Douglas-fir Tussock Moth Outbreak Model Keywords:

Program Execution Control:

DEBUG
DEBUTREE
DFTM
END
NODFRUN
NOGFRUN
PUNCH
RANNSEED
REPORT

Outbreak Scheduling and Initial Conditions:

ASHDEPTH
BIOMASS
DETLARVA
DFBIOMAS
GFBIOMAS
MANSHCED
MANSTART
PROBMETH
RANLARVA
RANSCHED
RANSTART
TOPO

Management Options:

CHEMICAL
NPV2
NPV3
SALVAGE

Modification of Model Assumptions:

NUMCLASS
REDIST
TMPARMS
WEIGHT

ASHDEPTH   This keyword is used to specify the soil ash depth needed to calculate the conditional probability that the subject stand will be involved in a regional outbreak when the conditional probability calculation method (specified in Field 1 of the PROBMETH keyword) is equal to "2".

Field 1   Soil ash depth in inches.

Fields 2-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	15.93						

BIOMASS   This keyword is used to specify the method for calculating the foliage biomass (in grams) and percentage of new foliage on the midcrown sample branches.

Field 1   Calculation method. Valid codes are as follows:

1 = Foliage biomass and percentage new foliage will be randomly drawn from normal distribution. See keywords DFBIOMAS and GFBIOMAS for additional parameters associated with this calculations method.
2 = Use species-specific equation developed by hatch and Mika.
3 = Use species-specific equations developed by C. R. Hatch.
4 = Same as method 3 above, except with a random normal error added to each prediction.

Fields 2-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	4						

CHEMICAL   This keyword is used to specify the chemical control to be applied in the phase of the outbreak specified in Field 1 to the instar specified in Field 2, and with the efficacy specified in Field 3. There can be multiple entries of the CHEMICAL keyword in a Douglas-fir Tussock Moth Outbreak Model keyword set as long as the phase in unique for each entry.

Field 1   Phase of the outbreak when chemical control will be applied.
[Range: 1 to 4]

Field 2   Instar that will be targeted for control.
[Range: 1 to 6]

Field 3   Specific mortality rate for this instar resulting from the chemical control treatment.
[Range: 0.0 to 1.0]

Fields 4-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	3	4	0.95				

DEBUTREE   This keyword is used to produce detailed output containing intermediate values associated with individual tree records.

There are no fields associated with this keyword.

DETLARVA   This keyword is used to assign different levels of first instar larvae to each third of the tree classes after sorting the tree classes by average diameter (in descending order).

Field 1   Host species. Valid codes are as follows:

1 = Douglas-fir
2 = Grand fir

Field 2   The number of larvae assigned to the largest third of the tree classes.

Note: The model uses the defaults for Fields 2 through 4 depending on the value entered in Field 1 (Host Species). The first value listed in each field is for Douglas-fir and the second value is for Grand fir.

Field 3   The number of larvae assigned to the middle third of the tree classes.

Note: The model uses the defaults for Fields 2 through 4 depending on the value entered in Field 1 (Host Species). The first value listed in each field is for Douglas-fir and the second value is for Grand fir.

Field 4   The number of larvae assigned to the smallest third of the tree classes.

Note: The model uses the defaults for Fields 2 through 4 depending on the value entered in Field 1 (Host Species). The first value listed in each field is for Douglas-fir and the second value is for Grand fir.

Fields 5-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants		11/15	9/10	7/5			

DFBIOMAS This keyword is used to alter the default parameter values that determine Douglas-fir sample branch foliage biomass. When method 1 is specified in the BIOMASS keyword, foliage biomass and percentage of new foliage will be randomly drawn from a normal distribution with mean and standard deviation specified by this keyword.

Field 1 Mean of the foliage biomass distribution, in grams, for Douglas-fir.

Field 2 Standard deviation of the foliage biomass distribution, in grams, for Douglas-fir.

Field 3 Mean of the percentage of new foliage distribution for Douglas-fir.
[Range: 0 to 100]

Field 4 Standard deviation for the percentage of new foliage distribution for Grand fir.
[Range: 0 to 100]

Fields 5-7 Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	214	64	27	13			

DFTM This keyword is a Forest Vegetation Simulator (FVS) keyword signifying that the Douglas-fir Tussock Moth Outbreak Model is to be called and that all following keywords, up to the corresponding END keyword will be Douglas-fir Tussock Moth Outbreak Model keywords. This keyword is required.

There are no fields associated with this keyword.

END This keyword is used to signify the end of a keyword set or the end of a COMMENT block within a keyword set as shown in the example below.

