

# Drought Generator Extension (v1.1)

## User Guide

LANDIS-II Extension

Eric Gustafson  
Brian R. Miranda

US Forest Service  
Northern Research Station

Last Revised: July 17, 2014

# Table of Contents

<b>1</b>	<b>INTRODUCTION .....</b>	<b>3</b>
1.1	What's New in Version 1.1 .....	3
1.2	Major releases .....	3
1.2.1	Version 1.0 .....	3
1.3	Minor releases .....	3
1.3.1	Version 1.1 .....	3
1.4	Bug fixes .....	3
1.5	Extension Description .....	3
1.5.1	Overview .....	3
1.5.2	Drought Variable .....	4
1.6	References .....	4
1.7	Acknowledgments .....	4
<b>2</b>	<b>PARAMETER INPUT FILE.....</b>	<b>5</b>
2.1	LandisData .....	5
2.2	Timestep .....	5
2.3	VariableName .....	5
2.4	Mu .....	5
2.5	Sigma .....	5
2.6	LogFile .....	5
<b>3</b>	<b>OUTPUT FILES.....</b>	<b>6</b>
3.1	Drought Generator Log .....	6
<b>4</b>	<b>EXAMPLE FILE.....</b>	<b>7</b>
<b>1</b>	<b>INTRODUCTION .....</b>	<b>ERROR! BOOKMARK NOT DEFINED.</b>
1.1	Version 1.0 .....	<b>Error! Bookmark not defined.</b>
1.2	Extension Description .....	<b>Error! Bookmark not defined.</b>
1.2.1	Overview .....	<b>Error! Bookmark not defined.</b>
1.2.2	Drought Variable .....	<b>Error! Bookmark not defined.</b>
1.2.3	Biomass Removal .....	<b>Error! Bookmark not defined.</b>
1.2.4	Establishment Modification .....	<b>Error! Bookmark not defined.</b>
1.3	References .....	<b>Error! Bookmark not defined.</b>
1.4	Acknowledgments .....	<b>Error! Bookmark not defined.</b>
<b>2</b>	<b>PARAMETER INPUT FILE.....</b>	<b>ERROR! BOOKMARK NOT DEFINED.</b>
2.1	LandisData .....	<b>Error! Bookmark not defined.</b>
2.2	Timestep .....	<b>Error! Bookmark not defined.</b>
2.3	VariableName .....	<b>Error! Bookmark not defined.</b>
2.4	MinDroughtVar .....	<b>Error! Bookmark not defined.</b>
2.5	MaxDroughtVar .....	<b>Error! Bookmark not defined.</b>
2.6	BackTransformation .....	<b>Error! Bookmark not defined.</b>
2.7	InterceptCorrection .....	<b>Error! Bookmark not defined.</b>
2.8	SpeciesParameters .....	<b>Error! Bookmark not defined.</b>
2.9	MapName .....	<b>Error! Bookmark not defined.</b>
2.10	LogFile .....	<b>Error! Bookmark not defined.</b>

**3    OUTPUT FILES..... ERROR! BOOKMARK NOT DEFINED.**

    3.1    Drought Biomass Removed Maps .....**Error! Bookmark not defined.**

    3.2    Drought Disturbance Log .....**Error! Bookmark not defined.**

**4    EXAMPLE FILE..... ERROR! BOOKMARK NOT DEFINED.**

# 1 Introduction

This document describes the **Drought Generator Extension** for use with the LANDIS-II model. For information about the model and its core concepts, see the *LANDIS-II Conceptual Model Description*.

## 1.1 What's New in Version 1.1

Version 1.1 is compatible with Biomass Succession v3.2.

## 1.2 Major releases

### 1.2.1 Version 1.0

Version 1.0 is compatible with LANDIS-II v6.0

## 1.3 Minor releases

### 1.3.1 Version 1.1

July 1, 2014

Updated for compatibility with Biomass Succession v3.2. A new dependency on the Biomass Library was added to Biomass Succession for compatibility with other succession versions.

## 1.4 Bug fixes

## 1.5 Extension Description

### 1.5.1 Overview

This extension generates a site-level variable representing a user-chosen measure of drought conditions. Examples of such a drought variable include average length of drought events, average drought severity, mean Palmer Drought Severity Index per decade. The variable is updated at each time step. The variable is given a user-defined name and made available for other extensions to use. The original intent of this extension is to provide information used by the Drought Disturbance Extension.

### 1.5.2 Drought Variable

The extension draws a value of the drought variable from a lognormal distribution. The user must provide Mu and Sigma values that define the lognormal distribution of the drought variable selected.

For each timestep, a value for the drought variable is stochastically drawn from the lognormal distribution. The user can choose any drought variable when estimating the parameters of the lognormal distribution, but the Drought Generator extension requires no information about the variable other than the two parameters defining the lognormal distribution of that variable. The user should ensure that the values generated by those lognormal parameters are consistent with the extension timestep parameter. The value of the variable is recorded as a site variable that is available to all other extensions. The user provides a name for the drought variable, which ensures that other extensions (e.g. Drought Disturbance) use the correct drought variable.

## 1.6 References

**Gustafson, E.J.**, B.R. Sturtevant. In Press. Assessing the spatial and temporal scale of forest mortality from drought stress: implications for climate change. Ecosystems.

## 1.7 Acknowledgments

Brian Sturtevant contributed to the design of this extension.

## 2 Parameter Input File

The input parameters for this extension are specified in a single input file. This text file must comply with the general format requirements described in section 3.1 *Text Input Files* in the *LANDIS-II Model User Guide*.

### 2.1 LandisData

This parameter's value must be "Drought Generator".

### 2.2 Timestep

This parameter is the extension's timestep. A new value of the drought variable is generated at each timestep. Value: integer > 0.  
Units: years.

### 2.3 VariableName

This parameter determines how the site variable stored from this extension will be identified for use by other extensions. The VariableName provided here must match exactly with the variable name provided in other extensions intending to access the site variable.

### 2.4 Mu

This parameter defines the Mu parameter of the lognormal distribution of the drought variable. Value: Any Real Number.

### 2.5 Sigma

This parameter defines the Sigma parameter of the lognormal distribution of drought years per decade. Value: Real  $\geq 0.0$ .

### 2.6 LogFile

The file parameter is the name of the extension's event log file (see section 3.2).

## 3 Output Files

The drought generator extension generates two types of output files: a) a map of number of drought years per decade for each time step, and b) a log of drought years for the entire scenario.

### 3.1 Drought Generator Log

The log is a text file that contains information about the generated variable values for each timestep over the course of the scenario. The information is stored as comma-separated values (CSV).

## 4 Example File

```
LandisData "Drought Generator"
```

```
Timestep 10
```

```
VariableName "Drought.Years"
```

```
Mu 1.0
```

```
Sigma 0.6
```

```
MapName "drought/DY-{timestep}.img"
```

```
LogFile "drought/droughtgen-log.txt"
```