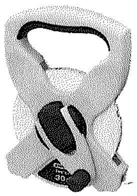
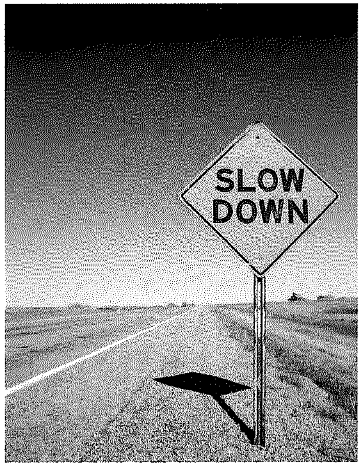


Surveying the Site

OK, so we've finally got there – the point where we can actually go out and do some designing? *Slow down, slow down*! Remember what's first? That's right, ***observation***.

"Don't just do something, stand there..."



Apologies for labouring the point, but this is by far the most common error I see being made during the main design exercise on my courses and I wouldn't want you to make it too. The first part of the process is simply to *observe* – NO designing! If you get any ideas, scribble them down on a piece of paper if you must, put them in your pocket and get back to the process of recording what you see, hear, smell, perhaps even taste and so on. How things are *right now*.

All our design frameworks begin with observing and recording and we should give good attention to this stage as it informs all the decisions we'll make later. Whereas most of us currently spend just 20% of our time planning and implementing something and then 80% maintaining it, in permaculture we set out to change those numbers around. Ironically the gift of oil has made us far more wasteful of energy, something our ancestors would never have done for long. We've used fossil fuels to replace skill with brute force in so many areas, particularly in food production. Thankfully, we haven't completely lost those skills yet and there are a few inspirational farmers who have a lot to teach us about using our resources wisely. They all understand that a well-designed system should, more or less, look after itself, though intensive food production inevitably involves a certain amount of interaction on our part, '*Harvesting as maintenance*' being the Holy Grail of design.

While this process can be applied to designing more than just landscapes (more about that in part three) we'll start off by doing this, as it's the easiest way to get a sense of the flow. In the land-based example we'll be following, the observation is made in two parts; first of the land and then of the client(s).

I say 'first the land' because personally, I like to look at a site before interviewing any client(s) in detail. This gives me an unclouded view of what I see there. The survey also often raises questions that may need further clarification, such as issues around the history of use of the site. So doing it this way around makes most sense to me. However, this isn't a hard and fast rule, and you'll have to ask the client(s) in advance about site boundaries anyway (so you know exactly *where* you're surveying!). When you do so, ask them if they already have a good map of the site that you can adapt for your own use. If they do have one it will save you mapping time later.

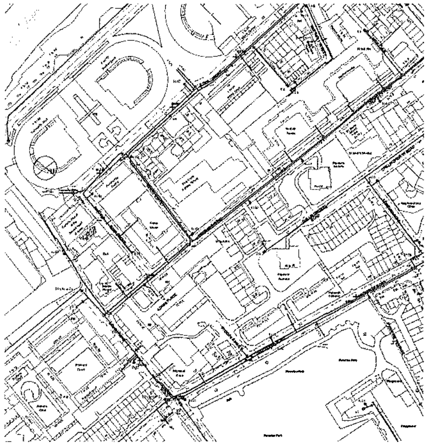
If you're designing for yourself, you'll already have a fairly clear idea of what you want, and if the site is familiar to you, a good sense of what is there. Then this process becomes one of clarification and expansion. It's your design process, so find the way that works best for you; be careful that you don't let your design ideas cloud your observations though! Enlisting a friend less familiar with the space, to add their own observations, can often illicit a new way of seeing familiar spaces. Such outside perspectives can help you sweep away blocks that had previously been limiting your ability to see the most obvious issues.

The main thing to remember here is that a little extra time spent observing now is going to save you a whole lot of effort later. Bill Mollison suggests observing our design site *for at least one full cycle*. For a land-based project, that means of course a *whole year*. However, if you don't have all that information to hand, there may be others who can help you fill in the gaps. Neighbours and previous owners may also know where the sunniest and shadiest areas are and where and when it floods or frosts etc. They might well have photographs that allow you to look back in time. Include these people as part of your client interview process if you can.

