PnET-II for LANDIS-II 5.1 User Guide

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1. Introduction

This document describes the PnET-II-for-LANDIS-II program which generates needed input parameters (mainly for Species' Establishment Probability- SEP, and Aboveground Net Primary Production -ANNP) for LANDIS-II Biomass Extension.

The PnET-II for LANDIS-II program is a specified version of PnET-II (Aber et al. 1995) in work with LANDIS-II model, and was designed and programmed by Dr. Chonggang Xu based on PnET-II VB5.1. PnET-II is a monthly time step model which is an improved version of the original PnET model (Aber and Federer 1992). The PnET models provide a nested set of modular approaches to simulating carbon, water and nitrogen dynamics of forest ecosystems. For detailed information about PnET model and its variations, see PnET model website: http://www.pnet.sr.unh.edu/.

LANDIS-II simulates forest succession, disturbance (including fire, wind, harvesting, insects), climate change, and seed dispersal across large (typically 10,000 - 20,000,000 ha) landscapes. LANDIS-II tracks the spatial distribution of discrete tree and shrub species and has flexible spatial and temporal resolutions. For information about LANDIS-II model and various extensions, including their applications and references, see LANDIS-II website: http://www.landis-ii.org/.

Please cite the following paper when use this program: Xu, C., G. Z. Gertner, and R. M. Scheller. 2009. Uncertainty in the response of a forest landscape response to global climatic change. Global Change Biology, 15, 116–131.

2. Installation and Running

The best performance operation system for the PnET-II-for-LANDIS-II program is Windows XP. Other operation system should also work ok.

2.1. First download the PnET-II for LANDIS-II program file (i.e., PnET-II for LANDIS-II**.**exe) from: http://sites.google.com/site/xuchongang/pnetiiforlandisii. The file is a self-extracting file. Click it to extract to a specified folder for extraction on your computer.

2.2. To install the program, open the "program" folder under your specified folder, click "setup.exe" to install. Installing the PnET-II for LANDIS-II program creates the following files and subdirectories under the specified folder for extraction on your computer:

…\ PnET for LANDIS readme	- program description file
…\program	- precompiled executable
…\examples	- project description files
…\examples\PnET	- sample PnET input files
…\examples\LANDIS	- sample LANDIS input files

Follow the instructions on your computer screen to complete the installation process. When the installations succeed, there will be a 'PnET-II C.W. 5.1' icon appeared on your "All Programs" item on Start menu of your computer desktop.

The current distribution package contains example files which will allow the user to run the program. Example files were provided to assist user familiar with program use and input/output format, which can be confusing for the users who are not familiar with LANDIS-II or PnET-II.

2.3 Running PnET-II-for-LANDIS-II**,** go to Window 'Start' Manu and then to 'All Programs'; execute the PnET-II C.W. 5.1.

2.4. Please note that if you want to install a newer update of the program, you need first to remove the program in "add/remove programs" from control panel of your system, and re-install a newer update or version.

3. Input files

There are five types of input files required to run the PnET-II-for-LANDIS-II program, which include Project file, List files, Species parameter files, individual site files, and Climate files:

3.1 The Project file (Project.txt)

Similar to the Scenario file in LANDIS-II, the Project file, is the main file for running the PnET-II-for-LANDIS-II program.

The Project file includes simulation start year, end year; climate type (Mean or Transient; use Transient for most cases); paths of the site list file (e.g., PNETSITE.LST), vegetation file (e.g., PNETVEG.LST), climate data file (e.g., VeMapCCC.clm), and output file (e.g., T.out).

This file also includes the CO_2 effect setting parameters. For example, CO2 Input (Fixed, Mauna, or File level), CO_2 effects on Photosynthesis (i.e., to check if the CO2 effect on stomatal conductance is included, true, false, or vegfile – read from vegetation file), and O_3 effect (i.e., check if ozone effect is applied, false or true).

This file also checks if need to copy the output result as LANDIS inputs (True or False). If true, simulation start year, simulation end year, LANDIS intervals, and on which lines SEP and ANNP to be copied. Finally, the file includes a list the file objects (paths and names) to be updated for LANDIS-II.

In addition, the Project file includes the output setting parameters, including output types (yearly or monthly), and the iterations of first year climate to equilibrate.

