

THE NATIVE POPULATION OF AMAZONIA IN 1492 RECONSIDERED

POR

WILLIAM M. DENEVAN
University of Wisconsin-Madison

Desde 1965 he realizado distintas estimaciones sobre la población nativa de la Amazonía en 1492. Mi método fue determinar la densidad de población aproximada, que suponía un total entre 5,1 y 6,8 millones para la Gran Amazonía. Actualmente cuestiono este método, dado que las comunidades que tenían mayor densidad de población, estaban concentradas en núcleos más densos, y no tan dispersos como antes pensaba. De todos modos, creo que manejar una cantidad de población entre 5 y 6 millones sigue siendo razonable

PALABRAS CLAVES: *Amazonía, población nativa, densidad de población, método, concentrado versus disperso, reconsideración, Woodrow Borah.*

WOODROW BORAH AND THE MAR DEL PLATA SYMPOSIUM

On June 10, 1965, while living in Peru and undertaking fieldwork in the Upper Amazon, I received a letter from Woodrow Borah asking me to present a paper at a symposium he was organizing on historical demography at the 37th International Congress of Americanists to be held in Mar del Plata, Argentina in September, 1966¹. This led me from being an interested observer to center stage of the great debate over the size of native American population numbers at the time of Columbus.

When I was a graduate student in geography at the University of California at Berkeley, I was certainly aware of Woodrow Borah through his close relationship with historical geographers Carl Sauer and James Parsons and some of their students. I took no courses from Borah, but in 1963 I discussed my doctoral research on Mojos in the Bolivian Amazon with him. Later, while I was in Lima in 1966

¹ Simposio *Demografía Retrospectiva: Nuevos Aportes y Nuevos Métodos*.

he arrived for a month to consult with various scholars, and we spent considerable time together socially and discussing historical demography. A particularly notable afternoon was spent with Woodrow and John Murra at our apartment. The two had a vigorous dialogue about Indian populations in Peru and Mexico, while I sat quietly in a corner overwhelmed by the power of their exchange. Later, young historians told me that they had found Borah to be intimidating, but that was not my experience.

I told Woodrow that I would prepare a paper on Mojos for his Mar del Plata symposium. In a chapter of my dissertation I had examined the native population of Mojos based on Jesuit accounts². However, instead of presenting this I developed a speculative statement on western Amazonia, which was later published³. The symposium participants, besides Borah and myself, included Ángel Rosenblat, Pierre Chaunu, Juan Friede, and ---. The highlight was a one-on-one debate, actually a gentlemanly discussion, between Borah and Rosenblat.

INITIAL CONSIDERATION

I wrote the Mar del Plata paper in Lima with limited source materials. Even if I had had access to a good library and archives, it was unlikely that I would have found much numerical data on Amazonia for the sixteenth century. Other methods were of limited utility⁴. Consequently my methodology was largely theoretical, what I have since called the «habitat-density» method, not unlike the culture-area density method essentially used in Julian Steward's 1949 population density map for South America in A.D. 1500⁵. I reasoned that if I could obtain a few local population densities for each of the major habitats in Amazonia, I could average them, then multiply each resulting habitat density times the total land area in each habitat to get total estimated populations for each habitat. The habitats used were floodplains, lowland savanna, upland savanna, coastal, low selva, and high selva. I then applied this method to Peruvian and Bolivian Amazonia, obtaining overall densities of 0.47 and 0.96 per square kilometer and populations of 369.000 and 664.000 for a total of 1.033.000. Feeling confident, being young and bold, I then

² William M. DENEVAN, *The Aboriginal Cultural Geography of the Llanos de Mojos of Bolivia*, Ibero Americana 48, Berkeley, University of California Press, 1966, pp. 112-120.

³ William M. DENEVAN, «The Aboriginal Population of Western Amazonia in Relation to Habitat and Subsistence», *Revista Geográfica*, Vol. 72, 1970, pp. 61-86.

⁴ William M. DENEVAN, «The Aboriginal Population of Tropical America: Problems and Methods of Estimation», Paul DEPREZ (ed.), *Population and Economics*, Winnipeg, University of Manitoba Press, 1970, pp. 251-269.

