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THE RISE AND FALL OF THE PREHISTORIC POPULATION OF NORTHERN ARIZONA[1]

By Dr. HAROLD S. COLTON

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IN the Southwest more people take an interest in the early inhabitants of the country than in any other portion of the United States. This is easy to understand because the evidence of these people exists on every hand. Even though we deplore the practice, many of the present population pot-hunt more or less and speculate on the pots and the makers of the pots. Archeologists tackle the same problems with refined technical methods. They too speculate, filling in the gaps that exist in the data and let their imaginations loose to complete the story.

In this paper I am going to speculate on the people of northern Arizona. The rise and fall of the prehistoric people is speculative, but the foundation rests on fairly solid rock. The age of the earth or the origin of mankind—subjects that are perfectly orthodox to discuss—rest on foundations which, in comparison, are laid on sand.

My problem was suggested to me several years ago by Dr. Ellsworth Huntington, of Yale. He suggested that a study be made of the prehistoric populations of the Near East, the Peruvian plateau and the Southwest, with a view to a possible correlation with climatic conditions. He hoped that I would make the study of the Southwest. The facts on which such a study might be based seemed so nebulous that I did not take it seriously. But I thought about it and after a while I decided that even if I did not have figures for an accurate census, still I might make an approximation of the truth. Therefore, I now with

[1] Address of the retiring president of the Southwestern Division of the American Association for the Advancement of Science, delivered at the sixteenth annual meeting of the Southwestern Division, held at Flagstaff, Arizona, from April 27 to 30, 1936.

due humility present to you the preliminary result of the study. Even when more material becomes available, I feel that few of the conclusions will be altered vitally, although the absolute values of the figures I am about to present may be somewhat changed.

The merest novice in the Southwest can see that the country once supported a great aboriginal population. Ruins everywhere testify to this conclusion. But when the white man came, except for a few small areas, the country was uninhabited. To the east of the Rio Grande ranged the Apaches, who had not yet crossed the river. Up the Chama River, northeast of Santa Fe, the elemental Navajos tended their fields of corn. The Yavapai, Walapai, Maricopas and other Yuman tribes roamed the area between the Colorado, the Verde, the Little Colorado and the Salt. In the report of Spanish travelers no mention is made of meeting nomads in the area between the Rio Grande and the Little Colorado. They only mention the few remaining Pueblos—Hopi, Zuni, Acomas and Rio Grande. That there had been a decline in population no one can doubt.

Explanations have been given for this decline of prehistoric pueblo population. Archeologists have almost invariably believed that the pueblos diminished because of the inroads of nomads, such as Navajos, Apaches, etc. Others, particularly those working on tree rings, believed that droughts causing migrations were responsible. Physiologists point out that an increasing population would destroy the game so that the people would be reduced to a corn diet lacking in necessary vitamins. This would, of necessity, lead to deficiency diseases. Indeed as many different reasons have been given for the decline of pueblo populations as the decline of classic Greek civilization. I do not think any one has tried to see just what did happen.

Certainly there must have been nomads hovering on the borders of the pueblo area; Luxan[2] in 1582 mentions them, but there is no documentary evidence that the Navajos or Apaches were much of a threat to the pueblos before they received horses. Indeed, it is not demonstrated that Apaches and Navajos were in Arizona before 1600. The nomads mentioned were more probably Yavapai or Paiutes. Besides, we have no evidence that nomadic hunters without horses or other beasts of burden in a semi-arid region seriously troubled a dense sedentary population. It was only when the population was thin that their inroads counted.

Haury[3] has shown us that droughts were sometimes so bad that there were considerable migrations of peoples, and there is no doubt that persons in early days were subject to deficiency diseases. Droughts no doubt lead to starvation, disease, migration and to wars, but droughts were probably on the long run not much worse in the years after 1100 than in the eight hundred years that preceded. The tree ring specialist can see no real difference in rainfall. As you will see later, the big decline in population began long before the twenty-three-year drought, the great drought that ended in 1300, which certainly was a major catastrophe in pueblo history.