3.2 List files

There are two types of List file: 1) the Site list file (e.g., PNETSITE.LIS), which include a list of the site file names, corresponding to the individual landtypes in LANDIS model; and 2) the Vegetation list file (e.g., PNETVEG.LST), which includes a list of the vegetation types or species names for a simulation with the PnET-II model.

3.3 Climatic data file (e.g., VeMapCCC.clm)

The climate data file mainly include information of timing (year and day), maximum and minimum monthly temperature, precipitation, CO_2 monthly concentration for a period of time.

Variable	Description	Unit
Year	Year	N/A
DOY	Day of the year	1 through 365
TMax	Maximum monthly temperature	N/A
TMin	Minimum monthly temperature	N/A
Par	Photosynthetically active radiation	$Mol/m^2/m$
Prec	Precipitation	cm
NH_4	NH_4 monthly concentration	ppm
NO_3	NO_3 monthly concentration	ppm
O_3	O_3 monthly concentration	ppm
CO_2	CO_2 monthly concentration	ppm
V1	Set as 0	
V2	Set as 0	
V3	Set as 0	
V4	Set as 0	

3.4 Species parameter files: (Balsamfi.veg, RedMaple.veg, and SugarMap.veg etc).

Variable	Description	Unit
AmaxA	Intercept of relationship between foliar N and max photosynthetic rate	
AmaxB	Slope of Amax versus N relationship	umol CO_2/g leaf/s
HalfSat	Half saturation light intensity	$umol/m^2/s$
BFolResp	Respiration as a fraction of maximum photosynthesis	
RespQ10	*Q*10 value for foliar respiration	
PsnTMin	Minimum temperature for photosynthesis	°C
PsnTOpt	Maximum temperature for photosynthesis	°C
AmaxFrac	Daily Amax as a fraction of early morning instantaneous rate	
FolRet	Maximum relative growth rate for foliage	% per year
SLWmax	Species leaf weight at top canopy	g/m^{-2}
SLWdel	Change in SLW with increasing foliar mass above	$G\ m^{-2}g^{-1}$
GDDFolS	GDD at which foliar production begins	
GddFolE	Growing degree days (GDD) at which foliar production ends	
GDDWoodS	GDD at which wood production begins	
GDDWoodE	GDD at which wood production ends	
SenescStart	Day of year after which leaf drop can occur	
FolMsMx	Site specific maximum summer foliage biomass	$g\ m^{-2}$
FolMsMn	Site specific minimum winter foliage biomass	$g\ m^{-2}$
k	Canopy light extinction constant	no units

FolNCon	Foliar nitrogen	%
FolRelGMax	Maximum relative growth rate for foliage	% per year
CFracB	Carbon as a fraction of tissue mass	
RootAlA	Intercept of relationship between foliar and root allocation	
RootAlB	Slope of relationship between foliar and root allocation	
GRspFrac	Growth respiration, as a fraction of allocated carbon	
WdMRespA	Wood maintenance respiration as a fraction of gross photosynthesis	
RootMRFPCReserv	Ratio of fine root maintenance respiration to fine root biomass production	
MinWoodFol	Minimum ratio of carbon allocation to wood and foliage	
DVPD1	Coefficients for photosynthesis reduction due to vapor pressure deficit (VPD)	kPa^{-1}
DVPD2	(VDP) in the power function DVPD = DVPD1 × VPDDVPD2	
WUECnst	Coefficient in equation for water-use efficiency (WUE) as a function of VPD	
PrecIntF	Fraction of precipitation intercepted and evaporated	
FFlowFr	Set as 0.1	
FLPctN	Min. N Concentration in foliar litter	%
RLPctN	Min. N concentration in root litter	%
WLPctN	Min. N concentration in wood litter	%
FolNConR	Max. fractional increase in N concentrations	%
FolNRet	Set as 0.5	no units
MaxNStore	Max. N content in PlantN pool	$g\text{-}m^{-2}$
WoodTrn	Fractional mortality of live wood per year	
RtTrnA	Coefficients for fine root turnover as a function of annual net N mineralization	$fraction.year^{-1}$
RtTrnB	Coefficients for fine root turnover as a function of annual net N mineralization	$fraction.year^{-1}$
RootTrnC	Coefficients for fine root turnover as a function of annual net N mineralization	$fraction.year^{-1}$
WdLitLs	Fractional loss of mass as CO_2 in wood decomposition	
WdCLoss Kho	Decomposition constant for SOM pool ($year^{-1}$)	
NImmobA	Coefficients for fraction of mineralized N reimmobilized as a function of SOM C:N	no units
NImmobB	Coefficients for fraction of mineralized N reimmobilized as a function of SOM C:N	no units
SoilRespA	Intercept of relationship between mean monthly temperature and soil respiration	$G\ C\ m^{-2}\ mo^{-1}$
SoilRespB	Slope of relationship between mean monthly temperature and soil respiration	
SoilMoistFact	Saturation ratio of the soil	no units
GDDMin	Based on LINKAGE model which have different baseline T (5.56 degree) from GddFolE GDDWoodS GDDWoodE (0 degree)	
GDDMax	Based on LINKAGE model which have different baseline T (5.56 degree) from GddFolE GDDWoodS GDDWoodE (0 degree)	
CO_2 EFFECT	CO_2 EFFECT on Stomata conductance - True or false	

