities. To do this, allowance must be made for a reserve of forest sufficiently large to allow used swidden plots to regenerate. An allowance of about one hundred acres of forest for each cleared acre would have been more than adequate.⁶¹ This gives population densities of twenty or more persons per square mile. This figure may seem low by modern standards, but the population of medieval

England as revealed by the Domesday survey was scarcely higher.⁶²

All the figures calculated above are crude baselines. They are probably minimal baselines though, so that any revisions would be in the direction of smaller acreages of cleared swidden plots, concomitant reductions in the necessary pools of forest reserves, and, hence, higher population densities. Therefore, on the basis on these figures, it can be reasonably hypothesized that prehistoric swiddenists had higher nutritional standards, worked less intensively, and were possibly as numerous as the supposedly more developed societies of medieval Europe. This last possibility regarding population densities is of particular interest.

That seemingly primitive agriculturalists can enjoy population densities as high as those of societies boasting complex civilizations or state systems is not only archaeological speculation but ethnographic fact. Once again, the classic example is Highland New Guinea, where population densities of forty individuals per square mile are common and figures approaching four hundred individuals per square mile are not unknown.⁶³ These figures do not, however, reach the maximum carrying capacities compatible with ecological stability. Calculations by geographers and anthropologists indicate that even the populous Chimbu operate at only sixty percent of potential carrying capacity while many other groups operate at well under fifty percent of capacity.⁶⁴ This may mean that the minimal baselines calculated above for prehistoric temperate Europe need to be pared down. Still, even if the population densities were halved to around ten individuals per square mile, many regions of eleventh century

England were lucky to boast this slender figure. And since the statistics suggested above for the prehistoric swiddenists were purposefully underestimated, figures of twenty or more inhabitants per square mile may be more indicative of the prehistoric norms even when the subsistence systems were operating at far less than carrying capacity. In any event, the absolute size of the figures is less significant than the more general implication that societies lacking states, bureaucracies, kings, or socio-economic classes could at least match, and possibly outdistance complex societies in the signal areas of agricultural productivity and population densities.⁶⁵

That primitive societies do not develop the trappings of state systems is probably attributable to the frequency and relative ease with which primitive social groups may undergo fissioning.⁶⁶ If inter-group tensions were to develop, there would be no extraordinary barriers to an aggrieved faction simply leaving the parent group to stake out on its own. A group of modest size could readily accomplish most of the tasks needed to feed, cloth, and house itself. The hived-off group might still find itself dependent on other groups for certain types of non-local resources, certain types of cooperative enterprises, and certainly for wives. These needs could be readily arranged on the basis of a renegotiation to replace a real or imagined former state of subordination. Beyond these important but occasional needs, however, there would be no pressing functional demands for pervasive divisions of labor binding families and small domestic groups together so that none could survive without the ongoing co-operation of the others.

A necessary precondition for the long term viability of such autarchic, if not completely autonomous, domestic groups would be a resilient natural environment.⁶⁷ Kings backed with armies and police can compel subordination, but so can easily maimed ecosystems that cannot support the self-contained agricultural systems needed by maverick households. The ecology of agricultural systems, then, is an important and often neglected dimension of any satisfactory explanation of the stability of primitive groups or the origins of states. It is not the only dimension, but to exclude ecological data, especially as in the case of temperate Europe where it forms our clearest and sometimes our only source of evidence, is foolhardy. In the past, studies on the origins of civilizations have centered on Mesopotamia, the Nile, or Mesoamerica, in arid regions where even the ecologists wonder whether to speak of wholistic ecosystems or simply of opportunistic biotic communities. These are fragile ecosystems, and even in these arid hearths of high culture, the prehistorians have more often than not fastened on later, more architecturally grandiose horizons.⁶⁸ In many instances, they have leaped so far beyond the true origins that the local ecosystems had already been decimated, and farming had fastened on hydroponics on flood plains, lake shores, and river deltas. The ecosystems of temperate Europe were much more resilient than those, say, of Southwest Asia, and this is probably one reason why the elaborate managerial controls over agrarian systems associated with state systems were so late in developing.

There were limits to the resiliency of temperate forest ecosystems, however, and by the late Iron Age, long millennia of use and misuse by prehistoric swiddenists were beginning to reach critical thresholds. By the beginning of the Christian era, primitive swiddenists in temperate Europe were beginning to press hard on the brown earths. Many had pressed so hard that the virgin forests had long ago disappeared, and the soils were beginning to show the effects of podzolization.⁶⁹ Deciduous forests could not so readily recolonize cleared fields, and mobile nutrient reserves dwindled or disappeared. Temperate forest ecosystems debilitated to one degree or another did not so readily cede their productivity to crops and livestock, and new methods of husbandry had to be devised, methods that, over the long run, were not so ecologically sound. In simple terms, the farmers of Europe were increasingly driven to rob natural ecosystems of fertility at a slow but appreciable rate in order to divert this to their fields where, unfortunately, it was not conserved.

By the time this transformation in agrarian ecology had run its course, most agricultural systems in temperate Europe had come to center on a humanly favored component called the arable. This privileged component was cropped nearly continuously for cereals. The course of seral progression was held in abeyance. Not even grasses, much less closed canopies of scrub or woodland communities were tolerated. At best, the arable might be bare fallowed from time to time. In ecological terms, the arable was expected to support

domesticated cereals whose nutrient demands were as high as those of mature, deciduous forest. But except in a few exceptional regions boasting rich, unweathered parent materials, arable lands could not in themselves yield harvests for more than a year or two, and bare fallowing alone would do little to raise fertility levels so that cereal cropping could be resumed. The arable, then, was not ecologically self-sufficient and could not sustain cropping without human intervention to boost the supply of necessary plant nutrients. Such human intervention had pervasive ecological consequences whose impacts were felt far beyond arable foci.

Without substantial external inputs of nutrients, a frequently cropped soil kept free of perennial vegetation rapidly loses its structure. Repeated tillage operations aggravate this loss of structure by creating ploughsoles, compacted subsoil layers, massive soil bodies, and clods. The bare topsoil is subjected to wind and water erosion, processes which even degrade soil texture by carrying off colloidal particles. With degraded structure and texture, leaching rates are accelerated. Against these losses, the soil can hope to receive the stubble and roots of the harvested annual cereals. The grain, highest in nutrients, especially nitrogen rich proteins, will have been removed. The remaining portions of the mature cereal plants will consist mostly of nitrogen deficient cellulose and lignin.⁷⁰ Unless ploughed in, much of the nutrient value of the stubble will be lost through weathering processes. On the other hand, even when ploughed in, recycling of the stubble may still be inhibited.

On degraded arable soils, populations of decomposer organisms may have been seriously reduced. On especially degraded soils, these will have been replaced by simplified communities of insects, nematodes, bacteria, fungi, and viruses that spread blights, rusts, mildews, and mosaic diseases to crops.⁷¹ On infested soils such as these, weeds and crop residues should be burned, and reuse of given plots should be delayed for a year or more.⁷² Preindustrial field rotations were often as not designed more to starve out deleterious decomposer organisms and parasites than to renew soil fertility.⁷³ Even where decomposer systems had not been seriously impaired, nutrient deficiencies could slow recycling to the detriment of crops. Ploughed-in crop residues are low in nitrogen. Soil micro-organisms need large amounts of nitrogen rich substances for the metabolic processes involved in humus breakdown. Therefore, micro-organisms may monopolize all available soil nitrogen for several months while metabolizing carbohydrates and lignin. This may create nitrogen deficiencies for subsequent cereal crops and may also inhibit the utilization of other nutrients.⁷⁴ Even after a lengthy fallow period, the soil's stock of nutrients will probably be less than when the cycle began. Repeated cropping cycles progressively deplete nutrient reserves and contribute to the degradation of soil structure and texture. This vicious circle of processes can be elaborated upon almost ad infinitum. Suffice it to say that arable land cannot maintain its own fertility levels.

Hence, in order for fertility to be maintained, the resources of other regions must be exploited. Such fertility transfers⁷⁵ are often obfuscated if an arable focus is mistakenly equated with the entire agricultural system. At best, the arable constitutes a field system set within a larger territory or Gemarkung.⁷⁶ This territory contains the meadows, pastures, woods, waste, and other "appurtenances" without which the field systems could not exist. The appurtenances provide materials for construction and craft activities, but, most importantly, they provide fodder and forage for livestock. Most of the natural perennial vegetation of temperate Europe cannot be eaten by man.⁷⁷ To tap this productivity, man must either replace the native vegetation by cultigens or must convert it via his livestock into meat, milk, and other useful byproducts. Replacing natural vegetation with cultigens on a massive scale would be ecologically disastrous. The grazing pressures of livestock pose a less immediate threat to the productivity of natural ecosystems. Livestock do add an extra link in the food chain between man and plants. Each link in a food chain entails losses through respiration so that milk and meat may represent only a fraction of the original caloric productivity of the plants. On the other hand, replacing perennial vegetation with weedy cereals would also result in enormous declines in productivity. Mixed farming, then, is probably as productive as a monocrop dependence on cereals, and it certainly poses less of a short term threat to ecosystem stability.

Since animals are inefficient in converting plants into their own tissues, they produce large quantities of relatively unmetabolized

organic matter. Normally, this would become part of the litter, which would then be attacked by decomposer organisms before finding its way back into an ecosystem's geochemical cycles. Manure can also be diverted for the more exclusive benefit of the arable, and such fertility transfers are the primary mechanisms for keeping the fertility status of farmlands high enough to support cereal cropping.

Unfortunately, much of this fertility is wasted.⁷⁸ If plants or decomposer organisms cannot readily pick up the nutrients in the manure, its value is diminished. Arable lands are usually under crops or bare fallow. It may prove awkward to apply manure when a field is in crop, so manuring must usually be done before or after harvesting. If applied during the late autumn, much of the benefit will be lost since the manure will be subjected to weathering and erosion during the winter months when the activities of soil micro-organisms reach a nadir. The best time for application is sometime prior to sowing when the threats of frosts and snows are past. Manure application too close to the sowing, however, may create problems for the crop. The manure, rich in nitrogen, may cause excessively fast stem and tiller growth, so that the grain will lodge. If applied somewhat earlier, much of the nutrient value may still be neutralized. High nitrogen levels will cause an explosive growth of soil micro-organisms, which will hold back nutrients from crops sowed shortly thereafter. The benefits of manure may only be noticed after the first year.⁷⁹ In the meantime, much of the fertility in the manure may have been leached or eroded away. In brief, when cereal rotations follow each other at close intervals, there is really no good time to apply manure.

Worse yet, the manure may lose close to half its fertility even before application. Since manuring can usually be done only at certain times of the year, manure must be collected and stored. Manure contains both solid and liquid fractions. Unless the storage facilities are waterproof, the liquid fraction, and with it most of the phosphorus, will be leached away. To reduce liquid losses, manure is usually mixed with straw or compost. The addition of this extra organic matter invariably raises the carbon to nitrogen ratio. This renders the manure less useable to higher plants since now the manure must pass through the food chains of soil decomposer organisms before repeated metabolisms lower the ratio to acceptable levels.⁸⁰ Fortunately, manure heaps are quickly colonized by various bacteria and fungi that can break down enough of the cellulose and lignin to bring carbon to nitrogen ratios to suitable levels for use by higher plants. Unfortunately, the usual Mist heap seldom offers an efficient medium for these composting organisms. Many nutrients will be lost through atmospheric oxidation unless the heap is carefully compacted. If the heap is too large or too small, improper insulation will inhibit efficient composting. If the heap is too small, insulation will be insufficient. Most of the decomposition will be by slow acting bacteria, and the build-up of heat will not be enough to kill pathogenic protozoa and unwanted weed seeds. If there is too much insulation, temperatures will rise so high that all the composting organisms will be killed off. High temperatures also encourage the production of large amounts of water soluble ammonia.

This will leach out, taking with it much of the nitrogen liberated during the composting process. If a manure heap is left exposed to the rain and weather, nutrients may be lost almost as rapidly as they are liberated. As a result, average farmyard manure piles lose over a third of their initial nitrogen content and nearly all their phosphorus.⁸¹ These imbalances, especially in phosphorus, may inhibit the use of the remaining nutrients by plants. The cumulative potential for waste in manure storage, composting, and application is enormous, many times worse than in natural recycling processes.

Wasted fertility constitutes a drain on the ecosystems surrounding a territory's arable focus. At the same time, overgrazing by livestock can disturb the community structures of natural ecosystems. The surrounding territories may not be stripped of their vegetation, but more subtle types of changes can take place. Browsing by cattle will inhibit the growth of various types of tussocky grasses, trees, and woody plants. Grazing by sheep will encourage the growth of turf grasses and plants with succulent forbes and efflorescences.⁸² Seral progression will be deflected although some control may be exercised over the types of resultant plant communities if the feeding habits of the animals are carefully managed and given periodic assists by burning, mowing, ploughing, or resowing.

Careful husbandry can produce swards of perennial grasses and legumes that, while immature by the climatic standards of temperate Europe, match the productivity of the grasslands of Steppe chernozems.⁸³ The root systems of such swards are often denser and deeper

than those of the supplanted forests. Since they are dominated by perennials, such grasslands prevent soil erosion and work efficiently with decomposer organisms to conserve soil colloids and mobile nutrient reserves. Bacteria on the root nodules of leguminous clovers can fix atmospheric nitrogen even more effectively than the free living bacteria of deciduous forests.⁸⁴ Hence, the replacement of deciduous forests by good grass swards is not necessarily ecologically deleterious, but such communities are unstable. They are transitional communities, and lapses in good management ensure their replacement by less productive community types.

Good management requires considerable amounts of time, energy, and ingenuity. The combination of arable for grain with carefully managed grass and clover leys was the basis of the agricultural revolution of early modern times.⁸⁵ Before this time, the farmers of Europe either shied away from or simply could not afford the luxury of good management. Instead of nutrient rich clovers and rye grasses, their hinterlands became dominated by less nutrient rich grasses or heath species. The diversion of fertility from these natural communities to arable lands further encouraged the development of nutrient poor types. Over time, good pasture could be turned into indifferent pasture and this into heath, moor, and waste.

The manure derived from poorly managed plagioseral communities would be less fertile than that derived from mature forests or good grass and clover swards. Animals would have to range farther afield to filch enough fertility to keep arable lands productive. This would slowly extend the range of the waste, eventually putting strains

on the walking dung carts⁸⁶ at the center of these fertility transferals. Animals would have to be very athletic to be able to range far enough to keep themselves and the arable alive. Sheep fared better under this transhumant regime than cattle. The rigors of the sheepwalk lie behind the development of the agile, hardy breeds of sheep that appeared from Iron Age times on.⁸⁷ Cattle were generally unable to keep up with the sheep and suffered from overwork and undernourishment. Hay meadows began to increase in importance, but cut vegetation rapidly loses its food value, and pre-industrial techniques for mowing, curing, and storing hay and silage were often as inefficient as the techniques for handling manure.⁸⁸

As a result, the number of heavy livestock that could be kept throughout the year was low. Overwintering was a problem for sheep as well, and these pressures on stocking rates compounded the problems of maintaining the pace of fertility transferals. Limited livestock also reduced the number of beasts that could be used in tillage operations, and tillage was becoming increasingly important to hold weeds at bay and give the degraded arable soils a semblance of structure. Decreased livestock cut into the supplies of high quality protein from milk and meat. Supplies of animal byproducts, e.g., horn, bone, hides, hair, and fleece, were also jeopardized, and the quality of these might be impaired by the undernourishment and breeding pressures induced by husbandry practices. For instance, the hardy sheep favored by transhumant practices had small bones, and,

while the mutton from their diminutive carcasses was lean and tasty, the coarse, sometimes hairy, fleeces were often good for little more than felt. Good cloth was more easily made from flax, and good woolen cloth became a treasure, the end product of a complicated manufacturing process.

These are the broad features of European husbandry practices from the Iron Age until early modern times. The constraints within which this style of husbandry had to operate were much more obvious and tightly drawn than for primitive swiddening. Both types of systems were vulnerable to crop failures, livestock diseases, or demographic fluctuations, but the defects of primitive swiddening could not easily spread to neighboring groups or to encompassing ecosystems. From the Iron Age onwards, failures affecting agricultural systems became increasingly likely, and such failures now spread beyond pockets of human activity to the natural environment. Growing imperfections in the homeostatic capacities of natural ecosystems meant that human cultural systems had to pick up the slack. Primitive swiddenists had had little incentive to accept social controls or develop elaborate divisions of labor and complimentary dependencies. By the late Iron Age, nature herself began to favor a growth in the complexity of social systems.

Social systems began to bear the dual responsibility of maintaining not only man and his cultures but the more fragile ecosystems on which the social systems were based. From the Iron Age on, it is difficult to study man or nature in isolation, the systems

involved being socio-ecosystemic wholes. Such systems have properties of their own, properties which, when viewed as wholes, render them inherently less stable than natural ecosystems. In one range of socio-ecological types, that of interaction spheres, these destabilizing tendencies are not pronounced. In another range of types, those characterized by significant trends toward bureaucratization, such tendencies are usually prominent. An analysis of these organizational extremes will be necessary for an understanding of the dynamics of socio-ecosystems in Northwest Europe and the problems of Roman frontier development in that region.

CHAPTER IV

BUREAUCRATIZATION AND SOCIAL MALADAPTATION

A cardinal feature of stable, mature ecosystems is the limited degree of coherence or "connenctance" between the various living and non-living subsystems and components and the remarkable redundancy of the interconnected pathways that do exist. Ecosystems are highly vulnerable to the reverberating fluctuations that over-coherence might entail, and they can sustain complex functional relationships only if coherence is reduced to low levels.¹ Human social systems often involve appreciably more coherence than natural ecosystems.² The coupling of social systems with ecosystems might well be expected to place strains on ecosystems, and even social systems are not immune to the potential destabilizing tendencies of excessive coherence. Human social systems obviously display coherence to varying degrees, but for analytical purposes, it is useful to isolate two broad categories of societies, the one distinguished by an avoidance of coherence, the other by attempts to accommodate coherence on a considerable scale. This distinction may mark a threshold with significant implications for the study of societal evolution³ although the empirical possibility and theoretical utility of alternative or transitional societal types should not be ignored. At the very least, the two broad categories to be developed in the present and the following chapter will certainly prove useful in the analysis of Roman frontier regions.

Societies which develop mechanisms for limiting or tempering the effects of systemic coherence will be referred to as interaction spheres or tribal hierarchies. Societies which attempt to develop mechanisms to cope with coherence will be referred to as state societies or societies dominated by bureaucratic structures.⁴ The discussion that follows will focus on some of the general features of state societies and particularly on features that promote instability and imperfections in control. A convenient point of departure is to specify the nature and importance of control in complex organizations.

In English, control has two meanings, to rule over or command and, more modestly, to check or verify. The second meaning has proved quite useful as a technical term to describe the role of communication flows in complex systems such as bureaucracies.⁵ In this technical sense, control involves comparing what actually happens against some model or standard of what should be happening, noting the difference if significant, and making this information known. This information can then be used to form the basis for appropriate responses or remedial actions on the part of components within a complex organization. Control presupposes channels of communication capable of passing along meaningful information. Often, these communication channels can be tacked on to existing systems, but oftentimes, communication channels may become associated with separate, specialized control mechanisms or functionaries.

Efficient control offers the best way for a complex organization to coordinate its activities, and, significantly, the more effective

the control mechanisms, the less is the need for reliance on direct physical compulsion, supervision, or intervention. The ways in which control mechanisms are organized can put considerable strains on their abilities to exercise effective control either over their own operations or over the affairs of the larger systems they are charged with regulating. The potentials for such strains are especially pronounced in the case of bureaucracies and societies dominated by bureaucratic structures.

The control mechanisms of most complex human social systems are highly centralized, involving many pyramidal levels of decision making institutions and functionaries. Such bureaucratic organizations form rather top heavy, vertical affairs, so that the control decisions of the higher orders can have drastic impacts on other system components. Centralization places a great responsibility on higher order control mechanisms, whose actions should, to insure long term stability, enhance the viability of the total systems of which they are parts. The alternative to good centralized control is progressive systemic transformation, potentially of an unplanned, chaotic sort that may prove deleterious both to stable social relationships and to stable relationships with other systems, e.g., ecosystems or neighboring societies that form the environments of a given complex social system. A system whose own structural features threaten both its own viability and the viability of its environment may be viewed as maladaptive.⁶ Maladaptation is a common occurrence in centralized, bureaucratically dominated social systems.

Centralized systems of any sort seem to be prone to imperfections of control,⁷ and centralized social systems are certainly no exception. Good control entails that information be efficiently communicated up and down a multitude of control levels. Good control is jeopardized if information flow is too slow or lacking altogether. The flow of information may also be so fast that decision makers are swamped by data. This is especially the case when such data becomes so over-selective or spotty that the communication of the obvious becomes a useless annoyance. Whatever its pace of transmittal, spotty or inadequately selected data may lead to poor control. Incomplete information transmitted to higher levels may give a misleading picture of what is actually happening, and information subsequently transmitted back from higher levels may be rendered equally misleading. The initial information garnered from individual components may not be totally wrong, but frequently, insufficient information may be garnered from the whole range of lower levels. If intermediate level functionaries are content to pass on this spotty data, errors in control are magnified at every stage of transmission. The information content of highest order control decisions based on such data may then be subject to a further round of distortions as it is transmitted back down the hierarchy. Centralized systems are often so internally specialized that control functionaries are liable to focus their attention too exclusively on narrowly defined fields where their competence is greatest. If the division of labor is defective or if information is somehow misrouted through lower levels, then chaos,

not control, may be the result. In simple terms, the system may drown in red tape and buck-passing, oblivious to the fact that anything is wrong.

Centralized systems often promote a blinkered view of reality, leading higher order control mechanisms or role holders to confuse their own interests and goals for those of larger, more inclusive systems. Emperors and kings have predilections for statements such as "the state is me," but such hubris is by no means limited to the apical levels. Lower order functionaries may covet the strategic heights. This may lead lower order personnel to meddle with control functions beyond their sphere of competence. They may meddle unintentionally, but whatever the motivation, highest order functionaries may be deprived of information or of the means to relay control decisions. If the ills of meddling and self-promotion are extreme, kings and emperors may be forced to take up the slack by meddling themselves with lower order functions. The solution may also take the form of departmental purges or the creation of parallel bureaux. All these expedients may be at the cost of reduced efficiency, and all these expedients are more cosmetic than remedial. Such strategies work less to eliminate control imperfections than to turn the game to a particular functionary's advantage. This perennial gamesmanship promotes competition and rivalry. It confirms highest order functionaries in a myopic view of their own importance and encourages rounds of coups and counter-coups by self-promoting underlings.

Even when total societal goals are not overspecified as a result of self-promotion, the specialization often associated with

the bureaux and departments of bureaucratic structures creates the potential for maladaptation, especially if this specialization spills out beyond the bounds of the control mechanisms themselves. To articulate with the specialized control feelers of a bureaucratic structure, societal or ecosystemic components may themselves become highly specialized.⁸ The complicated productivity balances of a mature ecosystem may be supplanted by the more readily ascertainable harvests of a monocrop agricultural system. The complexities of village life may be simplified or ignored to speed estimates of tax proceeds from a peasantry. In the process of accommodating to the divisions of labor favored by bureaucratic control, subsystem autonomy is sacrificed. Mature ecosystems prospered before man even existed as a species. A preindustrial peasantry's agricultural systems could not survive even one year without human intervention. A village of primitive swiddenists might be relatively self-contained while a village of peasants might become dependent for their survival on bureaucratically mediated tenurial rights. So long as control proceeds smoothly or nothing goes wrong, the coordination of such coherent systems may not be jeopardized. However, pervasive mutual interdependencies mean that variations affecting one component may reverberate through the whole system. Bureaucracies sometimes have enough trouble keeping their own houses in order: the task of keeping tabs on everything that happens presents an imposing task. Since bureaucracies are prone to place a high value on their own survivals, the interests of total societies may well be sacrificed when the limits of control are exceeded.

Ecosystems and peasantries may then be left to bear the full brunt of these imperfections of control.

When control fails, bureaucratic structures often fall back on command, i.e., the use of brute force to manipulate events to their liking. The jargon of sociology is replete with phrases such as economic power, social power, and, most particularly, political power, and periodic recourses to power and coercion are ubiquitous in the histories of centralized, bureaucratic structures. Both the descriptive phraseologies and the record of actual events are indices of the precariousness of control within bureaucratic structures and, potentially, within more inclusive social systems or even socio-ecosystems.

Bureaucracies have been hailed by sociologists such as Max Weber as technically superior to all other forms of corporate organization. "Precision, speed, unambiguity, knowledge of the files, continuity, discretion, unity, strict subordination, reduction of friction and of material and personal cost -- these are raised to the optimum point in the strictly bureaucratic administration."⁹ Strict subordination aside, bureaucracies as conceived in classical Weberian theory are frequently deficient on all these scores. Perhaps the most eloquent witness to these deficiencies is to be found in the writings of modern business administrators and organization specialists.¹⁰ The features of the classical model do conform to the features of most bureaucracies until very recent times. Corporate churches, states, and military forces still approximate very closely to Weber's notion of how bureaucracies should be set up. Modern businesses also

set out to model themselves on classical lines, but in the past few decades, the best minds of business have been actively engaged in attempts to implement alternatives to a strictly bureaucratic organization since such organizations lend themselves to all manner of gross inefficiencies.

In bureaucratically organized businesses, top managers tend to spend so much of their time tinkering with the affairs of their subordinates that they neglect their true responsibilities, which are to monitor relationships with persons and entities, e.g., customers, stockholders, lawyers, bankers, politicians, and labor leaders, that are beyond the range of active command, but whose control is, nevertheless, vital for corporate survival.¹¹ This dereliction of "environmental" responsibilities is facilitated by the narrow spans of control allotted top executives. Well intentioned efforts to limit the number of subordinates a manager has to monitor do not necessarily result in increased control.¹² More commonly, excessive organizational levels are added that run up costs and frequently become clogged by red tape if adherence to the strict rules of formal, rational-legalistic procedure are emphasized. More often than not, the official hierarchical rules are tacitly ignored, with business proceeding on the basis of more informal and friendly work groups. The informal norms worked out during coffee breaks, office parties, or luncheons get around the military discipline of strict subordination, merging levels into cooperative, interlocking associations.¹³

Traditional theory teaches that jobs should be highly specialized, with persons fitted to narrowly defined tasks and spheres of

of competence.¹⁴ If trouble arises, the jobs should be more carefully described and the personnel more carefully screened. In practice, overspecialization renders bureaucracies over-rigid.¹⁵ Inter-departmental communications are hampered since no one knows (or is expected to know) what other bureaux are doing. If changing market conditions or corporate mergers necessitate major reorganization, it is difficult to retrain existing personnel to their new duties. Even given a static division of labor, overspecialization, since it engages only fragments of a person's skills, abilities, and attention, results in worker apathy and poor productivity. Sustained efficiency often comes to hinge on a high turnover rate, getting rid of anomie by periodic shake-ups and purges.¹⁶ However, as one scholar has remarked, "traffic jams are rarely improved by firing drivers or telephone switchboards by firing operators."¹⁷ Weber praised bureaucracies, arguing that "the fully developed mechanism compares with other organizations exactly as does the machine with the the non-technical modes of production."¹⁸ Unfortunately, while inefficiencies in mechanical systems can be eliminated by re-engineering the components, human beings cannot be redesigned at will so easily. Management specialists now advocate adapting jobs to the skills of individuals rather than fitting people to jobs. The result is not only more "humanistic," it also results in greater job efficiency.¹⁹

One of the central tenets of bureaucratic organization is subordination.²⁰ Many business administrators would now argue that this tenet is also counter-productive. Strict subordination results in line organization, with top managers, middle managers, and so on down

a chain or line of authority and responsibility. Line organization frequently encourages a filtering of communications moving upwards.²¹ In traditional bureaucracies, a subordinate's future in a firm may hinge on how well he senses and communicates to his boss material that fits the latter's expectations. Strict adherence to the line principle breeds obsequious yes-men and renders communication meaningless. The ideal top manager in classical theory is supposed to possess the uncanny power to "know in its entirety what is intended and know it so clearly that he can see the end from the beginning."²² In traditional bureaucracies, a top manager has to have such god-like powers since, if problems develop, his cowered subordinates would hardly complain unless the onus of guilt could be pinned on someone else.

Even when the ills of subordination do not reduce an organization to non-communicative toadying or inter-bureau sabotage, traditional bureaucracies may still perform inefficiently. Weber felt that bureaucracies were more efficient than non-rational modes of corporate organization since the former could freely delegate authority while the latter types were trapped by the ascriptive straightjackets of traditionalism and patrimonialism.²³ Unfortunately, delegation in itself provides no guarantee that productive, efficient solutions to given problems or goals will emerge.

Delegation does not necessarily entail planning.²⁴ A top manager may assign a subordinate a task, but usually the subordinate is left to himself to do it. This may leave the subordinate unclear

as to exactly how the task should be accomplished, and frequently, the selection of a specific alternative may hinge on purely personal criteria conceptualized within the context of the ends of a specific, highly specialized department. Lost in the shuffle may be the interests of the firm as a whole. The mutual compatibility of the activities of different departments may be left entirely to chance. Delegation and subdelegation are possible all along a bureaucratic hierarchy, so that the chances for conflicts of interest within and between departments are multiplied. Overspecialization may blind lower echelons to the sources of friction, and strict subordination may deny any due process for raising grievances. At the lowest levels, the cumulative subdelegated chaos may be so intense as to render the claim to rational-legal organization a myth. Lower echelons are usually ignored in the formulation of general policies, and repeated, often ad hoc, subdelegation can create situations where employees are at a loss as to what constitutes proper procedure, much less what constitutes efficient procedure. Lower echelons may frequently be too apathetic or too cowered to ask for formal clarification.

If organizational solutions emerge, they commonly do so by an almost random process of bickering and petty competition.²⁵ For instance, in modern firms, lower order executives often cultivate what has been called the myth of the middle management entrepreneur.²⁶ Duties and responsibilities are seen only through the screen of a narrowly specialized subordinate niche, and the preferred solutions to organizational problems take the form of individualistically enhancing the performance record and power of one's own department

at all costs. Easily realized goals may be sought out while thornier assignments are avoided and pawned off on other departments if possible. Organizational equilibrium may then take the form of a delicate stasis between underlings jockeying to hold onto or enlarge some safe territory. Higher management recruited from lower levels may spread this syndrome throughout a firm, and top management may have to resort to draconian tactics to coordinate the conflicting aspirations of managers. As one scholar has remarked:

The bureaucratic system ... gives rise to so many coercive abuses that it often becomes an organizational jungle, devoid of a code of behavior... Because the bureaucratic model is essentially an unplanned decision making process, serious and persistent management problems arise.²⁷

Max Weber argued that there is no intrinsic difference between the bureaucratic activities of states and the management of private economic enterprises.²⁸ Weber was probably right. Having dealt at some length with the inefficiencies of bureaucratic businesses, it would seem ludicrous to count the bureaucratization of state societies as a necessary virtue. This eventuality may be a necessity in highly complex societies, but it is a necessity fraught with infortunate potentials. Certainly this was the case in the long struggles involved in the bureaucratization of Rome. Rome's tragedy during the Republic hinged on her difficulties in making the non-bureaucratic machinery of popular assemblies, a citizen militia, and an aristocratic magistracy bear the brunt of bureaucratic service as Rome expanded from a city on the Tiber

into a Mediterranean state. Rome's organizations difficulties then became the problem of all the neighboring societies with which Rome came in contact. Among these groups were interaction spheres, types of societies that came to form the building block of the Imperial frontiers in Northwest Europe.

CHAPTER V

INTERACTION SPHERES

In the last chapter, it was argued that complex societies dominated by centralized control mechanisms are prone to various types of maladaptive processes potentially jeopardizing not only the stability of bureaucratized structures but of other systems, social and natural, affected by bureaucratic pressures. For the better part of his species history, man has not lived in bureaucratized societies. The present chapter will attempt to gauge the adaptive features of such non-bureaucratic societies. An immediate problem is to designate this class of societies. The most convenient term would seem to be "tribe," but, unfortunately, this word has a number of disagreeable associations.

The Roman tribus from which our English word derives was a perplexingly malleable institution important in voting assemblies used as the sounding boards for a variety of legal, social, political, and military expedients. With the demise of the Republican governmental apparatus, the word tribe all but disappeared. Its revival was not guaranteed until the nineteenth century when it replaced the more neutral gentes or "folk" as a derogatory appellation for all the recently "discovered" primitives, savages, nomads, and barbarians of the colonial world, who were judged by their European masters to be

sadly lacking in the arts of civilization. The supposed rudeness of tribal life was given the stamp of science by various academicians or more dilettantish sorts of an "evolutionary" persuasion, and neither "tribe" nor "evolution" has ever fully recovered from this display of nineteenth century ethnocentrism.¹

Tribe, then, has proved a bothersome technical term, its connotations alternating between a studied vagueness and a dubious precision, both usages ultimately defined negatively and unfavorably in contrast to more "civilized" societies. Positive guidelines for distinguishing tribes have usually amounted to little more than heuristic lists of objectively or subjectively garnered traits used to break up strange assortments of customs, artefacts, or language stocks into convenient classificatory pigeonholes. Efforts to breathe synchronic or diachronic life into such tribal pigeonholes have been plagued by imprecisions. Most commonly, a specious "historical" framework results, whereby vaguely defined constellations of traits are conceived of as tribes or "cultures," and changes in trait constellations are touted as the imponderable migrations or invasions of tribal hordes.² Occasionally, some order is superimposed over these "unrewarding gyrations of barbarous tribes"³ by casting the separate histories against some broader canvas such as the sequence of Stone, Bronze, and Iron Ages met with in European archaeology. Verifying the reductionist simplicity of technological determinism with data based on the unfathomable idiosyncrasies of glottal stops or potsherd rim profiles has proved a frustrating exercise, suggesting pervasive theoretical and methodological

failings.⁴ Such constructions wrestle on the one hand with an unworkably teleological evolutionism and on the other with a wistfully romantic notion of how individual tribes should be defined in space and time.

Tribes almost invariably emerge as neatly bounded,⁵ static collections of traits and trait bearers, whose ongoing sameness is only violated by timely technological innovations or the more drastic kicks of invasions from without or migrations launched from within. Underlying this conventional model are certain vague assumptions about the inertia of primitive societies and the absolute autonomy of groups organized at a stage of natural, household, or domestic economy.⁶ Tribal discreteness, autonomy, and endogamy have often been implicitly or explicitly correlated with various ill-defined and often unsavory racial undertones.⁷ From these and other similar assumptions, it is commonly supposed that a suitably selected range of traits will show a considerable degree of coincidence, both temporally and spatially. Rather predictably, German archaeologists⁸ have been among the most dogged enthusiasts in the game of plotting the whereabouts of ephemeral historic and prehistoric tribes, whose perplexing illusiveness, mobility, and malleability has conjured an equally perplexing set of face-saving epicycles in the form of migrations and invasions.

From lists of atomistic and idiosyncratic traits, it is difficult to approach problems of organization and processual patterning, but it is precisely these problems that must be addressed if the concept of tribe is to have empirical reference. Even the most simplistic models

of a domestic economy, an ideal type devised by nineteenth century historical economists, have usually envisioned a rather complex system of families organized into clans and clans into tribes. The more thoughtful theorists on domestic economies even allowed for a broad range of inter-tribal linkages.⁹ Domestic economies were relatively autonomous only vis-a-vis a carefully specified range of subsistence and craft activities. Otherwise, domestic units were conceived as being relatively open to external articulation though hardly as internally differentiated as modern national economies.

The considerable subtlety of the so-called German Historical School was lost on most subsequent linguists, historians, archaeologists, and anthropologists. Tribal histories have usually been left to founder, then, on naive appeals to the deus ex machina of invasion or migration when appeal to the interplay of hierarchically nested systems and subsystems could have injected functional sense into a drama whose detail has been portrayed as purely random but whose plot has come off as theistically or mechanically determined. The hierarchical organization of tribes, however, is plainly different from that of nation states, but the familiarity and supposed evolutionary superiority of states, "civilizations," and bureaucratic hierarchies has posed and still poses a major obstacle to the recognition of organizational dimensions appropriate to the study of tribal societies. Where tribes seem to boast some degree of organizational complexity, they are invariably hailed as transitional chiefdoms, theocracies, or primitive kingdoms groping toward the higher

evolutionary stage of statehood, and their failures to cross this threshold are viewed as devolutionary relapses into barbarisms or savagery.¹⁰ Only in the past few decades has the organizational sophistication of tribal societies been sufficiently appreciated to challenge this smug unilinealism. Some of the most persuasive evidence has come from the unlikely quarter of archaeology.

Tribal institutions often have an uncanny geographical extent. The best evidence on this score comes from the Eastern United States in association with the so-called Hopewell complex.¹¹ The special assemblages of the Hopewell culture were once thought to represent a series of migrations or invasions spread over time.¹² Gradually, as dating techniques improved, it was recognized that the Hopewellian assemblages were roughly contemporaneous. Hopewell artifacts are common throughout the entire Eastern United States, the best known sites being associated with conspicuous ceremonial mounds scattered along the Ohio watershed. Institutional linkages centering on these ceremonial centers tied together an immense number of village-based intensive hunters and gatherers while other linkages effected articulations of lesser intensity throughout the North American continent.

Large scale survey and excavation programs are beginning to reveal the structural details of these impressive tribal hierarchies. Regional groupings of villagers were subject to long term climatic, ecological, and demographic cycles encouraging ongoing adjustments to maintain suitable man-land balances given the limitations of Hopewell subsistence techniques. Over shorter periods of time, these

adjustments might be limited to exchanges of spouses or resources between nearby villages. Over longer periods of time, depletion of local resources such as timber or game might entail larger scale population relocations. There is also the possibility that major climatic oscillations could change the biotic composition of favored river valley locations sufficiently so that movements involving whole groups of villages were entailed. So long as these changes were not too drastic or rapid, institutional linkages mediated through inter-regional ceremonial centers provided mechanisms to accommodate needed personnel and material exchanges. The regulatory machinery of these inter-regional institutions required its own maintenance as well. Ceremonial centers probably involved small bodies of resident specialists although additional personnel were undoubtedly mobilized as needed from affiliated village headmen. The maintenance of the role and authority structures of these higher order institutions was probably accomplished through various ritual gatherings and ceremonies represented in the archaeological record by the specialized ceramic, lithic, and metallic artefacts found and often manufactured at or nearby the ceremonial precincts. The term interaction sphere has been proposed to describe such supra-regional tribal hierarchies, and in recent years, variants of this model framework have found applications throughout the New World.¹³

Joseph Caldwell, the formulator of the interaction sphere concept, once advanced the hypothesis that many of the more geographically extensive archaeological cultures of prehistoric Europe were probably interaction spheres.¹⁴ Widely distributed high status artefacts, e.g., ornate bell beakers or carefully polished stone "battle axes"

found in burials of the late Neolithic and early Bronze Ages, would reflect higher level institutional linkages corresponding to those represented by the ceremonial goods of the Hopewell complex in the United States. Complex movements of migratory invaders sweeping across Europe could then be replaced by less cataclysmic movements or simply by trade and exchange mechanisms operating within an extensive institutional network. While the term interaction sphere has only begun to make its debut in works by European archaeologists,¹⁵ the model behind the term has been argued implicitly with increasing cogency for over a decade.

In the past, it is fair to say that the whole of European prehistory has been presented as a confusing tapestry of invasion after invasion, augmented at best by periodic waves of "diffusion" from the Mediterranean and the Near East. If a new type of pot or metal ornament appeared in an archaeological assemblage, its prototypes were sought out relatively far afield, and its introduction was reasoned as the result of some tribal migration or the diffusion of Oriental wisdom. Before the development of radioactive carbon dating techniques, relative chronologies for prehistoric Europe were pieced together by complicated synchronisms with artefacts from better stratified or more absolutely dateable sites. This approach encouraged the view that potential points of origin for synchronisms could also be used to plot invasion and trade routes. Until recently, it was assumed that the savages and barbarians of temperate Europe were the perennial borrowers, never the inventors, of everything from agriculture to metallurgy.¹⁶

The advent of new relative dating techniques such as radioactive carbon, which are not dependent on synchronisms, have knocked the foundations from under this convenient truism so that, to cite a typical instance, few people now believe that England's Stonehenge was the work of some wayward Mycenaean prince.¹⁷ Attention has now shifted to the importance of local innovations, local adaptations, and local continuity.

In some instances, it is arguable that this shift of emphasis has been too extreme, so that the possibility of certain significant types of inter-regional ties has been chased away along with unjustifiable waves of diffusion or migratory diasporas. Goods and even people were constantly on the move in prehistoric Europe, and if such percolations were slightly unbalanced, the space of a few hundred years could leave an archaeological trail looking very migratory indeed. The difference between the newer perspective and the more Wagnerian scenarios of years past is that functional backgrounds for population movements are now sought out which are more subtle than the older pictures of aimless wanderings accompanied by the extirpation of indigenous groups overwhelmed along the way. Population movements, exchanges of goods, and the institutional mechanisms that regulated these movements and exchanges probably allowed the maintenance of adequate man-land ratios for hamlet and village based agriculturalists given existing subsistence techniques and ecological tolerances. By the late Neolithic at least, these mechanisms had become sufficiently complex to assume intricate institutional forms,

wide geographical extent, and, occasionally, conspicuous monumental trappings. By the late Neolithic, then, temperate Europe was undoubtedly dotted with interaction spheres, and in the next two chapters, several of these will be explored in the context of Northwest Europe during the pre-Roman Iron Age.

The remainder of this chapter will be devoted to a comparison of the adaptive features of interaction spheres as opposed to bureaucratically dominated societies. As outlined in the last chapter, successful adaptation involves activities that enhance or at least do not jeopardize the viability of a given system and the larger systems of which it is part. Bureaucracies encourage complex divisions of labor while at the same time lessening the control capacities of highly specialized components. The adaptive autonomy of such components is minimized, and if control maladjustments develop, the effects of uncontrolled variations affecting one component may set off undesirable variations affecting other components. The centralization of control mechanisms in bureaucratic structures makes it necessary that the allocation of control functions and priorities be effective. The division of labor of control functions in most bureaucratic structures, however, is less a matter of planning than of a random, muddling series of delegations and subdelegations that all but guarantee lapses of communication and, hence, of control. The competition and rivalries stemming from lack of planning or coordination frequently met with in bureaucracies mean that little attention may be given to the priorities of various control functions.

Bureaucracies are often unable to look out after their own best interests, and, this being the case, they are seldom in a position to worry about the best interests of the larger systems, social and natural, with which they are connected. Nevertheless, even when bureaucratic structures have made a complete mockery of their regulatory roles, they may still be able to maintain themselves for considerable periods of time through the exercise of power.

Societies which can be characterized as interaction spheres are less likely to succumb to imperfections of control. While the lower order systems of interaction spheres are open to influences from other groups, they are not completely dependent on external ties, thus preserving a considerable degree of control autonomy. In the proper sense of the term, lower order families, kin groups, hamlets, and villages form self-sufficient domestic economies. These units may find occasional need -- sometimes pressing need -- for items such as brides, livestock, tools, or grain from neighboring groups, but appreciable latitude is left for budgeting the timing and priorities of such exchanges. A bachelor may remain celibate, a digging stick can make do for an ox-drawn plough, and the meat of farm stock can temporarily take the place of bread. As a consequence, variations affecting one local unit are not likely to have immediate debilitating effects on other units. Interaction spheres, therefore, are not overly coherent. Nor are they centralized. The arrangement of families into kin groups and kin groups into villages is hierarchical,¹⁸ but so many alternative networkings are provided by the alliance systems,

kin systems, age-grade systems, and other sodalities of tribal life that the failure of one link or even a whole series of links leaves ample auxiliary pathways. If a few families perish, their village may still survive. Neighboring villages will almost certainly have survived, and replacements for the original village can be tapped through marriage, adoption, or other means of drawing on pools of unaffected manpower. Likewise, if a village headman particularly offends a specific clan or family, the offended parties can seek incorporation in neighboring villages, or they can hive-off, if all else fails, to form a new settlement of their own.

In case of emergency or recurrent need, tribal hierarchies are capable of spawning higher order control mechanisms, the presence of important control mechanisms operating on an inter-regional basis being the crucial diagnostic of an interaction sphere. Such mechanisms may acquire impressive ceremonial trappings as with Hopewellian temple mounds or as with prehistoric Europe's brochs, duns, and hill-forts. Such mechanisms may form complicated systems in their own right, with special personnel and maintenance demands. Role holders in these higher order systems may even be tempted to bolster their control with the teeth of command. Marshall Sahlins cites a very apt saying of the ancient Hawaiians, whose chiefs were sometimes tempted to "eat the power of the government too much."¹⁹ Chiefs or similar functionaries may bloat their retinues with supernumerary officials. They may carefully husband, even overtax, the resources close at hand or in areas where good transportation makes the exaction

of tribute and the threat of sanctions feasible. Chiefs may even attempt to overawe their would-be subjects by dazzling displays of conspicuous consumption or by swashbuckling raids into restive hinterlands.

In the last analysis, though, chiefs simply lack the resources to back up arbitrary highhandedness: "Exaction by force is no customary gift, nor is pillage the chief's due."²⁰ Subjects can shift alliances, withhold support, or rebel. A chief might try to withhold his control functions, but in tribal hierarchies, the relative autonomy of local units would probably allow them to weather such a boycott better than a chief. For these reasons, chiefs seldom command or wield extraordinary power. Instead, chiefs must content themselves with control.²¹ Periodically, the need may arise for coordinated activities which chiefs can manage better than scattered domestic units, but when the need passes, so does the foundation of chiefly power. The prerogatives of chiefs or other interaction sphere personnel, therefore, have their ups and downs. Far from being retrograde or nonprogressive, these cyclical gyrations play an important role in conserving vital parameters of total societies such as man-land ratios.²² In tribal hierarchies, the needs of the total society have priority over the power of chiefs. The exercise of chiefly power is a convenient mechanism, not an ongoing necessity.

From the above discussion, it is arguable that tribal hierarchies generally operate so as to enhance or at least not jeopardize their own stability and viability. Interaction spheres, then, fulfill half

the specifications of adaptability. To complete the specifications, interaction spheres must not act to jeopardize the fitness of their environments, in this case, the natural ecosystems on which their subsistence depends. On this score, the record of tribal hierarchies is mixed, crucial factors being the success of human populations in holding down their own numbers and the resiliency of the ecosystems themselves.

Tribal groups often practice birth control in forms ranging from infanticide to abortion to abstinence or delayed marriage. If sparsely populated areas are available, families may practice out-migration. Tribal groups are also generally subject to high death rates from disease, accidents, inter-group warfare, or severe famines. In a previous chapter, the high yields from hunting and gathering and from swiddening techniques were outlined as well as the interesting statistic that primitive groups usually underexploit their subsistence potentials by fifty percent or more. Such under-exploitation may magnify local population losses during periodic calamities.²³ Under-exploitation is probably correlated with the obstacles that exist to the use of more efficient, specialized labor parties. Such productive arrangements would give higher yields, but these arrangements would probably require central coordination and control. If this higher productivity were necessary only once in a great while, the segmentary units of tribal societies might balk at such ongoing discipline. The result may be higher death rates and underexploitation of resources, but over the long term, this may have the unintentional consequence of preventing ecosystem degradation.

Tribal strategies would obviously be enhanced in very resilient ecosystems. In fragile environments, ecosystem degradation might be a relatively simple affair. Especially in arid, semi-arid, or Mediterranean climates, natural ecosystems are sometimes prevented from attaining true maturity. It is easy to simplify such biotic communities, and subsistence systems founded on such precarious bases may be perpetually under the threat of poor harvests. To feed himself, man may have to put up with considerable regimentation, pooling of resources, and interdependency. It is hardly surprising that the earliest state systems had their birth in just such fragile environments. In more mature ecosystems, state formation may be thwarted unless it is externally imposed. Temperate Europe is conspicuous for its late development of state systems as compared to the Middle East or the Mediterranean. This is sometimes attributed to an unpropitious climate and primitive technology.²⁴ The truth may be quite the opposite. Highly productive ecosystems capable of high yields from simple swiddening techniques would make states an unnecessary and unwanted luxury. By the time Rome began to push into temperate Europe, however, millennia of use and misuse had severely reduced the extent of climax forest. The remaining ecosystems were often less productive, at least harder to manage. Under these circumstances, a variety of perturbations could undermine the viability of tribal hierarchies or the ecosystems on which they depended. These perturbations could come from within or from without existing interaction spheres. With the advent of Rome, the balance was tipped toward the external sources.

CHAPTER VI

IRON AGE BASELINES AND THE ROMAN ADVENT

Roman frontiers generally emerged in the midst of pre-existing interaction spheres, where the exercise of military force could be bolstered by the leverage of lines of tribal articulation and exchange. Knowledge and calculated manipulation of the institutions of less politically sophisticated neighboring groups by preindustrial state systems has undoubtedly been common. Appreciable acculturation and modification of the less advanced groups has also been a common outcome. In the case of Rome, what is striking is the extent of the acculturative changes.