Maps

To design well, you always have to get onto the site, that said it helps to have a framework in which to record observations and maps can provide that for us. Hopefully your client can provide you with a map that you can use for this purpose, but if not there are still plenty of places from which you can obtain a useful one, including online services.† However, even if you're fortunate enough to be holding such a map in your hand, it's unlikely that it will be the perfect one for you just yet.

Maps are made for different reasons, so any you have will include some irrelevant things and lack other important data. What you need to know will vary of course depending upon where and what you are designing. For instance, having detailed contour information can save a lot of time surveying a large property, whereas it's unlikely you'll need to know this if you are designing a small urban garden.



Utility company map

Even having the basic outline of a site can be a helpful starting point, saving you a significant amount of surveying time in determining the boundaries, size and shape of the plot. It's important though to remember that maps are just a snapshot in time and may no longer be accurate. Only by visiting the site itself will you be able to determine this. Perhaps the only old maps that can be relied upon are those mapping geology and soils.

† *In Britain, Ordnance Survey maps are a good choice. Online services can now provide these and many other maps; I include links to some in the online resources. The most useful scale for most urban designs is around 1:1,250 to 1:2,500. Your local library may have copies of these for the site that you can view, as well as historical maps and photographs that can give clues about previous use. For rural properties, agricultural maps are often a good starting point. Land registry maps can also be helpful, though not always. Many homeowners will have these as part of their deeds. Utilities companies also often provide free maps with their supply lines mapped.*

So first identify what it is that you need to know and then investigate which maps are available that already contain this information. Remember, the right map can pay for itself many times over by saving you time spent gathering particular data. This is especially important if you're working to a budget. It's worth mentioning here that aerial photographs can also be useful, though care should be taken with those provided by free online mapping sites as they can be distorted at the point where individual photos are stitched together to create a seamless landscape. Sometimes the seam is obvious, such as when images were taken at different times of year (one issue with projecting an unnatural cloud-free landscape I suppose). You also should check such maps are up to date; at the time of writing, the Google Maps™ aerial photo of our home still shows it before it was extended by the last owner – over five years ago!

DIY mapping

There may be times when you won't have access to an existing map at a useful scale and you'll have to create your own. This is a useful skill to have anyway, so no mapmaking task is ever a waste of time. Although 100% accuracy is always worth aiming for, getting close to that can often be disproportionally time consuming. In practice 90-95% is good enough for most situations, with perhaps contouring for water management being one key exception – however nicely you ask it, water *never* flows uphill unaided!

Urban garden designs usually include a considerable amount of detail, planting schemes etc. and so need to be surveyed accurately enough to ensure that any proposed garden beds and paths will all fit into the given space. Broader scale (e.g. farm) designs are often more pattern based, addressing how separate systems can be connected together in the most effective way. Slight inaccuracies in DIY mapping may only lead to the need to plant a few more trees in a hedge line, and it's worth remembering that the final canopy sizes of trees given in books will always be approximate and site dependent. That said, paying for an accurately contoured map can allow you to for instance, design and precisely lay out a Keyline® system† on the ground using an affordable GPS unit.

† *A water harvesting and soil building strategy developed by P. A. Yeomans.*

Making base and field maps

As well as needing a map to communicate our design ideas, we also need one onto which we can record the information we'll be gathering. We call this our *base map*. It should be simple, mapping site boundaries and 'fixed' elements like buildings, roads, significant bodies of water and large trees. In addition it should include a scale for the map, the direction of north, the place and the date.