3.5 Individual site files (e.g., TEST1, TEST2, TEST3)

Variable	Description	Unit
LAT	Latitude	degrees
WHC	Water holding capacity, plant available water	cm
Climate file	VegMapHad	no units
BudC	Initial conditions for C pool - C of bud	$g\ C/m^2$
WoodC	Initial conditions for C pool - C of wood	$g\ C/m^2$
PlantC	Initial mobile carbon	$g\ C/m^2$
NRatio	NRatio	no units
PlantN	PlantN	
FolMass	Maximum foliage mass	$g\ C/m^2$

WoodMass	Initial wood mass	g C/m^2
RootMass	Initial wood mass	g C/m^2
SnowPack	SnowPack initial conditions	
Dwater	Initial parameter for effects of plant water stress	
Water	Initial parameter soil water	cm
HumusM	Humus organic matter pool	g biomass/m^2
HumusN	Nitrogen content	g Nitrogen/m^2
NH_4	NH_4	pmm
DeadWood	DeadWood	

4. Output Variables in Output files (e.g., TTEST1SugarMap.out)

Variable	Description	Unit
YEAR	Year	yr
GrossPsn	gross photosynthesis	
NetPsn	Net photosynthesis	
NPPFol	annual net primary productivity - foliar	g/m^2
NPPWood	annual net primary productivity - wood	g/m^2
NPPRoot	annual net primary productivity - root	g/m^2
Ppt	annual precipitation	cm
O_3	O_3 output estimate	ppb
ET	ET output estimate	
Drain	Drain-Water Yield	cm
NEP	Net Ecosystem Production	g/m^2
ANPP	aboveground net primary production	
SEP	species establishment coefficient	N/A

5. SEPs calculation

SEP is defined as the probability of seedling establishment (assumes no competition from other species) under a specific climate. The SEP is calculated by the product of the environmental adjusting factors of light, water availability and vapor pressure deficit for photosynthesis (calculated in PnET-II), and another adjusting factor of growing degree days based on the deviance of actual growing degree days from the optimum growing degree days for a specific species, which are commonly used to represent the overall effect of temperature on tree growth (Botkin et al., 1972; Pastor & Post, 1985).

6. Update LANDIS-II files

The pre-prepared LANDIS-II files can be updated during each run. By default, updated ANNP and SEP values are 10-year average values.