Any one who is familiar with the diet of the Hopi would realize that the pueblo people make use of many wild plants. They have many kinds of "spinach," which they gather locally or cultivate in a small way. They also sprout beans in their kivas in the winter time. Even without the insides of animals they would have a considerable variety of vitamins. So lack of vitamins from animal sources would hardly be a serious factor in causing deficiency diseases. But there is a neglected factor leading to a population decrease which seems very much stronger than any of these. This factor might be summed up in the words "bad sanitation." I will discuss this in its proper place.

Let us see how an archeological survey throws light on the problem. The Museum of Northern Arizona has continued a survey of prehistoric sites begun by the speaker in 1916. We now have over 3,300 sites recorded in our files. To simplify the study we will not consider the whole of northern Arizona, but will select an area bounded on the north by Utah, on the west by the Colorado River and the San Francisco Mountains, on the south by the Little Colorado and the Puerco and on the east by the Chinle. Over most of the area the sites are but a random sample of the sites present. In three areas we have a fairly complete census of sites. Those best studied are: (1) the area between the San Francisco Mountains and the Little Colorado River, east and northeast of Flagstaff, and including the drainages of Deadmans Wash, Walnut Creek, and Padre Canyon, (2) the Dogoszhi Biko, a tributary canyon in the Tsegi, northwest of Kayenta, and (3) the region surrounding the Hopi Mesas.

Stratigraphic studies have shown that certain pottery types were made in a chronological order. Out of the hundred types recognized in this area I will mention but one series of types, but types which bear styles of decoration which are found over most of northern Arizona. They run from the oldest, called Lino Black-on-white to Kana-a Black-on-white, to Deadmans Black-on-white, to Flagstaff Black-on-white, to Kayenta Black-on-white, to Jeddito Black-on-yellow, the most recent one considered.

Now we must call in the Dendrochronologist, the

[2] Diego Luxán, Quivira Society, p. 96, 1929.
[3] E. W. Haury, Medallion Papers, xiv, p. 151, 1934.

tree ring expert. He has approximately dated these pottery types by studies of the annual rings found on the charcoal and timber associated in the ruins on which they were gathered. (See Table I.)

TABLE I

Lino Black-on-gray	600 A.D.
Kana-a Black-on-white	800 A.D.
Deadmans Black-on-white	1000 A.D.
Flagstaff Black-on-white	1125 A.D.
Kayenta Black-on-white	1250 A.D.
Jeddito Black-on-yellow	1450 A.D.

As we use indicators in the form of fossils to correlate different strata in geology, so in this study we will let the styles of decoration on these pottery types serve as time indicators in the life of the people who made them.

It is important to note that styles of decoration common to these types were very popular. Styles of pottery in the Southwest in prehistoric times were very like those of women's clothing at the present time. When a style is evolved in Paris, in two months it has reached Hollywood, and it will be seen in every town from Hackensack to Kalamazoo. In another month the girls of Tokyo will adopt it. It was the same with pottery styles. From some center, a woman created an attractive design on her pottery. This was copied by others, and soon this design spread all over northern Arizona. Like modern women, the old girls of Wupatki, a pueblo ruin near Flagstaff, copied the styles of design from Chaco Canyon, New Mexico, or from Kayenta, Arizona, putting them on their own local pottery. They adopted the styles of decoration and form, but did not adopt the methods of technique, which include paste, temper, preparation of paint or firing methods. As attractive pottery types were widely traded and the styles of decoration frequently copied, it is possible to approximately date every prehistoric ruin in northern Arizona by the broken pottery picked up on the surface of the ground. Therefore, in our archeological survey, when we record a site the pottery fragments will furnish an approximate date.

As I stated above, three areas in northern Arizona have been fairly carefully studied and other areas sampled. The results are summed up in the following table.

