Do prehistoric Pueblo populist revolutions presage American politics today?

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The extreme architectural investment in Chaco Canyon typifies periods of peak building. Credit: Nathan Crabtree

Inequality. Economic recession. Wage stagnation. These are the buzzwords of the populist uprisings on both the left and the right during this 2016 election season. Although they're running strikingly different campaigns, Bernie Sanders and Donald Trump are both capitalizing on anger with the so-called "elites" in the United States – and promising

revolutions should they get elected (and predicting riots should Trump be denied).

Obviously this form of populist uprising isn't new, but could it be something common to all societies at one point or another, or even predictable?

Recently, we've been looking at revolutions in the prehistory of the southwestern U.S. – in particular, the history of the Pueblo people. In our recently published *Science Advances* paper, along with our colleagues Keith Kintigh and Jonathan Rush, we identified four points in Pueblo history between A.D. 500 and 1400 when such revolutions likely occurred.

What we discovered is that in each case, the revolution was instigated by drought that severely affected the primary subsistence base: maize agriculture. Although this may seem remote from today, the idea of an economy collapsing and leading to social upheaval shouldn't be too hard to imagine. And actually, as of 2013, maize is the world's most produced grain by weight. All societies are at risk when their subsistence bases hit very tough times.

Turning to the trees

To untangle the relationship between climate and social revolution, we analyzed two large databases built from information about trees.

A tree's rings give information about when it lived and the climate it encountered. Credit: PROMicolo J, CC BY

Most trees add a "ring" of growth for every year they're alive, and the widths of these rings are related to the changing climate a tree experienced over its lifespan. Tree-ring scientists – dendrochronologists – can compare a sample with a regional "master chronology" and establish the year each tree died (with varying levels of precision).

Started by fellow archaeologist Mike Berry in the 1970s, the first data set we used contains nearly 30,000 tree-ring dates collected from archaeological sites throughout the American Southwest. These are

samples (roof beams, posts and so on) from structures built by Pueblo people. So if we have a cluster of dates at A.D. 800 from timbers from a pithouse, we can be quite sure building was going on at that location in that very year.

The second tree-based data set we used collects ring-width chronologies from many trees in the same locale. Because trees put on growth rings of varying thickness in response to particular climate conditions, and these can be dated, we can piece together sequences from many trees in a local area to recreate its annual climate over centuries.

For example, pinyon and juniper trees from low elevations in the Southwest may be sensitive to annual variation in rain, while spruce and pines from higher elevations may be more sensitive to temperature variability. In an especially dry year a valley juniper might barely grow; in a wetter year it will put on a wide ring. Depending on the species and elevation of the tree, the width of its rings tells us about the rain or temperature in specific years.

Trees as thermometers and rain gauges

For this study, we drew on 532 of these ring-width chronologies from across the western U.S. We wanted to use these ring-width chronologies to predict – or *retrodict*, since we are predicting into the past – temperature and precipitation at each of over 2 million spots across the landscape, for A.D. 500–1400.

For each location, we know the spatial and temporal climate patterns from the 20th century based on weather station measurements that were then estimated at other points on the landscape. From that, we borrow a sophisticated algorithm from quantitative genomics to mine the ring-width data and reconstruct prehistoric conditions for each spot.

Balcony House in Mesa Verde National Park in southwest Colorado. Timbers incorporated into the structure are visible. Credit: Tim Kohler, CC BY-ND

Combining these annual precipitation and temperature reconstructions for each location, we wound up with a map for each year showing where the maize the Pueblo people depended on for survival could be grown without irrigation.

We then compared these two tree-ring-based data sets – construction dates and climate. It's no surprise that we find that people tended to live *where* they could farm, and that they built more *when* they could farm. People were building – and societies were flourishing – where and when the climate allowed them to make a good living growing maize.

Alternating between exploration and exploitation

What's more important is what we don't see in the data.

