

MISSING THE POINT: A Consideration of Small Sites Archaeology (Computer Modelling of Archaeological Sampling Strategies)

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ABSTRACT

Small archaeological sites are sometimes described as lithic scatters and with this designation small sites are often considered to be of little significance. As a consequence, these sites are sometimes given little consideration for further archaeological investigation. This paper examines the basis for these judgements through a look at the survey strategies employed (typically shovel testing and surface examination), the likelihood of discovering "lithic scatters" of certain sizes and densities using these techniques, and the implications of our impressions. We feel that there is an inherent bias against the discovery of certain site types built into our field methods and understanding these biases will help us to make better judgements in the future.

RÉSUMÉ

Très souvent on décrit les concentrations lithiques comme étant des petits sites et avec ce terme on leur attribue peu de signification. Ainsi, ces sites ne pèsent que très peu dans l'élaboration des recherches archéologiques. Nous voulons revoir le raisonnement pour ces conclusions en examinant les stratégies de reconnaissance utilisées (ordinairement un sondage à la pelle et une inspection visuelle de la surface), les chances de découvrir des concentrations lithiques de différentes tailles et densités en employant ces méthodes, et l'influence que peut avoir nos impressions préliminaires. Nous croyons que certaines méthodes de terrain oeuvrent contre la découverte de certains types de sites. En comprenant ce préjugé, nous serons mieux placés pour en arriver à de meilleures décisions à l'avenir.

INTRODUCTION

I would like to preface this presentation by saying that our original intent was to revise a paper (entitled Computer Modelling of Archaeological Sampling Strategies) given by Ian Kenyon to a meeting of archaeological consultants in Toronto about 1990. In this revision we intended to include more small sites or "lithic scatters" in the model and provide further details about these sites in my presentation to follow. Unfortunately, with the recent death of Tim Kenyon, the proposed changes to this paper were not possible. We know the audience will be able to compile thoughts from both papers, understand the importance that we place on small sites, and will not "miss the point".

Sampling is traditionally used in a variety of sciences to give reliable estimates and save on cost. A small portion or sample of a population is examined to provide estimates of what the entire population or universe is like. During archaeological survey or assessment we use sampling because it is simply more cost efficient. A variety of techniques involving test units, test squares or transect intervals, are employed. One thing we often do not know or should talk more about, is the efficiency and effectiveness or reliability of the various methods we use. There is a considerable body of literature on the notion of test pitting efficiency, and we do not care to summarize it here. But, we would like to present a model for discussion. That is the purpose of this paper.

Most of us do not have any problem in finding certain categories of sites. For example, if there is a huge Iroquoian village out there almost any technique, except perhaps the infamous windshield survey, is likely going to find it. But, there are other categories of sites, smaller sites or those with thinner distributions of artifacts, that are difficult to find. Anyone who carries out archaeological survey uses some form of sampling and always wonders to themselves - "Have I got them all? - Have I missed something significant? - How effective is this survey technique?". We all want to do a good job.

To form the basis of this discussion we would like to start with a real site. The type of sites we are talking about are often referred to as lithic scatters or chipping stations and are characterized by the presence of stone artifacts predominately distributed within the plowzone. But, these sites range from just a single artifact to sites with thousands of specimens. Sometimes, in the case of sites with few artifacts, we are inconsistent as to where to draw the line between a site and a non site and even more complex is the question "Which ones are significant and which ones are not?". How much do we need or what do we need to show that a site is significant and actually worth excavation? So we would like to look at a site that does seem to be significant and use it as a basis for discussion.

The site that we want to use is the Innes Site, a plow disturbed Archaic base camp once located on the 403 Highway right-of-way between Brantford and Woodstock (Ontario) and excavated by the Ontario Ministry of Transportation in 1982 (Lennox 1986). The Innes Site does appear to be a significant site, one largely confined to the plow zone. It was first identified by Ron Williamson during survey of the highway right-of-way in 1980. He made a surface collection of the site in the spring and found 83 artifacts including one projectile point. On the basis of this, Williamson recommended that further work be done (Williamson *et al.* 1980). Lennox was under contract with the Ministry of Transportation and went back to the site in 1981 and, under excellent survey conditions, recovered 127 specimens including 2 projectile points (Figure 1).

