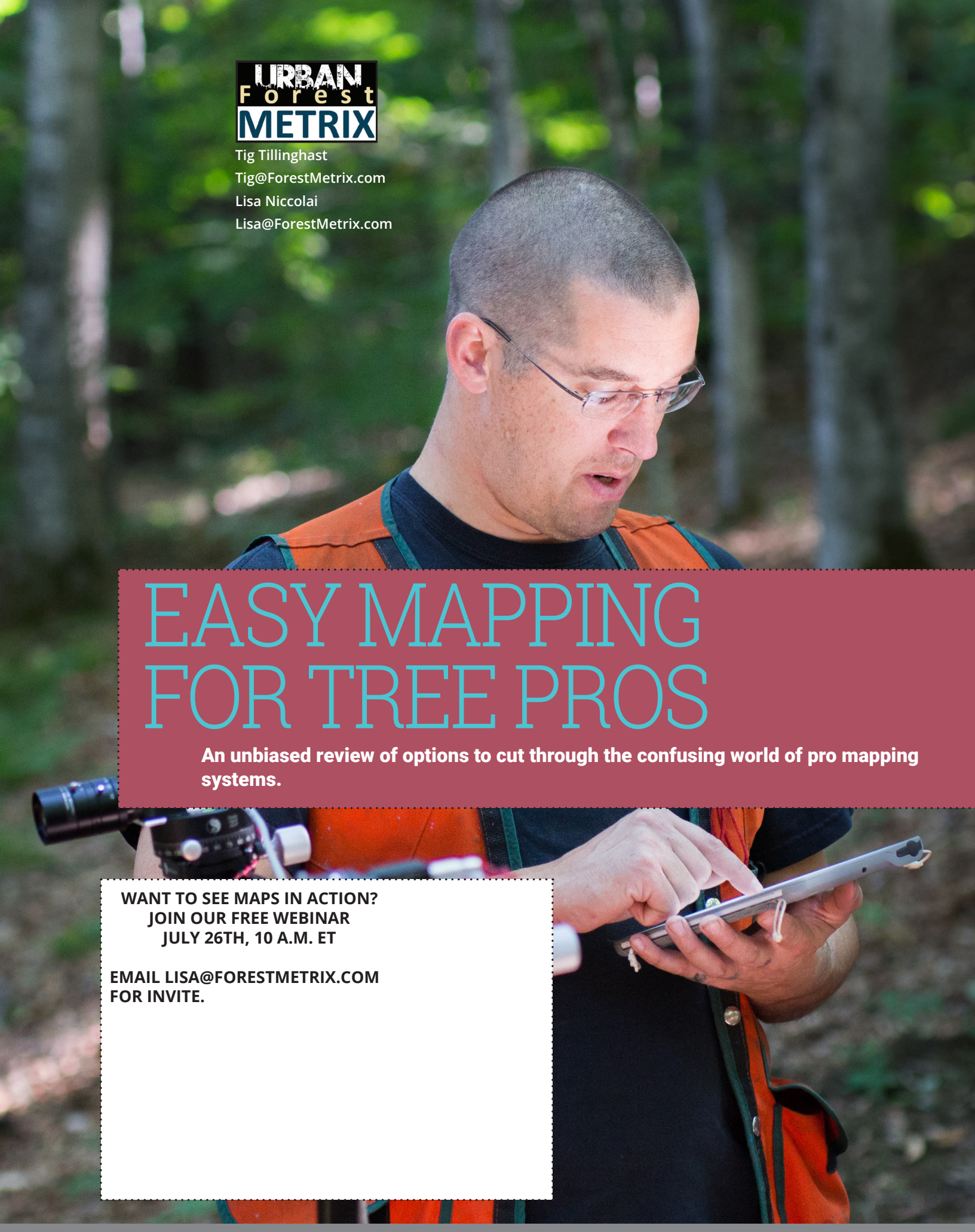

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EASY MAPPING FOR TREE PROS

An unbiased review of options to cut through the confusing world of pro mapping systems.