7. Example input and output files

7.1 Main parameter file

```
From year =2000          >>simulation start year
to Year =2029            >>simulation end year
climate =Transient       >>climate type----Mean or Transient; Use Transient for most case.
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C:\programing\Vc#\PnET-II.C.W.5.1\Publish\Example\PnET\PNETSITE.LST                  >>site list file
C:\programing\Vc#\PnET-II.C.W.5.1\Publish\Example\PnET\PNETVEG.LST                   >>list file for vegetation file
C:\programing\Vc#\PnET-II.C.W.5.1\Publish\Example\PnET\Climate\VeMapCCC.clm          >>Climatic data file
C:\programing\Vc#\PnET-II.C.W.5.1\Publish\Example\PnET\output\T.out                  >>output data file
C:\programing\Vc#\PnET-II.C.W.5.1\Publish\Example\PnET\PnET.log                      >>Log file
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CO2 Input= File                                     >>CO2 input--Fixed(level),Mauna,File;
CO2 EFFECT On Photosynthesis = true                 >>to check if the CO2 EFFECT on photosynthesis is inlucded
CO2 EFFECT On Stomata conductance = vegfile         >>to check if the CO2 EFFECT on stomatal conductance is inlucded
                                                    >>true, false,vegfile--read from vegetation file
O3 EFFECT=false                                     >> to check if ozone effect is applied
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Output Stype=Yearly          >>only output the final year simulation---Yearly,Final,Monthly;

spinup Years=50              >>iterations of first year climate to equlibrate

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LANDIS Copy=true >>check if need to copy the output result as LANDIS inputs
                 >>pay attention: the name in the vegetation list for PnET-II must match the name in the LANDIS-II species list
```

LANDIS From year=2000 >>simulation start year
LANDIS end year=2029 >>simulation start year
LANDIS intervals= 10 >>unit: year
LANDIS SEPs start line=37 >>1-based;
LANDIS ANNP start line=50 >>1-based;

>>List the fite object to be updated
C:\programing\Vc#\PnET-II.C.W.5.1\Publish\Example\LANDIS\CCCbiomass-succ2000-2009.txt
C:\programing\Vc#\PnET-II.C.W.5.1\Publish\Example\LANDIS\CCCbiomass-succ2010-2019.txt
C:\programing\Vc#\PnET-II.C.W.5.1\Publish\Example\LANDIS\CCCbiomass-succ2020-2029.txt

7.2 Site parameter file

File Diretory **********
C:\programing\Vc#\PnET-II.C.W.5.1\Publish\Example\PnET\Climate\
SiteVariables **********
LAT WHC Climate file
48 9.67 VeMapHad
Initial Conditions **********
BudC WoodC PlantC NRatio PlantN FolMass WoodMass RootMass
130 300 900 1.3993 1 0 20000 6
SnowPack Dwater Water HumusM HumusN NH4 DeadWood
13 1 12 10350 315 .01 11300
Scenario - for CN **********
Run Model From/To
1950 2099
Run Climate File From/To
1950 2099
From TO FromYr ToYr For Climate Change Scenario

0	0	1950	2099	DeltTMax
0	0	1950	2099	DelTMin
1	1	1950	2099	DelPrec
1	1	1950	2099	DelPar
1	1	1950	2000	DelWUE
370	370	1900	2000	CO_2
0	1	1900	1989	O_3
.2	1	1900	1964	NO3Wet
0	0	1900	2000	NO3Dry
.2	1	1900	1964	NH4Wet
0	0	1900	2000	NH4Dry

FertNO3	FertNH4	YrStart	YrEnd	MonStart	MonEnd
0	0	0	0	0	0

AgFrom	AgTo	Remove
0	0	0

# of Harvests

3

Year	Intens	RemFrac	SLossFrac
1750	.2	.01	0
1930	.5	.8	0
1950	.01	.01	.1

FolRegen

100

7.3 Species file

Red maple

AmaxA	AmaxB	HalfSat	BFolResp	RespQ10	PsnTMin	PsnTOpt	AmaxFrac
-46	71.9	200	.1	2	4	25.9	.75

FolRet	SLWmax	SLWdel	GDDFolS	GddFolE	GDDWoodS	GDDWoodE	SenescStart

1 75 .2 100 900 100 900 270
FolMsMx FolMsMn k FolNCon FolRelGMax
300 0 .57999 2.4 .94999
CFracB RootAlA RootAlB GRspFrac WdMRespA RootMRF PCReserv MinWoodFol
.45 0 2 .25 .07 1 .75 1.5
DVPD1 DVPD2 WUECnst PrecIntF FFlowFr f
.05 2 10.9 .11 .1 .04
FLPctN RLPctN WLPctN FolNConR FolNRet MaxNStore
.00898 .012 .002 .59999 .5 20
WoodTrn RtTrnA RtTrnB RootTrnC
.025 .789 .191 .0211
WdLitLs WdCLoss Kho NImmobA NImmobB SoilRespA SoilRespB SoilMoistFact
.1 .8 .07499 151 -35 27.46 .06844 0
GDDMin GDDMax >>based on LINKAGE model which have different baseline T(5.56 degree) from GddFolE GDDWoodS GDDWoodE (0 degree)
1260 6600
CO2 EFFECT On Stomata conductance = true