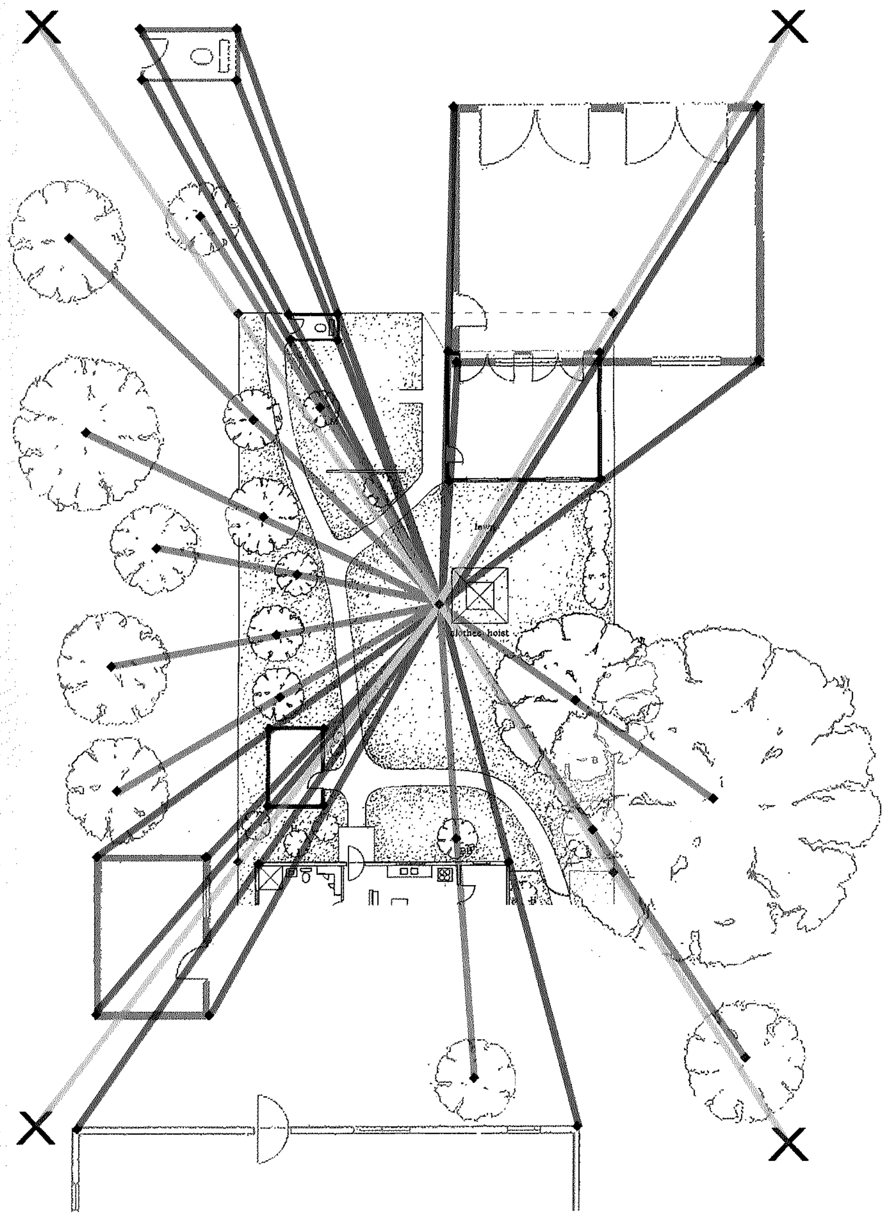
Create a base map from an existing map

If you've already found a good map, this should be a relatively simple process, but you'll still have to pick out the information you need and probably enlarge it too. Assuming the map is still accurate (and they won't always be), you should first scale it up to a useful size. You're going to need both a base map that you can present your ideas on later and a smaller field map that you can record information onto whilst on site. These will almost certainly need to be at different scales. Site work will usually involve using a clipboard (commonly A4, though A3 is also available), whereas design presentations, especially to a group of people, are better done at a larger scale (A3 or above).

Extend the boundaries

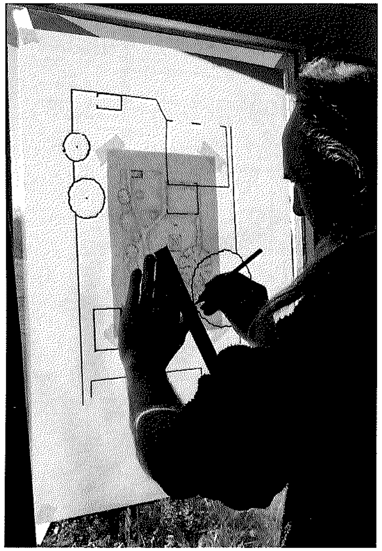
A good method for expanding or simply copying a map is to use a large window as a makeshift light box. Obviously this only works during the day! Tape your existing (smaller) map onto the inside of the window and then your larger sheet of paper fairly centrally over the top, so you can see through the big sheet to the small map underneath. Place a dot on your big paper somewhere over the middle of the smaller map beneath; this will act as the reference point for all your measurements in expanding the map. First though we need to determine how much we can scale up and that will depend upon the relative sizes of our paper.