The creation of Roman frontier marked a crucial turning point in the history of temperate European societies. This observation is rather obvious for areas such as Gaul that underwent provincialization, but its real thrust is aimed at non-provincialized on and beyond the frontiers. Roman contact restructured these non-provincialized areas too, perhaps even more thoroughly than was the case with the more fortunate provinces. Before the Roman advent, temperate Europe was dotted with types of societies that can be most conveniently called interaction spheres. After the Roman advent, non-provincialized temperate Europe was thoroughly barbarized. Before the Roman advent, temperate Europe boasted a number of relatively well

ordered, stable, and well adapted tribal hierarchies. After the Roman advent, one is in an unsettled heroic age,¹ where cohesive societies are all but impossible to distinguish.

Roman contact with other groups, while seldom completely benign, had not always had these pronounced destabilizing consequences. The early growth of the Roman Confederacy in peninsular Italy had involved the welding together of a number of leagues, city states, and tribes through a variety of political, military, and economic ties centering on Rome.² A case could be made for seeing this confederacy as an amalgam of various sorts of pre-existing interaction spheres, perhaps as an interaction sphere itself. From Bronze Age times at least, population growth spilling over into the highland regions and lowland plains of Italy had necessitated a complicated set of dependencies involving shared summer and winter pastures.³ These interdependencies often extended further to various types of crop specializations. Hill farms, with their more predictable winter cool spells and milder summers often offered the best places to grow winter grains, while the lowlands were best suited for interculture produce such as grapes, olives, and other tree and vine crops.⁴ In the course of the Iron Age and into Classical times, these basic subsistence interdependencies were often preserved, even in the face of the progressive urbanization of the lowlands. In fact, urbanization, given a giant boost by the Greek colonization movement, may have simply increased the degree of interdependence and specialization, adding to the pre-existing tangle of alliances

by merchant contacts between lowland towns.

In the aftermath of the Latin Wars, Roman contacts began to expand outside of Latium. The fairly rapid pace of Roman expansion after this date is sometimes attributed to some primordial bent for imperialism.⁵ A better interpretation is that having become caught up in an initial set of open-ended relationships, an ever wider set of involvements was almost inevitable. Indeed, during her early history, Rome showed a considerable subtlety in fashioning a whole complex of ties with her neighbors, e.g., Latin rights, civil rights without full Roman franchise, etc. Rome showed far more ingenuity in extending citizenship rights in her confederacy than did other Mediterranean groups such as the Greeks, and given this early precociousness in accommodating herself to neighbors showing a considerable heterogeneity in cultural, economic, and political development, Rome's subsequent crudity in her relationships with frontier groups is at first glance somewhat startling.

The unification of Italy was followed by the ordeal of the Punic Wars and the steady growth of large-scale provincial acquisitions throughout the Mediterranean. Rome's treatment of her burgeoning imperial provinces was sometimes as clumsy as any treatment met with along her frontiers. One of Rome's signal features was her relative poverty of full-scale state apparatus. The Roman Confederacy in effect had no legal institutions other than its army: no council, no magistrates, no administrative bureaucracy.⁶ The peninsular confederacy had been held together less by ordinary public institu-

tions than by a set of patronage ties centering on prestigious men and families holding posts in the city of Rome. These patronage ties had a religious aura attached to them, and this religious aura was deemed more binding and more efficacious than any secular law.⁷ Such networks of patronage and clientship worked fairly well while Rome's interests were centered on Italy. As Roman interests expanded throughout the ancient world, these extra-governmental channels became more difficult to organize and coordinate, but still, well into the late Republic and even into the Principate, a surprising amount of Rome's public dealings with her provincial dependencies had to adapt themselves to the exigencies of individually mediated ties of patronage.

The longevity of recourse to these patronage ties probably had much to do with the fact that by the end of the second century B.C., even the Roman army had lost its public basis. The old citizen armies were replaced by volunteer levies, and these levies were charged to prominent generalissimos holding special commands. These special commands often involved operations covering regions as large as whole kingdoms or whole blocks of provinces.⁸ The patrimonial staffs and personal contacts of these late Republican generalissimos frequently rivaled the size and scope of the governmental machinery of Rome, and in the civil wars of the first century B.C., much of this older governmental machinery was to be swept away or subsumed by the institutions of these over-inflated private armies.⁹

The civil wars brought into existence the largest military machine the ancient world had ever known, and the price that the

Roman Empire paid for an end to the incessant altercations between rival generalissimos was the permanent maintenance of this enormous military complex. The military clout of the princeps allowed the political unification of the entire Mediterranean Basin, but the tax revenues of these imperial core regions were stretched to the maximum to provision so many standing armies and to provide for other types of government functions. Generalissimos such as Sulla or Pompey had despaired at the task of maintaining hundreds of thousands of troops, one of the crucial problems being how to pension off retiring veterans with suitable stipends and grants of land. The logistics of provisioning standing armies concentrated in any one part of the empire was also nightmarish. Large concentrations of troops within the Mediterranean core were also a temptation for ambitious subordinates, a syndrome made obvious by the checkered careers of the two uneasy triumvirates of the late Republic. Finally, while Augustus and his successors often treated the old Republican institutions with a certain brusqueness, the empire could not be effectively run by the constant exercise of force as a military dictatorship. It took decades before the emperors' patrimonial bureaucracies could shoulder enough of the burdens of civil administration to dispense with the mechanisms of patronage and clientship¹⁰ centering on the Italian gentry and provincial aristocracies, and, indeed, to a certain extent these mechanisms were never entirely supplanted. These mechanisms could not work very well in an atmosphere of overt martial law. At the least, an emperor's mailed fist had to be veiled,

and one of the best ways to accomplish this was to neutralize militarily as much of the Mediterranean core as was possible.

As a result, newer provinces or areas removed from the Mediterranean core began to assume the status of military dumping grounds.¹¹ This softened the aura of military dictatorship in the Mediterranean core and also served to remove many of the burdens of supporting the legions and auxilia from the more stable regions of the empire. The core provinces were relieved of a large share of the responsibility of feeding and supplying the armies, and over time, they were even relieved of the responsibility of supplying recruits. Non-core provinces and marcher regions also provided convenient places for pensioning off retired veterans. Buying land or creating new colonies within the Mediterranean core was a tedious and expensive business. It was much easier to come by lands in non-core areas, and colonies of veterans provided a convenient leaven of Roman or at least romanized personnel and their descendants to tap for provincial and imperial administrative positions. Military roads, aqueducts, and settlements could often be converted to civilian use, and in many regions, e.g., southern and central Gaul, where pre-Roman economic and political development had provided a suitable foundation, a short period of duty as a military dumping ground might subsequently warrant elevation to core status. Where this was possible, the military machine was best moved onward to some new advance position.

In this fashion, the empire's ranks of core provinces could be slowly expanded, but this pattern of genuine provincialization

soon began to reach certain awkward thresholds. Provincialization was seldom successful in regions that had not boasted a considerable degree of sophistication before Roman occupation. In much of the eastern Mediterranean, Rome had inherited Hellenistic kingdoms that had usually been far more sophisticated than the Italian allies of the Roman Confederacy. Provincialization was also a relatively easy matter in the more developed portions of Carthaginian Africa and Spain and in regions of southern Gaul long associated with Greek colonies such as Massilia. Incipient state systems in much of the remainder of Gaul and in Lowland Britain facilitated the provincialization of these regions. Where Rome did not meet with sophisticated city states, pre-existing kingdoms, or incipient states, her record was less satisfying.

During the Republican period, the Roman experience in backward places such as Illyrica, Sardinia, and the central plateau of Spain was a dismal spectacle of mismanagement marked by native uprisings, guerilla warfare, and grisly, scandal-ridden military repression.¹² From the very beginning of the Principate, most of the areas chosen as military dumping grounds were relatively backward by the standards of the existing core provinces, and as the military zones moved forward, the newer regions often became ever more primitive. The Romans almost definitely expected military arenas to foot a substantial portion of the costs, material and social, of the armies. This expectation meant that prospective military zones should possess a certain amount of institutional and

economic sophistication that could be tapped to the military's advantage. Regions inhabited solely by extremely primitive groups were thus unsuitable as military dumping grounds. Regions boasting the closest approximations to state systems as possible were preferred, but where these conditions were not to be found, suitably sophisticated tribal groupings would do. In temperate Europe, this meant interaction spheres.

The task of fully establishing this proposed correlation of frontier zones with pre-existing tribal hierarchies would be enormous, demanding a more extensive knowledge of the Iron Age and Roman period than the present author, or perhaps any author, possesses. Within Northwest Europe, however, the correlation would seem to hold true as can be seen from a brief consideration of two of the best known Roman frontier regions, the Rhenish limes, especially along the middle Rhine, and the frontier in Northern Britain. Confirmation of my proposed correlation requires the refutation of the ubiquitous notion that limes systems such as those on the Rhine or along Hadrian's Wall were efforts to seal off hermetically the world of the empire from the barbarian world beyond.¹³ The military hardware of a Roman frontier was most commonly seeded squarely in the center of pre-existing lines of interaction sphere articulation, an assertion not so controversial in the case of Northern Britain, but possibly surprising in the case of the Rhenish frontier. If my hypothesis is correct, then, the Rhine was the backbone and the central focus of a pre-Roman tribal hierarchy, not a boundary and not a line of demarcation. An analogous case must be made for Northern Britain.

The Rhine is frequently assumed to have separated the pre-Roman Celts from the pre-Roman Germans.¹⁴ Germany, it is argued, lay beyond the Rhine, and Rome simply perpetuated this division after Varro's undoing in the Teutoburgerwald. These received views have never met with complete unanimity, and in the last decade or so, they have been sharply and persuasively criticized. The emerging revisionist opinion is that Germania was the Rhine watershed, at least the middle reaches of this watershed, and that only an unwarranted attempt to push back as far as possible the linguistic differentiation of Celts and Germans has prevented modern scholars from recognizing where and what Germania was.¹⁵

The use of rivers as boundaries is a contrivance of land surveyors or governmental functionaries living in bureaucratic societies.¹⁶ Rivers seldom divide in a tribal context, such functions falling more commonly to deserts or mountain ranges. In a tribal context, a watershed or collection of linked watersheds often form a natural unity. The Rhine watershed, from the foothills of the Alps to its lower reaches on the North European Plain, forms just such a unity, providing a natural network of communication and travel set within encircling rims of mountains, hills, and plateaux. The Rhineland is still a recognizable entity in modern, industrialized Europe, and one might well expect some similar degree of homogeneity and interconnectedness in prehistoric times.

Discussion of the prehistoric period is complicated by the lack of an unambiguous scholarly vocabulary.¹⁷ Words such as Celtic, Germanic, or Teutonic are tainted with Romantic and nationalistic

overtones and are commonly used to foist upon the reader a sense of cultural, linguistic, and perhaps racial discreteness that has simply never existed. These emotive entities, the Celtic and the Teutonic peoples, have then been read back into the remote past, where for Caesar or Tacitus to have met with and distinguished between around the beginning of the Christian era.

Both Caesar and Tacitus found peoples living in Germania, but a careful reading of their accounts is a frustrating experience for all but the most ardent Celticists or Germanists. Linguistic criteria have traditionally comprised the touchstone used by modern scholars to distinguish Celts from Germans, but ancient authors such as Caesar or Tacitus either had no ear for linguistic distinctions,¹⁸ or else these distinctions did not always exist. A large percentage of the proper names of "Germanic" leaders in the first centuries B.C. and A.D. are unabashedly Celtic in form. So are the names of many of the tribes and most of the places of which we have notice for this early period.¹⁹ The word German itself is probably derived from the name of a Celtic tribe,²⁰ and Caesar's catalogue of Germanic tribes reveals a curious focus on and about the middle Rhine, with many of Caesar's Germani already on the left bank of the Rhine. From the testimony of Caesar, one might well be tempted to conclude that the Germani were a group of middle Rhenish Celtic speakers whose demographic focus had slowly been shifting to the western banks and tributary watersheds of the Rhine. More Teutonic collective names begin to filter in with Tacitus' material, but while Tacitus at times gives the impression that the control of Germania by Teutonic speakers

was a long accomplished fact,²² it is interesting to note that the Tungri, who for Tacitus played a pivotal role in giving the Germani their Teutonic mould,²³ are not mentioned at all by Caesar. It would appear that the teutonization of Germany did not begin until after the time of Julius Caesar and that, curiously, Germany was a pre-existing entity of considerable antiquity with extensive outliers on both banks of the Rhine.

In recent years, archaeologists have made important contributions in fleshing out our notions of Germania around the time of Roman contact. Analyses of funeral assemblages, pottery, and settlement complexes such as hill forts reveal a network of culturally similar groups with roots going back chronologically into the La Tene Iron Age and with a distributional focus centering on the region between the Lippe and the Main.²⁴ As one moves north of the Hernycian Massif onto the flat expanses of the North European Plain, hill forts, not surprisingly, become rare. This lower Rhenish area was the focus of North Sea groups such as the Frisians. This North Sea area and its hinterlands will be discussed in more detail in the next chapter, but here it worthwhile to note that these lower Rhenish groups show a cultural and probably a linguistic continuity going back to the late Bronze Age and that this region had not been altogether teutonized even as late as the third to fifth centuries A.D.²⁵ The Iron Age Frisians were dubious Teutons, and this is even more the case with groups southward of the Lippe River on the middle Rhine. The hill forts of the middle Rhenish groups were not as grand as those in Gaul, and there are fewer signs of the emergence of large urban

complexes or states. The quality of middle Rhenish pottery and metalwork also falls somewhat below the standards of perfection achieved in Gaul, but these technical imperfections are not radical, and in the past, many middle Rhenish items have been cursorily dismissed as Gaulish imports. Imports there were, but these middle Rhenish groups were apparently on a cultural level not far inferior to the Gaulish groups met with by Caesar.

Once one has learned to distinguish the middle Rhenish assemblages from those of Gaul, it is rather easy to distinguish both these classes of assemblages from the true, Teutonic Germans. The heartland of the Teutonic Germans are usually placed around the shores of the Baltic.²⁷ Archaeological finds for the pre-Roman period in these areas are rather unsatisfying, consisting primarily of mortuary structures and their contents. Such assemblages as we do have are often conspicuous for their lack of almost any locally produced artefacts. It is as if these Teutons had no culture of their own. This impression is largely due to an archaeological bias that gives more attention to highly crafted and readily distinguishable articles that can be worked up into accurate typologies and chronologies, and these were the very types of articles that the ancient Teutons apparently thought most appropriate to include in their burials. The Teutonic Germans did possess a rudimentary subsistence technology, but even when allowance is made for the highly skewed nature of the archaeological record, the conclusion must be that these Germans were a rather primitive lot. Almost everything that is highly

wrought turns out to be an import. These, then, are the true Germans, whose hallmark is a near absence of material culture.²⁸

Caesar had in fact seen or heard about some of these bona fide Teutons, e.g., the Suebi.²⁹ Caesar did not think too highly of the Suebi, whose seemingly primitive agriculture and bellicose ways made them difficult and unrewarding to treat with or to conquer. Not all the groups in the vicinity of the Rhine and its tributaries were so primitive or so unlucrative as conquests. In fact, under Ariovistus,³⁰ several Rhenish-Germanic groups acting in concert proved sophisticated enough to check Caesar's advances. Perhaps because of these reverses Caesar attempted to give groups beyond the Rhine such as the Chatti and Cherusci³¹ as bad a reputation as the Suebi. Indeed, the Germani as a whole were denigrated by Caesar, and Caesar and later authors began to use the term German in a perjorative sense, so that the inhabitants of Germania became tainted by the imperialistic uselessness of the Teutons.

Still, in Caesar's day the majority of the Germani had relatively little to do with the artefact-poor Teutons of the North European Plain and the Baltic littoral. These prehistoric Rhenish groups are frequently called the Zwischenvoelker³² to distinguish them from the Celts of Gaul and from the Teutons. The Romans did not deem the Teutons worth conquering while the Zwischenvoelker seemed as lucrative a prize as had most of Gaul. The conquest of the Zwischenvoelker had barely begun under Caesar. By the time of Tacitus, their conquest, at least after a fashion, had been completed, but in the process fully half of Germania had become seeded with "Teutons" of a sort, and Ger-

mania across the Rhine became a land of peoples signally lacking in material culture. For the original Teutons in their Baltic homelands, this may have been a perfectly tolerable condition.³³ For the inhabitants immediately east of the Rhine, teutonization was a tragedy of the first magnitude. This tragedy is usually laid to invasions by Teutonic Germans.³⁴ The real culprits were the Romans, who broke the back of Germany under the Augustus in one of the most wretchedly botched conquests in all of history.

Augustus' German campaigns are among the murkier aspects of ancient or modern historiography, and much of the confusion is reducible to a misunderstanding as to what it was that Augustus set out to conquer. A common received view is that Augustus set out to conquer the Germans east of the Rhine in Germania.³⁵ This is a largely meaningless proposition. By Germans, the received view implies Teutonic speaking groups. By Germania, the received view envisions only the region beyond the Rhine eastward to the vicinity of the Elbe. The problem is that the true Teutonic Germans were not the most desirable of conquests, that the region to the east of the Rhine is only part of Germania, and that the major population groups of Germania were not at that time genuine Teutonic Germans. Augustus did not set out on an anthropological excursion among primitives. He wanted to carve out a province or provinces from Germania in the same way his adopted father had carved provinces out of Gaul.³⁶ The heartlands of the primitive Teutonic Germans lay on the morainic plains along the Baltic. Augustus did not set out primarily to capture these Germans. Augustus did set out to capture the more sophis-

ticated Zwischenvoelker and the whole of their territory, i.e., the whole of the Rhine watershed, i.e., Germania.

Augustus' decision to commence a large scale campaign is frequently painted as a reluctantly undertaken strategic ploy designed to secure a defensively safer position on the Elbe.³⁷ Underlying this assumption is the notion that all of Germany was sunk in acephalous primitivism. Imperial propaganda down through A.D. 9 did not paint the campaigns in such a defensive posture.³⁸ In fact, one gets the impression that Augustus was out to emulate, perhaps outdo, the achievements of Caesar in Gaul. Caesar's glory had been the conquest of potential provinces, not the laying out of Maginot Lines, and Augustus' intentions must surely have been along similar lines. Modern scholarship, and perhaps even ancient authors writing after the mid-first century have been thrown off by the stereotype of trans-Rhenish Germany as a sea of impoverished barbarians. This was not the case at the commencement of Augustus' campaigns. The Rhine watershed was as prosperous as much of Gaul had been in the time of Julius Caesar. From Caesar's time, the Romans had had a tenuous foothold in Germania among groups such as the Treveri along the Moselle. Under Augustus, a three-pronged attack was launched on the lower Rhine, the Lippe, and the Main.³⁹ The whole of the central axis of Germany quickly fell into Roman hands, and the campaign came to center on securing the major tributaries and their intervening plateaux and hill lands. Archaeological finds have shown that the major tributary watersheds were solidly festooned with base camps and marching camps as early as the death of Drusus in 9 B.C. Drusus' demise

and the troubles experienced by his successors with stubborn groups such as the Cherusci are frequently interpreted to mean that the Roman hold was still ephemeral, but scholars such as C.M. Wells have recently concluded that by the time Tiberius retired to Rhodes in 6 B.C., Germany was ripe for provincialization, with only the administrative chores of setting up taxation left to be accomplished.⁴⁰

The long Roman indecision as to the disposition of Germany after 6 B.C. may have been largely due to problems along the Danube, where the Bohemian kingdom of Marbodius absorbed an unexpectedly considerable portion of Roman diplomacy and generalship. The increasingly strained relations between Augustus and Tiberius also diverted imperial attention from Germany. Frontier policy on the Rhine seems to have been left somewhat indecisively to commanders on the scene. Imperial initiative was not really apparent again until around A.D. 6 when Tiberius returned to assume the Rhine command. Germany was quickly pacified, but then attention shifted to the Danube and subsequently to Pannonia and Illyrica where a determined series of revolts erupted that took some three years to suppress. Meanwhile, Augustus had entrusted a relatively placid Germany to L. Quintilius Varus. Varus is often denigrated as a "sublimely unmilitary general,"⁴¹ who was handed the Rhine command as the result of his marriage to a great-niece of Augustus. Nepotism was hardly new in Roman politics, and in itself is hardly grounds for denigration. In addition to his family connections, Varus had had a respectable career in provincial administration, and Varus had probably received the nod in Germany as an administrator, not as a general.⁴² Varus' force of three

legions was in fact quite large for a governor by Republican standards.⁴³ Three legions were more than enough for sheriff duty, and this was all that Varus or Augustus had envisioned. Sometime before A.D. 9, an altar to the cult of Augustus was set up at Cologne. This altar and its trappings seem very similar to a previously established cult center at Lugdunum, which had become a cultural and administrative focal point for Gaul.⁴⁴ The implication is that Germany seemed safe, and as Varus set out in A.D. 9 for a military promenade in the wooded hill country somewhere to the east of modern Koblenz, an ambush at the hands of the renegade Cheruscan auxiliary Arminius was the last thing the Romans expected.

Occupied with problems elsewhere, the Romans could not immediately respond, and by the time Tiberius reassumed the Rhine command, nearly all the positions across the Rhine had been lost. The next few years were dominated by Augustus' attempts to transfer his powers to a successor without sparking another civil war. Tiberius hardly had much zeal for wars in Germany, and after A.D. 14, when the title of Germanicus came to lodge like a sore in the ambitious progeny of Tiberius' brother Drusus, the new emperor not unexpectedly showed little enthusiasm for letting potential rivals retake the lost ground. By the end of the 20's A.D., the bravado of Drusus' son had helped fuel simmering revolts by tribute peoples on the lower Rhine and several army mutinies or near mutinies, but little else. The Romans had lost half or more of Germania, and they were never able to reassemble the whole province.

After Varus' disaster, the Rhine became festooned with forts and palisades. Many scholars would see nothing terribly significant in this since, after all, if the Rhine had not sprouted this defensive hardware the Elbe would have. Unfortunately, neither the Rhine nor the Elbe had been natural boundaries,⁴⁵ the Rhine in particular marking the very center of Germania. By throwing up a heavily militarized barrier on the Rhine, the Romans had severed vital exchange routes and may have severed whole tribes or confederacies spanning both banks of the river. Contacts between tribes occupying adjacent tributary watersheds on the same Rhine bank would have been similarly affected by the concentration of Roman military might. Decades ago, Olwen Brogan noted that the layout of Roman forts closely replicated prehistoric lines of articulation indicated by trade routes running roughly east to west along the trellis of the mid-Rhine drainage.⁴⁶ For each major exchange route, there was a Roman strongpoint to intercept it in the vicinity of the Rhine. Frequently, Roman bases simply supplanted pre-existing native centers that must have formerly served to coordinate articulations at these nodal junctures. Tribal groupings or subgroupings along major tributaries such as the Lippe, Main, or Moselle were often impressively extensive in themselves, as shown, for instance, by our knowledge of the well explored pagus of the Treveri.⁴⁷ The activities of coordinated leagues such as those associated with Arlovistus or Arminius hint at even more extensive groupings, and certain of the major Rhenish crossing points, e.g., Cologne, may have been the centers of these more inclusive associations or sodalities. While its membership had been considerably extended

under Augustus, the Council of the Three Gauls at Lugdunum had pre-Roman roots, underlying in some way the series of Caesarian revolts led by Vercingetorix.⁴⁸ Similarly, the cult of Augustus set up at Cologne may have capitalized on a similar set of pre-existing institutions articulating major tribal groupings along the Rhine drainage. Just as the cult center at Lugdunum may have represented a Gaulish interaction sphere, the center at Cologne may have represented an extensive interaction sphere among the Zwischenvoelker of Germania.

By planting their military presence along the central institutional and geographical spine of this hypothesized Rhenish interaction sphere, the Romans would have been in a good position to manipulate affairs throughout Germany, but the loss of a full one half of the interaction sphere after Varus' disaster must have been a severe jolt to the integrity of the pre-existing tribal hierarchy. With forts at every major crossing on the Rhine, the Romans could still intercept and monitor movements along and across the central axis of Germany, but with no real control over the trans-Rhenish groups, Roman monitoring commonly took the form of a severe truncation of pre-existing types of trade, exchange, and interaction. Goods and persons still flowed across and along the Rhine, but only through a screen of military and governmental inspection and scrutiny.⁴⁹ Flows were reduced, their timing disrupted, and their effectiveness impaired.

In the decades after Augustus' abortive conquest of Germania, the groups beyond the Rhine suffered a precipitous cultural simpli-

fication, so that by the time of Tacitus, many of these groups had become like Caesar's Suebi, poor in material culture but bellicose.⁵⁰ Beyond the Rhine, Teutonic dialects spread. This linguistic evolution was pent up at the Rhine, and this development, so markedly different from the linguistic continuum of the prehistoric period, is perhaps our strongest indication of the degree to which the Roman advent severed interaction contacts. By the late imperial period, the barrier of the Rhenish limes had isolated the linguistic community of the Celts from that of the Teutonic Germans, and centuries of accumulated changes had rendered the two language families mutually unintelligible, with no intermediary dialects as had been the case in the pre-Roman world of the Zwischenvoelker.

The linguistic teutonization of the trans-Rhenish Zwischenvoelker is commonly interpreted as evidence of massive intrusions by Teutonic peoples. Some large scale movements are undeniable, but the linguistic changes occurred over several centuries and could have been accomplished by mechanisms other than full scale invasions. Language elements diffuse just as do other cultural characteristics, and currents of diffusion can often outpace the physical movements of peoples. Place names, personal names, and everyday speech can also be drastically altered by the example of a small leaven of traders or chiefs, whose movements could similarly outdistance the movements of whole tribes. Recurrent trade contacts or political interactions may lead to important language changes, often by promoting the spread of limited purpose jargons or pidgins. The wide use of Greek and Latin within the Mediterranean world was partially due to the develop-

ment of easily comprehended pidgins spread by traders, provincial officials, and army drill masters. In the early Middle Ages, numerous shared words and grammatical forms in languages such as Old English and Old Saxon, languages which are otherwise quite distinct, have led scholars such as Hector Munro Chadwick to hypothesize a widely used pidgin along the North Sea coast which was also used further inland by the Saxons and was subsequently introduced to England by the coastally oriented Anglo-Saxons.⁵¹ Such pidgins were undoubtedly present in prehistoric times and might have found frequent use given the recurrent special purpose contacts and exchanges within interaction sphere societies. Among the last functions of the diffusion channels of the Zwischenvoelker interaction sphere may have been the widespread dissemination of Teutonic linguistic elements as a leaven of Teutonic Germans seized control of the sagging institutional leadstrings of trans-Rhenish Germania.

By the time of Tacitus, trans-Rhenish Germania was becoming a world of barbarians speaking Teutonic dialects. There is no justification for automatically identifying Teutonic speakers with barbarians. There is every reason to doubt that the heartlands of the Teutons on the Baltic shores necessarily spawned hordes of war-crazed berserkers. Barbarians of varied linguistic and ethnic stocks appeared on all of Rome's frontiers, and with many of these frontiers, e.g., Arabia or Ireland, there is no reason to call in external barbarians to explain the process. Frontier incorporation imposed extraordinary strains on pre-existing groups, in some instances, as on the Rhine, splitting the pre-existent worlds in two. It is scant wonder that

the population groups beyond the pale of Rome's faulty military grasp endured radical transformations. Along the Rhine, these transformations have often been too facilely explained by the appearance of Teutonic Germans, as if these groups spread barbarization by their very presence. Even the spread of Teutonic speech may not have necessitated massive movements of peoples, but even if the pace of Teutonic advance was as rapid as is usually envisioned, the crucial precipitating factor was not Teutonic rapaciousness but the vacuum left by the sudden disruption of interaction sphere institutions dealt by the Roman advent.

The changes gripping the German and other frontier areas will be dealt with in a subsequent chapter. For present purposes, it is enough if a case has been made for seeing the Rhine as the center of a pre-existing entity, not as a safe river frontier between Celts and Germans. The Rhine frontier was the chief mechanism responsible for the sharp distinction between Celts and Germans and marked one of Rome's most signal failures in using the core institutions of pre-existing interaction spheres to facilitate control throughout an extensive frontier zone.

The schism of the Zwischenvoelker was facilitated by the neat geographical permanence of the Rhine. In other portions of Northwest Europe, the lines of interaction sphere articulation were not so conveniently fixed, and Roman misadventures were denied the easy out of piling a river bank with forts and palisades. With landward frontiers, Rome was more hardpressed to hide from her mistakes and, hence, more often made attempts to rectify her blunders, even if this only made

matters worse. Rome's frontier in Northern Britain is a good case in point. This frontier is dominated by imposing structures such as the walls of Hadrian and Antoninus Pius. These grandiose monuments are sometimes pictured as attempts to hold the Picts and the Caledonians of the north at bay.⁵² Other scholars have seen the Brigantes to the south as an equal peril, the walls being designed to drive a wedge between two potential blocks of allies.⁵³ The latter view is probably nearer the truth. Britain from the Pennines north was never firmly in Roman control, and a prominent feature of Romano-British history is an incessant regrouping of military dispositions in the north.⁵⁴ Behind the seemingly static facade of the two walls lies a palimpsest of roads, forts, signal stations, and marching camps scattered from modern Yorkshire into Scotland. The walls themselves were not continuously occupied. Roman influence in the north had commenced with ties of clientship with groups such as the Brigantes but had quickly escalated into direct intervention as Rome's clients rebelled or were threatened with hostilities by neighboring non-federate groups.⁵⁵ Roman bribes, the dispatch of small bodies of troops as bodyguards, and other types of blatant meddling in native dynastic and inter-tribal affairs were probably at the root of this chaos, and a stronger dose of Roman intervention, while it produced periods of uneasy tranquility, may well have magnified the intensity of disruptions when they occurred. Roman military policy became an anxious game of jockeying among these restive northern tribesmen, with the frontier forming not a line on a map, but an extensive zone of military installations and tenuous alliances fashioned among and between the native groups.

The Brigantes and other large tribal associations were effectively pent up within unpropitious hill country reservations, and exchanges between such tribal groups were probably interrupted.⁵⁶ In the pre-Roman period, such exchanges had probably hinged on the mediation of tribal or inter-tribal political, ritual, and military ties. The Roman military presence severely curtailed inter-tribal ties, and even tribal cohesion may have been tampered with as a matter of overt policy. Despite these persistent divisive tactics, the pre-existing tribal groups showed an amazing resiliency, a fact best manifested during periods when Roman military setbacks allowed guerilla warfare to escalate into full scale revolt. The Brigantes in the Pennine region were a perennial source of trouble, and, interestingly enough, the Brigantes were often successful in rallying other groups to the north in occasional large scale outbreaks. These instances of concerted actions by the northern tribes may hint at pre-Roman sodalities or confederacies.⁵⁷ To offset the military threat of such supra-tribal alliances, the Romans, in addition to their heavy investment in forts and troops, went to considerable pains to cement the allegiance of groups such as the Votandi, promoting the interests of this group at the expense of their neighbors. Roman favoritism to the Votandi was probably aimed at fomenting discord between the northern tribes, making the settlement of inter-tribal grievances dependent on Roman intervention rather than on pre-existing native sodalities. The mixed success of Rome in eliminating these bonds of inter-tribal sympathy is a strong indication that before the Roman advent, Northern Britain had possessed some sort of tribal hierarchy of its own.

On the Rhine, the barrier of the river suggested a convenient, if not very effective, place for the Romans to cordon off a pre-existing interaction sphere. Northern Britain offered no similar natural barriers, and Rome was forced to garrison nearly every tribal region. The two walls on the narrowest reaches of the isthmuses between England and Scotland were the most conspicuous traces of this process of military cordoning, but here Rome was never allowed, as on the Rhine, a reasonably pacified hinterland to one side of her major military concentrations. As a result, the Romans were forced to dismantle much more of the tribal structures of Northern Britain than had been the case on the left bank of the Rhine. The left bank of the Rhine eventually developed into an adequate military dumping ground while the economic drain of Rome's military frontier in Northern Britain hamstrung the economic potential of the regions north of the Midlands and even acted as a brake on the pace of provincialization in Lowland Britain for a century or more.⁵⁸ Still, while the Rhine proved a more economically viable frontier than that in Northern Britain, the river frontier was not without its considerable drawbacks. Militarily, the Rhine proved difficult to police and almost impossible to defend in the face of concerted trans-Rhenish assaults.⁵⁹ The heavy burden of the armies made the provinces of the left bank second rate affairs on the whole,⁶⁰ and the ongoing barbarization of the trans-Rhenish areas made the eventual incorporation of these regions into the frontier complex a steadily more improbable venture.

The Roman advent in interaction sphere societies was a traumatic experience that put heavy strains on the native substructures. The

more resilient of these native substructures survived the initial shock and furnished material for provincialization. Lowland Britain, most of Gaul, and a string of provinces through Switzerland and along the Danube were testimonies to this. Less resilient interaction spheres such as Northern Britain or supremely unlucky interaction spheres such as the Zwischenvoelker of the middle Rhine recovered slowly if at all. As Rome's frontiers expanded into particularly nonresilient tribal regions or when the process of expansion resulted in near catastrophes as on the Rhine, the process of provincialization ground to a halt, and, concomitantly, the impetus for further advances of the military frontiers. With minor exceptions, Roman advance had everywhere ceased by the late first century A.D., and the task then became one of making the existing frontiers bear the burdens that the imperial division of labor had imposed upon them. These burdens usually proved as difficult or more difficult to bear than the initial shock of frontier incorporation, and Rome's control over her frontier zones became an increasingly desperate task.

Rome's frontiers became the foci of a set of maladaptive tendencies, whose impacts ultimately had far reaching consequences for provincialized areas and for societies on and beyond the frontiers. These tendencies were partly the result of maladaptive processes inherent in Rome's increasingly bureaucratized structural organization. These maladaptive processes became manifested with considerable impact along the frontiers, and one factor contributing to these frontier maladaptations were various types of fragilities in the pre-existing interaction sphere societies. These fragilities often

centered on a number of substructural features bearing on economic and demographic variables and factors of agrarian ecology. The superstructural sodalities and alliances of the pre-Roman tribal hierarchies had evolved in a fashion to regulate and maintain balances among these variables, but the control limits of the native institutions were often delicately drawn. Frontier inclusion frequently disrupted these balances. We are usually in relative ignorance of such substructural factors since ancient narrative sources invariably focused on the more apparent play of political and military affairs. This is even the case with the middle Rhine and Northern Britain, where narrative sources give indications of the existence of pre-Roman interaction spheres but reveal little about the underpinnings of these entities. In regions where documentation is substantially lacking, attempts to flesh out some picture of native life through disciplines such as archaeology have given us a fuller grasp of the substructural features of interactions spheres. These underpinnings will be explored in the next chapter for two Roman frontier regions, the lower Rhine or North Sea Coast region and Southwest England.

CHAPTER VII

THE PARAMETERS OF RESILIENCY

Roman frontiers were commonly set within pre-existing interaction spheres. The resulting linkages were often unstable. The frequent instability of Roman frontier zones was due in the first place to a set of destabilizing tendencies already present in Roman society, the Roman state, and the Roman military system. On the frontiers, the possibility of instability was further heightened by sets of limitations and constraints within which pre-existing tribal societies had operated and which frontier inclusion severely jeopardized. The tribal constraints often centered on fundamental aspects of agrarian ecology. In much of pre-Roman Europe, the task of earning one's daily bread had become evermore complicated as millennia of human use and misuse lowered the productiveness of temperate forest ecosystems. Subsistence practices began to entail a modicum of intergroup, even inter-tribal organization.

At the time of Roman contact, the institutions of such organizational superstructures were still intermittent in their operation and fairly decentralized. Temperate Europe might be dotted with chiefs and petty kings, but except on special occasions or during periods of stress, the real power of such figures rarely extended beyond a narrow patrimonial range of relatives and retainers. Temperate Europe might be interlaced with trade routes and exchange networks and might even possess certain specialized groups of long-distance traders,

but this trade did not cater to large scale commodity markets. Such political and exchange superstructures as existed were geared to regulating demographic pressures and redressing regional imbalances in vital subsistence goods or items crucial in the maintenance of locally based subsistence technologies. Such superstructures had to be maintained and regulated themselves, but the maintenance of these superstructures was not an end in itself. Chiefs and traders who ate too much of the power of the government would be rebuked by their semi-autonomous tribesmen and, if need be, by the natural environment. Ecosystems granted harvests to men more grudgingly than in previous eras, and maladaptive control by hybris stricken power holders could often bring in its train a vindictive round of famines, starvation, murrains, and diseases. By the same token, tribesmen's autarchic predilections were increasingly limited by the need, at least intermittently, for the support of supra-local organizations.

The growing burdens of societal interdependencies in temperate Europe are reflected in the prehistoric religious systems, for the gods of power and change and the gods of the earth, of fertility, and of pleasurable-ness had become inextricably bound together. The German peoples are a case in point.¹ In the Urzeit of Teutonic mythology, there occurred the great battle between the Aesir, led by Odin, and the Vanir, gods of the earth such as Frey. The battle ended in a truce, for none of the combatants could live without the cooperation of the others. The truce was uneasy, but it worked. Nevertheless, the joy of the gods in their concord was marred by the nagging prescience that someday, inevitably, the ravenous wolf Fenrir

would break his bonds in the time of Ragnarok. And if and when that time should come, the gods were doomed, the universe would burn with fire, the sun would be obscured, the stars would fall, and the earth would be engulfed by the sea. In the pre-Roman Iron Age, the tribal hierarchies of temperate Europe were dominated by such uneasy unions of ecosystems, husbandmen, priests, and chiefs. In two regions of Northwest Europe, in Southwest England and along the lower Rhine and the North Sea Coast, the outlines of such unions and their underlying fragilities can be seen.

Southwest England, basically the modern counties of Devon and Cornwall, forms a part of Europe's so-called Atlantic fringe.² This complex of littorals, islands, hill lands, and peninsuls running from Portugal into Scotland possesses striking climatic, geomorphological, vegetational, and cultural similarities. These similarities have been partially dictated by underlying commonalities in cultural responses to similar physio-geographical controls, but from a surprisingly early date, perhaps as early as the Neolithic, the parallel evolutions of local groups have been conditioned and re-enforced by appreciable inter-regional influences and interactions.³ At times, these inter-regional influences have undoubtedly been dominated by sizeable population movements, migrations, and even invasions. At other times, and perhaps as a prevalent tendency, the movements and interactions have been more balanced, involving cyclical flows of peoples, goods, and ideas, fit into rhythms of annual or longer durations and into arenas of varying geographical extent.⁴

The more localized of these exchanges probably involved limited movements of people as well as exchanges of foodstuffs, livestock, and craft items through kinship networks on the occasions of marriages, adoptions, and the like. Larger scale transactions might be geared to differential land use patterns, e.g., areas well endowed with pasture might trade excess stock for grain with regions better equipped for cereal production. Even where adjacent regions shared homogeneous mixed farming strategies, occasional poor harvests or livestock fatalities could still provide a basis for neighborly exchanges. Where one region had suffered only crop failures and another region only a reduction in the size of its herds, the logic for exchange is straightforward. Even where one group suffered both types of calamities, neighboring groups might still be generous. The alternative to generosity might be livestock rustling, looting, and petty feuding, and generosity created a debt of obligation for the creditors to draw on if similar calamities should ever strike them.

Exchanges and reciprocities of the kind described above could involve a rather small number of groups or could link together larger groupings. Larger scale groupings of some complexity and longevity were only likely or necessary where cropping and livestock systems were so plagued by recurrent failures or crises that a measure of supra-local organization was required either for the subsistence technology itself or for the maintenance of redistributive mechanisms to ration uneven surpluses between autarkic domestic groups. Supra-regional organization and redistribution would also be encouraged where local resource endowments were unbalanced so that certain mate-

rials, e.g., salt, pottery, or metals, could only be acquired by non-local interaction. Southwest England suffered both from fickle farming systems and from crucial local resource imbalances. The result was the evolution of tribal hierarchies or interaction spheres. The processes underlying the emergence of such societal ties are especially obvious in the Cornish portions of the Southwest peninsula and particularly so in the case of Cornwall's two most remote sub-peninsulas, the Land's End District and the Lizard Peninsula.

Cornwall, as is the case in much of the Atlantic fringe, is dominated by the contrasts between coastal lowlands and the highlands, moors, and bogs of the immediate interior.⁵ These contrasts are to some degree natural, but they have assumed their present pervasiveness only through the agency of man.⁶ In the post-glacial period, most of Atlantic Europe supported deciduous forests and, if not brown earths, at least a close approximation.⁷ Exposure to gale winds, salt laden air, and heavy rainfall rendered the post-glacial balance of forest and soil extremely delicate.⁸ With the onset of Neolithic man, the balance was tipped decidedly against forest regeneration and toward plagioseral regression and soil degradation. These processes affected the highlands first, where the pressures of exposure to winds and the increased rainfall that accompanies increased altitude led to the spread of peat bogs where drainage was impeded and grass and heather moors where sloping terrain or permeable subsoil materials prevented waterlogging. By the Bronze Age, these processes had turned the highland soils into unproductive podzols, and as mixed

farming strategies centered on the uplands became impracticable, prehistoric population groups began to make greater inroads in the less fragile lowlands.⁹

The lowlands proved only marginally less fragile. During the ice ages, glacial activity had severely pre-weathered soil parent materials, and even in areas such as Southwest England which had not been glaciated, peri-glacial activity in the tundra-like vicinities of the ice masses had resulted in parent material alterations almost as severe.¹⁰ In many other portions of Europe subjected to glacial or peri-glacial influences, the bedrocks had either been more inherently fertile, e.g., chalks or limestones, or the retreat of the glaciers had laid down loamy deposits of relatively unweathered boulder clays. The sandstones, metamorphic, and igneous rocks of the Atlantic facade make indifferent parent materials in any event, and the truncated expanses of lowland stretches beneath nearby highland massifs left little chance for the deposition of appreciable quantities of glacial till. The parent materials of Atlantic Europe, even its lowland reaches, usually began nutrient poor, and by the late Bronze Age, plagioseral regression and soil degradation were well underway as human pressures replaced climax forest with hazel scrub, gorse thickets, heather, and heathland grasses.

By the late Bronze Age, both cereal cropping and animal husbandry were becoming somewhat precarious affairs. Mixed farming became a matter of tapping the maximum productive potentials of Atlantic Europe's degraded ecosystems, a venture that usually involved efforts to tap to advantage the variant seasonal rhythms of

highland and lowland plant communities.¹¹ Lowland regions usually boasted slightly better soils. At the very least, they boasted less rainfall and appreciably longer growing seasons than the wet, fog draped upland moors. Lowland regions were thus better suited for cereal cropping. The longer growing seasons made for more productive pasture lands capable of providing grazings earlier in the spring and later into the fall than the uplands and capable of producing one or more mowings for hay. The relative shelter of the lowland zones also rendered them more suitable for overwintering livestock, especially young animals or pregnant females that might need extra attention or supplementary feeding to ward off diseases, injuries, or miscarriages.¹²

The highland moors had their value too. Through the spring and summer, calving and lambing would raise livestock numbers to peak levels which needed to be maintained until late autumn when older stock, unwanted males, and other culls would be butchered. If left in the lowlands, this seasonal surfeit of livestock might lead to overgrazing of lowland pastures, reducing their productivity later in the season.¹³ The extra livestock might also be a nuisance if left in the vicinity of growing crops. Fortunately, it is during the spring and early summer that the highland zones reach their productive peaks.¹⁴

An obvious strategy is to transfer most of the livestock to rough grazings on adjacent moorlands and heaths. Such a shift to new pastures also reduces the incidence of certain types of parasitical diseases spread where animal droppings mixed amid forage plants

allow various flukes, round worms, and the like to be reingested. A switch of pasture breaks the life cycles of the parasites and is often vital in preventing large mortality rates among nursing mothers or freshly weaned young.¹⁵ Moderate grazing pressures, especially of several species of livestock, also improves the quality of highland grazings.¹⁶ Well managed mixed grazing suppresses the incidence of plants with extremely short growing seasons, thus helping to lengthen the period in which the rough grazings are productive. Grazing and browsing of tuft-forming species such as molina grass decreases the build up of thick, peaty turves of almost undecomposable grass litter that impede drainage and promote the spread of poorer quality grasses, bog plants, and mosses. Mixed stocking with browsing animals such as cattle allows the control of woody species such as gorse that sheep cannot eat. Cattle can also control the fast propagating bracken fern, whose umbrella-like fronds choke out all the underlying species where it is allowed to form pure, closed stands. The deposition of animal manure and the livestock's treading of the soil may also be valuable in breaking up surface mats of raw humus and accelerating recycling rates of plant nutrients. Mixed grazing does substantially arrest the processes of natural seral progression, but judiciously managed mixed grazing can deflect plagioseral progression away from some its least productive trajectories.

Efficient use of both upland and lowland grazings can boost livestock numbers to the point that mixed farming strategies can rely heavily on meat and dairy products, with arable production kept in a

subsidiary role. Arable plots might then be left at the level of small, occasional swidden intakes, small permanently cropped garden plots, or a combination of the two as in historically attested medieval and early modern infield-outfield systems.¹⁷ If properly managed, outfield swiddening does not entail heavy fertility transfers from surrounding plant communities. Infield plots close to lowland settlements do require constant manuring, but in many regions of Atlantic Europe, this does not necessarily have to be at the expense of neighboring terrestrial ecosystems. Many lowland foci are close to the sea. Rocky coasts are good breeding places for various types of seaweed or wrack. Sandy coasts or mudflats may support a substantial marine flora and may also be rich in calcareous shellfish and diatoms. All these materials are rich in nutrients. Through the modern and early modern periods and into the middle ages, there is abundant documentary evidence that coastal settlements harvested wrack and hauled in beach sand and organic muds to deposit on their fields.¹⁸ Pedologists are now beginning to find clear evidence of prehistoric agricultural soils called plaggen soils formed by heavy emendations of marine materials.¹⁹ This would have lessened the dependence on animal manure and thus would have decreased trends toward excessive fertility transfers from terrestrial ecosystems to arable foci, trends whose long term effects would have been to steadily debilitate the productivity of the pastures and wastes from which the fertility was extracted. By the late Bronze Age, population groups of the Atlantic fringe were perennially on the verge of sliding into the

vicious circle of mixed farming based on fertility transfers. There is good reason to suspect, however, that severe limitations on the amount of arable cropping or arable cropping systems based on inputs of marine nutrients, this coupled with a judicious system of mixed grazing of highland and lowland zones, often made possible fairly productive and resilient subsistence bases.

Subsistence strategies such as those outlined above would entail types of limited transhumance, which should find some reflection in the distribution of settlement sites and their structural features. Transhumance is commonly associated with long distance movements of livestock, as in the Spanish Mesta, or the nomadic systems of Steppe pastoralists. The systems envisioned here are less radical, involving periodic movements over much shorter distances. In Atlantic Europe, upland pastures are seldom separated from coastal lowlands by distances of much greater than five or ten miles. The movements involved would be relatively modest and would not necessitate a complete rupture of ties with lowland regions. Early modern records attest many instances of such patterns, especially valuable materials coming from Ireland and Northwest Scotland.²⁰ The hallmark of these historical systems is that the upland grazings boasted numerous simple structures sufficient to house a considerable work force through the spring and summer. A large work force was needed because the stock was not only herded but milked. The upland sites were the scenes of a considerable amount of initial processing of these dairy products. Considerable care also had to be given to the weaning of young animals, the shearing of sheep, and the judicious timing of mating so that the

next year's crop of young animals would not be born in the dead of winter or the very early spring before lowland or highland pastures came into production. These upland shielings needed lodgings for the herdsmen, working compounds for processing and storing dairy products, wool, and the like, and various pens and folds.²¹

While the shielings were in use, the lowland foci would hardly be deserted. Spring was planting time. After this peak work season, considerable personnel could be spared for the upland shielings, but growing crops still needed to be tended, and the spring and the summer were also the best times to exploit marine resources such as fish, shellfish, and sea birds.²² Through the spring and summer, then, a community would be split or bifurcated into two components, not to be united until the fall when the harvest and the declining productivity of the hill grazings regrouped a community's labor force in the lowland focus for the winter months.

A transhumant system such as this required fairly large households or, better yet, the periodic cooperation of numerous households. An isolated nuclear family would be hardpressed to ration its labor force efficiently enough to exploit the full potentials of highland and lowland zones.²³ The system also presented certain awkward managerial problems, especially in the upland grazing areas. The boundaries between shieling zones were often hard to define, one community's grazings blending into another's. Livestock could hardly be expected to respect these vague demarcations, and disputes over grazing rights would be inevitable. Inter-community contacts in the highlands could be the source of considerable friction, even

hostilities. These contacts might also form the basis of lasting sodalities and reciprocities, perhaps even the basis of tribal identifications and associations.