In 1982, Mike Berry noted a pronounced pattern. Based on the number of dated timbers through time, there seemed to be a peak in building every 200 years or so. He suggested that the pattern of highs and lows over the centuries represented long periods of relatively good farming conditions during the peaks, and relatively poor growing conditions for maize during the intervening troughs.

But that's not what we find in our climate reconstruction, which represents the first attempt to figure out growing conditions for maize throughout the Southwest for the Common Era. Instead, we saw that while the peaks did *end* during somewhat unusual droughts, in general, the troughs weren't worse times for agriculture than the peaks.

So what explains the pattern of peaks and valleys in the number of dated timbers through time?

The extensive settlements at Chaco Canyon in New Mexico exemplify a hierarchical social system that eventually proved unsustainable. Credit: John Fowler, CC BY

We argue that Pueblo societies went through alternating phases of *exploration* and *exploitation* of niches that are simultaneously ecological, cultural and organizational. During exploration phases – the valleys of the date distribution – people experimented with farming in new areas of the Southwest, trying out new architectural and ceramic forms, social organizations and ritual practices. When droughts occurred during these

periods, they don't seem to have caused major social upheavals.

Eventually people converged on combinations of successful places for growing, along with behaviors (ceremonial, social and political) that allowed their societies to take off. During these exploitation phases – the peaks in building activity – conformity became the norm. More people began living in villages and clusters of these successful villages grew in size.

In the process, though, they became inflexible and eventually unable to cope with climate shifts. In some periods (especially during the Chaco era, by around A.D. 1100) inequality rose, as measured by variability in household size and access to prestige items such as ceramics from far-off places, or even high-quality meat like deer.

And at the end of each peak, these societies underwent revolutionary change, spurred by drought. Villages were abandoned – sometimes violently – and people again began exploring new ways of living. During the first building peak, people stored their maize in underground cists outside their homes; after the revolution they switched to storing corn in aboveground rooms connected with other living spaces. We think attitudes towards food sharing became more restrictive after the first revolution. At the end of the third peak in the mid-1100s, people stopped constructing the large "Great Houses," an apparent connection to Mesoamerican culture that had come to dominate regional architecture. And in the most dramatic revolution on record, people at the end of the 1200s completely left the northern Southwest and moved to points south.

Ingredients for revolutionary change

While social consensus – agreement on how to live together and be part of a community – might take decades to develop, it can disintegrate in a surprisingly short amount of time. We argue this cycle of slow

development of social consensus and rapid breakdown happened at least four times in the Pueblo past between A.D. 500 and 1400.

Inequality can have a pernicious effect on the stability of societies, making them less resilient in the face of environmental or economic challenges. In the Pueblo Southwest, these two were one and the same: the "market" was agricultural production, and "market forces" – which leaders were charged with controlling – were climate.

When ceremonies weren't working to bring the rains anymore, political and spiritual leaders lost their legitimacy. In at least the last two peaks, inequality in responsibilities and access to resources rose to such a degree that, when things did turn bad, those at the bottom rejected prior ways in what could be considered a "populist" uprising. These were often violent – the inhabitants of entire villages were massacred, and there is evidence for ritually linked cannibalism. In other research, we've found that at times there was also substantial environmental inequality in these societies. Some people lived in places where maize agriculture was very consistent, and others lived in much more marginal areas.

Is our society gearing up for revolution now?

Both of these conclusions have echoes today.

We are living in a period of dramatic economic inequality, aggravated by the recession eight years ago. Officially we "recovered" from the Great Recession in 2010, but large numbers of Americans haven't felt that recovery – many are even asking whether the American dream is dead.

The result is populist unrest – many voters have effectively cast a vote of no confidence in our current leadership and governmental systems. We may now be experiencing what Pueblo society experienced many times, many years ago. Inequality made Pueblo society less resilient in the face

of challenges – it remains to be seen how these populist sentiments play out this time around.

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