Example:
DFTM
Douglas-fir Tussock Moth Outbreak Model keywords here
.
.
.
COMMENT
any number of comment lines here
.
.
.
END
.
.
.
END

Fields 1-7 Not used.

GFBIOMAS   This keyword is used to alter the default parameter values determining Grand fir sample branch foliage biomass. When method 1 is specified in the BIOMASS keyword, foliage biomass and percentage of new foliage will be randomly drawn from a normal distribution with mean and standard deviation specified by this keyword.

Field 1   Mean of the foliage biomass distribution, in grams, for Grand fir.

Field 2   Standard deviation of the foliage biomass distribution, in grams, for Grand fir.

Field 3   Mean of the percentage of new foliage distribution for Grand fir.
                [Range: 0 to 100]

Field 4   Standard deviation of the percentage of new foliage distribution for Grand fir.
                [Range: 0 to 100]

Fields 5-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	227	64	35	7			

MANSCHED   This keyword is used to specify a particular year that a regional outbreak will occur. There may be multiple occurrences of the MANSCHED keyword in the keyword set so long as the date for each entry is unique.

Field 1   Date (calendar year or cycle number) in which a regional outbreak will occur. Date is entered as a 4-digit calendar year of 1 to 40 for cycle number.

Fields 2-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	1						

MANSTART   This keyword is used to manually schedule an epidemic. There can be multiple entries of the MANSTART keyword in a model keyword set as long as the date is unique for each entry.

Note: The MANSTART keyword may not be combined with the RANSTART keyword. This keyword is valid with the POPDYN and NOPOPDYN models.

Fields 1-7   Not used.

NODFRUN   This keyword is used to exclude the effects of tussock moth on Douglas-fir Tussock Moth Outbreak Model.

There are no fields associated with this keyword.

NOGFRUN   This keyword is used to exclude the effects of tussock moth on Grand fir in the Douglas-fir Tussock Moth Outbreak Model.

There are no fields associated with this keyword.

NPV2   This keyword is used to specify that the nuclear polyhedrosis virus will be applied in Phase II.

Field 1   Instar 3 mortality rate.
                    (Model parameter B0(9))

Field 2   Instar 4 mortality rate.
                    (Model parameter B0(10))

Field 3   Instar 5 mortality rate.
                    (Model parameter B0(11))

Field 4   Instar 6 mortality rate.
                    (Model parameter B0(12))

Fields 5-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	0.036	0.039	0.042	0.072			

NPV3   This keyword is used to specify that the nuclear polyhedrosis virus will be applied in Phase III.

Field 1   Instar 3 mortality rate.
(Model parameter B0(15))

Field 2   Instar 4 mortality rate.
(Model parameter B0(16))

Field 3   Instar 5 mortality rate.
(Model parameter B0(17))

Field 4   Instar 6 mortality rate.
(Model parameter B0(18))

Fields 5-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	0.036	0.039	0.042	0.072			

NUMCLASS   This keyword is used to specify the number of tree classes to be created for each host species and the proportion of tree classes to be created by the first tree compression algorithm. All trees in a given tree class will be represented by one midcrown sample branch in the Douglas-fir Tussock Moth Outbreak Model.

Field 1   Number of Douglas-fir tree classes.

      Note: The sum of fields 1 and 2 must not exceed 100.

Field 2   Number of Grand fir tree classes.

      Note: The sum of fields 1 and 2 must not exceed 100.

Field 3   Proportion of tree classes determined by the first tree class compression algorithm.
[Range: 0.0 to 1.0]

Fields 4-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	20	20	0.50				

PROBMETH   This keyword is used to select a method for calculating the conditional probability that the subject stand will be included in a regional outbreak. This keyword is normally used in conjunction with the RANSTART keyword. If this keyword is used with the MANSTART keyword, the conditional probability of outbreak calculations will be made and printed in the Douglas-fir Tussock Moth Outbreak Summary Table, but will otherwise be ignored by the model.

Field 1   Conditional probability calculation method. Valid codes are as follows:

                1 = Use model developed by Heller
                2 = Use model developed by Mika and Moore
                3 = Same as method 2 above, except that ash depth is not used

Field 2   A value must be entered into this field.

                Conditional probability scaling factor. A value of 5.0 would reduce the calculated conditional probability by half, and a value of 2.0 would double the calculated value.

Fields 3-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	1	1.0					

PUNCH   This keyword is used to write the input values and parameter arrays used by the Douglas-fir Tussock Moth Outbreak Model as well as the defoliation levels by tree class, species average, and stand average to a separate output file.

