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Survey Strategies in Landscape Archaeology

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This chapter considers survey strategies, a critically important component of research design that largely determines whether or not a useful contribution will be made to the problem under investigation. A survey strategy is a master plan that articulates a regional research question with a specific combination of sensing, survey, recording, collection, and analysis methods and techniques designed to capture the information necessary to address the problem (see also Cheetham, this volume; Conolly, this volume). Careful thought put in at this critical planning stage of a survey allows greater flexibility during its execution where, on multiyear projects in particular, the focus of the research may shift, owing to the discovery of un-expected data, changing local conditions, or even through the influence of new team members bringing in different ideas (Barker 1995: 40).

In many cultural heritage management (CHM) contexts, there is often only one chance to get it right. Paradoxically, although planning is even more important than usual when much of the archaeological record on a landscape is scheduled to be destroyed, it is precisely in such contexts that adequate time for consideration of survey strategy is sometimes lacking, resulting in hastily planned surveys. The topics covered in this chapter should thus be considered by anyone faced with developing a strategy to survey a landscape, regardless of the overarching reasons for the study.

**History of Regional Archaeological Landscape Studies**

The modern archaeological regional study of landscapes is generally agreed to have started with Willey’s (1953) South American settlement pattern surveys. Ten years later, Binford’s (1964) seminal paper on research design championed both the regional approach, plus probability sampling, in the context of providing a research program for processual archaeologists to follow. Over the next 15 years, archaeologists working mostly in the arid parts of the United States and Mexico undertook such regional studies, frequently with probabilistic survey sampling (e.g., Flannery 1976; Mueller 1975; Schiffer and Gumerman 1977; Thoms 1988). It is this regional approach, along with similar British studies around the Mediterranean from the mid-1970s onward (e.g., Barker et al. 1995; Cherry, Gamble, and Shennan 1978; Keller and Rupp 1983) that firmly established the validity and usefulness of the study of human behavior across the landscape so that it has, in the last two decades, permeated archaeological research of virtually any theoretical persuasion in
many parts of the world (e.g., Alcock and Cherry 2004a; Allen, Green, and Zubrow 1990; Ashmore and Knapp 1999; Bender 1993; Birks et al. 1988; Gillings, Mattingly, and van Dalen 1999; Nash 1997; Rossignol and Wandsnider 1992; Tilley 1994; Wilkinson 2004).

Distributional (“non-site,” “siteless,” “off-site”) approaches, in which past human behavior is conceived as having occurred across entire landscapes, view the surface archaeological record as more or less continuous but variable in organization and density. These studies, which focus on the discovery and the recording of individual artifacts, started to be undertaken in the late 1960s (e.g., Bintliff and Snodgrass 1988; Cherry 1983; Dunnell and Dancey 1983; Ebert 1992; Foley 1981a, 1981b; Gallant 1986; Lewarch and O’Brien 1981; Schadla-Hall and Shennan 1978; Stoddart and Whitehead 1991; Thomas 1975; Wilkinson 1982), but site-based surveys are still common. Many studies either combine off-site with site-based approaches (Alcock and Cherry 2004b: 3) or define “sites” in the laboratory after conducting an off-site survey, for modeling purposes or to satisfy the documentation requirements of government cultural heritage authorities (e.g., Keay and Millett 1991; Peterson and Drennan 2005; Richards 1998; Thomas 1988).

Off-site landscape archaeological studies rapidly expanded from their initial focus on stone artifact distributions to a broader range of elements, including pottery (e.g., Bintliff and Snodgrass 1988; Wilkinson 1982), faunal remains (e.g., McNiven 1992), and even modified trees (e.g., Rhoads 1992; Styrd and Eldridge 1993; Webber and Burns 2004). Discussion in this chapter is compatible with siteless and/or site-based approaches to the study of archaeological landscapes.

**Selection of a Landscape**

Once a research question is developed, a suitable landscape must be selected, except in CHM contexts, where it is often the case that meaningful research questions have to be devised to fit a landscape threatened by development.