In a series of studies on medieval Yorkshire and Wales, the geographer Glanville Jones has noted the prevalence of bifurcated settlement patterns very similar to those whose presence is well attested in early modern Ireland and Scotland.²⁴ Medieval Wales and Yorkshire had not been as thoroughly detribalized as early modern Ireland and Scotland, and the medieval material reveals an interesting highland feature that apparently went into decline with the rise of state systems and commercial influences in the later Middle Ages. In addition to shielings, the medieval highlands boasted structures that look for all appearances like prehistoric hill forts. Documentary and placename evidence for the medieval period leaves little doubt that these upland hill forts were the coordinating foci for numerous surrounding shielings and that these upland complexes were usually related to somewhat similar complexes in the lowlands, where groups of hamlets would be bound by food renders and other ties to a nobleman or lord residing in a substantial manorial compound. Jones argues that this type of bifurcated system with its chiefly trappings was a carry-over from the early middle ages or possibly from Celtic prehistory, and in recent years, his speculations as to the antiquity of this system have been given a measure of support in Southern England, where the great Iron Age hill forts of the downlands are now reasoned to have been connected with the rise of complicated stock raising systems and the need to coordinate the allocation of grazing

rights for sizeable tribal populations.²⁵ The downland hill forts stood astride the junctures between rough grazings and better watered pastures, meadows, and arable. In Yorkshire and Wales, hill forts and chiefly residences were themselves bifurcated, with one stronghold in the highlands and one in the lowlands.²⁶

Patterns conspicuously similar to those of medieval Yorkshire or Wales can be isolated from field surveys of prehistoric settlement sites in Cornwall's Land End District.²⁷ The settlement types in West Penwith fall into two broad categories: hill forts and rounds.²⁸ The hill forts of West Penwith are quite small as compared to hill forts in the downlands of Southern England, but, like their downland cousins, the Land's End structures generally possess substantial sets of palisades and ring ditches or at least are sited on hills, spurs, or prominences providing defensive advantages. Rounds, on the other hand, generally display no attention to defensive alignment. Their simple ringworks, if present, are more in the nature of fences than bulwarks. Some of the rounds may have simply been paddocks. Others contain huts and were probably farmsteads or hamlets. Some of the rounds have no proper palisades at all but consist of agglomerations of huts grouped in circular or semi-circular rings or compounds. Some of these hut circles are fairly substantially built of large slabs of granite. These substantial hut circles are called courtyard houses and consist of huts, working areas, and small enclosures grouped around a central open space.²⁹ In addition to the hill forts and rounds, West Penwith boasts a handful of settlements called cliff castles sited on coastal promontories and often cut off from the

mainland by sets of walls, palisades, or ditches. A few of these cliff castles have obvious defensive advantages and may represent adaptations of the hill fort pattern. In other cases, where defences are modest and where the nature of the cliff areas places the cliff castles well below the level of the adjacent terrain, one is probably dealing with simple farmsteads similar to the rounds.³⁰

The ninety or so square miles of West Penwith consist of a single granite boss or dome, an outcropping of the central granite spine that runs the length of the Southwest peninsula. Alterations in sea level from Pliocene times on have eroded distinct benches into the granite dome, so that in West Penwith the geomorphology resembles a two tiered layer cake.³¹ Elsewhere in Southwest England, where the granite spine has been pushed higher than in the Land's End, extra tiers are met with. The terrain between West Penwith's two tiers has been rounded off by erosion. As a result, four basic zones can be discerned. The crown of the granite boss forms a fairly undesiccated plateau lying above six hundred feet in elevation. The lower tier or bench begins at about the four hundred foot contour line and has been notched and eroded to form a gently sloping apron or shelf marked off into a set of gorged streams and their interfluves. Between the high plateau and its girdling shelf zone lies an area that, adapting the useage of Lt.-Col. F.C. Hirst, can be called the rise-fall zone. The rise-fall zone is dotted with springs and the sources of small creeks and has been gently scooped out by water erosion to form an interdigitating series of small, sheltered amphitheatres. Finally, as the shelf zone nears the sea at about

the two hundred foot contour line, it begins to arch in a pronounced convex fashion, then plunges suddenly to the sea in a series of sheer cliffs. Only on the south coast around the modern city of Penzance does this cliff zone give way to sandy beaches along Mount's Bay. East of a line running roughly from Penzance to St. Ives lies a narrow five mile isthmus linking West Penwith to the rest of Cornwall. Most of the isthmus area is very low lying, with sandy, heavily leached soils and stretches of marsh and swamp above the modern town of Marazion.³² The poor soil conditions created a broad, relatively uninhabited belt that effectively made the Land's End District an island, neatly and conveniently set off from other Cornish regions.

The sites of over two hundred rounds, huts, cliff castles, and courtyard houses are known in West Penwith, giving a solid statistical sample for locational analysis. Armed with such a large sample, even simple distributional treatments can reveal marked patterns in settlement placements. A very simple approach is to allot known or suspected settlement sites to the four major physiogeographical regions, i.e., plateau, rise-fall, shelf, and cliff zones, and then derive rough estimates of the relative densities of sites within each of the zones.³³ Even crude calculations will show that there is a clear bifurcated pattern, with site densities in the rise-fall and cliff zones exceeding those in the other two zones by a factor of three times or more. One is tempted to see here a transhumant complex of lowland and highland sites, and this inclination is strengthened if the rounds are subdivided into two classes: more substantial palisaded rounds that would have provided better overwintering foci

and less substantial rounds, courtyard houses, detached huts, and hut circles that would have provided work areas and seasonal lodgings during the spring and summer for transhumant activities. The more substantial rounds seem to predominate in lowland sitings on the lower reaches of the shelf or in the coastal zone.³⁴ The sites in the rise-fall zone or the high plateau zone have more the appearance of shielings.³⁵ The probability that these prehistoric settlement patterns reflect a bifurcated complex is further strengthened by considering the locations of hill fort type settlements, which show a pronounced bipolar distribution. The plateau zone is rather evenly partitioned among four or so hill forts sited on prominences or spurs overlooking the rise-fall zone. The lowland zone would show an analogous even partitioning if the larger cliff castles were counted as hill forts. On the other hand, since many of the cliff castles were probably no more than farmsteads, it is probably safer to leave them out. One is still left with a bipolar pattern, but with a striking concentration of lowland hill forts around modern Penzance.

The general impression gained from this simple analysis of settlement distributions in West Penwith is of a series of bifurcated, transhumant complexes, with the highland hill forts defining a number of tribal or sub-tribal units articulating sets of lowland rounds with highland shielings. One is also struck by a probable focus, economic, military, political, or ritual, for the whole of West Penwith in the agglomeration of lowland hill forts in the vicinity of modern Penzance overlooking Mount's Bay. The preeminence of the region around Mount's Bay is hardly unexpected. This region is relatively

well sheltered from gale winds coming in off the Atlantic. The region boasts the best soils in West Penwith.³⁶ The sandy beaches and the shallow waters of Mount's Bay encourage the exploitation of marine resources such as fish, crabs, and sea birds³⁷ as well as the calcareous sands of the beaches, sands which make an excellent plaggen material. It is also easy to navigate small ships into Mount's Bay, and throughout history, the region around Penzance has been a vital communications and trade link with the rest of the Southwest peninsula. All these factors would have worked to make the Penzance area an important redistributive center in prehistoric times.

Within West Penwith, the hill fort center around Penzance probably played a crucial role in basic subsistence exchanges between the north and south coasts. As mentioned above, the region around Penzance has the best agricultural lands in the Land's End District. Most of the north coast consists of a miniscule shelf apron less than a mile in extent sandwiched beneath the highland plateau. Much of the north coast is lacking in substantial coastal rounds, the primary settlement focus devolving on hut circles and courtyard houses nestled immediately below the plateau zone. Agriculture on any scale would have been a precarious business on the north coast, and settlers there probably concentrated heavily on animal husbandry,³⁸ counting on exchanges of livestock or animal products with groups on the south coast for an appreciable proportion of their cereal foodstuffs.

Complementary divisions of labor between the north and south coasts would have been reinforced by other types of exchanges between West Penwith and other regions in Southwest England. These exchanges probably centered on the three items of pottery, salt, and tin. Pottery and salt are absolutely indispensable for storage and preservation in an agricultural economy, but most of Cornwall, and especially West Penwith, is deficient in both these vital commodities. The granite bosses of Cornwall weather to produce a good quality kaolin or china clay, but under primitive conditions, china clay is extremely difficult to purify, form into a proper paste, or fire without huge losses in breakage.³⁹ In prehistoric Europe, most pottery was made from alluvial clays laid down by the action of sizeable streams or rivers.⁴⁰ Unfortunately, most of Cornwall lacks large rivers or streams, and the lower reaches of the existing major water courses have usually been drowned by alterations in sea level or subsidence of the land, thus submerging the alluvial deposits of the drowned river mouths. The north coast of Cornwall is almost completely lacking in good potting clay, and the south coast is only slightly better endowed.⁴¹

The relative dearth of rivers and the drowning of their mouths also renders salt making difficult. In prehistoric Europe, salt was chiefly acquired from brackish springs or by boiling concentrated brine solutions left behind on river deltas and estuaries.⁴² A poor quality salt can be obtained by boiling sea water itself, but the final product usually contains large amounts of impurities that may discolor or taint the taste of preserved meats and dairy products.⁴³

A better quality salt may be obtained, and obtained more easily, where much of the initial work of concentrating the brine has been done by solar evaporation acting on pools left behind after high tides on flat stretches of river estuaries⁴⁴ or on specially constructed salt pans. Such pre-concentrated solutions may then be filtered of impurities and dried to crystalline form, either by boiling or by further solar evaporation. In southern Europe, solar evaporation can be counted on to do nearly all the work of concentration. In temperate Europe, the process is best speeded along by final boilings of the pre-concentrated brine. The final steps in the preparation of the crystalline salt, then, invariably required various types of drying receptacles to hold the brine solution. Metal basins, cauldrons, or moulds would do, but throughout most of prehistory, and well into the Roman period, equipment made of rough fired clay or briquetage was more commonly employed than more costly metal receptacles.⁴⁵ The use of briquetage or ceramic moulds for the final crystallization also provided a cheap and expendable method for packaging and distributing the salt. Large quantities of potting clay, then, were an important prerequisite for efficient salt making.

Cornwall lacks any really excellent tidal estuary sites or "saltings."⁴⁶ A few such natural salt pans may have existed along the systems of drowned river mouths extending south from Truro into the Lizard Peninsula, but the relative poverty of potting clay supplies would have been a crucial limiting factor. Perhaps the best source of potting clay in the whole of Cornwall is to be found in

the Lizard Peninsula in modern St. Keverne parish around weathered outcrops of a rare igneous mineral called gabbro. From the Neolithic onward, the St. Keverne region seems to have acquired a near monopoly over much of the pottery production in Cornwall.⁴⁷ By Romano-British times, there is evidence that this trade in pottery was also connected with a trade in salt, and there is every reason to suspect that the salt trade was itself of considerable antiquity.

The potting clay in the St. Keverne region contains inclusions of the mineral gabbro. One has to go to Scotland before coming across other sources of gabbro, so evidence of gabbro inclusions in the fabric of Cornish ceramic specimens is near conclusive proof that the clay, and probably the ceramic, came from the St. Keverne region. Petrological analyses have shown that from the Neolithic on, gabbroitic ceramics were traded throughout Cornwall. One advantage of these clays was that the gabbro inclusions served as a natural tempering agent, giving the raw clay a near ideal plasticity. Vessels fabricated from gabbroitic pastes also show ideal firing qualities, with a very low percentage of wasters.⁴⁸ By Iron Age times, a large proportion of the pots used in regions of Cornwall adjacent to the Lizard Peninsula were made from gabbroitic clays.⁴⁹ Among these regions was West Penwith.⁵⁰

Salt almost definitely figured into this Iron Age trade in pots. While the beaches and streams around St. Keverne parish are mostly of a gravelly material that makes a poor natural salt pan,⁵¹ abundant sources of clay encouraged salt making utilizing man-made salt pans consisting of shallow troughs of briquetage. Finds of

briquetage are a good index of salt making, and recent excavations have disclosed gabbroitic briquetage specimens at a site in the St. Keverne region.⁵² A Romano-British date is indicated for this site, but there is little reason to doubt that similar concentrating apparatuses could have been fashioned during the pre-Roman period.⁵³ There is good reason to suspect that the fairly uniform sizes of much of the exported Iron Age pottery from the Lizard Peninsula is related to the use of the ceramics as containers for salt.⁵⁴ Gabbroitic pottery filled with salt would have made a much more desirable trade good than empty pots, and the need for salt as a preservative for butter, cheese, meat, and fish in prehistoric Cornwall must have been pressing.

In return for ceramics, the communities of the Lizard Peninsula may have received various types of foodstuffs. St. Keverne parish forms an island of relatively good soils within a sub-peninsula dominated by low nutrient bedrocks of serpentine and other igneous minerals that, from an early date, must have supported forbidding heaths such as the present day Goonhilly Downs.⁵⁵ Imports of food for exports of salt and ceramics would have assisted the inhabitants of the Lizard Peninsula in wresting a livelihood from their picturesque but incredibly unproductive heathlands. Certain trade ties, however, probably hinged on non-subsistence items. For instance, while West Penwith would have been heavily dependent on the communities of the Lizard for pottery and salt, the Land's End District had one valuable item of its own, i.e., tin.

Tin is a vital constituent in the alloying of copper to form bronze. The advent of bronze metallurgy has been hailed as a crucial technological stage in European and Old World history.⁵⁶ This claim may be somewhat misconstrued. The role of metal in ordinary subsistence activities has probably been over-rated.⁵⁷ Wood, stone, and flint are ubiquitous, can be readily fashioned into almost any type of tool, are fairly readily replaced, and are usually the match of any implement made of metal. Metal objects did revolutionize the technology of warfare.⁵⁸ Metal objects also became important items of display and prestation, forming a type of prehistoric wampum, often a wampum tightly controlled by elite strata.⁵⁹ The role of metals in the "technology" of social relationships may have been the truly revolutionary aspect of the Bronze Age. Acephelous, autarchic Neolithic societies would have had no use for bronze. Only more open, loosely hierarchical interaction sphere societies could have needed or provided the extensive trade contacts necessary to bring together rare copper with the even rarer tin. Older generations of archaeologists have argued that the desire for metals spurred the growth of complex societal interconnections.⁶⁰ The causal sequence was quite possibly reversed, with interaction spheres evolving before the interest in metals. But, given the existence of interaction sphere societies, the utility of bronze as a prestation counter in regulating relationships among and between lineages and chiefly elites is readily understandable. The use of bronze in display, personal adornment, and prestation actually increased during the Iron Age as interaction sphere societies spread throughout

Europe,⁶¹ and with this increase in the use of bronze, the demand for copper and tin increased concomitantly.

Southwest England boasts the most sizeable tin deposits in temperate Europe. These deposits are often found at or near the surface in the form of cassiterite gravel or pebbles around the metamorphicized edges of granite domes.⁶² The whole of West Penwith is a granite dome, but the metamorphic edge has been weathered away along the south coast. This is not the case on the north coast, which possesses one of the richer lodes of tin in the whole of the Southwest peninsula.⁶³ Medieval and modern mining activities have stripped away most of the surface deposits and with them nearly all traces of prehistoric tin working. These traces may have been very slight in any event since the low melting point of the ore allows a crude smelt to be performed in an oven scarcely more complicated than a campfire.⁶⁴ Traces of mining are unlikely to be found since no real shafts would have been necessary. Shallow trenches would have sufficed, and even this expedient might have been unnecessary on the northern coast of the Land's End. Today, this coast is notched with small gullies and gorges called "porths," "zawns," or "zeas." At the present time, these stream gorges are quite precipitous, but before large scale tin mining began in the middle ages, these gorges may have been choked along their lower courses with gravel and debris. Most of this debris has been removed by miners, who found this material a convenient source of tin ore.⁶⁵ Prehistoric tin mining may have similarly involved little more than scooping up pebbles from the bed of a creek. It is small wonder that almost no traces of pre-

historic tin mining or smelting have been pinpointed, but just as gabbroitic inclusions demonstrate a trade in Lizard pottery, so the widespread use of bronze in temperate Europe indicates that tin must have been extracted from surface deposits such as those in northern West Penwith.

The demand for tin throughout temperate Europe would have given a measure of stability and diversity to the economies of regions such as the north coast of the Land's End District where ordinary mixed farming is a risky avocation. Tin would place communities on the north coast in a more equitable position in exchanges with communities on the south coast. Communities on the south coast would also benefit from the tin as it was re-exchanged, say, to groups in the adjacent Lizard Peninsula for salt and pottery. In this fashion, an extensive set of interdependencies was undoubtedly encouraged benefiting all of the groups involved, but, at the same time, committing them all to ongoing participation in periodic trade and exchange.

Much of this inter-regional trade was probably mediated through the personnel of chiefly centers such as the concentration of hill forts around Penzance. Other Cornish centers may have played crucial roles in bulking supplies of tin for re-exchange with other areas in Northwest Europe. One coordinating focus may have lain in the St. Keverne area or in the adjacent estuary complex around Falmouth Bay and the Carrick Roads. Another focus may have lain along the convenient north to south crossing point gouged by the River Camel and the River Fowey through central Cornwall. In medieval times, this was a major pilgrim route connecting Ireland and Wales with sea

lanes leading to Armorica, France, and Spain.⁶⁶ This region is also rich in Iron Age remains,⁶⁷ with Castle Dore to the south and on the north coast, around Harlyn Bay, large promontory encampments such as that at the Rumps. Another likely inter-regional center is at the mouth of the River Tamar at Mt. Batten, where construction of a naval arsenal around the turn of the century unearthed some of the richest finds of Iron Age metal work known in Southwest England.⁶⁸ Centers such as Mt. Batten may have served as the entrepôts for contacts with the Veneti and the Coriosolites of Armorica, whose fleets of oaken ships apparently monopolized much of the long distance trade along the Atlantic fringe before Caesar's advance put an abrupt end to their preeminence.⁶⁹

The Romans referred to the peoples of Southwest England as the Dumnonii, a word that in the same blithe fashion as "Teuton" translates as "We of the World."⁷⁰ The Dumnonii were not an effective political or military unit, but the complicated networking of their trade and exchange relations certainly made them an ecumene of the interaction sphere variety. Archaeologists that have studied the culture groups of the Southwest peninsula have been struck by their "sheer material poverty"⁷¹ as compared to Iron Age groups of Lowland England. The material poverty of Iron Age Dumnonia was probably well managed, however, so that while the chiefs of the Dumnonii did not live in opulence, neither did their people live in the genuine physical poverty that would have attended the disruption of interaction sphere ties. Agricultural societies can live without gold, silver, or monu-

mental architecture, but they cannot live without pottery, salt, cereals, and livestock. Interaction sphere ties guaranteed better and more dependable supplies of the latter. This physical well-being in the midst of material poverty was tenuous though, depending as it did on hierarchically mediated transactions spread out over tens and hundreds of miles.

These far flung exchange ties could be disrupted or subverted by various means. From Diodorus Siculus, we learn that Venetic merchants could acquire slaves through barter for as little as a jar of wine.⁷² The occasional loss of a few persons as slaves may have been a tolerable economic drain, perhaps even a necessary drain in chronically overpopulated areas if stable mixed farming systems were to be maintained, and, of course, the Veneti would more often be after tin than slaves. With Caesar's conquest of Armorica, the Veneti were all but obliterated,⁷³ and with Roman control of Spain, deep shaft mines worked there by slaves and criminals took over the tin trade of the ancient world well into the third century A.D.⁷⁴ The collapse of the tin trade in Southwest England and other changes attending the Claudian invasion of Britain must have been a severe jolt to the Dumnonii, necessitating major reworkings in internal trade ties and local subsistence strategies. In West Penwith, courtyard house complexes in the rise-fall zone expanded into sizeable hamlets,⁷⁵ perhaps indicating an abandonment of the more complicated transhumant systems of the Iron Age in favor of a simpler pastoral system. Simpler subsistence systems might well have necessitated lower population densities, and it is interesting to speculate that one mechanism that

could have helped this population drop along would have been a steady stream of Roman ships loaded with wine in search of slaves. Whatever the nature of the early Roman period reorganization reflected in the growth of courtyard house villages in West Penwith, the experiment failed, and by the fourth century, most of these hamlets had been deserted.⁷⁶

By the third century, Roman interest in Cornish tin revived, partly because the Spanish mines were playing out, partly because of a growing popular demand for pewter table services and a growing imperial demand for base metals to use in debased coinages.⁷⁷ There are indications that this belated flurry of mining activity was imposed as a sort of tax on groups in mid-Cornwall along the Fowey and Camel drainage.⁷⁸ If the natives were rewarded at all, it may have been in debased coins which, not surprisingly, were soon neutralized as hoards or passed onto unsuspecting neighbors. Many of these hoards appear in West Penwith,⁷⁹ and one wonders if these Land's End folk or their leaders were as quick to part with slaves for antoniniani as they had been for wine.

By the late fourth century, the Romans had virtually abandoned Southwest England, and Britain as a whole was racked by the careers of a series of ambitious generals who progressively stripped the insular legions for tries at the purple. Not surprisingly, the fourth century saw an increasing incidence of raids on Britain by Picts, Irish, and Anglo-Saxons. Sometime between the fourth and the sixth centuries, a sizeable component of the population of Cornwall abandoned the chaos of Southwest England and set out in groups of varying sizes to stake

out claims on relatively deserted regions in Gaulish Armorica.⁸⁰

The evidence for the Roman period, while extremely spotty, hints at repeated disruptions in the pre-existing native patterns, culminating in some sort of awkward diaspora during the early middle ages. Direct Roman interference in Dumnonia was relatively limited as compared to other frontier regions, but even this limited meddling seems to have sufficed to alter trade connections, population densities, and subsistence practices. The economic substructures of the Dumnonii were delicately poised, and seemingly minor uninformed alterations imposed by the external and largely uncaring agency of Rome could have significantly altered the indigenous tribal hierarchies. A similar delicate balance existed on the North Sea Coast and its hinterland, and here, a natural calamity coincided with Roman meddling to disrupt a pre-existing interaction sphere.

In the stretch of coast from Flanders to Jutland, a surprisingly large number of major rivers meet the sea, the largest of these being the Rhine, the Weser, and the Elbe. This heavy concentration of river mouths is a product of glacial times when great ice masses from the north diverted all Europe's rivers to the west as they reached the North European Plain. This imposed east to west drainage pattern was reinforced during periods of glacial retreat as the outwash from the great ice masses glutted the existing river channels and even gouged out new ones. From the North Sea and Baltic southward to the so-called Boerde, which stretches in a line along the Hercynian Massif from Cologne to Leipzig, the North

European Plain has been sculpted into a corduroy pattern, with its wales running from east to west. The plain is dotted with some five lines of derelict drainage systems, the Urstroemtaler, choked with morrainic melt water during the glacial ages, but now lying too high above the water tables to carry anything but modest streams.⁸¹

The sandy floors of the Urstroemtaler are heathy or marshy deserts, unsuitable for human habitation. Much of the rest of the North European Plain has been rendered ecologically fragile by a thick mantle of silty or sandy glacial material that has all but obliterated the contours of the underlying solid geology. This glacial outwash often weathers to produce poor to indifferent soils, and the relatively featureless terrain makes for fitful drainage, encouraging the formation of marshes and peat bogs. The North European Plain west of the Elbe has been particularly impoverished since it was not touched by the last glaciation of the ice ages, the Vistula. In Eastern Europe, the retreat of the ice left behind relatively fertile patches of glacial till or boulder clay. All that Northwest Europe received was melt water and silt that either leached out or buried the finer depositional material of earlier glaciations. Deciduous forests did their best with the pre-weathered material and sluggish hydrology of post-glacial Northwest Europe, but from the Neolithic on, human interference with the natural vegetation cover promoted the spread of podzolic heaths where the soils remained free draining and gleyed soils and peat bogs where water became impounded. The boggy land were relatively useless, leaving prehistoric population groups to make the best of life on the heaths.

Mixed farming strategies in continental Northwest Europe are almost of necessity skewed toward animal husbandry. With the spread of heather moor conditions, the soils of the North European Plain have become among the most infertile in the world, and cereal production depends on heavy nutrient inputs to arable plots.⁸² Even heavy dunging may be to no avail on most of the sandier soils. The problem of fertility may be solved, but the sandy soils are incapable of holding water, and during summer droughts, crops may fail despite a water surplus the remainder of the year. One solution is to limit arable cropping to the rare patches of glacial till or loess, which are more water retentive.⁸³ Another solution is to select arable sites where the water table is high enough to be within reach of the root systems of maturing crops.⁸⁴ The advantages of both these solutions can be realized by planting settlements close to water courses.

The margins of streams, rivers, and creeks have high water tables, and throughout Northwest Europe, arable land huddles around water courses in narrow bands and strips determined by the depth of subsurface water.⁸⁵ Water courses also sort their beds, with sandy material being laid down where the current is strongest and loam and clay where the current is weakest.⁸⁶ On large streams and rivers, loams and clays are laid down in flood plains beyond the sandy levies defining the beds. In very flat areas, where the river or stream channels are prone to silt up, loams and clays are also to be found within the confines of the former levies. Loams and clays make better agricultural soils than extremely sandy land, so that where the subsoil water is neither too high or low, arable land will hug the levies.

Unfortunately, sitings near levies are subject to periodic flooding, which has the long term benefit of adding fresh depostis of loam, clay, and water borne nutrients to river bank soils, but which has the short term drawback of ruining standing crops. In regions where flooding is common, arable production becomes ever more risky, and substantial crop losses every few years must be allowed for.

As one approaches the North Sea Coast, the flood plains of the great rivers become so flat that the rivers and their tributaries begin to braid, i.e., they branch out into a myriad of slow moving sub-channels and rivulets. Braiding becomes ever more pronounced as one approaches the coast, so that enormous deltas are laid down over a substratum of glacial sand. Braiding is so extreme along the North Sea Coast that the landscape becomes broken up into innumerable small islands surrounded by half choked creeks called Preilen. This landscape constantly changes as water courses silt up or as flooding scours out old water courses or makes new ones. Throughout much of the braided area, the islands between the Preilen are of inhabitable sand, silt, leam, and clay. In the last few miles to the sea, however, the land is so low lying as to encourage the growth of freshwater peat or fenland. In the centuries before approximately A.D. 250, a solid band of relatively uninhabited peat stretchng from Flanders into Jutland. Beyond this band of peat, marine currents had built up an extensive set of sand bars and dunes forming a natural dike for the freahwater fens, damping the action of tidal ebb and flow.⁸⁷ These coastal dunes were tens of miles across in northern Holland but narrowed as one moved down the coast into modern Belgium and

and France. Around A.D. 250, the level of the sea rose slightly, the force of tidal ebb and flow increased, and extensive sections of the coastal dunes were breached.⁸⁸ Much of the freshwater fenland was destroyed under a blanket of sticky, saline marine clay. Increased tidal action also interfered with river discharge, especially in the spring, so that flooding increased all along the delta system. This Late Roman Transgression posed obvious complications for human occupation of the North Sea Coast, an area which had become heavily populated during the pre-Roman Iron Age.

By the late Bronze Age, there are strong archaeological indications that the heath regions of the North European Plain were becoming seriously overpopulated.⁸⁹ While the interior heathlands were capable of predictable outputs of cereals (especially rye) and animal products, these outputs were only possible through optimum siting of arable lands and carefully managed use of heather dominated rough pastures.⁹⁰ Attempts to farm on exceptionally poor soils or in areas with unsuitable hydrological characteristics would result in abysmal harvests, and attempts to boost stocking rates might soon exceed the winter productivity of grazing lands. The only real solutions to overpopulation on the heathlands would be population control or outmigration. By the early Iron Age, a gradual lowering of mean sea level along the North Sea Coast reduced the danger of flooding along the braided delta lands sufficiently to encourage large scale colonization.

By the time of the Roman advent, the North Sea Coast had become the primary focus of human settlement within the North European Plain

west of the Elbe.⁹¹ Judging from the number of sites, some scholars have reasoned that the population densities may have equalled or exceeded the rural population levels of the coastal Netherlands during the high middle ages.⁹² While this may be a slightly exaggerated estimate, the populations involved were high. The first settlements along the coast had been isolated farmsteads, perhaps mere shielings.⁹³ In time, the braided river systems became dotted with hamlets, then village-sized agglomerations. The first settlements were usually built flat on the level of the floodplains. Gradually the practice spread of placing houses, first singly, then as complete hamlets, on artificial mounds of earth, peat, straw, and gung. These terpen, to use the Dutch term, or Wurten, as they are called in Germany, offered safe refuges against periodic floods. The use of terpen continued into the middle ages, after which time artificial dike construction began to replace habitation mounds as a remedy for the floods. Still, terpen and Wurten have continued to be occupied till modern times all along the North Sea Coast, providing invaluable comparative insights for students of the prehistoric settlements.⁹⁴

While the danger of marine inundation lessened through the Iron Age and into the early Roman period, periodic flooding along streams and rivers was still a problem. Crops ranging from barley and beans to flax were grown on the North Sea Coast, either in garden plots on the terpen or in intakes along the Preilen, but periodic crop failures were inevitable. The marshy conditions of much of the pasture land must also have discouraged or complicated the keeping

of sheep, whose feet are **very** sensitive to excessive dampness.⁹⁶ Against these drawbacks, the coastal zone offered numerous inducements for cattle rearing. Cattle can stand up to wet pasture conditions better than sheep. At best, some winter housing and stall feeding might be appropriate, especially if dairy cattle were given emphasis. While most of the native grasses along the North Sea have rather short growing seasons, the area of natural grassland is immense, providing an inexhaustible source of mediocre quality hay meadows. From an early date, the terpen sites became dotted with large barn-like three aisled house-byres. Terpen middens became littered with the bone and horn debris of cattle, and the fossilized remains of pasture grasses and stable bedding abound in habitation mounds well tempered with manure.

While the possibilities for cattle raising were extremely attractive, the North Sea Coast may well have found itself short of sheep and wool.⁹⁷ Periodic crop failures affecting regions of varying extent also had to be reckoned with. The effects of crop failures could be partly offset by creating large storage facilities for cereal foodstuffs, and the more substantial prehistoric terpen hamlets often show one particularly large house-byre complex, perhaps the residences of village chiefs, which were well provided with outbuildings and other structures that may well have served as communal granaries.⁹⁸ Another strategy would have involved series of alliances between groups along the coast, alliances struck to assure assistance for flood-stricken terpen from neighboring groups who had experienced better harvests. Since the incidence and extent of flooding

were virtually unpredictable, such networks of alliances may have been fairly extensive, perhaps forming the underpinnings of the tribal groupings noted from time to time by ancient authors.

References by ancient authors and conspicuous similarities in archaeological assemblages suggest that a Frisian culture group spanned the coastal zone in much of present day Belgium and Holland.⁹⁹ Detailed analyses of ceramic assemblages for a similar large culture group situated roughly between the Ems and the Elbe suggest that this area was the focus of two or more fairly discrete sub-groups, either the whole collection or one of the sub-groups being associable with the Chauks noted in ancient sources.¹⁰⁰ It is highly probable that the Frisians were likewise a composite group, knitting together in some fashion a number of smaller tribal or sub-tribal units. Large scale associations such as the Frisians may have been based around complex exchange systems for subsistence items or around agreements making possible relocations of hamlet and village groups. Various types of periodically mobilized military commitments are another possibility. And, of course, these larger associations may have played a role in sets of exchange transactions along the coast moving goods from Gaul to Jutland and the Baltic.

The Frisians were noted in antiquity and later in the middle ages as traders,¹⁰¹ and middleman profits from transporting or merely transshipping exotic prestige goods from the south for the amber and furs of the north could well have been a vital source of supplementary income along the North Sea Coast. The Frisians and the Chauks may also have figured prominently in the regional distribu-

tion of cake salt from the springs near Lueneberg. The exceptionally high quality of the salt from these springs was later to form one of the economic underpinnings of the Hansa, and salt must have been a highly prized substance in the pastorally oriented mixed farming systems of Northwest Europe both along the coast and even in the heathlands of the interior.¹⁰²

While ties along the coast were probably of prime importance, the possibility of ties with groups in the interior should not be ignored. The coastal populations had originated in the interior geest lands, and an underlying substratum of cultural similarities between the two areas has long been recognized. Before approximately the mid-1950's, it was widely presumed that these signs of mutual influence had much to do with an ongoing trade in foodstuffs from the interior to the coast, the assumption being that the coastal areas could not have produced any harvestable crops other than from small garden plots on the terpen.¹⁰³ This assumption rested to a considerable degree on medieval analogies, by which time a striking division of labor had arisen between the coast, geared to cattle production and dairying, and the interior, geared to sheep farming and the production of small grain surpluses.¹⁰⁴ Palynological work on excavations begun since World War II coupled with actual field experiments designed to replicate prehistoric cropping conditions have demonstrated that barley, spelt, wheat, beans, and other crops could have been and actually were grown in sizeable quantities along the North Sea Coast making use of appropriate Freilen sitings.¹⁰⁵

These post-war findings have led recent scholarship to posit a virtual self-sufficiency for the terpen communities.¹⁰⁶ This viewpoint, while correct in many respects, ignores one vital factor, i.e., the inherent unpredictability of yields on the flood prone North Sea Coast. Modest but predictable grain surpluses could have been produced in the geest lands, and it seems reasonable to expect that some loose set of alliances would have been maintained between the coastal and interior groups. In addition to cereals, the interior regions could have supplied the coast with much of its wool. A trade in timber is also a possibility. The present landscape along the North Sea Coast is virtually treeless. Pollen analyses have shown that stands of timber still existed during the pre-Roman period.¹⁰⁷ By the late Iron Age, however, considerable inroads had been made in this timber reserve, especially in the supplies of oak so important for large structural supports used in houses or ships.¹⁰⁸ In return for grain, wool, and timber, groups in the interior could have received dairy products, hides, items worked up from bone and horn, good quality salt, and exotic trade goods, especially trade goods from the Gaulish and Roman south.

The high population densities on the coast are the surest indication that the terpen groups exploited all the alliances they could. In the middle ages, high population densities on the coast were only possible because of extensive inter-regional divisions of labor and inter-regional trade.¹⁰⁹ Even the most efficient of redistributive systems on the coast would probably not have completely sufficed to compensate for the dangers of periodic large scale

flooding and subsequent crop failures. Trade ties with the interior would have added an additional measure of stability since groups in the interior could generally be expected to produce modest surpluses. The prehistoric complex of alliances was perhaps not as sophisticated and specialized as during the middle ages, but without some close approximation to the medieval situation, the high population densities in prehistoric times are difficult to account for.

Such a multi-stranded set of inter-village and inter-tribal ties was designed to provide predictable margins of error for delicately balanced mixed farming systems. Without such alliances and without such margins of error, life on the North Sea Coast would become extremely precarious, at least for the high population densities involved. In the course of the first century or so of the Christian era, contact with Rome began to strain tribal ties, and in the course of the third century, a slow rise in the level of the sea, the so-called Late Roman Transgression, began to render large portions of the coastal zone a wasteland.

Rome was generally less interested in the North Sea Coast itself than in the region's importance in controlling north Gaul, Germany, and, after the reign of Claudius, Britain. The Romans saw little use in the heaths of the North European Plain, and they were completely baffled as how best to police the constantly shifting braided water courses of the lower Rhine.¹¹⁰ Except during major campaigns, such as Augustus' German operations or Claudius' invasion of Britain, the Romans preferred not to over-garrison the lower Rhine. A few patrol positions were kept during times of relative

calm,¹¹¹ but the main responsibility for the region was passed on to centers farther up the Rhine, e.g. Vetera or Cologne, and to a string of bases through Belgium and northern France centering on the major naval station at Boulogne.¹¹² These rearward implacements normally sufficed to hold the Rhine as an emergency route for ferrying supplies and troops as needed to spots around the North Sea and Channel coasts.

To bolster her control of these rearward base camps, Rome attempted to strike treaties with various of the coastal groupings, often using these federates as sources of auxiliary troops. During the early Principate, these treaty arrangements frequently backfired, one of the chief precipitating factors being the vague ambitions of the successive generations of Germanici spawned by Tiberius' brother Drusus. Groups such as the Marsi were virtually obliterated by Tiberius' nephew to give his balky troops something to do.¹¹³ Later in the century, the widespread chaos commencing with the end of Nero's reign included a revolt of troops and tributary tribes in northern Gaul and the lower Rhine, in the aftermath of which the rebels, including the heretofore loyal Batavii, were severely punished.¹¹⁴ In the course of the early Principate, another group, the Menapii, who had had a reputation as the Frisians of the Flanders coast, slowly sank into oblivion.¹¹⁵ The erratic nature of Roman policy on the lower Rhine was far more devastating than any calculated malice could have been, and the net result was undoubtedly to debilitate most of the groups behind the tentative frontier on the Rhine.

Groups beyond the Rhine fared somewhat better although Tiberius' reign saw a tax revolt by various of the Frisian groups along the Rhine.¹¹⁶ The primary ongoing problem for the trans-Rhenish groups was that Rome was in a position to manipulate long distance trade routes along the coast in an arbitrary manner in order to elicit political and military acquiescence from tribal groups on the coast and its hinterland.¹⁷ The second century saw few major emergencies in Northwest Europe, so the North Sea Coast groups enjoyed a form of benign neglect, which was at least predictable. The calm was broken in the course of the late second century and repeatedly in the third century as troubles erupted along many of Rome's frontiers and the spectre of civil war hung heavier and heavier over the Empire. The lower Rhine became a pawn in these larger emergencies, and, not surprisingly, it is during the third century that the Romans began to view the Frisians and other North Sea groups less as traders than as bothersome pirates. The reputation of the North Sea Coast groups was further blackened during the late third century in the course of an abortive attempt by Carausius to usurp the position of Maximian, Diocletian's colleague in the West.¹¹⁸ Basing himself at Boulogne and a few bases in Britain, Carausius rallied support from numerous native tribes along the coast. By 293, Carausius' revolt had been put down by Constantius Chlorus, the father of the future Constantine the Great, but in the process, sharp punitive measures were dealt out to the Frisians and their neighbors, involving not only the loss of life and property but a marked and sustained curtailment of trade with the empire.

Concomitant with the increasingly unpropitious political, military, and economic relations with Rome, North Sea Coast groups were plagued by a disaster of equally grave proportions, the Late Roman Transgression.¹¹⁹ A slight rise in mean sea level magnified the impact of high tides, especially those in spring, sufficiently to alter the ecology of sizeable stretches of the delta regions. Large sections of the sheltering coastal dunes were breached along the mouths of rivers and streams. These dunes had never been very substantial along many portions of the coast, but the dunes' diking actions had been vital in reducing the force of heavy tides. The dunes were almost entirely obliterated along the coasts of Flanders, and the curiously fragmented appearance of the mouths of the rivers Scheldt and Maas around modern Rotterdam are largely a product of this Late Roman Transgression. Where the dunes were substantially eliminated, high tides carried brackish water far inland and dumped a mantle of sticky, saline marine clay. In the course of the middle ages, much of this zone of marine clay would be reclaimed once the sodium had been flushed from the upper soil layers. Much of the zone of marine clay had been a solid belt of fresh water peat, and tidal deposition of silt and clay ultimately increased the extent of habitable land once the sea level had dropped again and as techniques of artificial diking, impoldering, and pumping became widespread. Unfortunately, these medieval developments were of little avail to the terpen communities of the Roman period.

During the Roman period, the onslaught of daily tidal encroachments served to imperil the already sluggish discharge of

the braided river systems, increasing the incidence of flooding for a considerable distance inland. If this Late Roman Transgression had been a single, pan-regional catastrophe, the terpen cultures might have been eliminated altogether, but the transgression was more insidious than cataclysmic. Only in a few regions were the rises in sea level heralded by decisive, permanent flooding. Over much of the North Sea Coast, the effects were halting and piecemeal, perceptible only over a long span of years or decades. The main effects would have been a slow decline in the quality of pasture lands tainted by brackish water, an increased likelihood of flooding, and a growing unpredictability in the incidence of minor inundations. This last effect, increased unpredictability, was probably the chief bane of the terpen cultures.

Life in the terpen zone had been predicated on the elaboration of cultural mechanisms allowing predictable margins of safety to a basically unpredictable mode of existence. The Late Roman Transgression slowly eroded this margin of safety and must have eventually begun to erode the effectiveness of pre-existing tribal and inter-tribal alliances. These strains were magnified by the impact of Roman contact. At about the same time the North Sea was making life difficult for the terpen groups, Roman policy was becoming increasingly hostile and increasingly erratic. The frontier on the lower Rhine was awkwardly planted in one of the regions harder hit by the rise in sea level. The task of maintaining the Rhine as a communications and logistics link between Britain, Gaul, and the middle Rhine was rendered naturally difficult by radical alterations in the hydrology of

the delta area. Serious flooding along the Rhine mouth must have also prompted a general demographic ferment as native groups tried to move to higher ground farther up the Rhine or farther to the south.¹²⁰ Rome's general reaction seems to have been to resist these territorial realignments.

One strategy used to hold the coastal peoples in check was through a cessation of trade. Trade in Roman goods, which had probably come to serve more as a bribe than as an economic transaction, was now redirected to groups farther inland in the heath regions.¹²¹ This redirection of Roman largess had a definite logic since there are strong indications that large numbers of North Sea inhabitants were attempting to recolonize the geest regions.¹²² This recolonization movement had begun in the second century, before the marine transgression, and in the third century very probably became a general movement. The geestlands had reached a dangerous demographic saturation in the late Bronze Age, a situation that had been remedied by favorable prospects for occupation of the coast during the Iron Age. The Roman period saw a renewed demographic glut in the sandy heathlands as refugees poured back from the coast. The geest region was poorly equipped to absorb the new populations, so pressure began to build up to the south along the Roman frontier above the mouth of the Rhine. Roman redirection of trade routes was probably inspired by attempts to stave off an influx of peoples into the empire from this new direction. Over the short term, this policy may have helped to hold the Rhine frontier, but over the long term, Roman meddling may have been the last straw in a wholesale disruption

of tribal and inter-tribal ties throughout Northwest Europe.

The combination of natural and Roman perturbations outlined above inaugurated a period of chaotic jostling and inter-group hostilities that slowly crescendoed from the mid-third century on. The coastal groups changed from traders to pirates, and the geest regions spawned their own collections of warlike freebooters. After the third century, the Roman state slowly deteriorated in the west, and a policy of holding the barbarians at bay devolved into a face-saving strategy of legitimatizing the landtakings of certain groups and setting these to fight their fellows. The Roman defenses in Britain were steadily farmed out to laeti and foederati drawn from Frisian and Anglo-Saxon pirates,¹²³ and the landward defenses in northern Gaul were progressively left in the hands of the Franks.¹²⁴ These avenues of legitimatized outmigration were apparently insufficient to solve the problems of the terpen peoples and their inland neighbors. The Franks in particular seem to have been able to prevent other groups from infringing on their sanctuaries in Gaul.¹²⁵ An ongoing infiltration into Britain¹²⁶ may have helped ease demographic pressures along the coast, but by the fourth century, the main problems may not have been exclusively demographic.

Life on the North Sea Coast, at almost any demographic levels, presupposed a modicum of inter-group cooperation. Increased inter-group hostilities from the third century on had radically transformed mechanisms of cooperation into mechanisms of internicine plunder. Robbery may seemingly accomplish many of the functions of peaceful exchange,¹²⁷ but robbery is often a singularly inefficient replacement

for peaceful alliances. On the North Sea Coast, peaceful exchanges had allowed groups handicapped by occasional crop failures to tap the small surpluses of unaffected regions. Hardpressed groups were tided over their temporary crises, the donor groups were not impoverished by their charity, and donor groups could anticipate similar reciprocities if and when they should experience troubles. The replacement of these peaceful mechanisms by violent ones ran the risk of depleting not only the surpluses but the capital of the forced donors. Raided parties might be wiped out or, if they survived, might be obliged to recoup their losses at short notice at the expense of still other groups. The net result would be to dry up incremental surpluses in a wasteful manner and impoverish whole regions through the inefficiency of runaway violent redistribution. Beginning in the mid-fourth century, there are signs of large scale abandonments and destructions of settlements throughout the North Sea Coast and its hinterlands.¹²⁸ These phenomena cannot be explained solely by the marine transgression, and dramatic theories of a genocidal Anglo-Saxon invasion sweeping from north to south through the coastlands before turning to England are now being subjected to critical scrutiny.¹²⁹ Britain undoubtedly absorbed some emigrés, but it is eminently probable that many of these groups succumbed in situ to the maladaptive impact of their own endemic violence, whose disruptive effects may have been worse than any punishments dealt out by the North Sea or by Rome.¹³⁰

Both the terpen groups of the North Sea Coast and the Dumnonii of Southwest England comprised delicately balanced tribal hierarchies

subject to limitations and constraints sufficiently tightly drawn that the introduction of Spanish tin or the diversion of trade routes from the North Sea to the interior could force radical alterations in the existing interaction sphere organizations. In both these regions, relatively minor doses of Roman meddling could induce substantial transformations. Transformations every bit as radical could be induced in areas with more resilient economic substructures if the scope of Roman interference were magnified. The effects of limes systems such as those on the middle Rhine or in Northern Britain could easily lead to drastic alterations in tribal life. The present chapter has outlined how substructural fragility could favor significant and maladaptive transformations. The next chapter will focus on the equally pervasive impacts of superstructural pressures on interaction sphere societies.

CHAPTER VIII

ROMAN PROVINCIALS, ROMAN FRONTIERSMEN, AND ROMAN BARBARIANS

The exigencies of frontier incorporation frequently occasioned radical transformations of pre-existing tribal societies. Usually, these transformations proved maladaptive for societies along the frontier zone. Indeed, frontiers became crucial interfaces for a number of processes affecting tribal societies well beyond the normal reach of Roman military or diplomatic pressure as well as the provincial heartland of the empire. The range and scope of these processes was beyond the effective control of any of the parties involved, even the Roman state. A number of these processes had cumulative destabilizing tendencies, tendencies whose ultimate impacts were felt throughout the whole of the ancient world.

The history of the Roman world from the late Republic on had been a record of less than happy solutions to the organizational problems of ancient societies. At the end of the civil wars that swept away both the letter and the spirit of many Republican institutions, the Roman state was reduced to an uneasy appendage of the vast network of patronage centering on the imperator Octavian and his legions. An enormous amount of centralized power had been placed in the hands of one man, but the vast Mediterranean arena thrust into Augustus' grasp was in many ways unmanageably large, and the organizational machinery at Augustus' disposal was woefully inadequate.

Having embraced the goal of centralized rule, Augustus' Principate began without anything that even vaguely resembled a proper bureaucracy. Great strides were made through enlarging the staff of slaves and freedmen comprising the emperor's own familia and through a vastly expanded roster of civil and military careers opened up for Roman citizens of equestrian status. By the second century, a career in the imperial service had become respectable for persons of senatorial rank, especially for senators drawn from provincial areas. By the second century, the Roman state had acquired numerous bureaucratic trappings, but from beginning to end, the imperial bureaucracy directly managed a rather minute range of the ancient world's affairs. Imperial control seldom extended beyond a few military matters and the taxation system mediated by provincial officials. The state had virtually no control over the basic underpinnings of the empire although its handle on military and fiscal affairs gave it considerable indirect influence on socio-economic variables.

Within the core provinces of the empire, the government leaned heavily on the continued viability of networks of elite patronage clustering around city states, municipalities, or various less highly urbanized cantons. The vast majority of public services stemmed from the munificence of personal liturgies and munera by local patrons, and the service aristocracy that emerged in the course of the first and second centuries A.D. was, in many ways, merely a supra-local extension of such local patronage tapped for the benefit of the state.¹ The graded ranks in the career structures of these regional and imperial elites did not constitute bureaucracies in any meaningful sense,

but because of the relative effectiveness of these hierarchical networks of patronage, ancient society was spared the inordinate expense that would have resulted had the minimally bureaucratized institutions of the state actually attempted to expand their spheres of control.

Because the government functioned by an accommodation to pre-existing elite nexuses, the state was fundamentally ignorant of many local level affairs, to the point that even the poll and land taxes were based less on knowledgeable assessments of personal wealth than on donatives, grudgingly or willingly granted, from public spirited contributors to communal finances.² The notion that imperial censuses extended to a careful evaluation of the value of land and harvests at the local level is largely a myth. The Roman Empire in its heyday never achieved such a knowledge nor did modern European states until surprisingly recent times.³ In a preindustrial society with a substantially uncommercialized rural economy, a central government would face an insuperable task determining the mere size of a harvest, much less its value since, never entering into monetized transactions, the foodstuffs would never be adequately quantified or acquire exchange values. In a society where land was less a source of ground rent than a mark of social status, land had no readily ascertainable value. Except in times of panic such as gripped Italy during Caesar's dictatorship, land was less commonly sold than inherited, acquired as largess, created out of wilderness, or confiscated. Under such conditions, a government could do little more than levy tributes or solicit donatives. Such was the tax

system of the Roman Empire in its heyday, and the nature of the tax system is a valuable index of the tenuous control the Roman government possessed over its rural economy.

