

```
* Potential Mast Production Module: Formulated for LANDIS output
* STATA (V.6) syntax
```

```
*
* By: Neal Sullivan - Forestry Department, University of Missouri
*      www.snr.missouri.edu/~sullivan
```

```
*
*           Last Edited:      3/01/02 10:21      NHS
*
```

```
* Begin Commands:
```

```
drop _all
set memory 400m
use filename.dta, replace
```

```
* keep if stand<20
set more 1
```

```
* To run: using a generic ageclass,
* create std_age (Simulation Age) = agep10 (Landis decade of simulation)

gen std_age=agep90
```

```
* *
```

```
* Est. number of dominant + codominant oak trees per cell by ageclass
```

```
local tpc_sl = -0.099          /* slope of age tpc relationship*/
local tpc_con = 24.1          /* intercept of age tpc relationship*/
local tpcsdsl = -0.08         /* slope of age tpc-sd relationship*/
local tpcsdco = 16            /* intercept of age tpc-sd relationship*/
```

```
* number of cell canopy oak trees (tpc):
* random selection from normal distribution by age of dominants
```

```
gen tpc=(`tpc_sl'*std_age+`tpc_con')+
        (`tpcsdsl'*std_age+`tpcsdco')*invnorm(uniform())
```

```
* Influence of Landtype on the number of canopy oak trees >12.7 D MOFEP Based
```

```
/*           Mean =      0.887           */
/*           multiplier           */
/* 1      1.119           */
/* 2      0.993           */
/* 3      1.164           */
/* 4      0.856           */
/* 5      0.867           */
/* 6      1.105           */
/* 7      0.895           */
```

```
replace tpc =tpc * 1.119 if landunit==1
replace tpc =tpc * 0.993 if landunit==2
```

```

replace    tpc    =tpc    *    1.164 if landunit==3
replace    tpc    =tpc    *    0.856 if landunit==4
replace    tpc    =tpc    *    0.867 if landunit==5
replace    tpc    =tpc    *    1.105 if landunit==6
replace    tpc    =tpc    *    0.895 if landunit==7

```

```

gen int cotpc = round(tpc ,0)
/* number of canopy trees rounded to whole number */

```

```

drop tpc

```

```

* Estimate of cell-stand mean diameter and distribution by age of dominants

```

```

* from FIA data, mean diameter per ageclass

```

```

* Assign a random diameter to 40 trees for each cell for each iteration

```

```

for new tr_1-tr_40: gen X = 0.5443953* std_age - (std_age*std_age*0.0025517) +
                        (std_age*std_age*std_age*4.11e-06)

```

```

/* Apply variability */

```

```

for var tr_1-tr_40: replace X = X + (0 + (0.1670191* std_age-
                        (std_age*std_age*0.000432)) * invnorm(uniform())))

```

```

/* replace diameter with 0 if very small */

```

```

for var tr_1-tr_40: replace X = 0 if X < 1.5

```

```

/*      Variation in Oak component (prop.)      Stand Structure (D)      */

```

```

/*      LANDIS      Affect on      */
/*      Type  ELT      Diameter      */
/*      1      17      1.001      */
/*      2      18      1.082      */
/*      3      11      1.164      */
/*      4      19      0.87      */
/*      5      5,7      0.956      */
/*      6      20,21      0.964      */
/*      7      other      0.965      */

```

```

for var tr_1-tr_40: replace X = X * 1.001 if landunit==1
for var tr_1-tr_40: replace X = X * 1.082 if landunit==2
for var tr_1-tr_40: replace X = X * 1.164 if landunit==3
for var tr_1-tr_40: replace X = X * 0.87 if landunit==4
for var tr_1-tr_40: replace X = X * 0.956 if landunit==5
for var tr_1-tr_40: replace X = X * 0.964 if landunit==6
for var tr_1-tr_40: replace X = X * 0.965 if landunit==7

```

```

* Make diameter 0 if tree-N > canopy trees per cell

```

```

replace    tr_1    = 0 if    cotpc < 1

```

```

replace    tr_2  = 0 if      cotpc < 2
.
.
.
replace    tr_40 = 0 if      cotpc < 40

```

* Factor regional variation in ratio of red oak and white oak groups

```

* by ageclass:    fraction of oaks that are red oak = -0.0027066*(ageclass) +
                  0.6286, R2 =.86 for FIA

```

```

* adjustment for Oregon County:  -0.0000179 * ageclass^2 + .644

```

```

gen cfro =      -0.0000179*(std_age)^2 + 0.644

```

* Adjust for landis land type (unit)

```

/*    Land type    MOFEP AVG    Adj.    Var. (SD)    */
/*          0.7111                                */
/*    1    0.741 1.04                                */
/*    2    0.734 1.04                                */
/*    3    0.831 1.17                                */
/*    4    0.647 0.91    0.05    */
/*    5    0.593 0.83                                */
/*    6    0.732 1.03                                */
/*    7    0.700 0.98                                */