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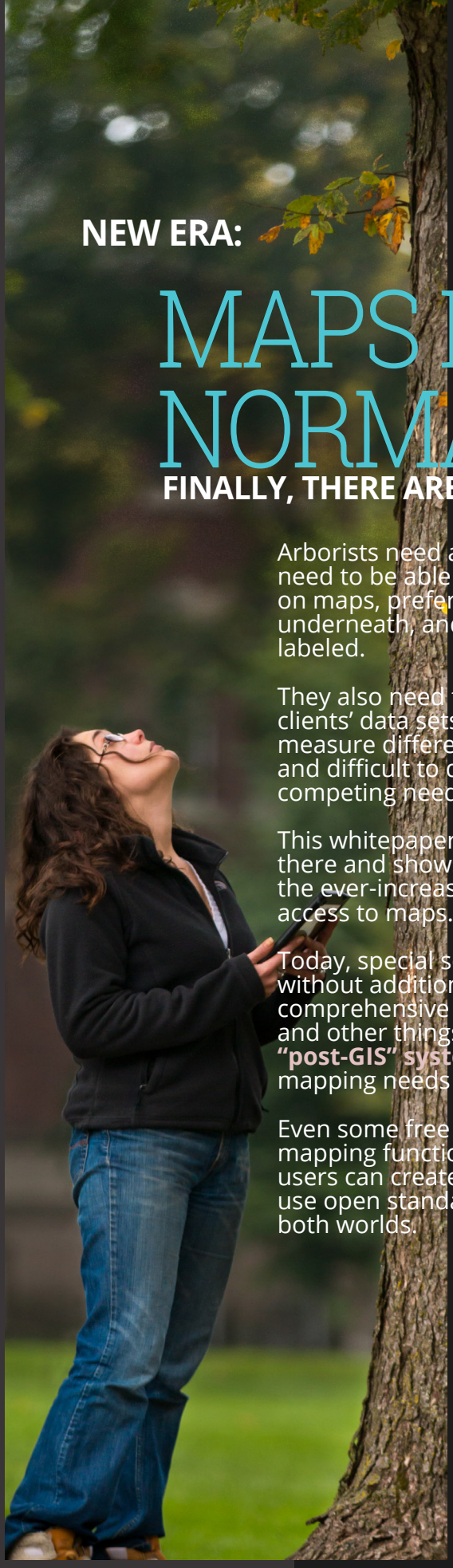

NEW ERA:

MAPS FOR NORMAL PEOPLE

FINALLY, THERE ARE APPS FOR THAT

Arborists need a few straightforward mapping capabilities. They need to be able to pin down tree locations and display them on maps, preferably with base maps (like photos) displayed underneath, and preferably with some flexibility with how they are labeled.

They also need to ensure their data integrates with their larger clients' data sets, which can be in different formats and actually measure different things. This is sometimes difficult to understand and difficult to develop workflows and systems that meet the competing needs.

This whitepaper describes the most common mapping systems out there and shows what is needed for today's tree professional, with the ever-increasing expectations of clients when it comes to having access to maps.

Today, special software made for arborists can handle this simply, without additional charges or training. These systems include a comprehensive database of clients, trees, treatments, proposals and other things beyond maps. These comprise a new class of **"post-GIS" systems** that are coming to dominate the day-to-day mapping needs of tree professionals.

Even some free consumer web services now provide much of this mapping functionality. Google Maps is a popular example, where users can create custom maps and share them. Tree databases that use open standards can export data to that, providing the best of both worlds.

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COLLECTING DATA

There are lots of ways to collect tree location data. It is easy to feel pressure to invest in costly hardware to get accurate locations. For the purposes of most tree professionals, though, simpler and cheaper methods - such as just touching a digital basemap provided by Google - are much easier and at times even provide more accurate real-world data.

MOST COMMON METHODS

REGULAR GPS

This is the simplest. The GPS device fixes a location. It is typically only about +/- 20 feet accurate. This works for most arborists when trees are not generally too close together.

AIDED GPS

GPS devices can be aided by additional devices that make the GPS readings more accurate. An example is the Bad Elf bluetooth device. These are generally about +/-12 feet in accuracy.

SUBMETER GPS

These systems require expensive hardware, sometimes subscriptions to streaming data, and sometimes a need to conduct post-processing on the data after the field visit. They can provide very accurate data.

TOUCH MAP

Maps have gotten easy, with many free services online and offline to take GPS points and make useful and interactive pictures, and with basemaps beneath. They allow users to simply touch the map to have the system calculate an accurate location. Most such applications generally give you 1 to 3 feet accuracy.

Simply using an on-board GPS chip on your existing device, whether it be your smartphone or iPad, doesn't cost anything incremental. These typically take less than a minute to produce a location.

Additional hardware, such as bluetooth devices made to increase GPS accuracy generally cost a few hundred dollars and roughly