Not surprisingly, the Roman state was unable to institute a genuinely effective fiscal or monetary policy. Economic equilibrium could be unwittingly disrupted by the state, but the government lacked the knowledge to remedy all but minor disruptions. For some two centuries or more, the central government was extraordinarily lucky in that its periodic fiscal embarrassments and its dynastic crises bordering on civil war did not unduly jeopardize the resiliency of its semi-autonomous substructure of local patrons and toiling peasants.

In the course of the so-called third century anarchy, this substructure was jeopardized. Public-minded patrons became rarer, the integrity and cohesion of municipal economies were severely impaired, and after Diocletian, the hapless central government was forced to grope beneath the level of the faltering communities to tap as best it could the productivity of individual landowners and tenants through the bureaucratically nightmarish system of iuga and capita.⁴ This late Roman taxation system dismally failed to distinguish between income and capital investment, so that a freshly planted olive grove or vineyard could conceivably be taxed more heavily than an indifferent patch of wasteland sown with cereals.⁵ This misguided progressive tax may have been the final straw that channeled entrepreneurial acumen away from profitable investment into the safe bets of seigniorial mediocrity and the tax shelters of imperial privilege. That Diocletian had pegged his expectations of productivity at so low a common

denominator, however, is a measure of how far the provinces had sunk into autarchic self-sufficiency by the late third century.⁶ The processes responsible for the widespread decapitalization of the late Roman economy had much to do with the central government's other arena of limited control, the military and the frontiers.

Without the legions, an empire as extensive as that under the Principate would have been unthinkable. The economic linkages between the various provinces were important but hardly pervasive, and these linkages had often been rendered more precarious by the mischances involved in the assembling of the empire. Rome's chief contribution to the economy of the eastern Mediterranean from the second century B.C. on had been the obliteration of the Rhodian fleet. This loss was never really made good, with the result that major sea lanes often went unpoliced and vast stretches of the coasts of southern Anatolia and the northern Levant became pirate's nests.⁷ The destruction of the Carthaginian fleet in the West had produced similar outcomes as attested in Octavian's early troubles with Sextus Pompeius. Even worse than unpoliced sea lanes was the economic havoc periodically set loose by disputed successions when the Mediterranean threatened to dissolve into civil wars reminiscent of the late Republic. Ideally, the Roman Empire probably should have fragmented into two or more parts, as it eventually did. A forced unity was maintained for two centuries and more largely because the core provinces were shielded from the worst accidents of Rome's military precociousness by the frontiers. The frontiers not only protected Rome from external barbarians, they also kept the

legions and auxilia at a respectable distance from the delicately poised political and economic life of the more settled provinces.

Attempts to lessen the more obvious signs of the empire's military sinews frequently conflicted with considerations of a strictly tactical or strategic nature. The thirty or so legions and a roughly corresponding number of auxiliary units maintained to the time of Diocletian were woefully inadequate to police the thousands of miles of fringing imperial hinterlands. A truly adequate force would have seeded the frontiers with far too many ambitious generals.⁸ As a result, the imperial defenses were often thinly spread although ambitious generals and mutinous troops were not entirely eliminated. Since the armies were so dispersed, their effectiveness depended on excellent training, discipline, and morale. Interestingly enough, the rigors of frontier duty seriously eroded these very qualities.

Terms of service in the Roman army were long, twenty five years for auxiliaries and twenty for legionary troops. Pay was nominal, and there is accumulating evidence that a graft ridden quartermaster system and a tendency toward petty extortion by lower echelon officers meant that troops seldom touched hard currency.⁹ The main inducement for recruitment was the prospect of a handsome pension upon discharge, often in the form of land in some Roman colony. For the auxiliaries, military service was the gateway to legal privilege for themselves and their progeny. For those lucky enough to rise to centurion rank, many attractive opportunities opened up both in further military service or civilian administration,

and a centurion's children were well placed to vault into the privileges of the equestrian class.¹⁰ Chances for such rapid advancement through the ranks were exceedingly slim,¹¹ but as soldiering became a near hereditary calling, the prospects of an honorific retirement and privileges for one's children apparently sufficed to keep recruitment levels high.¹²

The inducements of military service were not sufficiently lucrative, however, to attract many Italians or citizens from core provinces. By the second century, nearly the whole of the army, both legionaries and auxiliaries, were being drawn either from backward provinces or from the frontier areas in which the armies operated.¹³ From an early date, the prospects of being stationed far from one's place of recruitment must have cut into provincial recruiting. Since detachments within given legionary units were often moved from one corner of the empire to another during the early Principate, one could not even be sure of one's place of discharge. These frequent vexillations were made more irksome since the government promulgated a whole series of laws discouraging marriages or at least refusing to recognize the legitimacy of a marriage or its offspring. Such laws were resented and were progressively ignored or dismantled. Except in emergencies, the frequency of vexillations also decreased. The theatre in which one was stationed now became the area in which one would be discharged and pensioned off, and as army service became a de facto hereditary calling, place of recruitment and place of discharge came to coincide.

In the early Principate, frequent campaigns and vexillations

and rather Spartan living conditions¹⁴ had occasioned periodic grumblings among the troops, even a few mutinies. In the course of the second century, complaints over living conditions subsided, but only at the expense of a radical change in the complexion of the army. The professional armies of the Republic had been mobile field armies, geared to a high level of battle readiness. When not in use, these armies had usually been discharged or mustered out to some new theatre of operations. The armies of the Principate were usually in an awkward limbo between mobilization and demobilization, and as recruitment and discharge came to revolve around the selfsame districts, the armies began to assume the character of militias, whose battle readiness was often dubious.¹⁵

To maintain any sort of esprit d'corps and ward off the ills of total inactivity, troops were often set to a number of non-military or paramilitary tasks. Many of the legions were stationed at some distance rearward of the limes zones, and legionaries were commonly detached to aid governors as bodyguards, escorts, policemen, tax collectors, or intelligence agents.¹⁶ The army was frequently tapped as a corps of engineers, taking a hand in planning or building roads, aqueducts, or civic amenities. There is an excellent probability that much of the impressive masonry of frontier installations such as Hadrian's Wall were elaborate make-work projects designed to keep the troops busy at something when no other duties, military or paramilitary, were in the offing.¹⁷

In addition to ennui, a major danger to the effectiveness of the Roman military system came from the increasingly local allegiances

of the troops, to the extent that in the course of the second century, the Roman army was insidiously replaced by numerous regional armies. In the early Principate, the army had been a marvelous melting pot, infusing its recruits with a common Roman veneer, and, upon discharge, seeding them as exemplars throughout the empire. By the late second century, the emperors found themselves possessed of a set of locally attached militias. This might have been tolerated had these militias maintained the ability to fight. Unfortunately, they had not.

From about the time of Marcus Aurelius, when better than a century of relative peace was broken by a number of large scale frontier disturbances, the emperors were hard pressed to find any given set of legions in fighting trim. To meet emergencies, crack troops had to be vexillated from all ends of the empire.¹⁸ In time, the creation of special combat units formed from such extraordinary vexillations became standard practice. This policy won battles over the short term, but it often aggravated the lax discipline of the frontier forces by stripping them of their better personnel. Morale undoubtedly plummeted, but the emperors were too hardpressed to devise other alternatives. In the course of the third century, these painfully created vexillated units were increasingly kept together.¹⁹ A new elite group of mobile field armies slowly emerged, and Diocletian institutionalized this development in his military reforms. On paper, Diocletian seems to have doubled the size of the army. In fact, Diocletian and his successors merely finalized a process whereby a whole new army had had to be created, the older legions and auxilia

sinking to the status of second class militias of little strategic importance.²⁰

While the decrepitude of the original Augustan frontier system took over a century and a half to reach dangerous proportions, the unwieldiness of this far flung system was apparent almost from the beginning. The frontiers eventually cost the empire its armies and the expense of creating new ones. More immediately, the frontier system proved well nigh impossible to coordinate under any rational form of central control. The geographical division of labor between militarized frontiers and tribute producing core areas created a curious situation where an emperor either had to spend much of his life in the barracks, with a resultant lapse in civilian administration, or manage the core provinces to the neglect of the military. The importance of the military, not only in matters of defense but as the vital cement holding the empire together, commonly led to a skewing of priorities toward military affairs. Many aspects of civilian administration were thrown into confusion as the upper echelons of the imperial bureaucracy attempted to tag along after militarily minded emperors, garnering advice or approval on civilian affairs at odd moments in the midst of campaigns and valiantly attempting to relay such hastily conceived policy decisions back to the appropriate middle echelons in Rome or the provinces.²¹ Luckily, affairs in the core provinces could often be expected to run themselves, but the skewing of imperial concern toward an unmanageably diffuse military establishment boded ill should provincial management ever demand careful attention.

If the management and maintenance of the legions and auxilia were to create problems that seriously reduced the efficiency of the central government in responding to pressing military problems, the empire was in trouble. If organizational processes centering on the militarized frontiers in any way set in motion trends that jeopardized the poorly controlled economic underpinnings of the provincial core, the empire was in even graver trouble. Both these dangers were realized, and their realization was made almost inevitable since little heed was ever paid to the management of the societies along the frontiers and almost no heed was ever paid to the management of the problems of societies beyond the frontiers. Rome's considerable investment in her frontier systems was predominantly linked to the maintenance of a status quo that looked more to the preservation of the imperial core and its governmental superstructure than to the interests of the frontier hinterlands. Frontier societies had to adapt as best they could to the strictures of this overarching imperial system. The fate of subordinate components within a centralized, hierarchical system is often precarious even when control is well informed and timely. A centralized, hierarchical system that demands pliant subordination with little regard for, or a blithe ignorance of, the limitations and constraints of its lower order constituents is tempting trouble. Rome either set out upon or blundered into just such a policy toward its frontier hinterlands, and the result was a set of nagging destabilizing tendencies of the same kind met with in a poorly organized modern bureaucratic business enterprise.

The effects of centralized mismanagement were most apparent on the frontiers and among external tribal groups. The effects of these frontier maladaptations also had their impact on the Roman government and even on the fabric of provincial society. These more far reaching effects are less immediately apparent, largely because simple linear causal chains get lost in the convoluted circuitry of a complex, geographically extensive society. These reflexive causal pathways tied together the ancient world into one functional, or perhaps one should say dysfunctional, whole, and the impacts of these complicated functional relationships were pivotal in the phenomenon that F.W. Walbank has styled, in inelegant imitation of Ronald Syme, the Awful Revolution.²² The radical transformations that took place in the late Roman world are usually considered from various partial perspectives. Race mixture, lead poisoning, moral decadence, manpower shortage, over-taxation, Christianity, and barbarian hordes, singly or in combination, have been advanced to explain the fall of Rome. One of the problems with most efforts to isolate causes or culprits is that the subject, Rome, is never clearly defined.

The usual conceptualizations of the ancient world cut the provincial core off from its frontier hinterlands. This procedure seems quite innocent on a large scale map, but in the process, fundamentally important organizational features are severed or glossed over by an over hasty cartographical convenience. To separate the societies along and beyond the frontiers from the empire runs the risk of obscuring vital linking processes that cannot be grasped in isolation. To combine Roman provincials, Roman frontiersmen, and external barbar-

ians into one canvas may seem an unnecessary complication. In fact, this larger canvas allows one to grasp more readily certain overall processes and trends that are tightly interrelated. Such a totalization simplifies an analysis of the Awful Revolution while partial perspectives run the risk of beclouding the problem to the point that the fall of Rome has seemed to modern scholars, as it did seem to early Christian theologians, the work of something very much like Divine Providence. Perhaps some of the inscrutability can be removed by a more appropriate framework of analysis.

Roman frontiers commonly took shape within pre-existing tribal hierarchies. The institutions of these pre-existing societies had been primarily designed to control local level variables centering around demographic imbalances, unequal resource endowments, or oscillations in subsistence system productivities. The institutions of Roman frontiers were designed less to control these basic variables than to manipulate the lines of tribal and inter-tribal cleavage. Rome demanded relative peace from the native groups and, in addition, lands, personnel, and provisions for her armies. If these demands could be accommodated by the pre-existing institutional patterns, well and good. If such was not the case, the natives were still forced to adapt to the new demands as best they could. Where the Romans came into the whole of a fairly resilient interaction sphere, provincialization might ensue. Tribal centers would become towns or cities, tribal leaders municipal magistrates, and the erstwhile tribesmen farmers, peasants, and tenants. In Illyrica, Pannonia, Moesia, Spain, Gaul, and Lowland Britain, provincialization worked fairly well. Other

regions were either more delicately balanced or the Roman advent had disasterously miscarried, as with the crude partitioning of Germania following the massacre of Varus. In such contexts, provincialization was substantially thwarted, and attempts to manipulate the institutions of the pre-existing societies could lead to striking maladaptations.

Roman control along her frontiers was seldom as sensitive as the pre-Roman control mechanisms had been. Roman provincial administration was often none the best either, but in the provinces information, whether acted on or not, could at least be put forward through a number of channels. On the frontiers, control hinged almost entirely on military channels, and these channels often proved inadequate. Military establishments were ideal media for extorting command, compliance, and subordination, but where the strong arm tactics of command exceeded the limits of control, all the masonry of Hadrian's Wall or the Rhenish limes could not ensure that events would follow some anticipated course. Tribesmen might face starvation from crop failures or starvation. The conspicuous barrier of the Rhenish limes might tempt the Romans to ignore such facts altogether. Even if the dilemmas of frontier populations were not ignored, miles of palisades and figurative miles of protocol and red tape might still make it hard for the Romans to respond. And if there were a response, it might take the form of encouraging the tribesmen to attack their neighbors or their neighbors to attack them. If all else failed, the Romans might solve the problem by decimating the hungry and potentially restive natives in a show of military strength, perhaps using troops drawn from the

very groups being punished. Punishment might even be meted out for no apparent reason at all. A misunderstood rumor, an undetected lie, a clerical error, or a general's whim would suffice for the application of the universal military remedy, force. Punishment might be out of all proportion to the real or imagined offense. The Roman frontier forces were often spread thin and could take few chances, so that a minor problem might be dealt with severely before it reached unmanageable proportions. A truly major problem might prompt the creation of a problem free human desert, as seems to have been the policy along stretches of the middle Rhine during the Julio-Flavian period.²³

The frequent crudity of Roman control of native affairs along the frontiers was dictated in large part by the fact that the frontier garrisons were usually hard pressed to keep themselves in ordnance and rations. At any given time, well upwards of fifty percent of the men at a frontier post might be scattered at various points along the frontier zone or in rearward provinces.²⁴ The troops basically had to supply their own logistics trains,²⁵ and these duties, not uncommon in military history but made particularly irksome by preindustrial conditions, dipped heavily into the number of troops that could be pressed into battle at short notice. Except when campaigns could be planned well in advance, it was hard to reorganize frontier units into large strategic deployments.²⁶ As a result, Roman military response could be paltry or massive, but there was no real middle ground. The routine logistics duties of the troops were often so overwhelming that little allowance could be left for the affairs of

local native populations, and while local garrisons might become aware of native problems, the only information really worth gathering or passing on would be whether the problems posed a potential military threat.

Unless major campaigns were being planned, lower and middle echelon officers had relatively little to do except supervise the allocation of supplies and troops.²⁷ Even the upper officer grades might find little to do in a military way during times of relative peace. Since many of the officers were of senatorial or equestrian background and were more intent on the honors of a public career than in actual soldiering, long spells of peace could lead to a noticeable slackness in strategic planning or attention to overall policy decisions and organizational efficiency.²⁸ Such slackness could occasionally extend to the highest levels of the military and governmental hierarchy. Not all the emperors had a feel or even a taste for military matters. Many military governors were despatched with only the vaguest instructions, and many military governors and generals probably completed prosaically tranquil tours of duty without ever having to forward anything but routine information back to Rome.²⁹ In fact, unless an emperor were formulating some campaign or general policy revision, news other than routine information may have been extremely unwelcome.

Low numbers of tactically deployed troops, a heavy logistics burden, slackness in strategic planning and coordination, and a general desire to convey a picture of routine placidity all posed potential problems for the Roman army should the status quo be jeo-

pardized. Frontier garrisons often resembled bands of foragers or even paramilitary peasants where haymeadows, animal herding, or the tending of garden plots absorbed the attentions of the troops. The frequent comings and goings of the troops also encouraged smuggling activities and various other clandestine enterprises,³⁰ perhaps in an attempt to keep a step ahead of the petty extortion and loan sharking of minor officers and the quartermasters.

Higher ranks in the military hierarchy were not above twisting regulations to make themselves more comfortable during their tours of duty. On more than one occasion, emperors stumbled onto or ferreted out conspicuous pockets of corruption. The emperor Hadrian delighted in surprise tours of inspection,³¹ and Hadrian and other emperors were not above using agents such as the frumentarii to spy on their fellow troops. Far from improving the discipline of the armies, spying, surprise inspections, and a general atmosphere of suspicion may have worked to poison candor in communications up and down the line.³² Except in time of crisis, military communications might not be terribly informative in any event, but whether in time of crisis or not, they might become misinformative through outright lies or more subtle misrepresentations.³³ Corrupt officers might understandably stoop to falsehoods. Officers merely fearful of imperial intrigue, however, might also be tempted to put the best appearances on a not completely wholesome situation. Efforts might be lavished on suppressing problems or the appearance of problems. Easily accomplished but relatively meaningless evidences of success, e.g., the construction of new earthworks or fortifications,³⁴ might

be highly touted while matters such as rank and file discontent might be suppressed. Malcontent among native groups might be similarly downplayed or, still worse, might pass unnoticed through excessive time having been spent in whitewashing purely military problems. Local problems might mount in severity until some major calamity or an unexpected imperial inspection revealed their existence, by which time the problems could have become more than local in scope.³⁵

Frontier areas would be prone to pass on poor information or absolute misinformation to higher governmental levels. As a result, imperial policy was frequently poorly advised, anachronistic, or completely arbitrary.³⁶ The pressures that had led to the initially poor communication might create situations where lower order functionaries would fear retribution if they complained about the impossibility of implementing imperial policies. Still, inappropriate directives are hard to carry out, and the more inappropriate, the more ambiguous the actual intent of a directive might be. Ambiguities in line directives would be hard to clarify in the ancient world under the best of circumstances. The Roman post system was superb for its day, but it was still woefully slow unless emperors, generals, and their staffs were in close proximity, as during the prosecution of a carefully orchestrated campaign. When campaign conditions did not prevail, local commanders would be thrown back on their own devices, forced to act as best they could whatever the nature of standing policy. Where policy had been formulated on the basis of faulty information and where an atmosphere of distrust discouraged real attempts to clarify ambiguities in line decisions, lower order functionaries would

be tempted to second guess an order. Commanders might also be afraid to act at all,³⁷ or they might blindly pass some meaningless or completely inappropriate command on to their subordinates, perhaps with a view to pawning off potential blame for a bungled operation on the rank and file. A confused or overly timid general ran the risk of being reduced in rank or pensioned off for failure to execute satisfactorily a directive. Lowest order functionaries might be subjected to the harsher penalty of decimation.

Under normal conditions, frontier garrisons would be paralyzed by a lack of initiative and a failure to overcome or even to consider the broader organizational implications of poor coordination and poor communication. Initiative, when evidenced, might be resented,³⁸ and initiative often took the desperate forms of local level mutinies or conspiratorial revolts by whole groups of legions in the face of particularly ill received directives. The only way the Romans really found to put frontier forces into fighting trim and restore discipline, candor, and morale was through the personal presence during a well thought out campaign of the emperor or a particularly able and trustworthy representative of the emperor. The high estimation usually accorded to the Roman military establishment is based on an over attention to the incredible industry and ingenuity of the splendid generals of Augustus or of emperors such as Trajan or Hadrian, who tried to make their presense felt everywhere. Such dedication was extraordinary, and for this reason was more the exception than the rule.³⁹

In many instances, imperial diligence on the frontiers was

dictated as much by the threat of imminent danger as anything else. Long peaceful lulls could so disorganize the troops along a frontier and so becloud imperial awareness of what was going on that well ordered campaigns or programs to shore up discipline and morale became valiant remedial expedients to stave off mutinies or unexpected native uprisings.⁴⁰ Without the spur of imminent disaster, conditions on a frontier could decay to a nadir of unpreparedness and neglect, conditions quite likely to produce an unwanted crisis, whose dimensions might be misread or concealed until they had reached catastrophic levels.

Frontiers were the scenes of ominous slackness or fevered activity, these rhythms being imposed by the inability of the government to fund the military establishment necessary to handle all eventualities in a more even fashion. The unstable oscillations of military affairs on the frontiers, however, stymied efforts to institutionalize efficient centralized control. The most conspicuous manifestation of this problem was the frequent obligation of the part of the emperors to put all other business aside and tackle the endproducts of cycles of neglect on particular stretches of the frontiers.⁴¹ This hampered attempts to coordinate civilian and military activities efficiently at the highest levels of government, so that one area of business or the other was perennially slighted.

Fortunately, affairs within the provincial core could usually be expected to manage themselves. This could not be said for the problems of native groups on and beyond the frontiers. Frontier populations had to contend as best they could with the half-hearted

efforts at local control by foraging garrisons, and at any time, poorly framed or inefficiently executed policy decisions affecting whole stretches of frontier could further distract from Roman abilities to deal with native affairs. Provincial populations had better access to legal remedies and multiple channels of due process in the face of imperial mismanagement. Frontier populations were generally peregrini at best and had only the insensitive and distortion prone channel of military authorities to petition.⁴² It is no wonder that the affairs of native groups in the proximity of the frontier garrisons were often grossly mismanaged.

The affairs of native groups beyond the ordinary range of military control were managed yet more poorly. These groups were not even reckoned as peregrini but as barbarians. The term barbarian need carry no more than a sense of strangeness in speech or manners. During the Persian Wars, the Greek term acquired additional associations of hatred and contempt. By the beginning of the Christian era, the Romans too were beginning to view barbarians as inhuman as well as unmannered. Andreas Alföldi has written⁴³ of a moral vacuum along the Rhine that allowed the Romans to treat native peoples as animals and slaves without a second thought. Beyond her frontiers, the Roman state felt no obligation to hear grievances or even collect information beyond a narrow range of tactical and geographical information where the affairs of barbarians were concerned.

If Rome and the barbarians had been immune to the repercussions of this contemptuous attitude, then the attitude might call for little more than moral approbation. Unfortunately, neither party was immune

to the processes encouraging and encouraged by the barbarian stereotype. Eventually, Rome became dependent on the barbarians or on barbarized frontier populations for army recruitment, and by the fourth century, there are strong indications that a contemptuous attitude toward barbarians encouraged a calloused denigration of the whole military establishment by factions in the government and by the urban centered provincial populations.⁴⁴ Eventually, this attitude served to turn many of these frontier armies against a failing Roman society. Of greater immediate impact, though, was the role that contempt for the affairs of barbarian groups played in fueling the slave trade, and the slave trade was a vital force not only in the maladaptive transformation of non-provincial native societies but in a steady erosion in the rural economies of the provincial core regions.

Only summary treatment will be possible here, but it is probably no understatement to say that an appreciation of the ramifications of the slave trade is crucial in any treatment of the intertwined histories of Rome and of non-Roman Europe. The far reaching impact of the slave trade makes it futile to study the societies of barbarian Europe in isolation, but the history of Rome is equally incomplete if the broader systems with which it was inexorably linked are ignored. The histories of Rome and the barbarians are usually considered in isolation until the spectacular juncture of the Voelkerwanderungen, and as a result, the ramifications of processes such as the slave trade have been largely ignored.

That Rome traded with the barbarians is hardly a novel suggestion. The entire archaeological chronology for the proto-historical groups of temperate Europe is based on **synchronisms** with Roman artefacts. Much of this trade was probably balanced by raw materials and craft items. The vast Roman military complex created a ready market for meat, dairy products, hides, and other foodstuffs as well as for metals, salt, amber, and a variety of simple utensils. On the other hand, the larger military bases frequently boasted manufacturing capabilities that could outstrip native production in both quality and quantity.⁴⁵ Certainly this was so when the productive capacities of burgeoning provincial centers and established Mediterranean entrepôts are added to the consideration.

As a result, a whole range of cheap and readily available goods came to pervade the frontiers and areas beyond. Where this led to competition with native production, the Roman novelties were likely to win out.⁴⁶ Where displaced native craftsmen could not re-tool to compete with the new products, whole ranges of livelihoods or at least supplementary incomes were jeopardized. The Roman advent undoubtedly precipitated widespread changes in complex trade linkages and cycles. Trade with Rome was also subject to various delays and interruptions in accordance with the vicissitudes of imperial policy. These alterations were not necessarily geared to local needs or interests, with trade policy becoming, more often than not, a political tool for rewarding compliance and punishing restiveness. The cumulative effect of Roman trade, whatever its nature, almost certainly served to spread arbitrary inter-group friction and rivalry into spheres

where such societal competition had been minimal before the Roman advent.⁴⁷

The destabilizing effects of trade in material commodities were vastly magnified by the trade in human commodities, i.e., slaves. The slave trade is seldom mentioned in ancient narrative and epigraphic sources,⁴⁸ the paucity of evidence being especially grave for Northwest Europe. Most of the surviving evidence deals not with the initial acquisition of slaves but with their resale, manumission, adoption, or tangential commemorative references by offspring to slave or freedman fathers. To complicate matters, slaves regularly changed their names, especially when freed, and behind these terminal changes may lie a whole series of renamings each time the slave changed hands. A slave might receive one name from a dealer and another from his master. If freed, the slave usually sought to cloak his former status beneath a shroud of latinizations or aliases, commonly borrowed from a former master. These changes may be transparent, but they invariably obscure a slave's point of origin.⁴⁹

While slave names of all conceivable nationalities and tribal extractions are known, most have a Greek or an Oriental ring. From a fairly early date, modern scholars have taken this to mean that except during periods of large scale warfare or rapid territorial advance, the eastern portions of the empire, and especially provinces in northern Greece, Asia Minor, Syria, and Egypt, were the primary sources of slaves.⁵⁰ Piratical kidnapping and more importantly childpawning by poverty stricken parents are the commonly advanced mechanisms whereby the orient yielded its steady crop of human chattels.⁵¹

Such views have colored all subsequent opinions and have served to concentrate studies on eastern epigraphic sources and on the wealth of papyrus documents from Egypt.

Many portions of the eastern empire were overpopulated and racked by indebtedness, banditry, and piracy. These factors worked to supply appreciable numbers of slaves to adjacent regions in the Mediterranean. The numbers of slaves produced by these internal sources were substantial. From the early twentieth century, scholars such as Tenney Frank saw in this proliferation of orientals to slave blocks as far away as Italy the roots of the racial mixing to which he largely attributed the fall of Rome.⁵² Dubious racial theories are largely to blame for the subsequent neglect of the problem of slavery in ancient society, so that for decades a single scholar, William L. Westermann, had a lonely monopoly on the topic. Westermann followed the lead of earlier scholars in downplaying the role of non-oriental sources of slaves after Rome's expansionist phase culminating under the Julio-Claudian emperors. With the onset of the pax Romana, Westermann argued that military operations produced only a trickle of slaves, the only dependable sources, and these increasingly expensive, becoming the territories fringing the eastern Mediterranean. In recent years, scholars **have** argued that as slaves became dearer the more inhumane treatments of slaves recorded during the Republican period were abandoned so that the existing slave populations were able to maintain themselves through breeding, with periodic replenishments from the sources emphasized by Westermann.⁵³ With minor variations, however, the received view would downplay

the role of sources of slaves outside the empire itself after the mid-first century A.D.⁵⁴

While there is much in the work of scholars such as Westermann of lasting value, it has long been apparent that slave names are a treacherous index of point of extraction. As early as 1924, Mary Gordon demonstrated that the prevalence of oriental and Greek names for slaves was due to longstanding associations of such names with servile status.⁵⁵ Much of the organization for the distribution and re-sale of slaves within the empire had merely been taken over from pre-existing operations in the eastern Mediterranean, and since slaves frequently acquired their initial names from dealers, the eastern appellations often stuck. Latin names such as Rufus or Fortunatus were common, but Latin was poor in names compared to a language like Greek. Since Greek was the most common second language of Romans, slaves of whatever nationality were likely to receive some sort of Greek name. And finally, Greek, although a barbarian tongue, was not considered the language of a barbarous people by the Romans. Giving a Greek name to a slave of Celtic, Zwischenvoelker, or Germanic extraction might be an act of kindness since it removed the disparaging associations heaped upon truly barbarous peoples. Pawning a barbarian chattel off as a Greekling might also bring in a higher market price. Therefore, there is the strong possibility that renamed Celts and Germans figured prominently in the slave trade long after the frontiers had ossified behind their garrisons and palisades.

If such external sources are allowed, then one does not have to resort to improved servile fecundity⁵⁶ to account for slave populations that remained impressively high well past the Julio-Claudian period. Slaves employed as clerical functionaries, domestics, or skilled artisans were indeed likely to breed. Such slaves were also in an ideal position to amass sufficient wealth or influence to purchase their freedom or elicit manumission. They and their offspring would remain clients of their former masters, but they would no longer be slaves, and it is arguable that even as slaves such skilled persons enjoyed more prestige and security than the average "free" peasant. The vast majority of slaves, though, would have had few ways to negotiate their manumissions on equitable terms, but for the same reason would have had little more incentive to rear families than the destitute rabble, mostly free, that spilled into **Rome** and other large imperial cities. The slave population of the ancient world probably needed constant replenishment, and this slave population was a vital economic leaven. The ancient world was not dominated by slave labor,⁵⁷ but its widespread use left a distinctive impact on the ancient economy. The term must be used cautiously, but to a greater degree than any other extensive pre-industrial state system, the ancient economy was a slave economy.⁵⁸

Slaves were used in large scale manufacturing for pottery or bronzes.⁵⁹ An unfortunate few were sacrificed to mining. Many more were engaged in agriculture. The profits of slavery were obvious during the Republican period when huge cattle ranches or interculture plantations were able to use masses of slaves in the most wasteful

manner. Slaves were never so plentiful or so cheap as in peninsular Italy during the middle and late Republic, and, under less extraordinary circumstances, the profits of slavery were more subtle. Slaves seldom formed the whole of the labor force on Roman villas. Slaves provided only a skeleton staff that could be usefully employed throughout the year.⁶⁰ During peak work seasons, e.g., sowing or harvesting, additional labor would be recruited from the surrounding peasantry.⁶¹ Villas were not necessarily large, their essential feature being, rather, the ability to dispense with all but the minimum work force during long agricultural lulls while being able to expand the work force rapidly with temporary help when needed. The average peasant family was incapable of such calculated flexibility. Kinsmen and neighbors could lend each other some assistance, and family members could be kept busy in various ways during agricultural lulls doing odd jobs and peddling craft items, but peasants were seldom able to slash their overheads in as calculated a fashion as villa owners.

Peasants and peasant communities had to maintain and reproduce both themselves and their social relations in addition to their relations of production.⁶² Slaves were tools that could be used with mechanistic precision and then, almost literally, discarded.⁶³ Peasants, unfortunately, were human beings, and the need to rear families, train children, contract marriages, care for the aged and infirm, and carry out public roles in their communities or countries put them at a disadvantage to slave run estates. Economic or other misfortunes could ruin a peasant family while slaves could be

amortized as an item of capital and eventually replaced.

The mechanistic precision of slave farming, the larger sizes of villa estates, and their owners' outside connections and knowledge made it possible to realize profits, often unintentionally, from the relative imprecision of peasant life. Villas had substantial inventory capacities, allowing them to buy cheap and sell dear.⁶⁴ They could afford to wait for the most favorable market conditions on staple crops and might even have carried on a locally oriented speculation in subsistence crops, exploiting the seasonal peaks and troughs from autumn harvests to winter dearth.⁶⁵ By careful timing of plantings and careful selection of crops, villa owners could coordinate their demands for occasional day labor with idle moments in the peasantries agricultural cycles, tapping labor when it was abundant and cheap for lack of alternative employment. Villa owners were in a much better position to weather prolonged economic crises than the peasantry. Peasant families operated on relatively slender margins, and when these were exceeded, peasant families needed charity not credit. If the normal agricultural hazards of poor weather, bad crops, or unanticipated illnesses or deaths were aggravated by excess population, high taxation, or military duties, whole peasant communities could face ruin if charity was grudging or carried some usurious charge. The widespread use of agricultural slavery tempted landowners to calculate the social overhead costs of peasants, who were human beings, on the basis of the upkeep of slaves, who were treated as expendable tools. The pressing need by smallholders for supplementary income off their farms⁶⁶ obliged

them to take what they could get. But if landowners were more after profits than grateful clients, the peasants might get very little indeed.

Some scholars have argued that when focused on certain cash crops and applied to larger units of land, slave labor gave appreciably higher returns than ordinary peasant farming.⁶⁷ A case can also be made that the presence of such villa estates encouraged a calculated drain on the social overhead of surrounding peasant families and communities.⁶⁸ Short-term profits could be made by uncharitably reducing peasants to tenants, then to landless laborers who would eventually drift into towns and cities to solicit whatever charity they could from society at large and swell the urban woes of the ancient world. A system of profits resting on foundations such as these was ultimately self-defeating, but these ultimate effects might take several generations of insidious and gradual impoverishment to make themselves felt in an economically unequivocal fashion. Slave agriculture as a profit-making venture depended on markets for staple products, either locally or in readily accessible large urban centers. But villa agriculture had a progressively debilitating impact on the purchasing powers of local peasantries and, in the last analysis, on the towns and cities that had to accommodate the rural poor. As town and countryside became pauperized, demand would plummet. Such an economically sterile environment would eventually make its impression on the profit-oriented villa owners who would have to find new markets and new countrysides to impoverish.

The corrosive influences of villa farming were seldom allowed to run their full course, but even when peasantries were not totally ruined, slave labor had other undesirable drawbacks. Villa farming rewarded the rather unimaginative, although continuous use of semi-skilled labor. The technology of villa farming was labor intensive but rudimentary. The vines, groves, cereals, and pulses of an interculture regime required more dull patience than technical complexity and skill. The skills and talents demanded of seasonal laborers were often just as rudimentary. The technological backwardness of ancient society has often been noted.⁶⁹ This backwardness was assured where villa farming had free rein and the labor of free men was rendered just as menial and unrewarding as that of slaves.⁷⁰ Where the most productive form of agriculture was less a matter of an innovative cooperation with nature than a dull business of tapping subsoil water and nutrients within a degraded, desert-like ecosystem, technical ingenuity was unlikely to find much utility. And where villa competition and manipulation denied peasants both profits and subsistence from the land, the resultant proletariat guaranteed stagnation.

The vicious cycle endured by rural societies dominated by villa farming hinged on a steady supply of slave labor. Part of this need was met internally, possibly through slave breeding, and definitely from the piracy and child pawning of the overpopulated east. Much of the ancient world's slave population, however, must have come from external sources, from the frontiers and from the barbarian societies beyond.⁷¹

Although major campaigns were spasmodic after the Julio-Claudians, the pax Romana along the frontiers was transient and dotted with innumerable minor hostilities. For instance, the frontier in Northern Britain was constantly shifting its central focus in response to native revolts and guerilla warfare. The maintenance of the human desert on the right bank of the middle Rhine must similarly have occasioned periodic hostilities. On both these frontiers, our knowledge of minor shifts and disturbances is based less on narrative texts, which usually note little more than major dislocations, than by panegyrics, coin issues, epigraphy, or archaeology. Where these bodies of evidence are spotty, minor disturbances can elude all detection although the very nature of the frontier system make incessant troubles of one sort or another extremely probable. Such incessant troubles, with their raids and counter-raids, would have produced captives.

In some areas, as on the middle Rhine, minor incidents and their by-products of captives may have been periodically provoked by the Romans. Low key frontier hostilities of this sort might have provided an appreciable source of slaves, but there are strong reasons to suspect that the frontier zones were not ordinarily the primary sources of slaves. Slaving on too grand a scale would have fanned native resentment in areas too close for comfort to the thinly manned Roman garrisons. Local goodwill may also have been worth cultivating if the military posts needed occasional native labor or food renders. The final disincentive for local slaving stemmed from the progressive dependence on frontier peoples as

military recruits. It was usually inexpedient, then, to enslave the natives near at hand.

The primary source of slaves was most likely to have been from barbarians farther afield, and the slaves were probably procured not by the Romans but by the barbarians themselves. This hypothesis rests primarily on West African analogies⁷² although the source materials for temperate Europe contain suggestive hints. Very simply, the incredible social dislocations associated with slaving are not the sort of thing the Romans, or any other people, would willingly allow on their own soil. One does not enslave one's own population: one enslaves strangers, enemies, or barbarians. Ideally, one leaves the whole nasty business to the barbarians so that the corrosive effects of slaving are screened out entirely. The Romans were never happy with the piratical kidnapping and child pawing that provided internal sources of slaves and periodically sought to stamp out these social cankers.⁷³ Internicine warfare among the external barbarians was another matter entirely. In fact, the greater the carnage the better since this would create more captives, keep barbarian political life unstable, and prevent the formation of monopolistic coalitions beyond the frontier to drive up the price of slaves.

Comparative materials are very suggestive. Sub-Saharan West Africa was the primary source of slaves for the modern European colonies of the New World. Europeans did not catch slaves: the natives did. Kingdoms sprouted on the Gold and Ivory Coasts, and in most instances, the existence of these coastal states was tied

to the trade in slaves with the Europeans. If the Europeans had had to bear the whole cost of capturing slaves and keeping restive natives at bay, slavery would have been as much a failure in the New World as were the early attempts by the Spanish and Portugese to enslave the American Indians.⁷⁴ With African slaves, the social, political, and economic liabilities of slaving were borne almost exclusively by the Africans.

African culture history around and immediately following European contact has always been something of a riddle, inexplicable as a simple matter of local adaptations to environment and ecosystems.⁷⁵ The demographic, political, and productive patterns of pre-colonial Africa were often in blatant defiance of carrying capacity or environmental potential. Only when the intervening impact of the slave trade is added do these perplexing skewings begin to make sense. Villages can still be found where people crowd together behind massive walls instead of being more efficiently scattered throughout the countryside on their distant farms. These villages often hold horses in religious terror.⁷⁶ In pre-colonial times, such villages were probably preyed upon by mounted warriors in search of slaves. The settlement landscape had to adapt to these pressures, often to the detriment of good farming practices. These West African analogues hold valuble clues as to the probable impact and organization of slaving in temperate Europe.

The task of following up cross-cultural clues is a perplexing job since nearly all the more obvious sources are silent for slaving in temperate Europe. The polished authors of narrative texts seldom

travelled far beyond the frontiers, and most were unlikely to go to the trouble of interviewing the frontier troops or Mediterranean middlemen who might have known the details of this unsavory enterprise.⁷⁷ Even epigraphy fails us. Apparently those closely involved with the slave trade were embarrassed at their calling since only one funerary inscription has been found of a Greek freedman with the temerity to boast about his professional connections.⁷⁸ Such sources as we have are mostly late, some in fact amounting to legends only committed to writing in the course of the early middle ages.

Perhaps our best glimpses into the scale of barbarian slaving comes from early medieval Irish and Scottish material. Apparently, inter-tribal raiding and slaving in the late Roman period around the Irish Sea was endemic,⁷⁹ the most famous captive being St. Patrick. Early Irish epics are filled with descriptions of raids by warrior elites on neighboring groups for booty and hostages. Some scholars have associated the most famous of these Irish chiefs, Niall of the Nine Hostages, with the raids that netted St. Patrick.⁸⁰ This correlation is debatable, as is the historicity of both Niall and Patrick, but beneath these semi-legendary bits lies a solid core of fact. Slaving was endemic among the Irish during the Roman period. In fact, Irish slaving activities survived the Roman period so that tenth century Anglo-Saxon bishops bemoaned the presence of Celtic Christians on the slave block at Bristol, a major collecting entrepot for a slave trade along the Atlantic facade.⁸¹

As compared to the Irish Sea region, our ignorance of slaving activities elsewhere in Northwest Europe, e.g., beyond the Rhine

limes, is almost total. Still, while Northwest Europe lacks legends as suggestive as those of Niall and St. Patrick, archaeological finds of sumptuous imports dating to the Roman period in regions such as Denmark that would have been export poor in any commodities other than slaves,⁸² coupled with abundant late Roman evidence of vast numbers of servile or semi-servile Germanic laeti and dedicii having been procured to resettle deserted or devastated areas of provincial Gaul,⁸³ provide strong circumstantial evidence for the movement of human chattels. In the heyday of the Empire, it is hard to imagine that there were no German slaves and no slave trade in continental Northwest Europe.⁸⁴

It is interesting that both the trans-Rhenish and the Irish Sea materials suggest that the slave trade survived long after the Romans and Roman demand for slaves had disappeared.⁸⁵ There is the possibility, however, that the procurement of servile labor continued to fill a demand among the barbarians themselves. Once again African analogies are suggestive.⁸⁷

While the Europeans acquired millions of slaves during the pre-colonial period and transformed the political geography of coastal regions from Senegal to Nigeria, slavery of a sort had existed long before the European advent, and African societies progressively began to find uses of their own for slaves. Africans had long been familiar with various types of domestic slavery. Tribal warfare generated a certain number of captives in the course of minor territorial bickerings. Hostages might also be exchanged as pledges of non-belligerency. Slaves were useful in a number of household duties,

and they might also be sought after to bolster the numbers of sagging kin groups. The offspring of slaves did not have to be shared out through normal prescriptive marriage networks, thus allowing awkward deficits of males or females to be evened out. After a generation or so, former domestic slaves and their progeny might become fully integrated as ordinary clan or lineage members.

Slaves also had other uses which approximated more closely to the usual notion of slaves as tools or chattels. Given the existence of slavery, many West African rulers began to use slaves in large scale productive activities requiring considerable coordination.⁸⁸ Average tribesmen were unable to compete with these slave run enterprises, leaving the rulers with virtual monopolies over many types of production. Initially the areas of production involved were extremely limited, e.g., gold mining or salt making, but eventually the use of slaves was applied to a broader spectrum of productive uses. Especially along the coast, the European trade was plagued by interruptions and fluctuations, and by the mid-nineteenth century, the external trade in slaves was officially abolished. Slaves were now retained for the indigenous economies along the coasts and even in the interior as plantation labor to grow oil palms and kola nuts. The staple items so produced figured in a continuing legitimate trade with the Europeans, but there also developed a burgeoning internal trade in various commodities and human chattels.

The use of slave labor in pre-colonial Africa proved infectious, spreading far beyond its initial domestic nexus and even spreading beyond the confines of mining, saltmaking, and large scale

plantation farming. One reason for the widespread use of servile labor was that the productivity of slaves could be tapped much more fully and effectively than the labor of free tribesmen and could be flexibly pooled and concentrated in ways virtually impossible through traditional kinship links and matrimonial alliances. Control over sizeable pools of slave labor allowed new avenues for the attainment of prestige and power, and many traditional lineage systems were transformed beyond recognition as these new non-ascriptive mechanisms of economic accumulation were brought to bear in the manipulation of status and ranking systems.

The proliferation of slavery within West African societies also figured in the development of new types of military technologies based on firearms that did away with the need to recruit a broadly based tribal following. Pre-European techniques of armor, lances, and mounted horsemen had been enough to crystalize specialized bodies of warrior slavers that emerged as ruling elites during the contact period.⁸⁹ Power was further concentrated with the introduction of European firearms since a minute body of marksmen could wield more force than a large body of horsemen often organized into egalitarian lineages.

If an ambitious man could gain control over supplies of weapons, powder, and shot, almost anyone could be recruited as a subordinate marksman. Often slaves or persons of low status were pressed into service so that private armies came to be used not only to catch fresh slaves but to discipline a ruler's erstwhile fellow tribesmen. This enormous concentration of power did away with the need for

broadly based tribal militias or extensive bodies of equestrian knights. Social relations increasingly became a matter of superiority or subordination based on imbalances of military and economic power.⁹⁰ Kin ties both within tribes and ruling elites were strained, streamlined, and centralized, creating frictions and hostilities that favored further transformations. Since rulers could no longer proscribe the accumulation of wealth and power through traditional tribal sanctions and since rulers did not have absolute monopolies on supplies of firearms, wealthy or well-connected individuals could and did attempt coups. Slave armies were difficult to manage and frequently rebelled. Erstwhile tribesmen reduced in status to exploited peasants could also stage uprisings. By the end of the nineteenth century, the societies of West Africa had been exposed to a whole gambit of socially disruptive tendencies, experiencing within the span of a few generations most of the stresses that can stem from unplanned political and economic concentration, coherence, and centralization.

Barbarian Europe was undoubtedly subjected to analogous processes. Long before the Roman advent, ecological degradation had magnified the importance of control mechanisms in tribal hierarchies. These instruments of control could also be turned to coercion, and the dislocations accompanying the creation of the Roman frontier system were more than sufficient to numb the sensitivities of chiefs and rulers to the delicate nuances of local affairs. Trade with Rome and the growth of slaving provided budding tribal elites with ways of maintaining themselves even in the face

of local demographic or ecological catastrophe and tribal opposition. Contact with Rome taught tribal leaders devastatingly effective new military techniques and gave them favored access to a range of iron and bronze weaponry that proved the European equivalent of the African's firearms.⁹¹ Emergent warrior aristocracies still lacked the logistics to storm and lay siege to Roman cities, but they had more than sufficient power to overawe or even enslave their erstwhile tribal peers.

This externally induced political revolution had far reaching repercussions, and in Europe, as in Africa, one important development was a growing concentration of social and economic power. Slaves and cowered peasants can be exploited much more effectively than free, autonomous tribesmen. It is doubtful whether slave labor found much use in factory-type set ups as met with in African gold mining. It is also doubtful whether servile labor was employed to produce agricultural staples as on African palm oil plantations. In barbarian Europe, use of slave and servile labor came to center on forms of serf agriculture ancestral to the seigneurial and manorial systems that formed the economic basis of feudal Europe.

Serf agriculture involved the withdrawal of a surplus from peasant agriculture sufficient to underwrite an inordinately large military elite. Regulation of local level demography or ecology was incidental or at least demoted in priority. In the pre-Roman world of tribal hierarchies and interaction spheres, the autonomy of local groups was such that unless elite groups fulfilled important control functions, their efforts to exercise power could be effectively

thwarted. The prevalence of slavery and the thorough militarization of warrior elites in the course of the Roman period allowed rulers to eat the power of the government in ways that stymied local resistance.⁹²

The development of serf agriculture gave warrior elites an increasing autonomy in the face of accidental or calculated interruptions in trade support from Rome, and once institutionalized, the resultant system of warriors and dependant peasantries was largely self-sustaining although any system based on imposed serf agriculture created hazards of its own. Intergroup competition and mistrust was more pervasive in the new social formations than in former interaction spheres. Given a conflict between the interests of cultivators and warrior elites, the interests of the latter were more likely to be served and a slow attrition of mechanisms of intergroup reciprocity would make it difficult to redress local level dislocations in any event. Given serious dislocations, dependent cultivators could face ruin despite the best efforts of their masters. The warrior elites might survive, however, by offering or imposing their services on other groups.

Local dislocations of a less catastrophic nature might allow the short term survival of both peasants and warriors, but soils and ecosystems could suffer slow but steady degradation. The maladaptive violence of barbarian Europe was surely a human tragedy; it was also a tragedy for all living things. The barbarization of pre-Roman interaction spheres placed the mores of an heroic age above the value of human life or life in general. Such hubris makes

for the stern plots of epic verse and is fine for warrior elites. For peasants and for ecosystems, the impact of unbridled heroism may not be so fine. Before the Roman period, the resiliency of temperate forest ecosystems had already been taxed. In many regions, careful husbandry was required lest ecosystemic productivity, and thereby agricultural productivity, be jeopardized.

By the early middle ages, the rural economies of temperate Europe have been described in terms of almost indescribable poverty, plagued by poor technology and, as a result, poor yields.⁹³ Many historians would have us believe that this was the inevitable lot of primitive agriculturalists. This was not the case. In the proper environments and with the use of sensible husbandry, primitive agriculturalists could enjoy substantial yields even with the most primitive of technologies. In fact, in a pre-industrial context, improved technology, especially when interpreted in the narrow sense of improved tools, can usually do little to boost or even maintain yields. Good yields are a matter of sensible husbandry, which depends more on knowledge, foresight, and organization than on ploughs, harrows, or horse collars.

