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Author(s): Bruce D. Smith

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## Low-Level Food Production

Bruce D. Smith<sup>1</sup>

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*Societies with low-level food production economies occupy the vast and diverse middle ground between hunting–fishing–foraging and agriculture. Efforts by Ford, Harris, Rindos, Zvelebil, and others to characterize this “in-between” territory are discussed, and a new conceptual framework is proposed. Domestication, the central landmark of this middle ground, is situated well away from the boundaries with hunting–gathering and agriculture, and separates low-level food production economies into two broad categories. Key issues and questions concerning societies with low-level food production, both with and without domesticates, are discussed. Hunter–gatherer and agriculture boundary zones on either side of the middle ground are considered, as are the developmental pathways that traverse them.*

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**KEY WORDS:** food production; domestication; origins of agriculture; subsistence economy.

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### INTRODUCTION

The transition from hunting and gathering to an agricultural way of life has long been recognized as a major turning point in human history. Not surprisingly, this “Neolithic revolution” continues to represent a very active and expanding general area of research in archaeology. Efforts to gain a better understanding of this basic and far-reaching transformation, however, continue to be hampered by poorly developed conceptual frameworks of the “middle ground”—the definitional and developmental “no-man’s land” that stretches between hunter–gatherer–foragers, with economies based exclusively on wild plants and animals, on one side, and agriculturalists, who strongly depend on domesticated species as food sources, on the other. The Neolithic revolution is often viewed as the successful developmental journey made by some human societies across this intervening middle ground from a hunting and gathering way of life to one largely dependent on the management and

<sup>1</sup>Department of Anthropology, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560; e-mail: smith.bruce@nmnh.si.edu.

production of domesticated plants and animals. This territory between hunting–gathering and agriculture is turning out to be surprisingly large and quite diverse; it has also proven to be quite difficult to consistently describe in even the simplest conceptual or developmental terms (Smith, 1998b). You could say that it has not been easy to map and understand its various categorical regions, to trace the developmental routes that traverse them, or indeed to grasp the relationships between these regions and routes.

### THE DUALISTIC EPISTEMOLOGY

Before looking at the different regions and developmental routes of this middle ground between hunter–gatherers and agriculturalists, it is worthwhile to ask if this “in-between” territory even exists. Many researchers have employed a tidy either–or, cooked or raw, conceptual dichotomy and have classed present-day and past human societies as either hunter–gatherers or agriculturalists, with no intervening options. Hunn and Williams, for example, documented a dramatic bimodal distribution of relative dependence on agriculture in a sample of 200 societies drawn from Murdock’s *Ethnographic Atlas*, with the “gap between the extremes” (Hunn and Williams, 1982, p. 5) reflecting a very low frequency of societies having a 5–45% reliance on agriculture (Fig. 1). One might draw the conclusion from this bimodal distribution that few viable long-term subsistence solutions exist between hunting and gathering on one side, and agriculture on the other, that they are “mutually incompatible ways of life” (Zvelebil, 1986a, p. 12) and that the developmental transition between the two was both radical and rapid (Hunn and

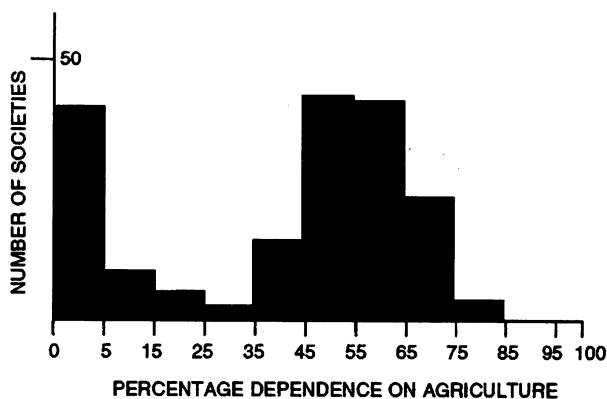


Fig. 1. The relative dependence on agriculture of 200 societies drawn from Murdock’s *Ethnographic Atlas* (Murdock, 1967). Redrawn from Hunn and Williams, 1982, Figure 3 (see also Zvelebil, 1996, Figure 18.2).

Williams, 1982, pp. 5, 6; Zvelebil, 1996, pp. 326, 327). Other scholars, in general, disagree with such either-or approaches, however, arguing that such “polarizing categories . . . tend to obfuscate the analysis of subsistence” (Ellen, 1988, p. 127) and highlighting “the recognition that many societies, both ethnographic and prehistoric, filled the hitherto ill-defined gap between hunter-gatherers and farmers through a close management of their resources” (Zvelebil, 1995, p. 80). The dualistic perspective, however, continues to be appealing, particularly for archaeologists trying to explain, with very limited relevant information, the developmental pathway(s) leading from the land of hunter-gatherers to that of agriculture. As early as the 1930s, V. Gordon Childe obliquely commented on this assumption of an essential duality and a rapid transition between hunting-gathering and agriculture: “The neolithic revolution . . . was the climax of a long process. It has to be presented as a single event because archaeology can only recognize the result: the several steps leading up thereto are beyond the range of direct observation” (Childe, 1951, p. 87).

Accompanying this central assumption of duality are a number of implicit correlates that have shaped, to a greater or lesser degree, widespread perceptions of the intervening conceptual and/or developmental territory (if any) that lies between hunter-gatherers and agriculture. Many scholars see the boundary between hunter-gatherers and agriculturalists as a thin line. Hunter-gatherer-foragers and agriculturalists are considered to be not very far apart developmentally. This thin boundary is also often considered to be a one-way membrane. For those crossing over to agriculture, there is no turning back. According to another correlate, the question of how hunter-gatherer societies transformed themselves into agriculturalists can and should be viewed in *universalist* terms; a single explanation should be sought that universally applies to all cases (e.g., Hayden, 1995, p. 294). According to another key correlate, hunter-gatherers and agriculturalists should be considered as steady-state situations, with the transition between them being necessarily rapid. Between these two generally stable and successful solutions or adaptations, however, there are no intervening solutions—only societies in transition from one steady state to another. Thus the examples of societies, past or present-day, that do not fall in either of these two steady-state categories must be few in number (so let’s not look too hard for them). These few anomalies, these categorical misfits, must either represent societies that are actually in the short-term process of transformation or be stunted transitional failures of some sort that somehow stalled or stumbled in midstride, between the “solution” states of hunting-gathering and agriculture. Is this true? Or as Ellen warns in his discussion of the in-between Nuaulu of Seram, is it “dangerous to think of them (or any other similar group) as if they occupied some classificatory (and by implication evolutionary) space . . . transitional between foraging and agriculture” (Ellen, 1988, p. 127).

Taken together, the central conceptual dichotomy and its various correlates form an overarching dualistic epistemology. As a result of this epistemology’s influence, scholars will attempt to categorically relegate or displace to one side

or the other any anomalous in-between societies, both past and present-day, that neither rely exclusively on wild species nor strongly depend on domesticated species. This is often accomplished with the use of adjectival boundary extensions such as “complex” hunter–gatherers, and “incipient” agriculturalists. In this way, the territory between hunting–gathering and agriculture is effectively depopulated and reduced in size until it becomes a thin boundary line.

Over the past several decades, for example, considerable attention has been paid to developing the “affluent forager paradigm” (Zvelebil, 1986a, p. 8). This has involved exploring and defining the upper end of the range of cultural complexity on the hunter–gatherer side of the thin boundary line, and in identifying and characterizing post-Pleistocene or “postglacial” (Zvelebil, 1986b, p. 173) hunter–gatherer societies that are either “affluent” in terms of increased security and wealth or “complex” in terms of socioeconomic organization and technology or both (Price and Brown, 1985; Zvelebil, 1986a, p. 8, 1993, p. 148, 1995, p. 81). Even though much has been made of the substantial degree to which these affluent and complex postglacial groups are quantitatively and qualitatively distinct from the more pedestrian foraging societies that relied exclusively on wild species of plants and animals from the late Pleistocene back in time for more than a million years, they are still, in the end, lumped in with them as hunter–gatherers. This, in effect, serves to conceptually shift the hunter–gatherer boundary toward agriculture and to absorb the intermediate, neither–nor societies of the middle ground into the land of (complex) hunter–gatherers.

Bender, for example, identifies the archaeological (Middle Woodland, ca. 200 B.C.–A.D. 200) Hopewell societies of eastern North America as a paragon of hunter–gatherer cultural complexity. Hopewell societies are confidently placed on the hunter–gatherer side of a dichotomous boundary line, even though they “display social and ideological features usually attributed to farmers” (Bender, 1985, p. 21). She does hedge somewhat, however, in the classification of Hopewell as hunter–gatherers by suggesting that “perhaps they are farmers, but in a surreptitious and disappointingly invisible way” (Bender, 1985, p. 21). Even as Bender was presenting Hopewell as (complex) hunter–gatherers, however, other researchers had already clearly established that Hopewell societies were far from surreptitious in their farming efforts and that evidence for their cultivation of maize (*Zea mays*) and at least seven different indigenous seed crops (four of which were domesticated) was neither disappointing nor invisible (e.g., Asch and Asch, 1978, 1985; Ford, 1979; Smith, 1984, 1985a,b; Stoltman and Baerreis, 1983). It is more than a little ironic, then, that in the process of attempting to deconstruct one paired set of dualistic conceptual boxes (hunter–gatherers are naturally simple, agriculturalists are culturally complex), Bender was endorsing and reinforcing another, equally reductionist, essentialist, and dichotomous world view that societies are either hunter–gatherer–foragers or farmers.

Hopewell groups are not alone in being absorbed across the boundary line as complex hunter–gatherers. Jomon societies of Japan, for example, often cited

as another example of archaeological complex hunter-gatherers (e.g., Price and Brown, 1985, pp. 10, 11), have been identified as having domesticated crop plants as an integral if minor component of their economy (Crawford, 1992a,b). Present-day Amazon lowland societies having a mixed economy of forest hunting and manioc cultivation also have occasionally been identified as hunter-gatherers (Gould, 1985, p. 433), whereas Northwest Coast societies are often characterized as hunter-gatherers (Ames, 1985), even though recent research indicates that they employed a wide range of management strategies in the cultivation of various root crops (Deur and Turner, submitted). Harlan (1995, pp. 15, 16) characterizes Jomon and Northwest Coast societies as sophisticated and "luxurious" hunter-gatherers, while Zvelebil (1986a, p. 8) lists both Northwest Coast groups and Great Basin Shoshoneans as "complex" hunting-gathering societies. It is thus not at all difficult to find scattered throughout the literature, or within the covers of a single volume, varied examples of scholars positioning the boundary of hunting-gathering so as to include both past and present-day societies that don't comfortably qualify as either hunter-gatherer-foragers or full-scale agriculturalists.

The spread of food production economies across northern Europe provides another interesting perspective on the theoretical hegemony of the dualistic epistemology and its numerous developmental correlates within a context of efforts at processual explication in a single world area. Following a number of other scholars, including Dennell (1985); Price and Gebauer (1992), and Zvelebil (1986a,b, 1993, 1995, 1996), Bogucki (1995) has succinctly profiled and challenged this central assumption of hunter-gatherer/agricultural duality as it has been applied by researchers to the Mesolithic (hunter-gatherer) to Neolithic (agricultural) transition in the region. He argues that such a dualistic perspective—viewing the transition as a shift between two static stages or stable adaptive solutions—may capture the beginning and end points of the process but fails to consider what comes in between, as populations that had previously relied exclusively on wild resources adopt cultivation and animal husbandry. Bogucki further suggests that, by viewing this in-between process of change in a straight-ahead linear sense as leading quickly and irreversibly to agriculture, the dualistic perspective "suppresses consideration of the more interesting period in which this process occurred" (Bogucki, 1995, p. 105). He concludes that, when viewed against the rich and varied backdrop of comparative ethnological data on societies occupying the middle ground between hunting-gathering and agriculture, the static categories of "Mesolithic" and "Neolithic" (and the imbedded dualistic epistemology) begin to fade as useful characterizations of reality: "These terms continue to have utility as chronological markers or technical shorthand, but they obscure the complex shifts in subsistence behavior that must have been repeated in countless different ways around the world throughout the Holocene" (Bogucki, 1995, p. 105).