TABLE II

THE BEST STUDIED AREAS AND THE NUMBER OF SITES FOR EACH PERIOD

	600 A.D.	800 A.D.	1000 A.D.	1125 A.D.	1275 A.D.	1400 A.D.	1900 A.D.
Dogoszhi Biko.	1	29	22	9	4	0	0
Deadmans	5	24	228	103	1	0	0
Hopi	9	25	29	11	10	10	10

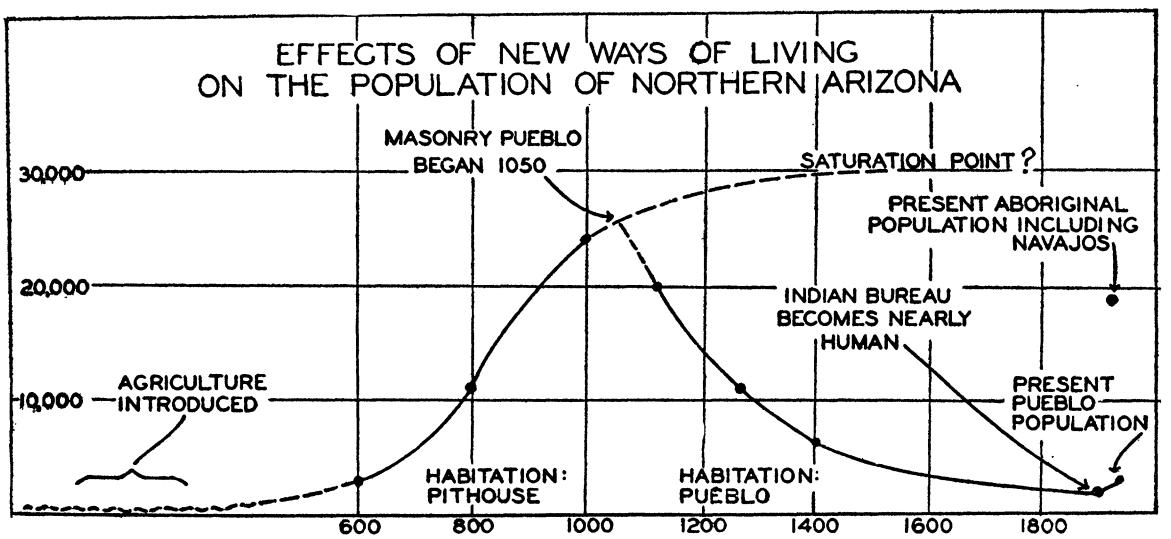

FIG. 1.

The above data do not give a true picture of the population question because they do not give the number of people, but the number of sites. We must translate sites into persons. To do this we must first know something about the methods of life of the people, and the archeologist has supplied this.

Up to about 1100 in northern Arizona, single families lived in earth lodges which were usually pithouses. That is, the floor was below the level of the ground. The material out of which the sides of these structures were made depended on the region. Where timber was plentiful and stone poor, timber was used for the retaining wall, as in the San Francisco Mountains. In other places, the people laid up walls of masonry, sometimes good and sometimes poor. The roof of the structure was composed of timbers covered with brush and earth.

After 1100 the people changed their habits and constructed masonry structures with flat roofs in which several families dwelt in closely contiguous rooms. It marked a change from rural conditions to urban—a change from a family or a small group of families living in detached one-roomed houses placed near their farm plot, to a condition of many families living in multi-storied apartment houses and walking some distance to reach their fields. I want to stress the fact that the change occurred in northern Arizona about 1100 A.D. The statement may not apply to the area east of the Chinle Valley and certainly does not apply at all to New Mexico or Colorado.

So far we are on pretty firm ground, but now our toes will begin to leave the concrete, for we will have to make assumptions, and assumptions are dangerous. The assumptions that we must make are as follows: We must determine (1) the number of rooms per site, (2) the number of families per room, and (3) the number of persons in a family.

In the pithouse period we find in the San Francisco Mountains area about two houses per site or two dwelling rooms per site. West of the Little Colorado the groups seem larger, so we assume four houses per site. In the pueblo period we can often count the rooms or, if we can not count the rooms, at least we can measure the area of the site and divide by the area of one room (180 square feet). Of course, the actual number can only be determined by complete excavation of the site.

In no area have we recorded all the sites, so that the number of rooms are under-estimates, rather than over-estimates. On the other hand, pithouse sites are harder to locate than are the pueblo sites. The former are seldom visible from a distance, so one has to be on the site to recognize it.