For example, the agricultural revolution of early modern times was not so much a matter of improved technology than of skill in the management of high nutrient grass and clover species that produced plagioseral climaxes with productivity levels as high as virgin forests.⁹⁴ Through knowledge and control based on knowledge, early modern man was able to create temperate European equivalents of steppe chernozems. Fast maturing long leys boosted the fertility

of soils so that a sixty percent reduction in the amount of arable still allowed just as much grain to be produced as under ecologically unsound open field agriculture.⁹⁵ This was a revolution indeed, and was accomplished without pesticides, herbicides, or chemical fertilizers. It was a testimony to human ingenuity, an ecological triumph that often underlies the waning esthetic charm of modern European countryside, softening the oligotrophic wounds still left as the result of open field systems and their ancestor, serf agriculture.

No agricultural revolution was ever reared on the basis of open field "husbandry." The so-called agricultural revolution of the middle ages is a myth contrived by historians ignorant of agronomy and ecology. Revolutions of this sort are supposed to be self-sustaining at the least. Recent investigations of the best, probably the only, production series for the middle ages show that the increase in yields resulting from the supposed "revolution" was modest and was dissipated within a generation or so.⁹⁶ Within a century, harvests on the revolutionized estates of the Bishop of Winchester had fallen to appalling lows. Some manors abandoned three-field agriculture for its reputedly more primitive two-field predecessor and were rewarded by somewhat more satisfying yields. No revolution was possible within the framework of open field agriculture, however, and against a background of rising population, there is some justification to J.Z. Titow's assertion that the demographic calamity of the Black Death was in many respects a Providential kindness.⁹⁷

The ecological desecration behind the agricultural revolution of the middle ages was the end product of shortsighted

greed coupled with peasant desperation. Men, until recently, have not knowingly destroyed their land, but open field agriculture made this an unintentional inevitability. Medieval open field agriculture was the lineal descendent of the serf agriculture of barbarian Europe, and serf agriculture perennially invited bad husbandry when coupled with centuries of maladapted priorities resulting from the rise to dominance of warrior elites on the ruins of the control mechanisms of tribal hierarchies. Bad husbandry would result in the progressive degradation of already fragile ecosystems. Serf agriculture set within degraded ecosystems was an almost hopeless husbandry, upon which Georges Duby's infinitely penurious societies were based. Serf agriculture was Rome's chief legacy both to her barbarized frontiers and to external barbarians far beyond the frontiers. It was the all but inevitable end-product of social maladaptation on a scale that staggers the imagination.

Along her frontiers, Rome created an ideal environment for perennial organizational dilemmas that favored the spread of social maladaptations. As a result of the tireless attentions lavished on the error prone military frontiers, imperial control over the affairs of the provincial core was incomplete and erratic and ultimately rested on the pious hope that regional networks of patronage and clientship would suffice to regulate an economic substructure which the central government could not even pretend to control directly. The boundaries for the equilibrium of the imperial system were tightly drawn, and, unfortunately, the effects of Roman mismanagement of the affairs of native populations on and beyond her frontiers

acted to push the imperial system beyond the limits of control. By the third century, the burden of military control on the central government became exorbitant. The old limes system fell into chaos, and the repercussions of this chaos threw the political life of the core provinces into a long series of civil wars far more destructive than the violence of the late Republic. And finally, by the third century, the impact of the slave trade had worked to fuel the insidious pauperization of provincial economies through the perpetuation of villa farming and had seeded barbarian Europe with a superabundance of warrior elites whose military calibre began to rival or surpass that of the deteriorating Roman might.

For nearly two centuries, a trouble-ridden world system⁹⁸ of Roman provincials, frontier populations, and barbarians had maintained itself. By the third century, however, maintenance of any aspect of this total system was an impossibility. By this time, the mobile field armies of the early Principate had become so inefficient in their perpetual frontier bivouacs as to render them useless in the face of genuine emergencies. In the face of serious dislocations, vexillations were necessary, pooling crack units from many locations to form a suitable fighting force. This practice had grown increasingly common in the course of the second century, reaching a crescendo during the frontier disasters on the Danube under Marcus Aurelius.

It was expensive to assemble crack units to form an effective mobile field army and even more wasteful to disband these armies after the emergency conditions had passed. Under the Severii,

definite trends are noticeable towards the preservation under normal conditions of mobile field armies.⁹⁹ With the end of the Severan dynasty began the so-called anarchy of the third century, with its barracks emperors constantly in the field. By the time some semblance of order was re-established under Diocletian and Constantine, the dismantling of the old frontier armies was complete.

Constant vexillations seriously impaired the quality of the remaining troops in the frontier regions. If nothing else, the favoritism lavished on the new crack units disastrously weakened morale and discipline. In time, frontier defence was entrusted to native levies, often drawn from the barbarians that were the cause of Rome's frontier woes. These native militias were more irregular and poorly equipped than the units they supplanted. Often these militias were not paid at all. Instead they were given the legal status of laeti, and frontier defense was imposed upon them as a hereditary duty in return for grants of land. In effect, Rome was creating barbarized serf armies to fight the barbarians. Predictably, these units were not generally very effective.

The poor quality of the laeti reflected the complete breakdown of the elaborate logistics and ordnance train of the earlier centuries. Frontier areas became dependent almost entirely on their own resources. Behind this development lay a slow decay of rearward provinces which heretofore had been able to supply timely assistance. Especially in the West, the built-in contradictions of an economic system built around villa estates had dried up market outlets and inter-regional commerce. Villa agriculture was supplanted by self-

contained latifundia worked by servile coloni. In short, the provincial areas of the western Roman Empire were evolving their own versions of serf agriculture.

Economic stagnation and decay seriously curtailed the central government's ability to exact tax revenues and, concomitantly, to provide even elementary governmental services. In the course of the third century, even the tenuous money economy disappeared in the West. This situation grew in part out of accumulating balance of payment deficits with the Far East that drained specie from the Mediterranean. This problem was compounded by governmental tampering with the gold and silver content of the currency, promoting inflationary trends and public mistrust of the debased fiat money. The final straw may have been the growth of the tenant farming systems that replaced older forms of villa farming. Coloni were expected to pay rents. The growing volume of such widespread small transactions over-extended an already delicate monetary system.¹⁰⁰ In short order, then, a money economy was replaced by barter, with peasants charged with various renders and liveries and the central government left to administer the annona, an extraordinarily wasteful and corrupt system wherein a large proportion of the original exactions in kind were lost, misappropriated, or consumed in transit before finding their way to or from governmental storehouses.¹⁰¹

Economic decay eroded the precarious fiscal and commercial unity of the provincial system, so that by the third century, an integrated Roman economy was replaced by numerous relatively autonomous regional economies. Economic fragmentation was crowned by

political fragmentation as the imperial system proved unable to ward off raids by barbarians, mediate disputes between municipal units, or hold down a growing level of internal banditry and guerilla warfare.¹⁰² In the course of the third century, nearly every major western town and city sprouted its own walls and fortifications.¹⁰³ The old limes system was replaced by a new "frontier in depth."¹⁰⁴ Frontier violence and the barbarization it encouraged now descended on the provinces themselves.

In the old frontier zones, and increasingly in large reaches of former provinces, the central government, by now in open retreat to the eastern Mediterranean, was powerless to exercise genuine control. From time to time it could indulge in cosmetic efforts to reassert its presence. The central government lacked the means, however, to effect true restorations. More commonly, such expensive displays were bypassed for the cheaper expedient of setting barbarians against each other by bribes, tribute payments, grants of titles, and espionage. This subtle meddling was incredibly effective in squelching political stability and peaceful alliances and in promoting rampant militarism vented through internicine warfare.¹⁰⁵ Ironically, the areas being meddled with were now more often than not former provinces which had to endure treatment similar to that which had heretofore been reserved for frontier areas and external tribesmen. As these practices became a matter of course, the barbarization of Rome's former European provinces was assured.

It was within this context of maladaptive chaos that the Voelkerwanderungen took place. These are usually pictured as

movements of whole peoples and tribes. By the late Roman period, it is doubtful whether anything as organic as a whole people or tribe existed anywhere in temperate Europe. The various group names, e.g., Franks, Vandals, Lombards, etc., that dot late Roman sources are seldom if ever associable with recognizeable archaeological assemblages. The term Mischgruppen is sometimes used by archaeologists¹⁰⁶ to describe these motley groups associated with funerary finds of weapons and the clasps, fittings, and fibulae that held together warriors' uniforms and fighting apparel. The wanderings of the tribes in fact represent the erratic careers of bands of warriors and mercenary troops whose bonds with ordinary tribesmen or peasants were a matter of passing expediency.

Such warbands¹⁰⁷ could prosper wherever serf agriculture or fitful bribes from the Roman government in the East allowed the maintenance of an appropriate number of fighting men. By the fifth century, such conditions were commonplace from the Baltic to the Mediterranean. In fact, there might be little to distinguish Germanic speaking barbarians from the barbarized remnants of the Roman army or the gangs of armed vigilantes increasingly retained by Latin speaking landed magnates. A few empty titles doled out by a distant central government might give some barbarians better claim to their spoils of war than other barbarians, but empty titles were cheap and so are over-fine distinctions of legitimacy. By the fifth century, the difference between Romans and Germans was a linguistic point of little practical significance. The former Roman system had been completely transformed, and Western Europe

was settling into its feudal age. Over-blown groups of warrior elites lorded it over a dependent peasantry and a decrepit system of serf agriculture, and the pathologies of bureaucratic structures were perpetuated in miniature beneath an etherealized ideology of empire all the more potent because it was unrealizable and, therefore, dysfunctional.¹⁰⁸

CHAPTER IX

CONCLUSIONS

My major arguments can be recounted briefly. Most of pre-Roman temperate Europe was characterized by fairly extensive societal groupings that I have called interaction spheres or tribal hierarchies. While these societies seldom evidenced the degree of hierarchialization and centralization characteristic of state societies, interaction spheres were far more complex than the usual conception of tribal groups as closed, self-contained, and acephalous. Interaction spheres were often quite extensive in geographic extent and involved the coupling of numerous semi-autonomous local groups into an overarching hierarchy of exchange, ritual, military, and political ties often mediated by specialized chiefly strata. The structuring and persistence of these supra-local institutions was geared to the control of important societal variables involving ecological tolerances, demographic fluctuations, and uneven regional resource endowments. Failure to discharge these control functions could lead to the reorientation of interaction sphere ties. The real power of chiefly groups was relatively limited, and local groups still had sufficient autonomy to boycott a particularly inept or needlessly selfserving leader. Only successful and efficient control was rewarded, which meant that adaptive responses were encouraged in the face of the major environmental and societal inter-

relationships affecting the pre-Roman tribal hierarchies of temperate Europe.

State dominated societies differ from interaction sphere societies in terms of greater hierarchialization, greater specialization, greater centralization, and greater coherence. In short, the control mechanisms characteristic of state dominated societies generally show a marked degree of bureaucratization. Bureaucratic structures can be controlled, but this happy eventuality is the outcome of ongoing planning. Most historic bureaucratic structures have been conspicuously deficient in planning and, hence, in control efficiency. The difficulty of planning is not hard to understand, as can be seen from a brief counter-example. Among the more efficient specimens of bureaucratic organization have been modern business corporations and factories. Let us focus our attention on a well organized factory.

The economist Nicolas Georgescu-Roegen has emphasized¹ why the productive abilities of factories are usually vastly superior to those of traditional craft systems. Craft systems involve single workers performing series of tasks and operations to produce a finished product. A worker may be busy at all stages of production, but various tools and factors of production must usually sit idle as a worker moves from stage to stage. Factory systems differ from craft systems in that techniques are developed to keep all factors of production in constant use. This may be accomplished by staggering the work schedules of skilled craftsmen using a common pool of tools, but it is usually accomplished by coordinating specialized

repetitive tasks performed by unskilled operators in an assembly line fashion. By keeping all factors of production in operation, factories can outstrip the productive capabilities of craft systems. Similar considerations would apply as one moves to the level of groups of related factory operations, i.e., an industry, or even to whole economies. Similar considerations would also apply to bureaucratic operations geared to churning out less obviously economic goods or services.

The organizational coordination required to keep a modest factory operation in harmony is facilitated since the various partial productive operations are usually susceptible to relatively straightforward auditing techniques. Most of the commodities or constituent components of commodities turned out by a factory can be counted or assigned approximate money values. This provides a convenient means of checking the performance of all the stages along an assembly line and provides a solid basis for managerial decisions as how to remove bottlenecks and gross inefficiencies.²

Most large scale bureaucratic structures and nearly all non-economically oriented bureaucratic "factories" are more difficult to plan and coordinate than the idealized picture of an assembly line factory given above. These difficulties are nowhere more apparent than in governmental bureaucracies. Many of the decisions and services provided by governments defy quantification or monetary representation, and when the value of the product is so vaguely defined, efficiency criteria for the various bureaux of a large bureaucracy must remain equally impressionistic. Governmental

bureaucracies, in a manner similar to many large business organizations, are less concerned with optimizing than with "satisficing."³ In simple terms, satisficing means getting the job done. The relative merits of rival organizational solutions to bureaucratic problems may defy ready discrimination even when care is lavished on planning, so that it is hardly surprising that bureaucracies, and especially governmental bureaucracies, are prone to almost unimaginable inefficiency. Where the groups adversely affected by governmental mismanagement are vocal, visible, and near at hand, a bureaucracy may be prodded into searching out some new organizational solution, perhaps even a better one. Where the groups adversely affected by governmental mismanagement are unheard, unseen, and geographically far removed from the centers of power and control, bureaucratic maladaptation is given free rein.

. Roman frontier regions evolved in the midst of pre-existing interaction spheres, and, not surprisingly, this evolution was marked by perennial problems affecting native groups along the frontiers, barbarized natives beyond the frontiers, the Roman military, the overall effectiveness of the imperial government, and, through the slave trade and villa systems, the socio-economic underpinnings of provincial societies. Roman frontier regions became the focal points for a set of social maladaptations that are, in this author's opinion, unrivaled in human history. I would also suggest that the Roman example, while perhaps somewhat extreme, provides the basis for a cross-cultural model of frontier interactions.

Frontiers are places where the maladaptive tendencies of bureaucratic structures are given relatively uncontrolled rein. Until the revolutions in transportation and communication of modern times, the foci of bureaucratic maladaptation were most likely to emerge in the hinterlands of more highly developed metropolitan cores. For pre-industrial Rome, this meant her hinterlands of fringing interaction spheres. For the early modern and even the modern period, this meant the colonial world. For industrial times, colonial holdings were joined by somewhat better represented hinterlands such as the American West. While this model of frontiers may not be thoroughly universal, it would seem to be very nearly so and is offered as a framework for future comparative studies.

NOTES

CHAPTER I

- 1 Compare Frederick Jackson Turner, The Character and Influence of the Indian Trade in Wisconsin: A Study of the Trading-Post as an Institution (John Hopkins University Studies in Historical and Political Science, 9th ser., 11-12 [Baltimore, 1891]), pp. 7-11 with "The Significance of the Frontier in American History," in The Early Writings of Frederick Jackson Turner, ed. by Fulmer Mood (Madison, 1938), pp. 185-229.
- 2 See the perceptive analysis in David Harry Miller and William W. Savage, Jr., "Introduction," in Frederick Jackson Turner, The Character and Influence of the Indian Trade in Wisconsin: A Study of the Trading Post as an Institution, ed. by David Harry Miller and William W. Savage, Jr. (Norman, in press). My thanks to Dr. Miller for the opportunity to consult the manuscript.
- 3 For commentaries on the type of hypothesis formulation and validation or falsification to be employed here, see Stanislaw Andreski, The Uses of Comparative Sociology (Berkeley, 1965), pp. 78-83; Maurice N. Richter, Jr., Science as a Cultural Process (Cambridge, Mass., 1972), pp. 35-61; Lewis R. Binford, "Archeological Perspectives," in New Perspectives in Archeology, ed. by Sally R. Binford and Lewis R. Binford (Chicago, 1968), pp. 5-32; and Albert C. Spaulding, "Explanation in Archeology," in New Perspectives, pp. 33-39.
- 4 My conception of the industrial revolution and of developed industrial economies follows the standard interpretations associated with scholars such as Walt W. Rostow and Simon Kuznets: Rostow, "Introduction and Epilogue," in The Economics of Take-Off into Sustained Economic Growth, ed. by Walt W. Rostow (New York, 1963), pp. xiii-xxvi and "Leading Sectors and the Take-Off," in Ibid., pp. 1-21; Kuznets, Economic Growth and Structure: Selected Essays (New York, 1965); and Modern Economic Growth: Rate, Structure, and Spread (New Haven, 1966). For elaborations or modifications within this framework of national income accounting, sectorial analysis, and investment-capitalization thresholds, see R. M. Hartwell, The Industrial Revolution and Economic Growth (London, 1971); Phyllis Deane and W. A. Cole, British Economic Growth, 1688-1959: Trends and Structure (Cambridge, 1962); and Alexander Gerschenkron, Economic Backwardness in Historical Perspective: A Book of Essays (Cambridge, Mass., 1962).

- 5 J. D. Gould, Economic Growth in History (London, 1972), pp. 164-81, 235-40, 257-65; and R. E. Baldwin, "Patterns of Development in Newly Settled Regions," Manchester School of Economic and Social Studies, XXIV (1956), 161-79. Also of value is the so-called staple approach described in such studies as D. C. North, "Location Theory and Regional Economic Growth," Journal of Political Economy, XLIII (1955), 243-58; M. H. Watkins, "A Staple Theory of Economic Growth," Canadian Journal of Economic and Political Science, XXIX (1963), 141-58; and J. W. McCarty, "The Staple Approach in Australian Economic History," Business Archives and History, IV (1964), 1-22.
- 6 As with industrialism, some of the more rigorous models and definitions of colonialism center on economic relationships. Adaptations of the staple theory approach mentioned in note 5 above seem especially promising. See A. G. Hopkins, An Economic History of West Africa (New York, 1973) and Dudley Seers, "The Stages of Economic Development of a Primary Producer in the Middle of the Twentieth Century," Economic Bulletin of Ghana, VII (1963), 57-69.
- 7 Colonies were undoubtedly important in fueling the growth of merchant capitalism and the "primitive accumulation" that preceded the industrial take-off in eighteenth century Western Europe. See the classic exposition in Adam Smith, An Inquiry into the Nature and Causes of the Wealth of Nations, ed. by Ernest Belfort, 2 Vols. (London, 1908), I, 274-84, 335-55. See also Eric J. Hobsbawm, Industry and Empire: The Making of Modern English Society, 1750 to the Present (New York, 1968); Herbert Henton, "Mercantilism as a System of Public Finance," in Mercantilism: System or Expediency, ed. by Walter E. Minchinton (Lexington, Mass., 1969), pp. 46-50; Andre Gunder Frank, Capitalism and Underdevelopment: Historical Studies of Chile and Brazil (New York, 1969); and Anthony Leeds, "The Significant Variables Determining the Character of Squatter Settlements," América Latina, XII (1969), pp. 54-57.
- 8 See esp. Charles Verlinden, The Beginnings of Modern Colonization, trans. by Yvonne Freccero (New York, 1970) and Joshua Prawer, The Crusaders' Kingdom: European Colonialism in the Middle Ages (New York, 1972).
- 9 Owen Lattimore, Inner Asian Frontiers of China (New York, 1940) and Studies in Frontier History: Collected Papers, 1928-1958 (London, 1962). To my knowledge, the work of this great scholar represents the only explicit attempt by a professional historian to develop a comparative concept of frontier interactions applicable to preindustrial contexts.
- 10 For an indication of the increasing sophistication of studies of agrarian ecology, see Robert McC. Netting, "Agrarian Ecology," Annual Review of Anthropology, III (1974), 21-56.

CHAPTER II

- 1 For some indications of our modern dependence on such non-ecosystemic energy sources, see John McHale, The Ecological Context (New York, 1970), p. 47.
- 2 Anthropologists such as Leslie A. White in his The Science of Culture (New York, 1949), pp. 368-69 have argued that cultural evolution has centered around a steady augmentation of the energy sources at man's disposal. A more reasonable viewpoint is that, until modern times, human societies made the best of rearranging rather static total food and energy cycles to their advantage. See James G. Horsfall, comp., Agricultural Production Efficiency (Washington, D.C., 1975), pp. 118-19.
- 3 See Chapter III below for an extended discussion.
- 4 Geographers use an elaborate letter coded system called the Koeppen system in their climatological classifications. In this widely used system, the climates involved are labeled Cb, for marine west coast, and Da, for humid continental. See briefly Edward B. Espenshade, Jr., Goode's World Atlas, 13th edition (Chicago, 1970), pp. 12-13. See the discussion in Glenn T. Trewartha, An Introduction to Climate, 4th edition (New York, 1968), pp. 305-39 where Trewartha outlines his own simplified version of the Koeppen system.
- 5 E. M. Bridges, World Soils (London, 1970), p. 51.
- 6 See extensively V. E. Shelford, The Ecology of North America (Urbana, Ill., 1963), pp. 17-55, 211-37.
- 7 A good summary of the effects of glacial conditions on subsequent vegetational history is found in S. R. Eyre, Vegetation and Soils: A World Picture (London, 1963), pp. 90-93. In Europe, the constant advance and retreat of temperate forest communities during interglacials and glacial periods over the barrier of the Alps resulted in the extinction of a number of species that are the analogues of the North American maple and hickory.
- 8 Goode's World Atlas, p. 22; Ladd Haystead and Gilbert C. Fite, The Agricultural Regions of the United States (Norman, 1955), map facing p. 28.
- 9 The term intrazonal is also used. See Charles E. Kellogg, The Soils That Support Us: An Introduction to the Study of Soils and Their Use by Men (New York, 1941), p. 141; and Bridges, World Soils, pp. 29-31.

CHAPTER II, continued

- 10 Hans Jenny, Factors of Soil Formation: A System of Quantitative Pedology (New York, 1941), pp. 14-20.
- 11 Bridges, World Soils, p. 19. The catena approach finds wide use in describing heavily eroded Mediterranean landscapes.
- 12 Ibid., p. 34. Much of Northern Europe, e.g., Northern England, Scotland, Ireland, and Scandinavia, can be usefully approached using the land system approach.
- 13 Ibid., p. 36. The river mouths along the North Sea Coast are commonly analyzed using a soil complex approach.
- 14 The classic definition of the ecosystem approach is A. G. Tansley, "The Use and Abuse of Vegetational Concepts and Terms," Ecology, XVI (1935), 284-307. Good introductions to contemporary ecological concepts are found in Eugene P. Odum, Fundamentals of Ecology, 3rd edition (Philadelphia, 1971) and M. G. Staalfelt, Staalfelt's Plant Ecology: Plants, the Soil and Man, trans. by Margaret S. Jarvis and Paul G. Jarvis (New York, 1972).
- 15 Ecosystems are not merely communities of living organisms. See Odum, p. 8.
- 16 The demonstration of this principle by Justus von Liebig in the nineteenth century was the foundation of modern soil science. See Liebig's The Natural Laws of Husbandry, trans. by John Blyth (New York, 1863). For a modern discussion of nutrient uptake by plants, see Staalfelt, pp. 137-77, 347-71.
- 17 E.g., Charles H. Lowe, Arizona's Natural Environment: Landscapes and Habitats (Tucson, 1964), pp. 7-8.
- 18 W. J. McGee, "The Beginnings of Agriculture," American Anthropologist, old ser., VIII (1895), pp. 359, 365-66; and Bernard L. Fontana, "Man in Arid Lands: The Pima Indians of the Sonoran Desert," in Desert Biology: Special Topics on the Physical and Biological Aspects of Arid Lands, ed. by G. W. Brown, Jr., 2 Vols. (New York, 1974), II, 523. There is very little intra-species competition in desert ecosystems, a feature in sharp contrast to situations in more humid climates where water is not such a limiting factor.
- 19 Odum, p. 264. Climatic climaxes are the typical mature seral stages associated with the predominant climatic conditions of an extensive region. Localized topographical or other "edaphic" variations within a region make it worthwhile at times to recognize localized edaphic climax communities. I will use the term climax in the sense of climatic climax unless otherwise indicated.

CHAPTER II, continued

- 20 Odum, p. 251, from which terms such as seral stage or seral progression are derived.
- 21 Ibid. See further Ramon Margalef, Perspectives in Ecological Theory (Chicago, 1968), pp. 81-82.
- 22 J. Maynard Smith, Models in Biology (Cambridge, 1974), pp. 116-24; and Odum, pp. 273-74. Groups of species often share in important reciprocal relationships, e.g., the interactions between herbivores and their favored forage or predators and their favored prey. The evolutions of such sets of species relationships are often studied better as units than as separate species evolutions. This principle seems to have considerable applicability, hinting that natural selection may operate at higher levels of organization than the individual organism.
- 23 Bridges, World Soils, pp. 21-22; and R. I. Davies, "The Podzol Process," in Soil Heterogeneity and Podzolization, ed. by E. M. Bridges (Welsh Soils Discussion Group Report, No. 11 [Aberystwyth, 1970]), pp. 133-42.
- 24 Bridges, World Soils, p. 45.
- 25 Staalfelt, pp. 303-304, 360; and T. W. Walker, "The Significance of Phosphorus in Pedogenesis," in Experimental Pedology, ed. by E. G. Hallsworth and D. V. Crawford (London, 1965), pp. 295-316.
- 26 Staalfelt, p. 304.
- 27 Ibid., pp. 109, 178. Humus comprises a wide variety of organic materials which cannot be identified morphologically with dead or decayed remains of living organisms (identifiable remanants being called litter) but which have not yet been broken down into simple organic or inorganic compounds,
- 28 On the nitrogen cycle, see ibid., pp. 146-57; and Odum, pp. 87-91.
- 29 Staalfelt, p. 315.
- 30 V. Jensen, "Decomposition of Angiosperm Tree Leaf Litter," in Biology of Plant Litter Decomposition, ed. by C. H. Dickinson and G. J. F. Pugh, 2 Vols. (London, 1974), I, 94; C. S. Millar, "Decomposition of Coniferous Leaf Litter," ibid., I., 105 and 121; and S. T. Williams and T. R. G. Gray, "Decomposition of Litter on the Soil Surface," ibid., II, 628-30.

CHAPTER II, continued

- 31 Williams and Gray, ibid., p. 628. Polyphenols are chemically related to tannins and may even react with water to form tannins. Tannins are used in the tanning of leather and are very caustic. The presence of such substances in podzols are a major factor behind the reduced populations of soil decomposer organisms. Polyphenols and tannins alter humus molecules into erratic shapes that are not easily metabolized by the digestive enzymes of decomposer organisms. Polyphenols are also important catalysts in the processes causing the transport of clay particles and iron and aluminum compounds to illuvial horizons. See further J. E. Satchell, "Introduction: Litter -- Interface of Animate/Inanimate Matter," ibid., I, xxiv; C. Bloomfield, "The Mechanism of Podzolization," in Soil Heterogeneity and Podzolization, ed. by E. M. Bridges (Welsh Soils Discussion Group Report, No. 11 [Aberystwyth, 1970]), p. 114; and R. I. Davies, "The Podzol Process," ibid., pp. 134-38.
- 32 See the comparison of the compositions of pine and deciduous litters in P. Duvigneaud and S. Denaeyer-De Smet, "Biological Cycling of Minerals in Temperate Forest Ecosystems," in Analysis of Temperate Forest Ecosystems, ed. by David E. Reichle (New York, 1970), pp. 218-220.
- 33 Soil colloids will be discussed in some detail below. On the role of calcium as a buffering agent, see Staalfelt, pp. 258-64.
- 34 Eyre, Vegetation and Soils, p. 66.
- 35 See the comparisons in Duvigneaud and Denaeyer-De Smet, p. 220.
- 36 Jensen, "Decomposition of Angiosperm Tree Leaf Litter," in Biology of Plant Litter Decomposition, I, 96.
- 37 Ibid., p. 99; and J. R. Lofty, "Oligochaetes," in ibid., II, 476-77. Earthworms are extremely efficient in breaking down macroscopic fragments of litter into the partially digested byproducts excreted in their casts. These casts are readily incorporated into the soil and provide an ideal medium for further microbial activity. Earthworms are rare or lacking in podzolized soils.
- 38 Williams and Gray, "Decomposition of Litter," in ibid., II, 626. Nitrogen levels may be more than doubled. This extra nitrogen may help make up for the loss of other nutrients in cases where oak litter is passed over for a time by organisms such as earthworms that prefer litter from elm or ash leaves with lower polyphenol contents.

CHAPTER II, continued

- 39 Heinrich Walter, Vegetation of the Earth in Relation to Climate and the Eco-physiological Conditions, trans. by Jay Wieser (New York, 1973), p. 41; and J. Balough, "Biogeographical Aspects of Soil Ecology," in Methods of Study in Soil Ecology, ed. by J. Phillipson (Paris, 1970), p. 36.
- 40 L. E. Rodin, N. I. Bazilevich, and N. N. Roszov, "Productivity of the World's Main Ecosystems," in Productivity of World Ecosystems, ed. by David E. Reichle, F. Franklin, and David W. Goodall (Washington, D.C., 1975), pp. 15-17; and Jerry S. Olsen, "Productivity of Forest Ecosystems," in ibid., pp. 35, 38-39. The greater productivity of tropical ecosystems owes much to the fact that tropical areas have no winter seasons. Temperate forests lose most of their leaves as litterfall in the autumn, and many of the nutrient cycling mechanisms of temperate ecosystems have evolved in response to the effects of marked seasonality.
- 41 E.g., Staalfelt, p. 201. Well developed brown earths may consist of better than twenty percent unmineralized organic substances.
- 42 The processes are similar to those described above in connection with pine litter.
- 43 This particular terminology is taken from Staalfelt, pp. 435-63. A vast literature on ecosystem control of geochemical cycling is relevant. I have profitted especially from the approaches exemplified in F. H. Borman and G. E. Likens, "Nutrient Cycling," Science, CLV (1967), 424-29; "The Ecosystem Concept and the Rational Management of Natural Resources," Yale Scientific Magazine, XLV (1971), 2-8; "A Watershed Approach to Problems of Nutrient Cycling in Forest Ecosystems," in Proceedings of the Sixth World Forestry Congress, Madrid, Spain (n.p., n.d.) II, 2303-2305; and F. H. Borman, "A Holistic Approach to Nutrient Cycling Problems in Plant Communities," in Plant Geography and Ecology, ed. by K. N. H. Greenidge (Halifax, Nova Scotia, 1969), pp. 149-65. My thanks to Dr. Frank J. de Noyelles, formerly of the University of Oklahoma Department of Zoology, for much helpful advice on the ecological significance of nutrient cycling.
- 44 Staalfelt, pp. 318-19; and W. A. Albrecht, "Soil and Livestock," The Land, II (1943), p. 301. Tropical soils are often composed of laterized clays with high admixtures of aluminum, iron, and magnesium that drastically reduce the ability of clay particles to hold onto nutrients. High leaching rates then assure the low nutrient statuses of most tropical soils.

CHAPTER II, continued

- 45 On chernozems, also known as black earths, see Staalfelt, pp. 328-32.
- 46 E. John Russell, The World of the Soil (London, 1957), pp. 7, 40; Bridges, World Soils, p. 11; and Staalfelt, pp. 252-66. Individual colloids are less than 0.002 millimeters in diameter and are the smallest mineral particles not in some sort of leachable form. Their small size relative to soil pores (soil pores are about 0.4 millimeters in diameter) makes it relatively easy for single colloids to slide down between soil pores as in the transport of clay particles in the podzolization process.
- 47 Roy L. Donahue, Soils: An Introduction to Soils and Plant Growth (Englewood Cliffs, N.J., 1958), p. 71; J. E. Satchell, "Introduction," in Biology of Plant Litter Decomposition, I, xxiii. Most humus colloids last only a few years.
- 48 H. Teuscher and R. Adler, The Soil and Its Fertility (New York, 1960), pp. 178-79; S. E. Millar, Soil Fertility (New York, 1955), p. 88; and Donahue, pp. 71-74. Humus colloids may account for up to fifty percent of the total exchange capacity of a soil.
- 49 Donahue, p. 77; and Staalfelt, pp. 254-55. Colloids of this type are called chelates. Chelates also help make soil phosphates more utilizable for higher plants. Chelating materials are found in appreciable quantities in manure.
- 50 Staalfelt, pp. 269-72; and Bridges, World Soils, p. 13.
- 51 Bridges, ibid. Soils with good crumb structure are up to fifty to sixty percent pore space. In soils with poor structure, the amount of pore space may decline to twenty percent to fifteen percent or even less.
- 52 Staalfelt, pp. 265-66; and Donahue, p. 186. Soils with poor structure have low subsurface drainage rates or infiltration rates. The infiltration rates of such degraded soils may be over seventy-five percent lower than those of soils with good crumb structure.
- 53 Sandy soils are particularly prone to drought. Under ordinary conditions, most soil water is loosely bound in thin films around the surfaces of soil particles. The smaller the soil particles, the greater is the total surface area available on which the films may form and the less susceptible these films are to evaporation during drought periods. Sand particles are approximately a hundred times larger than clay particles, and, as a result, sandy soils are always "thirsty" for water and for nutrients. See briefly Bridges, World Soils, p. 15.

CHAPTER II, continued

- 54 E. W. Russell, "Soil Structure: Its Maintenance and Improvement," Journal of Soil Science, XXIII (1971), 137-51; and J. E. Satchell, "Introduction," in Biology of Plant Litter Decomposition, I, xxiii.
- 55 Staalfelt, pp. 449-55; J. D. Ovington, Woodlands (London, 1965), p. 98; and Ernst Krebs, "Welfare Functions of the Forest," in The Forest, ed. by Walter Kuemmerly, trans. by Ewald Oser (New York, 1973), pp. 166-67. In modern times, these effects have been magnified by large scale land clearance and industrial pollution.
- 56 Ovington, Woodlands, p. 98; and "Nutrient Cycling in Woodlands," in Experimental Pedology, ed. by E. G. Hallsworth and D. V. Crawford (London, 1965), p. 217.
- 57 An even shorter time span was envisioned by W. H. Pearsall, "The pH of Natural Soils and Its Ecological Significance," Journal of Soil Science, III (1952), p. 43 and throughout his Mountains and Moorlands, revised by Winifred Pennington (London, 1968). Pearsall, however, wrote before the significance of the anthropogenic impacts on temperate forest ecosystems were fully appreciated. These anthropogenic factors will be discussed at length in Chapter III below.
- 58 If this could not be accomplished, genetically or otherwise, with the species potentials of the deciduous forests, then large scale replacements by species from other ecosystems, e.g., northern pine forests, would be very likely.
- 59 The sense of control used here does not imply that temperate forest ecosystems could alter the gross climate, but aims at the sense of an ability to monitor or to make compensatory responses. The significance of control defined in this manner will be discussed in greater detail in subsequent chapters.

CHAPTER III

- 1 Homeostasis refers to the tendency of biological or other systems to react to various external perturbations in a fashion so as to maintain some specified parameter or state of equilibrium characteristic of the system as a whole. See Odum, p. 34 and more extensively Walter B. Cannon, The Wisdom of the Body (New York, 1939). The equilibrium conditions may be virtually static; they may involve steady rates of change (e.g., the processes of sustained economic growth characteristic of developed capitalist economies); or the equilibrium conditions may involve complex series of mutual adaptations between systems coupled in various ways (e.g., the hierarchical nestings of organisms, communities of species, and environmental variables met with in the seral progression of ecosystems). See further Odum, pp. 34-34; and Roy A. Rappaport, "Nature, Culture and Ecological Anthropology," in Man, Culture and Society, ed. by Harry L. Shapiro, rev. edition (London, 1971), pp. 238-40. The geneticist C. H. Waddington in his The Strategy of the Genes: A Discussion of Some Aspects of Theoretical Biology (New York, 1957), pp. 32, 43 has suggested the term "homeorhesis" for phenomena involving non-static "developmental homeostasis."
- 2 L. B. Slobodkin, "Towards a Predictive Theory of Evolution," in Population Biology and Evolution, ed. by Richard C. Lewontin (Syracuse, N.Y., 1968), pp. 187-205 suggests ways in which the analogy of "life chances" can be given formal rigor using mathematical techniques from the theory of games, whereby evolution is pictured as a formal game in which the only rewards or payoffs would be the privilege of remaining in the game.
- 3 The differences in the homeostatic strategies of pioneer versus mature ecosystems are set out in Frank W. Preston, "Diversity and Stability in the Biological World," in Diversity and Stability in Ecological Systems, ed. by G. W. Woodwell and H. H. Smith (Brookhaven Symposia in Biology, No. 22 [Upton, N.Y., 1969]), pp. 1-12.
- 4 Preston, ibid., p. 7. See further Ramon Margalef, "On Certain Unifying Principles in Ecology," American Naturalist, XCVII (1963), 357-74
- 5 The problems of coherence in multi-species ecosystems are set out at length in Robert M. May, Stability and Complexity in Model Ecosystems (Princeton, 1973) and in C. S. Holling, "Resilience and Stability of Ecological Systems," Annual Review of Ecology, IV (1973), 1-23. See further Mark R. Gardner and W. Ross Ashby, "Connectance of Large Dynamic (Cybernetic) Systems: Critical Values for Stability," Nature, CCXXVIII (1970), 784.

CHAPTER III, continued

- 6 The problems of coherence, both for ecosystems and for more inclusive socio-ecosystems are elaborated in Roy A. Rappaport, "Maladaptation in Social Systems," Ann Arbor, 1974 (Typewritten.). My thanks to Dr. Rappaport for permission to consult a draft of this paper. Many of the concepts appearing in this paper have been touched upon in Rappaport's "The Sacred in Human Evolution," Annual Review of Ecology and Systematics, II (1971), 23-44 and Kent V. Flannery, "The Cultural Evolution of Civilizations," Annual Review of Ecology and Systematics, III (1972), esp. 412-21.
- 7 See the classic exposition of G. Evelyn Hutchinson, "Homage to Santa Rosalina, or Why Are There so Many Kinds of Animals?" American Naturalist, XCIII (1959), 221-46.
- 8 Compare Arthur G. Tansley, The British Islands and Their Vegetation (Cambridge, 1939), pp. 224-26 with Willis, Introduction to Plant Ecology, p. 45. In the United States, the term "disclimax," referring solely to anthropogenic plagioseres, is more common. See Odum, p. 267.
- 9 The fluctuating boundary in Russia between zones where podzols are climatically dictated and zones where the development of brown earths and their associated vegetation is very possibly a good case in point. See Staalfelt, pp. 326-27. Such boundaries or edges would sometimes qualify as ecotones, about which more below. In humid climates, the possibility of higher leaching rates would seem to favor less nutrient rich plagioseres or ecotonal edges than in more arid regions.
- 10 The following examples of plagioseral deflections are adapted from Eyre, pp. 18-20, 60-62, 80-82, 152-57.
- 11 Many of Eyre's examples, ibid., of the regeneration of forest communities are taken from field research in England's New Forest. For an extended discussion of ecological work in the New Forest, see Colin R. Tubbs, The New Forest: An Ecological History (Newton Abbot, 1968).
- 12 The term heath community covers various types of vegetation containing large proportions of woody shrubs such as heather, heath, gorze, or bracken fern. Communities with fewer shrubs and with more grasses, rushes, sedges, and bog mosses are called heather-grass moors or grass moors. Where grasses are absent except for water tolerant species such as cotton grass and where mosses and bog plants predominate, one is dealing with a peat bog, peat moor, or cotton grass moor. See briefly Roger Burrows, The Naturalist in Devon

CHAPTER III, continued

- and Cornwall (Newton Abbot, 1971), pp. 62-64; William Davies, The Grass Crop: Its Development, Use and Maintenance (London, 1952), pp. 52-55; R. G. Stapledon, The Hill Farms of Britain (London, 1937), pp. 52-61; and Staalfelt, pp. 472-76. See extensively W. H. Pearsall, Mountains and Moorlands, revised by Winifred Pennington (London, 1968) and F. Fraser Darling and J. Morton Boyd, The Highlands and Islands (London, 1969). The course of "natural" plagioseres must often be reconstructed from the study of plagioseres where anthropogenic factors are of obvious importance.
- 13 The inefficiencies of immature ecosystems and plagioseres in nutrient recycling will be explored in detail below. In temperate Europe, these inefficiencies are a major reason why non-forest ecosystems can usually attain or maintain only a tenth the total biomass of deciduous temperate forest ecosystems. See Ovington, Woodlands, p. 104.
- 14 William Gill and Glen E. Vanden Berg, Soil Dynamics in Tillage and Traction (Agricultural Handbook No. 316 [Washington, D.C., 1967]), p. 453. The power of wind and rainfall can deliver an awesome two billion kilocalories per acre per day to the surface of a soil. A closed canopy forest or a good sod of perennial grasses can damp out nearly all the destructive effects of these environmental factors. Clearing away these buffering plant communities, therefore, can cause substantial alterations in the top inch or so of a soil.
- 15 Ibid. Even the awesome energy of wind and rainfall affect little more than the surface of the topsoil. Man can induce significant pedological alterations extending through several feet of soil with his tillage implements.
- 16 Among the first agronomists to emphasize the deleterious effects of ploughing was Edward H. Faulkner, Plowman's Folly (Norman, 1943). See further Gill and Vanden Berg, pp. 193, 328-29, 444-46, 453; Kellogg, p. 217; G. V. Jaks, Soil (London, 1954), pp. 123-24; and Donahue, pp. 178, 186-87.
- 17 For graphic demonstrations of the differences between clods and crumbs, see J. H. Stallings, Soil: Use and Improvement (Englewood Cliffs, N.J., 1957), p. 63.
- 18 E.g., Ovington, Woodlands, p. 3.
- 19 See extensively the essays in R. B. Lee and I. DeVore, eds., Man the Hunter (Chicago, 1968). See also Marshall D. Sahlins, Stone Age Economics (Chicago, 1972), esp. at p. 21.

CHAPTER III, continued

- 20 This where productivity is measured on a per capita basis and is balanced against the inputs of human and other energy required for the agricultural output. See Sahlins, p. 6; and Jonathan Hollima, "Ecological Approaches to Agricultural Development," in Human Ecology and World Development, ed. by Anthony Vann and Paul Rodgers (New York, 1974), pp. 97-98, 107-109. These factors are masked in many modern agricultural systems where large inputs of cheap, non-ecosystemic fossil fuels are possible. See Horsfall, comp., Agricultural Production Efficiency, pp. 23, 111, 117-24.
- 21 Research in the past two decades has resulted in a softening of the notion of a decisive "Neolithic Revolution" proposed by V. Gordon Childe, e.g., his Man Makes Himself, rev. ed. (New York, 1951), pp. 59-86. A milestone was the recognition of a lengthy "proto-Neolithic" phase in excavations at early village sites like Jarmo in Iraqi Kurdistan, on which see Robert J. Braidwood, Bruce Howe, and Charles A. Reed, Prehistoric Investigations in Iraqi Kurdistan (Studies in Ancient Oriental Civilization, No. 31 [Chicago, 1968]). See further Lewis Binford, "Post-Pleistocene Adaptations," in New Perspectives, ed. by Binford and Binford, pp. 311-41; Kent V. Flannery, "The Origins of Agriculture," Annual Review of Anthropology, II (1973), 271-310; and the valuable collection of studies in Stuart Struever, ed., Prehistoric Agriculture (Garden City, N.Y., 1971).
- 22 The inadequacies of older definitions based largely on supposedly decisive genetic alterations in plants or animals are discussed in E. S. Higgs and M. R. Jarman, "The Origins of Plant and Animal Husbandry," in Papers in Economic Prehistory: Studies by Members of the British Academy Major Research Project in the Early History of Agriculture, ed. by E. S. Higgs (Cambridge, 1972), pp. 3-13; and H. N. Jarman, "The Origins of Wheat and Barley Cultivation," in ibid., pp. 15-36.
- 23 The following discussion draws heavily on the author's "Ecotones and Broad Spectrum Economies: Toward an Ecological Explanation," Papers in Anthropology, XV (1974), 37-54 and Robert E. Rhoades, "The Ecotone Concept in Anthropology and Archeology," Papers in Anthropology, XV (1974), 23-36. The association of ecotones with early centers of plant domestication was proposed by David Harris, e.g., his "Agricultural Systems, Ecosystems and the Origins of Agriculture," in The Domestication and Exploitation of Plants and Animals, ed. by Peter Ucko and D. W. Dibleby (Chicago, 1969), pp. 3-16.

CHAPTER III, continued

- 24 E.g., W. C. Allee, et al., Principles of Animal Ecology (Philadelphia, 1949), pp. 476-78; and Odum, pp. 157-59.
- 25 Kent V. Flannery, "Origins and Ecological Effects of Early Domestication in Iram and the Near East," in Domestication and Exploitation of Plants and Animals, ed. by Ucko and Dimbleby, p. 60; Braidwood, Howe, and Reed, p. 134; Philip E. L. Smith and T. Cugher Young, Jr., "The Evolution of Early Agriculture in Greater Mesopotamia," in Population Growth: Anthropological Implications, ed. by Brian Spooner (Cambridge, Mass., 1972), p. 31; and Jack R. Harlan and Daniel Zohary, "The Distribution of Wild Wheat and Barley," Science, CLIII (1965), 1078
- 26 My thanks to Dr. Paul Risser of the Oklahoma University Department of Botany for useful comments on the significance of periodic drought cycles in ecotonal situations.
- 27 Edgar Anderson, "Man as a Maker of New Plants and New Plant Communities," in Man's Role in Changing the Face of the Earth, ed. by William L. Thomas (Chicago, 1956), pp. 763-77; and J. G. Hawkes, "The Ecological Background of Plant Domestication," in Domestication and Exploitation, ed. by Ucko and Dimbleby, pp. 17-30.
- 28 The contrasts between pioneer and mature ecosystems are conveniently summarized in Odum, p. 252.
- 29 The constant fluctuations in the sitings of ecotones due to the effects of drought cycles would work to relocate ecotonal species such as cereals in fresh soils before their high nutrient uptake requirements had exhausted the nutrient reserves within a given locale.
- 30 Jack R. Harlan, "A Wild Wheat Harvest in Turkey," Archaeology, XX (1967), 197-201; and Frank Hole and Kent V. Flannery, "The Prehistory of Southwestern Iran: A Preliminary Report," Proceedings of the Prehistoric Society, XXXIII (1967), esp. 201.
- 31 For reasons outlined in note 28 above.
- 32 A crucial index is the continued reliance on wild cereals within ecotones versus the widespread use in such regions of genetic variants that would have required planting. Use of wild grains in Southwest Asia was nearly total from about 10,000 to 8,000 B.C. and continued as an important strategy in ecotonal sitings until around 5,000 B.C. See Flannery, "Origins and Ecological Effects of Early Domestication," pp. 60-62.

CHAPTER III, continued

- 33 A good summary of these progressive ecological changes is found in Frank Hole, Kent V. Flannery, and James A. Neely, Prehistory and Human Ecology of the Deh Luran Plain: An Early Village Sequence from Khuzistan, Iran (Memoirs of the Museum of Anthropology, University of Michigan, No. 1 [Ann Arbor, 1969]), pp. 342-71.
- 34 Convenient summaries of current research on this topic are found in Flannery, "The Origins of Agriculture," pp. 278-84.
- 35 See the recent summary article by M. R. Jarman and P. F. Wilkinson, "Criteria of Animal Domestication," in Papers in Economic Prehistory, ed. by E. S. Higgs, pp. 83-96. Smaller sized animals with small horns or with no horns at all were obviously easier to handle than were the larger, wild parent stocks.
- 36 Good syntheses of recent work on the slow drift of village life and more complex social systems to sites suitable for irrigation agriculture are to be found in Gregory Alan Johnson, Local Exchange and Early State Development in Southwestern Iran (Anthropological Papers, Museum of Anthropology, University of Michigan, No. 51 [Ann Arbor, 1973]); and Robert McC. Adams and Hans J. Nissen, The Uruk Countryside: The Natural Setting of Urban Societies (Chicago, 1972).
- 37 For a standard interpretation, see Stuart Piggott, Ancient Europe: From the Beginnings of Agriculture to Classical Antiquity (Chicago, 1965), pp. 24-70. For a good summary of the Neolithic and Early Bronze Age in the Aegean, see J. Lawrence Angel, The People of Lerna: Analysis of a Prehistoric Aegean Population (Princeton, 1971), pp. 7-34. An excellent survey of pre-Iron Age Italy is found in G. W. W. Barker, "Prehistoric Territories and Economies in Central Italy," in Palaeoeconomy, ed. by E. S. Higgs (Cambridge, 1975), pp. 111-75. Both the Aegean area and Italy may have witnessed more or less autonomous developments of agriculture with only minor impetus from the Near Eastern area. Temperate Europe, on the other hand, almost definitely received a strong leaven of agricultural colonists, esp. from the so-called Danubian Peasants described by V. Gordon Childe in his The Danube in Prehistory (Oxford, 1929).
- 38 J. G. D. Clark, Prehistoric Europe: The Economic Basis (London, 1952), p. 92. Once cleared of timber, Mediterranean landscapes are recolonized by highly fire-prone garrique or maquis vegetation covers that all but preclude forest regeneration. See Klaus Stern and Laurence Roche, Genetics of Forest Ecosystems (New York, 1968), p. 234; and Peter Sartorius and Hans Henle, Forestry and Economic

CHAPTER III, continued

Development (New York, 1968), pp. 12-16. By the Iron Age, only hilly or mountainous areas or the upper reaches of river watersheds still retained substantial woodland reserves, and heavy inroads were made on these reserves in the course of the classical period. See J. B. Ward-Perkins, "Central Authority and Patterns of Rural Settlement," in Man, Settlement and Urbanism, ed. by Peter Ucko, Ruth Tringham, and D. W. Dimbleby (London, 1972), p. 869; and Barker, "Prehistoric Territories," p. 165.