Fortunately, even though it is easy enough to find evidence of the substantial extent to which the dualistic epistemology continues to obfuscate and hinder consideration of the conceptual and developmental territory that stretches

between hunting–gathering and agriculture, this middle ground is not completely uncharted.

## EXPLORING THE MIDDLE GROUND

Over the past 30 years, a number of scholars with diverse disciplinary and regional perspectives have ventured out in attempts to actually chart and characterize the cultural and developmental landscape of the middle ground rather than to reclassify it out of existence. The most notable efforts in this regard are those of Ford (1985), Harris (1989, 1990, 1996a,b), Higgs (1972, 1975), Hole (1996), Jarman *et al.* (1982); Rindos (1984), Smith (1985a), and Zvelebil (1986a,b, 1993, 1994, 1995, 1996). None of these researchers seek out and document in detail any specific societies that occupy this neither–nor territory. Rather, they focus on identifying and defining categories of human–plant and human–animal interaction that could be considered as the characteristic defining attributes of such middle-ground societies (e.g., Figs. 2–5)—as well as the developmental pathways that cross it (e.g., Fig. 6). The various categories of interaction considered form a continuum of increasing human intervention or involvement in the life cycle of target species—a continuum that conceptually encompasses the landscape that lies between hunting–gathering and agriculture. This “behavior-pattern” scale of inquiry has several obvious advantages over targeted consideration of particular societies. First, when considered in isolation, such examples of human intervention in the life cycle of plants and animals need not be drawn only from the limited pool of potential neither–nor societies but from a wider range of groups. Secondly, such general categories of human patterns of intervention can, in turn, be used

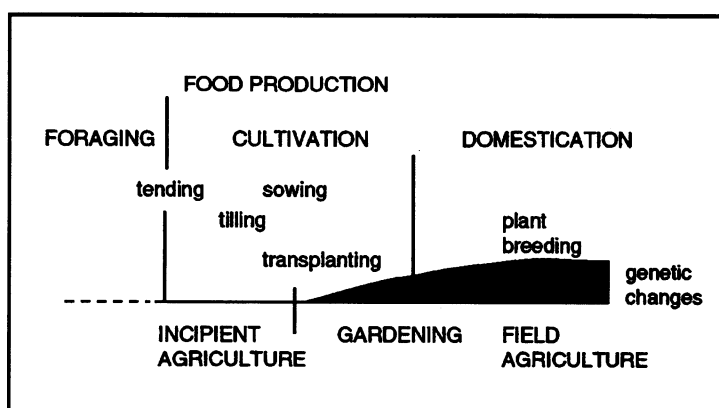


Fig. 2. Ford's stages and methods of plant food production. Redrawn from Ford, 1985, Figure 1.1.

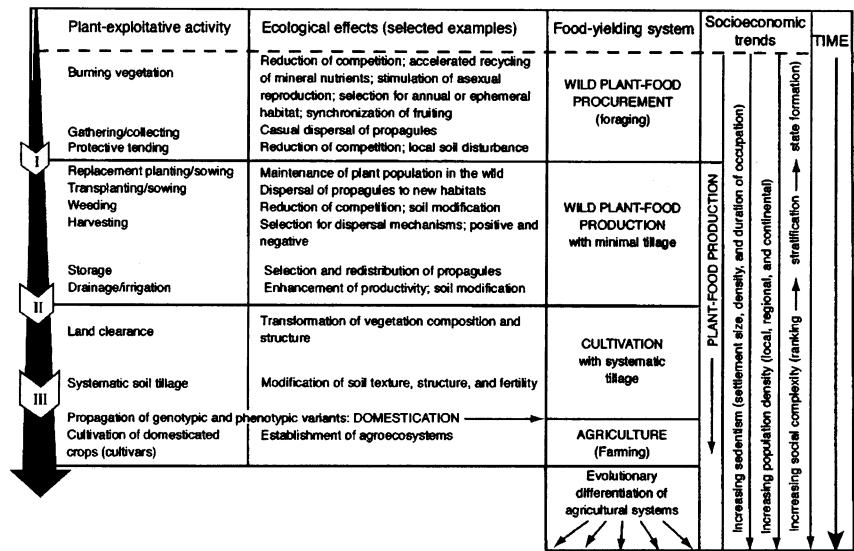


Fig. 3. Harris' classificatory and evolutionary model of plant-food yielding systems. Redrawn from Harris, 1989, Figure 1.1.

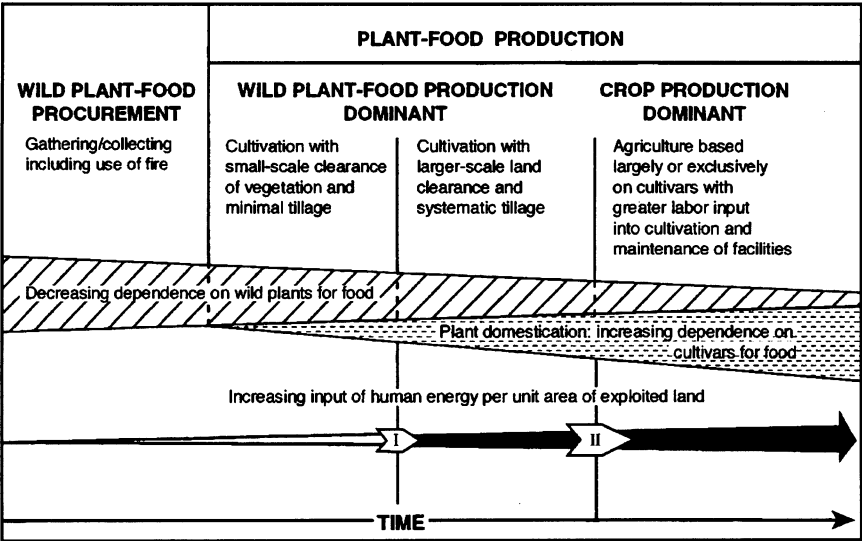


Fig. 4. Harris' evolutionary classification of systems of plant exploitation. Redrawn from Harris, 1996b, Figure 15.1.



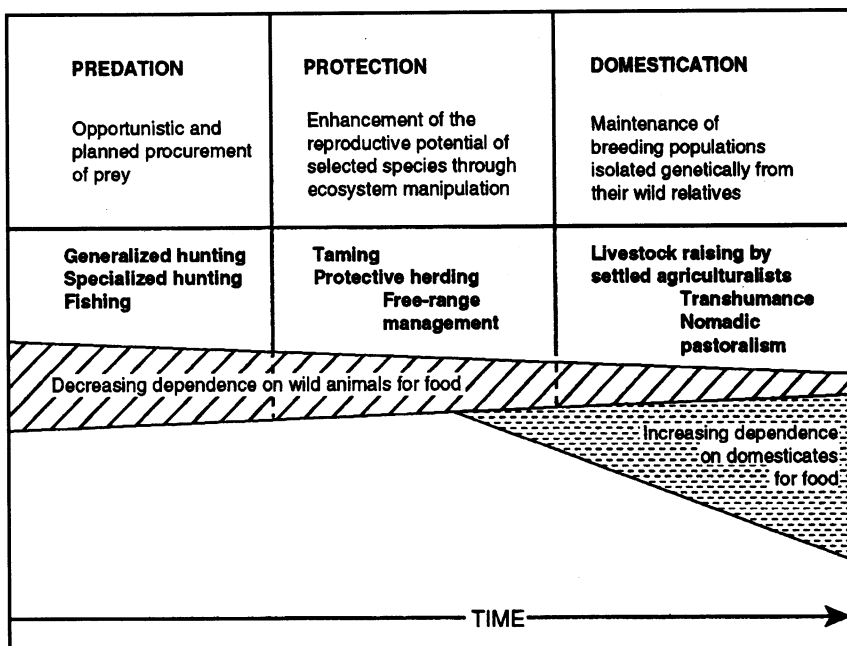


Fig. 5. Harris' evolutionary classification of systems of animal exploitation. Redrawn from Harris, 1996b, Figure 15.2.

to construct an abstract template for profiling and positioning particular societies within the middle ground between hunter-gatherers and agriculture.

This middle ground is not an easy landscape to traverse, nor is it a simple matter to reconcile the conceptual mapping efforts of Ford, Harris, Hole, Jarman *et al.*, Rindos, Smith, and Zvelebil, as there is less than complete consistency in the terminology each employs, or even in the meaning they assign to the same term. As a result, it is easy to lose your way, to be "bedeviled by confusion over the meanings attributed to such terms as agriculture, cultivation, domestication, and food production" (Harris, 1989, p. 11):

The published literature on "agricultural origins" is characterized by a confusing multiplicity of terms for the conceptual categories that define our discourse. There is little agreement about what precisely is meant by such terms as agriculture, horticulture, cultivation, domestication and husbandry. This semantic confusion militates against clear thinking about the phenomena we investigate. (Harris, 1996a, p. 3)

The debilitating absence of uniform standards of meaning is amply demonstrated by the extent to which scholars are repeatedly forced not only to define their usage of terms, but also to explain how they equate with the terminology employed by other scholars (e.g., Zvelebil, 1995, pp. 82–88).

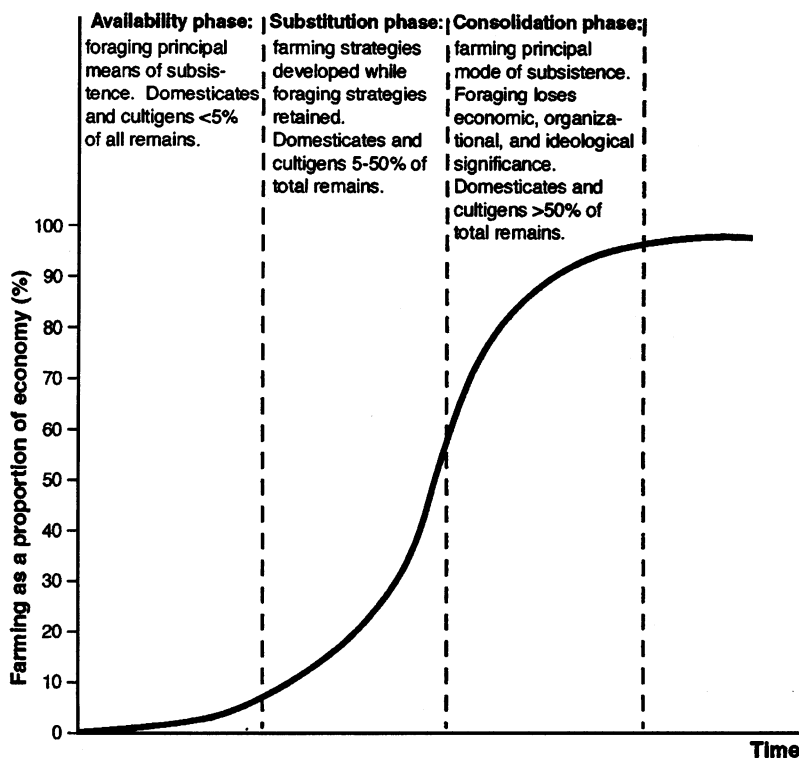


Fig. 6. Zvelebil's three-stage availability model of the transition to farming. Redrawn from Zvelebil, 1996, Figure 18.1.