7.4 Climate file

1800

Year	DOY	TMax	TMin	Par	Prec (cm)	NH4	NO3	O3	CO2	V1	V2	V3	V4
1950	15	-11.6	-25.8	344.0031436	6	0	0	0	311.17	0	0	0	0
1950	45	-4.9	-18.2	509.488904	1.1	0	0	0	311.17	0	0	0	0
1950	75	-1.6	-15.2	697.7568054	5.5	0	0	0	311.17	0	0	0	0
1950	105	4.2	-5.9	730.7429723	9.1	0	0	0	311.17	0	0	0	0
1950	135	17.3	2.4	988.8024034	11.9	0	0	0	311.17	0	0	0	0
1950	165	23.2	7.7	989.9286792	8.8	0	0	0	311.17	0	0	0	0
1950	195	22.6	10	859.4204957	9.4	0	0	0	311.17	0	0	0	0
1950	225	21.6	7.2	878.119425	7.5	0	0	0	311.17	0	0	0	0
1950	255	18.8	6.7	658.3677421	6	0	0	0	311.17	0	0	0	0

1950	285	12.3	1.9	460.9672755	8.2	0	0	0	311.17	0	0	0	0
1950	315	-1.6	-10.4	301.2036367	4.6	0	0	0	311.17	0	0	0	0
1950	345	-8.5	-19	275.7332975	3.8	0	0	0	311.17	0	0	0	0
1951	15	-9.1	-21.7	334.809399	2	0	0	0	311.612	0	0	0	0
1951	45	-5.9	-18.1	478.4481599	4.4	0	0	0	311.612	0	0	0	0
1951	75	-1	-14.4	693.3516833	4.4	0	0	0	311.612	0	0	0	0
1951	105	9	-3	802.4446132	3.9	0	0	0	311.612	0	0	0	0
1951	135	20.6	4.5	991.8855988	6.6	0	0	0	311.612	0	0	0	0
1951	165	20	7.4	856.5438321	10.6	0	0	0	311.612	0	0	0	0
1951	195	24.9	10.7	934.115	7.1	0	0	0	311.612	0	0	0	0
1951	225	20.8	9.5	744.0825451	14.3	0	0	0	311.612	0	0	0	0
1951	255	16	5.1	653.1377246	12.5	0	0	0	311.612	0	0	0	0
1951	285	10.3	0.6	437.5905857	8.2	0	0	0	311.612	0	0	0	0
1951	315	-1.6	-11.6	334.5603701	2.8	0	0	0	311.612	0	0	0	0
1951	345	-7.3	-16.9	245.0639411	3.4	0	0	0	311.612	0	0	0	0
1952	15	-7.5	-21.3	340.9324715	1.9	0	0	0	312.075	0	0	0	0
1952	45	-2.8	-14.3	473.091267	0.4	0	0	0	312.075	0	0	0	0
1952	75	-0.3	-13.1	667.8164693	4.4	0	0	0	312.075	0	0	0	0
1952	105	14.8	-1.9	921.7797548	5.3	0	0	0	312.075	0	0	0	0
1952	135	17.8	2.9	975.2780606	2.4	0	0	0	312.075	0	0	0	0
1952	165	23.3	9.6	908.5327723	11.8	0	0	0	312.075	0	0	0	0
1952	195	24.8	11.5	887.3328784	15.3	0	0	0	312.075	0	0	0	0
1952	225	23.2	10	795.4085716	12.6	0	0	0	312.075	0	0	0	0
1952	255	19.2	6.7	646.7321593	2.1	0	0	0	312.075	0	0	0	0
1952	285	9.7	-2.9	507.6498266	1.4	0	0	0	312.075	0	0	0	0
1952	315	2.7	-5.6	277.760635	3.4	0	0	0	312.075	0	0	0	0
1952	345	-3.3	-11.4	254.8460755	0.8	0	0	0	312.075	0	0	0	0
.													
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.													
.													
2099	15	-3.9678	-7.406	228.56049	3.15073	0	0	0	706.465	0	0	0	0
2099	45	-2.7614	-7.0965	358.5669203	1.80356	0	0	0	706.465	0	0	0	0
2099	75	6.1967	-5.1377	713.5757863	4.03185	0	0	0	706.465	0	0	0	0