⁵ Julian H. STEWARD, «The Native Population of South America», J. H. STEWARD (ed.), *The Handbook of South American Indians*, Bureau of American Ethnology Bulletin, No. 143, Washington, D.C., Smithsonian Institution, Vol. 5, 1949, p. 659.

applied this questionable method to all of Greater Amazonia (tropical interior of South America), and obtained an overall density of 0.59 per square kilometer and a total population of 5.750.000^{6,7}. There was little response to my method or results at the symposium, although Borah was quite supportive, nor to the published version.



Woodrow W. Borah en el Congreso Internacional de Americanistas de Mar de Plata, Argentina, de 1966. (Fotografía cedida por William Denevan).

This venture into historical demography led me and others to consider publishing an anthology of existing articles on the Indian demography debate, with

⁶ DENEVAN [3], pp. 79-82.

⁷ This total compares with prior estimates for just Brazil of 1.0 million by Rosenblat and 1.1 million by Steward, but 6.0 million for tropical South America by Dobyns. See Ángel ROSENBLAT, *La población indígena e el mestizaje en América*, Buenos Aires, Editorial Nova, 1954, Vol. 1, p. 102; STEWARD [5], p. 666; and Henry F. DOBYNS, «Estimating Aboriginal American Population: An Appraisal of Techniques with a New Hemispheric Estimate», *Current Anthropology*, Vol. 7, 1966, p. 415, note f.

encouragement from Borah and also from Carl Sauer, the founder of the Berkeley School of historical demography⁸. This plan was aborted by a lack of interest from university presses, and instead we opted for a collection of mostly original articles, which I edited⁹. It consists of eight essays plus my regional surveys¹⁰.

Borah initially believed that all our papers from the Mar del Plata symposium would be published in the Americanist Congress Proceedings, however after several years of waiting none were, for whatever reason¹¹. However, three of those papers were included in my 1976 volume: Borah, Rosenblat, and Denevan. Borah's essay is a review of the debate over the size of Indian populations - «an attempt at perspective». In it he repeated his earlier estimate of «upwards of one hundred million in the New World» ca. 1500¹², with the qualification that this was «an admittedly hasty and general estimate»¹³. Rosenblat's chapter¹⁴ was taken from an expanded version of his Mar del Plata paper which had been published in Mexico¹⁵, an aggressive defense of his previous conservative population estimates dating to 1935. I translated the Hispaniola section into Spanish, and Rosenblat made revisions and added an «Addenda» of eight pages, which is particularly a critique of Sauer's population material on Hispaniola¹⁶. Rosenblat indicated before his death in ---- that he was quite pleased to have had

⁸ William M. DENEVAN, «Carl Sauer and Native American Population Size», *Geographical Review*, Vol. 86, 1996, pp. 385-397.

⁹ William M. DENEVAN (ed.), *The Native Population of the Americas in 1492*, Madison, University of Wisconsin Press, 1976.

¹⁰ Upon reviewing population estimates for the major regions of the hemisphere by various scholars, I suggested a total of 57.3 million, or, when allowing for a degree of error of 25 percent, a range of from 43 to 72 million; see William M. DENEVAN, «The Aboriginal Population of Amazonia», W.M. DENEVAN (ed.), [9], 1976, p. 291. I later revised the total downward to 53.9 million, or, with a 20 percent margin of error, a range of from 43 to 65 million; see William M. DENEVAN, «Native American Populations in 1492: Recent Research and a Revised Hemispheric Estimate», W. M. DENEVAN (ed.), [9], Second Edition, 1992, pp. xxvii-xxix.

¹¹ Borah, in a letter to me dated November 17, 1969, commented: «It would be odd to omit our symposium from the Proceedings, but I suppose it might be done. The reasons could be so diverse that I see no point in speculating until we know more. Since all reports on the [Congress] stressed [our] symposium, it will be an interesting mystery for future readers».

¹² Woodrow BORAH, «America as Model: The Demographic Impact of European Expansion Upon the Non-European World», *Actas y Memorias XXXV Congreso Internacional de Americanistas*, México, D.F., Vol. 3, 1964, p. 381.

¹³ Woodrow BORAH, «The Historical Demography of Aboriginal and Colonial America: An Attempt at Perspective», William M. DENEVAN (ed.), [9], 1976, p. 17.

¹⁴ Ángel ROSENBLAT, «The Population of Hispaniola at the Time of Columbus», William M. DENEVAN (ed.), [9], 1976, pp. 43-66.

¹⁵ Ángel ROSENBLAT, *La población de América en 1492: Viejos y nuevos cálculos*, México D.F., El Colegio de México, 1967, pp. 7-23, 82-84.