This is particularly true in regard to the terminology of partition and boundary. In the first paragraph of this article I offered seemingly straightforward common-sense boundary definitions for both hunter-gatherers—"economies based exclusively on wild plants and animals," and agriculturalists—"strongly dependent on domesticated species as food sources." But when these boundary conditions are considered more closely, a number of more complex and elusive questions come into clearer focus. On one side of the middle ground, for example, along the boundary line for agriculturalists, what exactly is meant by "strongly dependent" on domesticates? Should perhaps a consistent annual caloric budget reliance on domesticates of, say, 40, 50, or 60% be the dividing line between nonagriculturalists and agriculturalists, or should some other minimal qualification for agricultural status be employed? Rindos offers little advice, stating only that "the common-sense definition of agricultural subsistence is a dependence upon domesticated plants for a substantial part of the diet" (Rindos, 1984, p. 236). Similarly, Harris (1996b, p. 446) marks the boundary of agriculture as "denoted when domesticated plants (cultivars) are the main or exclusive components of systems of crop

production . . . and when more human labor is invested in cultivation and the maintenance of agricultural facilities.” In his consideration of the transition to farming in the circum-Baltic region, Zvelebil places the agricultural border—“the shift to full dependence on agriculture”—at 50% reliance on domesticates; in his “substitution” phase or stage, domesticates comprise less than 50% of faunal assemblages on a regional scale, and in the subsequent “consolidation” phase, domesticates constitute 50–100% of regional-scale faunal samples (Zvelebil, 1996, p. 325). Whether the agricultural boundary is drawn as a specific “percentage contribution of domesticates” line, or defined as a relatively broad clinal zone of transition (e.g., 40–60%), it is clear that placement of societies relative to this border will not be a simple task. The limitations of the archaeological record, for example, place severe constraints on Zvelebil, who is forced to define the regional-scale boundary line on the basis of faunal assemblages alone. A number of meticulous subsistence studies of present-day societies situated in the general vicinity of the agricultural border zone serve to further underscore the definitional difficulties inherent in drawing the boundary of “agriculture.” Ellen’s fine-grain caloric intake analysis of the Nuaulu, a population of around 600 people situated along the south coast of central Seram, for example, calls into question both the difficulties in drawing and the relative value of a hard and fast boundary line or zone. Palm sago (*Metroxylon*) dominates the Nuaulu diet, contributing 63% of their entire energy intake, with 54% of the sago-derived calories coming from naturally regenerating (nondomesticated) forest plants and 46% harvested from tended sago groves. The sago in tended groves can “best be described as being managed minimally though not obviously domesticated, with technical practices which are more comfortably described as ‘well husbanded collecting’ rather than ‘agriculture’” (Ellen, 1988, p. 127). This lowland rainforest society would thus appear to comfortably and ambiguously straddle the hypothetical 40–60% agricultural boundary zone mentioned above. Overall, 40% of their daily calories come from wild resources (120 species of wild animals, 48 species of wild plants), 30% from domesticated crops, with the remaining 30% derived from cultivated sago groves. If the sago groves were composed of domesticated plants, then the Nuaulu would clearly fall on the agricultural side of the border, with 70% caloric reliance on domesticates. If on the other hand, the tended sago were wild, the Nuaulu could just as comfortably be labeled as nonagriculturalists, with only 30% of their calories coming from domesticates. The tended sago, however, would appear to be neither wild nor domesticated, but something in-between, leaving the Nuaulu in a wonderful categorical limbo and also underscoring the difficulties in establishing a universally applicable and easily drawn agricultural boundary with any confidence or clarity.

The complexities inherent in attempting to place the Nuaulu in relation to an agricultural boundary line also highlight several other related questions. As one approaches agriculture, moving across the developmental and conceptual landscape of the middle ground toward the agricultural border, is there any sort of

“natural” boundary that can be seen, perhaps demarcated by a zone on either side that is devoid of examples? Or, on the other hand, as you approach the agricultural transition zone, is the landscape tightly packed with societies having gradually increasing, clinal reliance on domesticates, making agricultural boundary definition a more arbitrary and artificial affair? In addition, do potential boundary definitions for agriculture, either natural or artificial, exist that are broadly applicable, in developmental or simple descriptive terms, to both past (archaeological) and present-day societies? An even more basic question raised by the Nuauulu and their tended groves of sago, in relation to this minimal qualification or boundary definition for agriculture, centers on the term “domesticate.” What exactly distinguishes domesticated plants and animals from their wild cousins, and from entities and interactions that exist in a not-wild, yet not-domesticated realm between wild and domesticated?

Interestingly, if we turn in the opposite direction and approach the hunter-gatherer boundary line along the other side of the middle ground, the same set of questions again come into focus, in mirror image. Is the hunter-gatherer boundary natural or artificial? Is the border zone empty or crowded and clinal? Are there boundary markers that apply broadly, in descriptive and developmental terms, to both archaeological and present-day situations? And of central importance, imbedded in the boundary condition for hunter-gatherers—that they rely exclusively on wild plants and animals—is the question of what exactly distinguishes “wild” from “nonwild”? To what extent does nonwild equate with domesticated, and what range of other categories exist between wild and domesticated? These elusive and complex mirror-image sets of questions that arise as one attempts to approach and characterize the boundary zones of hunting-gathering and agriculture (and thus define what lies between) highlight the extent to which domestication dominates conceptualizations of the middle ground. Once defined, “domestication” and “domesticates” provide the key feature of this neither-nor landscape from which intrepid travelers can orient themselves. As might be expected, Ford, Harris, Hole, Zvelebil, and other explorers have defined and expanded the application of the term “domestication” in different ways and situated the concept differently in their interpretation of the intermediate landscape that stretches from hunting and gathering to agriculture. From a dualistic perspective, in which only a thin line separates hunting and gathering from agriculture, and there is no intervening territory, domestication, of course, was situated right on and in large measure defined the boundary line between the two. Hunter-gatherers had no domesticates, and any societies with domesticates had agriculture. As scholars began to recognize the existence of a conceptual territory between hunter-gatherers and agriculturalists, their use of domestication as a boundary marker changed.

In his 1989 study, for example, Harris placed domestication squarely on the border of agriculture (Harris, 1989, Figure 1.1) (Fig. 2). In doing so, he retained the conventional partitions that hunter-gatherers have no domesticates and any societies with domesticates have agriculture. At the same time, however, he recognized

a broad middle ground of societies that are nonagricultural, yet are not hunter-gatherers, since they do not rely exclusively on wild species of plants and animals. Harris continued to equate domestication with agriculture in a publication that appeared the following year: "the distinction between cultivation and agriculture rests on the presence or absence of domesticated crops . . . therefore, if it can be shown archaeologically that the plant remains recovered at a given site are from domesticated taxa . . . then there is a secure basis for inferring that agriculture was practiced in the vicinity of the site" (Harris, 1990, p. 13, Figure 1) (Fig. 3). In the figures of his 1996 articles, however, Harris shifts the placement of initial domestication of plants from one side of the middle ground to the other, relocating it from the border of agriculture to the boundary of hunter-gatherer economies (Harris, 1996a, Table 1.1, 1996b, Figure. 15.1) (Fig. 4).

Accompanying this relocation of domestication, Harris redefines "agriculture" in a manner that is close to that offered at the opening of this chapter: "agriculture is denoted when domesticated plants . . . are the main or exclusive components of systems of crop production . . . and when more human labor is invested in cultivation and the maintenance of agricultural facilities (field systems, tools, storage, etc.)" (Harris, 1996a, p. 446). With this graphic relocation of domestication from one border to another, Harris, on the one hand, keeps domesticates as a boundary marker for hunter-gatherers (a society is no longer on the hunter-gatherer side of the line if domesticates are present) while at the same time acknowledging that there is a broad and diverse middle ground where societies have some reliance on domesticates yet are not agriculturalists. In relocating domestication of plants to the hunter-gatherer border, at least in the figures of his 1996 articles, Harris also would appear to bar from the middle ground any societies that lack domesticated plants. Without such domesticates they would be placed on the hunter-gatherer side of the line. In his discussion of the landscape between hunter-gatherers and agriculturalists in his 1996 articles, however, Harris makes it very clear that there is considerable territory allocated to societies that are not hunter-gatherers yet lack domesticated plants (Harris, 1996b, p. 446). Similarly, in his consideration of animals, Harris clearly places domestication at a distance from the hunter-gatherer border, rather than on it (Harris, 1996b, Figure 15.2) (Fig. 5). As a result, even though several of his "maps" of the middle ground suggest otherwise, I think it is safe to conclude that by 1996 Harris had decided that domestication of plants and animals was not situated on the boundary line of either agriculture or hunting-gathering, but rather was located out on the broad landscape between the two.

Ford, too, places domestication between the boundaries of hunting-gathering and agriculture (Ford, 1985, Figure 1.1) (Fig. 2), whereas Rindos addresses this issue by defining three different forms of domestication. The first of these, "incidental domestication," encompasses the entire human experience: "domestication has been present, to a greater or lesser extent, in all cultures and at all times"

(Rindos, 1984, p. 258). As defined by Rindos (1984, p. 159), “specialized domestication” involves a range of deliberate human behaviors that alter the general ecology and local environment in ways that place certain species at a distinct advantage (Rindos, 1984, p. 159), whereas “agricultural domestication” is “very close in concept to *domestication* as it has been used in most of the literature” (Rindos, 1984, pp. xv, 164). From his discussion of specialized and agricultural domestication, it is clear that Rindos places both between the borders of hunting–gathering and agriculture, even though the term “agricultural domestication” could easily be assumed (incorrectly) to be a boundary marker for agriculture.

Zvelebil, like Rindos, attaches a range of modifiers to the term “domestication.” Many of these [“full domestication,” “genetic domestication,” “complete domestication” (Zvelebil, 1986b, p. 174); “economic domestication” (Zvelebil, 1993, pp. 151, 157); and “full biological domestication” (Zvelebil, 1995, p. 86)] refer to the generally accepted standard definition of the term (discussed below)—“genetic selection which resulted in the establishment of desired characteristics” (Zvelebil, 1986b, p. 174). The modifiers are necessary in order to differentiate domestication, as generally defined, from a second, less intensive, potentially precursor general category of human interaction with plant and animal resources that he labels as “cultural domestication” (Zvelebil, 1995, p. 98) and “behavioral domestication”—not to be confused with Hodder’s “social,” “conceptual,” or “symbolic” domestication (Zvelebil, 1995, p. 96). Setting aside cultural domestication for later consideration, it is clear that Zvelebil, too, at different times, places (full, complete, economic, genetic, and biological) domestication on both the boundary line of hunter–gatherers relying exclusively on wild resources and the agricultural border, which he recognizes as being separated by a broad middle-ground landscape of richly varied adaptive opportunities. In Figure 1 of his 1993 publication, for example, he places the initial appearance of domesticates on one side of this middle ground, coinciding with and defining the agricultural boundary—the beginning of “agropastoral farming.” In both earlier and later publications, however, in his presentation of “the availability model of the transition to farming” (Fig. 6), Zvelebil places the appearance of domesticates on the other side of the middle ground, at the boundary that separates hunter–gatherer societies of the “availability phase,” those that have not yet adopted any elements of farming, from societies of the “substitution phase,” those having a 5–50% occurrence of domesticates (Zvelebil, 1986a, p. 12, 1996, p. 325). This ambiguity in Zvelebil’s boundary placement of domestication, along with his substantial expansion of the definitional parameters of the term itself, certainly reflects both the limited “marker value” of domesticates in the archaeological record of the Mesolithic of northern Europe and the complexity of his multiscale approach to modeling the forager–farming transformation in the region. More importantly, however, it also indicates that Zvelebil’s interests lie not with simple boundary definitions and “sterile classification” (Price, 1985, p. 360), but with opening up the conceptual–developmental middle ground for

consideration, both regionally (the Mesolithic of northern Europe) and more generally. He consistently presents a tripartite template, with the central category—the middle ground—bounded on one side by agriculturalists (agropastoralists) having a 50% plus reliance on domesticates and on the other by hunter–gatherers relying exclusively on wild plant and animal resources. For Zvelebil, the initial appearance of domesticates is situated somewhere out in this middle ground.