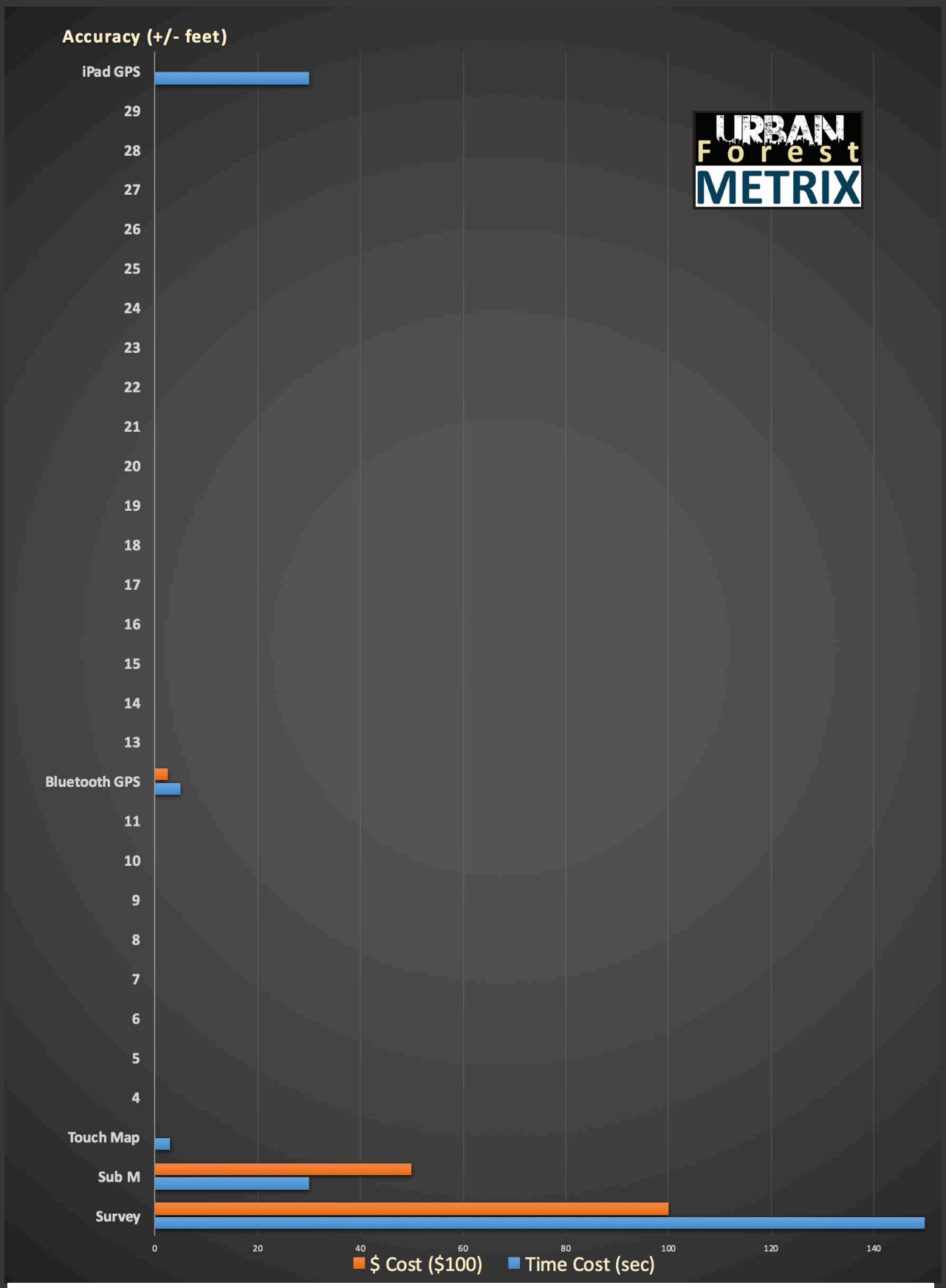
double the accuracy of the locations (see device at right).

Submeter GPS units vary quite a lot in both price and degree of accuracy, depending on the hardware, and depending on how that hardware is employed. To get true sub-meter results, one must often use external aerials, take multiple

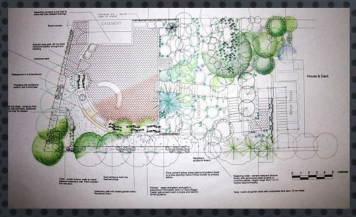
readings over different timespans and bring the data back to the office to be processed. Some systems also rely on ground-based broadcast stations, which are available only in certain regions. To move this level of accuracy takes significant funds and time on an ongoing basis, so should be based on a real need.

Recently launched by UFM, Touch Map allows a user to simply look at a basemap from Google and touch the tree being observed (see right). That allows the UFM system to calculate a location based on the geo-located map underneath. Accuracy is typically between 1 and 3 feet. The service does not cost any additional money, but it does require internet access to work. In areas without internet access UFM reverts to GPS or aided GPS use. A comparison of methods and accuracy can be seen below.

ACCURACY VERSUS COSTS



DIFFERENT SYSTEMS TO STORE MAP DATA



CAD

GPS

GIS

Tree System

Survey Crew

Guy w/ iPad

URBAN Forest METRIX

AT THE CENTER OF IT ALL...

A DATABASE

GPS data is collected to provide reference to tree locations. This data might be simply put in a spreadsheet. It may be put into a "geographic information system" (GIS), which can create a more sophisticated set of layers of information, but it is complex and difficult to use. Alternately, a survey crew can locate trees and put those locations into a "CAD system" which is a type of drawing program often used by architects and construction engineering firms. Unfortunately, the data from these types of systems don't allow for mixing of the two, as they are most commonly used in a way that does not share common reference points.

Nowadays, the data is increasingly kept in a database designed for tree professionals. It is then the job of the software to prepare data that can be exported to these various mapping systems, depending on the client. This is the new advance that tree pros previously couldn't do, forcing them to use expensive and time consuming processes.