- 39 Increasingly populous lowland plains were subject to extremely mild winters, which were often not cold enough to ensure the vernalization of winter wheat. This could lead to periodic crop failures. See M. R. Jarman and D. Webley, "Settlement and Land Use in Capitunata, Italy," in Palaeoeconomy, ed. by E. S. Higgs, p. 179. Excellently overviews of the problems of Mediterranean agrarian systems are to be found in John Linton Myres, Greek Lands and the Greek People (Oxford, 1910); Who Are the Greeks? (Berkeley, 1930), pp. 1-25; and Mediterranean Culture (Cambridge, 1943).
- 40 My thanks to Mr. A. M. ApSimon of the University of Southampton for this apt phrase. For a recent survey of the effects of Neolithic man on the temperate forests of Britain, see A. G. Smith, "The Influence of Mesolithic and Neolithic Man on British Vegetation: A Discussion," in Studies in the Vegetational History of the British Isles: Essays in Honour of Harry Godwin, ed. by D. Walker and R. G. West (Cambridge, 1970), pp. 81-96. The British experience finds close parallels on the continent. These Neolithic pressures were fairly impressive, probably due to the widespread and rather indiscriminate use of fire to force clearings.
- 41 A possibility first emphasized by Robert L. Carneiro, "Slash-and-Burn Cultivation among the Kuikuru and Its Implications for Cultural Development in the Amazon Basin," in The Evolution of Horticultural Systems in Native South America: Causes and Consequences, ed. by Johannes Wilbert (Antropologica Supplement Publication, No. 2 [Caracas, 1961]), pp. 47-67. For applications of Carneiro's concepts to the European Neolithic, see Bohumil Soudsky and Ivan Pavlu, "The Linear Pottery Culture Settlement Patterns of Central Europe," in Man, Settlement and Urbanism, ed. by Ucko, Tringham, and Dimbleby, pp. 1-13.
- 42 A stubborn defender of this thesis is Betty J. Meggers, "The Law of Cultural Evolution as a Practical Research Tool," in Essays in the Science of Culture: In Honor of Leslie A. White, ed. by Gertrude E. Dole and Robert L. Carneiro (New York, 1960), pp. 302-16. Meggers' pessimism may well be due to generalizing from her experience with particularly unpropitious environments in Amazonia.

CHAPTER III, continued

- 43 The marginality of most surviving swiddening systems in early modern Europe was clearly recognized by Marc Bloch, French Rural History: An Essay on Its Basic Characteristics, trans. by Janet Sondheimer (Berkeley, 1966), pp. 26-30. See further D. N. McVean and J. D. Lockie, Ecology and Land Use in Upland Scotland (Edinburgh, 1969), where the authors repeatedly compare degraded temperate moorlands to deserts or deforested tropical ecosystems, none of which are suitable for large scale production of high protein grains or livestock rearing.
- 44 E.g., Lynn White, Jr., Medieval Technology and Social Change (London, 1964), pp. 39-78, who pictures the early middle ages as a devolutionary phase in terms of technology and necessarily, therefore, in terms of agricultural productivity. White's views are widely held.
- 45 Eric Kerridge, The Agricultural Revolution (New York, 1968), pp. 207-208.
- 46 These were the typical yields of open field husbandry in northern France during the early modern period. See Michel Morineau, "Was There an Agricultural Revolution in Eighteenth Century France?" in Essays in French Economic History, ed. by Rondo Cameron (Homewood, Ill., 1970), pp. 140-49.
- 47 These are the abysmal yield ratios suggested for the high middle ages by Georges Duby, "Medieval Agriculture, 900-1500," in The Fontana Economic History of Europe, Vol. I: The Middle Ages, ed. by Carlo M. Cipolla (London, 1972), p. 196.
- 48 Staalfelt, pp. 470, 493, where he cites yield rates from spring sown crops on forest swidden plots in early modern Sweden. In areas farther to the south, where winter sowing would be possible, swidden yields would have been higher since winter grains enjoy a longer growing season and have more extensive tiller growth due to vernalization. See John Percival, The Wheat Plant: A Monograph (London, 1921), pp. 413-32. The yield rates cited by Staalfelt would be anticipated on theoretical grounds (since temperate forests and annual cereal crops have very similar nutrient uptake requirements), but solid empirical evidence is extremely welcome.
- 49 P. Duvigaud and S. Denaeyer-De Smet, p. 219; and J. D. Ovington, "Prairie, Savanna and Oakwood Ecosystems at Cedar Creek," in Grazing in Terrestrial and Marine Ecosystems, ed. by D. J. Crisp (Oxford, 1969), pp. 50-51.

CHAPTER III, continued

- 50 Ovington, Woodlands, p. 96 notes that clear felling of a fifty year old pine plantation would remove only a tenth the nutrients of an agricultural crop grown on the same area. Swiddening systems based on pine or heather communities would obviously run the risk of operating at a substantial nutrient deficit unless cropping activities were severely limited in their scope or duration.
- 51 The cumulative drain spread over a millenium or so, however, could be appreciable.
- 52 Good descriptions of the probable nature of prehistoric swiddening procedures can be found in J. G. D. Clark, Prehistoric Europe, pp. 92-107.
- 53 These considerations are based on data assembled in Roy A. Rappaport, Pigs for the Ancestors: Ritual in the Ecology of a New Guinea People (New Haven, 1967), pp. 252-62 where information from a number of similar horticultural systems is brought together. See further Jonathan Holliman, "Ecological Approaches to Agricultural Development," in Human Ecology and World Development, ed. by Anthony Vann and Paul Rogers (New York, 1974), p. 99; and Horsfall, comp., Agricultural Production Efficiency, pp. 121-22.
- 54 These conversion figures are taken from information supplied in Eric Waddel, The Mound Builders: Agricultural Practices, Environment and Society in the Central Highlands of New Guinea (American Ethnological Society Monograph, No. 53 [Seattle, 1972]), p. 118. Cereals are a much better food source than are prtein deficient sweet potatoes, so that the reduction made here from Rappaport's 16:1 caloric output statistic is a safe, even an over-severe estimate.
- 55 Horsfall, comp., Agricultural Production Efficiency, pp. 111, 121-124.
- 56 The contribution from non-cereal food resources is difficult to estimate precisely, partly because the importance of various food items changed noticeably over time from the early Neolithic down through the Iron Age. Piggott, Ancient Europe, pp. 51-52 notes the much greater importance of domesticated animals in the Iron Age as opposed to early Neolithic economies where game and wild plant foods were of more significance. Staalfelt, p. 467 argues that non-cereal foods supplied an overwhelming percentage of the diet in temperate Europe down through the Iron Age. An estimate of fifty percent non-cereal food sources to fifty percent cereal food sources would not seem to be unreasonable and probably gives too much weight to the more labor intensive cereal crops.

CHAPTER III, continued

- 57 Exact figures for the productivity of animal husbandry in pre-historic swiddening systems are impossible to derive. In Horsfall, comp., Agricultural Production Efficiency, p. 194, it is noted that grazing animals convert forage into body tissue and, hence, into potential food energy for human populations, at an efficiency of four to ten percent. Photosynthesis in plants, ibid., p. 113, operates at an efficiency of less than one percent in converting sunlight into potential food energy. Even if as much labor were required to tend livestock as to tend crops (and livestock would probably require less attention), the returns from animal husbandry would be at least five times greater than the returns from cereal cropping. Even if animal husbandry accounted for only half of the total agricultural productivity (as assumed in note 56 above), the total energy returns on all food producing activities would still be between ten to twenty calories of food for each calories of labor expended. A greater emphasis on animal husbandry would allow for even higher caloric returns.
- 58 Waddell, The Mound Builders, p. 118.
- 59 This was the normal range in traditional temperate European farming systems according to Percival, pp. 326-27, 416, 430.
- 60 This is allowing over a third of an acre per person and neglecting the fact that women and children use less food than an adult male.
- 61 Enrique Marcet, "Species of Trees," in The Forest, ed. by Walter Kuemmerly (New York, 1973), p. 72 notes that beech and oak trees take about fifty to eighty years to reach maturity.
- 62 E.g., H. C. Darby and E. M. J. Cambell, The Domesday Geography of Southeast England (Cambridge, 1962), where this relatively populous portion of Norman England was lucky to boast regional concentrations of more than ten persons per square mile.
- 63 See extensively H. C. Brookfield and Paula Brown, Struggle for Land: Agriculture and Group Territories Among the Chimbu of the New Guinea Highlands (Melbourne, 1963). See further H. C. Brookfield, "Intensification and Disintensification in Pacific Agriculture," Pacific Viewpoint, XIII (1972), 30-48; and Eric Waddell, "Agricultural Evolution in the New Guinea Highlands," Pacific Viewpoint, XIII (1972), 18-29.
- 64 Sahlins, pp. 41-48, where a large body of ethnographic information is assembled.

CHAPTER III, continued

- 65 The high potential productiveness of many swiddening systems is undoubtedly behind the evolution of complex chiefdoms or "civilizations" among the ancient Maya in Mexico and Guatemala or the Khmer in Cambodia. Colin Renfrew, "Monuments, Mobilization and Social Organization in Neolithic Wessex," in The Explanation of Culture Change: Models in Prehistory, ed. by Colin Renfrew (Pittsburgh, 1973), pp. 539-58 has recently argued for comparable levels of complexity for the late Neolithic and Early Bronze Age groups associated with the Stonehenge complex in England. The typicality of complex, and probably populous, social groupings of this sort in European prehistory must await further research.
- 66 Sahlins, pp. 41, 74-86, 95-102. These notions were first clearly expressed by Robert L. Carneiro, "Slash-and-Burn Agriculture among the Kuikuru," in The Evolution of Horticultural Systems in Native South America, pp. 47-67; and in Eric Wolf, "Concluding Remarks," in ibid., pp. 111-16.
- 67 Sahlins, pp. 74, 86 notes how the divisiveness and frequent underproductivity of semi-autonomous domestic groups renders individual households liable to near total decimation if faced by massive crop failures or livestock losses. Such erratic fluctuations in productivity would be more characteristic of badly degraded ecosystems than of resilient, mature ecosystems.
- 68 Archaeologists such as V. Gordon Childe reasoned that the first civilizations emerged in the flood plains of river systems such as the Tigris and Euphrates, e.g., Man Makes Himself, pp. 114-42. It is now apparent that the appearance of state societies must be pushed back several thousand years and that such processes first centered not on the great flood plains but along the steppes below the hilly flanks of the Zagros Mountains. See G. A. Johnson, pp. 98-111.
- 69 See esp. A. G. Smith, "The Influence of Mesolithic and Neolithic Man on British Vegetation," in Studies in the Vegetational History of the British Isles, ed. by Walker and West, pp. 81-96; and Judith Turner, "Post-Neolithic Disturbance of British Vegetation," in ibid., pp. 97-116. These authors argue for similar trends on the continent as does N. J. G. Pounds, An Historical Geography of Europe, 450 B.C.-A.D. 1330 (Cambridge, 1973), pp. 16-17. Early notions that noticeable alterations in forest ecosystems around the beginning of the Iron Age were the result of a hypothesized sub-Atlantic climatic deterioration are now being revised in favor of anthropogenic causes. See W. Pennington, "Vegetation History in the North-west of England: A Regional Synthesis," in Studies in the Vegetational History of the British Isles, pp. 76-77.

CHAPTER III, continued

- 70 Any mature crop will have stems and leaves low in nitrogen content. This is why green manures must be ploughed in well before they flower, after which time nitrogen-rich proteins and other materials will be diverted from vegetative growth to seed production. See Millar, Soil Fertility, pp. 98, 104, 308; and Teuscher and Adler, pp. 200, 257.
- 71 The decomposer fungi and bacteria normally associated with temperate forest ecosystems secrete chemical substances similar in composition or effect to penicillin that act to keep down their numbers or keep them in a dormant state. Significant alterations of the soil environment can interrupt these mechanisms and encourage massive population surges among existing organisms or invading parasites. See F. A. Skinner, "Microbial Heterogeneity of Soil," in Soil Heterogeneity and Podzolization, ed. by E. M. Bridges, pp. 23-30; and R. S. Forbes, "Decomposition of Agricultural Crop Debris," in Biology of Plant Litter Decomposition, ed. by C. H. Dickinson and G. J. F. Pugh, 2 Vols. (London, 1974), II, 723-42.
- 72 Cereal stubbles, related weed species, and even a variety of shrubs provide excellent over-wintering habitats for micro-organisms that act as vectors for pathogens. See extensively John Charles Walker, Plant Pathology, 2nd ed. (New York, 1957); and Laurence J. King, Weeds of the World: Biology and Control (New York, 1966). See further E. R. Bullen, "Burning Crop Residues in England," Proceedings of the Tall Timbers Fire Ecology Conference, No. 13 (1973), 223-35; W. C. Shaw, "Weeds in Barley and Their Control," in Barley: Origins, Botany, Culture, Winterhardiness, Genetics, Utilization, Pests (Agricultural Handbook No. 338 [Washington, D.C., 1968]), pp. 39-42; and J. G. Moseman, "Barley Diseases and Their Control," in ibid., pp. 45-60.
- 73 Almost no attention has been given to the role of soil pathogens in the timing of preindustrial crop rotation patterns. Georges Duby, The Early Growth of the European Economy: Warriors and Peasants from the Seventh to the Twelfth Century, trans. by Howard B. Clarke (Ithaca, 1974), p. 158 describes ergotism, common throughout the middle ages, as either a diet deficiency or as an epidemic disease when in fact it is a type of alkaloidal poisoning caused by eating heads of grains infected with the fungal pathogen ergot. See J. C. Walker, Plant Pathology, p. 351.
- 74 A key index is the carbon to nitrogen ratio in the soil. If this ratio is greater than about 15:1, plants experience difficulties in taking up nitrogen. Nitrogen deficiencies trigger difficulties in phosphorus metabolism and so forth. See William Davies, The Grass Crop, p. 34; Teuscher and Adler, pp. 198-99; and T. W. Walker,

CHAPTER III, continued

"The Significance of Phosphorus in Pedogenesis," pp. 198-99.

- 75 The phrase "fertility transfer" is taken from G. V. Jacks, Soil, pp. 196-98 and from Joseph Hutchinson, Farming and Food Supply: The Interdependence of Countryside and Town (Cambridge, 1972), pp. 46-47. The delightful phrase "fertility filching" has been suggested by T. L. Bywater, "The Function and Use of Leys in Grassland Agriculture," Proceedings of the Sixth International Grassland Congress, 4 Vols. (State College, Pa., 1952), I, 705. See further Staalfelt, pp. 464-549.
- 76 This terminology has been suggested for standard use by historical geographers in Harald Uhlig, ed., Basic Material for the Terminology of the Agricultural Landscape, I: Types of Field Patterns (Giessen, 1967), p. 37.
- 77 Cattle and sheep can eke out an existence on mature roughages since they have colonies of symbiotic bacteria in their digestive tracts that can break down lignin and cellulose into volatile fatty acids. See Horsfall, comp., Agricultural Production Efficiency, p. 114; and Harry W. Colvin, "Digestion," in Animal Agriculture: The Biology of Domestic Animals and Their Use by Man, ed. by H. H. Cole and Magnar Ronning (San Francisco, 1974), p. 452.
- 78 Esp. valuable discussions of the logistics of manure application are found in Donahue, pp. 248-68; and Teuscher and Adler, pp. 266-71, 285-93.
- 79 For instance, an acid soil deficient in calcium may be unable to take advantage immediately of the full measure of nutrients such as nitrates or phosphates in the manure. Likewise, if the manure has imbalances in certain key nutrients, the levels of the nutrients that are in shortest supply will set limits to the rate at which plants can metabolize the others. This is an example of Liebig's famous Law of the Minimum which was devised to show why a scientifically prepared chemical fertilizer could achieve better results than manures of unknown or unpredictable composition. See Justus von Liebig, The Laws of Natural Husbandry, p. 208.
- 80 In addition to the references cited in note 78 above, see K. R. Gray and A. J. Biddleston, "Decomposition of Urban Waste," in Biology of Plant Litter Decomposition, ed. by Dickinson and Pugh, II, 743-75, which contains much valuable information on composting.
- 81 Donahue, pp. 248-49; and Millar, Soil Fertility, p. 343.

CHAPTER III, continued

- 82 The qualities of various types of plagioseral heath and grass communities are discussed in Stapledon, pp. 48-65.
- 83 William Davies, pp. 170, 246-47; Jacks, Soil, p. 194; and G. V. Jacks and R. O. Whyte, Vanishing Lands: A World Survey of Soil Erosion (New York, 1939), pp. 90-91.
- 84 E. John Russell, The World of the Soil, p. 67, where he calculates that legumes can fix up to 350 pounds of nitrogen per acre per year. In a very real sense, the use of leys in traditional high husbandry amounted to a type of swiddening, using grasses and clovers that came to maturity faster and fixed nitrogen at a higher rate than forest ecosystems. Trees take decades to mature, and free-living bacteria in the soil fix nitrogen at a fairly low rate. See Borman and Likens, "The Ecosystem Concept and the Rational Management of Natural Resources," p. 7; Teuscher and Adler, p. 203; and Staalfelt, p. 163.
- 85 See extensively Eric Kerridge, The Agricultural Revolution; and The Farmers of Old England (Totowa, N.J., 1973).
- 86 This apt phrase is taken from Kerridge, e.g., The Agricultural Revolution, p. 311.
- 87 See J. P. Wild, "Prehistoric and Roman Textiles," in The Wool Textile Industry in Great Britain, ed. by J. Geraint Jenkins (Boston, 1972), pp. 3-18; Eric Kerridge, "Wool Growing and Wool Textiles in Medieval and Early Modern Times," in ibid., pp. 19-33; Michael L. Ryder, "The Wools of Britain," in ibid., pp. 51-64; John A. Iredale, "Preparation of Wools," in ibid., pp. 65-70; and Robert Trow-Smith, Life from the Land: The Growth of Farming in Western Europe (London, 1967), pp. 89-90. The luxury of breeding sheep specifically for wool has been a rather recent development. Down until modern times, the animals' role in the sheepwalk was primary, and good quality wool was often more the result of painstaking sorting and processing than anything else. Good quality wool was sometimes the unintentional byproduct of extending agricultural colonization to marginal areas such as the chalk and lime-stone Downs of England. In such areas, the high calcium content of the forage on rough pastures produced a fine, hard fleece on an otherwise unremarkable breed of sheep.
- 88 The complexities of haymaking and the numerous possibilities for losses in nutrients and nutritive value are outlined in K. L. Turk, "Changes in the Composition and Quality of Forage Dried on Barn Finishing Systems," Proceedings of the Sixth International Grassland Congress, II, 1739-45. Even with modern haymaking and silage

CHAPTER III, continued

techniques, livestock still need grain supplements during winter months. E.g., cows need grain supplements to the tune of ten pounds per day to hold their weight and give milk. Much modern hay comes from well-fertilized pastures. For the problems of hay production from the frequently nutrient deficient meadows and pastures of pre-modern times, see Staalfelt, pp. 480-82, 487-88. Heavily exploited meadows could play out in as little as ten years. The resultant lack of winter fodder would mean that most livestock would have to be slaughtered by late autumn.

CHAPTER IV

- 1 See Robert M. May, Stability and Complexity in Model Ecosystems; and C. S. Holling, "Resilience and Stability of Ecological Systems," pp. 1-23.
- 2 The implications of excessive coherence for systems of any sort are explored in Mark R. Gardner and W. Ross Ashby, "Connectance in Large Dynamic (Cybernetic) Systems," p. 784. See also Roy Rappaport, "The Sacred in Human Evolution," pp. 33-37; and Kent Flannery, "The Cultural Evolution of Civilizations," pp. 399-426. I have also profitted from being able to consult a draft of Dr. Rappaport's "Maladaptation in Social Systems."
- 3 The decisiveness of the transition from tribal to state systems was argued for by V. Gordon Childe, Man Makes Himself, pp. 114-42, under the rubric of Childe's so-called "Urban Revolution." The decisiveness of the transition to state societies is now being re-approached on slightly different lines as the result of recent investigations of early state development in Southwest Asia. E.g., G. A. Johnson, Local Exchange and Early State Development in Southwest Iran, pp. 2-3.
- 4 Ibid., p. 3, where states are defined as possessing decision-making organizations of at least three hierarchical levels, such organizations being charged with coordinating major economic, political, and military activities. In simple terms, the decision-making organizations of state societies are bureaucracies. Governmental bureaucracies are commonly listed as traits associated with states. Bureaucracies may be the most important trait.
- 5 Geoffrey Vickers, Making Institutions Work (New York, 1973), pp. 112, 154, and Towards a Sociology of Management (New York, 1967), pp. 20-43. The following discussion makes extensive use of points and examples covered by Vickers.
- 6 Adaptability is often conceptualized in terms of the homeostatic capacities of a given system isolated for study, and this may be an adequate criterion so long as a system's environment is immune to any of the effects, actions, or outputs of the isolated system. This is not always the case, especially when longer periods of time are considered. These matters were first stressed in Lawrence J. Henderson, The Fitness of the Environment (New York, 1927), p. 267. The reciprocal aspects of adaptation can be usefully applied to many aspects of ecosystems and socio-ecosystems. See further Rappaport, "The Sacred in Human Evolution," pp. 24-25.

CHAPTER IV, continued

- 7 Gardner and Ashby, p. 784; and Flannery, "The Cultural Evolution of Civilizations," pp. 411, 420-21. As the number of subordinate components or positions below a given hierarchical level increases arithmetically, the number of potential inter-relationships increases geometrically. Obviously, centralized, pyramidal hierarchies leave themselves open to coherence on a massive scale.
- 8 The dangers of loss of autonomy for subsystems linked to centralized, and potentially over-coherent, systems are emphasized in Rappaport, "Nature, Culture and Ecological Anthropology," pp. 262-64.
- 9 Max Weber, "Characteristics of Bureaucracy," in Organization Theories, ed. by William Sexton (Columbus, Ohio, 1970), p. 41.
- 10 The findings of business administration researchers have been largely ignored by sociologists, anthropologists, and historians. Good introductions to the insights to be derived from the business administration literature include: Organization Theories; Herbert A. Simon, Administrative Behavior: A Study of Decision-Making Processes in Administrative Organizations, 2nd ed. (New York, 1957); James G. March and Herbert A. Simon, Organizations (New York, 1958); Richard A. Johnson, Fremont E. Kast, and James E. Rosenzweig, The Theory and Management of Systems (New York, 1963); Stanley Young, Management: A System Analysis (Glenview, Ill., 1966); and Arnold S. Tannenbaum, et al., Hierarchy in Organizations: An International Comparison (San Francisco, 1974).
- 11 Seymour Tilles, "The Manager's Job: A Systems Approach," in Organization Theories, pp. 214-26.
- 12 William Sexton, "The Scalar Process," in Organization Theories, pp. 44-46; and Rocco Carzo, Jr., "Organizational Realities," in ibid., pp. 286-300. Many businesses try to limit a manager's immediate subordinates to six or less. This encourages extensive subdelegation and the creation of excessive numbers of poorly defined and poorly coordinated hierarchical levels.
- 13 Carzo, p. 293; Warren Bennis, "Beyond Bureaucracy," in Organization Theories, pp. 388-97; and Rensis Likert, "An Integrating Principle and an Overview," in ibid., pp. 426-30.
- 14 This approach was pioneered by Frederick Winslow Taylor, e.g., his Shop Management (New York, 1911), pp. 99-104, and now forms the basis for much of the job placement activities conducted by private businesses and state employment agencies. For critiques of such policies, see Carzo, pp. 286-300; John T. Dorsey, Jr., "A Communications Model for Administration," in Organization Theories, pp. 253-

CHAPTER IV, continued

- 265; and Joseph A. Litterer, "Conflict in Organizations: A Re-examination," in ibid., pp. 328-38.
- 15 Carzo, p. 291.
 - 16 Karl Deutsch, "On Communications Models in the Social Sciences," in Organization Theories, p. 25.
 - 17 Ibid.
 - 18 Max Weber, "Characteristics of Bureacracy," p. 41.
 - 19 Chris Argyris, "The Organization: What Makes It Healthy?" in Organization Theories, pp. 191-208; and Dorsey, p. 265.
 - 20 Young, pp. 8-9 notes that older theories concerned themselves almost exclusively with the processes of delegation of responsibility and subordination of authority. As an example, see James Mooney, "The Scalar Principle," in Organization Theories, pp. 42-51.
 - 21 Likert, pp. 422-23.
 - 22 Mooney, p. 49.
 - 23 Talcott Parsons, "Introduction," in Max Weber, The Theory of Social and Economic Organization, trans. by A. M. Henderson and Talcott Parsons (New York, 1947), p. 64.
 - 24 Young, in toto.
 - 25 Ibid., pp. 389-401. See further Herbert A. Simon, The Sciences of the Artificial (Cambridge, Mass., 1969), p. 68.
 - 26 Young, pp. 363-78.
 - 27 Ibid., pp. 377, 401.
 - 28 Weber, "Characteristics of Bureaucracy," p. 40.

CHAPTER V

- 1 Francis John Byrne, "MacNeill the Historian," in The Scholar Revolutionary: Eoin MacNeill, 1867-1945, and the Making of the New Ireland, ed. by F. X. Martin and Francis John Byrne (New York, 1973), pp. 17-36; and Francis John Byrne, "Tribes and Tribalism in Early Ireland," Eriu, XX (1971), 128-66, notes how nineteenth century tribal stereotypes were a major stumbling block to a scholarly understanding of the early history of England's nearby Celtic colony. For typical examples of nineteenth century thinking on tribes and their role in the cultural evolution of "lower races" to the higher stage of "civilization," see Edward B. Tylor, Researches into the Early History of Mankind and the Development of Civilization (London, 1865), pp. 150-
Anthropology: An Introduction to the Study of Man and Civilization (New York, 1881), pp. 401-40; A. Moret and G. Davies, From Tribe to Empire: Social Organization Among Primitives and in the Ancient East, trans. by V. Gordon Childe (New York, 1926); and Andrew Lang, A History of Scotland from the Roman Occupation, 4th ed., 2 Vols. (New York, 1907), I, 77-85. Morton H. Fried, "On the Concepts of 'Tribe' and 'Tribal Society'," in June Helm, ed., Essays on the Problem of the Tribe (Proceedings of the 1967 Annual Spring Meeting of the American Ethnological Society [Seattle, 1968]), pp. 3-20 makes a convincing argument that the types of societal units commonly labeled as tribes are nearly all acculturation products showing the effects of pervasive alterations stemming from contact with state systems or colonial powers. Similar views are expressed in Immanuel Wallerstein, "Social Conflict in Post-Independence Africa: The Concept of Race and Status-Group Reconsidered," in Racial Tension and National Identity, ed. by Ernest O. Campbell (Nashville, 1972), pp. 205-26.
- 2 For a critical discussion of such "historical" approaches in the context of European archaeology; see Colin Renfrew "British Prehistory: Changing Configurations," in British Prehistory: A New Outline, ed. by Colin Renfrew (London, 1974), pp. 1-40. See further J. G. D. Clark, "The Invasion Hypothesis in British Archaeology," Antiquity, XL (1966), 172-89.
- 3 Hugh Trevor-Roper, The Rise of Christian Europe (New York, 1965), p. 9. A phrase applied to sub-Saharan Africa but showing a type of scholarly condescension that is still widespread.
- 4 The tensions between these two opposing tendencies are well illustrated in the writings of V. Gordon Childe. Cf. his "Is Prehistory Practical?" Antiquity, VII (1933), p. 417, where prehistory is defined as the study of the differentiations and wanderings of

CHAPTER V, continued

- archaeological cultures, with his "The Social Implications of the Three 'Ages' in Archaeological Classification," The Modern Quarterly, I (1946), 18-32, which tends toward an unadulterated technological determinism. While here and elsewhere I am adopting a critical stance toward Childe, many of his ideas (e.g., see chapter VII, note 60 below) are eminently operational, and he is not to be dismissed lightly.
- 5 Fried, pp. 15-18 stresses that precise delimitations are generally the result of colonial administration and reservation impoundment.
 - 6 Echoes of such assumptions, often based more on a paucity of evidence than anything else, lurk behind Stuart Piggott's category of "conserving societies," e.g., Ancient Europe, p. 17.
 - 7 Convenient examples of "tribal" scholarship at its worst can be culled almost at random from the early volumes of the American Anthropologist before the editorship passed to Franz Boas. E.g., J. W. Powell, "From Barbarism to Civilization," American Anthropologist, O.S., I (1888), 229-42; Henry W. Henshaw, "Who Are the Indians?" ibid., II (1889), 193-214; H. Solotaroff, "On the Origin of the Family," ibid., XI (1898), 229-42; and W. J. McGee, "Piratical Acculturation," ibid., XI (1898), 243-49. For a survey of the perils for objective scholarship of such basically racist approaches, see Gloria A. Marshall, "Racial Classification: Popular and Scientific," in Explorations in Anthropology: Readings in Culture, Man, and Nature, ed. by Morton H. Fried (New York, 1973), pp. 75-83. V. Gordon Childe's carefully couched definition of an archaeological culture in The Bronze Age (Cambridge, 1930), pp. 41-42 was an attempt to avoid the pitfalls of the prevalent association of cultures and tribes with races.
 - 8 The dean of German tribal scholarship was Gustav Kossinna, on whom see Reinhard Wenskus, Stammesbildung und Verfassung: Das Werden der fruehmittelalterlichen Gentes (Cologne, 1961), pp. 113-42. See further Kossinna's Die deutsche Vorgeschichte: Eine hervorragende nationale Wissenschaft (Leipzig, 1921) and his Ursprung und Verbreitung der Germanen in vor- und fruehgeschichtlicher Zeit (Leipzig, 1921). Further examples of this sometimes blatantly racist or nationalistic approach are to be found among the essays in Hans Reinerth, ed., Vorgeschichte der deutsche Staemme: Germanische Tat und Kultur auf deutschen Boden, 3 Vols. (Leipzig, 1940).
 - 9 E.g., Carl Buecher, Industrial Evolution, trans. by S. Morley Wickett (New York, 1907), pp. 41-82, 88-95, 111-12. See further Sahlins, p. 76.

CHAPTER V, continued

- 10 See the astounding passage in Piggott, Ancient Europe, p. 257 where the Roman conquest of Gaul is seen as a just reward for the Celts, who are upbraided for having manifestly failed to reach, on their own initiative, the heights of civilization. Even V. Gordon Childe in his Social Evolution (New York, 1951) fell back on the old value-laden terminology of stages running from savagery to barbarism to civilization.
- 11 The subsequent discussion draws on the following collections or studies: Joseph R. Caldwell and Robert L. Hall, eds., Hopewellian Studies (Illinois State Museum, Scientific Papers, XII, No. 3 [Springfield, 1964]); Stuart Struever, "Woodland Subsistence-Settlement Systems in the Lower Illinois Valley," in New Perspectives in Archeology, ed. by Binford and Binford, pp. 285-312; Stuart Struever and Gail L. Houart, "An Analysis of the Hopewell Interaction Sphere," in Social Exchange and Interaction, ed. by Edwin H. Wilmsen (Anthropological Papers, Museum of Anthropology, University of Michigan, No. 46 [Ann Arbor, 1972]), pp. 47-79; and Stuart Struever and Kent D. Vickerby, "The Beginnings of Cultivation in the Midwest-Riverine Area of the United States," American Anthropologist, LXXV (1973), 1197-1220.
- 12 E.g., Olaf H. Prufer, "The Hopewell Complex of Ohio," in Hopewellian Studies, p. 64, where Hopewellian culture traits in Ohio are "explained" by invasions or migrations from Illinois.
- 13 Consciously applied by Geoffrey W. Conrad, "Toward a Systemic View of Mesoamerican Prehistory: Inter-Site Sociopolitical Organization," in The Rise and Fall of Civilizations: Modern Archaeological Approaches to Ancient Cultures, ed. by C. C. Lamberg-Karlovsky and Jeremy A. Sabloff (Menlo Park, Ca., 1974), pp. 145-56. Such an approach is implicit in Kent Flannery, "The Olmec and the Valley of Oaxaca: A Model for Inter-Regional Interaction in Formative Times," in The Rise and Fall of Civilizations, pp. 64-83; and Lee A. Parsons and Barbara J. Price, "Mesoamerican Trade and Its Role in the Emergence of Civilization," in Observations on the Emergence of Civilization in Mesoamerica, ed. by Robert F. Heizer and John A. Graham (Contributions of the University of California Archaeological Research Facility, No. 11 [Berkeley, 1971]), pp. 169-95.
- 14 Joseph R. Caldwell, "Interaction Spheres in Prehistory," in Hopewellian Studies, pp. 138-39.
- 15 My thanks to Mr. Humphrey Case for making available a pre-print of his "The Beaker Culture in Britain and Ireland" to be presented

CHAPTER V, continued

- at the Ninth International Congress of Prehistoric and Proto-historic Sciences at Nice, France in September of 1976. In this paper, Mr. Case applies the interaction sphere concept to culture groups of the late Neolithic and early Bronze Age. See further David L. Clarke, "A Provisional Model for an Iron Age Society and its Settlement System," in Models in Archaeology, ed. by David L. Clarke (London, 1973), pp. 801-69.
- 16 An excellent critique of this viewpoint is contained in J. G. D. Clark, "The Invasion Hypothesis in British Archaeology," pp. 172-89.
 - 17 See Colin Renfrew, "Wessex Without Mycenae," Annual of the British School at Athens, LXIII (1968), 277-85; and "Trade and Culture Process in European Prehistory," Current Anthropology, X (1969), 51-78.
 - 18 Simon, Sciences of the Artificial, pp. 87-90 suggests the term "flat hierarchies" to distinguish such nested relationships from the centralized, "vertical hierarchies" of bureaucracies.
 - 19 Sahlins, pp. 144-47.
 - 20 Ibid., p. 147 citing another apt Hawaiian proverb.
 - 21 Anthony Leeds has reasoned that most so-called tribal chiefs have been less wielders of power than information brokers. See his "Ecological Determinants of Chieftainship Among the Yaruro Indians of Venezuela," in Environment and Cultural Behavior: Ecological Studies in Cultural Anthropology, ed. by Andrew P. Vayda (Garden City, N.Y., 1969), pp. 377-94.
 - 22 An excellent study of the role of cyclically operating trade, military, and political ties is Mervyn Meggitt, "system and Subsystem: The Te Exchange Cycle Among the Mae Enga," Human Ecology, I (1972), 111-23.
 - 23 This point is emphasized in Sahlins, pp. 101-102.
 - 24 This assumption is implicit in V. Gordon Childe, "Trade and Industry in Barbarian Europe Till Roman Times," in Cambridge Economic History, II, 1, 31; and Social Evolution, pp. 86, 117-18.

CHAPTER VI

- 1 This phrase was coined by Hector Munro Chadwick. See his The Heroic Age (Cambridge, 1912). While much of his detailed historical analysis is outdated, there is still much of lasting value in Chadwick's treatment of the Greek and European Dark Ages for a comparative study of preindustrial frontiers.
- 2 For an excellent description of the growth of the Roman Confederacy, see A. N. Sherwin-White, The Roman Citizenship (Oxford, 1939), pp. 3-125.
- 3 See G. W. W. Barker, "Prehistoric Territories and Economies in Central Italy," in Palaeoeconomy, ed. by E. S. Higgs, pp. 111-75. In the Mediterranean, livestock are threatened both by winter cold and summer drought, so that stock from the hills and highlands must be overwintered in the valleys and plains of the lowlands while lowland stock must be moved to higher pastures during the parching heat of summer. The differentiation of highland tribes from lowland population centers probably goes back to Bronze Age times, but these disparate groups were always thrown together into alliances, for the sharing of seasonal pastures, if for nothing else.
- 4 K. D. White, Roman Farming (Ithaca, 1970), p. 56 observes that the best places for grain growing in Italy were the lower reaches of valleys overlying unweathered, calcium-rich subsoil materials sited between the coastal plains and the central spine of the Apennines. A plausible explanation for such preferred sitings is offered in Jarman and Webley, "Settlement and Land Use in Caputunata, Italy," p. 179. Upland sites have growing seasons too short for anything except spring sown crops. Likewise, summer droughts discourage spring sown crops in the lowland plains, and there, even quicker ripening winter sown crops may fail since the winters in the lowlands are not always cold enough to ensure vernalization, i.e., a state of dormancy that encourages extra tiller production and larger grain yields. On vernalization, see Percival, The Wheat Plant, p. 423.
- 5 J. P. V. D. Balsdon, Rome: The Story of an Empire (New York, 1970), pp. 7-14 gives a recent, and particularly strident formulation. For a selection of older scholarly views on the issue of Roman imperialism, see Donald Kagan, ed., Problems in Ancient History, Vol. II: The Roman World (London, 1970), pp. 182-206.
- 6 Ernst Badian, Foreign Clientelae, 264-70 B.C. (Oxford, 1958), p. 143, notes that in the strictest sense, there was not even a Confederate army, only the Roman army, with the various socii providing troops and assistance according to individual treaties.

CHAPTER VI, continued

- 7 Badian, ibid., pp. 1-11, who builds on notions advanced earlier by historians such as Matthais Gelzer, The Roman Nobility, trans. by Robin Seager (New York, 1969); and Numa Denis Fustel de Coulanges, The Ancient City: A Study of the Religion, Laws, and Institutions of Greece and Rome, trans. by Willard Small (Garden City, N.Y., n.d.).
- 8 For a good recent treatment of the growth of special commands, see Badian, Roman Imperialism in the Late Republic (Ithaca, 1971).
- 9 Ronald Syme, The Roman Revolution (Oxford, 1939), in toto.
- 10 For good discussions of the evolution of the imperial administrative staff, see Balsdon, pp. 43-87, 126-76; and P. R. C. Weaver, Familia Caesaris: A Social Study of the Emperors' Freedmen and Slaves (Cambridge, 1972).
- 11 Tacitus, Histories, I. 9 sardonically notes the usefulness of distant frontier assignments for keeping troops at their proper duties. Dio Cassius, LII. 27 assigns a speech to Augustus' general Maecenas, who emphasizes the necessity of removing standing armies from the Mediterranean provinces in order to lessen the possibility of renewed civil war. See further Ronald Syme, "The Northern Frontiers under Augustus," in Cambridge Ancient History, 2nd ed., X, xii (Cambridge, 1934), p. 352.
- 12 A good summary of the Celtiberian campaigns, perhaps the most inglorious of these guerilla wars, is found in H. H. Scullard, A History of the Roman World from 753 to 146 B.C., 3rd ed. (London, pp. 287-94).
- 13 See M. Rostovtzeff, Rome, trans. by Elias J. Bickerman (London, 1960), p. 179 for a typical example.
- 14 E.g., Martin Bang, "Expansion of the Teutons," in Cambridge Medieval History, 2nd ed., I, vii (Cambridge, 1936), p. 188. More recently, see Balsdon, p. 41.
- 15 See R. Hachmann, G. Kossak, and H. Kuhn, Voelker zwischen Germanen und Kelten: Schriftquellen, Bodenfunde und Namengut zur Geschichte des noerdlichen Westdeutschlands um Christi Geburt (Neumuenster, 1962); R. Hachmann, The Germanic Peoples, trans. by James Hogarth (London, 1971); and C. M. Wells, The Germanic Policy of Augustus: An Examination of the Archaeological Evidence (Oxford, 1972). See further H. M. Chadwick, The Nationalities of Europe and the Growth of National Ideologies (Cambridge, 1945), a work whose wartime publication has apparently led to its near total neglect by subsequent scholars. The following is indebted to the works listed above.

CHAPTER VI, continued

- 16 See the excellent discussion in Wells, pp. 24-25.
- 17 The steady accretions of ambiguities in the scholarly vocabulary since the Renaissance are outlined in Chadwick, Nationalities, pp. 142ff.
- 18 Ibid., p. 148 suggests that the Romans were not attuned to dialectical nuances, so that the linguistic significance of larger groupings such as Germans or Celts mentioned in ancient texts is usually hard to fathom.
- 19 On the linguistic evidence of names and places, see H. Kuhn in Voelker zwischen Germanen und Kelten, pp. 105-28 and esp. at p. 116.
- 20 Chadwick, Nationalities, pp. 147-48 notes the affiliations of the word Germani to Paemani and the even more Celtic Genomani.
- 21 Ibid., p. 147 and Wells, pp. 24-27, where both authors bring together references to Germans other than the Suebi scattered through Caesar's De Bello Gallico, esp. II, VI, and VII. The problem of the Suebi will be touched on again below.
- 22 Tacitus, Germania, 2. In one phrase, Tacitus speaks of the Germans as recent arrivals while in another phrase he notes that many of the Germans considered themselves as autochthonous. Chadwick, Nationalities, p. 147 notes the endless scholarly controversy this self-contradictory passage has engendered.
- 23 Tacitus, Germ., 2. Chadwick, Nationalities, p. 147 notes that Tacitus seems to imply that the Tungrians took on the pre-existing appellation of Germani more as an indication of the geographical region they occupied rather than as an ethnic or linguistic tag.
- 24 See the convenient summarization in Wells, pp. 15-24.
- 25 Ibid., p. 23 with references cited. See further Chadwick, Nationalities, p. 146, who emphasizes that even early medieval Frisian or Old English were not genuine Germanic dialects in the sense that Old Saxon or Old High German definitely were.
- 26 The statement of Syme, "The Northern Frontiers under Augustus," p. 361 that the Germani on the Rhine were "centuries" behind the Gauls is overdrawn and is based on a confusion of these Rhenish groups with genuinely Teutonic groups farther to the east.

CHAPTER VI, continued

- 27 For typical older treatments, see Ernst Sprockhoff, "Zur Entstehung der Germanen," in Germanen und Indogermanen: Volkstum, Sprache, Heimat, Kultur; Festschrift fuer Herman Hirt, ed. by Helmuth Arntz, 2 Vols. (Heidelberg, 1936), I, 255-74; or Ernst Schwartz, Germanische Stammeskunde (Heidelberg, 1956), pp. 17-24, 35-37.
- 28 Hans Juergen Eggers, et al., Kelten und Germanen in Heidnischer Zeit (Baden-Baden, 1964), pp. 7, 15, 85. In what follows, I will use phrases such as true Germans or Teutons to distinguish the culture-poor groups on the Elbe and Baltic shores around the beginning of the Christian era (as will be pointed out below, e.g., chapter VIII, note 82, these formerly "poor" areas became glutted with Roman imports from the first century A.D. onwards) from the groups along the Rhine whose culture showed marked La Tene affinities.
- 29 The Suebi were centered on the lower Elbe region in the time of Caesar. Thereafter, a number of Suebian groups such as the Quadi and the Marcomanni were to move to the upper Rhine and then down the Danube, and the term Semnonen began to supplant the term Suebi as a designation for the Elbe groups. See Wells, pp. 18-19. The Suebi were the chief villains in Caesar's B.G., their mercenary activities and freebooting having been used as a pretext for Caesar's move into Gaul. The Suebi were also singled out as typical Germans in the ethnographical sections of B.G., VI to provide a most unflattering contrast to the Gauls.
- 30 Ariovistus is noted by Caesar, B.G., I. 53. 4 as having one Suebian wife, but his name is Celtic in form and his precise ethnic affiliation is the subject of much debate. See Wells, p. 14. Throughout most of Caesar's account, Ariovistus is the leader of a very mixed body of mercenaries operating in Gaul.
- 31 Tacitus, Germ., 3 asserts that the Chatti, Cherusci, Suebi, and another group, the Hermunduri, were all related and belonged to a race called the Herminones (or Irminones), one of Tacitus' three so-called Mannus races. Reading these identifications back to the time of Caesar is a risky business, and the whole Mannus taxonomy itself is now considered unworkable as possibly contrived by many scholars, e.g., A. Russchen, New Light on Dark-Age Frisia (Drachten, 1967), pp. 18-22; and Voelker zwischen Germanen un Kelten, pp. 48-51.
- 32 The term Zwischenvoelker was introduced in Volker zwischen Germanen und Kelten, and the reasonable English equivalent, "border peoples," is used by Wells.

CHAPTER VI, continued

- 33 As will be made clear in the following chapter, most of the Teutonic heartland on the North European Plain was ecologically hard-pressed to support anything other than simple swidden-based subsistence technologies such as had characterized most of temperate Europe through the Neolithic and Bronze Ages. The "primitiveness" of the early Teutons around the shores of the Baltic probably represented an adaptive accommodation to their constrained subsistence base. Analogous primitivization of groups along the Rhine is another matter entirely.
- 34 E.g., M. Bang, "Expansion of the Teutons," p. 188, who would even push the teutonization of the Rhine area back to the second century B.C.
- 35 See typically Syme, "The Northern Frontiers," pp. 340-81.
- 36 See P. A. Brunt, "Review and Discussion of Meyer, Die Aussenpolitik des Augustus," Journal of Roman Studies, LIII (1963), 170-76 and "Reflections on British and Roman Imperialism," Comparative Studies in Society and History, VII (1965), 267-88 on Augustus' imperial ambitions.
- 37 This tradition has roots going back to Edward Gibbon, e.g., his The History of the Decline and Fall of the Roman Empire, ed. by J. B. Bury, 9th ed., 7 Vols. (London, 1925), I, 2-3, and can be found repeated almost verbatim in any number of modern textbooks and reference works, e.g., Roztovtzeff, Rome, p. 179; Balsdon, p. 93; and Syme, "Northern Frontiers," p. 351.
- 38 Blatantly imperialistic passages from Vergil, Horace, and other court litterateurs are conveniently assembled in Wells, pp. 3-5. Ibid., pp. 8-10 notes how the non-aggressive terminologies used by ancient authors to laud Augustus' wars of conquest were in keeping with the Roman fiction that all their wars were just wars.
- 39 Wells, in toto.
- 40 Ibid., pp. 239, 249. Older scholarship, e.g., Syme, "Northern Frontiers," p. 363, pictured Germany as minimally pacified, taking strong issue with ancient sources such as Velleius Paterculus, II. 117. 4. Velleius was over-ardent in his admiration for Tiberius, and his attitude toward the Germans was decidedly bigoted. Nevertheless, he was a contemporary, and often an eyewitness, of the events connected with the campaigns in Germany. Syme is probably overly harsh with Velleius, as he is with nearly all other sources except Tacitus.