We do this by measuring the distance between your central dot and a point on the boundary of the small map. Then decide how many times you can multiply that distance and still have the expanded version of the map fit on the bigger sheet. In the example opposite we are doubling our measurement.

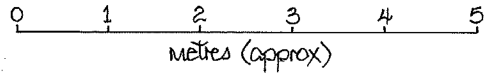


Expanding a map from a central point, in this case doubling its scale

So for instance, if you were expanding your map from A4 to A2, you'd see that you can extend a line from the central dot, through a boundary point on the small map and on to a point twice that distance, still fitting the longer line on the bigger sheet. In our example, if it were 15cm from the central dot to one point on the small map boundary, you could also fit in another 15cm beyond that on the bigger sheet (30cm in total). In order to scale up the map you would simply multiply all your other distances from the centre to the boundary points by two. Remember though to leave room on the expanded map for a key and scale etc., so don't go right to the edge of the paper all the way around. Once you've extended each boundary point (and those of any other fixed elements like buildings), join them together. If you've something resembling a large version of what you started with, well done! If not, you did something a little different than I'd hoped and learned one way not to do it. Have another go.



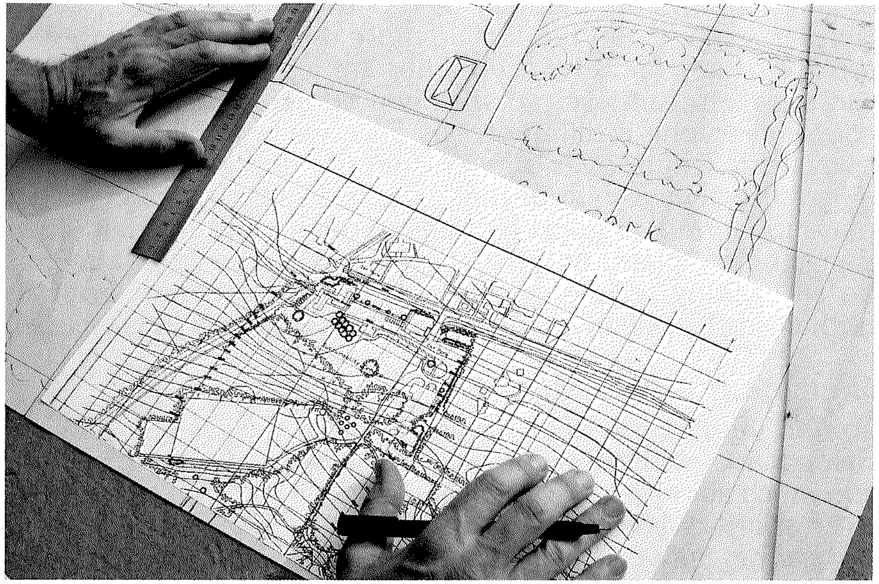
Don't forget to enlarge the scale. One important thing to know is that if your original map scale is written as a ratio (such as 1:100), then it will be wrong as soon as you enlarge or shrink it. For this reason, expressing scale in a 'ruler' form (see example below) which expands with the map, is always the safest option.



You'll discover this method works best for mapping human-designed systems where there are lots of corners and straight edges. Trees can be fairly easily mapped too as they have a centre, but more organic curves like the course of a stream or the edge of a pond will need many more points to be plotted.

Enlarge the grid

This next technique can help fill in those gaps fairly quickly. Any map with grid lines can be enlarged by hand; take your larger piece of paper and draw an expanded version of the grid on it. Then copy the information you need, one grid box at a time, into the larger grid as shown below.