¹⁶ Carl O. SAUER, *The Early Spanish Main*, Berkeley, University of California Press, 1966, pp. 65-69.

his position on low Indian population numbers published in English¹⁷. For Hispaniola he held to an estimate of only 100.000 to 120.000¹⁸, far below the estimates of Cook and Borah¹⁹, Sauer²⁰, N.D. Cook²¹, and others. In any event, the Mar del Plata symposium has had long-term repercussions.

In my own article in the 1976 volume, I considerably revised by Mar del Plata paper on Amazonia, with changes in the habitat densities, overall density (to 0.70), and total population for Greater Amazonia (to 6.8 million)²². However, I also allowed for a «buffer effect», or zones of no-man's lands between Indian groups, of 25 percent, thereby reducing the total to 5.1 million. This article received considerable attention, and the totals have been frequently cited, mostly uncritically. On the other hand, I was challenged by a few authorities for being either too conservative²³ or excessive²⁴, while others found my densities to be acceptable²⁵.

In the introduction to the second edition of *The Native Population of the Americas in 1492*, I again revised my regional estimates for Amazonia, using the same habitat density methodology, but taking into consideration demographic information and estimates from new research by various scholars. For Greater Amazonia my new total was 5.7 million, using a buffer zone of only 15 percent²⁶.

RECONSIDERATION: THE *VÁRZEA*

The method used in the 1966 Mar del Plata paper and in the several published versions²⁷ assumed that in each of the habitat types used, the population density was more or less uniform. Thus, known local densities could be extrapolated to the full areas of each habitat to obtain total populations for each. However this is

¹⁷ Ángel ROSENBLAT, personal communication, 1976.

¹⁸ ROSENBLAT [14], p. 59.

¹⁹ Sherburne F. COOK and Woodrow BORAH, «The Aboriginal Population of Hispaniola», S.F. COOK and W. BORAH (eds.), *Essays in Population History: Mexico and the Caribbean*, Berkeley, University of California Press, Vol.1, 1971, pp. 407-408.

²⁰ SAUER [16], pp. 55-69.

²¹ Noble David COOK, «Disease and the Depopulation of Hispaniola, 1492-1518», *Colonial Latin American Review*, Vol. 2, 1993, pp. 219-220.

²² DENEVAN [10], 1976, pp. 230, 234.

²³ Nigel J.H. SMITH, «Anthrosols and Human Carrying Capacity in Amazonia», *Annals of the Association of American Geographers*, Vol. 70, 1980, p. 566; Thomas P. MYERS, «El efecto de las pestes sobre las poblaciones de la Amazonía Alta», *Amazonía Peruana*, Vol. 8, 1988, pp. 63, 69.

²⁴ Magnus MÖRNER, *Review of The Native Population of the Americas in 1492*, William M. DENEVAN (ed.), 1976, *Latin American Indian Literatures*, Vol. 32, 1979, pp. 27-28.

²⁵ Erwin FRANK, «Delimitaciones al aumento poblacional y desarrollo cultural en las culturas indígenas de la Amazonia antes de 1492», *Tübinger Geographische Studien*, Vol. 95, 1987, p. 113.

²⁶ DENEVAN [10], 1992, pp. xxvii-xxix.

²⁷ DENEVAN [3]; [10], 1976; also William M. DENEVAN, «La población aborigen de la Amazonia en 1492», *Amazonía Peruana*, Vol. 5, 1980, pp. 3-41.

a fallacy. We now know that for the várzea (floodplain), *terra firme* (upland forest), and also the llanos (savannas), populations were concentrated into large, probably semi-permanent villages, separated by extensive areas of small villages and sparse, dispersed populations.

I became aware of this patch pattern» for the várzea when I reexamined settlement locations. Sixteenth-century accounts indicate long stretches of large linear villages, with gaps that I initially assumed were buffer zones. Most of these villages were not located in the floodplains but rather on the adjacent bluffs, well above periodic flooding, and were apparently supported by a complementary subsistence system that depended on both seasonal floodplain *playa* cultivation (plus fishing) and semi-permanent year-round cultivation and orchards (plus hunting)²⁸ on the bluff tops²⁹. However, I argued, this system could only function where continuously navigable river channels impinged against a bluff, not where the main channels were in mid floodplain or against the opposite bluff. This pattern is supported by ethnohistory, archaeology, and by the presence of *terra preta* (black anthropogenic soil)³⁰ along the bluff tops.

