# **Crop Stage Model** – Crop Specification Language

## Basic Structure

Crop models are specified in an XML-based language syntax. Crops are defined using a <crop> tag. Any number of crops can be defined: The must be nested within the <crops> which in turn must be nested inside the <farm\_model> tag.

For example:

<farm\_model …

<crops>

<crop name="Potato" id ="177" code="PT" >

<stage name ="Preplant">

<do name="Update Crop Age" action="CROPAGE=CROPAGE+1" when="DOY = 1" />

<crop\_event id="101" name="Yield Failure" yrf="1.0" when="DOY=DEC1"/>

<transition to="Planted" when="DOY >= APR15 and PDAYS > 155" />

</stage>

<stage name="Planted">

<transition to="Harvested" when="PDAYS>900" />

<transition to="Preplant" when="DOY=DEC31" />

</stage>

<stage name="Harvested">

<transition to="Preplant" when="DOY=365" />

</stage>

</crop>

</crops>

**<crop> Attributes:**

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| --- | --- | --- |
| Attribute | Definition | Notes |
| name | Name of the crop |  |
| id | LULC\_B code of the crop in questions |  |
| code | Two letter code for this crop |  |
| root | Path to CSV file contain root coefficients for this crop | Only needed when VSMB enabled |
| yrf\_threshold | Crop-specific yield reduction factor (0-1) | Optional, overrides global setting |

Crops are defined using growth stages. Any number of growth stages can be defined. Crop stages are defines with a <stage> XML tag, nested within the <crop>. Each stage is characterized by: 1) actions that should be executed during the growth stage (typically updating an IDU database field), 2) crop events that indicate important events during the growth stage that fire when specific conditions are met, and can return a yield reduction factor for the event, and 3) transitions that indicate the crop should move to a new growth stage when specified conditions are met. These are defined with their own tags as follows

**<do> - Specifying Actions to Update an IDU field**

These are actions that typically update and IDU field. They are specified with a “when” condition that indicates when the actions ‘fires’, and an “action” that specifies an IDU field to update and an expression that is used to update the field, e.g.

<do name="Update Crop Age" action="CROPAGE=CROPAGE+1" when="DOY = 1" />

In this action, the IDU field [CROPAGE] is incremented by one whenever the query DOY=1 is satisfied during the specified growth stage. ***action*** expressions are of the form ***IDU Field={expr}***, where {expr} is any legal Envision map expression – see <http://envision.bee.oregonstate.edu/Guides/MathExprLanguage.aspx> for details. The ***when*** query indicates the conditions that trigger the ‘firing’ of an action. Note that the Envision Query Language has been extended to support the additional (reserved) keywords defined below. These keyword evaluate to the current content, meaning the current day of year and idu upon which the crop is planted. Any number of <do> tags can be defined for a given growth <stage>.

**<crop\_events> - Specifying Significant Crop Events**

These are events occurring during the crop <stage>, typically adverse events that may cause some specified yield reduction, when some condition is met, e.g.

<crop\_event

name="Yield Failure"

yrf="0.25"

when="DOY>JUN13"

action="CROPAGE=CROPAGE+1" />

***yrf*** is a yield reduction factor associated with the event, which is cumulative over the annual life cycle of crop, and indicates the fraction by which the crop yields should be reduced by when this event is triggered. The ***when*** query indicates the conditions that trigger the ‘firing’ of a crop event, and is any valid Envision query, see <http://envision.bee.oregonstate.edu/Guides/QueryLanguage.aspx> for details. The ***action*** keyword is optional, but if includes allow the triggering of the event to also update an IDU column, similar to a **<do>** statement (see above). Note that the Envision Query Language has been extended to support the additional (reserved) keywords defined below. These keyword evaluate to the current content, meaning the current day of year and idu upon which the crop is planted. Any number of <crop\_event> tags can be defined for a given growth <stage>.

**<transition> - Specifying Transition to a Different Crop Stage**

Transitions indicate when a crop moves from one growth stage to another, defined by a “to” attribute indicating one of the other growth stages for this crop, and a “when” query that indicates the conditions that trigger the transition to occur, e.g.

<transition

to="Active Growth"

when="DOY>CRITDATE and Avg(TMEAN,5)>20"

action="CROPAGE=CROPAGE+1" />

***to*** is the growth stage to transition to; it MUST be defined elsewhere within the scope of the same crop. The ***when*** query indicates the conditions that trigger the ‘firing’ of a crop event, and is any valid Envision query, see <http://envision.bee.oregonstate.edu/Guides/QueryLanguage.aspx> for details. The ***action*** keyword is optional, but if includes allow the triggering of the event to also update an IDU column, similar to a **<do>** statement (see above). Note that the Envision Query Language has been extended to support the additional (reserved) keywords defined below. These keyword evaluate to the current content, meaning the current day of year and idu upon which the crop is planted. Any number of <transition> tags can be defined for a given growth <stage>.

## Envision Query Language Extensions - Reserved Keywords

These apply to the current IDU at the current time. Note that they are CASE-SENSITIVE

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| --- | --- | --- |
| Keyword | Description | Units |
| DOY1 | Day of Year (1-based) | Day of year |
| PDAYS | Potato Days |  |
| PRECIP | Current Precipitation for the current day |  |
| HPRECIP | Historic Precipitation for the current day |  |
| GDD0 | Growing Degree Days (0°C base, starting Jan 1) | °C-days |
| GDD0APR15 | Growing Degree Days (0°C base, starting Apr 15) | °C-days |
| GDD5APR1 | Growing Degree Days (5°C base, starting Apr 15) | °C-days |
| GDD5MAY1 | Growing Degree Days (5°C base, starting May 1) | °C-days |
| CHUMAY1 | Corn Heat Units (starting May 1) |  |
| TMIN | Daily Minimum Temperature | °C |
| TMAX | Daily Maximum Temperature | °C |
| TMEAN | Daily Mean Temperature | °C |
| PET | Potential Evapotranspiration ( |  |
| pAWC | Percent Average Water Content | (0-100) |
| pSAT | Percent Saturation |  |
| SWC | Average Soil Water Content |  |
| SWE | Snow Water Equivalent |  |

1DOY values can be integer days or MMMDD value, e.g. JAN1 (1), DEC31 (365)

## Envision Query Language Extensions - Functions

The Envision Query Language has been extended with three functions:

* Avg(*keyword*,*n*) – returns the **average** over the prior “n” days of the keyword variable specified. See keyword table below.
* AbovePeriod(keyword,threshold)- returns the length of time, in days, for which the specified keyword variable was **above** the specified threshold value in the period prior to the current time. See keyword table below.
* BelowPeriod(keyword,threhold)- returns the length of time, in days, for which the specified keyword variable was **below** the specified threshold value in the period prior to the current time. See keyword table below.
* DOYFromCHU(chu,0) – returns the day of year a particular Corn Heat Unit (chu) is met for the current year and IDU.

|  |  |
| --- | --- |
| Keyword | Definition |
| PRECIP | Returns average Precipitation over the past ‘n’ days |
| HPRECIP | Returns average Historic Precipitation over the past ‘n’ days |
| TMIN | Returns average Minimum Daily Temperature over the past ‘n’ days |
| TMAX | Returns average Maximum Daily Temperature over the past ‘n’ days |
| TMEAN | Returns average Mean Daily Temperature over the past ‘n’ days |

E.g. <transition to="Active Growth" when="Avg(PRECIP,5) &lt; 0.2" />