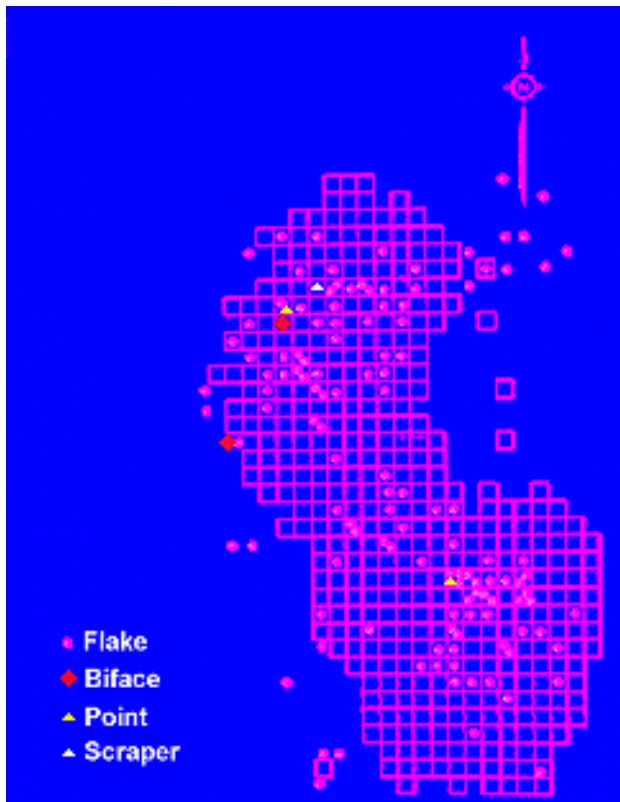


Figure 1 The 1981 artifact distribution mapped from the surface of the site superimposed on the later limits of excavation.

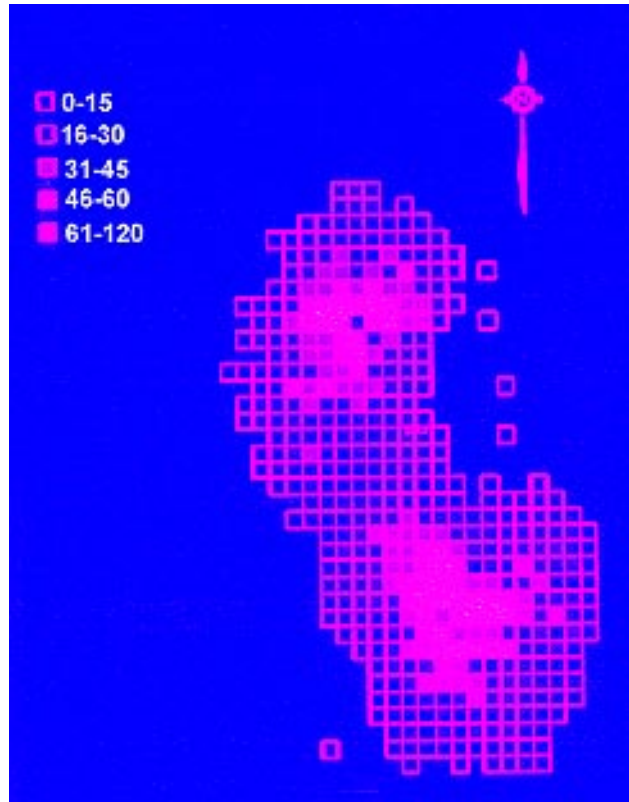


Figure 2 Artifact frequency per square metre excavated.

Of interest here is that the results of the surface surveys are similar, Williamson recovering 83 specimens and Lennox 127 under similar, spring survey, field conditions. These results became more interesting following the excavations.

During the 1981-2 seasons, we excavated 446 square metres of plowzone, screening the soil through quarter inch mesh screens. The total excavated assemblage from the plowzone, excluding the materials recovered from 2 subsoil features, was 10,500 specimens including 35 projectile points.

When we look at these numbers in comparison to the two surface collections, Williamson's surface survey, compared to the excavated total, represents 0.8% of the site while our survey recovered 1.2% of the site from the surface collection. If we average these we find that 1% of the site was visible under surface examination during ideal field conditions. We would like you to keep that 1% figure in mind. While some of us may have slightly different results from similar investigations the 1% rule seems to have proven itself several times.