The mid sixteenth-century and early seventeenth-century chroniclers of the Amazon River, Carvajal, the men of Úrsula/Aguirre, and others, reported linear villages on the bluffs, as long as 1 to 5 leagues (ca. 6 to 30 kilometers), in places as large as 800 to 3.000 people and some possibly as large as 10.000, with sectors of empty lands between villages³¹. In 1557 the Salinas de Loyola expedition on the Río Ucayali in Perú reported village house numbers that may have contained

²⁸ A case can be made for semi-permanent prehistoric cultivation because of the inefficiency of stone axes for clearing forest, in contrast to shifting cultivation in colonial and modern times made possible by much more efficient iron and steel axes. With stone axes, forest once cleared would likely be kept in production rather than fields being frequently shifted. See William M. DENEVAN, *Cultivated Landscapes of Native Amazonia and the Andes*, Oxford, Oxford University Press, 2001, pp. 115-127.

²⁹ William M. DENEVAN, «A Bluff Model of Riverine Settlement in Prehistoric Amazonia», *Annals of the Association of American Geographers*, Vol. 86, 1996, pp. 654-681.

³⁰ The origin of *terra preta* has long been debated; see Smith [23], pp. 553-556. Scholars now mostly agree that the black form, generally filled with ceramics and bones, is a pre-European midden (garbage) derived soil associated with long-term settlement. A brownish form (*terra mulata*) is much more extensive and appears to be the result of semi-permanent cultivation involving mulching, composting, and frequent in-field burning. These are fertile soils that seem to be self sustaining. See William I. WOODS and Joseph M. MCCANN, «The Anthropogenic Origin and Persistence of Amazonian Dark Earths», *Yearbook, Conference of Latin Americanist Geographers*, Vol. 25, 1999, pp. 7-14; and Joseph M. MCCANN, William I. WOODS, and D. W. MEYER, «Organic Matter and Anthrosols in Amazonia: Interpreting the Amerindian Legacy», R. M. REES, B. C. BALL, C. D. CAMPBELL, and C. A. WATSON (eds.), *Sustainable Management of Soil Organic Matter*, New York, CAB International, 2001, pp. 180-189.

³¹ DENEVAN [29], pp. 657-664.

as many as 4.000 and 8.000 people³². While exaggeration is possible, support is provided by lengths of *terra preta* of up to 6 kilometers and measuring several hundred hectares in extent³³. Sites at Araracuara on the Río Caquetá in the Colombian Amazon were occupied for 800 years or more³⁴. At Açutuba on the lower Rio Negro, terra preta extends for 3 kilometers with 30 hectares of settlement activity, with nearly continuous occupation from at least A.D. 1 to 1440³⁵.

Possibly only about 20 percent of a bluff along one side of a floodplain has easy river access and thus to *playas*, aquatic resources, and river travel³⁶. This is where the large semi-permanent villages were located, in narrow strips separated by longer strips of sparse populations. For the well-settled sectors, with an estimated sustaining area of 15 kilometers depth (10 kilometers in from the bluff edge and 5 kilometers into the floodplain), the associated riverine population density would be 10.4 per square kilometer. The total riverine population for the main Amazonian rivers would be about 1.5 million³⁷. This compares with my earlier estimate of a floodplain population of about 1.8 million³⁸. However, the 20 percent densely occupied sectors and the 15 kilometer deep sustaining zone, based on this «bluff model», are rough estimates.

RECONSIDERATION: *TERRA FIRME*

For the upland forests, I originally used a conservative density of 0.2 people per square kilometer³⁹, as did Steward for marginal (non-agricultural) tribes⁴⁰. Even this low density produces a total of 1.26 million people given the enormous area of upland forest involved (nearly 6 million square kilometers in greater Amazonia). The 0.2 density was assumed to represent a relatively uniform distribution of well-spaced small villages, mostly of 100 people or less⁴¹. Meggers

³² Thomas M. MYERS, «Spanish Contacts and Social Change on the Ucayali River, Perú», *Ethnohistory*, Vol. 21, 1974, pp. 140-141.

³³ DENEVAN [29], pp. 664-666.

³⁴ HERRERA, Luisa Fernanda, Inés CAVELIER, Camilo RODRÍGUEZ, and Santiago MORA, «The Technical Transformation of an Agricultural System in the Colombian Amazon», *World Archaeology*, Vol. 24, 1992, pp. 107, 110.