Given that Ford, Harris, Rindos, and Zvelebil all place domestication somewhere between the boundary lines for hunting–gathering and agriculture, we can now turn to a closer consideration of this concept. What exactly is domestication? Where is it located on the conceptual and developmental landscape that stretches between hunting–gathering and agriculture? What does this in-between territory and its border zones actually look like?

### DOMESTICATION AND THE MIDDLE GROUND

Domestication, I would argue, is the single most important and most dominant feature on this landscape that stretches between hunting–gathering and agriculture. It is important not only because it marks a major threshold in human history, but also because it is a clear and constant vantage point and point of reference. Like a massive and sinuous mountain range that runs roughly parallel to the border zones of hunting–gathering and agriculture, it towers over the countryside (Fig. 7), providing a solid platform from which one can view, in the distance, hunting and gathering in one direction and agriculture in the other, and which at the same time is clearly visible across considerable space and time. The visibility of domestication across time is, of course, of considerable importance to scholars interested in documenting and understanding the initial appearance, thousands of years ago, of human societies in different world areas that did not rely exclusively on wild species of plants and animals. And while many if not most of the other categories of human behavior characteristic or diagnostic of societies of the middle ground between hunting–gathering and agriculture are not visible in the archaeological record, evidence for the presence of domesticated plants and animals often is, providing at least one solid point of reference in an otherwise dimly seen developmental landscape.

Domestication has been viewed and described from a number of different directions over the years. Many of these varied characterizations, including those of Ford, Harris, and Rindos, among others, have emphasized two prominent features of domestication: genetic and phenotypic (physical–morphological) changes in the domesticated species of plants and animals, and the reliance of these modified species on humans for survival (Fig. 7). These two features of domestication are often considered to be also linked in a cause and effect relationship, with domesticates being, above all, a purely human creation. Human societies cause either physical or genetic changes or a combination of both, in target species of

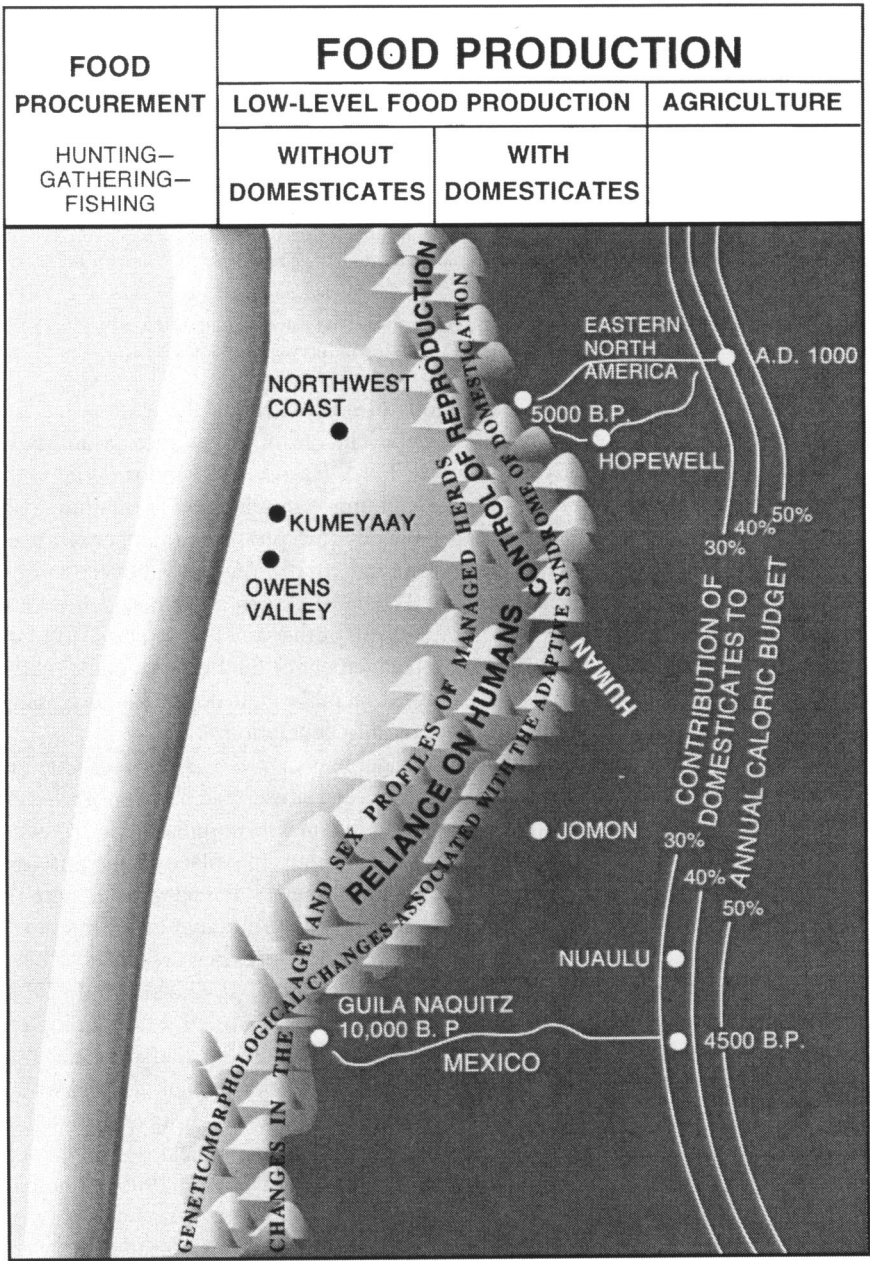


Fig. 7. A conceptual-developmental map of the middle ground between hunting-gathering and agriculture.



plants and animals such that these new domesticates are no longer viable without continued human protection and care.

Cultural selection for useful phenotypic characters resulted in new plants dependent upon humans for their existence. Domesticated plants are cultural artifacts. They do not exist naturally in nature; they cannot normally survive without human assistance (Ford, 1985, p. 6).

... domestication meaning that genetic and/or phenotypic selection has led to morphological change and a degree of dependence on human actions for the plant's survival (Harris, 1996b, p. 446).

Morphological change in the plant is the most important indicator of domestication pressures and serves to tie the survival of the plant to activities of humans (Rindos, 1984, p. 140).

In addition to offering similar descriptions of domestication that emphasize and causally connect phenotypic and/or genetic change in target species and their resultant reliance on humans for survival, Ford, Harris, and Rindos, along with other explorers of the landscape between hunting-gathering and agriculture, also identify the particular kind of human behavior that produces the changes used to identify domestication—intervention in, and control of, the life cycle and reproductive process of the target species. The causal chain of domestication thus begins with human intervention in the life cycle of the target populations of plant or animal—specifically the control and management of their reproduction, which results in genetic and morphological changes that make them dependent on humans for their continued existence, from generation to generation.

In seed plants, such control and management of the cycle of reproduction entails the harvesting, storage, and planting of seed stock, which not only releases the managed plants from selective pressures acting on wild populations in regard to seed dispersal, germination dormancy, etc., but also puts into place a quite different set of selective pressures. Under the general heading of “the adaptive syndrome of domestication,” such managed seed plant populations automatically respond to these new sets of seed bed and harvesting selective pressures in ways that have been described and explained in some detail (e.g., Harlan *et al.*, 1973; see Smith, 1992, 1995a, 1998a for fuller discussion). The results are very distinctive morphological changes (such as larger seeds and compacted seed heads, e.g., ears of corn) that are in turn very good markers of domestication and deliberate planting, and which are visible in the archaeological record. Once the sustained planting of stored seed stock begins, morphological markers of domestication can appear within the relatively short span of several hundred years (Hillman and Davies, 1990). If human intervention and reproductive control, along with associated selection pressures on target species were to cease, however, and managed populations of seed plants were once again exposed to the same selection pressures that shaped wild populations of the same species, the genetic and phenotypic characters—the distinctive morphological markers of domestication—would fade. The domesticated expression of the species would disappear.

The domestication of animals similarly involves human oversight and control of the reproductive process of managed herds, resulting in new selective pressures that elicit adaptive responses, and associated genetic and phenotypic changes such that they are dependent on humans for their continued existence. These morphological markers of domestication in animal species are less well understood and documented than is the case for seed plants, however, and given the longer life span of the species involved, their appearance can lag much further behind initial human management and reproductive isolation of herds. Fortunately, however, clearer and more direct evidence of the management and control of reproduction in domesticated herds can be observed in faunal assemblages from archaeological sites, since sex-specific age profiles change dramatically when domesticated herds are structured and managed for meat production (Hesse, 1984; Zeder, 1999, *in press*; Zeder and Hesse, 2000).

Domestication, of course, is an extremely complex and interesting developmental process that continues to draw the active attention of a wide range of researchers in a variety of scientific disciplines. The brief foregoing discussion of domestication, while far from comprehensive, does serve to set the stage for further exploration of the conceptual and developmental landscape that stretches between hunting–gathering and agriculture. It is clear, I think, that domestication does not define the boundary of either agriculture or hunting and gathering, but rather is situated well away from both border zones. In addition, it is useful to view domestication as a major topographic feature—a metaphorical mountain range on this conceptual and developmental landscape between hunting–gathering and agriculture (Fig. 7)—because it represents such a significant level and form of intervention by humans in the life cycle of plant and animal species, and also because it is so clearly visible and recognizable across considerable spans of space and time. In this regard the mountain range of domestication also represents a solid partition, separating those societies that occupy the territory between agriculture and hunting–gathering and have developed domesticated plants or animals and those that have not. As a result it provides an excellent vantage point from which to consider both of these poorly mapped regions on either side.

## NONAGRICULTURAL SOCIETIES WITH DOMESTICATES

Let us first gaze out in the direction of the border with agriculture. Situated on the far horizon and only dimly visible through the haze, the agricultural boundary zone is, I would argue, a region of considerable socioeconomic heterogeneity and definitional complexity. Rather than being clearly demarcated and having a “natural” border, the boundary-zone transition into agriculture can best be considered, in my opinion, as a region of clinal increase, with isobars of 30, 40, and 50% for the contribution of domesticates to annual caloric budgets spanning the range of boundary-zone societies that various travelers to the region might identify

as agricultural (Fig. 7). This clinal transition zone is also characterized, both categorically and developmentally, by numerous societies that have developed specific solutions to particular natural and cultural environmental contexts that involve distinctive combinations of wild, minimally managed, and domesticated species, and which are difficult to easily classify as agricultural versus nonagricultural (Ellen, 1988, p. 128; Zeder, 1994). Past societies of this border zone that are only known through the archaeological record are often particularly difficult to characterize clinally, since it is only rarely possible to accurately gauge the relative contribution that domesticates make to their total caloric budget. An interesting partial exception to this general rule is provided in eastern North America, where the broad and dramatic shift to maize agriculture and a strong dietary reliance on corn at A.D. 900–1100 has been documented through stable carbon isotope analysis of human skeletal remains (Smith, 1992). Although it is not possible to directly translate stable carbon isotope values into specific caloric input figures (e.g., 30, 40, 50%) for maize, the shift in carbon isotope ratios between A.D. 900 and 1100 is now widely accepted as marking the initial appearance of maize-centered agricultural economies over a broad latitudinal zone of the east, from southern Ontario to northern Florida. This well-documented broad-scale ca. A.D. 1000 increase in the dietary contribution of corn in eastern North America, when combined with the equally well-dated evidence for the initial domestication of at least four local seed plants in the East at ca. 3000 cal. B.C. (Smith, 1992, 1995b), also provides one of the best-outlined regional maps of the temporal–developmental territory between the mountain range of domestication and the border zone of agriculture. In the midlatitude deciduous forests of the eastern United States, domestication and agriculture (defined in terms of a significant reliance on domesticates) are separated by a full 4000 years of time (Fig. 7). This 4000-year-wide developmental landscape is occupied by human societies that relied on a rich diversity of different economic systems—solutions that involved various combinations of wild plant and animal species and domesticated crop plants. It is possible that at least some of these societies may have been situated close to or within the clinal transition zone of the agricultural border prior to the shift to maize-centered agriculture in the region. A number of Middle Woodland Hopewellian premaize farming societies, for example (classed as complex hunter–gatherers by Bender, 1985), appear to have substantially increased their reliance on indigenous seed crops by ca. 350 cal. B.C. (Smith, 1992); it has been proposed that the seed-filled human paleofeces from Mammoth Cave, Kentucky, reflect an even earlier society-wide reliance on local crop plants [as opposed to representing a specialized caver’s trailmix (Gremillion and Sobolik, 1996, p. 536; Watson, 1985, p. 128)]. It remains difficult, however, to convincingly establish the dietary importance of domesticates and the exact placement of these societies on the vast developmental/conceptual landscape that stretches between the domestication mountains and the clinal transition zone to agriculture.