Research problems often require a landscape to be representative of a larger area, so the distributional patterns of the surface record and associated human behavioral interpretations can be widely extrapolated. This issue was assessed by David Hurst Thomas for the first regional probabilistic sampling study (also the initial non-site survey), the Reese River Valley, Nevada survey, undertaken

We were very careful to collect a 10% random sample from within the study area, and I felt sanguine about generalizing the results for the entire 25 x 30 km area. But the ultimate objective of this fieldwork . . . is to generate statements of anthropological rather than statistical relevance. One must wonder: How far can the Reese River pattern be generalized beyond the 1,400 square tracts in the initial population? After all, three years is no small investment in such labor-intensive fieldwork, and mere description of 800 km² hardly seems worth the effort. Could one legitimately extend the observed settlement pattern to the 160-km length of the Reese River Valley? . . . to the entire central Nevada region? . . . across the entire Great Basin? . . . What is the population against which to project these sample results? (Thomas 1988: 160)

Thomas (1988: 162) took the issue of regional representativeness seriously enough to undertake a second large scale regional landscape study, in the 30-km distant Monitor Valley, to test whether the archaeological patterning observed within the Reese River Valley study area was present.

A research problem may sometimes only be able to be addressed in a study area containing unique characteristics, so that the research results can inform on a process of great general interest and importance. An example of this approach to regional landscape selection is MacNeish’s decades-long research into the development of agriculture in Mesoamerica, which saw him undertake extensive landscape reconnaissance surveys in several locations, until he found a landscape in the Tehuacan Valley that contained an archaeological record suitable for answering his research question (MacNeish 1978).

There is a current trend toward the study of smaller and smaller landscapes in more and more detail (Terrenato 2004: 47); this is both a logical and desirable outgrowth from the much more spatially extensive surveys of past decades in many parts of the world, providing complementary datasets suitable for differing scales of analysis.

**Landscape Formation Considerations**

Following selection of a regional landscape study area, the formation of its present surface characteristics needs to be considered in developing the
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Geomorphology

If a specific archaeological phenomenon or period is the subject of interest, then the survey strategy needs to have a strong geoarchaeological emphasis, so that survey is directed to landforms of the appropriate age (Butzer 1982: 262; Terrenato 2004: 39; see Denham, this volume; Stern, this volume). It is still important to know the age of land surfaces across the region for more broad-based, comprehensive surveys, to promote understanding of observed patterning of the surface record. Of course, it is not only the age of landforms that is of interest, but formation processes of the archaeological record on a landscape scale (Foley 1981a; Zvelebil, Green, and Macklin 1992: 204; see Head, this volume; Heilen, Schiffer, and Reid, this volume). Understanding landscape-wide minor processes that could obscure or expose artifacts on specific survey tracts should result in provision for measuring and recording their effects during survey, thus providing data for post-survey analysis of site formation and "ground surface visibility" effects (e.g., Barton et al. 2002; Fanning and Holdaway 2004).

Another factor affecting visibility of the ground surface, and one considered by most archaeologists, is vegetation, discussed in more detail below.

Surface Vegetation

Logically, there should be an inverse linear relationship between the proportion of a land surface obscured by vegetation and the number of artifacts or sites observed. Recent research is demonstrating that this is not the case (Bevan and Conolly 2004; Fanning and Holdaway 2004; Thompson 2004). These studies support long-held intuitive beliefs by some archaeologists that the relationship between vegetation and surface visibility is complex and nonlinear.

A landscape survey project on the island of Kythera, Greece, examined the relationship between both artifact and site discovery and surface visibility and found that "although mean tract densities of artifacts do increase with ground visibility, there is no linear correlation between individual tract artifact densities and tract visibility ($r^2 = 0.06$)") and, further, that ground visibility has little predictive effect on site discovery (Bevan and Conolly 2004: 127–28).

Similarly, Thompson (2004: 74) found for the relationship exists between vegetation density and site discovery." He also noted that there are "higher than expected artifact densities at lower visibility ranges" in the Metaponto and several other Mediterranean surveys (Thompson 2004: 76). A possible explanation forwarded for this patterning is that the recording of vegetation cover on a ploughed surface is actually a proxy measure for surface weathering:

Following plowing, both sown crops and/or weeds gradually establish themselves, while at the same time the plowed surface weathers, settles, and deflates. One of the consequences of this weathering process is that, in addition to being cleaned by rain and irrigation water, artifacts previously lying at least partially within the surface gradually come to rest on the surface . . . Although weeds and crops may grow up through this surface, partially obscuring it in the process, weathering of the surface soils actually acts to make the archaeological component of these soils more visible. (Thompson 2004: 77)

Because of its potential broad applicability, Thompson’s hypothesis is worth testing empirically by others (cf. Clark and Schofield 1991: 102).