Visit your local copy shop

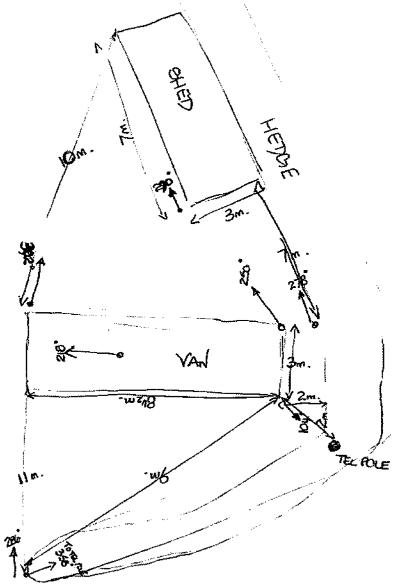
Sometimes modern technology can be really helpful and worth using if the end goal justifies it. Just don't create systems that rely upon it! For instance, photocopiers are very good at taking a map at one scale and quickly enlarging it to another (though travelling to a copy shop and back may take time and energy). To use this method, identify the relevant area on your original map and have it enlarged to fill a whole page.† You can then use this as the basis of a new map if the original contains a whole host of superfluous information. Simply trace over it onto another sheet of paper (the window technique works well for this too) or use the gridding process described above. Don't forget to add a scale and a north arrow if you've copied just one area from a bigger map and leave room for a key too.

† *This could be to just A4 and then enlarged again later, or straight to your final presentation scale and later reduced again for field mapping use.*

A base map from your own measurements

If you have to create a map completely from scratch, you've a bit more work to do. With a moderate investment and the right know-how, GPS can make plotting points onto a map fairly easy, but I haven't the space to cover how to do that here. For this process I'm assuming that your measuring tools are a little more rudimentary (and perhaps more appropriate). Simpler technologies tend to be more reliable and/or easier to replace if they fail. Our own limbs are a given length and we can use them to make remarkably accurate measurements. Of course everyone is different, but once we're familiar with our own stride length over different terrains and gradients, we've a measure always with us that gives us 90-95% accuracy. That may not sound so good by laser standards but it's fine when designing for plants and trees. A Bunyip† water level may not be an exciting technology, but its reliability comes from an unchanging law of physics – that water always finds its own level.

Sketch out a field map



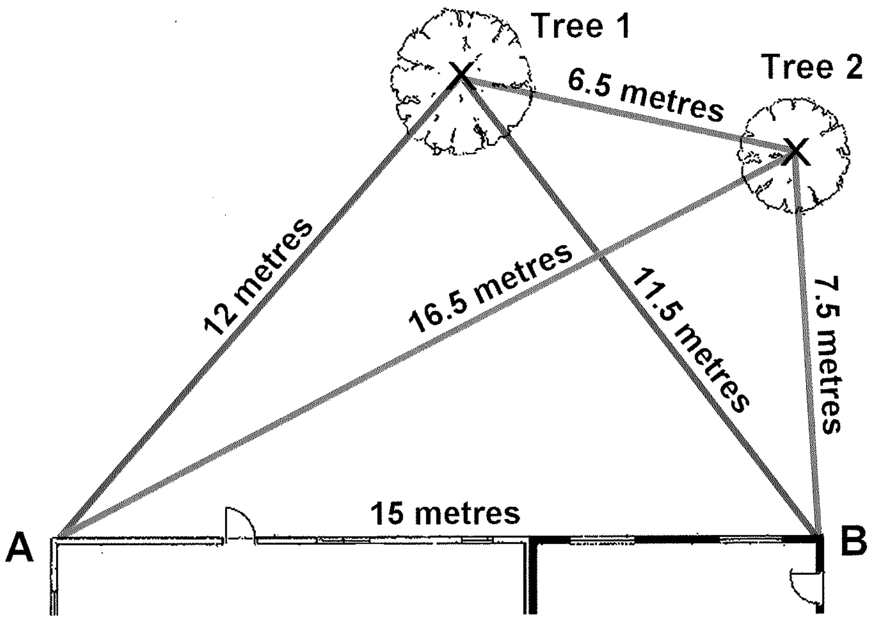
To start with, sketch out a rough field map, without worrying too much about accuracy. You'll use it shortly to record distances or bearings between everything, giving you the data you'll need later to make a more accurate map. Remember that where you stand will alter your perspective, making the site look bigger side to side than front to back. Only from above can you get a true picture. So stand in the middle and make a simple pencil sketch, or if this is difficult choose the mid point of one boundary and then adjust your sketch based on a second viewpoint at approximately right angles to the first. This should give you a reasonably good starting point.