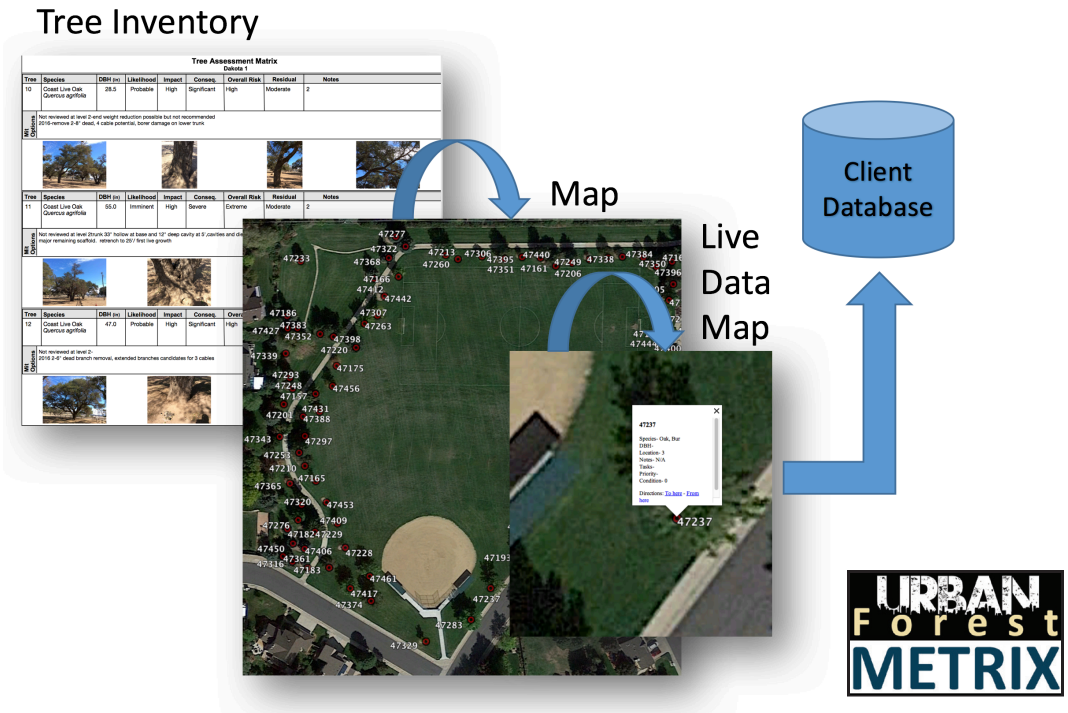
YOUR CLIENT'S PERSPECTIVE...

REPRODUCEABLE, EDITABLE MAPS

Tree professionals are better off having their own databases of clients and tree information. This allows them to produce the types of maps that they wish to make - rather than the arbitrary ones available through a client's system. Having a database allows the tree pro to select which types of trees should show up on a map, how they are labeled, and even provide interactivity online, allowing clients to be able to click on icons to bring up more information about that tree. Data can be exported to the client's own database, if they have one.

Because mapping programs are advancing so quickly, the mapping engine in any tree-specific software is likely to be limiting over the long-term. Systems that export map information into the fast-developing world of online mapping services already provide more complete capabilities.

From the client's perspective, they receive data they can import into their system, along with links to an online map that is interactve. That map can even be made publicly accessible, as more and more municiple clients desire. The tree pro retains the data in a system that allows for much better management of recommendations, inventory updates and can even show the evolution over time of a client's urban forest.

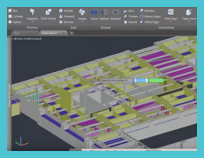


MARRYING COMMON SYSTEMS

Professionals might have a municipal client that requires publication of their data into GIS. Another of their clients might be an engineering firm doing construction planning, and they need that to go into CAD software. Still another client might be a homeowner or a homeowner's association that doesn't want to deal with the hassle or expense of either system, and just wants a link to an interactive map on the internet.

HUMANS NEED TO MAKE THESE DETERMINATIONS

A real person - not a computer - needs to determine what is the best data format for a particular client. A conversation needs to happen early on to know what the output needs to be.



AUTOCAD

Autocad is self-referential. In other words, the location data - as used by most clients - is only placed relative to the other structures in the document, not to a fixed position on the planet Earth.

GIS

GIS systems, such as ArcGIS can hold multiple layers of information, allowing institutions to relate trees to other data, such as roads. They can be very complex and require hours to produce client-requested maps.

SIMPLE GPS MAPPING

Online tools are often free, can be downloaded for offline use and are extremely easy to use. The quality of the graphics and the functionality is improving constantly.

THE GIS SYSTEM

In the past, "GIS" was the only way to reliably create reproduceable maps that could also accept new data in the future, all on the same set of coordinates. But the systems are rather expensive, and also quite frustrating to use for many people. They require many times the training time. For occasional users, even simple maps can be time consuming to create and difficult to produce professional results

They are still the most capable systems out there today, but the unique capabilities apply to very few arborists – generally those who already have in-house teams of people handling the GIS stuff.

The critical component of GIS is that it stores information in "layers," allowing the superimposition of one set of data upon another. Better still, this data can be used to calculate many things, such as whether or not an object on one part of the map would be in the view of another location on the map.

Municipalities and large institutions often will use GIS because it allows them to put many of the diverse types of geolocation information into one common database. The size of those institutions also allows them to spread the high costs of running such a system across several or many different departments and applications.