In Mexico, the temporal–developmental distance between domestication and the agricultural border is even greater. Although squash (*Cucurbita pepo*) was domesticated by 8000 cal. B.C. in Oaxaca (Smith, 1997a), the village-based societies with maize–beans–squash farming economies that have been viewed generally as marking the agricultural border did not appear until about 2500 cal. B.C., a full 5500 years later (Fig. 7). A similarly expansive and complex temporal and developmental landscape covering perhaps 3000 years or more has been recognized as separating domestication and the subsequent initial emergence of agricultural economies in the Near East (Hillman, 1996; Hole, 1996, p. 266; Smith, 1998a; Willcox, 1998).

Here then, is a very basic and very important point to be made regarding the scale of the territory that lies between domestication and agriculture. These three regions—Mesoamerica, the Near East, and eastern North America—are the best-documented primary centers of domestication and subsequent agricultural emergence. And in each of these three areas, where the temporal–developmental placement of both initial domestication and the subsequent transition to agriculture can be determined with a reasonable degree of accuracy, they are separated by large, still mostly uncharted territories stretching across 2000–5500 years of time. In each area, these vast expanses are occupied by in-between societies that are not hunter-gatherers, nor are they agriculturalists, even though domesticates contribute to their economies. Similarly, Zvelebil (1986a,b, 1993, 1995, 1996) has addressed the long, complex, and regionally variable transition from hunting and gathering to farming in Europe, and the societies that fall in between hunter-gatherers and farmers, tracing their development over a span of more than 4000 years (Zvelebil, 1993, pp. 155–157).

How, then, should these vast, unmapped, and largely unrecognized developmental landscapes be characterized? What name(s) should be given to this territory? Over the years, a number of different labels have been proposed for, or affixed to, this region and have met with various degrees of acceptance. The terms “cultivation,” “gardening,” and “horticulture,” for example, which are often used as labels for the landscape between domestication and agriculture, are also all surrounded by a variety of definitional problems. While there are good reasons for proposing the use of these three terms in this context, they all suffer from a long history of usage and an accompanying multiplicity of meanings that blur and largely defeat their value as descriptive labels that can be understood easily and unequivocally: “Such labels as . . . ‘cultivation’ are inadequate and often conceal important and distinctively different subsistence strategies and resources bases” (Ellen, 1988, p. 128).

Consider, for example, the various meanings and applications of different forms of the term “cultivation” (e.g., cultivator or cultivating societies, quasi-cultigen, cultigen, cultivated plants, etc.). Moving from the general to the specific, cultivation can be defined in common usage as (1) promoting or improving the

growth of a plant by labor and attention; (2) preparing and tilling the land in order to raise crops; and (3) working the earth around growing plants to loosen the soil and destroy weeds. At all three levels of specificity, cultivation involves a lesser degree of intervention in the life cycle of plants than does the term "domestication." Thus the terms "cultivated," "cultigen," and "quasi-cultigen" are often used to refer to plants that do not exhibit any morphological markers of domestication yet, because of their abundant representation in archaeobotanical assemblages, are suspected to have been generally encouraged by humans in a manner that carries them beyond the realm of simple harvesting of wild plants. This use of the term "cultivation," which follows from common usage and focuses both on the nature and intensity of human-plant interaction and on the territory between wild plant collecting and domestication, is clearly evident in Ford's exploration of the territory between hunting-gathering and agriculture (Ford, 1985, p. 4). Under the heading of cultivation, Ford places any and all human undertakings involving plants, short of full control of reproduction and resultant domestication, including tending (weeding, pruning), tilling (soil preparation), transplanting, and seed or other propagule sowing (at harvest) (Fig. 7).

In clear contrast to Ford, however, Harris (1996a,b), in his most recent statements expands the coverage of cultivation in several respects. First, he extends cultivation from the border of hunting-gathering ("wild plant food procurement") past domestication, all the way to agriculture (Fig. 4). At the same time, he adds another major dimension to the meaning and use of the term "cultivation" when he combines extent of land clearance and soil preparation with the various forms of human encouragement of plants identified by Ford as cultivating activities. Subdivided into "cultivation with small-scale land clearance and minimal soil tillage, and cultivation with larger scale land clearance" (Harris, 1996b, p. 446) (Fig. 4), Harris draws the boundary between cultivation and agriculture in terms of "when domesticated plants (cultivars) are the main or exclusive components of systems of crop production" (Harris, 1996b, p. 446). Thus Harris places a greater emphasis on an increasing level of human energy investment and expanding areas under crop (and indirectly, the contribution of cultivated plants to the economy), rather than on the specific nature and degree of human intervention in the life cycle of plants.

To further complicate matters, yet another application of the term "cultivation" is clearly evident in the "cultivating ecosystem type" as formulated by Stoltman, and Baerreis for eastern North America. In a manner similar to Harris, Stoltman and Baerreis (1983, p. 257) distinguish agriculture ("reserved for contexts of substantial dependence on [domesticated?] plants by humans") from cultivation ("only that a useful species has been deliberately caused to reproduce by man"). They differ from Harris, however, in that for Stoltman and Baerreis cultivation does not extend all the way from hunting-gathering to agriculture, but only from domestication to agriculture. Although not explicitly stated, it is clear from their discussion that cultivation began with the initial appearance of domesticated plants in eastern

North America and covers the subsequent period of time during which domesticates were present but agricultural economies had not yet developed.

In summary, while all of these researchers employ the term “cultivation” in their descriptions of the landscape between hunting–gathering and agriculture, they define it in different ways and apply it to different parts of the landscape, substantially undermining its usefulness. Ford, for example, applies cultivation to the region between hunting–gathering and domestication, Stoltman and Baerreis to the region from domestication to agriculture, and Harris encompasses the entire in-between territory from hunting–gathering to agriculture. The value of the term “cultivation” is even further reduced when one takes into account its long-established common application to fully agricultural crops and economies. Consider, for example, a standard farm implement called a cultivator that is drawn between rows of field crops to turn the soil and uproot weeds. At the same time, while some scholars would argue that, by definition, plants that are the subject of various forms of human encouragement classed as cultivation should in turn be considered as cultivated plants, it is not at all difficult to find reference to the cultivation of wild plants (e.g., Figs. 3 and 4).

Like “cultivation,” several other terms in widespread common usage have limited value when used in reference to the conceptual landscape between hunting–gathering and agriculture because of their multiple meanings and past applications. The related terms “gardening,” “garden,” and “horticulture,” for example, have been used as general labels to characterize societies that are less than agricultural in terms of both their investment of human labor in land clearance, crop management, etc., as well as in the limited contribution of domesticated crop plants to their annual caloric budgets. This simple dichotomy between small and large scales of human labor investment and reliance on crop plants (i.e., horticulture vs. agriculture, garden vs. field, crop diversity vs. monoculture) is clearly presented in Stoltman and Baerreis’ characterization of the cultivating societies of eastern North America that preceded the transition to maize agriculture in the region: “rather than having to depend primarily on wild stands of plants, humans prepared, planted, and cared for garden plots, which can be distinguished from fields by their smaller size and greater botanical diversity . . . it seems unlikely that yields from these gardens were substantial enough to be considered true staples” (Stoltman and Baerreis, 1983, p. 257; see also Crawford, 1992b, pp. 17, 18; Ford, 1979, p. 236, 1985, p. 6).

The use of the terms “horticulture” and “garden” in this way, however, is problematic from several perspectives. In current common usage, these words are limited in application to particular categories of plants, referring to the small-scale raising of ornamentals, herbs, flowers, fruits, and vegetables. At the same time, as Harris points out in his discussion of the definitional difficulties of horticulture and gardening, they also have quite different meanings in some scholarly circles: “in some of the literature on agricultural systems and their evolution, particularly that which relates to Melanesia and the Pacific islands, the term horticulture or

'gardening' has come to be used as a synonym for agriculture . . . rather than as a means of distinguishing between 'field' and 'garden' cultivation" (Harris, 1989, p. 19). Harris goes on to point out that when used in reference to traditional, doorway, or house gardens, the terms "garden" and "horticulture" carry additional definitional baggage; these practices bring with them a host of adventive wild and weedy taxa, and the possibility of domesticatory processes. Rindos, in turn, adds to the definitional confusion by pointing out that as originally developed: "the concept of horticulture [was meant] to describe an early stage of agriculture in which plants, notably trees, were domesticated by selective preservation of the plants" (Rindos, 1984, p. 101). Given the multitude of overlapping and conflicting definitions and applications assigned to horticulture and garden over the years, these labels tend to confuse rather than to clarify when they are employed in attempts to characterize in general terms any of the regions on the conceptual landscape between hunting-gathering and agriculture.

There is a similar range of difficulties with the use of the term "husbandry" (plant husbandry, animal husbandry), which in general usage refers to the overall management and care of crops and livestock. The use of the term has declined considerably in the Americas since the 1980s, when it came under postmodern attacks as being androcentric, in that it: "implies a skewed division of labor in favor of men and arbitrarily narrows the multitude of relationships between people and their biological environment" (Ford, 1985, p. xii).

Zvelebil, however, has kept husbandry alive in Europe, subsuming and updating its earlier "Higgsian" applications (Zvelebil, 1986a, p. 9, 1986b, 1993, p. 153, 1996, p. 331) and restricting its usage to the range of Mesolithic cultural-domestication or resource-management strategies that were focused on nondomesticated plants and animals, and situated on the middle ground between resource procurement and production (Zvelebil, 1995, p. 87). In his usage, husbandry is "the planned and deliberate application of promotional strategies to plants or animals designed to increase their productivity and to gain greater control over them" (Zvelebil, 1995, p. 98), and "a set of practices intermediate in intensity between hunting and gathering on the one hand, and keeping domestic livestock on the other" (Zvelebil, 1995, p. 97).

In addition to being judged politically incorrect, however, the term "husbandry," like the other middle-ground terms discussed above, also suffers from a long history of much broader and variable usage and a multiplicity of meanings. The most obvious problem with Zvelebil's restricted definition of husbandry is that a number of scholars, including Zvelebil himself, continue to use the term in a larger context of meaning to apply to a much broader spectrum of human interaction with both wild (Zvelebil, 1995, p. 97) and domesticated (Zvelebil, 1995, p. 80) plants and animals.