2099	105	20.3511	1.2078	983.0381953	8.40002	0	0	0	706.465	0	0	0	0
2099	135	23.1553	8.3688	918.1278784	9.42345	0	0	0	706.465	0	0	0	0
2099	165	28.8205	15.4608	852.0165565	5.37733	0	0	0	706.465	0	0	0	0
2099	195	29.7067	16.3643	831.2139181	7.53917	0	0	0	706.465	0	0	0	0
2099	225	30.4109	16.6496	789.5924226	4.39129	0	0	0	706.465	0	0	0	0
2099	255	22.7043	11.473	613.050436	11.20213	0	0	0	706.465	0	0	0	0
2099	285	14.4037	3.7872	461.2986297	11.11892	0	0	0	706.465	0	0	0	0
2099	315	6.4004	-5.022	343.2696067	5.17991	0	0	0	706.465	0	0	0	0
2099	345	-3.8278	-11.8621	229.786131	2.52063	0	0	0	706.465	0	0	0	0
2100	15	-5.0981	-8.9714	237.4694835	4.41536	0	0	0	711.681	0	0	0	0
2100	45	-2.5151	-6.2937	307.5554134	1.6782	0	0	0	711.681	0	0	0	0
2100	75	1.5553	-7.4841	701.9902967	3.45033	0	0	0	711.681	0	0	0	0
2100	105	11.4132	-3.1675	926.3901769	9.36529	0	0	0	711.681	0	0	0	0
2100	135	22.646	7.5895	946.2026534	13.42346	0	0	0	711.681	0	0	0	0
2100	165	27.2789	14.1155	871.0538202	11.50688	0	0	0	711.681	0	0	0	0
2100	195	30.5063	17.8908	794.8628842	10.73859	0	0	0	711.681	0	0	0	0
2100	225	29.4338	16.3887	744.5317415	15.14373	0	0	0	711.681	0	0	0	0
2100	255	22.7315	10.9676	642.6060399	9.11732	0	0	0	711.681	0	0	0	0
2100	285	17.6838	7.0205	455.2258557	4.33131	0	0	0	711.681	0	0	0	0
2100	315	9.3301	-2.1339	303.2944119	12.55253	0	0	0	711.681	0	0	0	0
2100	345	-4.2728	-12.0123	216.7304881	2.17791	0	0	0	711.681	0	0	0	0