³⁵ Michael J. HECKENBERGER, James B. PETERSEN, and Eduardo Góes NEVES, «Village Size and Permanence in Amazonia: Two Archaeological Examples from Brazil», *Latin American Antiquity*, Vol. 10, 1999, pp. 356-364.

³⁶ DENEVAN [29], p. 673.

³⁷ *Idem*.

³⁸ DENEVAN [10], 1976, p. 230.

³⁹ DENEVAN [3], p. 72; DENEVAN [10], 1976, p. 225.

⁴⁰ STEWARD [5], p. 661.

⁴¹ Julian H. STEWARD and Louis C. FARON, *Native Peoples of South America*, New York, McGraw Hill, 1959, p. 299.

believed that tropical forest village size did not exceed 1.000 people each, based on her perceived «environmental limitation on the development of culture»⁴². In making my own estimates I ignored reports that there were also some much larger villages numbering several thousand people each.

The evidence for large villages in the uplands is of three types: archaeological, terra preta soil, and historical⁴³. The best archaeological examples are in the Upper Xingu basin. Recent excavations there indicate village extents of from 30 to 50 hectares, with village populations of «at least 1.000 to 1.500», compared to the largest, current near-by Kuikuru village of only about 6 hectares and 330 people⁴⁴. These villages were occupied continuously for hundreds of years, with ringed moats and roads and terra preta soil, and they apparently were supported by semi-permanent cultivation. A site partially surrounded by long trenches near the Rio Kuluene, also in the Upper Xingu region, covered 110 hectares⁴⁵, but it was not likely a single village. An Aratu village site in Goiás, 10.3 hectares in size, «had an estimated maximum population between 1.043 and 1.738 persons»⁴⁶.

Large terra preta sites in upland forests include over 120 hectares at Oitavo Bec south of Santarém⁴⁷ and 200 hectares at Comunidade Terra Preta between the lower Tapajós and the Rio Arapiuns⁴⁸. Other very large expanses of terra preta have been reported but not measured⁴⁹. Such large sectors of anthropogenic soils, however, are in large part created by cultivation and do not represent single village sizes, but they are indicative of large, permanent villages. There are also large numbers of small terra preta patches, 1-2 hectares or less⁵⁰, likely occupied by just a few people over a long period of time or frequently reoccupied.

There are numerous historical reports of large forest villages of 1.000 or more, dating from the sixteenth century to the early twentieth century, despite depopulation and social disruption after initial contact. For example, the largest, prin-

⁴² Betty J. MEGGERS, «Environmental Limitation on the Development of Culture», *American Anthropologist*, Vol. 56, 1954, p. 814. Meggers later argued that large archaeological sites in Amazonia reflect multiple occupations of these sites rather than large single, permanent villages. See Betty J. MEGGERS, «Prehistoric Population Density in the Amazon Basin», John W. VERANO and Douglas H. UBELAKER (eds.), *Disease and Demography in the Americas*, Washington, D.C., Smithsonian Institution Press, 1992, pp. 197-205; and Betty J. MEGGERS, «The Continuing Quest for El Dorado: Round Two», *Latin American Antiquity*, Vol. 12, 2001, pp. 304-325.

⁴³ DENEVAN [28], pp. 115-132.

⁴⁴ HECKENBERGER, *et al.* [35], p. 370.

⁴⁵ Gertrude E. DOLE, «A Preliminary Consideration of the Prehistory of the Upper Xingú Basin», *Revista do Museu Paulista*, Nova Série, Vol. 13, 1961, pp. 403-404.

⁴⁶ Irmhild WÜST and Cristiana BARRETO, «The Ring Villages of Central Brazil: A Challenge for Amazonian Archaeology», *Latin American Antiquity*, Vol. 10, 1999, pp. 9, 14.

⁴⁷ WOODS and MCCANN [30], p. 12.

⁴⁸ Nigel J.H. SMITH, *The Amazon River Forest: A Natural History of Plants, Animals, and People*, Oxford, Oxford University Press, 1999, p. 26.

⁴⁹ Joseph M. MCCANN, personal communication, 2001.