Like cultivation, gardening, horticulture, and husbandry, the term "incipient agriculture" has been frequently affixed as a label, particularly in developmental

terms, to the region between domestication and agriculture. Interestingly, the modifier “incipient,” when applied to the term “agriculture,” functions in mirror image to the way “complex” does when used as a modifier for hunter–gatherer—serving to conceptually shift the agricultural boundary toward foraging and to absorb the intermediate neither–nor societies of the middle ground into the land of agriculture. Steward coined the phrase “era of incipient cultivation” as part of his effort to identify cultural regularities and establish a developmental sequence for five centers of world civilization. He characterized this era of incipient cultivation as follows: “It must have been very long, passing through several stages, which began when the first cultivation of plant domesticates supplemented hunting and gathering, and ended when plant and animal breeding was able to support permanent communities” (Steward, 1949, p. 10).

In the 1950s and 1960s, MacNeish applied the term “era of incipient agriculture” to the long temporal and developmental span leading up to fully agricultural societies in Mesoamerica (MacNeish, 1958, 1967, 1991; Mangelsdorf *et al.*, 1964). As employed by MacNeish and other scholars (e.g., Flannery, 1986), incipient agriculture began between 10,000–8,000 years ago, with various regions of Mexico witnessing different species of plants (maize, beans, squashes, etc.) being locally brought under domestication, and then gradually, over the millennia, contributing in ever-increasing percentages to annual caloric budgets, until the appearance about 3500 years ago of village-based agricultural societies. In the half century that has passed since Steward coined the phrase and MacNeish first applied it to Mexico, landmark archaeological research (e.g., Flannery, 1986; MacNeish, 1967) has supported and sustained the basic elements of the era of incipient agriculture—that over a long period of time various domesticated crops contributed in a limited way to economies largely based on wild species of plants and animals (Smith, 1997b).

Although there is considerable empirical support for the basic outline of the era of incipient agriculture in Mesoamerica, there are also a number of strong reasons to question how appropriate it is to use the label “incipient agriculture” in either general or specific terms for the conceptual and developmental region between domestication and agriculture. In developmental terms, to be sure, domesticated species are a prerequisite for, a necessary first step toward, agriculture. And some societies in Mexico did transform their low-level reliance on domesticates into fully agricultural economies. So it is not unreasonable to say that agriculture, in some sense, “begins” with domestication. But these incipient agricultural societies were not truly agricultural in terms of reliance on domesticates, and extending the term “agriculture” so far over the border, even with a qualifier like incipient, only serves to compress and obscure, both conceptually and developmentally, the vast and richly variable sociopolitical and economic landscape that stretches from domestication to agriculture. In some respects, it places domestication back on the boundary of agriculture. Labeling this region as incipient, as “beginning,” or as a developmental precursor to agriculture casts it in the pale and partial illumination



reflected from full agriculture. The modifier "incipient," I would argue, carries the imbedded implication that domestication to agriculture is a route rather than a region, consisting only of a dim developmental pathway between the steady states of hunting-gathering and agriculture.

But these vast and largely uncharted regions are not just uninhabited territory crossed on the way to an anticipated agricultural destination by evolutionary interstates without exits. They are, to the contrary, regions occupied by diverse, vibrant, and successful human societies that have developed stable, long-term economic solutions that combine low-level reliance on domesticates with continued use and management of wild species. Given the considerable temporal and developmental breadth of such territories and their great uncharted diversity, both within and between different world areas, one should not expect to always find the same standard boilerplate route to agriculture. Rather each region and its particular pathways to agriculture need to be approached and understood within the context of their specific natural and cultural constraints and possibilities (Fritz, 1990; Price and Gebauer, 1992; Zeder 1994; Zvelebil, 1995). Quite diverse developmental pathways in all likelihood existed in different regions. At the same time, societies of such regions should not be seen simply as reference points on the way to agriculture, as roadside markers of progress, but rather as stable solutions, as end points and destinations worthy of study in and of themselves (Zvelebil, 1993, p. 159, 1995, p. 87).

The record of such societies can be found along the myriad branching, crossing, and coalescing pathways of historical development that mark the conceptual-developmental landscape between domestication and agriculture. Some of these pathways might qualify for incipient-agriculture designation, since they ultimately led more or less directly up to and across the boundary with agriculture. Others trace a more leisurely meandering course, of which a good number never approach the border zone for agriculture. Societies on these pathways never do develop agricultural economies, but rather sustain successful and appropriate solutions to local environmental settings that involve only a limited use of domesticates.

Indeed, it would be possible for the Nuaulu to subsist entirely on non-domesticated resources without too much difficulty, and there appears to be a structural incentive not to expand or elaborate gardening practices. All this has resulted in the underdevelopment of agriculture. For Seram more generally, this tendency has long been recognized (Ellen, 1988, p. 119).

A number of interesting points, I would suggest, emerge from this discussion of incipient agriculture. These relate to both a better basic understanding of the landscape between domestication and agriculture, and why incipient agriculture is an inappropriate and misleading label for it. First, not all roads lead to agriculture. Harris alludes to this when he characterizes the phrase "incipient agriculture" as "vague and by implication deterministic" (1989, p. 19). Although it may be appropriate in some cases to apply the phrase "incipient agriculture" to

specific, well-documented large-scale and short-term pathways that lead directly to agriculture, it is not a good blanket label for entire regions of the middle ground, since such areas can also contain societies and pathways that either take a long time to reach agriculture, or never do. Secondly, in developmental terms, if one acknowledges that not all roads of the regions between domestication and agriculture lead to agriculture, and many that do take a long time getting there, it logically follows that past (archaeological) and particularly present-day (ethnohistoric) societies of these regions with low-level reliance on domesticates do not necessarily represent much of an in-progress or incipient reference class for attempting to explain the origins of agriculture (Ellen, 1988, p. 127; Layton *et al.*, 1991). When viewed as anomalous “caught-in-midstep” societies from the brief and unsustainable transition zone between hunting–gathering and agriculture, such groups have often been employed as a foundation for attempting to understand the transition to agriculture. When seen, however, as stable long-term residents of an extremely broad and diverse temporal and evolutionary landscape and as having a range of different possible future trajectories of development and change, their potential relevance to understanding agricultural emergence is far less clear. This is particularly the case where historically documented in-between societies that have sustained nonagricultural economies right up into the historic period and represent shining examples of alternative pathways and alternative long-term stable solutions are nonetheless cast as “on the road” to agriculture and presented as harboring the secrets of how and why agricultural economies developed (e.g., Keeley, 1995). Yen (1989, p. 66) underscores the errors inherent in viewing such in-between societies as “transitional or proto-agricultural.” They are not “the backward relicts of a single evolutionary line which most accounts seem to suggest.” Rather they should be recognized as not being “pristine hunter gatherers, but groups who, in achieving qualitatively distinctive cultural end points, have followed different pathways of subsistence-system development from a common beginning.”

Finally, even when focusing on the archaeologically documented societies that were situated along a major developmental pathway within primary centers of agricultural origin, it is important to acknowledge the essentially stable, if gradually changing, long-term nonagricultural solutions they sustained over very long spans of time. In Mesoamerica, for example, the temporal distance separating initial plant domestication at 10,000 cal. B.P. and the subsequent development of village-based agricultural economies at 4500 cal. B.P. is a full 5500 years (Fig. 7). Nonagricultural societies with low-level reliance on domesticates thus flourished in Mexico for a longer period of time than either preceding hunter–gatherer societies or later agricultural ones. Thus these in-between societies hardly match the profile of a brief transition phase between two steady states. Nor do they represent a beginning or incipient lead up to full agriculture. Rather they represent a rich and diverse array of comparatively stable and successful sociopolitical-economic solutions that should be recognized and studied in their own right.

In summary, as all of these terms and labels—husbandry, cultivation, gardening, horticulture, and incipient agriculture—for one reason or another, are confusing and misleading when applied to the region between domestication and agriculture, what terminology can and should be employed? To be appropriate, such terminology should have a history of usage in specific reference to this in-between territory, have few if any other applications either in general usage or scholarly contexts, be applicable to human use of both plants and animals, and should have been used in a clear and consistent manner by a range of researchers. Although it needs some amplification, the single label that I think satisfies these requirements is the term “food production.”

### FOOD PRODUCTION

As discussed by Harris (1989, p. 13), the term “food production” has a long and relatively consistent usage in archaeology and the study of agricultural origins. Childe coined the term more than 60 years ago as he contrasted “food producing” with the “food gatherers” of earlier times in his accounts of the transition from hunting–gathering to agriculture—the Neolithic revolution (Childe, 1951, pp. 61, 70, 71). Childe defined the boundary between food gathering and food production in terms of humans gaining control over their own food supply (Childe, 1951, p. 59). Although there are certainly varying kinds and degrees of such control, Childe appears, without ever being specific, to equate such control with the initial domestication of plants. The term “food production” is subsequently adopted by Braidwood (1952, 1960, 1977) and employed as a broad general heading in dichotomous distinction with earlier hunting–gathering societies. Binford (1968, p. 318) and Flannery (1968, pp. 80, 82) also employ the term in this general way, distinguishing between societies with food-procurement and food-production economies, without considering exactly where and on what basis to draw the boundary between the two. Zvelebil uses the term only once, where it roughly equates with farmers, agriculture, the use of domesticated resources, and the Neolithic (Zvelebil, 1993, p. 148).

This consistent, if generally vague, broad-scale use of “food production” thus provided no difficulties or constraints for Ford (1985) when he employed the term as a dichotomous label to distinguish utilization of wild plants (foraging) from any and all forms of human intervention in the life cycle of plants (food production) (Fig. 2). Although earlier scholars as far back as Childe had made some attempts at lower-level labeling under the banner of food production [e.g., Childe’s “primitive nomadic garden culture cultivation” (Childe, 1951, p. 64)], Ford offered one of the first systematic and schematic efforts to further partition the broad conceptual category of food production (see also Smith, 1985a). In a similar fashion, Harris subsequently developed and refined detailed organizational frameworks that filled in under the general heading of food production (Harris, 1989, 1990,

1996a,b). As discussed above, however, there are problems of epistemology, definition, noninclusion of both plants and animals, and nonstandard usage, with many of these lower-level terms used by Ford and by Harris, as well as those used by Rindos, MacNeish, and other scholars over the years.

To remedy these problems, I propose an alternative conceptual framework that, on the one hand, maintains the established general-consensus, overarching terminology of the dichotomy between food procurement and food production, while also establishing a lower-level tripartite partitioning of food production (Fig. 7). This commonsense and minimalist three-part division of food production employs labels that admittedly are neither elegant nor easy to acronym, but do have the advantage of being clear, unequivocal, and historically unencumbered, unlike earlier schema (e.g., Figs. 2–6). These labels and categories also uniformly encompass human interaction with both plants and animals, as well as incorporating domestication as a clear and dominant feature of the conceptual landscape between hunting–gathering and agriculture. In this classification system, food production societies relying on domesticates for less than 30–50% of their annual caloric intake are simply referred to as low-level food production economies. The simple presence or absence of domesticates in turn provides the partition between the low-level food production economies with domesticates and those low-level food production economies without domesticates (Fig. 7). The conceptual and developmental scope and attributes of the territory on one side of this “mountain range of domestication” stretching from domestication to agriculture (low-level food production economies with domesticates) have already been considered, along with the nature and placement of the agricultural border zone. Let us now return to the vantage point provided by the peaks of the mountain range of domestication and this time gaze in the opposite direction, out over the territory of low-level food production economies without domesticates, toward the border with food procurement.

