RESEARCH REPORT

AN EXTRACTOR DEVICE FOR STUCK OR BROKEN INCREMENT BORERS

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ABSTRACT

A lightweight, portable device for extracting stuck or broken increment borers is presented and its operation described. The “Decorum” extractor is compact and weighs less than 400 g. It is easily carried in a belt pouch or pocket and is both reliable and easy to operate. The extractor does not require fixed tie points nor does it damage the tree. It offers an effective solution to a widely occurring problem in dendrochronology and forest research.

Keywords: increment borer, forestry, dendrochronology, rotten, hollow, “Decorum”.

BACKGROUND

Increment borers are essential to the work of the forester and dendrochronologist as they provide the only non-destructive means of accessing tree-ring archives. When borers are sharp and well maintained, many trees can be sampled in a single field campaign without significant difficulty or incident. However, despite one’s best efforts and experience, an increment borer may sometimes get stuck in a tree, or the shaft of the borer may break, thereby preventing its retrieval.

Stuck borers most typically occur when a borer passes into rotten wood or directly into a void or hollow section of the tree such that the threaded cutting head cannot re-engage in sound wood to enable its retrieval. Similarly, a stuck borer may also result when coring resinous trees in which resin may coat the cutting head (Grissino-Mayer 2003), or dense hardwood trees that exert sufficient pressure around the borer shaft to create a resistance such that the small threads of the cutting head are incapable of drawing-in or pushing-back, the shaft. As a consequence, the borer turns in a futile manner rapidly creating a small void of macerated wood pulp around the

cutting tip inside the tree. We have found this problem typically occurs when working with the larger diameter borers (22-mm outside diameter [OD], 12-mm diameter core), or longer (800 mm) borers and occasionally when sampling for isotopic or dendrochemical analyses in which contaminating lubricants such as wax or WD40® must be avoided (McCarroll and Loader 2004). Less frequently, a borer may break in a tree owing to flaws in the shaft’s construction, if the borer strikes a hidden object (*e.g.* a bullet or large nail), or, because of poor coring technique.

Whatever the cause, when a borer jams in a tree, the consequences can be significant, and it is vital that the borer is retrieved as safely as possible and without damage to the tree or to the borer. Additionally, if the shaft remains in the tree and cannot be retrieved then there are potential safety concerns to consider, particularly if the tree is in an area of active forest management, as contact between a damaged borer and a chainsaw could cause serious injury. The development of an inexpensive mechanical device for extracting stuck increment borers would be a valuable contribution towards minimising the needless loss of increment borers, or worse, the use of chain saws to remove stuck bits (Yamaguchi 1991).

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Several methods have been developed for extracting jammed borers and all work, but vary significantly in their price, weight and efficiency. The cheapest and easiest approach is for the operator to apply a *gentle* reverse-pull on the borer while rotating it anti-clockwise. Often this is sufficient to free the borer if it is not deeply stuck, but if too great a force is applied, damage to the borer, particularly to the retaining clip (“keeper”) or the operator can result. A variant of this approach is to use a rope looped around the borer shaft and a suitably anchored object (a rock or nearby tree) located directly behind the borer, in line with the long axis of the borer shaft. The operator gradually applies tension to the rope by turning the borer or winding the rope loop into itself, and if the rope is strong enough, sufficient tension builds to pull the borer back into solid wood. This “windlass” approach is time consuming and potentially very hazardous, but effective on deeply stuck borers. When using the approach it is essential the operator stands clear of the rope, which is under significant tension, and not between the borer and the anchor, as any failure of the anchor, rope, or “keeper” could result in serious injury.

Two alternative mechanical approaches are based upon the use of a modified hoist-puller and a car scissor-jack (Phipps 1985; Agee and Huff 1986; Yamaguchi 1991). The hoist-puller or “come along” operates in a manner similar to the “windlass” by applying an extracting force onto the jammed borer (Yamaguchi 1991). The scissor-jack method has the advantage of not being reliant upon a nearby securing object/anchor, yet like the hoist-puller, is also large and unwieldy (Grissino-Mayer 2003). In light of these alternatives, their limitations and our own field experience, we have developed a lightweight, portable extractor, small enough to be carried in a pocket or pouch, capable of retrieving stuck or broken increment borers.

DESCRIPTION AND OPERATION

The “Decorum” extractor (Figure 1A–E) comprises a stainless steel baseplate fitted with studs and a threaded hollow shaft. A modified chuck assembly with an internal thread engages

with the thread on the baseplate shaft (Figure 1A). A tethered chuck-key is used to tighten the modified chuck so that it grips the shaft of the increment borer. Rotation of the borer simultaneously rotates the modified chuck, which engages to pull the borer shaft away from the tree and into solid wood.