```

```

gen mncfro =      1.04 * cfro

```

```

replace mncfro =      1.04 * cfro      if landunit==1

```

```

replace mncfro =      1.17 * cfro      if landunit==2

```

```

replace mncfro =      0.91 * cfro      if landunit==3

```

```

replace mncfro =      0.83 * cfro      if landunit==4

```

```

replace mncfro =      1.03 * cfro      if landunit==5

```

```

replace mncfro =      0.98 * cfro      if landunit==6

```

* Add random variability to Fraction red oak group

```

replace mncfro = mncfro + 0.05 * invnorm(uniform())

```

* Randomly assign trees to ro and wo species groups

```

/* create a species code for each tree on each cell */
for new sp_1 -sp_40:          gen str2 X = "W0"
for new temp1-temp40: gen X = (uniform())
/* randomly assign tree to sp group */
replace sp_1      ="R0" if    temp1 < mncfro
replace sp_2      ="R0" if    temp2 < mncfro
.
.
.
replace sp_40      ="R0" if    temp40      < mncfro

drop temp1-temp40

```

* Adjust diameter for different growth rates for subgenus's

```

*
*   model of multiplier to get W0 scaler
*
*       adjust =      -0.0010492  (age) +      1.010843
*
*
replace tr_1 = (std_age * -0.0010492 + 1.011)  * tr_1 if sp_1 == "W0"
replace tr_2 = (std_age * -0.0010492 + 1.011)  * tr_2 if sp_2 == "W0"
.
.
.
replace tr_40 = (std_age * -0.0010492 + 1.011)  * tr_40 if sp_40 == "W0"

* Set diameter to 0 if very small

for var tr_1-tr_40: replace X = 0 if X < 1.5

```

* Tree diameter and mast production (index) relationship---
 * generates a 0-1 index of relative mast production

```

/*              Coeff. (0-1)DBH              */
/*              */
local rod  = -3.361032  /*              -0.22407  D              */
local rod2 = 0.1279035 /* Scaler      0.00853   D2              */
local rod3 = -0.0017115 /*for desired  -1.14E-04 D3              */
local rod4 = 0.000007515 /* range      5.01E-07  D4              */
local rodc = 28.65     /* Maximum =15  1.91000 interc. */

/* Similar to range of kg/tree */
local wod  = -1.4629095 /* 0      -0.09753      D              */
local wod2 = 0.0567975 /* 0      0.00379       D2             */

```

```

local wod3 = -0.000705      /*      0      -4.70E-05      D3      */
local wod4 = 0.000002835    /*      0      1.89E-07      D4      */
local wodc = 11.85          /*      0      0.79000      interc. */

```

```

gen rms_1=tr_1*`rod'+(tr_1^2)*`rod2'+(tr_1^3)*
               `rod3'+ (tr_1^4)*`rod4'+`rodc' if sp_1=="R0"
gen rms_2=tr_2*`rod'+(tr_2^2)*`rod2'+(tr_2^3)*
               `rod3'+ (tr_2^4)*`rod4'+`rodc' if sp_2=="R0"
gen rms_3=tr_3*`rod'+(tr_3^2)*`rod2'+(tr_3^3)*
               `rod3'+ (tr_3^4)*`rod4'+`rodc' if sp_3=="R0"
.
.
.
gen rms_40=tr_40*`rod'+(tr_40^2)*`rod2'+(tr_40^3)*
               `rod3'+ (tr_40^4)*`rod4'+`rodc' if sp_40=="R0"

```

```

gen wms_1=tr_1*`wod'+(tr_1^2)*`wod2'+(tr_1^3)*
               `wod3'+ (tr_1^4)*`wod4'+`wodc' if sp_1=="W0"
gen wms_2=tr_2*`wod'+(tr_2^2)*`wod2'+(tr_2^3)*
               `wod3'+ (tr_2^4)*`wod4'+`wodc' if sp_2=="W0"
gen wms_3=tr_3*`wod'+(tr_3^2)*`wod2'+(tr_3^3)*
               `wod3'+ (tr_3^4)*`wod4'+`wodc' if sp_3=="W0"
.
.
.
gen wms_40=tr_40*`wod'+(tr_40^2)*`wod2'+(tr_40^3)*
               `wod3'+ (tr_40^4)*`wod4'+`wodc' if sp_40=="W0"

```

* Correct for artifact of mast = f(D)*function for very large trees

```

replace rms_1 = 5 if tr_1 > 91 & sp_1=="R0"
replace rms_2 = 5 if tr_2 > 91 & sp_2=="R0"
.
.
.
replace rms_40 = 5 if tr_40 > 91 & sp_40=="R0"

