Production Use of the BMP Tree Risk Assessment Method

By Jerry Bond

It is exciting that we now have a Best Management Practices (BMP) on tree risk assessment that builds upon up-to-date research and broad professional experience (Smiley et. al 2011). It is also challenging, since its very publication sets a prescription for risk assessment that affects us all in many ways. Given the singular importance of this document for future professional work, it is critical that we test the BMP under field conditions in order to provide constructive feedback. In this article, I look at the production demands encountered during activities such as inventories and other large projects. If the new system is to succeed when available assessment time is limited, then the effects of that limitation will have to be accommodated.

Test Project

The test we used was a large risk assessment project on a property covering approximately 150 acres. We used the Limited Visual assessment technique to quickly assess an estimated 2,000 trees. From that population we identified about 300 trees needing a more detailed, Basic assessment; this group of trees is the main subject of this article. Because the project was ultimately bid on and won on the basis of a trees/hour rate, we knew that we would have to thread the needle between speed and responsibility.

Our testing prior to the beginning of the project revealed that the new BMP method presents certain difficulties for production use:

- The assessor needs to categorize each tree with respect to the likelihood of failure, the likelihood of impact, and the consequences of a tree failure. To consult tables means putting down the data logger and any other tools, increasing time per tree.
- The categorizations require judgment about very complex factors, slowing down data collection.
- Important decisions are embedded, making quality control difficult.

To get the rate we needed, we concluded that it would be most efficient to separate categorization from matrix use, so we could exclude the matrices from field work. Then we wanted to factor out the principal components of the important judgments, rendering those—and thus their review—easier. We accomplished those

objectives by automating lookup in the background and then expanding the number of tables.

First: Get the Tables Out of the Way

We began by limiting the assessor to only filling in tree risk assessment observation fields with pull-down menus for Failure, Impact, and Consequences (BMP Table 1, Table 2). The judgments behind the actual choices of values remains challenging, as each requires multiple decisions; but eliminating the use of matrices in the field simplified and sped up the data collection.

Next, the lookup mechanism for the two BMP tables needed to be set up in the back end (here, a spreadsheet). The easiest way to do this is to use a formula that incorporates two instances of the Excel software's function vlookup (Microsoft 2012) to consult "arrays" constructed from the BMP tables in the spreadsheet. (Values in an array, but not a table, can be referenced by position). The first instance is used to find a row in the relevant array, and the second to find the column that should be consulted. Here, for example, is how our formula looked for estimating the likelihood of a tree failure impacting a specified target:

$$=VLOOKUP(H2,Likelihood,VLOOKUP(F2,Impact,2))$$

Despite how it may seem, this formula is pretty straightforward. It tells the computer to:

1. Get the value in the cell H2 (the tree's Failure rating), then use that value to find the correct row in the table array called "Likelihood" (=BMP Table 1).
2. Get the value in the cell F2 (the target's Impact rating), then use that value to find the correct column in the Likelihood table.
3. Record the value at the intersection of that row and that column (=Likelihood of failure and impact).

We created a similar formula to use the recorded value in step three to consult the BMP's Table 2 and produce the risk rating.

Second: Add More Tables

It may sound counterintuitive to hear that adding more tables could speed things up, but that is what happens in this case. The increase in production rate comes from breaking down a complex field judgment into two simpler ones. Having more tables may not be practical when using paper, as the field person could quickly lose his/her mind keeping track of them all; but extra tables are very easy to deploy when an electronic back end is doing all of the lookups.

For this project two new tables were added:

- DEFECT by LOAD, whose output provides the values for "Failure" in BMP Table 1. This new table derives from the mechanical principle that failure occurs when stress is greater than strength, allowing us to incorporate load into the assessment in a clear manner (Bond 2011).

Relationship of new (red) tables to existing (blue) BMP tables.
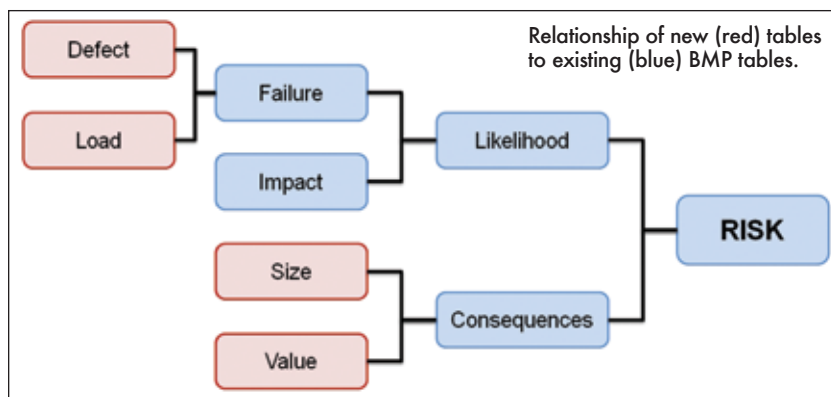
- SIZE by VALUE, whose output provides the values for "Consequences" in BMP Table 2. During setup testing, we found it difficult to evaluate the interaction of size of part and value of target quickly and consistently, and using this table made it easier and faster.

The new tables were populated with values following the approach used in the BMP.

Table 1 and Table 2 fully comply with the BMP protocol; they simply alter its field implementation. The BMP recommends that the arborist consider load, though it does not say how, and similarly with defect, size, and value. As an aside, I want to add that we concluded that it was necessary to establish definitions for all table fields (for example, a "probable" defect) to speed up data collection and increase its precision (repeatability)—but that is a topic for another time.

This procedure worked very well, and allowed us to reach our goal of substantial reduction in field time. In addition to solving the demands of this particular project, the resulting set of tables and formulas now constitutes a template that can be inserted as a new sheet into any future spreadsheet containing tree risk field data, saving a lot of preparatory work the next time.

Let's Share

Setting up spreadsheet formulas correctly takes time and requires familiarity with a software's functionality, and many people may lack the knowledge, time, or interest to do it. Since I had to do it already (and since I can't see any way to make a profit from it...), I have posted the formula sheet for free download online [http://www.urbanforestanalytics.com/node/24#Risk] (Bond 2012). My hope is that this tool will facilitate and encourage the use of the new BMP risk evaluation system, as well as promote a healthy discussion among professionals.

Literature Cited

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Table 1. Failure matrix, showing failure as a combination of the severity of the defect and the magnitude of the load.

Defect	Load			
	Low	Medium	High	Extreme
Imminent	Possible	Probable	Probable	Imminent
Probable	Possible	Possible	Probable	Probable
Possible	Improbable	Possible	Possible	Probable
Improbable	Improbable	Improbable	Possible	Possible

Table 2. Consequences matrix, showing consequence as a combination of the size of the part most likely to fail and the value of the target most likely to be struck.

Size	Value			
	Low	Medium	High	Extreme
Very large	Significant	Significant	Severe	Severe
Large	Minor	Significant	Significant	Severe
Medium	Minor	Minor	Significant	Significant
Small	Negligible	Minor	Minor	Significant

Table 3. Final data collection fields and values, with the middle row of cells coming from the BMP Tree Risk Assessment "Basic method" tables, and remaining four (red-shaded) rows from the two new tables.

Field	Values			
Defect	Imminent	Probable	Possible	Improbable
Load	Extreme	High	Medium	Low
Impact	High	Medium	Low	Very low
Size	Very large	Large	Medium	Small
Value	Extreme	High	Medium	Low