⁵⁰ SMITH [23], p. 563.

principal Tupinambá villages ranged up to «perhaps 6.000 to 8.000»⁵¹. Clastres estimated that Tupinambá village size ranged from about 400 to 3.000 or more, and he cites André Thevet in 1556 as reporting single villages of 6.000 and 10.000 people, probably an exaggeration⁵². A Bororo village in the early twentieth century had an estimated 1.500 people⁵³, and another in the 1930s had «an estimated population of more than 1.000 people»⁵⁴. A Kayapó village in 1896 had about 1.500 Indians⁵⁵. The outline of the Kayapó village of Pyka-tô-ti, which existed to possibly 1919, covers 87 hectares and was estimated by Posey to have had «perhaps 3.500 to 5.000 people»⁵⁶. Paresi villages in the early eighteenth century were as large as possibly 1.200 people, and in the sixteenth century one Xarae village may have had 7.500 people⁵⁷. An Apinayé village in 1824 was said to have numbered 1.400⁵⁸.

None of these reports is conclusive as to actual village size, but they do suggest that villages over 1.000 were not uncommon during both pre-European and historical times in the upland forests. It is also known that many smaller villages were present. Overall there was clearly a wide diversity of village sizes, possibly a range from one single family house to as high as 5.000 people. Many if not most villages were probably permanent or semi-permanent, given the evidence of terra preta and my argument that semi-permanent cultivation was practiced. Villages may have been shifted over short distances within sectors of terra preta soil and anthropogenic vegetation, but the high degree of village mobility known from historical times may not have been as common in prehistoric times⁵⁹.

⁵¹ William C. STURTEVANT, «Tupinambá Chiefdoms?», Elsa M. REDMOND (ed.), *Chiefdoms and Chieftaincy in the Americas*, Gainesville, University Press of Florida, 1998, pp. 141-142.

⁵² Pierre CLASTRES, «Elements of Amerindian Demography», P. CLASTRES (ed.), *Society Against the State: Essays in Political Anthropology*, New York, Zone Books, 1989 [1974], p. 87.

⁵³ Irmhild WÜST, «The Eastern Bororo from an Archaeological Perspective», Anna ROOSEVELT (ed.), *Amazonian Indians from Prehistory to the Present: Anthropological Perspectives*, Tucson, University of Arizona Press, 1994, p. 323.

⁵⁴ WÜST and BARRETO [46], p. 14.

⁵⁵ Darrell A. POSEY, «Environmental and Social Implications of Pre-and Postcontact Situations on Brazilain Indians: The Kayapó and a New Amazonian Synthesis», Anna ROOSEVELT (ed.), *Amazonian Indians from Prehistory to the Present: Anthropological Perspectives*, University of Arizona Press, Tucson, 1994, p. 272.

⁵⁶ Darrell A. POSEY, «Contact Before Contact: Typology of Post-Columbian Interaction with Northern Kayapó of the Amazon Basin», *Boletim do Museu Paraense Emílio Goeldi, Série Antropológica*, Vol. 3, 1987, p. 147.

⁵⁷ WÜST [53], p. 337.

⁵⁸ Curt NIMUENDAJÜ, *The Apinayé*, Oosterhout, Anthropological Publications, 1967 [1939], p. 12.

⁵⁹ Village fissioning as result of internal conflict (social tension) undoubtedly did occur; see Eduardo Góes NEVES, «Village Fissioning in Amazonia: A Critique of Monocausal Determinism», *Revista do Museu de Arqueologia Etnologia da Universidade de São Paulo*, Vol. 5, 1995, pp. 195-209. However this did not necessarily result in village abandonment. Abandonment of both houses and villages because of death, disease, vermin, house deterioration, witchcraft, etc. could result in shifts of houses to an immediately adjacent spot or a few hundred yards away, not necessarily to a

Arguments that environmental limitations held average population densities to those of surviving Indian groups of 0.3 per square kilometer or less⁶⁰, or even that the size of permanent villages could have been up to 2.000 people based on shifting cultivation⁶¹, must be reconsidered if semi-permanent cultivation was indeed practiced. Higher densities and larger villages were possible. One argument against large villages away from rivers is that there were inadequate sources of animal/fish protein for a crop diet based on protein-poor manioc and other tubers⁶². However, on fertile *terra preta* soils, near-continuous cultivation of protein-rich maize is possible.

Thus, for *terra firme* forests, there seems to have been great variation in population density, with sparse populations surrounding patches of dense populations in the sustaining areas of scattered large villages. We have no idea how many of these large villages existed, so it is impossible to estimate an average population density and a total population. If large villages were fairly numerous, then pre-European overall densities of 0.2 to 0.3 per square kilometer⁶³, based on such densities for small villages today⁶⁴, could be much too low.