On the other hand, mounds or piles of conspicuous rocks mark the pueblo site and can be seen from a greater distance. Therefore, we record relatively more pueblo sites than pithouse sites. This difference will be balanced by the probable shorter occupation of the pithouse site. Although we have one pithouse dated by the tree ring method that indicates an occupation of over one hundred years, most of them indicate a much shorter occupancy.

The number of families to a room in the pithouse period we assume to be one. In the latter part of the pithouse period we find brush or masonry granaries of one to four very small rooms associated with the pithouses. As they were not dwelling rooms, we do not count these in our estimates.

In the pueblo period we assume two ground-floor rooms for each family. This factor was derived by counting the ground-floor rooms in the Hopi pueblo plans made in 1881–1882 by Mendeleeff and comparing them with 1890 Hopi census for each village. In 1890 the Hopis were living much as they lived in prehistoric times, and the 1890 census was one of the best. The count gives 1,088 ground-floor rooms occupied by 1,996 Hopis, or two persons per ground-floor room. As most pueblos are multi-storied this leaves plenty of space for store-rooms.

If a race is more than holding its own, the number of persons in a family should be about five persons. Sauer,[4] in his study of Azatlan, places the number at six persons per family. Brainard[5] shows that among the Hopi, a tribe little more than holding its own, the family is 4.17. From 1890 to 1930 the Hopis increased from 1,996 to 2,475, or about 12 persons per year. I assume that the one family of six persons occupied each pithouse and that two persons, on the average, occupied each ground-floor room in a pueblo.

In the three areas under discussion we find the distribution in time, of the population, illustrated in Table III.

TABLE III

PERSONS PER PERIOD

Drainage	600 A.D.	800 A.D.	1000 A.D.	1125 A.D.	1275 A.D.	1400 A.D.	1900 A.D.
Dogoszhi Biko.	24	756	528	150	948	0	0
Deadman - Walnut-Padre ..	60	342	4,178	1,898	840	0	0
Hopi (exclusive of Jeddito) .	216	360	720	990	960	3,500	2,000

We can see that in general the population increased, and then in two areas decreased to zero.

When making an archeological survey, one soon discovers that sites are much denser in some areas than in others. An area of about 500 square miles northeast of Flagstaff has been about equally well explored all over. In some sections there are over fifty sites and in others we have searched for hours and never found a site.

Using the experience of this well-studied area and the two other well-studied areas, it is possible to divide all northern Arizona into areas of different population densities. By this means we have plotted on the map the population according to the estimated number of persons per square mile for each of the periods of time that we have considered. By cutting up the map and weighing the fragments it was possible to find out the number of square miles in each area. Knowing the area of each section and the density per square mile, it is possible to easily compute the population for each area and period. The sums of these populations are given in Table IV.

We have by this means plotted the population of

[4] Carl Sauer, *Ibero-Americano*, 10: p. 2, 1935.

[5] Margaret Brainard, "Hopi Indian Family," p. 205. University of Chicago, Thesis, 1935.

the region north of the Santa Fe railroad and east of the San Francisco Mountains for each period from 600 A.D. to the present time. The population rises from about 3,000 in 600 A.D. to about 23,000 in 1000 A.D. to fall to about 1900 in 1890. It has now risen to 2,800.

TABLE IV

600 A.D.	3,000
800 A.D.	10,000
1000 A.D.	23,000
1150 A.D.	19,000
1400 A.D.	7,400
1890 A.D.	2,000

It is interesting to note that if we add the number of Hopis in 1930 to the number of Navajos living in this area in 1930, the sum is about the same as the pithouse population in 1000 A.D.

That people migrated back and forth across northern Arizona is evident to the archeologist. The memories of these migrations comprise a large part of Hopi clan legends. We can see them depicted in petroglyphs. We are at this time interested not so much in the migrations themselves, but as to how much those migrations might influence our figures on population. This means that we must consider the migrations in some detail.

