

Bucking with R

Using the tapeR package

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19 October 2012

Why another bucking routine?

- Needed volume calculations for SMC Type III data.
- Wanted volumes to closely approximate scaled volumes.
- Had a dll full of taper equations.
- I wanted something to use in R.

Taper Functions

Stem form from taper functions:

- Hann 2011 & 2010
- Kozak 1988 & 1969

Implemented in C++ classes exposed to R with the Rcpp package.

Taper Functions

Two member functions:

C++

```
// DibAtHeight
double taper::DibAtHeight(std::string ModelName, std::string Species,
    double Dbh, double TotalHt, double TopHt,
    double CrRatio);
// HeightAtDib
double taper::HeightAtDib(std::string ModelName, std::string Species,
    double Dbh, double TotalHt, double Dib,
    double CrRatio);
```

R through Rcpp

```
# DibAtHeight
taper$DibAtHeight(taperFun, spp, dbh, ht, cut.ht, cr)
# HeightAtDib
taper$HeightAtDib(taperFun, spp, dbh, ht, merch.dia, cr)
```

Making Virtual Logs

Think like a cutter:

- Preferred and minimum lengths — 32 & 16-feet
- Stump height — 1-foot
- Trim — 10-inches
- Length multiples — 1-foot
- Minimum diameter inside bark — up to you...
- Start at the stump and take 'er apart!

Bucking

MakeLogs() function turns a tree into logs given species, DBH, height, crown ratio:

- 1 Get number of full logs
- 2 At least one log:
 - 1 Cut the logs
- 3 Short logs:
 - 1 If longer than minimum length – cut to the nearest multiple.
 - 2 If shorter than minimum length
 - 1 Leave it...
 - 2 Merge with second log for two approximately equal-length logs.

Return a data frame with containing logs with lengths and diameters.

Volume Calculations

Calculates Scribner and cubic-foot volumes as if scaled:

- Diameters rounded down
- Trim not included
- `bf.volume()` function calculates Scribner using scaling factors
- Cubic using Samlian's formula (`smalian.vol()` function) or frustum of a cone (`frust.vol()` function)

Example – Bucking

```
> library(tapeR)

> taper <- new(tapeR, "US")

> args(MakeLogs)
function (dbh, ht, cr, merch.dia, spp = "DF", taperFun = "Hann2011",
  log.length = 32, multiples = 1, trim = 10/12, stump = 1,
  min.length = 16)
NULL

> MakeLogs(18, 125, 0.4, 6)
  ldia    sdia length
1 17.47657 13.75208    32
2 13.75208 11.03888    32
3 11.03888  6.00000    31
```


Example – Bucking

```
> MakeLogs(18, 125, 0.4, 8)
```

	ldia	sdia	length
1	17.47657	13.75208	32
2	13.75208	11.03888	32
3	11.03888	8.00000	20

```
> MakeLogs(18, 125, 0.4, 4)
```

	ldia	sdia	length
1	17.476573	13.752078	32
2	13.752078	11.038881	32
3	11.038881	8.183888	19
4	8.183888	4.000000	20

Example – Volume

```
> args(tree.volumes)
function (dbh, height, cr, spp = "DF", taperFun = "Hann2011",
  log.length = 32, multiples = 1, trim = 0, stump = 1,
  min.length = 16)
```

```
NULL
```

```
> tree.volumes(18, 125, 0.4)
      BF_6      CV_6 BF_4      CV_4      CV_T
[1,] 397 85.47728 391 87.10391 87.84565
```

Example – Volume

```
> args(bf.volume)
function (dia, len, nearest = 1, min.length = 16)
NULL
```

```
> args(smalian.vol)
function (D, d, h)
NULL
```

```
> args(frust.vol)
function (D, d, h)
NULL
```

Example – Volume

```
> logs <- MakeLogs(18, 125, 0.4, 6)

> apply(logs, 1, function(x) bf.volume(x[2], x[3]))
  1  2  3
193 144 39

> apply(logs, 1, function(x) frust.vol(x[1], x[2], x[3]))
  1      2      3
42.75414 26.92369 12.62963

> apply(logs, 1, function(x) smalian.vol(x[1], x[2], x[3]))
  1      2      3
43.15643 27.13706 13.34475
```

Conclusion

- Basic set of taper equations and volume functions are there but lightly tested (aside from Hann 2011).
- Not tested against other volume calculators.
- All trees are perfect – No defect or breakage.
- Not optimal.
- Needs some documentation and I will make it available when I find a space.
- Rcpp package is cool! Just make sure you follow the documentation...
- *Should* be easily extensible to include other taper functions.

Thank you.

Questions?

Comments?

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