**Glossary of terms for modeling in the classroom**

Randy’s notes: I will be verbose here to hopefully inspire and help Megan as she winnows down the text and makes something useful. I will also ‘bin’ things and also add a few terms.

## Model Organization

SyncroSim has ‘levels’ of structure to help users organize their work, and to make sure that model inputs are in the best place for the software to run properly.

**Library**-a file type that serves as the organizational structure for model inputs. Consider a master bread recipe that defines core ingredients (e.g., flour, water, and yeast) and how the oven is set up (e.g., temperature and where racks are placed). Similarly the library provides the basic structure to organize the model inputs, outputs and how the model is run. If you go into the Library Properties you can do things such as define where outputs are stored, how model backups are dealt with, and tell your computer how many of its processors to use. You will likely never change any of the properties of a Library in a classroom setting.

***Library:*** *The foundational structure or database that organizes and stores the model components, including the defined states, the transitions between states, and the probabilities associated with each transition.*

**Project**-the level of organization that contains information such as disturbance (e.g., wind or fire) and state (e.g., early and late) types used in the model. In our bread recipe analogy you might decide to have “pan” and “flat” recipes organized separately. In SyncroSim you might decide to have “coniferous” and “deciduous” projects. In our classroom work we use one project.

***Project:*** *The container where the components for the modeling project are stored. A project may include different types of disturbances, state types, ecosystems or species; each project holds its own set of assumptions, scenarios and configurations for a particular modeling exercise. In this classroom setting, one project is used to keep the focus on learning the principles of state and transition modeling.*

**Scenario**-the level of organization where most work is completed, and on which the actual “running of the model” happens (and where outputs are created). With our bread analogy this is where the actual amounts of ingredients are set, how much kneading (if any) is defined, etc., and where the actual mixing and baking is done. What is fun about our modeling is that you can easily create new scenarios and try out different ‘ingredients’ so to speak quickly.

***Scenario:*** *The unique “location” where the models are built, run and modified. Within each scenario, model parameters can be adjusted to simulate different possible futures. Model outputs are created following each run and can be used to inform scenario adjustments.*

## Specific model definitions

**State class**. For organization, tracking and understanding we break up an ecosystem into developmental stages (e.g., early, mid, late). In the field states might be different from each other in terms of vegetation height, vegetation cover and or species composition. In SyncroSim they are defined by start and end timesteps (see below). The modeler has the ability to further label states not only by timesteps, but also with terms such as “early” and “open”. In a human analogy, states might include “toddler” and “mature”.

***State class****: A practical tool in Syncrosim to monitor, sort and track the development stages of an ecosystem (early, mid, late). It sets the growth timeline of an ecosystem using start and end points, Students can interactively experiment with these stages and timelines, providing an adaptable model for ecosystem development.*

**Start and end time steps**: basically the beginning and end ages of a state class. More technically, the age of the model at which an acre will become a state, and when it will end being that state. In a human analogy, “teenager” might be a state, with a start age of 13, and an end age of 19.

***Start and end time steps****: The duration over which the state of a system or ecosystem is observed or predicted. During the time span the model simulates how the forest transitions through various states based on probabilities, simulated disturbances and other factors.*

**Transition**: an event that triggers an acre moving from one state to another (or changing age within a state-more on that below) such as fire or flooding that might cause an acre of closed canopy forest to become open canopy forest. With a human later on in the ‘middle age’ state obtaining a new and better job will not change the state they are in, but it could invigorate and functionally make them feel more like they were at the beginning of the middle age state.

***Transition****: A shift of a system or ecosystem from one state to another over time due to natural processes, disturbances, or human interventions. For example, a closed canopy forest may transition to an open canopy forest due to flooding or fire, creating a new system “state”*

**Probability**: in SyncroSim this would be the odds of a certain transition happening within a timestep (defined as a year in our work). In ecology we typically do not think in terms of probabilities, but rather in terms of ‘return intervals’, or the amount of time that typically passes between events such as hurricanes. For SyncroSim we can convert return intervals into probabilities by dividing 1 by the return interval. For example if you predict a 25 yr return interval for grazing you would do this math to get the probability:

1/25 = 0.04

***Probability:*** *The likelihood of a certain transition happening within a timestep (1 timestep = 1 year).*

## **State labels**

The user can define state labels for tracking and documentation. In the following screenshot we see labels such as “Mid2” and “CLS”. For LANDFIRE these terms were variable from ecosystem to ecosystem. For example, the “Early1” class might last from 0-5 years in one ecosystem, or from 0-20 years in another. It is all based on what the modeler thought was appropriate. SImilarly, “OPN”, “CLS” and “ALL” are user defined. OPN (or ‘open’) might mean -20% canopy closure in one ecosystem, and 0-50% in another. These specifics for LANDFIRE are defined in the Biophysical Settings Model Descriptions.

***State labels:*** *User-defined state labels are simply the names or identifiers given to the various states that a system or ecosystem can be in. For example an early successional forested ecosystem state might be labeled as “Early1”*