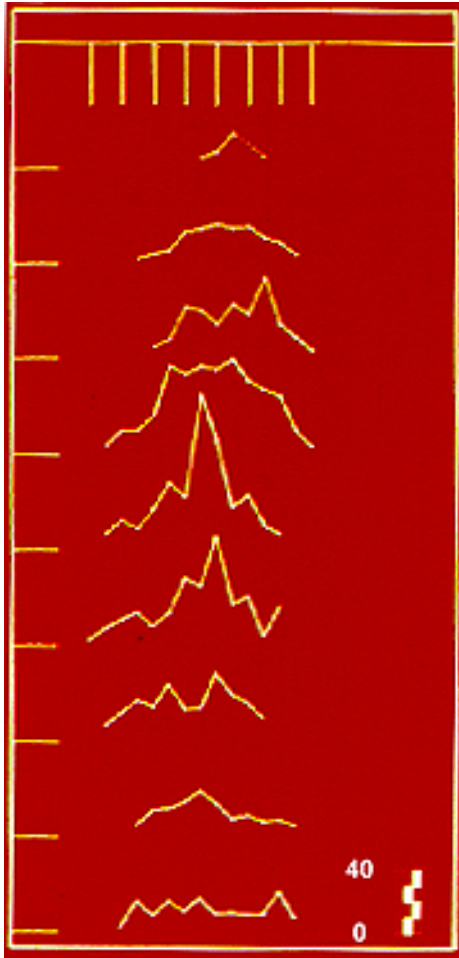


Figure 3 Debitage density transects from the Innes site.

bivariate modal distribution (Figure 4) and we would like to think that each cluster at the Innes Site actually looks like this. In other words, the site is not characterized by a sheet of material with set boundaries but rather, there is a fall off from a central point in every direction.

Figure 2 shows the frequency of cultural materials recovered from the one metre squares of plowzone excavated at Innes. The artifact distribution at the site indicates the presence of two loci each about 10 metres long and 8 metres wide. With the artifact assemblage nearly equally divided, each locus contained approximately 5,000 specimens. The greatest concentration of cultural material occurs toward the centre of each locus and diminishes toward the excavation limits.

To use the Innes Site as a generalized model in the evaluation of test pit survey strategies we looked at the debitage density pattern for one of the Innes loci. The debitage density transects (Figure 3) illustrate the familiar bell-shaped curve or normal distribution pattern seen in our statistics textbooks. In three dimensions it is known as a

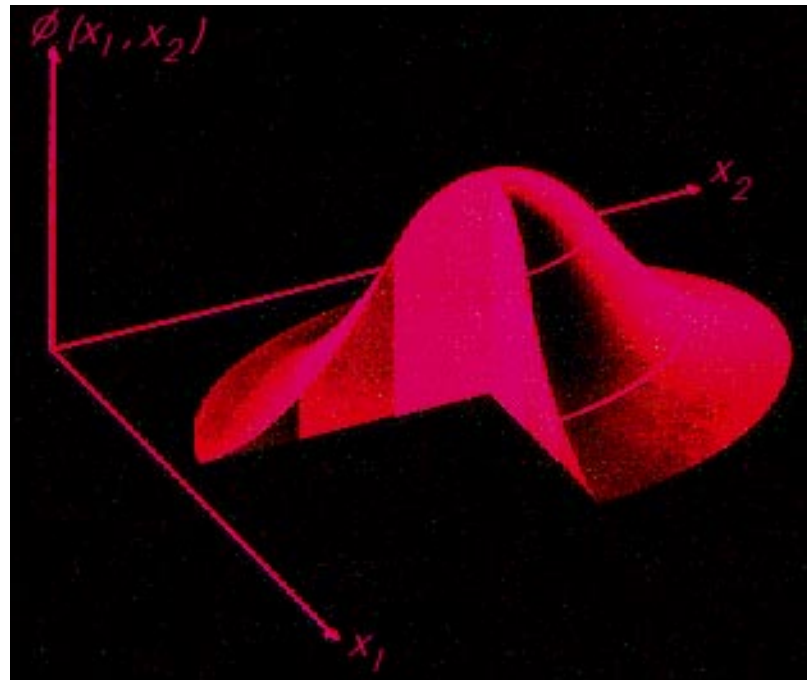


Figure 4 A bivariate modal distribution.