To employ the extractor, the chuck is screwed down fully onto the baseplate (Figure 1B) with its jaws fully opened. The handle of the borer is then removed and the extractor is slid down the shaft of the borer (Figure 1C) until the baseplate rests firmly against the bark of the tree. The back of the “Decorum” baseplate is studded to enable it to grip the bark tightly and avoid slippage (Figure 1D). Holes in the baseplate provide additional fixing points for nails or a belt/rope (such additional securing of the extractor is not normally required). The chuck is then tightened with the key so that it grips the shaft of the borer without slippage. After replacing the handle of the increment borer, rotating the borer anti-clockwise drives the studs on the baseplate into the bark and causes the chuck to rotate with the borer. The chuck slowly moves outward along the threaded shaft of the baseplate and, in so doing, pulls the borer out of the tree. Once the cutting head of the borer re-engages into solid wood the extractor will lift away from the tree and the borer can continue to be retrieved as normal (Figure 1E). In more extreme situations, where the borer is lodged in a deep void, when the cutting head has detached completely from the borer shaft, or where the shaft is tightly gripped within the tree, it may be necessary to reposition the extractor as described above and repeat the extraction several times until the borer/broken shaft is fully recovered.

We have tested the extractor device in the field and have found it operates well in retrieving stuck borers, thereby prolonging effective field-work. The present design is suitable for standard 9-mm OD (4-5-mm internal diameter core) increment borers and bespoke alternatives may be developed for larger diameter devices or more specialist applications. A minimum of *ca.* 5 cm of borer protruding from the tree is required in order for the chuck assembly to fit between the handle and the tree. By reducing the length of

Figure 1 (A–E). The “Decorum” Extractor for stuck or broken increment borers – Description and Mode of Operation. (A) The extractor and chuck-key “in-use” positioned on an increment borer. (B) Ensure that the chuck is screwed onto the baseplate and that the jaws of the chuck are fully open. (C) Remove the handle of the increment borer and carefully slide the extractor along the shaft. (D) Push the baseplate firmly into the bark of the tree then tighten the jaws of the chuck so that it grips the borer shaft, remove the key. (E) Replace the borer handle and rotate the increment borer anti-clockwise (as if removing it). The baseplate will embed in the bark and the chuck will pull the borer out of the tree. When the thread re-engages, the baseplate will lift away from the tree.

“Decorum’s” threaded column, a shorter length of exposed borer can be accommodated. However, this modification requires more frequent repositioning of the “Decorum” extractor. The standard design has a retraction distance sufficient to retrieve and re-engage the full length of the threaded cutting head on a standard borer (*ca.* 3 cm), and we have found this dimension to be satisfactory in the majority of applications. We have not noticed any significant damage to the borer shaft when using the “Decorum” extractor. However, if the chuck is not firmly attached to the borer (a good hand-tightening is usually sufficient) then slippage of the chuck may occur resulting in minor scratching of the borer shaft or loss of the Teflon coating. A small rubber sleeve is supplied with each unit which may be used to reduce metal-on-metal contact.

SUMMARY

We have developed and describe a device for the retrieval of stuck/broken increment borers. The “Decorum” extractor device is compact and weighs less than 400 g. It can easily be carried in a belt pouch or pocket and is both easy to operate and affordable. Costing less than a standard increment borer, it makes an ideal addition to any fieldwork toolkit. Alternative approaches to corer retrieval are available, but we have found this approach to be both quick and reliable. The “Decorum” extractor does not require fixed tie-points to operate nor does it damage the tree or overly stress the borer. The ability to repeatedly extract stuck or broken

increment borers from a tree in remote locations should not be underestimated, particularly where the alternative to retrieval is felling the tree or loss of the borer and sampling opportunities. The “Decorum” borer extractor offers a robust and effective solution to a widely occurring problem in dendrochronology.

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REFERENCES CITED

- Agee, J. K., and M. H. Huff, 1986. *The Care and Feeding of Increment Borers*. National Park Service, Cooperative Park Studies Unit, College of Forest Resources, University of Washington, CPSU/UW 86-3; 14 pp.
- Grissino-Mayer, H. D., 2003. A manual and tutorial for the proper use of an increment borer. *Tree-Ring Research* 59(2): 63–79.
- McCarroll, D., and N. J. Loader, 2004. Stable isotopes in tree rings. *Quaternary Science Reviews* 23:771–801.
- Phipps, R. L., 1985. *Collecting, Preparing, Crossdating and Measuring Tree Increment Cores*. US Geological Survey Water-Resources Investigations Report 85-4148; 48 pp.
- Yamaguchi, D., 1991. Mechanical devices for extracting stuck increment borers. *Canadian Journal of Forest Research* 21: 712–714.

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