RECONSIDERATION: THE SAVANNAS

I originally estimated densities of 0.5 per square kilometer for the well-drained upland savannas (mainly in central Brazil) and 1.3 to 2.0 for the seasonally flooded lowland savannas (mainly Mojos and the Orinoco Llanos)⁶⁵. The former density was based on a Nambicuara density of 0.2 in 1907, adjusted to 0.5 on contact. The lowland density was based on my estimate for the Llanos de Mojos in Bolivian Amazonia and a guess for the Orinoco Llanos. All these densities are problematical.

It is now obvious that there was just as much demographic variability in the savannas as in the upland forest. People in both types of savannas were concen-

distant location, especially if there had been large local investments in the existing village, intensive cultivation, roads, and defensive works (moats, palisades).

⁶⁰ MEGGERS [42], 1992, p. 203.

⁶¹ Robert L. CARNEIRO, «Slash-and-Burn Agriculture: A Closer Look at its Implications for Settlement Patterns», Anthony F.C. WALLACE (ed.), *Selected Papers of the Fifth International Congress of Anthropological and Ethnographical Sciences*, Philadelphia, University of Pennsylvania Press, 1960, p. 232.

⁶² DENEVAN [28], pp. 81-83.

⁶³ STEWARD [5], p. 661; DENEVAN [10], 1976, p. 225; MEGGERS [42], 1992, p. 203.

⁶⁴ For 13 *terra firme* groups, Beckerman indicates that the average population density of 12 of them was between 0.1 and 1.0 per square kilometer; see Stephen BECKERMAN, «Swidden in Amazonia and the Amazon Rim», B. L. TURNER II and Stephen B. BRUSH (eds.), *Comparative Farming Systems*, New York, Guilford Press, 1987, p. 86.

⁶⁵ DENEVAN [10], 1976, pp. 288, 230.

trated at forest edges, in forest islands, and in gallery forests, utilizing resources from both forest and savanna. Villages within savanna were usually near forest and lakes or rivers. Settlement in open savanna was usually sparse and semi-nomadic. Exceptions were in the raised-field clusters that occur in the seasonally flooded savannas of Mojos, the Orinoco, and the coast of the Guianas⁶⁶. Densities were probably over 50 people per square kilometer of combined ditch and field surfaces. Associated villages were located on artificial mounds in open savanna.

For savannas, there are several estimates of large village size based on archaeology. Most notable, Marajó Island in Brazil, ca. A.D. 400-1300, had enormous artificial mounds covering as much as 50 and 90 hectares, with villages on the largest mounds having had about 1.000 people and large multi-mound sites having had several thousand, one with 40 mounds «likely to have had a population of more than 10.000 people»⁶⁷. The Gavan site in the Orinoco Llanos, A.D. 550-1.000, had an estimated 670 to 1.000 people⁶⁸.

Examples of reported historical village sizes include: Mojos (1617), single-family house counts of 280, 350, and 400, which at a rough five people per house equal 1.400, 1.750, and 2.000 each⁶⁹; Caquetío, Orinoco Llanos (1539), one village with 4.000 people⁷⁰; Orinoco delta (mixed forest, swamp, savanna) (1583), villages of 2.000 and 4.000⁷¹. On the other hand, many savanna villages, had less than 100 people, and semi-nomadic bands such as the Nambicuara. Sirionó, and Yaruro had only a few small temporary huts, at least in recent times.

Thus the savannas also had a wide range of population densities and village sizes, with some villages numbering several thousand and with very high densities in sectors with raised fields. Large areas elsewhere had either small frequently shifted villages and very low densities (probably under 0.1 per square kilometer), as in the soil-impooverished central Brazilian plateaus where agriculture is difficult today without heavy inputs of chemical fertilizers, or were only utilized for hunting by people who lived and farmed in adjacent forests. Estimati-

⁶⁶ DENEVAN [28], pp. 215, 253.

⁶⁷ Anna C. ROOSEVELT, *Moundbuilders of the Amazon: Geophysical Archaeology on Marajó Island, Brazil*, San Diego, Academic Press, 1991, pp. 31, 38. In a harsh critique of this book, Meggers only briefly questions Roosevelt's population estimates, primarily the 1.000 for the small (3.0 hectares) Teso dos Bichos mound, and she acknowledges the large size of some of the other mounds, but not of any as extensive as 60 and 90 hectares; see Betty J. MEGGERS, «Amazonia: Real or Counterfeit Paradise», *Review of Archaeology*, Vol. 13, No. 2, 1992, pp. 27-28, 36.