There will be projects from those larger clients where they will require tree professionals to be GIS-compliant. Until recently, this meant tree professionals needed their own GIS. Today, though, information can be exported from systems like UFM into open formats that the clients' GIS can read. This recent development eliminates the need to run GIS for most tree professionals, even for those with very large clients.

THE CAD SYSTEM

The other odd sort of mapping data that will appear occasionally with larger cliens is the Computer Aided Design (CAD) format. CAD is essentially a big graphic file that places objects in precise locations relative to one another, but generally not very accurately relative to a particular place on Earth.

Engineers like CAD because it provides great precision for building projects, and this is easily represented on those architect-type drawings where the lawn is perfectly green and the trees all look like they came out of the same Lego box.

Engineering firms require such precision in locating the multiple objects that they will be constructing that they rely on surveyors to physically measure things, rather than trust someone taking a reading from a device. Those engineering clients tend to hold the surveyors in great regard, which sometimes is problematic. Surveyors have a long history of not paying very close attention to trees, especially where there is not a threat between a tree and a structure. As a result, arborists sometimes find trees out of place, unmeasured trees, or - commonly - trees marked as incorrect species.

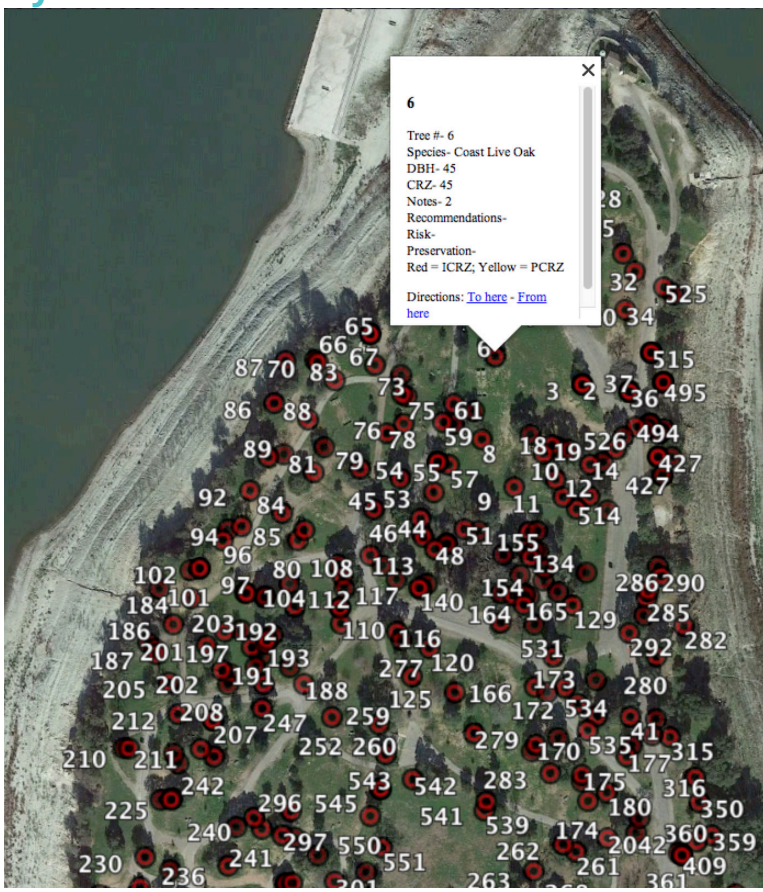
It may be useful for arborists to take their own location measurements, not because they'll be more accurate but because it is very difficult to produce interactive maps for a client regarding the trees without that data. Unfortunately, CAD data is often incompatible with other common systems, since CAD systems are typically used in a way that does not place objects in an actual physical place. Instead, objects in a CAD file only relate easily to one another.

CAD files, unlike the others, also presume that the Earth is flat, so a client in Seattle, about half-way between the equator and the North Pole would see his lot lines drawn as a square by the CAD user, but it would look more like a keystone shape to the GIS user. These differences refer to the "projection" of the earth underneath the lot.

PROJECTIONS, TRANSLATIONS AND OTHER THINGS THAT GO BUMP IN THE NIGHT

How to Avoid Unneeded Complexity

When a client gives you a set of numbers, you may not even know how they were derived, and what cooking you need to do to get them to the correct place on Earth.



GPS DATA

If you stick to GPS data, you're in luck. GPS data is now generally normed to a common projection of Earth. This means that data from one device is interchangeable with that from another. You might find that the numbers are represented differently (expressed in degrees rather than decimals), but this is easily translateable back and forth.

CAD DATA

CAD data often does not match up with another system. Sometimes the State Plane system is used, and those data become translateable - with enough knowledge - back to latitudes and longitudes. Client experience shows that CAD users often do not appreciate the difficulty others will have. The good news: data from a tree database can usually be imported into CAD systems so that it can display collected tree data.

