

Researchers explore population size, density in rise of centralized power in antiquity

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Ruins of the Temple of the Amphitheatre in the Late Preceramic Period archaeological site of Caral in Peru. Credit: Courtesy of Daniel Sandweiss

Early populations shifted from quasi-egalitarian hunter-gatherer societies to communities governed by a centralized authority in the middle to late Holocene, but how the transition occurred still puzzles anthropologists. A University of Maine-led group of researchers contend that population size and density served as crucial drivers.

Anthropology professor Paul "Jim" Roscoe led the development of Power Theory, a model emphasizing the role of demography in political centralization, and applied it to the shift in [power](#) dynamics in prehistoric northern coastal societies in Peru.

To test the theory, he, Daniel Sandweiss, professor of anthropology and Quaternary and climate studies, and Erick Robinson, a postdoctoral anthropology researcher at Utah State University, created a summed probability distribution (SPD) from 755 radiocarbon dates from 10,000-1,000 B.P., or before present.

The team found a correlation between the tenets of their Power Theory, or that population density and size influence political centralization, and the change in power dynamics in early Peruvian societies.

The team shared their findings in a report published in *Philosophical Transactions of the Royal Society B*.

"I've always been interested in how, in the space of just five to 10,000 years, humans went from biddy little hunter-gatherer groups in which nobody could really push anyone else around to vast industrial states governed by a few people with enormous power. From my fieldwork and other research in New Guinea, it became clear that leaders mainly emerged in large, high-density populations, and Power Theory explained why," Roscoe says. "Unfortunately, it was difficult until recently for archaeologists to get a handle on the size and densities of populations in the past. SPD techniques are a major help in bringing these important variables into understanding how human social life underwent this dramatic transformation."

Scientists have previously posited that population in northern coastal Peru rose during the Late Preceramic, Initial, Early Horizon and Early Intermediate periods, or between about 6,000-1,200 B.P. The SPD from

Roscoe and his colleagues validates the notion.

The people who settled in the coastal plain first lived as mobile hunter-gatherers or incipient horticulturalists in low density groups, according to researchers. Millennia afterward in the Late Preceramic period, however, several developments brought increased interaction and shareable resources. People began farming, developed [irrigation systems](#) and became more settled as time passed. Eventually, some of the world's first 'pristine' states formed in the plain.

The onset and growth of agriculture, irrigation and sedentism, propelled by upticks in [population size](#) and density, fostered the capacity of political agents to interact with and manipulate others. Political centralization and hierarchy formed as a result, according to researchers.

Roscoe and his colleagues demonstrated through their radio-carbon SPD that the rise in centralized authorities in early Peruvian communities that resulted from farming, irrigation and settlement coincided with an uptick in [population](#) size. The results of their work demonstrate "a broad, low-resolution congruence between the expectations of Power Theory and what is currently known about coastal Peruvian antiquity," they wrote in their study.

The project also highlights the capability of SPDs for examining the influence of demography in the growth of prehistoric political centralization. Determining the extent of that influence, however, requires additional study.

"We're hoping this work demonstrates the value of SPDs for understanding the role of demography in the emergence and development of power centers on Earth," Roscoe says. "What we need now is to increase the size of our SPD databases and filter out some of the weaknesses we know they contain."

More information: Paul Roscoe et al, Population density and size facilitate interactive capacity and the rise of the state, *Philosophical Transactions of the Royal Society B: Biological Sciences* (2020). [DOI: 10.1098/rstb.2019.0725](https://doi.org/10.1098/rstb.2019.0725)

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