⁶⁸ Charles S. SPENCER, Elsa M. REDMOND, and Milagros RINALDI, «Drained Fields at La Tigra, Venezuelan Llanos: A Regional Perspective», *Latin American Antiquity*, Vol. 5, 1994, p. 134.

⁶⁹ DENEVAN [2], p. 112.

⁷⁰ Charles S. SPENCER, «Investigating the Development of Venezuelan Chiefdoms», Elsa M. REDMOND (ed.), *Chiefdoms and Chieftaincy in the Americas*, Gainesville, University Press of Florida, 1998, p. 108.

⁷¹ Neil L. WHITEHEAD, *Lords of the Tiger Spirit: A History of the Caribs in Colonial Venezuela and Guyana 1498-1820*, Doordrecht, Foris Publications, 1988, p. 13.

ing average population densities for the savannas with any confidence is impossible. If it were just a matter of very sparse semi-nomadic populations, an approximation could be made, but there were also large villages and we don't know how many.

CONCLUSION

Consequently I now reject the habitat-density method I used in the past to estimate a Greater Amazonia population in 1492 of from 5.1 to 6.8 million⁷². There was too much variability in densities in each habitat to be able to formulate meaningful average densities on the basis of a few sample densities.

The other main methodology used is totaling tribe-by-tribe counts plus estimates based on various criteria, as done by Steward to obtain 1.1 million and by Hemming to obtain 3.2 million⁷³, both for all of Brazil⁷⁴. This is just as unreliable as habitat-density calculations because the counts used are often well after the sixteenth century, because recent populations are assumed to represent maximum possible populations and hence past populations, because known numbers are not systematically projected back to initial contact to account for depopulation, and because many groups which became extinct are not considered at all.

So what would my mentor on historical demography, Woodrow Borah, say? Thirty five years of trying to estimate the native Amazonian population in 1492, and now Denevan gives up! Says it can't be done with any meaningful result. Woodrow would probably be disappointed. On the other hand, I have some perspective from all these years of attempting to make estimates; from having examined and reexamined the relevant archaeological, historical, environmental, and agricultural evidence; from being familiar with the methods and estimates of others; and from having conducted fieldwork on several Indian groups in the South American lowlands including research on prehistoric and recent cultivation practices. This perspective, which I believe permits more than just guesswork,

⁷² DENEVAN [3, 10, 29].

⁷³ STEWARD [5], pp. 661-663, 666; John HEMMING, *Red Gold: The Conquest of the Brazilian Indians*, Second Edition, London, Macmillan, 1995, pp. 505-521.

⁷⁴ The totals by Steward and Hemming for Brazil can be compared with recent estimates by Denevan, 3.3 million for the Amazon basin (including western Amazonia but not southern Brazil); by Meggers, 1.5 to 2.0 million for the Amazon basin (not defined), based on a 0.3 overall density derived from present densities; and by Newson, 4.86 to 5.46 million for the Amazon basin, projected from her estimates for eastern Ecuador; see DENEVAN [29], p. 656; MEGGERS [42], 1992, p. 203; and Linda A. NEWSON, «The Population of the Amazon Basin in 1492: A View from the Ecuadorian Headwaters», *Transactions of the Institute of British Geographers*, New Series, Vol. 21, 1996, p. 15. On the extreme side, highly speculative, are estimates of 10 million by Myers for just upper Amazonia in 1524, and 15 million by Smith for all of Amazonia in 1500; see MYERS [23], p. 69; and SMITH [48], p. 28.

gives me confidence that the Indian population in 1492 was indeed *at least* 5 to 6 million for Greater Amazonia and at least 3-4 million for the Amazon basin. These numbers give overall densities of only 0.51-0.61 and 0.51-0.68 per square kilometer. There were large areas with fewer people, but there were also locations with many, many more.

Since 1965 I have made several attempts to estimate the native population of Amazonia in 1492. My method was to determine rough habitat densities, which project to totals for Greater Amazonia of from 5.1 to 6.8 million. I now reject this method, given that the denser populations were mostly clustered rather than evenly dispersed. I nevertheless still believe that a total of at least 5 to 6 million is reasonable.

KEY WORDS: *Amazonia, native population, habitat density method, clustering versus dispersal, reconsideration, Woodrow Borah.*