From about 600 A.D., a date when data become available for population studies, until about 1100 A.D., the population of northern Arizona in general was increasing rapidly. During this period one migration only seems evident. Notice the great increase in the population of the Deadman, Walnut and Padre drainages, between 800 A.D. and 1000 A.D. This was caused by an event unique in American archeology.

About 885 ± 25 years A.D., a date recently established by Mr. J. C. McGregor[6] by tree-ring studies, Sunset Crater, a volcano lying about fifteen miles northeast of Flagstaff, burst into activity and spread a layer of black volcanic sand over an area of about 1,000 square miles, covering the houses of the ancient inhabitants.

Pottery studies show us that between 950 and 1100 people flocked into this area from all about, and a survey of sites indicates that for two centuries the Flagstaff area held one of the densest rural populations in northern Arizona. Although some people seem to have come in from the west, the major migrations were from the north and from the southeast. These newcomers almost swamped the original settlers of the region. They brought in new ideas and methods of making things. Some Hohokam families appear to have come from the far-away southern Arizona. The population of the San Francisco Mountains area between 1100 and 1200 must have formed a very cosmopolitan group.

This migration seems to have been caused by the black volcanic sand from the volcano forming a mulch, conserving the water and so making agriculture possible where it had never been before. Archeological surveys show that the prehistoric dry farmer could only farm where the soil was very sandy or light. Clay soils without a sand mulch were avoided, and those regions were almost uninhabited during the periods we have studied.

All the other migrations took place in the later pueblo periods and seem to have been due to a shrinkage of peoples. The second migration that we can distinguish seems to have occurred near the Utah border about 1250 A.D. This resulted in a partial abandonment of much of the Rainbow Plateau and a centralization of people in the canyons when Betatakin and Keet Zeel and other pueblos reached their height. By 1400 the country was abandoned. This introduces our third series of migrations. You will note from Table III that all the people left this region between 1275 and 1400, but people still continued to live forty miles south of Flagstaff at the Kinnikinick, Grapevine and Chavez Pass pueblos and in the Verde Valley. At the same time you can see the great increase in population in the Hopi between 1275 and 1400, an increase of over four fold. This is due to the migration just before 1300, when the country north, east and west of the Hopi country was abandoned by the puebloans. The Hopis must have received the survivors of dozens of pueblos.

This third series of migrations was due directly to the great drought of the late twelve hundreds. Haury[7] has shown that many pueblo people of White Mountain area at this time went south and invaded the domain of the Hohokam in southern Arizona. The peoples of the Tsegi, the Rainbow Plateau and Black Mesa abandoned their great pueblos and seem to have joined the Hopi, swelling Oraibi, Shungopavi, Mishongnovi, Chuckovi, Hoyapi and Walpi. The Jeddito pueblos were swelled by accretion, perhaps from the Chinle Valley, Rio Pueblo Colorado and Puerco drainages, so that from Kokopnyama to Awatovi, five great towns flourished with a total population of over 3,000.

At this time the San Francisco Mountains area was abandoned, the few remaining people moving probably to the region of Chavez Pass, the Verde Valley or to Winslow. The Wide Ruin area was abandoned, the people moving either to the Hopi Buttes, the Jeddito or the Petrified Forest.

By 1400 the only settlements north of the Tonto Rim were on the Hopi Mesas, in the Jeddito, in the Hopi Buttes, in the Petrified Forest, in the White

[6] John C. McGregor, *American Antiquity*, II: 1, 15, July, 1936.

[7] *Op. cit.*

Mountains, in the Verde Valley, besides those on the Little Colorado near Winslow and in Chavez Pass. These were great towns, many of which must have had hundreds of persons each. It was a period in northern Arizona of an artistic revival. It was then that finest textiles and the best pottery was made. Except on the outskirts it was not a period of decadence, as Kidder and others maintain.

But the shrinkage of the population continued. After 1400 and before 1540 another big migration occurred, marked by the abandonment of the Verde Valley, Chavez Pass, Winslow pueblos and the probable absorption of the remnants by the Hopi.