There may also be “archaeologist effects” that partially counteract the masking of surfaces by vegetation, including these: (1) archaeologists try harder to find artifacts or sites when vegetation reaches a certain density threshold—this may take the form of walking just a little more slowly across an overgrown tract than across a freshly ploughed one, resulting in more items being found than expected; (2) when vegetation cover is dense, but patchy, the archaeologist’s gaze is directed away from the vegetation and onto any expanses of bare ground, so these are scrutinized with greater intensity than they would be under more open conditions, again resulting in unexpectedly high artifact, or more particularly, site discovery rates; (3) archaeologists will discover large, dense scatters almost regardless of surface vegetation cover—skilled eyes will not miss such scatters if virtually any ground surface is visible.

Human Land Use

The other side of landscape formation is, of course, human land-use history, particularly large-
these activities are often as profound as general geomorphological processes, or even more damaging. In some cases, landscape-wide cultural formation processes are directly relevant to the subject of interest, rather than simply something to be measured as a negative effect on the record. For example, when research involves study of the development of agriculture, then evidence of land-clearing and cultivation, terracing, construction of water control systems, and the like are phenomena that the survey will probably be designed to record. To another archaeologist interested only in nonagricultural systems, these activities may be of interest mainly in regard to their effects on transforming the targeted record.

After decades of study and experimentation, archaeologists have some understanding of the effects of ploughing (including tilling, disk ing, and harrowing) on the surface record (e.g., Ammerman 1985; Lewarch and O’Brien 1981; O’Brien and Lewarch 1981; Odell and Cowan 1987; see Brooks, this volume). Essentially, what has been learned is that: (1) some horizontal dispersion of clusters of items does occur after initial ploughing, so that they are found archaeologically as somewhat larger, less dense clusters or scatters on a ploughed surface (Ammerman 1985: 40; Clark and Schofield 1991: 96–99; Lewarch and O’Brien 1981: 309; Odell and Cowan 1987: 481); (2) around 5% of the artifacts in the ploughzone will be exposed on the surface after a ploughing event (Ammerman 1985: 39; Clark and Schofield 1991: 99–100; Odell and Cowan 1987: 480); (3) larger items come to the surface disproportionately frequently (Clark and Schofield 1991: Tab. 8.2; Lewarch and O’Brien 1981: 310; Odell and Cowan 1987: 480). It has been suggested that cultivated surfaces should be surveyed more than once, each time following a ploughing episode, to obtain a representative sample of the contents of the ploughzone (Lewarch and O’Brien 1981: 311; Shott 1995: 488), although this may not always be practical, particularly in CHM situations.

**Correction Formulae**

Various factors obscure, expose, or remove aspects of the surface archaeological record. The effects of surface vegetation (e.g., David 1996: 44–45), small-scale sedimentation (e.g., Fanning and Holdaway 2004), surface sediment type (for example, gravel versus sand), ploughing (e.g., Schott 1995), or amateur artifact collecting (e.g., Richards and Jordan 1999: 83–112) on a sample survey should be considered by archaeologists, but one approach, calculation of “effective survey” and related correction formula. This is a highly fraught road to take in that the effects of vegetation or sedimentation on the visibility of the surface archaeological record are highly landscape-specific, locally variable (Fanning and Holdaway 2004), and changeable over short durations (Burger et al. 2004: 418). The application of simple cookbook formulas risks introducing more distortion and uncertainty than they are likely to “correct” for, especially if formation issues have not been adequately considered analytically for the landscape under study (Bevan and Conolly 2004: 127; Thompson 2004: 83).

**Survey Considerations**

Once the characteristics of the selected landscape are understood, choosing the other elements of the survey strategy largely involves decisions based on sampling considerations (Tables 54.1 and 54.2).