7.5 List file

3
TEST_Only(space delimted) TEST1
TEST_Only(space delimted) TEST2
TEST_Only(space delimted) TEST3

3
Balsam fir Balsamfi
Red maple RedMaple
Sugar maple SugarMaple

8. Example output files

8.1 PnET-II output

YEAR	GrossPsn	NetPsn	NPPFol	NPPWood	NPPRoot	Ppt(cm)	O_3(ppb)	ET	Drain	NEP	ANPP	SEP
2000	994.30	735.05	229.20	587.09	203.73	73.45	0.000	42.81	30.64	95.62	816	0.16
2001	973.80	738.96	229.20	587.09	189.16	87.54	0.000	43.08	44.46	97.61	816	0.06
2002	968.44	697.77	241.03	587.11	213.80	67.59	0.000	41.61	25.99	55.23	828	0.12
2003	865.37	594.38	228.36	560.96	216.41	67.83	0.000	38.67	29.16	31.82	789	0.19
2004	874.97	632.80	194.59	505.12	199.29	71.42	0.000	39.74	31.69	40.70	700	0.22
2005	923.78	713.67	196.41	506.23	161.47	72.39	0.000	38.71	33.67	120.62	703	0.10
2006	1056.57	779.30	210.71	545.43	201.41	70.71	0.000	45.57	25.13	115.76	756	0.29
2007	1017.95	752.80	221.28	593.00	182.36	63.72	0.000	40.21	23.52	141.98	814	0.17
2008	866.30	574.28	222.64	606.19	212.01	61.58	0.000	37.89	23.69	2.47	829	0.23
2009	1041.06	811.40	200.19	526.83	169.62	72.01	0.000	42.76	29.25	155.21	727	0.15
2010	862.64	603.44	225.07	603.61	187.40	66.95	0.000	35.06	31.89	38.43	829	0.12
2011	1058.34	808.40	205.53	538.70	186.82	73.97	0.000	41.55	31.10	177.28	744	0.20
2012	1058.94	787.71	209.68	610.28	202.75	71.71	0.000	44.36	28.66	107.69	820	0.26
2013	956.90	690.48	216.15	644.02	184.40	77.49	0.000	39.63	37.86	86.60	860	0.20
2014	997.04	718.86	215.24	613.76	196.00	72.79	0.000	41.52	31.27	81.15	829	0.24
2015	1037.50	746.24	212.91	608.25	197.67	77.71	0.000	43.94	33.77	88.20	821	0.29
2016	946.90	685.85	213.79	619.19	175.99	71.87	0.000	38.85	33.02	70.02	833	0.18
2017	1027.48	760.70	208.65	597.48	188.59	72.01	0.000	39.46	32.56	107.31	806	0.20
2018	865.11	646.47	215.21	622.25	162.76	72.94	0.000	36.11	36.83	75.14	837	0.01
2019	1119.54	854.02	215.59	578.35	203.74	79.66	0.000	44.03	35.63	157.86	794	0.19
2020	1160.17	881.49	231.31	649.44	196.42	85.38	0.000	45.02	40.36	205.64	881	0.15
2021	1080.00	809.81	235.55	702.08	202.65	81.65	0.000	42.36	39.29	105.61	938	0.12
2022	1032.99	712.60	247.63	696.17	222.52	60.06	0.000	38.25	21.80	131.28	944	0.20
2023	1044.60	768.42	215.76	641.10	203.72	71.08	0.000	40.96	30.12	147.20	857	0.19
2024	961.61	669.33	215.65	651.75	211.69	62.03	0.000	39.02	23.01	37.94	867	0.23
2025	1030.39	779.53	204.29	610.16	171.21	66.46	0.000	38.74	27.72	162.45	814	0.15
2026	1177.17	906.83	210.49	644.95	182.94	76.81	0.000	43.44	33.37	206.12	855	0.14
2027	1065.76	781.10	227.79	726.07	198.32	55.58	0.000	39.29	16.29	164.84	954	0.15

2028	1228.14	903.93	227.68	706.62	215.26	68.76	0.000	44.24	24.53	228.29	934	0.32
2029	1340.55	980.87	234.09	753.63	224.50	78.87	0.000	50.39	27.67	227.37	988	0.41

8.2 LANDIS-II updated file

"LandisData "Biomass Succession - Climate Change"

>> **********
MinRelativeBiomass

>> Species Ecoregions
>> -------- ----------

	Eco1	Eco2	Eco3
1	24.70%	24.70%	24.70%
2	32.60%	32.60%	32.60%
3	42.80%	42.80%	42.80%
4	58.80%	58.80%	58.80%
5	100%	100%	100%

>> **********
BiomassParameters

>> Species	Leaf	Woody	Biomass		Mortality	Curve
>> Longevity		Decay	Rate	Shape	Parameter	
>> --------	---------	----------		----------		
Balsamfi	4		0.1	10		
RedMaple	1		0.1	10		
SugarMaple	1		0.1	10		

>> **********
EstablishProbabilities

>> Species Ecoregions

>> -------- --------------------------

	Eco1	Eco2	Eco3
Balsamfi	0.671	0.664	0.682
RedMaple	0.169	0.162	0.175
SugarMaple	0.44	0.426	0.46

>> **********

MaxANPP

>> Species Ecoregions

>> -------- ------------------- ------

	Eco1	Eco2	Eco3
Balsamfi	769	711	820
RedMaple	777	697	887
SugarMaple	826	738	930

>> **********

LeafLitter:DecayRates

>> Species Ecoregions

>> -------- ------------------------

	Eco1	Eco2	Eco3
Balsamfi	0.999	0.999	0.999
RedMaple	0.999	0.999	0.999
SugarMaple	0.999	0.999	0.999