† *Named after a fierce stick-limbed aboriginal dreamtime creature. The water level comprises a clear hose attached to two tall measuring sticks.*

Choose your baseline

Next, plot the key fixed points on the site such as buildings, gateways, fencing corner posts, telegraph poles or big trees. Start by choosing two points, perhaps along one side and a good distance apart, from which you can measure everything else. If need be, drive in two posts yourself for this purpose. For most urban garden designs you might choose two corners of an adjacent building. Such walls are often straight, making it easy to measure between those points and so providing you with a useful *baseline* for your mapping.

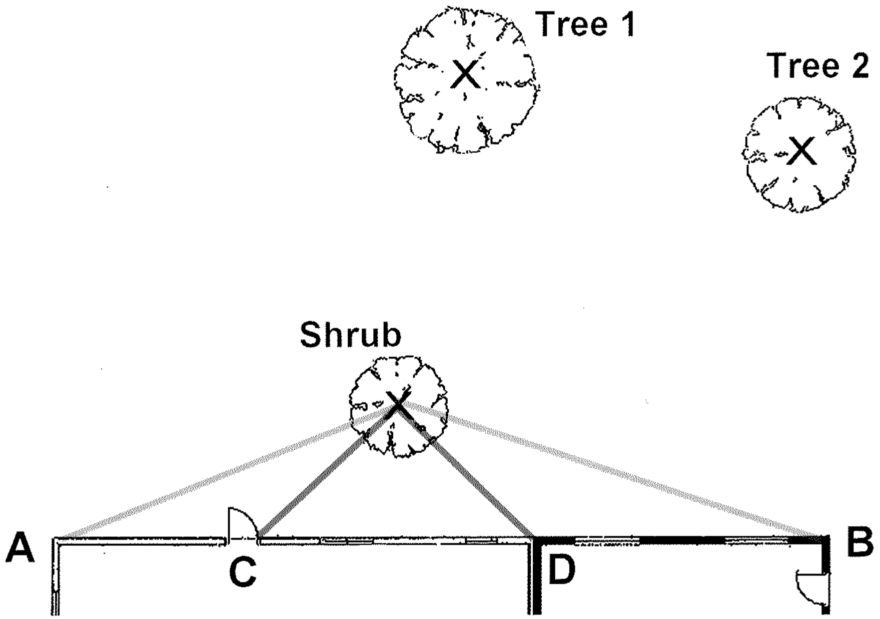
Measure distances or take bearings



In this diagram we see a building being used as a baseline for the survey, corners A and B being measured as 15m apart. We know such a building will be easy to draw using one or more straight lines, so it will be a good way to start our map. From here, the simplest method of pinpointing the other elements on the site, such as Trees 1 and 2, is to measure their distances from each corner, A and B. You can use a site tape or pacing, see the online resources for a simple pace conversion table.¤

This will later allow us to use trilateration† to map all their positions accurately. This technique is most accurate where the directions of the measurements to any element are closest to being at right angles to each other, like to Tree 1 in the previous example. Therefore it's useful to choose another point that can be fairly accurately located from A and B (such as Tree 1), that can act as a third reference point. Hence in addition to measuring Tree 2 from A and B (measurements that are at quite an acute angle to each other), we can also measure from Tree 1.

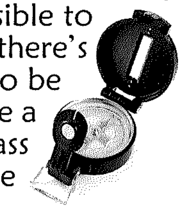
As you do this, you'll notice that your third reference point is most useful if it's close to the other side of the site. So in order to measure its position accurately, we're better off starting with a baseline along the *longer* dimension of the site. The down side of this is that any elements close to the middle of this baseline (like our shrub below) will have measurements crossing at very obtuse angles, the opposite problem that we had in locating Tree 2, but equally unhelpful.



† *The determination of absolute or relative locations of points by measurement of distances, using the geometry (in 2 dimensions) of triangles.*

In this case the measurements from A and B cross at an obtuse angle, reducing again the accuracy of locating it. So our ideal baseline might have other points along its length that we can use for pinpointing closer elements. In the case of our building, the edges of doors and windows would be ideal. In our example we've also measured to the shrub from C, the side of the door and D, the join between the house and the garage. This gives us close to a right angle again. Of course more measuring takes more time, but personally, I'm inclined to invest that time while surveying a site. Each measurement I make provides me with a further check when I'm later creating the base map.