Hopi tradition still remembers this migration, for they tell how the people of Homolovi, by the Little Colorado near Winslow, were driven out by the mosquitoes and when they arrived at Shungopovi the people stood on the house tops and said, "Here come the 'Mosquitoes.'" They finally settled at Shipaulovi, and Shipaulovi, meaning the place of the mosquitoes, commemorates that migration of the 1400's.

The White Mountain peoples with those from the Petrified Forest seem to have been absorbed by the Zuni and their survivors were seen by Coronado in the Seven Cities of Cibola.

So in 1540 there were in Arizona only five Hopi pueblos—Oraibi, Shungopavi, Mishongnovi, Sikyatki and Walpi—and two Jeddito pueblos—Kiwaikihu and Awatovi—all that remained of a once great population.

In our population studies the only factors of migration that might affect the area under question are increments to the San Francisco Mountains area received between 900 and 1050 from the west, south and southeast, and the increments received by the Hopi about 1450 from the south. The area might have lost a small number in 1450 by some of the Moqui Butte people moving to the Petrified Forest and to Zuni. As far as our observations lead us all other migrations were within the area and so would not affect our totals. Migration will, therefore, not account for the general populations decrease. Although the largest migrations were in the periods of the greatest general loss of population, yet the same loss can be demonstrated to have occurred over the whole Southwest. If there was no great mortality, where did those people go?

We must now study the lives of certain modern Indians who live in the area that we have been considering and whose manner of living is most similar to the prehistoric people. I select the Navajos and the Hopi.

The Navajo Indians, for example, are now living in the same area under much the same conditions as the pithouse people lived before 1100 A.D. and so will furnish us with contemporary material to study the conditions of life of the pithouse dwellers. The main difference that we can observe is that the Navajos are pastoral and the pithouse people agricultural, but in certain fundamental conditions of life they are the same. The Navajos dwell in earth lodges called "hogans." These hogans are widely spaced. It is rare that one finds four close together. Sometimes two may be within a hundred feet of one another. It is customary for one family to occupy such an earth lodge. I have no figures as to the average size of the family. They move frequently. Their water supply is usually distant from their living quarters. Although the human excreta are deposited not far from the hogan, as there is no density of population and the climate is semi-arid it does not amount to a menace to health.

Like the pithouse dwellers of yore, the Navajos are increasing rapidly. Since 1868, when they were replaced on the Reservation after their forced sojourn at Bosque Redondo, they have increased, it is said, from 8,000 to nearly 48,000. I think the 8,000 figure is far too low a value, as information exists that Kit Carson did not capture more than half of the tribe and the rest scattered onto the Rainbow Plateau, Black Mesa and into the Little Colorado Valley. We will consider 16,000 as a much more likely figure. Even then the increase is phenomenal, for in sixty years they have increased three fold, or on an average of about 3 per cent. per year. When the population of the United States was largely rural, in the 1820's and 1830 and immigration was at a low ebb, the annual increase was a little over 3 per cent. In the four hundred years from 600 A.D. to 1000 A.D., the pithouse people increased at the rate of from 1 to 2 per cent. per year. (First 200 years at 1 per cent. and second 200 years at 1.7 per cent. per year. Hopis are increasing about 0.5 per cent. per year, that is, since the Indian Bureau has been concerned about them.)

The pueblo family, on the other hand, lives in crowded quarters. Families live close together, and the excreta are deposited in the narrow plazas, streets, middens and passages near the houses. Were it not for the arid climate, conditions would be impossible.

Although the drinking water is usually procured from a spring at some distance from the village, yet in times of heavy rainfall, temporary pools form on the rocks close to the village which are filled by surface run-off. This water is contaminated from excreta. When one protests to a Hopi grandmother about giving an infant a drink from the pool in the street, she says that the water can't be bad because it fell from the clouds and so was especially sent by the Heavenly God. This water is of ceremonial impor-

tance. The infant mortality of the Hopi children under two years of age after the summer rainy season is very great. I have no exact figures, for the Hopi agent and the Indian Bureau keep no vital statistics, but in 1934 nearly all the children under two years of age died of infantile dysentery at Shungopavi and also at First Mesa. (The agent blames the deaths on too much watermelon.)