If we took a slice through the site and plot the artifact densities per square metre, the resulting frequency distribution resembles a standard normal curve (Figure 5). Here we show this model distribution compared to one of the Innes artifact clusters. Roughly estimating, with

the standard deviation of 3 metres in space, and taking 5,000 artifacts as the total number of artifacts for the theoretical density distribution, Figure 5 shows that there is a reasonable fit between the theoretical model and the actual debitage densities along transects through the Innes Site. On the same figure you can see that about 95% of the specimens, that is at 2 sigma, are within 6 metres of the centre point of the site. In other words approximately 95% of one of the Innes loci, is within a 12 metre diameter area.

An interesting thing about the Innes excavations is that they began roughly in the centre of the high density portion of either loci and continued outward until flake densities fell below 15 specimens per metre square. In fact, the two sigma or 95 percent line intersects the theoretical curve at 12 flakes, remarkably close to the arbitrary limits of excavation. This suggests that what was happening on the site statistically was that excavations were continued to 2 sigmas from the mean point of the distributions and were probably obtaining, at least on the theoretical curve, something like 95% of the site (of course, none of this was foremost on our minds during the excavations).

So, in the following, we imagined that we had a site, like the Innes Site, that had a certain number of specimens distributed in a given area, but really looked like a bivariate normal curve instead of a real site. Of course, this is one of those famous simplifying assumptions that we like to use.

We make a few more assumptions so that we can look at some abstract versions of these data and other, essentially plowzone, sites. In our survey we are going to use test units that are 25 cm squares, the equivalent of a standard shovel test pit. Artifact recovery from each test pit uses ¼ inch mesh screens, the same screens used for most archaeological surveys and also that used for artifact recovery at the Innes site during excavations.

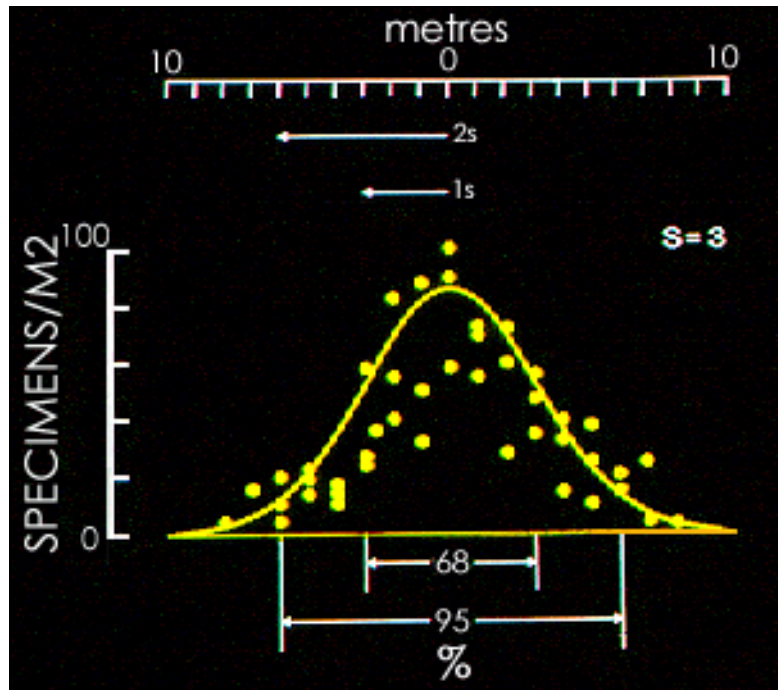


Figure 5 Innes artifact densities per square metre compared to normal curve.