**Intensity and Coverage**

Survey intensity is “the degree of detail with which the ground surface of a given survey unit is inspected” (Plog, Plog, and Wait 1978: 389) and is commonly measured by the spacing between individual surveyors walking parallel paths (commonly referred to as “transects”) (Schiffer, Sullivan, and Klinger 1978: 13). Survey intensity has generally increased over the past several decades, to the point where field walkers are regularly spaced only 5 m or 10 m apart. However, survey intensity needs to be precisely geared to the nature of the archaeological record of interest (that is, its size, abundance, and obtrusiveness), the specific research goals, and ground visibility within the landscape. Situations to avoid involve survey that is not intense enough to recover data necessary to adequately address the research question, or unnecessarily intensive coverage, which is wasteful of time and resources and could have profoundly negative effects on the overall sample size. For example, if large earth mounds are the target of the survey, the spacing between survey transects can be much wider in comparison to a focus on finding and recording all potsherds on the landscape. Also, walking parallel transects may not be the most appropriate approach in some situations—zigzag or other patterns may be more effective for certain purposes (for example, when targeting discrete, obtrusive features).

Traditionally, and simplistically, all regional landscape studies are dualistically divided into sample surveys vs. complete (or full-coverage) sur-
surveys. In particular, the classic New Archaeology probabilistic sampling surveys of the American Southwest and Great Basin from the late 1960s onward have long been regarded in many quarters as exemplary sample surveys. There is, however, a vast, worldwide literature of regional landscape studies that are based on nonprobabilistic sampling or that incorporate some randomizing or systematic sampling procedures in combination with judgment and/or opportunistic sampling. This has to do with the highly variable adoption of processual archaeology and its methods outside the United States, including English-speaking countries where the classic texts of the New Archaeology have been most widely available. Probabilistic and other forms of survey sampling have limitations, especially in regard to informing on the spatial structure of the archaeological record, which many have suggested can be overcome by complete surveys. What is a full-coverage survey anyway? Certainly, a limited objective survey may provide a complete inventory of discrete and obtrusive aspects of the archaeological record such as architectural or monumental ruins, but full-coverage implies that the entire landscape has been walked and all visible components of the surface archaeological record recorded. As noted earlier, intensive survey generally is acknowledged to involve the use of 5–10 m spaced parallel pedestrian transects. Regardless of spacing, if all other factors influencing artifact discoverability are optimal, then the area thoroughly observed by a surveyor walking a straight line would at most be a 2-m wide window. Thus, with 10-m transects, only 20% of the available ground surface will be systematically searched. If an entire study was looked at in this way, a 20% systematic survey would be effectively undertaken, not a full-coverage survey. If 10-m transects within a sam-

<table>
<thead>
<tr>
<th>Sampling Design</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple Random</td>
<td>Random selection of sample elements, each of which must be known in advance.</td>
</tr>
<tr>
<td>Cluster</td>
<td>Random selection of sample units (e.g., quadrats or transects), each of which contains clusters of elements (e.g., artifacts or sites).</td>
</tr>
<tr>
<td>Stratified Random</td>
<td>Landscape divided into two or more sub-areas on basis of assumed greater homogeneity of variables of interest within each stratum than across whole landscape.</td>
</tr>
<tr>
<td>Systematic Random</td>
<td>Origin point of grid of equally spaced sample units is randomly chosen.</td>
</tr>
<tr>
<td>Stratified Systematic</td>
<td>Landscape is gridded into units (actually strata) and a smaller sample unit is randomly chosen from within each unit.</td>
</tr>
<tr>
<td>Unaligned</td>
<td>Initial sample units are randomly selected, but additional neighboring units are surveyed when a condition within a sample unit is met (i.e., contains artifacts) and further neighboring units will be surveyed adjacent to any of the first set of neighboring units meeting the condition, and so on until no units meet the condition.</td>
</tr>
<tr>
<td>Systematic</td>
<td>Nonrandom, equally spaced sample units, such as parallel transects or a grid pattern of quadrats.</td>
</tr>
<tr>
<td>Judgment</td>
<td>Archaeologist uses expertise and experience to survey locations where sites are likely to be located or to select “diagnostic” artifacts for recording attributes in survey units.</td>
</tr>
<tr>
<td>Targeted</td>
<td>Specific components of the archaeological record are of interest only.</td>
</tr>
<tr>
<td>Opportunistic</td>
<td>Survey is undertaken on basis that is neither random nor based on judgment, e.g., all fields with good surface visibility, tracts for which permission to survey is granted, etc.</td>
</tr>
<tr>
<td>Grab</td>
<td>Selection of first items which come to hand from a sample unit.</td>
</tr>
</tbody>
</table>