I want to stress this difference between the sanitary conditions of families that live in independent houses and the conditions under which people live in city "slums." There is a good deal of evidence that the people of cities, up to very recently, did not reproduce themselves and were it not for immigrants from the country, cities would dwindle in population. If this applies to cities in so-called civilized countries, why would it not be more true of the Hopi, who is living under much the same conditions as the population of a European city lived two hundred years ago as pictured by Lowie.[8] Indeed in 1890 the author visited the German cities along the Rhine. At that time sewage flowed in the streets, and they were more odoriferous than any Hopi town. It is only by modern sewage disposal and sanitation that modern cities hold their own. In my youth the annual loss in Philadelphia of adults by typhoid and of children by infantile dysentery was terrific. I can remember the headlines in the papers when the annual September typhoid epidemic was reported. All statistics show that from the point of view of population increase, it is better to live in a farm house than in a city flat.

Various ethnologists of the early days, including Sir John Lubbock,[9] have recorded the density of populations of primitive hunting tribes. If we select from these data tribes that were living under semi-arid conditions, such as in Patagonia and Australia, we find that 100 square miles will support by hunting from one to five persons. Hinsdale[10] has shown that the game is dependent on the vegetation, and very fertile regions will support more vegetation, hence more game, hence more hunters. Using these data we can gain some idea of the population of northern Arizona before the days when agriculture was introduced. From an inspection of the curve of population increase from 600 A.D. to 1000 A.D. (Fig. 1) this event does not appear to have occurred in the very dim past. Although the curve of growth might appear to be in an almost straight line, yet from a study of fruit-flies raised in a closed environment, Pearl[11] has shown that such curves are really letter S's. While the country is thinly inhabited the curve increases rapidly until the limit of available food supply begins to be felt and then rounds off. Newly introduced factors will affect the curve, so in the case of the pueblo population, when the change of housing methods occurred between 1050 and 1100, the curve was affected so that the curve began to fall.

We can infer that before the introduction of agriculture the population probably rose and fell as game was scarce or abundant, forming a wavy line. This wavy line probably ranged from two to four persons per 100 square miles. When agriculture was introduced, the population began to increase. Sir Arthur Keith considers that agriculture would support a population in a very fertile country of as much as 20,000 per 100 square miles, whereas in the same rich region without agriculture fifty persons might eke out a very miserable existence. I think, by the application of the formula of Pearl's logistic curve[12] it might be possible to determine the approximate time when agriculture was introduced into the Southwest. This is a tool that has not yet been used.

Our studies show us that the population of northern Arizona increased seven fold between 600 A.D. and 1100 A.D. This was possible by the introduction of agriculture, together with the custom of families living in isolated houses.

During the next eight hundred years, when urban communities such as Wupatki grew up, the population decreased. This decrease was equal to the previous gain. We do not have to postulate nomads, we do not have to postulate drought. The mere fact that people lived in crowded tenements under bad sanitary conditions, and so could not raise their children is a sufficient explanation to account for a loss of population.

Until the Hopi adopt sanitary measures in keeping with the crowded conditions of city life, they will never compete in numbers with the wandering Navajos. This is a lesson taught by a study of northern Arizona's prehistoric population. Without sanitation country life is better than city life.

[8] R. H. Lowie, "Are We Civilized?" p. 74, 1929.

[9] Sir John Lubbock, "Prehistoric Times," p. 585, 1913.

[10] W. B. Hinsdale, Occasional Papers from the Museum of Anthropology, University of Michigan: No. 2, p. 6.

[11] Raymond Pearl, *Proceedings Nat. Acad. Sci.*, Vol. 6, No. 6, p. 282, 1920; also Vol. 8, No. 7, p. 212, 1922.

[12] Pearl, *op. cit.*

OBITUARY

JUSTUS WATSON FOLSOM

DR. JUSTUS WATSON FOLSOM, entomologist in the Division of Cotton Insect Investigations, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, died at the infirmary at Vicksburg, Miss., on September 24, after an illness of several weeks following heart attacks.