In most circumstances making distance measurements should be enough to enable you to make a fairly accurate base map later. However, there are times when it's not possible to easily measure between two points, such as when there's a large pond in between. This is when it's useful to be able to use a sighting compass. As long as you have a sight line, you can always take a bearing. A compass can, amongst other things, save you a lot of time walking back and forth across big sites.



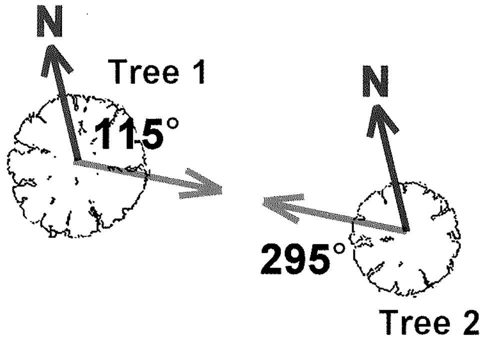
So rather than measuring the distance between elements, we could instead take bearings for later triangulation.† We can do this because the Earth provides us with a reliable reference point that we can use: *magnetic north*. At least it's reliable across our site – the position of the magnetic north pole slowly shifts about and is different from the true pole,‡ the angle between them (called magnetic declination) varying across the globe.

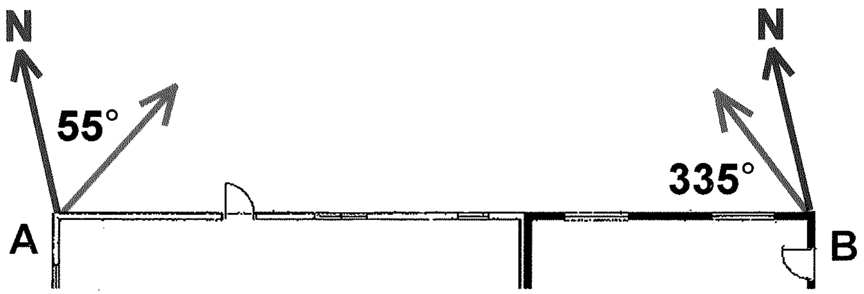
So starting again from one end of our baseline, say A, we take a bearing to any element we wish to map, e.g. Tree 1 in the next diagram. Without moving we can then take bearings to all the other visible elements too. Only once we have finished (and taken photos – more about that shortly) will we need to walk to the other end of our baseline and repeat the process. This can make surveying a much quicker process. However the same issue applies about placements being more accurate where bearings cross at close to right angles.

† *The process of determining the location of a point by measuring angles to it from known points at either end of a fixed baseline.*

‡ *The direction along the earth's surface towards the geographic north pole.*

It's also worth mentioning though that the process of walking about a lot across a site increases the likelihood of you noticing any number of important things you might otherwise miss.





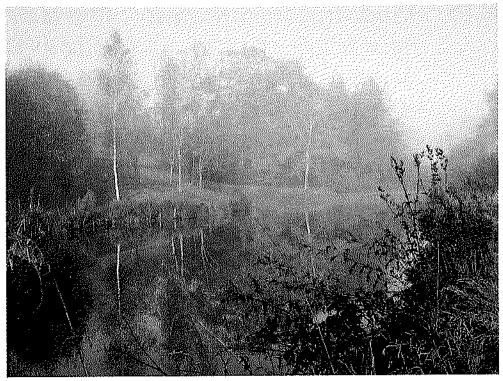
So it's useful once more to have a third reference point, ideally on a different boundary, and already pinpointed from our baseline. In this case we'll assume that Tree 2 is along a straight fence line at right angles to the building and easy to pinpoint. Adding a third bearing from there, enables us to pinpoint Tree 1 even more accurately.

Note that the bearing you take will be 180° different from that taken from the opposite viewpoint (i.e. from Tree 1 to Tree 2), so mark its direction on your field map with an arrow, as shown in the diagram. There's one more thing you should be aware of that applies to both measuring distances and taking bearings; if you now try to locate another element using Trees 1 and 2 as a baseline, you'll multiply any errors in their positioning. So try to measure everything in relation to just a few, easily located reference points.