Field 1   File unit number.
                 [Range: 20 to 35]

Fields 2-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants							

RANLARVA   This keyword is used to randomly allocate first instar larvae to the tree classes at the start of every outbreak. This is the default larval allocation method. Larval density for the host species specified is drawn from a normal distribution with the mean and standard deviation specified. Mean larval density may vary from outbreak to outbreak if the between-outbreak standard deviation is a positive number. This keyword is best suited for use with the keywords that produce multiple outbreaks (primarily RANSCHED).

Field 1   Host species. Valid codes are as follows:

                   1 = Douglas-fir
                   2 = Grand fir

Field 2   Average number of first instar larvae per midcrown sample branch for this host species.

                   Note: The model uses the defaults for Field 2 depending on the value entered in Field 1 (Host Species). The first value listed is for Douglas-fir and the second value is for grand fir.

Field 3   The within-outbreak standard deviation of first instar larvae.

Field 4   The between-outbreak standard deviation of first instar larvae.

Fields 5-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants		9/11	2.0	0.0			

RANNSEED   This keyword is used to change one or more of the random number
                generator seed values contained in the model.

Field 1   Seed value.
                [Range: any large odd number]

Fields 2-7   Not used.

Field Default Values

Field	1	2	3	4-7
All variants	1409859205	402656419	-328609067	

RANSCHED   This keyword is used to invoke the random automatic scheduling process which will stochastically generate a list of regional outbreaks to occur during the simulation period.

Field 1   Minimum waiting time, in years, between regional outbreaks.

Field 2   Event probability used in the random process; essentially the annual probability of a regional outbreak given that the minimum waiting time since the last outbreak has been exceeded.

Field 3   Date (4-digit calendar year) of the last regional outbreak.

Fields 4-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	30	0.1	1492				

RANSTART   This keyword is used to determine if the subject stand is to be included in the regional outbreak. This is done by calculating a conditional probability that the subject stand will be infested by tussock moth and comparing it to a random number between 0 and 1.

There are no fields associated with this keyword.

REDIST This keyword is used to specify the annual redistribution rate of insects between tree classes.

Field 1 Annual tussock moth redistribution rate. Range: 0.0 to 1.0; a rate of 0.0 results in no redistribution and a rate of 1.0 results in completely uniform redistribution.

Fields 2-7 Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	0.25						

REPORT　　　　This keyword is used to control the amount of tussock moth output generated by the Douglas-fir Tussock Moth Outbreak Model.

Field 1　　　　Report level code. Valid codes are as follows:

0 = No tussock moth output will be generated.
1 = Only the DFTM Outbreak Summary Table will be printed.
2 = All normal tussock moth table output will be printed.

Fields 2-7　　　　Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	2						

SALVAGE   This keyword is used to specify the level of which host trees will be salvaged after having survived a tussock moth outbreak.

Field 1   Minimum percentage tree defoliation for trees that will be salvaged. [Range: 0 to 100]

Fields 2-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	50.0						

TMPARMS   This keyword is used to alter certain parameters in the Douglas-fir Tussock Moth Outbreak Model. The parameters are contained in an internal storage area of the model (see the reference for a detailed description of this area). The TMPARMS keyword can be used to replace any parameter in this storage area and the parameter value will be reset to its default value if additional stands are processed in the same run.

Field 1   Record number which contains the parameter to be replaced in the model storage area.
[Range: 2 to 12 or 19 to 25]

Field 2   Field number on the record which corresponds to the parameter to be replaced in the model storage area.
[Range: 1 to 6]

Field 3   Replacement value for the specified field and record.

Fields 4-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants							

TOPO   This keyword is used in conjunction with the PROBMETH keyword to enter the numeric code specifying the topographic position of the stand.

Field 1   Topographic position. Valid codes are as follows:

1 = ridgetop
2 = sidehill
3 = bottom

If Field 1 of PROBMETH keyword = 2 or 3, TOPO codes are:

1 = ridgetop or upper slope
2 = midslope or lower lope

Fields 2-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	1						

WEIGHT   This keyword is to specify the relative importance of the two foliage variables used by the algorithm for compressing the list of trees into the number of tree classes specified by the NUMCLASS keyword. The default values result in percentage new foliage biomass being equally important.

Field 1   Weight given to the percentage of new foliage. Value greater than 1.0 will increase weight and value less than 1.0 will decrease weight.

Field 2   Weight given to the foliage biomass. Values greater than 1.0 will increase weight and value less than 1.0 will decrease weight.

Fields 3-7   Not used.

Field Default Values

Field	1	2	3	4	5	6	7
All variants	1.0	1.0					