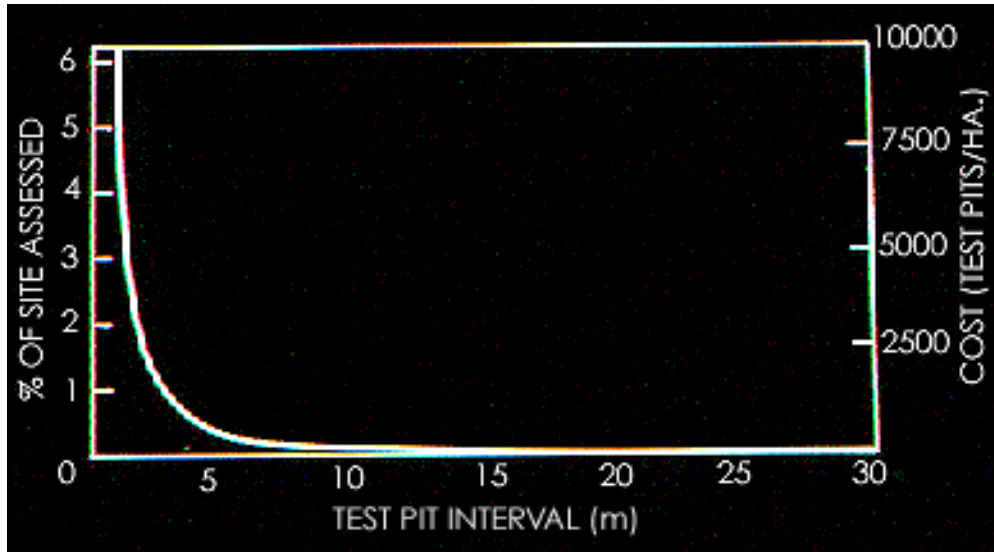


Figure 6 Percent of site assessed according to test pit interval.

What would happen, if we started out using 25 cm square test units on a systematic grid with the test pits at different intervals? What are the chances that we're likely to find one of the loci of the Innes site?

First of all, we are going to talk briefly about the implication of using different test pit intervals. This is one of those good news bad news variables. As shown in Figure 6, test pit intervals range from 0 to 30 metres and as test pit interval decreases, a greater percentage of the site will be assessed. For example, using 25 cm test pits, at a test pit interval of 20 metres, you are actually encountering .02% of the site. Even at 10 metres its only .06% - not very much of the site. At five metres you finally have a ¼ of a percent and at a 2 metre interval its actually 1.5% of the site. So as you tighten up the interval you're actually sampling a greater percentage of the site and the probability curve increases at an exponential rate indicating that the chances of identifying a site become more likely. As you do this however, your survey becomes more costly in time and labour. So, for example, if you are testing a hectare of ground using a 20 metre interval you will only have to dig 25 test pits but at a 10 metre interval it is 100 test pits and at a 5 metre interval we have to again quadruple the test pits to 400. At a 2 metre interval we would excavate 2,500 test pits and at 1 metre intervals we would dig 10,000 test pits, this of course being unreasonable. In general, test pit strategies are somewhere in the middle with the finer intervals seemingly too intensive and the larger intervals perhaps not capturing enough information.

Another consideration concerning probabilities, is that we can calculate the reliability of the sampling procedure (Figure 7). Let us say we are testing on a site, like the Innes site, where artifact densities range from 15 to 80 specimens per metre square. If you dig a 25 cm test unit and

can assume that the artifacts are distributed randomly within a square metre, using a *Poisson* distribution we can calculate the probability of finding 0 specimens. Here we see that with a density of about 15 flakes per square metre, about half the time you would find nothing in a test unit. To get up to the magical 5% level of probability the actual artifact density would have to be about 50 flakes per square metre, a density found close to the centre of the debitage concentrations at the Innes site. On low density sites, say with 10 specimens per square metre, a test pit will have about a .60 probability of yielding no specimens.

