APPENDICES TO CHAPTER III

Appendix 3-1: Sources of Data for Tables in Chapter III

A. Sources of Data for Table 3-1

The data for the three rainfall series come from a database of roughly 8700 weather stations over the globe reported in the eight volumes of C. W. Thornthwaite Associates, Laboratory of Climatology (1962-65). Temperature data come from Whiting (reported by Divale and Gray, 2001, variables 186-88). Effective temperature is calculated from data on the average temperature in the hottest and coldest months and also reflects the length of the growing season. This statistic is discussed by Robert Kelly (1995: 66 ff.) and is based on a formula developed by H. Bailey (1960).

Slope and soil data come from maps presented by FAO/UNESCO (1971-78), adjusted in a manner described by Pryor (1986). The suitability of climate to major crops is based on data from Papadakis (1966 and 1970), adjusted in a manner described by Pryor (1986). All three variables are also reported by reported by Divale and Gray (2001: variables 921, 922, 924, and 926). The composite variables are also presented in Pryor (1986) and reported in Divale and Gray (2001: variables 921 and 928).

B. Sources and Meaning of Data for Table 3-2

My codes come from Statistical Appendix 2. For the remaining series, I first specify the original source of the data and then, for data contained in the data bank of Divale and Gray (2001) data bank, the number of the variable preceded by "V".

Line 10. Carneiro complexity scale (1970), see discussion of variable 2-6 in Appendix 2-2.

Line 11. Existence of corporate descent groups, Murdock and Wilson (1972): V70. I have recoded this series so that 0 = no corporate kinship groups (coded 5 by Murdock and Wilson); 1 =

membership in any type of corporate kinship group (all the remaining Murdock and Wilson codes).

Line 12. Social stratification; Murdock and Provost (1973): V158. 1 = egalitarian; 2 = hereditary slavery; 3 = two classes, no castes/slavery; 4 = two classes, castes/slavery; 5 = three social classes or castes, with or without slavery.

Line 13. Political differentiation. This is an unweighted average of seven political variables, all of which led to roughly the same conclusions when presented in the format of Table 3-2. The first step was to recode one of the variables (the leadership variable) so that it formed a linear scale. The second step was to transform linearly all of the variables onto a scale running from 1 to 4. And the final step was to calculate the unweighted average. The seven variables were:

i. Community leadership. Murdock and Wilson (1972): V76. 1 = none; 2 = local council; 3 = single leader plus council; 4 = dual/plural headmen; 5 = single local leader; 6 = single local leader and subordinates; 7 = higher level of political authority.

ii. Levels of sovereignty. Tuden and Marshall (1972): V83. 1 = stateless society; 2 = sovereignty, first political hierarchical level up from village; 3 = sovereignty, second hierarchical level up; 4 = sovereignty third or higher hierarchical level.

iii. Higher political organization. Tuden and Marshall (1972): V84. 1 = absent; 2 = groups sworn to peace; 3 = alliances; 4 = confederation; 5 = international organization.

iv. Executive concentration. Tuden and Marshall (1972): V85. 1 = absent; 2 = council; 3 = executive and council; 4 = plural executive; 5 = single leader.

v. Specializing of policing. Tuden and Marshall (1972): V90. 1 = not specialized; 2 = incipient specialization; 3 = retainers of chiefs; 4 = military; 5 = specialized.

vi. Administrative hierarchy. Tuden and Marshall (1972): V91. 1 = absent; 2 =

popular assemblies; 3 = heads of kin groups; 4 = heads of decentralized territorial divisions; 5 = heads of centralized territorial divisions; 6 = part of a centralized political system.

vii. Frequency of external war. Ember and Ember (1992): V1650. 1 = warfare rare or absent; 5 = warfare seems to occur once every three to ten years; 10 = warfare seems to occur at least every two years; 14 = warfare seems to occur every year, but usually during a particular season. The code ends at 17 = warfare seems to occur almost constantly and at any time of year. The values between those supplied here are intermediate values in the specified period.

C. Sources of Data for Table 3-3

For each series I first specify the original source of the data and then, for data contained in Divale and Gray (2001), the number of the variable preceded by 'V'.

Line 2. Data on the fixity of community come from Murdock and Wilson (1973): V61. My own ratings for this variable for societies with less than 45-percent reliance on agriculture for subsistence are practically the same..

Line 3. For 68 societies in the SCCS, the data on population density come from Pryor (1985); they are supplemented by data from Murdock and Wilson (1973): V1130. I must emphasize that these estimates are very rough. To calculate the averages, assumptions also had to made about the average densities at the end points of the scale: I assumed 0.1 for the density of all societies with less than 0.2 people per square mile; I also assumed 650 for all societies with a density greater than 500 people per square mile.