DATA FROM GIS

GIS systems allow the collection of different forms of data, so you never really know what a client will give you from a GIS installation. It might be GPS coordinates translated to the standard NAD83 projection. It might, however, be "northings" and "eastings," Optimally a client with a GIS system would provide to the tree pro locations published as GPS points. Having a common projection is important is that any new location data taken by a tree pro in the field will need to match up with the existing trees in the database.

NORTHINGS & EASTINGS

These are coordinates that need to be located on earth before they become meaningful. Northings and eastings often conform to a regionally-shifting set of rules called the State Plane system. For instance, near Seattle, there are two different systems, depending on the town. The coordinates start at a specific place on the ground and often have some arbitrary numbers added. For example, in Kings County, WA they add an additional 500,000 to one of the numbers. Much local knowledge is required to perform such translations.

THE REALITY OF WORKING WITH MULTIPLE CLIENTS USING DIFFERENT METHODS

A problem with both CAD and GIS is that the people who use them tend to believe that everyone else either uses those same systems, or at least they should. They tend to discount the idea that other systems are more useful and practical for people with other objectives. The worst part: these people with those misimpressions are often your clients.

We've had several clients who were stuck between the proverbial rock and a hard place, with an ultimate client who uses GIS, an engineering subcontractor that uses CAD, with the tree guys left as sub-subcontractors stuck with the task of integrating all of this together into something that an actual human could hold in their hands and understand. This may seem insurmountable, but don't despair; there are ways to thread this needle. Here is how we've seen our clients best manage these data and these relationships:

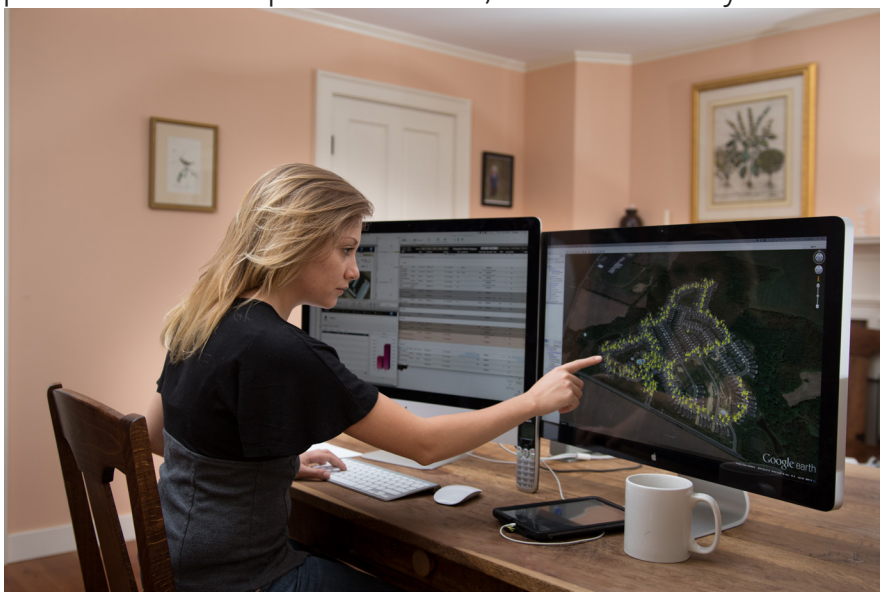
1) Let the client know up front that you use geolocation data, and that this can be expressed in multiple formats. Your system can export latitudes and longitudes into open standard formats that can be read both by GIS and CAD programs as coordinates, along with extra information on each tree.

2) Tell the engineering side that if they provide surveyed locations for trees, that this data will be useful to place the trees relative to drawn structures and plans, but is not adequate to locate that point on an actual map, unless those points are corrected for a standard map projection. (Inevitably, they will give you a quizzical look, but that's fine: they're on notice that it is their data set that lacks the needed information, and they won't be as quick to tell their client that your firm is a bunch of idiots.)

3) If the engineering firm or ultimate client uses GIS, ask them for the specific fields that they like to see associated with the trees. With a flexible professional tree database, you can publish an "attribute table" that will provide the tree-specific information that will fold right into their data. Let them know that you can publish to them the coordinates in KML format, which has become the most common open format for passing along mapping data. Another format frequently seen is GPX, a popular stand-alone open file format.

With those three things disclosed, the project will go much more smoothly, with little misunderstanding between parties.

Ultimately, all of this effort of collecting data on trees is usually useless unless it can be put into the form of a map. Those with GIS probably wish to produce this map themselves, otherwise they wouldn't spend the significant money and time to maintain such a system.