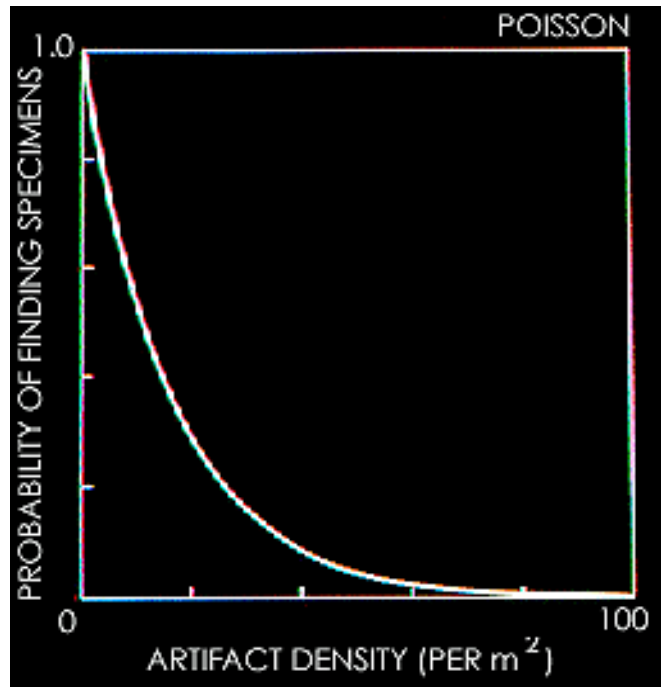


Figure 7 Reliability of the sampling procedure

The probability of finding a site depends on a number of variables. One is the test pit interval, another is the size or spread of the site and finally the number of items within that spread. Figure 8 looks at test pit interval and the probability of missing a site or in other words digging a bunch of test holes and finding nothing - that is not one thing in any of the test pits. The figure also considers the total number of specimens on a site given a reasonable spread. These curves would apply to sites that had a standard deviation of 3 metres, sites comparable to the Innes Site. The test cases range from sites which have a total of 100 specimens up to sites with 20,000 artifacts. This is a big number considering that one locus at the Innes Site, our test case, included only 5,000 specimens.

Figure 8 indicates that if you are testing for a site like the Innes Site using a 10 metre interval the probability of finding the site would be 95%. That's a 5% chance of missing the site using a 10 metre interval. If we decreased the test pit interval to 5 metres you would almost certainly find it. However, if a 20 metre test pit interval had been used there would actually be a 50-50 chance of missing or finding the 5,000 flake concentration. So, in this case the 10 metre interval would have worked very well for sites like Innes.

A lot of sites, however, are smaller than the Innes site. For example, it is quite common to find sites which contain only 1,000 specimens. If we are looking for sites like that using a 10 metre interval, we would miss the site two thirds of the time, where as, if we were to use a 5 metre interval we would only miss such sites about one-third of the time. To effectively find very tiny sites, those in the range of say 100 to 500 specimens, a small, impractically small, test pit interval would have to be used.

Somehow, in a general way, the number of artifacts on a site probably relates to the significance of a site. It is true that using a 5 or 10 metre test pit interval that you would have great difficulty in finding some of these smaller sites. But, in fact, we might well ask “How many of these small sites are even significant?”. Remember, that using the 1% surface visibility on a plowed site, that a 1,000 item site would only be represented by 10 specimens on the ground surface. How many of these sites with 10 specimens under good surface conditions are simply written off?

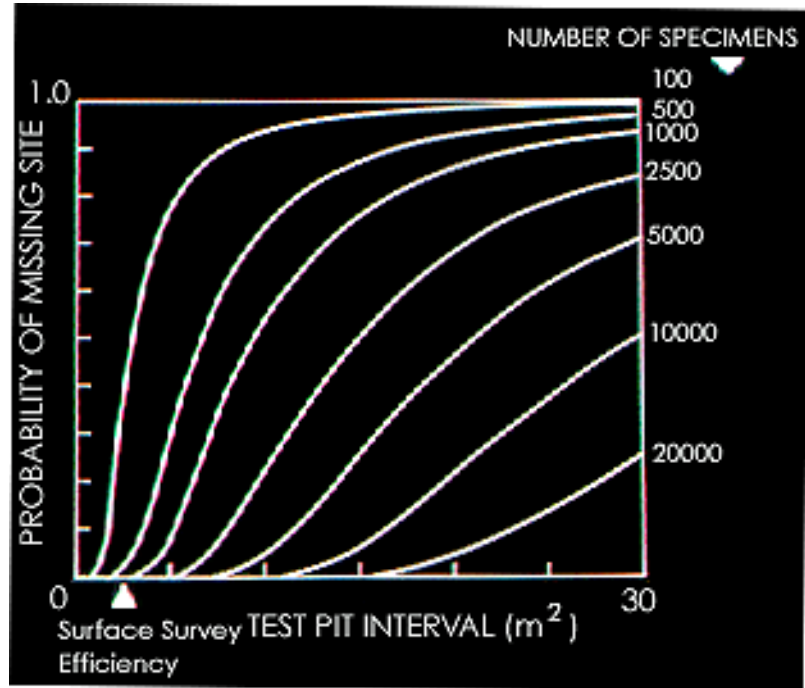


Figure 8 The probability of missing sites of various artifact densities at varying test pit intervals.