Line 4. The estimation is discussed in the text.

Line 5. Following a procedure derived by Robert L. Kelly (1983; 1995: 121) I calculated consumable biomass (also called "primary biomass" or "secondary productivity" by others) from data on the natural biomass production, effective temperature, and precipitation. Effective temperature, which measures the effective solar radiation as well as its annual distribution, was calculated using a formula discussed by Kelly (1995: 66) and employs data on the average temperature in the hottest and coldest months (from John Whiting, unpublished: V187 and V188). The precipitation data come from Thornthwaite (1962-65). In a correspondence concerning his chart (1983), Kelly informed me that the axis of the consumable biomass should have been labeled grams/meters^2, rather than kilograms/meters^2, so that the consumable biomass would be a fraction of natural biomass production. This means, however, that the formulae he presents are in milligrams/meters^2, rather than grams/meters^2. I have made the necessary corrections in the table.

Line 6. This is discussed in the table note.

Appendix 3-2: Technical Problems in Estimating Land-Resource Stress

Formula for determining biomass: Rosenzweig's regression calculation (1968) relating net terrestrial biomass production to environmental variables uses only forty-eight locations, all but two of which are in the United States or Canada. Two other formulae are also available: the Lieth-Box formula (cited by Sharpe, 1975), which also uses evapotranspiration as the single explanatory variable; and my formula, which is based on a Lieth's (1975) sample of forty-five different locations over the planet and which follows a procedure that he suggests for using average annual temperature and rainfall data instead of evapotranspiration. Calculated for the 186 SCCS societies, the average difference of the latter two series to the Rosenzweig calculation is about 50 percent; these two other formulae also yield a somewhat lower mean. There is, however, no systematic difference in the estimates for societies with different reliance on agricultural production for subsistence. For this chapter I use the Rosenzweig formula only because Kelly (1983, 1995) used it in his adjustments to calculate the consumable biomass from the actual biomass production used the Rosenzweig formula.

Estimate of variables reflecting the environment: Kelly (1983, 1995) uses somewhat different estimates of evapotranspiration, temperature, and precipitation than I do, so that our estimates of natural biomass production and the classification of environments (humid and arid) also vary. This, in turn, raises problems in using his formulae for societies whose environments are on the burder between these two classifications. After a useful communication with him about these matters, I reclassified the environment of a several of these societies to eliminate extreme cases because their environment was close to the critical borderline.

Tests of meaningfulness: I employed four different tests suggested in the anthropology literature to assess the meaningfulness of the estimates of consumable biomass per person (the inverse of land resource stress). These involved correlating my variable with other variables that might be related to land-resource stress.

C For primarily foraging societies a stress on land resources might be revealed by a higher ratio of gathering to hunting. This would arise because eating animal flesh is an inefficient way of obtaining nourishment from the environment, since animals consume considerable biomass that is not contained in their meat. Unfortunately, after eliminating societies with less than 25-percent reliance on fishing and agriculture (plant production and animal husbandry) and two societies with data problems, I was left with only eleven societies for the investigation. The regression coefficient has the right sign, but the results are not statistically significant.

C Stress on land resources might be related, as Rosenberg (1990) and Hayden (1995) have suggested, to the existence of territoriality and/or private ownership of land. Unfortunately, only SCCS societies with less than 45-percent reliance on agriculture have been coded for territoriality and private property. With regard to territoriality, the predicted relation is found and it is statistically significant. The results, however, seem to be driven by several societies with particularly high estimates of consumable biomass per person; when these are removed, the relationship is no longer statistically significant. As for private ownership of land (or trees), the regressions do not reveal statistically significant relationships.

C Another possible indicator of stress on land resources, some anthropologists have argued, is famine. This seems dubious, since famine could be the result of weather conditions that are unrelated to land stress and that could affect gathering as well as agriculture. Nevertheless, I dutifully tried to test this proposition. For the sample as a whole, consumable biomass per person is inversely and significantly related to the presence and frequency of famine, in part, I suspect, because agriculture is much more specialized than gathering and, hence, more prone to general crop failure. For foraging societies with less than 35-percent reliance on fishing, I found no relationship. The famine indicator was the average of four indicators of famine in Dirks (1993) and Ember and Ember (1992), reproduced as Variables 1265, 1267, 1683, and 1685 by Divale and Gray (2001).

C Some anthropologists have suggested that frequency of external warfare is related to land stress, an hypothesis that overlooks other incentives for warfare such as booty, slaves, or wives. I explored the relationship of reliance on agriculture to frequency of external warfare (from Ember and Ember, 1992, and reported as Variable 1650 by Divale, 2001) but found little evidence for such a relationship.

It should be added that this measure of consumable biomass tells us nothing about the available biodiversity.

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