I'm not going to explain how to use a sighting compass here, as that would take up too much space and if you buy one it will come with instructions. All I'm going to say is that as long as you're careful not to hold the compass too close to metal objects (including those you are carrying such as phones, PDAs, torches and clipboard clips), taking bearings in this manner is a quick way of pinpointing elements across a site.

Mapping non-point elements

I mentioned earlier that when expanding a map, any non-point element (such as a stream or pond) is more difficult to plot. The same applies when mapping a site from scratch. So far we've been measuring elements that we can pinpoint, whereas the curved bank of a pond is less easy to define. We might be able to map the point at which another element, such as a stream or a jetty interacts with it, but what about the rest of its edge? Assuming you don't have a GPS unit (this is where technology can really save you time), or an aerial photo that can give you a sense of the outline of, say a large pond or small lake, we need to consider some lower-tech methods.



We can start by pacing the circumference of a lake. We can measure the shortest distance between our already mapped points and its edge. We can take bearings from those points towards the left and right edges of the lake and to points like a jetty. We can also spend a little time sketching out its shape, from different angles. If you've someone else to work with, and your measuring tape is long enough, you could walk either side of the lake, measuring across it in different places.

These measurements combined should be enough to help you plot its shape on your map later. For large bodies of water, aerial photos can clarify the shape, though it's better to take plenty of measurements while on site in case you can't get hold of one that's sufficiently up to date.

Recording contours and any significant slope

If the site is small and essentially flat, it may not be necessary to give this much attention. However, if there are neighbouring slopes channelling water and materials towards or away from the site, these certainly need to be recorded and accounted for. Larger sites and small sloping sites will certainly need to have any gradients surveyed and contours marked.

If so:

* *Use a level (e.g. A-frame, Bunyip water level, laser or dumpy level) to identify important contours and any difference in height between key elements on the site, such as the fall of streams. Remember a body of water like a lake gives you a handy level reference around its edge.*

* *Mark this information onto a new copy of your base map or an overlay.*† *Ideally also sketch out a cross-section of the site through different areas of planting and terrain and mark its line upon your base map.*

Marking out a contour using an A frame

I always choose a water level over an A-frame, because of its speed of use. However, the parts for a makeshift A-frame are more easily found in nature; three branches, some vine and a rock suffice if nothing else is available. While more costly, an outdoor rotating laser level allows you to mark contours quickly and over longer distances, GPS can then be used to record these coordinates for later transfer into computer-based mapping programs. While obtaining a good map in advance, can save you a lot of contour surveying on larger sites, if your design calls for Keyline® ploughing or swales you'll be marking these lines out on the ground later anyway.

† *Semi-transparent sheets, such as tracing paper containing additional information.*

Take plenty of photos (or video)

While I measure as many distances and bearings as I can while on site, I've sometimes found when creating my base map later, that I've missed a vital measurement. So if the site is any significant distance from my home, I'll take plenty of photos across it, from many different angles, especially from the fixed points I've chosen (making notes where each photo is taken from). These help me later with any uncertainties in my map-making, showing me valuable sight lines and saving me the need for a return visit to clarify anything I forgot to record the first time around. More about that later. Of course, if your camera (or phone) has video capabilities too you can record some panoramas at the same time.

Useful site surveying tools

(for mapping and gathering site information)

Simple tools (that many of us own or can make or borrow):

- Clipboard (A4 or A3)
- Clear plastic sheet/bag to keep paper dry
- Plenty of paper, or copies of the base map
- Tracing paper for information overlays
- Pens, pencils, sharpener, eraser
- Measuring tapes, rope with knots, or pacing chart
- Magnetic compass (sighting versions are best)
- Water level (small syringe useful for calibrating) or A-frame
- Soil testing charts (see online resources)
- Spades (two makes soil sampling easier)
- Jars for soil samples (tall are better, with good seals on lids)
- Bags for collecting samples
- Camera (digital is best) and spare batteries

More specialised tools:

- pH/salinity testing kits
- Sun compass
- Dumpy or outdoor rotating laser level kit
- Hand held GPS unit
- Video camera (for recording dynamic events such as strong winds or heavy rainfall)