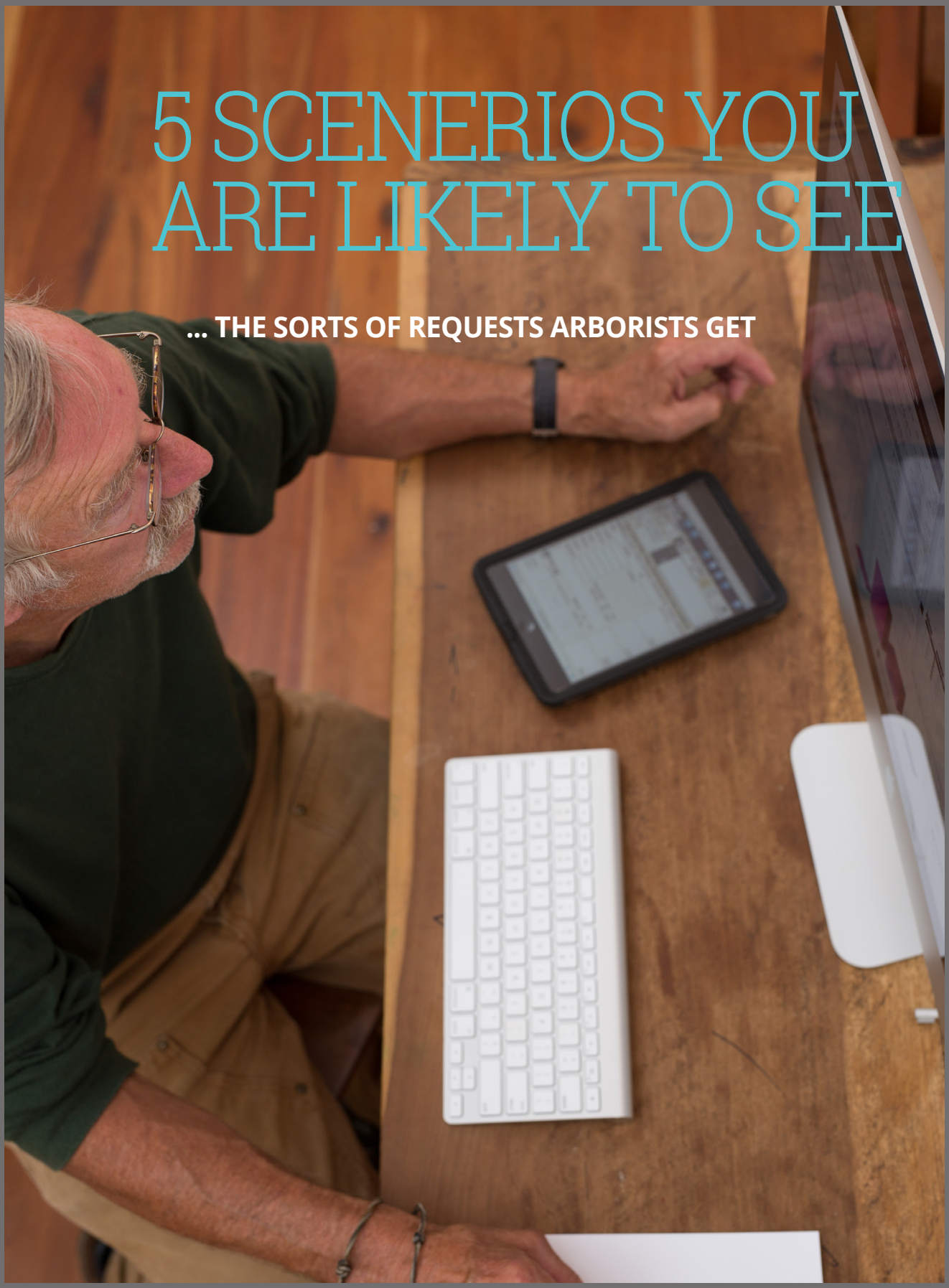


If you are using a self-contained database system like Urban Forest Metrix, you can just click a button to produce a map, even selecting which trees should be included based on specific criteria, and coloring and labeling them by different factors. When producing maps for clients, UFM users usually export that data into a KML file and open it up in a favored mapping program, like Google Earth, which is useful for providing the base maps beneath the trees, so clients can see the buildings, streets, and other real-world features lining up correctly with the trees.

If your client wants to put this data in their own system, they too can use that KML file to import the data, as it is the commonly accepted open format among different mapping systems.

5 SCENERIOS YOU ARE LIKELY TO SEE

... THE SORTS OF REQUESTS ARBORISTS GET



#1 CLIENT: WE HAVE AN OLD INVENTORY, BUT NO SYSTEM. WHAT SHOULD WE DO?

You will want to help your client choose a long-term home for the data you will be providing. It should be one that uses open standards so that they are not needlessly locked in to a vendor's system.

There are several systems out there now that have sophisticated enough databases and a decent mobile component - the two key requirements. Without both of those elements, the database will become stale.

Often clients are attracted to these systems not by the mapping capabilities, but by the cost savings won from more efficient operations, scheduling and the like.

Our clients also find that, once deployed, such systems greatly increase the perceived value of a tree professional's work. This is often cause simply by the fact that a relevant map is automatically included in various reports, work orders, inventories and analyses that they publish to their clients.

REMEMBER:

If they rely simply on Excel spreadsheets and printed copies, this data won't be useful for very long. Useful inventories are updated on an ongoing basis; otherwise the data quickly becomes too stale to be used.

A "living inventory" requires entry of ongoing work. That requires a relational database - something that can record multiple observations over time.

#2 CLIENT: OUR GIS IS PAINFUL. WE WANT OUR NEW INVENTORY TO MIGRATE US TO A NEW SYSTEM.