#### **LOW-LEVEL FOOD PRODUCTION ECONOMIES WITHOUT DOMESTICATES: THE TERRITORY FROM HUNTING AND GATHERING TO DOMESTICATION**

The societies and developmental pathways of the territory that stretches between hunting–gathering and domestication are as poorly documented as those of the landscape that stretches between domestication and agriculture. The border zone between hunter–gatherer food procurement societies and those with low-level food production economies without domesticates is a particularly interesting portion of this landscape. It has long presented the difficult and often-avoided challenge of boundary definition.

Both Ford (1985) and Harris (1996b), however, provide relatively clear and comparable descriptions of where to draw the boundary line between food

procurement and food production, both in general terms and in reference to particular landmarks—behavior sets and particular societies that fall on either side of the border. In looking at human patterns of intervention in the life cycle of plants and animals in this border zone, they both consider not only the relative level of energy investment but also the casual or inadvertent versus deliberate intent of such actions and the degree to which they are broadly scattered as opposed to focused and sustained, both on particular target species and on particular parcels of land. Ford, for example, draws the line between food procurement and food production in terms of the “deliberate manipulation of specific floral species by humans for domestic use or consumption” through “activities affecting the biological growth by means of cultural practices” (Ford, 1985, p. 2). He goes on to further define food production as not only involving deliberate human intervention in the life cycle of target species, but also as having a spatial focus—that such “deliberate actions were undertaken to assist the growth of a plant species in a particular location” (Ford, 1985, p. 3). In a similar vein, Harris identifies food production, as opposed to food procurement, in terms of a range of different forms of human intervention in the life cycle of plants: “planting, sowing, weeding, harvesting, storing, and even the drainage and/or irrigation of undomesticated crops” (Harris, 1996b, p. 446). He ties these cultivation activities to particular cleared plots of land. Ford, too, identifies and discusses a number of categories of human activity that, when deliberate and sustained, can serve to distinguish low-level food production economies from the food procurement economies of hunting and gathering societies. All of these actions, in various ways, involve the beneficial disruption of the life cycle of a plant population in order to ensure easier, more reliable, and more abundant harvests. Ford (1985, pp. 3–6) arranges these diagnostic activities of low-level food production into four categories: tending, tilling, transplanting, and sowing.

Tending, defined by Ford as the encouragement of plant growth both by direct care of target species and by limiting competition, primarily focuses on weeding—the removal by hand of competing vegetation near useful plants. Tilling, in turn, is defined by Ford as deliberate soil disturbance with a digging stick or hoe to facilitate and encourage the appearance or germination of target species. Tillage could involve deliberate efforts to expand the size of stands of seed plants through soil disturbance around such stands in advance of natural seed dispersal, or the churning of soil and detachment of bulblets and lateral tubers during the harvesting of roots and bulb-bearing species. Transplanting is defined as the movement of a plant, usually perennial herbs and shrubs, or tree from one locality to replant in another for easier access. It can be quite casual and scattered, or can involve considerable long-term protection and care, perhaps in designated spaces where a variety of plants from different habitats are brought together (Ford, 1985, pp. 4, 5). Sowing, too, can range from the casual broadcasting of mature seed at the time of harvest, to sowing in new locations or even new habitats, perhaps in combination with soil tillage for seed bed preparation and seed storage.

Complementing these considerations of human–plant interactions that are characteristic of low-level food production economies in the absence of domesticates, Harris (1996b, pp. 447–456) (Fig. 5) and Hole (1996, pp. 264, 276) identify and discuss those forms of human intervention in the life cycle of animals that focus on protection and enhancement to ensure continued or increased availability, and which could occur on the landscape between hunting–gathering and domestication. These include efforts to reduce predator populations and to increase or enhance pasturage, as well as the raising of tame animals and various types of free-range management systems.

Zvelebil, too, provides a very thoughtful and comprehensive consideration of a range of different human interactions with plant and animal species during the Mesolithic in northern Europe that fall between exploitation of wild resources and domestication (Zvelebil, 1995, pp. 87, 88). He covers much the same conceptual ground as Ford and Harris, characterizing human behaviors of this type as “husbandry” and “cultural domestication” (discussed briefly above) and as “resource management” (Zvelebil, 1995, p. 80).

It is important to keep in mind, however, that none of these general categories of behavior, identified by Ford, Harris, Hole, and Zvelebil as representative of low-level food production economies, are restricted only to one side of the border. All are considered as having casual and scattered tails (in terms of the low-occurrence end of a probability curve) that trail across the border and attenuate in the realm of hunter–gatherer societies. The capturing, taming, and raising of young wild animals, for example, or the casual broadcast sowing of seed or other propagules at the time of harvest, are not the exclusive behavior of food-producing societies, but rather have also been observed in hunter–gatherer contexts. Some of these cross-border behaviors, in fact, such as inadvertent stand enhancement as a result of the digging of tubers and roots, and the broad-scale burning of vegetation cover to enhance habitat for favored animal and plant species, are encountered frequently on both sides of the border and thus are considered as characteristic of both food procurement and low-level food production economies (Harris, 1996b). As a result, any efforts to determine where exactly to place societies in this complex boundary zone of intensive food procurement and low-level food production is not simply a matter of ascertaining the presence or absence of certain forms of life-cycle-intervention activities on the part of humans, but rather should include consideration of the intensity, intentionality, species focus, and total range of such activities that are present in a group’s economic repertoire.

Many of the activity-scale studies of behavior patterns typical of this border zone—how human societies reshape or “domesticate” (to load the term in yet another way) their environments in order to increase usable plant products—focus on either hunter–gatherer societies with limited and attenuated sets of life-cycle-intervention activities [e.g., Australian aborigines (Yen, 1989)] or on clearly agricultural societies who also carry out activities that could be considered

characteristic of low-level food-producing societies without domesticates (e.g., Moran, 1993, 1996; Posey, 1985). Moran, for example (1996, pp. 538–541), documents the considerable extent to which Amazonian agriculturalists, in the wake of slash-and-burn agriculture, have left behind fallow-cycle vegetation communities that are substantially enriched in forest species of economic value in comparison to their composition prior to clearing.

When such activity-level case studies of life-cycle intervention, potentially diagnostic of low-level food producers without domesticates, are drawn from agricultural societies, it also serves to raise the obvious question of whether or not such activities developed as supplemental additions to already established agricultural economies, or if they were preexisting stand-alone practices that survived the agricultural transition. Are, for example, the rock mulching and habitat extension of agave by pre-Hispanic agricultural societies of southern Arizona documented by Fish (1995) a supplemental subsistence extension developed by the region's maize-centered agricultural societies, or a surviving practice of earlier low-level food-producing societies? Castetter and Bell (1951, pp. 177, 178) raise this issue in concluding their description of one of the most frequently cited examples of food production involving nondomesticated plants—the “semicultivation” of several seed-bearing species by Cocopa societies of the lower Colorado (Alvarez de Williams, 1983; Castetter and Bell, 1951; Kelly, 1977). This semicultivation of wild grasses by the Cocopa, which ceased with the 20th-century construction of upstream dams, involved the broadcast sowing, in decrue fashion (Smith, 1995a, p. 113; see also Smith, 1992, pp. 249–266), of seeds harvested the previous fall on thin, muddy, nutrient-rich river-bank soils exposed by the receding floodwaters of the Colorado. Plots planted in this manner, which could be 50–100 m wide and extend up to a mile (1.6 km) along the river, and received no further attention prior to harvest, could include any of five different identified species. Of these, three were historic-period introductions of Eurasian origin while two species of panic grass (*Panicum*) were indigenous and known to have been grown at least as far back as 1541, leading Castetter and Bell to raise the “very interesting and tantalizing question: Did the semicultivation of grasses precede or follow the introduction of maize-tepary [bean]-pumpkin cultivation?” (Castetter and Bell, 1951, pp. 177, 178).

Along with the Cocopa, the Great Basin and California regions of western North America provide a wide range of both activity-level and society-scale examples of human manipulation of plant resources that fall into this boundary zone of intensive resource utilization and low-level food production of non-domesticates (Bean and Lawton, 1973; Downs, 1966; Lewis, 1973; Steward, 1941). Two of the most interesting and oft-cited are the Kumeyaay Indians of southern California and the Owens Valley Paiute of eastern California. The Kumeyaay provide a society-scale example of what, in my opinion, qualifies as low-level food production without domesticates, based on ethnohistoric analyses and interpretations (Shipek, 1989). They not only burned extensive areas to both improve forage

for deer and remove competing species of plants prior to broadcast sowing of a wild grain grass, but they also had an extensive and far-reaching program of transplantation and tending of a select yet broad assemblage of wild plant species (e.g., oaks, pines, palms, mesquite, agave, yucca, wild grapes, cacti, etc.).

The Owens Valley Paiute of eastern California (Lawton *et al.*, 1976) provide another good society-scale example of low-level food production without domesticates. Based on Steward's informant interviews of the 1920s and 1930s, the Owens Valley Paiute, prior to the massive disruption of their way of life in 1863, were similar in many respects to neighboring Great Basin Shoshoni hunter-gatherer groups (Bettinger, 1977, 1989; Lawton *et al.*, 1976; Liljeblad and Fowler, 1986; Steward, 1930, 1933, 1938). Their economy was largely structured around the procurement of a wide range of wild species of plants and animals, with pine nuts and rabbits playing prominent roles. The Owens Valley Paiute, however,

were distinctive for their band ownership of hunting and seed territories . . . the population was comparatively dense, stable, and settled in unusually permanent villages. The country was fertile, so that subsistence activities could be carried on according to a comparatively fixed routine within a small territory. Each territory was only large enough to embrace all the natural resources habitually exploited and included both game and vegetal foods (Steward, 1938, pp. 255, 256).

Among the environmental features of the Owens Valley that set it apart from other areas of the Great Basin, and which allowed the development of such relatively stable and fixed camping sites and seasonal rounds, were the extensive tracts of swampy low-lying meadows near the Owens River. The vegetation of these waterlogged, river-valley resource zones included a number of bulbous hydrophytic food plant species, including wild hyacinth, nutgrass (*Cyperus*), and spikerush (*Eleocharis*), that had long been an important component of Owens Valley subsistence economies (Bettinger, 1977). Major permanent camping sites were often located near these floodplain meadows. Owens Valley groups both enriched and expanded these water-meadow resource zones through irrigation, thus increasing the size and the reliability of each year's wild root crop harvest. This enhancement and expansion of the natural habitat of the water-meadow root crops was carried out on a large scale in several locations. The construction and subsequent removal of temporary diversion dams each year along some of the tributary creeks of the Owens River called for the labor of all of the men of communities, under the direction of a communal irrigator. Feeder ditches up to 4 miles (6.5 km) long carried nutrient-rich, early summer mountain runoff from dams to the river valley plots, the largest of which were 2–4 sq. miles (5.2–10.4 sq. km) in size (Steward, 1933, p. 247). No efforts were made at planting, tilling, or tending either the wild root crops of these water meadows or the adjacent downstream stands of wild seed plants (including sunflower, chenopod, and lovegrass) that also benefited from the irrigation efforts.

Interestingly, several parallels can be drawn between Owens Valley and the Northwest Coast in terms of their respective patterns of low-level food production



centered on nondomesticated crop plants (Deur and Turner, submitted). In both the Owens Valley and in some contexts along the Northwest Coast, for example, food production includes hydrophytic tuberous/root crop species. In addition, rather than being monocrop in nature, up to perhaps a half-dozen food plant species are involved. And in both areas, these targeted suites of food crop species are all components of natural wet-soil communities, with food production efforts directed toward the deliberate and sustained enrichment and expansion of the habitat zones of these plant communities. In both situations, such human labor investments in habitat expansion and improvement, resulting in increased harvest yields and reliability, centers on getting nutrient-rich water to the target species. There is also in both regions an investment of labor, sometimes communal, sometimes family, on particular, often demarcated, parcels of land associated with food production. And, not surprisingly, there are associated parallel shifts in, and strengthening of, concepts of community and individual ownership of such land parcels and the yearly harvests that they yield. In this regard, Steward (1938, p. 106), in his discussion of seed sowing by Great Basin Shoshoni groups, states that "ownership of sowed plots accords with the Shoshoni principle that there are property rights only in things in which work has been done." Perhaps changing concepts of ownership may turn out to be a good boundary marker of the transition zone between food procurement and low-level food production.