CHAPTER VI, continued

- 41 Balsdon, p. 94.
- 42 Wells, p. 239.
- 43 An excellent survey of the staff at the disposal of a Republican governor is found in Balsdon, pp. 46-51.
- 44 Wells, pp. 156-57 stresses that the dedication of such a cult center in Germany is a strong sign that the Romans considered the pacification and provincialization of Germany well in hand.
- 45 The Elbe was the cultural focus of groups such as the Suebi. A thesis worth considering would be that the delays in setting up a provincial administration for Germania were related to Roman efforts to expand their control over the peoples of the Elbe watershed, probably with the aim of carving out another province. This intension may lie behind the poorly documented campaigns of the general L. Domitius Ahenobarbus between 6 B.C. and A.D. 4. Ahenobarbus met with a number of initial successes, capped by the erection of an altar to Augustus on the Elbe. See Wells, p. 158. This fledgling Elbe province would have been entirely obliterated after the disaster of Varus. Later ancient writers may have conflated these two separate provincial gambits, giving the basis for the received view that Augustus aimed at subduing "Germany" as far as the Elbe. Markedly discrete Siedlungskammern existed along the Rhine and along the region from about the middle Weser to the Elbe in the early medieval period, on which see Eike Gringmuth-Dallmer, "Zur Kulturlandschaftsentwicklung in fruehgeschichtlicher Zeit im germanischen Gebiet," Zeitschrift fuer Archaeologie, VI (1972), maps following p. 64. Similar discrete interaction sphere loci very probably existed at the time of Roman contact.
- 46 Olwen Brogan, "Trade between the Roman Empire and the Free Germans," Journal of Roman Studies, XXVI (1936), 195-222.
- 47 The Moselle valley was the focus of the well explored Hunsrueck-Eifel culture. For Iron Age and Roman period developments in this region, see E. M. Wightman, Roman Trier and the Treveri (New York, 1971).
- 48 The Council of the Three Gauls is commonly dismissed as an artificial creation, e.g., Balsdon, pp. 92-93. There is growing evidence, however, that the site of this cult center and the nearby site of Lugdunum may have been native cult centers of some importance. See Olwen Brogan, "The Comming of Rome and the Establishment of Roman Gaul," in France Before the Romans, ed. by Stuart Piggott, Glyn Daniel, and Charles McBurney (London, 1974), pp. 196-204; and

CHAPTER VI, continued

- Raymond Chevallier, "Gallia Lugunensis: Bilan de 25 ans de recherches historiques et archeologiques," in Aufstieg und Niedergang der roemischen Welt: Geschichte und Kultur Roms im Spiegel der neueren Forschung, Vol. II: Principat, Part 3, ed. by Hildegard Temporini (Berlin, 1975), pp. 912, 928-29. The role of such native councils or cult centers in an ongoing series of nativistic revolts from the time of Vercengetorix to Vindex are examined in Stephen L. Dyson, "Native Revolt Patterns in the Roman Empire," in ibid., pp. 138-75.
- 49 E.g., Tacitus, Hist., IV. 63, where the long-standing complaints of the Tencteri are registered against Roman obstruction of their movements back and forth along the Rhine near Cologne.
- 50 This transformation is outlined in Wells, pp. 30-31.
- 51 Chadwick, Nationalities, pp. 78-79. P. H. Sawyer, "The Two Viking Ages of Britain: A Discussion," Mediaeval Scandinavia, II (1969), pp. 109, 204 has introduced the kindred issue of bilingualism in his treatment of medieval English-Danish interactions. A whole branch of linguistics, socio-linguistics, has grown up with bilingualism and pidgins as central topics of study, e.g., see Dell Hymes, ed., Pidginization and Creolization of Languages (Cambridge, 1971).
- 52 E.g., Ian Richmond, "The Roman Frontier Land," History, XLIV (1959), 1-15, who developed an elaborate "curtain-screen" theory of the tactical purpose of the forts and milecastles of Hadrian's Wall based on his conviction that barbarians to the north were the peril. Richmond's theory has been subjected to sweeping criticism, e.g., see B. Dobson and D. J. Breeze, The Building of Hadrian's Wall, 2nd ed. (Durham, 1970), pp. 4-7.
- 53 E.g., Donald R. Dudley, The Romans, 850 B.C.-A.D. 337 (New York, 1970), pp. 202-203.
- 54 See D. R. Wilson, Roman Frontiers of Britain (London, 1967); S. S. Frere, Britannia: A History of Roman Britain (Cambridge, Mass., 1967), pp. 68-166; Barry W. Cunliffe, Iron Age Communities in Britain: An Account of England, Scotland and Wales from the Seventh Century B.C. Until the Roman Conquest (London, 1974), pp. 118-28; Graham Webster, The Roman Imperial Army of the First and Second Centuries A.D. (London, 1969), pp. 59-95.
- 55 A good study of Roman dealings with the Brigantes and neighboring groups is John Clarke, "Roman and Native, A.D. 89-122," in Roman and Native in North Britain, ed. by Ian A. Richmond (Edinburgh, 1958), pp. 20-59.

CHAPTER VI, continued

- 56 Tacitus, Agricola, 12 outlines Roman policies of keeping tribal factions from acting in concert. A situation analogous to that of the Brigantes may present itself in the treatment of the Quadi and Marcomanni along the Danube in the second century A.D. Dio Cassius, LXXII. 20. 1 notes that the Romans went so far as to exclude native flocks and herds from lowland pastures to close the lowlands to arable use whenever these Danubian tribes proved restive. Similar practices seem quite possible in the Pennines and, as on the Danube, may have sometimes driven the natives to such despair as to foment the very revolts these cordoning policies were designed to prevent. Cunliffe, Iron Age Communities, p. 125 describes the Roman's Brigantian policy as being designed to "divide the old confederacy into a multiplicity of easily patrolled fragments." What better way to do this than by striking at the underlying logistics of tribal subsistence patterns. See further chapter VII, note 26 below.
- 57 Tacitus, Agric., 17 calls the Brigantian confederacy at the time of its subjugation the most prosperous in the entire province. The lack of any connected narrative dealing with Britain except for the brief span of the governorship of Tacitus' father-in-law makes definite assertions impossible. A fuller picture of the tribes of North Britain is beginning to emerge as the result of field surveys and excavations of the type described in George Jobey, "Homesteads and Settlements of the Frontier Areas," in Rural Settlement in Roman Britain, ed. by Charles Thomas (Council for British Archaeology Research Report, No. 7 [London, 1966]), pp. 1-14.
- 58 A. L. F. Rivet, "Social and Economic Aspects," in The Roman Villa in Britain, ed. by A. L. F. Rivet (New York, 1969), pp. 193-95 feels that the military establishment in North Britain was a stupendous drain on the economy of the lowland south, this factor depressing the economy of Lowland Britain for nearly a century.
- 59 The nightmarish logistics of the Rhenish limes will be touched on in a subsequent chapter.
- 60 Hermann Hinz, "Die Landwirtschaft in roemischen Rheinland," Rheinische Vierteljahrsblaetter, XXXVI (1972), 1-27 notes the predominance of small, rather modest farmsteads or villae rusticae, which perhaps represented nothing more than an adaptation of pre-existing native patterns to the logistics and ordnance demands of the armies. S. S. Frere, "Verulamium and the Towns of Britain," in Aufstieg und Niedergang der Roemischen Welt: Geschichte und Kultur Roms im Spiegel der neueren Forschung, Vol. II: Principat, Part 3, ed. by Hildegard Temporini (Berlin, 1975), p. 322 notes that in the Ger-

CHAPTER VI, continued

manies, the government promoted urban over rural development. Frere reasons that this was to provide a more "civilized hinterland," but a more cogent reason would have been to keep tabs on a potentially restive native population and their leaders.

CHAPTER VII

- 1 This summary of Germanic epic material dealing with the birth and death of the world is based on the discussions in E. O. G. Turnville-Petre, Myth and Religion of the North: The Religion of Ancient Scandinavia (New York, 1964), pp. 156-79, 263-85. While these epic motifs, esp. those dealing with the Vanir and Aesir, have traditionally been used to construct a pseudo-history of conquests of earth worshipping indigenous peoples by invading worshippers of sky gods, a much more attractive hypothesis has been suggested by Georges Dumézil, e.g., in his Gods of the Ancient Northmen, ed. by Einar Haugen (Berkeley, 1973). Dumézil argues that the various strata and types of gods are a mythic reflection of the loosely hierarchical social structures common among Indo-European peoples such as the Germans or the Norsemen.
- 2 E.g., E. Estyn Evans, "Ireland and Atlantic Europe," Geographische Zeitschrift, XXXII (1963), 224-41; "The Ecology of Peasant Life in Western Europe," in Man's Role in Changing the Face of the Earth, ed. by William L. Thomas (Chicago, 1956), pp. 228-31; and "The Atlantic Ends of Europe," Advancement of Science, XV (1958), 54-64.
- 3 For a recent synthesis, see E. G. Bowen, "Britain and the British Seas," in The Irish Sea Province in Archaeology and History, ed. by Donald Moore (Cardiff, 1970), pp. 13-28.
- 4 An excellent appraisal of the nature and the rhythms of these less cataclysmic types of interactions is found in Humphrey J. Case, "Settlement Patterns in the North Irish Neolithic," Ulster Journal of Archaeology, 3rd ser., XXXII (1969), pp. 5-7. My thanks to Mr. Case for helpful advice, criticism, and encouragement on many of the points to be discussed below.
- 5 Good introductions to the natural and cultural landscapes of Cornwall and Southwest England may be found in A. H. Shorter, W. L. D. Ravenhill, and K. J. Gregory, Southwest England (London, 1969); B. S. Roberson, The Land of Britain: The Report of the Land Utilization Survey of Britain, Vol. IX, Part 91: Cornwall (London, 1941); E. A. Edmonds, M. C. McKeown, and M. Williams, British Regional Geology: South-West England, 3rd ed. (London, 1969); Roger Burrows, The Naturalist in Devon and Cornwall (Newton Abbot, 1971); Roy Millward and Adrian Robinson, Landscapes of Britain: The Southwest Peninsula (London, 1971); W. G. V. Balchin, Cornwall: An Illustrated Essay on the History of the Landscape (London, 1954); and R. M. Barton, Cornwall's Structure and Scenery (Truro, n.d.).

CHAPTER VII, continued

- 6 For detailed examinations of these plagioseral processes, see Staalfelt, pp. 470-76; and McVean and Lockie, in toto. An excellent regional synthesis, with many points of comparison with Southwest England, is Humphrey J. Case, et al., "Land Use in Goodland Townland, Co. Antrim from Neolithic Times Until Today," Journal of the Royal Society of Antiquaries of Ireland, XCIX (1969), 39-53.

- 7 Analogies probably exist in Southwest Ireland, e.g., see M. J. Conry, "The Properties, Genesis and Classification of Brown Podzolic Soils in the Southwest and West of Ireland," in Soil Heterogeneity and Podzolization, pp. 102-11, where Conry concludes that the pre-Neolithic ecosystems consisted of an oak dominated forest with a dense, though not completely closed, canopy and brown podzolic soils. For Cornwall and Southwest England, see B. Clayden and D. J. R. Manley, "The Soils of the Dartmoor Granite," in Dartmoor Essays, ed. by I. G. Simmons (Exeter, 1964), pp. 117-36; B. Clayden, "Soils of Cornwall," in Present Views on Some Aspects of the Geology of Cornwall and Devon, ed. by K. F. G. Hosking and G. J. Shrimpton (Penzance, 1966), pp. 311-30; ibid., Soils of the Middle Teign Valley District of Devon (Soil Survey of Great Britain, Bulletin No. 1 [Harpenden, 1964]); I. G. Simmons, "Environment and Early Man on Dartmoor, Devon, England," Proceedings of the Prehistoric Society, XXXV (1969), 203-219; ibid., "Pollen Diagrams from Dartmoor," The New Phytologist, LXIII (1964), 165-80; G. W. Dimbleby, "Pollen Analyses from Two Cornish Barrows," Journal of the Royal Institute of Cornwall, N.S., IV (1963), 364-75.

- 8 A good discussion of these checks to forest regeneration is found in N. V. Pears, "Wind as a Factor in Mountain Ecology: Some Data from the Cairngorm Mountains," Scottish Geographical Magazine, LXXXIII (1967), 118-24.

- 9 See esp. I. G. Simmons, "Environment and Early Man on Dartmoor," pp. 211-12. E. Estyn Evans, "The Ecology of Peasant Life," p. 228 reasons that this was a common trend throughout most of the Atlantic Fringe by late Bronze Age times. In this particular article, Evans perhaps underestimates the role of anthropogenic factors.

- 10 Clayden, "Soils of Cornwall," pp. 313-14. See further E. A. Fitzpatrick, "Deeply Weathered Rock in Scotland: Its Occurrence, Age and Contribution to the Soils," Journal of Soil Science, XIV (1963), 33-43.

- 11 A seminal article is E. Estyn Evans, "Transhumance in Europe," Geography, XXV (1940), 172-80. Much useful information is also found in David MacKenzie, Farmer in the Western Isles (London, 1954).

CHAPTER VII, continued

- 12 The role of lowland arable and pasture is repeatedly emphasized in Stapledon, Hill Farms. See further R. Holliday and W. N. Townsend, "Agriculture and Soils," in Leeds and Its Region, ed. by M. W. Beresford and G. R. J. Jones (Leeds, 1967), pp. 62-88.
- 13 Holliday and Townsend, in toto; and MacKenzie, p. 99.
- 14 MacKenzie, p. 81 notes that modern hill farms can seldom over-winter enough stock to utilize more than a quarter of the seasonal yield of the summer grazings.
- 15 Ibid., pp. 74-75, 97-99; and John Seymour and Sally Seymour, Farming for Self-Sufficiency: Independence on a 5-Acre Farm (New York, 1974), pp. 21-33.
- 16 Stapledon, pp. 59-65, on which the following discussion is based.
- 17 Mixed farming systems of this sort are commonly held to provide clues to the features of early medieval and prehistoric systems. Among the best representatives of a massive literature, see E. Estyn Evans, "Some Survivals of the Irish Open-Field System," Geography, XXIV (1939), 24-36; V. B. Proudfoot, "Clachans in Ireland," Gwerin, II (1959), 108-22; D. McCourt, "Infield and Outfield in Ireland," Economic History Review, 2nd ser., VII (1955), 369-76; Harald Uhlig, "Old Hamlets with Infield and Outfield Systems in Western and Central Europe," Geografisker Annaler, XLIII (1961), 285-312; James H. Johnson, "The Development of the Rural Settlement Pattern of Ireland," Geografisker Annaler, XLIII (1961), 165-73; G. Whittington, "Field Systems of Scotland," in Studies of Field Systems in the British Isles, ed. by Alan R. H. Baker and Robin A. Butlin (Cambridge, 1973), pp. 530-79; Ronald H. Buchanan, "Field Systems of Ireland," in ibid., pp. 580-618; and G. Elliot, "Field Systems of Northwest England," in ibid., pp. 41-92.
- 18 For early modern Cornwall, see Richard Carew, The Survey of Cornwall: To Which Are Added Notes Illustrative of Its History and Antiquities by the Late Thomas Tonkin, Esq. (London, 1811), pp. 62, 89-90; A. T. Lucas, "Sea Sand and Shells as Manure," in Studies in Folk Life: Essays in Honour of Iorwerth G. Peate, ed. by Geraint Jenkins (London, 1969), pp. 183-203; E. Estyn Evans, Mourne County: Landscape and Life in South Down, 2nd ed. (Dundalk, 1967), pp. 143-49; Trefor M. Owen, "The Role of the Township in a Hebridean Crofting Economy," Gwerin, II (1959), p. 150; and Brian J. R. Blench, "Seaweed and Its Uses in Jersey Agriculture," Agricultural History Review, XIV (1966), 122-28.

CHAPTER VII, continued

- 19 M. J. Conry, "Irish Plaggen Soils -- Their Distribution, Origin and Properties," Journal of Soil Science, XXII (1971), 401-16. For archaeological evidence of such practices in early medieval Cornwall involving emendations of sea sand, see A. C. Thomas and P. J. Fowler, "Arable Fields of the pre-Norman Period at Gwithian," Cornish Archaeology, XIV (1966), 122-28.
- 20 Evans, Mourne County, pp. 133-39; Malcolm D. MacSween, "Transhumance in North Skye," Scottish Geographical Magazine, LXXV (1959), 75-88; Malcolm D. MacSween and A. Gailey, "Some Shielings in North Skye," Scottish Geographical Magazine, V (1961), 77-84; and Ronald Miller, "Land Use by Summer Shielings," Scottish Studies, XI (1967), 193-221.
- 21 Excellent descriptions of shieling activities are found in E. Estyn Evans, "Dairying in Ireland Through the Ages," Journal of Dairy Technology, XVII (1954), 179-88.
- 22 Case, "Settlement Patterns in the North Irish Neolithic," pp. 5-7 gives a schedule of seasonal labor needs which probably has applicability for much of Northwest Europe throughout prehistory and even into medieval and early modern times. For Southwest England, these seasonal rhythms can be estimated from information in J. M. Hussey, Sea Fishing Round Cornwall (Truro, 1970); Rennie Bere, Wild Life in Cornwall and the Isles of Scilly (Truro, 1970); R. D. Penhallvrick, Birds of Cornwall: Sea and Shore (Truro, 1970); A. K. Hamilton Jenkin, Cornwall and Its People, reprinted (Newton Abbot, 1970), pp. 85-104, 368-94; A. S. Oliver, Boats and Boatbuilding in West Cornwall: A Study of Traditional Cornish Fishing Craft (Truro, 1971), pp. 19-45; G. E. Fussell, "Cornish Farming, A.D. 1500-1910," Amateur Historian, IV (1960), 338-45; and Charles Vancouver, General View of the Agriculture of the County of Devon (London, 1808), pp. 159, 326-47.
- 23 MacKenzie, p. 164 gives a graphical tabulation of his labor requirements throughout a year. The early spring, from about March to April, involves a severe peak labor demand that the author concludes could never be satisfactorily handled by an ordinary nuclear family. Only a large family, or the pooled resources of several families, would suffice.
- 24 Glanville Jones, "Early Territorial Organization in Northern England and Its Bearing on the Scandinavian Settlement," in The Fourth Viking Congress, ed. by Alan Small (Edinburgh, 1965), pp. 67-84; "The Multiple Estate as a Model Framework for Tracing Early Stages in the Evolution of Rural Settlement," in L'Habitat et les paysages ruraux d'Europe, ed. by F. Dussart (Les Congrès

CHAPTER VII, continued

et Colloques de l'Université de Liège, Vol. LVIII [Liège, 1971]), pp. 251-67; and "Medieval Open Fields and Associated Settlement Patterns in North-West Wales," Annales de l'Est, Memoire No. 21 (1959), 313-38.

- 25 Richard Bradley, "Stock Raising and the Origins of the Hill Fort on the South Downs," Antiquaries Journal, L (1971), 8-29; and Barry W. Cunliffe, "Some Aspects of Hill-Forts and Their Cultural Environments," in The Iron Age and Its Hill-Forts: Papers Presented to Sir Mortimer Wheeler, ed. by Margaret Jessen and David Hill (Southampton, 1971), pp. 53-69. My thanks to Professor Cunliffe for useful comments and criticism on the model for Cornish subsistence practices to be outlined below.
- 26 The work of Glanville Jones (see above note 24) suggests lines for future research on Roman policies along her northern frontier in Britain. Stuart Piggott, "Native Economies and the Roman Occupation of North Britain," in Roman and Native in North Britain, ed. by Ian A. Richmond (Edinburgh, 1958), pp. 14-15 has stressed the pastoral element in the subsistence patterns of pre-Roman North Briton societies. The management of flocks and herds probably involved transhumant practices coordinated from hill fort centers. The Roman policy of dismantling or otherwise forcing the abandonment of native hill forts is a good indication that Roman control over tribal groupings was aimed at the basic subsistence underpinnings of clan and tribal sodalities.
- 27 Much of the following discussion is based on the author's analyses of field archaeological materials contained in Vivien Russell, West Penwith Survey (Truro, 1971).
- 28 A good introduction to Cornish settlement types of the Iron Age and Romano-British periods is Charles Thomas, "The Character and Origins of Roman Dumnonia," in Rural Settlement in Roman Britain, pp. 74-98.
- 29 The type sites are Chysauster and Porthmeor, on which see Hugh O'Neill Hencken, "An Excavation by H.M. Office of Works at Chysauster, Cornwall, 1931," Archaeologia, LXXXIII (1933), 237-84; and Lt.-Col. F. C. Hirst, "Excavations at Porthmeor, Cornwall, 1933, 1934 and 1935," Journal of the Royal Institution of Cornwall, XXIV (1937), 1-81. See further P. K. Baillie Reynolds, Chysauster, Cornwall (Basingstoke, 1960). For more recent excavations of courtyard house type complexes, see A. Guthrie, "Excavation of a Settlement at Goldherring, Sancreed, 1958-1961," Cornish Archaeology, VIII (1969), 5-39; Patricia M. Christie, "Carn Euny Excavations: Interim Report on the 1964 Season," Cornish Archaeology, IV (1965),

CHAPTER VII, continued

24-30; and ibid., "Carn Euny Excavations: Interim Report on the 1966 Season," Cornish Archaeology, VI (1967), 24-28.

- 30 Excavations, such as they are, for cliff castles in West Penwith include C. B. Crofts, "Maen Castle, Sennen: The Excavation of an Early Iron Age Promontory Fort," Proceedings of the West Cornwall Field Club, N.S., I, No. 3 (1955), 98-115; and A. S. R. Gordon, "The Excavation of Gurnard's Head, An Iron Age Cliff Castle in Western Cornwall," Archaeological Journal, XCVII (1940), 96-111. A plan of the surface remains of a cliff castle near the modern town of St. Ives is given in Charles Henderson, Essays in Cornish History, ed. by A. L. Rowse and M. I. Henderson (Oxford, 1935), pp. 80-81. None of the West Penwith castles seem to have had the heavy defenses of large cliff castles elsewhere in Cornwall, e.g., the well excavated site at the Rumps, for which see R. T. Brooks, "The Rumps. St. Miniver: Interim Report on the 1963 Excavations," Cornish Archaeology, III (1964), 26-34. The West Penwith cliff castles were probably simple farmsteads of a type attested elsewhere in the British Isles, e.g., the dark age site discussed in V. B. Proudfoot and B. C. S. Wilson, "Further Excavations at Larrybane Promontory Fort, Co. Antrim," Ulster Journal of Archaeology, 3rd ser., XXIV/XXV (1961-1962), 91-115. Ibid., p. 106, where the authors note that by choosing sites close to the cliffs, the occupants of this Irish settlement could enjoy considerable shelter from gale winds deflected by the sheer cliff faces.
- 31 Lt.-Col. F. C. Hirst, "courtyard House Sites in West Cornwall," Journal of the British Archaeological Association, 3rd ser., II (1937), 71-97 provides an excellent discussion of the geomorphology of West Penwith. The following distributional study employs the topographical subdivisions outlined in ibid., p. 76.
- 32 Today, the isthmus is a major horticultural region, but this is made possible only through heavy applications of artificial fertilizers, manure, and composted town refuse. Without such massive fertilization, these soils develop serious nitrogen and potassium deficiencies and, hence, seem to have been avoided until relatively modern times. See Roberson, Cornwall, pp. 435-38.
- 33 The following conclusions are based on unpublished locational analyses in the possession of the author. Site densities may be readily calculated by determining the altitude for each site location given in Vivien Russell's West Penwith Survey, assigning each site to its appropriate topographical zone, and dividing the numbers of sites in each zone by an index figure representing the real or the relative areal extent of each of the zones.

CHAPTER VII, continued

- 34 Thomas, "Roman Dumnonia," p. 91 argues that nearly all homestead sized rounds lie below the 400 foot contour line (i.e., below the plateau and rise-fall areas) in West Penwith and elsewhere in Cornwall. None of these more substantial rounds have been excavated in West Penwith. Their probable characteristics can be surmised from excavations in central Cornwall, e.g., Leslie Murray Threipland, "An Excavation at St. Mawgan-in-Pyder, North Cornwall," Archaeological Journal, CXIII (1956), 33-81; and A. M. ApSimon and E. Greenfield, "The Excavation of Bronze Age and Iron Age Settlements at Trevisker, St. Eval, Cornwall," Proceedings of the Prehistoric Society, XXXVIII (1972), 302-81. My thanks to Mr. ApSimon for many helpful comments on Cornish archaeology, esp. concerning the ceramic materials to be discussed below.
- 35 While most of these rise-fall and plateau sites are labeled rounds, closer examination reveals that nearly all are courtyard houses, hut circles, single huts, or paddocks and work areas. See Charles Thomas, "Trial Excavations at Mulfra Vean, 1954," Cornish Archaeology, II (1963), 23-28; and Dorothy Dudley, "Late Bronze Age and Early Iron Age Settlements in Sperris Croft and Wicca Round, Zennor, Cornwall," Journal of the Royal Institution of Cornwall, N.S., III (1957), 66-81. The case for the pastoral nature of these upland sites is strengthened by evidence from pollen analyses from Carn Euny, these analyses revealing no cereal pollen in the vicinity of this site during its prehistoric occupation. See the appendix by G. W. Dimbleby in Patricia M. Christie, "Carn Euny Excavations: Interim Report on the 1966 Season," Cornish Archaeology, VI (1967), p. 28. These upland Cornish sites show similarities with prehistoric pastoral enclosures on Dartmoor in Devon. See R. Hansford Worth, Dartmoor, ed by G. M. Spooner and F. S. Russell (Plymouth, 1953), pp. 133-62. It has recently been suggested (Cunliffe, Iron Age Communities, p. 19) that these Bronze Age Dartmoor "pounds" were the shieling sites of associated "rounds" which served as wintering areas and agricultural foci. Aileen Fox, South West England (London, 1964), pp. 86-96 saw these Dartmoor settlements as separate populations of pastoralists and agriculturalists. Such refusals to consider agricultural and pastoral components as parts of the same cultural complexes are rife in European archaeology, thus leading to many unnecessary multiplications of archaeological cultures and numerous purported phases of invasions and counter-invasions. See the comments in Andrew Sherratt, "Discussion," in Bronze Age Migrations in the Aegean, ed. by R. A. Crossland and Ann Birchall (Park Ridge, N.J., 1974), pp. 100-101.
- 36 On the contrasts between the north and south coasts and their agricultural significance, see Roberson, Cornwall, pp. 416, 434-35.

CHAPTER VII, continued

- 37 See Hussey; Penhallurick; P. Cowls, "The Longshoreman's Chart," Old Cornwall, II (1931), 36-40; N. J. G. Pounds, "Cornish Fish Cellars," Antiquity, XVIII (1944), 36-41; and A. K. Hamilton Jenkin, Cornwall and Its People, pp. 85, 96-104, 368-76, 384-85. Excellent information on the capture and use of sea birds is found in Kenneth Williamson, "The Economic Importance of Sea Fowl in the Faeroe Islands," The Ibis, LXXXVII (1945), 249-69.
- 38 Hamilton Jenkin, p. 379 notes that in early modern times, and probably for earlier periods, the northern parishes were almost entirely given over to pastoral activities. During the prehistoric period, some cereal production seems to be attested by old field boundaries described in Dorothy Dudley, "A Late Bronze Age Settlement on Trewey Downs, Zennor, Cornwall," Archaeological Journal, XCVIII (1941), pp. 109-11; P. A. S. Pool and Vivien Russell, "Antiquities in the North-East Part of the Parish of Gulval," Proceedings of the West Cornwall Field Club, N.S., II, No. 4 (1959-1960), pp. 146-49; and A. Guthrie, "Terraced Fields at Boswednack, Zennor," Proceedings of the West Cornwall Field Club, N.S., I, No. 4 (1956), 164-66. Most of these sites cluster in a set of small stream valleys flanking the modern hamlet of Zennor. This region, and another small pocket around the modern hamlet of Morvah, have been described as agricultural oases along a coast otherwise unpropitious for cropping. See Millward and Robinson, p. 124; and Balchin, pp. 43-44. Note the poor representation of ancient field systems in northern West Penwith except in these "oases" on the map in Thomas, "Roman Dumnonia," p. 95.
- 39 Henry Hodges, Artifacts: An Introduction to Early Materials and Technology (London, 1964), pp. 23-24. China clays generally have high melting or vitrification points, and primitive kilns may not be able to produce a well-fired ceramic. The higher temperatures and potentially longer firing times needed for china clays would also heighten the risks of breakage.
- 40 Ibid.
- 41 H. L. Douch, "Cornish Earthenware Potters," Journal of the Royal Institution of Cornwall, N.S., VI (1969), 33-64, esp. at p. 34. My thanks to Mr. Douch for his useful comments on the distribution of Cornish potting clays.
- 42 See extensively Jacques Nenquin, Salt: A Study in Economic Prehistory (Dissertationes Archaeologicae Gandenses, VI [Bruges, 1961]).
- 43 Ibid., pp. 108-112.

CHAPTER VII, continued

- 44 See the detailed analysis in Ethel H. Rudkin and Dorothy M. Owen, "The Medieval Salt Industry in the Lindsey Marshland," Lincolnshire Architectural and Archaeological Society Reports and Papers, N.S., VIII (1959-1960), 76-84 for a region that also boasted extensive salt working in the Iron Age.
- 45 Nenquin, in toto. See further Francis W. Reader, "Report of the Red Hills Exploration Committee, 1906-1907," Proceedings of the Society of Antiquaries of London, 2nd ser., XXII (1907-1908), 165-207; F. T. Baker, "The Iron Age Salt Industry in Lincolnshire," Lincolnshire Architectural and Archaeological Society Reports and Papers, N.S., VIII (1959-1960), 26-34; S. J. Hallam, "The Romano-British Salt Industry in South Lincolnshire," ibid., 35-75; K. Riehm, "Prehistoric Salt Boiling," Antiquity, XXXV (1961), 181-91; and P. L. Gouletquer, "Briquetages et Sauneries," Annales de Bretagne, LXXVII (1970), 135-53.
- 46 Reader, p. 168, "saltings" being the modern venacular name for saltworking sites of this type in eastern England.
- 47 See D. P. S. Peacock, "Neolithic Pottery Production in Cornwall," Antiquity, XLIII (1969), 145-49; "A Contribution to the Study of Glastonbury Ware for South-Western Britain," Antiquaries Journal, XLIX (1969), 41-61; and "Archaeology, Science and the Lizard," The Lizard, IV, No. 1 (1969), 3-5.
- 48 My thanks to Dr. Peacock for information stemming from experimental firings he has conducted using these gabbroitic clays.
- 49 ApSimon and Greenfield, "The Excavation of Bronze Age and Iron Age Settlements at Trevisker," pp. 341, 355-56. During the Bronze Age, the clay itself seems to have been taken from the Lizard to be mixed with local clays around the Trevisker site. During the Iron Age, export of finished gabbroitic ceramics seems to have been the rule. While coarse, plain wares of local clays were undoubtedly produced throughout Cornwall, the Lizard Peninsula apparently came to exercise a solid monopoly on well-fired, well-turned, and finely decorated ceramics. In private conversation, Dr. Peacock has estimated that well over eighty percent of the finer wares in Iron Age Cornwall were acquired from the Lizard Peninsula.
- 50 Peacock, "Glastonbury Ware," p. 42 for distribution map and pp. 57-60 for a site gazetteer.

CHAPTER VII, continued

- 51 D. P. S. Peacock, "A Romano-British Salt-working Site at Trebarveth, St. Keverne," Cornish Archaeology, VIII (1969), pp. 48, 63-64.
- 52 Ibid., pp. 47-65.
- 53 Peacock, "Archaeology, Science and the Lizard," p. 4.
- 54 Mr. ApSimon notes a degree of uniformity in the diameters of smaller bowls and jars, with a diameter range of between six to ten inches. From profiles of fairly complete pots given in Leslie Murray Threip-land, "An Excavation at St. Mawgan-in-Pyder," pp. 54-69, volumetric estimates can be made, and, from these, estimates may be derived for the weight of salt such vessels could have contained. My own estimates are of around three to five pounds. Peacock, "Trebarveth," p. 64 estimates the briquetage evaporating troughs at Trebarveth could have produced around three pounds of salt for each complete evaporation process. Ibid., where Peacock notes the presence at the site of a number of fragments from fire-reddened pots, many of these being hand made. Thick, nearly crystallized brine from the evaporation troughs may have been ladeled into drying moulds of pottery saggars and rough made pots, with the finished cake salt then being packed into good quality ceramic containers, each of these holding a standard weight of something around three pounds of salt. Much more work is needed on a hypothesis of this sort, but a similar interpretation has been argued for by Aileen Fox, South-West England, 3500 B.C.- A.D. 600, rev. ed. (Newton Abbot, 1973), p. 185.
- 55 Emphasized in Peacock, "Archaeology, Science and the Lizard," pp. 3-4. See further Roberson, Cornwall, pp. 440-42.
- 56 With esp. persistence by V. Gordon Chile, e.g., his "Social Implications of the Three 'Ages'," pp. 18-32.
- 57 E.g., Evzen and Jiri Neustupny, Czechoslovakia Before the Slavs, trans. by Lewis Ducke (London, 1961), pp. 100-101, note that during the Bronze and Iron Ages, changes in the organization of what was still basically a Neolithic subsistence technology were much more important than the composition of the tools. Jacques Briard, "Bronze Age Cultures: 1800-600 B.C.," in France Before the Romans, p. 147 notes that during the Bronze Age in France, most tools were still made of wood, stone, and flint.
- 58 Piggott, Ancient Europe, p. 118.
- 59 See the suggestive comments by Stuart Piggott, "A Late Bronze-Age Wine Trade?" Antiquity, XXXIII (1959), 122-23. See further J. M. de Navarro, "Massilia and Early Celtic Culture," Antiquity, II (1928), p. 435.

CHAPTER VII, continued

- 60 E.g., V. Gordon Childe, "The Bronze Age," Past and Present, No. 12 (1957), p. 4. However, Childe was ambivalent on this point, and in various of his other writings, he definitely abandoned this simplistic technological determinism, e.g., Man Makes Himself, p. 14, where economic and social-structural changes are clearly seen as a necessary precursor to the use of metals as objects of prestation or technology. Childe's more sophisticated explorations of the changes attending the Bronze Age in Europe are fit against a framework of interactions and mutual adaptations on the part of the ancient state systems of the Near East and "barbarian" societies in the Aegean and temperate Europe. While many of the details of Childe's reconstructions have been faulted, his writings contain the basis for a model quite similar in many respects to my own model of preindustrial frontiers. Once again, while I may criticize Childe on certain points, my intellectual debt to him is profound.
- 61 E.g., Childe, "Trade and Industry in Barbarian Europe," p. 26.
- 62 See Edmonds, McKeown, and Williams, pp. 43-51, 85-88 for the geological particulars.
- 63 Henry Dewey, "The Mineral Zones of Cornwall," Proceedings of the Geologists' Association, XXXVI (1925), pp. 131-32.
- 64 Denys Bradford Barton, Essays in Cornish Mining History (Truro, 1968), I, 130-48 for many useful details on tin metallurgy.
- 65 Millward and Robinson, p. 119.
- 66 Henderson, Essays in Cornish History, pp. 26-43.
- 67 The Iron Age importance of this route is emphasized by Dorothy Dudley, "The Early Iron Age in Cornwall," Proceedings of the West Cornwall Field Club, N.S., II, No. 2 (1957-1958), pp. 50-51, with full references to archaeological sites in this region.
- 68 P. J. Clarke, "The Neolithic, Bronze and Iron Age, and Romano-British Finds from Mt. Batten, Plymouth, 1832-1939," Proceedings of the Devon Archaeological Society, XXIX (1971), 121-40.
- 69 For a recent appraisal of the role of the Armoricans in British trade, see Cunliffe, Iron Age Communities, esp. pp. 150-51. While Cunliffe notes, ibid., p. 106, that the decline of groups such as the Veneti did not totally disrupt contacts between Armorica and Southwest England, the last decade of the first century B.C. and the decades leading up to the Claudian invasion in the first century

CHAPTER VII, continued

A.D. saw a notable increase in the importance of cross-Channel routes centering around Kent, Sussex, and other points to the east of Dorset. This undoubtedly resulted in a reorientation of internal exchange flows and political balances, mostly to the detriment of Southwest England.

- 70 Thomas, "Roman Dumnonia," p. 77.
- 71 Ibid., p. 76.
- 72 Diodorus Siculus, V. 26. 3. Diodorus preserves a number of interesting fragments from earlier travellers, esp. the Greek Pytheas. For commentary on the implications of these fragments, see Aileen Fox, South-West England, rev. ed., pp. 131, 135-36, 178-81.
- 73 On the Caesarian conquest of Armorica and its repercussions, see Nora K. Chadwick, Early Brittany (Cardiff, 1969), pp. 89-98; Mortimer Wheeler and Katherin N. Richardson, Hillforts of Northern France (Reports of the Research Committee of the Society of Antiquaries of London, No. 19 [Oxford, 1957]), pp. 1-22; Thomas, "Roman Dumnonia," pp. 81-83; Aileen Fox, South-West England, rev. ed., pp. 135-36, 151-52; P. Merlat, César et les Vénètes, " Annales de Bretagne, LXII (1955), 154-83; P. Emmanuelli, "César et les Vénètes: Le Combat naval de 56 av. J.C.," Annales de Bretagne, LXIII (1956), 55-87; M. Denis, "La campagne de César contre les Vénètes," Annales de Bretagne, LXI (1954), 126-53; and P. R. Giot and J. B. Colbert de Beaulieu, "Au seuil de l'histoire," in Histoire de la Bretagne, ed. by Jean Delumeau (Toulouse, 1969), pp. 59-88.
- 74 Thomas, "Roman Dumnonia," p. 85; Fox, South-West England, rev. ed., p. 151.
- 75 Thomas, "Roman Dumnonia," p. 91; Fox, South-West England, rev. ed., pp. 175-77. Thomas notes that the courtyard house sitings were not well situated for arable farming. Many of these courtyard house hamlets are set in secluded natural amphitheaters scooped out at the heads of small streams. These sites are nearly invisible from coastal approaches, and this defensive factor may well have something to do with their proliferation during the Roman period.
- 76 Thomas, "Roman Dumnonia," p. 91 would place the latest occupation of these sites at circa A.D. 500.
- 77 Ibid., pp. 91-94; and Fox, South-West England, rev. ed., pp. 183-84. Debased coinage appears in a torrent beginning with the reign of the Gallic Emperor Postumus (A.D. 258-268).

CHAPTER VII, continued

- 78 Fox, ibid., p. 183 notes that tin ingots recovered from river dredging operations in central Cornwall bear stamps similar to those used at mining sites elsewhere in Britain where Roman military supervisors apparently exacted the metals as a sort of tax from the natives. While no late Roman installations have been firmly pinpointed in Cornwall by excavations, possible sites are suggested by a number of suspiciously Roman-looking rectangular, palisaded enclosures, on which see Dorothy Dudley, "Sub-rectangular Earthworks with Rounded Corners," Proceedings of the West Cornwall Field Club, N.S., I, No. 2 (1954), 54-58. Native intermediaries may very well have played a prominent role, as is hinted by sites such as the bizarre semi-romanized "villa" at Magor Farm, on which see B. H. St. J. O'Neil, "The Roman Villa at Magor Farm, Near Camborne, Cornwall," Journal of the British Archaeological Association, XXXIX (1933), 116-74; and Thomas, "Roman Dumnonia," pp. 92-94.
- 79 Thomas, ibid., map showing late Roman hoards on p. 93.
- 80 Nora K. Chadwick, pp. 124-237. The initial stages of the Breton migration correspond with the disturbed period of courtyard house abandonment in West Penwith.
- 81 An excellent survey of the impact of the glacial period and its implications for subsequent land use is found in P. J. Powrie and A. J. Mansfield, North-West Europe, 6th ed. (London, 1971), pp. 156-79, 405,40.
- 82 Alan Mayhew, Rural Settlement and Farming in Germany (New York, 1973), p. 20; Harald Uhlig, "Old Hamlets with Infield and Outfield Systems," pp. 285-312; C. H. Edelman, Soils of the Netherlands, trans. by J. Verwey (Amsterdam, 1950), pp. 2-3, 23, 32. The productivity of agriculture in the present-day Netherlands depends on the highest consumption of commercial fertilizers in the world. See further H. Reytenens and A. van Slijcken, "The Grasslands of Belgium," Journal of the British Grassland Society, X (1955), 7-17.
- 83 Edelman, p. 31.
- 84 Ibid., pp. 31-32.
- 85 Ibid., pp. 41-63.
- 86 Ibid., esp. at p. 58. Much of the following discussion of Iron Age and Roman period agrarian systems draws on Edelman's observations concerning the potentials of various soil types along the braided river systems of the North Sea Coast and its hinterland.

CHAPTER VII, continued

- 87 Ibid., pp. 66-70, 95-96.
- 88 Good surveys of the cycles of marine transgressions from the post-glacial period on include J. P. Bakker, "The Significance of Physical Geography and Pedology for Historical Geography in the Netherlands," Tijdschrift voor economische en sociale Geografie, XLIV (1953), 214-26; and Werner Haarnagel, Das Alluvium an der deutschen Nordseeküste (Probleme der Kuestenforschung im suedlichen Nordseegebiet, Vol. IV [Hildesheim, 1950]).
- 89 For summaries of the prehistory of the western portions of the North European Plain, see H. T. Waterbolk, "The Lower Rhine Basin," in Courses Toward Urban Life, ed. by Robert J. Braidwood and Gordon R. Willey (Chicago, 1962), pp. 227-53; and S. J. de Laet and W. Glasbergen, De Voorgeschiedenis der Lage Landen (Groningen, 1959), pp. 113ff.
- 90 Edelman, p. 23 estimates that under traditional farming systems, agriculture had to contend with an arable to pasture/fallow ratio of around 1:10, with an additional substantial hinterland of heath and moorland needed to provide rough pasture for sheep. Efforts to extend the arable would result in rapidly declining soil fertility and insufficient winter keep for livestock.
- 91 The subsequent discussion draws extensively on the following: H. T. Waterbolk, "The Bronze Age Settlement of Elp," Helinium, IV (1964), 97-131; A. E. van Giffen, "Praehistorische Hausformen auf Sandboeden in den Niederlanden," Germania, XXXVI (1958), 35-71; W. A. van Es, Terpen (Kampen, 1971); "Friesland in Roman Times," R.O.B. Berichten, XV-XVI (1965-1966), 37-68; Wijster: A Native Village Beyond the Imperial Frontier, 150-425 A.D. (Palaeohistoria, Vol. XI [Groningen, 1967]); Peter Schmid, "Die vorroemische Eisenzeit in nordwestdeutsch Kuestengebiet," Probleme der Kuestenforschung im Gebiet der suedlichen Nordsee, VI (1957), 49-120; "Die Keramik de 1. bis 3. Jahrhunderts nach Chr. im Kuestengebiet der suedlichen Nordsee," Probleme der Kuestenforschung im Gebiet der suedlichen Nordsee, VIII (1965), 9-72; Werner Haarnagel, "Zur Grabung auf der Feddersen Wierde, 1955-59: Versuch einer siedlungsgeschichtlicher Darstellung der einzelnen Dorfhorizonte," Germania, XXXIX (1961), 42-69; "Die Ergebnisse der Grabung Feddersen Wierde bei Bremenhaven in den Jahren von 1955-1957," in Neue Ausgrabungen in Deutschland, ed. by Werner Kraemer (Berlin, 1958), pp. 215-28; "Die Grabung Feddersen Wierde und ihre Bedeutung fuer die Erkenntnisse der Baeuerlichen Besiedlung im Kuestengebiet in der Zeitraum vom 1. Jahrhundert vor bis 5. Jahrhundert nach Chr.," Zeitschrift fuer Agrargeschichte und Agrarsoziologie, X (1962), 145-57; "Die praehistorischen Siedlungsformen im Kuestengebiet der Nordsee," in Beitraege zur Genese der Siedlungs- und Agrarlandschaft in Europe, ed. by Helmut Jaeger,

CHAPTER VII, continued

- Anneliese Krenzlin, and Harald Uhlig (Weisbaden, 1968), pp. 67-111; "Die Marschen im niedersaechsischen Kuestengebiet der Nordsee," in Methodisches Handbuch fuer Heimatforschung in Niedersachsen, ed. by Helmut Jaeger (Hildesheim, 1965), pp. 346-62; Kaethe Mittelhaeusser, "Zur Siedlungsgeschichte der Geestgebite," in Methodisches Handbuch fuer Heimatforschung in Niedersachsen, pp. 363-77.
- 92 B. H. Slicher van Bath, "The Economic and Social Conditions in the Frisian Districts from 900 to 1500," A.A.G. Bijdragen, XIII (1965), pp. 99-102 for comparisons of population densities from the Iron Age until A.D. 1500.
- 93 Haarnagel, "Die praehistorischen Siedlungsformen," p. 68 notes that the early settlement at Jemgum on the Ems River (occupation beginning during a regression phase in the late Bronze Age) consisted of small huts lacking the extensive stall facilities of later settlements of the Iron Age and Roman periods. This might imply that the earliest phases of the occupation of the coast following regressions involved seasonally used shieldings. Such patterns are well attested during subsequent regression phases during the middle ages, on which see Adriaan Verhulst, Histoire du paysage rural en Flandre de l'époque romaine au XVIIIe siècle (Brussels, 1966), pp. 11-12.
- 94 Excellent use of such comparisons is made by Waldemar Reinhardt, "Studien zur Entwicklung des laendlichen Siedlungsgebildes in den Seemarschen der ostfrieschen Westkuesten," Probleme der Kuestenforschung im Gebiet der suedlichen Nordsee, VIII (1965), 73-148.
- 95 The evidence for crop production on the North Sea Coast is set out at length in Udelgaard Koerber-Grohne, Geobotanische Untersuchungen auf der Feddersen Wierde (Wiesbaden, 1967). Earlier researchers had doubted that grain could be grown at all except in garden plots on the terpen. While this older view is probably erroneous, recent research has perhaps argued too strongly for self-sufficiency, ignoring the risk factors involved in cereal cropping in these flood prone areas.
- 96 While sheep were kept, e.g., see Hans Reichstein, "Die Haustier-Knochenfunde der Feddersen Wierde," Probleme der Kuestenforschung im Gebiet der suedlichen Nordsee, X (1973), 95-112, their numbers were low as compared to cattle (ibid., p. 111 lists 48% cattle to 24% sheep). In addition to the dangers of foot infections, many areas along the coast suffer from severe nutrient deficiencies in soils and pastures that could have made it difficult to maintain even modest flocks of sheep without periodic acquisitions of breeding stock from the interior regions. See Edelman, p. 45, where

CHAPTER VII, continued

- deficiencies of potassium and phosphorus, in addition to the ubiquitous calcium deficiencies, are noted. Such deficiencies produce forages that make for slow or arrested growth and poor or erratic reproduction rates among livestock. See extensively Frank A. Gilbert, Mineral Nutrition of Plants and Animals (Norman, 1948); and W. A. Albrecht, "Soil and Livestock," The Land, II (1943), 298-305.
- 97 Forage deficient in calcium and phosphorus can produce a fleece so weak that it tears excessively when combed or carded. See Albrecht, p. 303.
- 98 Esp. noticeable at Feddersen Wierde. In the medieval period, the sites of such former chief's residences were often replaced by castles, manor houses, or churches. See Mayhew, p. 35.
- 99 A standard, though somewhat outdated, introduction to the Frisian culture area is P. C. J. A. Boeles, Friesland tot de elfde eeuw: zijn voor- en vroege Geschiedenis, 2nd ed. (The Hague, 1951). Suggested revisions are outlined in A. Russchen, New Light on Dark-Age Frisia (Drachten, 1967), pp. 5-22 for the pre-medieval period.
- 100 Argued at length in Schmid, "Die Keramik des 1. bis 3. Jahrhunderts," esp. at p. 38. Schmid sees the zone between the Ems and the Weser as having been progressively drawn into the sphere of influence of the Frisians, with the area between the Weser and the Elbe remaining the solid core to Chaukian cultural features. The Frisian culture group or sub-groups were apparently much more fluid than was the case with the Chauks. See further M. Ihm, "Chauci," in Pauly's Real-Encyclopaedie der classischen Altertumswissenschaft, ed. by Georg Wissowa (Stuttgart, 1899), III, Part 2, cols. 2201-2202.
- 101 Works dealing with the early medieval period containing material pertinent to the Iron Age and Roman periods include Archibald R. Lewis, The Northern Seas: Shipping and Commerce in North Europe, A.D. 300-1100 (Princeton, 1958); Herbert Jankuhn, "Der frankisch-friesische Handel zur Ostsee in fruehen Mittelalter," Vierteljahrsschrift fuer Sozial- und Wirtschaftsgeschichte, XL (1953), 193-243; D. Jellema, "Frisian Trade in the Dark Ages," Speculum, XXX (1955), 15-36; and Philip Grierson, "Commerce in the Dark Ages: A Critique of the Evidence," Transactions of the Royal Historical Society, 5th ser., IX (1959), 123-40. My thanks to Mr. Dafydd Kidd for much stimulating discussion on the problems of North Sea culture groups.
- 102 On the salt trade, see H. Marschelleck, "Die Salzgewinnung an der friesischen Nordseekueste," Probleme der Kuestenforschung im suedlichen Nordseegebiet, X (1973), 127-50.

CHAPTER VII, continued

- 103 Fragments from domesticated plants found preserved in layers of compost or manure from pre-World War II terpen excavations were usually reasoned to have been grown on the mounds themselves, not in fields surrounding the terpen. It is now reasoned that careful selections of sites along silted up Preilen made possible substantial crop intakes.
- 104 Excellent descriptions of the medieval patterns are to found in Slicher van Bath, pp. 97-133.
- 105 See Koerber-Grohne, Geobotanische Untersuchungen, esp. at pp. 209-31, where the author describes actual experimental plantings of domesticated plants in plots chosen to replicate the conditions of the occupation phases at Feddersen Wierde.
- 106 Ibid., pp. 2-3.
- 107 Ibid., pp. 34-35.
- 108 Ibid., p. 30.
- 109 Slicher van Bath, p. 106.
- 110 Our best documented examples are the amphibious operations carried out by Germanicus under the reign of Tiberius. These forays invariably ended in stalemate or disaster due to piecemeal shipwrecks or to wholesale catastrophes to the troop carriers during storms and high tides. E.g., Tacitus, Annals, I. 70.
- 111 A number of these lower Rhenish positions are described in A. E. van Giffen, "Three Roman Frontier Forts in Holland, at Utrecht, Valkenburg and Vechten," in The Congress of Roman Frontier Studies, 1949, ed. by Eric Birley (Durham, 1952), pp. 31-40.
- 112 By the third century, the military frontier had in effect fallen back to a line between Cologne and Boulogne. See G. Faider-Feytmans, "La frontière du nord de la Gaule sous le bas-empire," in Mélanges de philologie, de littérature et d'histoire anciennes offerts à J. Marouzeau par ses collègues et élèves étrangers, ed. by Julliette Ernst, et al. (Paris, 1948), pp. 161-72; and J. Mertens, "Laat-Romeins Graf te Oudenburg," Helinium, IV (1969), 219-34.
- 113 Tacitus, Ann., I. 48-51. See further Wells, p. 241.