REMEMBER:

Clients who spent a great deal of time and money on GIS systems and the mobile hardware will sometimes be sensitive about drawing explicit comparisons about the low or no-cost alternatives you are offering for ongoing mapping.

Several of our tree service and arborist clients saw their clients waiting some years before switching to a modern system because they needed to put some time between the new system and the expense of the old.

You will want to load that old inventory data into the system you use to take and update inventories in the field. This requires a system that has the capacity to import such data, which narrows things down.

It must be a system that can take information from multiple visits per tree over time. The geolocation data from the older inventory is probably quite useful, as trees tend not to move around a great deal. Also, even if trees have been removed, they may provide data on what quality that site is for a potential new tree.

So long as the GIS information is translateable into modern latitude and longitude coordinates, this will be worth importing over. A key map report to produce after conducting the updated inventory would be the comparison map of where trees were versus where they are now. Inevitably, there will be some surprising changes, and observing these will bring home to a client the need to make that inventory a living document, deriving maximum value out of it.

#3 CLIENT: OUR INVENTORY AND GIS SYSTEM NEED TO BE UPDATED. CAN YOU DO THAT ON A REGULAR BASIS?

Almost all GIS systems keep track of only relatively simple tree factors, rather than providing the capability to keep multiple records of various things, such as additional visits over time and multiple risk conditions. Tree people need a relational database for trees to make sure they can see tree medical histories over time, and keep track of multiple treatment records, etc.

This means that the arborist will likely do best to have his own database, parts of which are periodically uploaded to the client's inventory.

In this fashion, the arborist controls the more useful database, able to sift through multiple layers of time for useful insights. But the client will want to have the data for the most recent visit for each tree.

REMEMBER:

It will be critical to first import data into your field system. This will set up the commonality required to match up records publishing back to the client's GIS system.

That information is best exported to the client system by using a KML file that can contain a description field that will then get imported into the GIS system's "attribute table" for each tree.

Because their system limitations most often leads to over-writing of the previous data, this export/import process is usually best scheduled on a quarterly or annual basis. In the intervening months, people using the GIS system will continue to see that single time slice of the tree inventory.

#4 CLIENT: WE HAD A SURVEY DONE. COULD YOU FILL IN THE TREE INFORMATION?

REMEMBER:

The client is unlikely to want you to enter that data back in the original CAD file, but rather provide a separate map with the tree information and – possibly – a separate database that can be the basis of an ongoing inventory.

In the case of construction consulting, more often than not the client does not care about an ongoing inventory. It will be critical to make sure to ask about these expectations prior to beginning the project.

If a survey has been done, it is probably an engineering firm that commissioned it, and there may be a need to evaluate trees for potential encroachments, risks and/or appraisal values: typical elements for which engineering firms hire arborists and tree services. You may want to check to make sure that any system you recommend be used for the project can conduct both appraisals and tree risk assessments.

If the client provides northings and eastings data from a survey, it is likely translatable into gps points on earth, provided they are able to describe which State Plan zone and offsets they employed.

We find that many clients don't themselves understand that people in different counties apply different State Plane variables, and may not initially be able to provide that data without doing some investigation.

In the event that the client does want specific tree information to be input back onto the survey document, this can either be done physically by writing or printing on an existing survey map, or by having the engineering firm import data back into their CAD software. You can facilitiate that import by providing an open format export (typically .csv or .kml) of your data that can then be aligned and imported into their database.

In the event that the engineering firm wishes the tree service person to enter the information, this must be factored into the price - including the potential need to purchase the CAD software, which typically runs in the low thousands per year.

#5

CLIENT: WE HAVE A NEW SURVEY AND AN OLD GIS INVENTORY. CAN YOU MARRY ALL TOGETHER WHILE UPDATING?.

REMEMBER:

A client's GIS system and its engineering firm's CAD system serve different purposes via different mechanisms. More often than not, clients don't understand this (and arborists and tree service firms tend to have hazy grasps on it as well).

The best course of action is to suggest that the tree service firm provide data on a regular basis that updates the client's GIS system. This is done typically with the arborist's database because it - being the more modern of the two - will be able to handle the more diverse bits of information, such as tree visits over time. In the end, simple information gets fed back into the GIS system periodically.

The CAD data can be translated into a GIS file as well, but it will show a redundant set of location data, and likely not much else. It is most practical to simply archive the survey data for the purposes of starting a new inventory database, provided you have latitudes and longitude already from the other system. The survey data can then be referenced when needed, but the more practical GPS points can be used to produce maps.

Over time, the arborist's database will prove the more valuable, as it will have richer and richer information about the trees in the inventory.

Contact us directly to see how mapping can be integrated into your practice.

URBAN Forest METRIX

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THANK YOU FROM

FOREST METRIX

Our clients of our Urban Forest Metrix tree management and mapping software have been our eyes and ears for developing new and simpler ways to conduct mapping workflow. We cannot bring these observations - or constantly improving software - to you without the help, encouragement and comaraderie that we find with our clients. Thank you all.