Table 54.1 Sampling design for survey unit or artifact selection (Haggett 1965; Nance 1983; Orton 2000; Read 1975; Thomas 1975).
survey of the landscape surface is achieved. This point has been made once every ten years or so since the 1970s (e.g., Cowgill 1990: 254; Orton 2000: 90; Plog, Plog, and Wait 1978: 389–94), although its implications have not been fully digested by many archaeologists.

Although intensity may be the most critical element in a survey strategy, a major problem is this: although it is known that increasing the intensity for a given survey area results in more sites being found, it is still not understood what proportion of the total population of artifacts or sites that samples found by even the most intensive surveys represent (Terrenato 2004: 44). One way of addressing this problem is by undertaking a crawling survey, where every square centimeter of land surface is eyeballed. Odd as this may seem, such a survey has recently been completed, with highly provocative results. A team of archaeologists in northwestern Nebraska employed a “Modified-Whittaker multiscale sampling plot, which gathers observations . . . on the same sample units at multiple resolutions” (Burger et al. 2004: 409).

Walking survey of the 1,000-square-m plots involved a 70-cm-wide spacing between surveyors (literally shoulder to shoulder), which is much more intensive than most other surveys. Nevertheless, the subsequent crawling survey of subplots within the 1,000-square-m plots found walking survey covering the same area (Burger et al. 2004: 416–19). The authors concluded:

The results of the crawling survey are considered a close estimate of the total number of artifacts on the surface at the time of the survey and can be used to evaluate the accuracy of coarser-grained coverage of the same area . . . Comparison of the techniques indicates that the crawling survey increased the total number of chipped stone artifacts discovered per square meter by 362% . . . . The magnitude of this increase was greater than many archaeologists (ourselves included) might have assumed and the implications need to be considered. (Burger et al. 2004: 418–19)

The crawling survey results provide a closer picture of the actual surface record (or artifact population) within the sample units, allowing the effectiveness and representativeness of more traditional pedestrian survey methods to be reliably measured (Burger et al. 2004: 418). It would therefore be useful to include similar nested intensity surveying during the first field season of many landscape studies, so that a sampling strategy for the subsequent seasons can be based on detailed knowledge of the characteristics of the surface artifact population.
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Subsurface Testing

Commonly, the surface of a landscape is at least partially obscured by dense pasture grass, or covered in thick leaf litter, loose, drifting sand or flood-deposited silts. Shovel probing, augering, excavation of test pits or mechanical trenching are commonly employed to survey obscured surfaces, the shallow subsurface or even relatively deeply buried surfaces, particularly in CHM contexts (e.g., Alexander 1983; Lovis 1976; Lynch 1980; McManamon 1984; Plog, Weide, and Stewart 1977; Richards 1998; Richards and Johnston 2004; Stone 1981; Thomas and Kelly 2007). Given the premise that the surface record is usually a reflection of the shallow subsurface record, and subsurface testing is a means whereby the shallow subsurface record is looked at as a substitute for examining the surface, it must be concluded that this whole approach is actually getting away from the subsurface testing design.

Subsurface testing is time-consuming and expensive, and its proper use is not as a primary regional survey tool but rather as a supplementary approach to primarily pedestrian regional surveys to overcome surface visibility problems (e.g., Lovis 1976; Shott 1989) or for evaluating the concordance between the surface and near-surface records (Burger et al. 2004: 419; Lightfoot 1986). Also, many of the considerations in evaluating surface survey intensity apply to finding subsurface artifacts, either singly or in variable density scatters and clusters (that is, sites) (Cowgill 1990; Kintigh 1988; Lightfoot 1986: 492–95; Nance and Ball 1986: 479; Wandsnider and Camilli 1992). For example, with a staggered grid pattern of test pits to find buried sites, there is a 0.94 probability of a test pit being within the boundary of a site with a diameter equal to the test pit interval (Krakker, Shott, and Welch 1983: 472). That site, however, will be found only if the test pit encounters artifacts, so it is critical to match test pit size to artifact density (Lightfoot 1986: 493). Chances of encountering an artifact, and thus discovering a site with an artifact density of one artifact per square meter, are slim if 20-cm shovel probes are employed (Krakker et al. 1983; Nance and Ball 1986; Orton 2000). Knowing site or artifact scatter/cluster size and artifact density parameters prior to undertaking the testing may not be possible in some CHM applications, so estimates must be made on the basis of the results of surveys on comparable landscapes and applied to the subsurface testing design.