The Owens Valley Paiute also serve to highlight the considerable problems such low-level food production societies represent, both conceptually and developmentally, for scholars hindered by inadequate maps of the landscape between hunter-gatherers and agriculturalists, and the almost complete lack of an appropriate conceptual/categorical reference class. Liljeblad and Fowler (1986, p. 418), for example, when faced with an either-or situation, place the Owens Valley Paiute on the hunter-gatherer food procurement side of the border and characterize their low-level food production focused on nondomesticates as "part of a perfected gathering complex, a spontaneous extension and prolongation of an observable natural process . . . well within the scope of the hunter-gatherer adaptations and utterly unlike any other horticultural development in the region." Steward resolved this dilemma in developmental terms, placing the Owens Valley Paiute in the brief interval of transition between the two steady states of hunting-gathering and agriculture, caught "on the verge of horticulture" (Steward, 1933, pp. 248, 250).

Were the Owens Valley Paiute in the process of developing greater reliance on food production, or do they represent a stable long-term adaptation? Are they a good analog for attempting to gain a better understanding of the developmental transition from hunting and gathering to agriculture, or are they more properly viewed as a successful "end-point" economic solution. In documenting the emergence of this Owens Valley subsistence-settlement system of which irrigation was a part, Bettinger (1989) concluded that it first emerged between A.D. 600–1000 and that, given the nature of the plant species under irrigation, it represented a stable

end-point equilibrium adaptation rather than holding the potential for substantial future development into a more highly productive agricultural system. He suggests that, while there was certainly room for a quantitative increase in the number of irrigation facilities, the introduction of a highly productive domesticated crop plant such as maize would have been necessary to push Owens Valley irrigation beyond its stable end-point solution status.

## DISCUSSION

The Owens Valley Paiute, like the Kumeyaay of southern California and the Nuaulu of Seram, half a world away, attest to the long-term viability and the relative end-point solution status of societies occupying the middle ground. In addition, the postglacial archaeological records of a number of world regions, most notably eastern North America, Mesolithic Europe, the Near East, and Mexico, document the existence and steady-state development of a broad spectrum of middle ground, subregional-scale subsistence solutions across vast expanses of time and space.

The “gap between the extremes” of agriculture and hunting–gathering, documented by Hunn and Williams from Murdock’s *Ethnographic Atlas* (Fig. 1), whereas real, is not evidence of foraging and farming representing “mutually incompatible ways of life” (Zevelebil, 1986a, p. 12). Also, it does not indicate that the transition from hunting and gathering to agriculture was a necessarily rapid and unstable journey between steady states (Fig. 6). Rather it reflects the simple fact that, by the time the societal case studies included in the *Ethnographic Atlas* were undertaken, most of the world’s middle-ground societies had already been replaced by, or retooled into, agriculturalists. Keep in mind, for example, that the oft-cited middle-ground Kumeyaay and Owens Valley Paiute economies are known only through archaeology and oral history.

This middle ground exists then, and it is peopled by societies that are, I would argue, distinctly, qualitatively different from the pre-Holocene hunter–gatherers on one side and agriculturalists on the other. They are neither just on the way to agriculture, nor are they simple extensions of hunter–gatherers. Although acknowledging and admiring the remarkable range of overall variability that already has been documented across the societies of the middle ground, particularly in the American west and the European Mesolithic (e.g., variation in settlement size and complexity, seasonal round and sedentism, storage, technology, exchange, ritual and world view, subsistence and resource management, etc.), I would also argue that it is essential to break the “categorical impasse” (Price, 1985, p. 360) by conceptually and terminologically distinguishing this richly heterogeneous group with a general reference label such as “low-level food production.” The important point is not so much the actual general label itself, but the tripartite cognitive template that it creates—that the societies of the middle ground are not pale reflections

or logical extensions of either agriculturalists or hunter-gatherers, but a separate general class of extremely variable, successful long-term socioeconomic solutions, fine-tuned to a wide range of local cultural and environmental contexts. Such a general tripartite cognitive template is not only necessary in order to bring the middle ground into better focus, but also to encourage researchers to begin to more closely and clearly identify and define themselves in terms of the middle ground, rather than approaching it from beyond the borders, from the perspective of either farmers or hunter-gatherers. Firmly entangled in the rich complexities of the middle-ground societies of the European Mesolithic, if still somewhat hindered by the use of “complex hunter-gatherers” as a boundary extender, Marek Zvelebil’s remarkable set of penetrating studies over the past 15 years provide probably the best example of the rewards of adopting a tripartite cognitive template.

While also acknowledging both the difficulties involved in attempting to define the boundaries of low-level food production as well as the inherent dangers of drifting off into sterile exercises in classification, I think that many of the more interesting core questions regarding the nature of middle-ground societies are situated along the border zones. Although simply moving the boundary lines on either side inward, through the use of modifiers such as “incipient” with agriculture, and “complex” or “affluent” with hunting-gathering, is certainly one way of addressing these boundary-zone placement problems, such terminological appropriations of the middle ground will only hinder recognition and closer comparative consideration of societies having low-level food production economies, particularly closer to the hunter-gatherer border zone.

One might reasonably counter, however, that low-level, when employed as a modifier of food production, is nothing more than another terminological boundary extension from the agriculture side, designed to appropriate large areas of the middle ground away from the land of hunter-gatherers. But although I would agree that “low-level food production” is not as elegant or as imposing a general label for the middle ground as I would have preferred, it is at the same time both explicitly defined and easily perceived as a relatively neutral, unencumbered term, not easily equated with or linked to agriculture. Although a better general label for the middle ground may well be found, low-level food production appears to be the least problematic of the candidate terms currently in use. It also has the distinct advantage of drawing attention directly to a general question area situated along the boundary zone between hunter-gatherer reliance on wild species of plants and animals and low-level food production. The simple question centers on what are the best criteria by which to distinguish between behavior sets of human-plant and human-animal interaction that should be identified as resource procurement versus resource production? Although clear and simple solutions are not likely to be forthcoming, further scrutiny of this basic procurement/production question is an essential aspect of gaining a better understanding of the middle ground.

From my perspective, this is what sets the societies of the middle ground apart from hunter-gatherers and agriculturalists and makes them both so interesting and

so elusive, particularly in the archaeological record—their broad-ranging postglacial exploration of deeper and more complex relationships of interaction with plant and animal communities. Scholars approaching this general category of human–plant/animal interaction from the direction of hunter–gatherer societies often view it under the general label of more “intensive” exploitation of wild species of plants and animals. Researchers viewing it from the agriculture perspective, in contrast, consider it in terms of activity sets leading up to domestication and the eventual emergence of agriculture. Zevelebil’s application of the term “resource management” to some of the human–plant/animal interaction behavior sets in this general category is more neutral (unlike his synonyms of “husbandry” and “cultural domestication”), is more in line with a tripartite cognitive template, and clearly identifies the broad range of human activities that are more than intensified exploitation of wild resources, but which often do not lead up to domestication.

A number of very interesting and very challenging questions can be identified in the general area of this resource-management category of human–plant/animal interaction. On one side of resource management, for example, when considered at a human-activity scale of analysis, what are the key attributes that differentiate intensive exploitation of wild plant and animal species from management of nondomesticates? How does one compare the massive, labor-intensive eel-trap earthworks of southwestern Victoria (Lourandos, 1988, p. 153) with the canal construction of the Owens Valley Paiute? On the other side of resource-management activities, what are the attributes inherent in the targeted resource species themselves, or in the cultural or environmental landscape, that either engender or hinder the transformation of such managed resources into domesticates?

Moving up from an interaction-behavior level of consideration to societal-scale comparative analysis of the postglacial middle ground, the most obvious and intriguing set of questions centering on resource management involve how different human groups combined nonintensive and intensive strategies of exploitation of some wild species with active management of others, as well as the small-scale storage and planting of domesticated seed stock and the herding of domesticated animals, below the threshold of agriculture? A number of different attempts to organize and classify the societies of the middle ground have been proposed, many having an inherent logical linear framework of ever-ascending degrees of human involvement and control of resources (e.g., Figs. 2–7). In reality, the patterns of variation and the profiles of relative resource-category reliance (i.e., the mix of nonintensively and intensively exploited wild species, managed species, and domesticates) across the middle ground are still poorly described and will no doubt be found to diverge in very interesting ways from a classification system predicated on a lock-step pattern of inexorable progress from intensification-centered societies through management-oriented economies, into those which develop or adopt domesticates and gradually expand their reliance on them until agriculture is attained. In Fig. 7, for example, domestication is identified as the major landmark and vantage point of the middle ground, and this, I would argue, is appropriate

both because domesticates are a beginning point and precondition for agriculture and because initial domestication of plants and animals is so visible in the archaeological record. But the presence or absence of domesticates is probably not a good higher-level partition with which to attempt to compare societies of the middle ground. Guilá Naquitz and Hopewell, for example, are both situated in a similar position in Fig. 7, relative to the domestication mountains, yet the two societies are very clearly quite distinct from each other in many aspects of their culture and economy. Most important from a perspective of resource-category profile, the inhabitants of Guilá Naquitz would appear to clearly belong to the territory of hunter-gatherers in terms of almost every measure of relative affluence and complexity, with no evidence of either intensive use of wild resources or any clear management of resources. But they also very clearly were growing a single domesticated crop plant, *Cucurbita pepo*, which quite likely contributed to their overall caloric budget in only a very minor way. Hopewell groups, in contrast, were far more complex than the ancient Oaxacans who occupied Guilá Naquitz in terms of material culture, settlements, and sociopolitical organization. They were also growing at least four domesticated seed crops, and these domesticates would appear to have been less important in their overall diet than another half-dozen seed plants that would qualify only as being managed, since they exhibit no morphological changes associated with domestication. In addition, Hopewell societies exploited a wide range of wild species of plants and relied exclusively on a rich variety of wild species for animal protein.

These obvious substantial differences, in turn, raise the basic question of to what extent Guilá Naquitz and Hopewell match up well with other societies of the middle ground? As is the case with the organization of the galaxies in the universe, are there natural clusters of societies of the middle ground in terms of their relative reliance on wild, managed, and domesticated species, separated by vast voids? Are there other groups like the inhabitants of Guilá Naquitz that add a single domesticate into an otherwise nonaffluent, noncomplex hunting and gathering existence? How many other societies of the middle ground compare well with Hopewell? Does the overall structure and composition of the biotic community, or the historical background and sociopolitical organization of middle-ground societies play substantial roles in shaping their resource-category reliance profiles, or can just a few high-potential plant or animal components open particularly promising fast-track pathways of development?

Clearly, there is still a great deal of interesting research to be carried out in the middle ground, from seeking evidence in the archaeological record of intensification of exploitation of resources and the management of plant and animal species leading up to domestication (e.g., College, 1998; Hillman, 1996; Zeder, 1999) through broad-ranging documentation and comparative analysis and classification of different behavior sets qualifying as "intensification" and "resource management," to looking for clusters of societies having similar economic profiles and

to typologizing “at a lower level of generalization and group subsistence systems which share certain key ecological, technical, and social characteristics and which focus on particular nonhuman species, or groups of related species” (Ellen, 1988, p. 128).

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