CHAPTER VII, continued

- 114 This revolt, led by Civilis, was esp. brutal because of its length, coinciding as it did with the anarchy after the death of Nero, and because it provoked bitter infighting among the Gauls and the Rhenish peoples. The Batavian revolt occupies much of Tacitus, Hist., IV.
- 115 Ibid., IV. 28 notes that many of the Menapii were crushed during the Batavian revolt when they refused to join the rebels. As a result, they were attacked by Civilis, this marking the culmination of a string of misfortunes dating back to the Caesarian conquest. The northern part of their territory would later be devastated by the Late Roman Transgression. The southern portion of their range may have been subsumed in the slowly expanding line of defenses from Boulogne to Cologne, and large numbers of Menapians were moved, perhaps deported, as auxiliaries to other portions of the Empire. See S. J. de Laet, "Les limites des cités des Ménapiens et des Morins," Helinium, I (1961), 20-34; and H. G. Wackernagel, "Menapii," in Pauly's Real-Encyclopaedie der classischen Altertumswissenschaft, ed. by Wilhelm Kroll (Stuttgart, 1931), XV, Part 1, cols. 766-768. The comments by A. R. Lewis, The Northern Seas, pp. 8-9, 11-12 asserting that the Roman period brought economic prosperity to the Menapiens are not to be trusted.
- 116 Tacitus, Ann., IV. 72-74.
- 117 W. A. van Es, "Friesland in Roman Times," pp. 53, 59 suggests that in the course of the first and second centuries A.D., the Romans may have begun to supply grain to the coastal peoples. This could have led to a weakening of ties with interior population groups, a reduction in population in the interior due to declining trade opportunities with the coastal groups, and the build-up of excessively high population densities along the coast. If correct, this hypothesis would help explain the far-reaching effects of the stoppage of Roman trade with coastal groups after the second century.
- 118 The career of Carausius is explored at length in Donald A. White, Litus Saxonium: The British Saxon Shore in Scholarship and History (Madison, 1961).
- 119 Edelman, pp. 66-72, 95-148 gives an excellent pedological analysis of the marine clay landscape and the problems of farming in such regions.
- 120 W. A. van Es, Wijster, pp. 531-45.
- 121 Ibid., p. 553.

CHAPTER VII, continued

- 122 W. A. van Es, Wijster, pp. 532-33.
- 123 Sonia Chadwick Hawkes and G. C. Dunning, "Soldiers and Settlers in Britain, Fourth to Fifth Century," Medieval Archaeology, V (1961), 1-70.
- 124 See esp. Joachim Werner, "Zur Entstehung der Reihengraebernzivilisation," Archaeologia Geographica, I (1950-1951), 23-32 and "Kriegergraeber aus der ersten Haelften des 5. Jahrhunderts zwischen Scheldt und Weser," Bonner Jahrbuecher, CLVIII (1958), 372-413.
- 125 Wijster, pp. 549-50, 561.
- 126 The received view of an Anglo-Saxon "invasion" is in many ways misleading, as the author has argued at length in his "The Invasion Hypothesis and the English Settlements," (unpublished M.A. Thesis, University of Oklahoma, 1972).
- 127 Esp. so if so highly ritualized as to involve no destruction of life or property. For a well-documented example of such forced exchanges, see Louise E. Sweet, "Camel Raining of North Arabian Bedouins: A Mechanism of Ecological Adaptation," in Peoples and Cultures of the Middle East, ed. by Louise E. Sweet, 2 Vols. (Garden City, N.Y., 1970), I, 265-89.
- 128 W. A. van Es, "Friesland in Roman Times," pp. 65-66.
- 129 Supposed archaeological substantiations advanced in the early part of this century for the garbled invasion sagas of early medieval documentary sources are slowly being rejected or revised. For representative older views, see Alfred Plettke, Ursprung und Ausbreitung der Angeln und Sachsen: Beitrage zur Siedlungsarchaeologie de Ingvaeonen (Hildesheim, 1921); and Boeles, Friesland tot de elfde eeuw, pp. 578-81. Various lines of current reinterpretation are assembled in Russchen, pp. 23-28.
- 130 Russchen, p. 28 notes that a trait commonly hailed as an index of an Anglo-Saxon invasion of Frisia is the appearance of small huts called Grubenhaeuser that often seem to have supplanted the substantial house-byres of the older Frisian cultures. While some researchers have argued that the Grubenhaeuser were merely outbuildings associated with house-byres that have escaped detection, Russchen suggests that many of the coastal peoples may very well have been reduced to living in such crude shelters as the result of drastic social and economic decline. Such poverty and dislocation could have been generated locally, without appealing to hordes of poverty-stricken invaders.

CHAPTER VIII

- 1 See extensively Walter Goffart, Caput and Colonate: Towards a History of Late Roman Taxation (Toronto, 1974), esp. at pp. 27-30. Goffart argues that the tribute payments based on "censuses" that began to replace the graft-ridden system of farmed tithes from the time of Augustus on were not income taxes in any modern sense of the term. The Roman notion of census had its roots in the status allocation schedules of the ancient Servian reforms. A method of allocating responsibilities to the chief men of a region can by no means be equated with modern census-based tax systems.

- 2 Ibid., pp. 13-14 feels that except for a small number of indirect sales, excise, and inheritance taxes, the notion that there were specific direct taxes in the early empire is a misnomer. On the basis of a careful examination of the terminology used in sources dating to the Principate, Goffart argues that tributa consisted of a collection of indirectly assessed and collected exactions. A certain amount of tribute would then be expected from a city or region, but local decurions were left to exact this tribute in any way they saw expedient, using a broad repertoire of tax gathering strategies. Many eastern cities solved the problem of raising the tribute by setting aside special landed endowments, the rents from which were used to defray the imperial tribute in part or in whole. See ibid., p. 10.

- 3 Ibid., p. 98, where Goffart notes the similarities between the Roman situation and the logistics of early modern European taxation systems. Goffart may have very well isolated a cardinal feature of all preindustrial tax systems, a feature which he comes close to advancing as an empirical generalization at pp. 144-45. Such a principle was clearly enunciated decades ago by Joseph Strayer in regard to medieval France. See Joseph Strayer and Charles H. Taylor, Studies in Early French Taxation (Cambridge, Mass., 1939), p. 21: "None of [the government's] taxes could be collected without consulting the people who were taxed. This was true because medieval governments had little information about the numbers and wealth of their subjects. The number of hearths in a town could be found only by consulting the town government; the income or wealth of a landlord could be determined only by consulting the man himself or his neighbors. It is also true that there were never enough government officials to take care of the details of assessment and collection. Even the most oppressive taxes were assessed and collected by the people who paid them."

- 4 Goffart, in toto, whose analysis offers a signal advance over older views epitomized, for instance, by A. H. M. Jones, "The Roman Colonate," Past and Present, No. 13 (1958), 1-13.

CHAPTER VIII, continued

- 5 Our best source for late Roman tax schedules on various types of cropped land is contained in a sixth century tract commonly referred to as the Syro-Roman Lawbook. A translation and discussion of the relevant portions of this source are found in Goffart, p. 33. Orchards and vineyards were clearly to be taxed at a rate several times that of land under cereal crops. The Syro-Roman Lawbook apparently makes no allowances for periodic replantings of trees and vines and no allowances for the high risk factors involved in wine production. Goffart, pp. 104, 108-10 notes that while the tax system of the early empire, which involved fixed tribute rates for a whole city or region, encouraged investments in agriculture since capital gains were not taxed, the late Roman system created disincentives for investment, instead encouraging communities to put on "a face of poverty" to keep their assessments low. See further Arthur E. R. Boak, A History of Rome to 565 A.D., 4th ed. (New York, 1955), p. 463.
- 6 While Goffart has done a splendid job in isolating several cardinal differences between the early and late Roman taxation systems, I cannot follow his attempt to down-date the economic decay of the Mediterranean provinces to the fourth or even the fifth century.
- 7 I know of no satisfactory study of the impact of piracy and the lack of properly policed sea lanes on the economy of the Mediterranean. M. I. Finley, "Classical Greece," in Second International Conference of Economic History, Vol. I: Trade and Politics in the Ancient World (Paris, 1965), pp. 12-25 lamented this lacuna, but one still awaits an analysis of ancient trade as perceptive as the seminal work on medieval and early modern Mediterranean trade by Frederick C. Lane, see esp. his Venice and History (Baltimore, 1966).
- 8 Maecenas' speech in Dio Cassius, LII. 23. 4 and LII. 27 is steeped in a fear of over-ambitious frontier generals. Suetonius, Divus Augustus, II. 25. 3-4 reflects similar fears as does Tacitus, Ann., XI. 19 and Hist., I. 9.
- 9 Webster, pp. 258-59. Among the complaints of the mutinous troops in Pannonia described in Tacitus, Ann., I. 35 were the excessive bribes being exacted by their officers.
- 10 See extensively Brian Dobson, "The Significance of the Centurion and the 'Primipilaris' in the Roman Army and Administration," in Aufstieg und Niedergang der römischen Welt: Kultur und Geschichte Roms im Spiegel der neueren Forschung, Vol. II: Principat, Part 1, ed. by Hildegard Temporini (Berlin, 1974), pp. 299-338; and David J. Breeze, "The Career Structure Below the Centurionate during the Principate," in ibid., pp. 435-51.

CHAPTER VIII, continued

- 11 Dobson, "The Significance of the Centurion," p. 428 notes that unless a centurion was attached to the praetorian guard, his chances were very slim of achieving higher office. The chances for an average praetorian legionary soldier of achieving rank higher than centurion were only about one in three, and for the average non-praetorian soldier, the odds of any sort of advancement were astronomically low. Breeze, "Career Structure Below the Centurion," p. 449 notes that the major obstacle to rapid advancement was that a soldier had to serve a circus of four or five posts before being eligible even for centurion status. Most soldiers (assuming they lived long enough) would be too old or infirm by the time they finished such a circus for further service.
- 12 These are the conclusions of R. W. Davies, "The Daily Life of the Roman Soldier under the Principate," in Aufstieg und Niedergang der römischen Welt: Kultur und Geschichte Roms im Spiegel der neueren Forschung, Vol. I: Principat, Part 1, ed. by Hildegard Temporini (Berlin, 1974), p. 334.
- 13 See J. C. Mann, "The Role of the Frontier Zone in Army Recruitment," in Quintus Congressus Internationalis Limitis Romani Studiosus (Acta et Dissertationes Archaeologicae, III [Zagreb, 1963]), pp. 145-50 for an excellent summary of these trends.
- 14 Webster, p. 57 notes that it was not until the time of Claudius that substantial stone or timber-built winter quarters became general. Abominable winter quarters were another of the complaints voiced by the Pannonian mutineers during the reign of Tiberius, on which see Tacitus, Ann., I. 17.
- 15 See the excellent analysis in J. C. Mann, "The Frontiers of the Principate," in Aufstieg und Niedergang der römischen Welt: Kultur und Geschichte Roms im Spiegel der neueren Forschung, Vol. II: Principat, Part 1, ed. by Hildegard Temporini (Berlin, 1974), pp. 510-17.
- 16 Davies, "Daily Life," pp. 305-14, 326.
- 17 Mann, "Frontiers of the Principate," p. 532 refers to Hadrian's Wall as an example of "displacement activity."
- 18 Webster, esp. at p. 100.
- 19 Ibid.
- 20 Mann, "Frontiers," p. 517. Furthermore, by the late third century, the frontier legions were experiencing severe difficulties in maintaining their troop strengths, even when army service was made

CHAPTER VIII, continued

hereditary. A legionary career was obviously no longer as tolerable as it had been.

- 21 Emphasized by Balsdon, Rome, p. 145. Even Tiberius' moody retreat to Capri sufficed to through the affairs of government into turmoil, on which see Tacitus, Ann., IV. 74; and Suetonius, Tiberius, III. 41. See further Dio Cassius, LXXII. 6. 1-2 who gives an excellent account of Marcus Aurelius' hectic attempts to keep up with provincial business while in the midst of his campaigns on the Danube.
- 22 F. W. Walbank, The Awful Revolution: The Decline of the Roman Empire in the West, new ed. (Liverpool, 1969).
- 23 Ulrich Kahrstedt, "The Roman Frontier on the Lower Rhine in the Early Imperial Period," in The Congress of Roman Frontier Studies, pp. 41-54. Such calloused actions led A. Alföldi to write "The Moral Barrier on Rhine and Danube," in ibid., pp. 1-16, the title being self-explanatory.
- 24 A rate of 40% to 60% is given for legionary troops by Davies, "Daily Life," pp. 305-10. The percentages may well have been higher for auxiliary troops.
- 25 In addition to supplying weapons and military equipment, the problems of feeding the frontier forces were enormous. Piggott, Ancient Europe, p. 252 places the grain needs of a legion at the yield of 70,000 acres per annum. Webster, p. 198 gives estimates of the two year storage capacities of excavated legionary granaries which convert into acreage statistics in line with Piggott's figures. The task of collecting such a grain tribute or carting it in from other regions would have been awesome, and it is no wonder that the government often had to prevent soldiers from expanding garden plots into their own grain fields, on which see Ramsey MacMullen, Soldier and Civilian in the Late Roman Empire (Cambridge, Mass., 1963), pp. 2, 9-10. In addition to their personal needs, auxilia had to worry about providing fodder for their mounts, making it even harder for them than for legionaries to keep from lapsing into a motley soldier-peasantry. See Webster, p. 258. On the general problems of supplying the army's ordnance requirements, see Davies, "Daily Life," pp. 317-18.
- 26 Webster, p. 120 notes that under normal conditions, a legion fell apart into miniscule centuries of around eighty men, cohorts and legions only being mustered together during campaigns or tactical exercises. After the mutinies at the beginning of Tiberius' reign, emperors were usually fearful of maintaining troop concentrations

CHAPTER VIII, continued

of more than a legion, and the logistical burdens of feeding concentrations of troops even this large further encouraged thin deployments. It is not surprising that Roman military handbooks, such as those preserved in Vegetius' Epitoma Rei Militaria, seldom described tactical deployments larger than a legion and, for the most part, were only concerned with much smaller units such as the cohort or century.

- 27 Davies, "Daily Life," p. 313; and H. M. D. Parker, The Roman Legions (Oxford, 1928), p. 190. Most legionary tribunes were less officers than senatorial or equestrian gentlemen sent out for short tours of duty as clerks and bookkeepers to compile duty rosters and inventories of ordnance received or dispensed. Our best insights as to the daily chores of officers and their clerical staffs come from papyrus documents. The surviving records (which come, not surprisingly, from the eastern empire but whose general content seems applicable as well to the western empire) are, in the main, deadeningly routine. See the collection in Robert O. Fink, Roman Military Records on Papyrus (Philological Monographs of the American Philological Association, No. 26 [Cleveland, 1971]).
- 28 Parker, Roman Legions, p. 188 notes the frequent inexperience of most senior officers and concludes, somewhat sardonically, that "the greatness ... of the Roman army cannot be regarded as lying in the method of appointing the legionary commanders." With an officer corps of this calibre, it is not surprising that the Roman army almost never won a battle or a war by strategy, relying instead on massing overwhelming numbers of tactical centuries and cohorts.
- 29 Dio Cassius, LIII. 5. 4 mentions that governors normally received a set of instructions as they went out to their provinces, but it is quite possible that subsequent communiques would either be extremely formal or routine and would seldom involve attempts to frame future policies. Fink, Roman Military Records, pp. 348-49 is hard pressed to find any literary references to or papyrus examples of significant higher echelon communiques. Many communiques probably involved no more than summaries or condensations of the inventories and muster lists compiled by the tribuni and other clerical personnel. The Scriptores Historiae Augustae, Hadrian, XI notes that Hadrian set great store by these military receipts. Judging from Pliny the Younger's correspondence with Trajan, e.g., Letters, X, nos. 35, 36, 52, 53, 88, 89, 100, 101, 102, 103, 110, and 111, many communiques other than military receipts may have simply been congratulatory messages or statements that all was well. There are indications that Trajan found Pliny's voluminous correspondence tiresome, e.g., ibid., nos. 11, 78, 82, 95, 98, 109, 113, and 117, and tolerated it only out of personal friendship. In times of real

CHAPTER VIII, continued

crisis, a military governor would have to act of his own initiative, the imperial post being far too slow to seek instructions from Rome. Even in normal times, governors may have been substantially left of their own devices. Emperors may have felt the threat of subsequent extortion trials or lack of promotion sufficient to elicit honesty on the job during a governor's short term of office, relying on various types of spies or the rivalries between military governors and imperial legates to generate non-routine information. See Dio Cassius, LXIX, 9. 2-3; and S.H.A., Hadrian, XIII. 10. There are strong indications that military governors commonly destroyed most of their official papers, saving them only to ward off possible litigation or to use a blackmail, e.g., see Dio Cassius, LXVII, 2. 1-2.

- 30 Davies, "Daily Life," pp. 316, 326-27; Webster, p. 262; and MacMullen, Soldier and Civilian, pp. 86-89. Our best information comes from the eastern empire, but similar patterns seem to have prevailed along the European frontiers.
- 31 S.H.A., Hadrian, X. 3-7 notes how Hadrian tirelessly searched out cases of extortion, lapses of discipline, indulgence in overly luxurious living quarters and apparel, and misappropriations of funds for construction of items such as brothels. Webster, p. 88 cites archaeological evidence for ornately decorated officers' quarters.
- 32 Dio Cassius, LXIX. 5. 1 remarks that Hadrian was remembered for his great meddlesomeness. Ibid., LXIX. 9. 2-3 notes Hadrian's frequent recourse to spying. Ibid., LII. 33. 8-9 notes how, through fear of those in power, candor was seldom forthcoming from subordinates. Lack of candor and deceitful dissimulation form the leit motifs of Tacitus' often virulent condemnations of the Principate under the Julio-Claudians and Flavians. This situation was ameliorated only slightly under the Antonines.
- 33 Candor often fell victim to the jealousies engendered by the overlapping spheres of authority of military governors and their nominally subordinate legati. Tacitus, Ann., XI. 19-20 notes how under Claudius, the general Corbulo was forced to break off a series of successful campaigns on the lower Rhine because of slanderous rumors circulated by other generals, and perhaps the military governor, back to the government in Rome. Ibid., XIII. 53 records the case of another status rivalry during the reign of Nero between an able legate and the governor of Belgica. Ibid., XIII. 54 notes that circulation of false rumors and slanders was rife among the mutually jealous and distrustful officials along the Rhine frontier.
- 34 Hadrian's Wall being a case in point.

CHAPTER VIII, continued

- 35 The classic instance was the bitter rivalry between the legate Paetus and Corbulo, then military governor of Syria, during the reign of Nero. In an attempt to outshine Corbulo, Paetus seriously overextended his troops, whereupon Corbulo held back sending reinforcements until Paetus had been forced to sue for peace with the Parthians. Meanwhile, Paetus had been sending back false reports of great victories to Nero, who only learned the true state of affairs when Parthian ambassadors arrived in Rome. See Tacitus, Ann., XV. 6-17.
- 36 A combination of poor communications, nepotism, suppression of information, and rampant distrust engendered by political rivalries and constant spying turned Rome into a chaos of rumors, half-truths, and outright lies. Unfortunately, the emperors themselves were often thrown back on this gossip mill for information. The bad effects of this situation on the workings of the government are complained of by Tacitus, Ann., IV. 74 and Dio Cassius, LII. 19. 3. Martial, Epigrams, IX. 35 bemoans the obsession in Rome with news and rumor. The impact on government of misinformation was especially keen when the emperors were absent from Rome. Martial's pleas for Domitian to return to Rome, e.g., Epigrams, VII, 5-7 and 21, were not completely feigned since the same pressing need for the imperial presence is repeated in ibid., X. 7 vis-a-vis Trajan.
- 37 Dio Cassius, LII. 33. 9 complains of the frequent timidity of subordinates. Tacitus, Agricola, 41 contrasts his father-in-law's initiative with the inertness and timidity of most governors and generals. While Pliny the Younger was a non-military governor while in Bithynia, his massive correspondence with Trajan often betrays great indecisiveness, even fear to act, whenever the slightest possibility of controversy or risk presented itself. This syndrome was quite possibly widespread.
- 38 E.g., the jealousy at Corbulo's initiatives on the lower Rhine, Tacitus, Ann., XI. 19-20 or Agricola's rapid political eclipse when Domitian felt him too successful and, therefore, a potential rival. Suetonius, Divus Augustus, II, 25. 3-4 attributes to Augustus a maxim that commanders should be safe rather than bold, with the clear implication that any battle entered into should be a safe bet and that defeats were the quickest way to rouse imperial disfavor. It is little wonder that frontier hostilities, or least information concerning them, were kept to a minimum.
- 39 S.H.A., Hadrian, XX. 11-12 relates the marvelous capacity of Hadrian to write, dictate, listen to conversation, and converse himself all at the same time. More stereotype than anything else, this passage does reflect Hadrian's uncanny energy in administrative affairs. Dio Cassius, LII. 38. 3 sums up the powers needed by a ruler to

CHAPTER VIII, continued

govern effectively with the phrase: "He must get at the disposition of his subjects not only by what they say but also by what they think." Such superhuman mental and physical capacities are reminiscent of the equally unrealizable qualification needed by the model business executive as spelled out by James Mooney, "The Scalar Principle," pp. 49-50.

- 40 Tacitus, Agricola, 16 notes how idle troops tended to become demoralized and ineffective for hard fighting. Similar opinions are expressed in S.H.A., Hadrian, X. 3 and by Dio Cassius, LXIX, 9. 2-3. Dio's own experiences, e.g., ibid., LXXX, 4. 2, with mutinous troops while he was governor of Pannonia are indicative of the extremely bad condition of many frontier garrisons by the late second century.
- 41 By the time of Marcus Aurelius, the difficulties in organizing an effective defense on the Danube played a crucial role in Marcus' willingness to accept a co-rulership with Verus, to whom were entrusted the defenses of the eastern provinces. The growing decrepitude of frontier forces throughout Europe was an invitation to widespread mutinies, revolts, and native uprisings, whose incidence increased steadily from the time of Marcus Aurelius on and aggravated the growing political and economic fragmentation of the empire.
- 42 Ernst Levy, West Roman Vulgar Law: The Law of Property (Memoirs of the American Philosophical Society, Vol. XXIX [Philadelphia, 1951]) has made a good case that the barbarian law codes of the early middle ages had their roots in the legal arrangements that had evolved between Roman officials and the peregrini along the sagging frontier zones. See further J. M. Wallace-Hadrill, "Frankish Gaul," in France: Government and Society, ed. by J. M. Wallace-Hadrill and John McManners (London, 1957), pp. 42-43.
- 43 Alfoeldi, "Moral Barrier," pp. 1-16. D. B. Saddington, "Race Relations in the Early Roman Empire," in Aufstieg und Niedergang der römischen Welt: Kultur und Geschichte Roms im Spiegel der neueren Forschung, Vol. II: Principat, Part 3, ed. by Hildegard Temporini (Berlin, 1975), pp. 112-37 has attempted to soften the "rigidity" of Alfoeldi's claims, but Saddington can do little better than rank Tacitus as "enlightened" in comparison to the blatant racism of author's such as Velleius Paterculus.
- 44 Peter Brown, Religion and Society in the Age of Saint Augustine (London, 1972), p. 15. This syndrome left a deep imprint on early medieval society in western Europe, on which see ibid., pp. 53-56. See further E. A. Thompson, "Christianity and the Northern Barbarians," Nottingham Medieval Studies, I (1957), 3-21.

CHAPTER VIII, continued

- 45 The manufacturing capacities of the larger Roman camps are described in MacMullen, Soldier and Civilian, pp. 26-32.
- 46 Trade links with technically advances Mediterranean societies from the late Bronze Age onward had led to a slow erosion in the standards and organization of many locally-based tempered European crafts, with the production of wine services, bronze vessels, glass-ware, and, significantly, amny kinds of weapons gradually becoming a monopoly of the Mediterranean world. See Clark, Prehistoric Europe, pp. 277-78.
- 47 Maurice Godelier, Rationality and Irrationality in Economics, trans. by Brian Pearce (New York, 1972), pp. 289, 312-13.
- 48 M. I. Finley, "Aulus Kapeilus Timotheus, Slave Trader," in his Aspects pf Antiquity: Discoveries and Controversies (New York, 1968), pp. 162-76 gives a full description of the only epigraphic instance known by Finley of a merchant who definitely took part in the external slave trade. K. D. White, Roman Farming, p. 369 remarks that epigraphic finds at Delos and Byzantium give little indication that both these places were the centers of large slave markets. We are largely dependent for such knowledge on stray passages in Polybius, IV. 38 for Byzantium and Strabo, XIV. 5. 2 for Delos. The paucity of epigraphic material dealing with the slave trade is also noted by Cedric A. Yeo, "The Development of the Roman Plantation and Marketing of Farm Products," Finanzarchiv, N.F., XIII (1952), p. 327.
- 49 See extensively Mary L. Gordon, "The Nationality of Slaves Under the Early Roman Empire," Journal of Roman Studies, XIV (1924) 93-111, which is still the best prosopographical study of trends for the empire as a whole.
- 50 E.g., R. H. Barrow, Slavery in the Roman Empire (London, 1928), pp. 15-19, who relies heavily on the work of M. Bang, "Die Herkunft der roemischen Sklaven," Mitteilungen des kaiserlichen deutschen archaeologischen Instituts, Roemische Abteilung, XXV (1910), 223-55.
- 51 Barrow, pp. 5-13, who emphasizes the ongoing contributions of piracy and brigandage even more than does William L. Westermann, The Slave Systems of Greek and Roman Antiquity (Memoirs of the American Philosophical Society, Vol. XL [Philadelphia, 1955]), pp. 84-90, 96-102. Westermann, ibid., p. 96 hazards the estimate that eight slaves were produced by internal mechanisms such as child pawning for each slave acquired from outside the empire.
- 52 Tenney Frank, "Race Mixture in the Roman Empire," American Historical Review, XXI (1916), 689-708.

CHAPTER VIII, continued

- 53 The breeding hypothesis has been touted by historians such as Cedric A. Yeo, "The Economics of Roman and American Slavery," Finanzarchiv, N.F., XIII (1952), pp. 459-60; A. H. M. Jones, "Slavery in the Ancient World," Economic History Review, 2nd ser., IX (1956), pp. 193, 196-97; and P. A. Brunt, "Reviews of W. L. Westermann, The Slave Systems of Greek and Roman Antiquity, D. Tudor, Istoria Scavajulvi in Dacia Romana and J. Vogt, Struktur der Antiken Sklavenknege," Journal of Roman Studies, XLVIII (1958), 164-70. Elsewhere, however, Brunt has been more cautious, e.g., his "Work and Slavery," in The Romans, ed. by J. P. V. D. Balsdon (New York, 1965), pp. 177-91.
- 54 Jones, "Slavery," pp. 193, 197 pictures the supply of slaves as having reached a nadir in the second century A.D. due to a dwindling of external supplies and a virtual cessation of piracy and brigandage within the empire. White, Roman Farming, pp. 369-70, however, assembles evidence that indicates that kidnapping and its concomitants, piracy and brigandage, were still problems as late as the time of Hadrian. White, ibid., p. 370 and Brunt, "Review of Westermann," p. 166 are now dubious of older assertions such as that of Jones that slave supplies shrank during the second century.
- 55 Gordon, pp. 105-106.
- 56 Many ancient historians have been influenced by "revisionist" historians of slave systems in the ante-bellum South. "Cliometricians" such as Alfred H. Conrad and John R. Meyer, The Economics of Slavery and Other Essays (Chicago, 1964) have made a good case that plantation slavery could pay handsome profits although their further assertion that slavery did not retard overall economic growth has aroused much debate. Demographers such as Philip D. Curtin, The Atlantic Slave Trade: A Census (Madison, 1969) have shown that in many areas of the New World, African populations were able to maintain themselves or even augment their numbers through natural increase, the prime example being the United States. In much of the Western Hemisphere, however, it can be shown that slave populations enjoyed rates of natural increase only when plantation systems had fallen into economic decrepitude and "slaves" were in fact allowed to assume a status similar to that of tenant farmers. Otherwise, plantation systems devoured their human chattels at an alarming rate, on which see Sidney W. Mintz, "The Caribbean Region," in Slavery, Colonialism, and Racism, ed. by Sidney W. Mintz (New York, 1974), pp. 49, 60; Robert Dirks, "Slaves' Holiday," Natural History, LXXXIV (1975), p. 88; Stanley J. Stein, "Brazilian Slavery Examined," in Slavery: A Comparative Perspective; Readings on Slavery from Ancient Times to the Present, ed. by Robin W. Winks (New York, 1972), pp. 119-27; and Marvin Harris, "The Myth of the Friendly Master," in ibid.,

CHAPTER VIII, continued

pp. 128-37. Slave breeding did succeed in the United States, but this was probably due to a nightmarish system of forced conceptions, on which see Richard Sutch, "The Breeding of Slaves for Sale and the Westward Expansion of Slavery, 1850-1860," in Race and Slavery in the Western Hemisphere: Quantitative Studies, ed. by Stanley L. Engermann and Eugene D. Genovese (Princeton, 1975), pp. 173-210. Stanley L. Engermann, "Comments on the Study of Race and Slavery," in ibid., p. 514 emphasizes the atypicality of the United States vis-a-vis the rest of the United States.

- 57 As scholars such as P. A. Brunt, Social Conflicts in the Roman Republic (New York, 1971), in toto and Ramsey MacMullen, "Peasants during the Principate," in Aufstieg und Niedergang der römischen Welt: Kultur und Geschichte Roms im Spiegel der neueren Forschung, Vol. II: Principat, Part 1, ed. by Hildegard Temporini (Berlin, 1974), pp. 253-61 have ably argued, the agrarian history of the ancient world hinges on the vicissitudes of the free peasantry.
- 58 Far from being a universal evolutionary stage, societies making extensive use of industrial or plantation slavery have been atypical throughout history, the colonial hinterlands of the early modern and modern West and the Graeco-Roman world being the primary examples, a fact now acknowledged even by Marxist scholars. See L. S. Vasil'ev and I. A. Stuchevski, "Three Models for the Origins and Evolution of Precapitalist Societies: On the Problem of the Asiatic Mode of Production," Soviet Studies in History, V (1966-1967), 24-37; I. A. Lentsman, "A Contribution to the Discussion of the Asiatic Mode of Production," Soviet Studies in History, IV (1965-1966), 22-30; and L. V. Danilova, "Controversial Problems of the Theory of Precapitalist Societies," Soviet Anthropology and Archeology, IX (1970-1971), 269-328. See further M. I. Finley, "Between Slavery and Freedom," Comparative Studies in Society and History, VI (1964), 233-49.
- 59 E.g., W. L. Westermann, "Industrial Slavery in Roman Italy," Journal of Economic History, II (1942), 149-63.
- 60 The fundamental research on the economics of Roman slavery remains the two articles by Cedric A. Yeo, "The Development of the Roman Plantation and Marketing of Farm Products," Finanzarchiv, N.F., XIII (1952), 321-42 and "The Economics of Roman and American Slavery," Finanzarchiv, N.F., XIII (1952), 445-85. The latter article contains extensive discussion of the importance of trimming the labor force to a level that could be kept busy throughout the year. See Cato the Elder, De agricultura, 23-53, where an elaborate work schedule is given designed to keep a skeleton staff of slaves occupied throughout the year.

CHAPTER VIII, continued

- 61 Cato, ibid., never mentions the harvesting of grapes, olives, or cereals. Ernest Brehaut, "Introduction," in Cato the Censor on Farming, trans. by Ernest Brehaut (New York, 1933), pp. xxxvii-xxxviii argues that these tasks were omitted from Cato's slave overseers' manual since these tasks, which would have overtaxed the skeleton villa work crews, were contracted out to peasant laborers. See further W. E. Heitland, Agricola: A Study of Agriculture and Rural Life in the Greco-Roman World from the Point of View of Labour (Cambridge, 1921), p. 157.
- 62 Brilliantly enunciated in A. V. Chayanov, On the Theory of Peasant Economy, trans. and ed. by Daniel Thorner, Basile Kerblaus, and R. E. F. Smith (Homewood, Ill., 1966). See further Claude Meillassoux, "From Reproduction to Production: A Marxist Approach to Economic Anthropology," Economy and Society, I (1972), 93-105.
- 63 Fritz Heichelheim and Cedric A. Yeo, A History of the Roman People (Englewood Cliffs, N.J., 1962), p. 162; White, Roman Farming, p. 374; G. E. M. de Ste. Croix, "Slavery: A Review of William L. Westermann, The Slave Systems of Greek and Roman Antiquity," The Classical Review, N.S., VII (1957), pp. 57-59; and Max Weber, The Theory of Social and Economic Organization, trans. by A. M. Henderson and Talcott Parsons (New York, 1947), pp. 276-77.
- 64 Cato, De ag., 10. 4 and 11. 1 gives recommended storage facilities for staple crops such as olive and wine as well as for cereals. Since the storage space is given in standard amphorae, conversion into modern volumetric or weight units is possible (e.g., see the convenient conversion table in Brehaut, "Introduction," p. xlv). Cato clearly envisioned holding the equivalent of five vintages in inventory, almost definitely in an effort to secure the best market price. See Richard Duncan-Jones, The Economy of the Roman Empire: Quantitative Studies (Cambridge, 1974), p. 38, who argues that the inventory systems described by Cato were also typical of later periods. Yeo, "Economics of Roman and American Slavery," pp. 447, 454 describes several excavated villas from imperial Italy whose inventory capacities were as large, and in some cases much larger, than those recommended by Cato.
- 65 From information in Cato, De ag., 10. 4; 11. 1-2; 54; 56; and 60, it is apparent that Cato kept grain on hand far in excess of the needs of the villa staff and its livestock. Elsewhere, ibid., 2. 7, Cato suggests that excess grain should be auctioned off if the prices warrant and in 5. 3-4 cautions villa foremen never to give credit, charity, or favorable terms to anyone off the estate without the master's permission. See the discussion in Yeo, "Economics," p. 450. Duncan-Jones, p. 38 notes the continuing

CHAPTER VIII, continued

interest by Roman agronomists in grain storage pits and silos that allowed for longer storage times, e.g., Columella, Res Rustica, I, 6. 12-16 and II, 20. 5-6. Ibid., I, 8. 3 also makes explicit mention of trafficking in livestock and other goods by overseers, who often pocketed some the profits behind the masters' backs. That grain prices fluctuated through the year is well attested in sources such as Cicero, Verr., II, 3. 82-92. Duncan-Jones, pp. 38, 146, 252 assembles a number of such references to seasonal price differentials from the Republic down through the imperial period, and he concludes that normal annual price variations were about sevenfold, with variations of twentyfold or more during famines. Ibid., p. 38 suggests that grain profiteering on the local market was a prevalent feature of many villa operations. For excellent studies of the impacts on a modern African peasantry of such profiteering in subsistence goods, see Polly Hill, Studies in Rural Capitalism in West Africa (Cambridge, 1970) and Rural Hausa: A Village and A Setting (Cambridge, 1972).

- 66 Brunt, Social Conflicts, p. 35 concludes that by the late republican period, the average Italian peasant household could expect to make little more than food for the family's table off their own land, leaving "no fodder for animals, no fruits, no margin for sales out of which other necessities could be obtained." Ibid., p. 36 concludes that extra income had to come from supplementary day labor, the leasing of extra land, and income from rights of pasture on public lands. Even these sources only sufficed to keep the peasantry at a bare subsistence level.
- 67 E.g., Yeo, "Economics," pp. 471-85.
- 68 Heitland, Agriicola, p. 156.
- 69 E.g., M. I. Finley, "Technological Innovation and Economic Progress in the Ancient World," Economic History Review, 2nd ser., XVIII (1965), 29-45.
- 70 White, Roman Farming, pp. 347-48 notes how estate owners often treated contracted day laborers in a more cruel and miserly fashion than they did their own slaves. Yeo, "Economics," p. 465 notes that many of the jobs left to free peasants, e.g., heavy spading, ditching, or the removal of large stones and debris from fields, were the hardest, the nastiest, and the most hazardous types of work. The stigma attached to manual labor in the ancient world is hardly surprising since the free peasantry was frequently placed in a role more obviously denigrating than that of a slave.
- 71 de Ste. Croix, "Slavery," p. 58; E. A. Thompson, "Slavery in Early Germany," in Slavery in Classical Antiquity: Views and Controversies,

CHAPTER VIII, continued

- ed. by M. I. Finley (New York, 1968), pp. 191-203; and M. I. Finley, "The Black Sea and Danubian Regions and the Slave Trade in Antiquity," Klio, XL (1962), pp. 57-59.
- 72 The following discussion draws on material contained in Claude Meillassoux, "Introduction," in The Development of Indigenous Trade and Markets in West Africa, ed. by Claude Meillassoux (London 1971), pp. 49-86; Emmanuel Terray, "Long-distance Exchange and the Formation of the State: The Case of the Abron Kingdom of Gyamon," Economy and Society, III (1974), 315-45; Jack Goody, Technology, Tradition and the State in Africa (London, 1971); and Phyllis M. Martin, The External Trade of the Loango Coast, 1576-1870: The Effects of Changing Commercial Relations on the Vili Kingdom of Loango (Oxford, 1972).
- 73 de Ste. Croix, "Slavery," p. 58; and Finley, "The Black Sea and Danubian Regions," pp. 57-58. Since such clandestine sources were often subject to official crackdowns, they were, if nothing else, unpredictable.
- 74 See Elman R. Service, Cultural Evolutionism: Theory and Practice (New York, 1971), pp. 75-90.
- 75 Meillassoux, "Introduction," p. 86.
- 76 Goody, Technology, Tradition and the State in Africa, p. 72. Interesting parallels are suggested for the problems of Christian missionaries in early medieval Europe in eliminating the sacrificial slaying and eating of horses.
- 77 Thompson, "Slavery in Early Germany," p. 198 is duly apologetic for the almost "trifling" nature of the references in ancient sources to the slave trade.
- 78 Finley, Aspects of Antiquity: Discoveries and Controversies, pp. 162-76.
- 79 Francis John Byrne, "Tribes and Tribalism in Early Ireland," Eriu, XXII (1971), p. 150; and Nora K. Chadwick, Early Brittany, pp. 183-84.
- 80 William Ridgeway, "Niall 'of the Nine Hostages' in Connection with the Treasure of Trapun Law and Ballinress and the Destruction of Wroxeter, Chester, Caerleon and Caerwent," Journal of Roman Studies, XIV (1924), 123-36.
- 81 E.g., J. W. Sherborne, The Port of Bristol in the Middle Ages (Bristol, 1965), p. 2. The possibility of an ongoing, although

CHAPTER VIII, continued

slowly declining, slave trade serving Gaul to replenish pools of servile labor throughout the Merovingian and Carolingian periods has been suggested by Georges Duby, The Early Growth of the European Economy, pp. 31-33, 39-40. The ongoing importance of the slave trade within Anglo-Saxon England down through the tenth century or so has been stressed by H. P. R. Finberg, The Formation of England, 550-1042 (London, 1974), pp. 61-62, 68, 72, 214-19.

- 82 Ole Klindt-Jensen, Denmark Before the Vikings, trans by Eva Wilson and David Wilson (London, 1957), p. 103; and Palle Lauring, The Land of Tollund Man: The Prehistory and Archaeology of Denmark, trans. by Reginald Spink (London, 1957), pp. 114-15. Rich graves begin to abound during the Roman period from the mid-Elbe and to the east around the shores of the Baltic, regions not noted for their opulence during the pre-Roman Iron Age (see above, chapter VI, note 28). See Hans Juergen Eggers, Der roemische Import in freien Germanien (Hamburg, 1951), pp. 49-51, 67-69, who is hardpressed to find reciprocal trade goods to account for the imported "aristocratic" trappings of these Fuerstengraeben.
- 83 Ramsey MacMullen, "Barbarian Enclaves in the Northern Roman Empire," L'Antiquité Classique, XXXII (1963), 35-44.
- 84 Eggers, Der roemische Import, pp. 67, 76 distinguishes between trade along the frontiers, i.e., Grenzhandel, involving Roman merchants dealing at native emporia, and trade in the interior, i.e., Fernhandel, involving movements of goods by native intermediaries to the bulking centers visited by the Roman traders. Romans may have been in relative ignorance of trading patterns or methods beyond the zone of Grenzhandel, just as early modern European slave dealers were relatively ignorant of the Fernhandel in the interior of West Africa.
- 85 Donncha O'Corrain, Ireland Before the Normans (Dublin, 1972), pp. 45-48; Francis John Byrne, Irish Kings and High Kings (New York, 1973), pp. 272-73; Charles Verlinden, "Slavery," in The New Catholic Encyclopedia (New York, 1967), XIII, 283-84; and ibid., Wo, Wann und Warum gab es einen Grosshandel mit Sklaven waehrend des Mittelalters? (Koelner Vortraege zur Sozial- und Wirtschaftsgeschichte, Vol. XI [Cologne, 1970]).
- 86 Charles Verlinden, L'Esclavage dans Médiévale, Vol. I: Péninsule Ibérique-France (Bruges, 1955), e.g., at p. 715.
- 87 The following discussion draws extensively on Meillassoux, "Introduction," pp. 49-86.

CHAPTER VIII, continued

- 88 Good discussion in Terray, "Long-distance Exchange," pp. 315-45.
- 89 Goody, Technology, Tradition and the State in Africa, in toto.
- 90 Excellent description of such a transformation is found in Martin, The External Trade of the Loango Coast, pp. 160-74.
- 91 Meillassoux, "Introduction," p. 66 notes that military organization may be influenced as much by the means of obtaining arms as by the inherent lethal qualities of the weapons. In note 46 above, it has been emphasized that from late Bronze Age times, metallurgical production in much of temperate Europe began to pale before the output of technologically advanced Mediterranean sources of supply. By the Roman period, this could have led to a relative scarcity of weapons and other armaments. This could have encouraged the emergence of differential patterns of access to imported war equipment and to differential patterns in the disposal of war equipment and booty accruing from internal raiding. These factors would have encouraged the emergence of tightly specialized warrior elites.
- 92 Meillassoux, ibid., p. 55 notes the utility of moving slaves considerable distances from their points of capture to lessen the possibilities of escape and to render the slaves "ethnically" distinct. thus lessening their chances of rapidly merging into some familial status or role. Only in this way could slave labor be manipulated more effectively than ordinary kinship sodalities. Yeo, "Economics," pp. 470-71, 478 emphasizes the difficulties of using slaves in their most efficient and controllable form, i.e, continuously worked gangs of uniform size, in agricultural systems centered on grains or on a large variety of crops or tasks where long idle spells or the need to shift labor parties of varying sizes from one task to another precluded the use of massed gangs. Vasil'ev and Stuchevski, p. 27 note how the relatively dispersed settlement patterns of barbarian temperate Europe, which was, furthermore, an area of cereal cropping and mixed agriculture, made servile status hard to impose as a permanent or hereditary role. Thompson, "Slavery in Early Germany," p. 20 emphasizes the near necessity of an ongoing trade in slaves to help sustain sets of servile statuses. The difficulties in institutionalizing sets of servile statuses among indigenous population groups in temperate Europe may have been a spur in encouraging levels of militarism nad concentrations of power centering on warrior elites far in excess of that simply needed to maintain a slave trade aimed soley at external, Mediterranean markets.
- 93 Such have been the conclusions of medievalists such as Georges Duby, e.g., his The Early Growth of the European Economy, pp. 5-30.

CHAPTER VIII, continued

- 94 The ecological foundations of high husbandry are emphasized by Kerridge, The Agricultural Revolution, p. 39. The subsidiary role of technology is reflected by noting the levels of capital investment in agriculture, which were no higher in early modern England during the heyday of high husbandry than during the high middle ages. Cf. R. H. Hilton, "Rent and Capital Formation in Feudal Society," in Second International Conference of Economic History (Paris, 1965), II, 33-68 and J. Z. Titow, English Rural Society, 1200-1350 (New York, 1969), pp. 49-50 for the medieval period with B. A. Holderness, "Capital Formation in Agriculture," in Aspects of Capital Investment in Great Britain 1750-1850: A Preliminary Survey, ed. by J. P. P. Higgins and Sidney Pollard (London, 1971), pp. 159-83.
- 95 Kerridge, The Agricultural Revolution, p. 208. The explanation being that the more ecologically sound landscapes of high husbandry could provide yields one hundred or more percent higher than were possible under an ecologically degradative regime of open field husbandry.
- 96 J. Z. Titow, Winchester Yields: A Study in Medieval Agricultural Productivity (Cambridge, 1972), esp. at pp. 29-32.
- 97 J. Z. Titow, "Some Differences between Manors and their Effects on the Peasantry in the Thirteenth Century," in Essays in Agrarian History, ed. by W. E. Minchinton (Newton Abbot, 1968), I, 39-51.
- 98 Here I am adopting a phrase used by Immanuel Wallerstein, The Modern World System to describe the political and scio-economic taxonomy of the modern capitalist world economy. The world system of antiquity was less geographically universal and its divisions of labor less ordered by economic considerations than with the modern world system, but a framework for the ancient world more inclusive than the separate compartments of the empire or the external barbarians would seem useful for a wide range of problems.
- 99 Esp. in the case of special military contingents in Egypt and in Mesopotamia which were placed under equestrian officers and split off from the usual control by provincial governors. For the evolution of these practices through the Severan dynasty, see Parker, The Roman Legions, pp. 164-68. The Severan reforms, which presaged the civil and military reorganizations of Diocletian and Constantine, are also discussed in H. M. D. Parker, A History of the Roman World from A.D. 138 to 337 (London, 1935), pp. 84, 272-73.
- 100 Pavel Oliva, Pannonia and the Onset of Crisis in the Roman Empire, trans. by Iris Urwin (Prague, 1962), pp. 110-12.

CHAPTER VIII, continued

- 101 A. H. M. Jones, The Late Roman Empire, 284-602: A Social, Economic and Administrative Survey (Norman, 1964), I, 448-69 and II, 1053-58.
- 102 The magnitude of internal banditry and rebellion is explored in E. A. Thompson, "Peasant Revolts in Late Roman Gaul and Spain," Past and Present, No. 2 (1952), 11-23.
- 103 R. M. Butler, "Late Roman Town Walls in Gaul," Archaeological Journal, CXVI (1959), 25-50, whose conclusions are applicable to most of the continental provinces in the western empire.
- 104 Mann, "Frontiers of the Principate," p. 520 criticizes the orderliness implied by this commonly used scholarly euphemism. The late Roman "frontier in depth" was in fact an exercise in chaotic expediency.
- 105 Dimitri Obolensky, The Byzantine Commonwealth: Eastern Europe, 500-1453 (New York, 1971), esp. pp. 69-133. Comparative insights on the insidious effectiveness of such indirect divide and conquer tactics are suggested in Robert McC. Adams and Hans J. Nissen, The Uruk Countryside: The Natural Setting of Urban Societies (Chicago, 1972), pp. 68-93, where Adams describes the plight of the Marsh Arabs of the lower Tigris-Euphrates drainage under the Ottoman Empire and the modern Iraqi government.
- 106 J. N. L. Myres, Anglo-Saxon Pottery and the Settlement of England (Oxford, 1969), p. 22. Wenskus, Stammesbildung und Verfassung, pp. 429-57 coins a variety of phrases to highlight the ephemeral and mongrel nature of most early Germanic tribal groupings.
- 107 The usefully prosaic equivalent for the Germanic comitatus used by E. A. Thompson in his The Early Germans (Oxford, 1965).
- 108 The pervasive impact of Roman notions of empire on early medieval notions of kingship and kingdom have recently been stressed by Herwig Wolfram, "The Shaping of the Early Medieval Kingdom," Viator, I (1970), 1-20. My particular thanks to Mr. John Fowler, whose notion of the importance of imperial ideology in stimulating perennial mismatches of power and authority relationships in early medieval Europe suggests some of the more crucial elements needed for a comparative model of feudal societies.

CHAPTER IX

- 1 Nicolas Georgescu-Roegen, The Entropy Law and the Economic Process (Cambridge, Mass., 1971), esp. at pp. 237-75, 306-15, whose concept of "in-series" and "in-line" production forms the basis for the following contrast between craft and factory production. See further Nicolas Georgescu-Roegen, "Process in Farming Versus Process in Manufacturing: A Problem of Balanced Development," in Economic Problems of Agriculture in Industrial Societies, ed. by Ugo Papi and Charles Nunn (New York, 1969), pp. 497-533.
- 2 For examples of the considerable mathematical precision that management decision can attain given readily auditable production processes, see Barry Shore, Operations Management (New York), esp. pp. 392-431.
- 3 Simon, Sciences of the Artificial, p. 64.

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