Finally, shovel probes should be undertaken only away from known sites; any subsurface sampling detailed excavation methods, to avoid unacceptable damage to archaeological sites without properly recording the relationship of archaeological materials to one another and to chronostratigraphic details.

Recording and Collection

A big decision to be made in developing a survey strategy is whether to collect surface artifacts or record attribute states in the field, although it is much more common these days not to collect. Field recording has been facilitated by global positioning systems and small portable computers, but the mere availability of useful technology doesn’t help to decide which attributes on which items to record so as to obtain data critical to the research problem. Anything less than total recording of all items detected on the ground surface adds another level of sampling, sometimes of dubious representativeness—it was once common to collect a “grab sample” of items from each transect within a survey tract while field walking and to examine them back in the laboratory. Such sampling has, however, been shown to seriously bias the record toward selected artifact types, without the integrity of those types being adequately understood or assessed. More recent approaches have included: (1) the targeting of all temporally sensitive items, particularly diagnostic potsherds or projectile points, for collection or field recording; (2) using a “clicker” to record counts of a ubiquitous class of artifact; (3) recording or collecting all items encountered during survey; (4) collecting all artifacts within a small and well-defined sample area (for example, 1 m²) within a broader surveying area or site; (5) employing a separate team of specialists to return to all or selected artifact concentrations/sites to record some or all items in detail.

The long and the short of it is, in the development of a survey strategy careful decisions need to be made regarding which attributes should be recorded to address the targeted research question(s) and whether to measure these on all or a sample of surface artifacts while being aware of the potential impact of sampling decisions on the ultimate research results (Foley 1978: 60).

Predictive Modeling

Predictive modeling arose in the late 1970s and 1980s in North America as a cultural heritage management planning tool involving modeling of the distribution and density of archaeological sites or...
1986: 400). The models frequently were based on correlations between environmental variables and archaeological distributions, but there was always a tension between the goals of modeling relationships between site location and environmental variables and modeling the human behavior behind site location (Kohler and Parker 1986: 442).

Despite this tension, many highly worthwhile studies were undertaken (e.g., Judge and Sebastian 1988), but ultimately, predictive models have largely come to be perceived as costly tools of limited utility by cultural heritage managers on the one hand, and of environmentally deterministic character and limited explanatory power to research archaeologists on the other. Predictive modeling has, however, received something of a minor revival with the recent broadly available desktop PC geographic information system computer programs (e.g., Westcott and Brandon 2000; Wheatley and Gillings 2002: 165–81), although the fundamental problems of relating correlations between sites or artifacts and environmental variables to past human behavior remain (Ebert 2000: 130).

## Conclusions

The first decision to be made in relation to survey strategy, and probably the most important, is which landscape to study. Today, choice of a landscape is frequently dictated by CHM exigencies, but for archaeologists with the luxury of being able to select their study area, the location and the extent are determined by the nature of the research question, as well as the resources available. It is apparent, however, that when archaeologists are able to choose, they usually pick a landscape with good surface visibility—at least partially to avoid having to employ subsurface testing methods on a large scale and also because of the larger surface sample readily available for study.

Once research goals are defined, a study landscape selected, and initial considerations such as geomorphology and landscape formation have been considered, development of a survey strategy is largely a sampling exercise. A critically important sampling issue to be considered is survey intensity, or how closely the ground surface is to be scrutinized. While Burger and associates (2004) caution against using their crawling survey results in other regions, this only highlights the desirability of similar surveys to be undertaken by other archaeologists so the surface record of additional landscapes may be equally well understood. The resulting knowledge of actual surface artifact population characteristics should stimulate the posing of more informed research questions and result in better-designed survey strategies.

## References


Part V: Characterizing Landscapes