For comparative purposes, we have added a surface survey efficiency using the 1% rule to Figure 8. This is an indication of how well you would do on a site given good surface conditions, a plowed and well washed field with little vegetation, using systematic transects. About the only thing you are likely to miss are the 100 specimen sites and normally anything that small that might be considered significant is likely an artifact cache or something in that realm.

It is almost impossible to pick the best test pit interval unless you have some idea of what it is that you want to find and what it is that you think you can afford to miss. As we have discussed in this paper, the decision may be based on the site size and the number of artifacts that it might contain but it could also be based on a number of other variables that we have not considered. In other words, to define an appropriate test pit interval you must make some *a priori* decision about what it is that you think you can afford to miss. As this figure indicates there is no best interval. Any interval you pick has a consequence in terms of what it is you are going to find.

Figure 9 shows exactly the same three variables except that they have been reorganized such that we see the total number of specimens on a site, the test pit interval and the probability of missing a site. Remember when looking at this data, what we mean by missing a site. Missing a site is going through the motions of digging your test pits across the entire site area and not finding one artifact. At the 5% level, what we might think of as good probability, typically if you had done the appropriate test pitting based on the site size, you still only have three artifacts. So,

to establish the size of the site and its significance you would certainly have to use another mode of investigation. You might tighten up the test pits or use a series of 1 metre squares or perhaps plow that area for further evaluation.

So then, it is obvious that the 10 metre interval which is commonly used is almost certainly going to miss a lot of small sites. These sites may not be significant, but we should be aware that we are going to miss two out of three of these sites if we choose that interval. In sum, we have

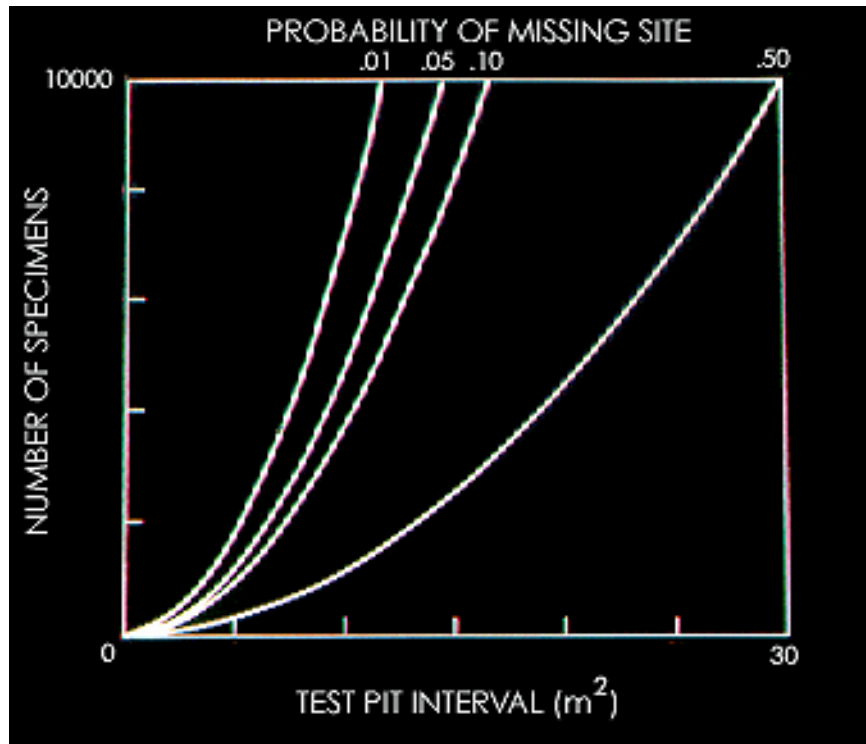


Figure 9 The probability of missing sites of various artifact densities and test pit intervals.

tried to show what the consequences are of choosing a certain survey strategy or test pitting interval. The sampling interval, along with the number of artifacts over a particular area of land will determine the results of our survey. What we really have to think about are the consequences of choosing survey strategies, what we think is significant, and what is not.

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