```

* Factor per tree inherent variability in acorn production (randomly assigned)

```
*          Fraction of population      /* proportion of population */
* Non-producers      0.15             /*      0.10                */
* Low Prod           0.30             /*      0.30                */
* Mod Prod           0.40             /*      0.45                */
* High Prod          0.15             /*      0.15                */
*
* /* macros assigning class thresholds */
```

```
*                      relative  production rate
```

```
* No prod      (gt)  0.00
* Low Prod     (gt)  0.15      0.30
* Mod Prod     (gt)  0.45      0.75
* High Prod    (gt)  0.85      1.00
```

```
for new pr_1-pr_40: gen X = 0
```

```
for new temp1-temp40: gen X = (uniform())
```

```
replace pr_1 = 0.3 if temp1 > 0.15
replace pr_2 = 0.3 if temp2 > 0.15
```

```
.
```

```
.
```

```
replace pr_40 = 0.3 if temp40 > 0.15
```

```
replace pr_1 = 0.7 if temp1 > 0.45
replace pr_2 = 0.7 if temp2 > 0.45
```

```
.
```

```
.
```

```
replace pr_40 = 0.7 if temp40 > 0.45
```

```
replace pr_1 = 1 if temp1 > 0.85
replace pr_2 = 1 if temp2 > 0.85
```

```
.
```

```
.
```

```
replace pr_40 = 1 if temp40 > 0.85
```

```
drop temp*
```

* Scale per tree mast production for red oak group by randomly assigned but subjective productivity classes

```
replace rms_1 = pr_1 * rms_1
replace rms_2 = pr_2 * rms_2
.
.
replace rms_40 = pr_40 * rms_40
```

* Re-calculate for assignment of inherent productivity to white oak group

```

for new temp1-temp40: gen X = (uniform())

replace pr_1 = 0.30 if temp1 > 0.15
replace pr_2 = 0.30 if temp2 > 0.15
.
.
replace pr_40 = 0.30 if temp40 > 0.15

replace pr_1 = .70 if temp1 > 0.45
replace pr_2 = .70 if temp2 > 0.45
.
.
replace pr_40 = .70 if temp40 > 0.45

replace pr_1 = 1 if temp1 > 0.85
replace pr_2 = 1 if temp2 > 0.85
.
.
replace pr_40 = 1 if temp40 > 0.85

drop temp*

```

```

* Scale per tree mast production for white oak group by randomly
* assigned but subjective productivity classes

```

```

replace wms_1 = pr_1 * wms_1
replace wms_2 = pr_2 * wms_2
.
.
replace wms_40 = pr_40 * wms_40

```

```

* Set mast production at 0 if trees less than 20 cm in diameter

```

```

replace rms_1 = 0 if tr_1 < 20 & sp_1=="R0"
replace rms_2 = 0 if tr_2 < 20 & sp_2=="R0"
.
.
replace rms_40 = 0 if tr_40 < 20 & sp_40=="R0"

replace wms_1 = 0 if tr_1 < 20 & sp_1=="W0"
replace wms_2 = 0 if tr_2 < 20 & sp_2=="W0"
.
.
replace wms_40 = 0 if tr_40 < 20 & sp_40=="W0"

```

```

* drop per tree diameter information for trees 2-40 ,
* tree 1 retained for model evaluation
drop tr_2-tr_40

```

```

* drop per tree inherent productivity information for trees 2-40 ,
* tree 1 retained for model evaluation
drop pr_2-pr_40

```

*** Generate Mast production indices**

*** Cell totals for red oak subgenus**

```
gen  rmst =rms_1 if sp_1=="R0"

replace rmst =rmst +rms_2 if sp_2=="R0"
replace rmst =rmst +rms_3 if sp_3=="R0"
.
.
replace rmst =rmst +rms_40 if sp_40=="R0"
```

*** Cell totals for white oak subgenus**

```
gen  wmst =wms_1 if sp_1=="W0"
replace wmst =wmst +wms_2 if sp_2=="W0"
.
.
replace wmst =wmst +wms_40 if sp_40=="W0"
```

*** drop per tree level mast production trees 2-40, tree 1 retained for model evaluation**

```
drop  sp_2-sp_40
drop  rms_2-rms_40
drop  wms_2-wms_40
```

*** Set cell subgenus mast production to zero if missing**

```
replace  rmst = 0 if rmst ==.
replace  wmst = 0 if wmst ==.
```

*** Generate overall cell mast production value**

```
gen mst = rmst+wmst
```

```
gen kg = mst*10000/900 /* convert to scale similar to kg per ha 30 m cell */
```

*** Age of simulation used:**

```
* resultsfilename.dta
```