



## 1 AGPWhiteClover

### Properties (Outputs)

Name	Units	Type	Settable?
AboveGround	g/m2	Get above ground biomass	False
AboveGroundDeadN	kg/ha	Amount of N in dead tissues above ground (kgN/ha).	False

Name	Units	Type	Settable?
AboveGroundDeadWt	kg/ha	Dry matter weight of dead tissues above ground (kgDM/ha).	False
AboveGroundHarvestable	g/m2	Get above ground biomass	False
AboveGroundLiveN	kg/ha	Amount of N in live tissues above ground (kgN/ha).	False

Name	Units	Type	Settable?
AboveGroundLiveWt	kg/ha	Dry matter weight of live tissues above ground (kgDM/ha).	False
AboveGroundN	kg/ha	Amount of N in the plant above ground (kgN/ha).	False

Name	Units	Type	Settable?
AboveGroundNConc	kg/kg	Average N concentration in the plant above ground (kgN/kgDM).	False
AboveGroundOrgans		AboveList< <a href="#">PastureAboveGroundOrgan</a> > ground organs.	True
AboveGroundWt	kg/ha	Dry matter weight of the plant above ground (kgDM/ha).	False

Name	Units	Type	Settable?
Albedo	0-1	Canopy double albedo, fraction of sun light reflected (0-1).	True
BasePotentialPhotosynthesisC	kg/ha	Base potential photosynthetic rate, before damages, in carbon equivalent (kgC/ha).	False

Name	Units	Type	Settable?
BelowGroundLiveN	kg/ha	Amount of N in live tissues below ground (kgN/ha).	False
BelowGroundLiveWt	kg/ha	Dry matter weight of live tissues below ground (kgDM/ha).	False

Name	Units	Type	Settable?
BelowGroundN	kg/ha	Amount of N in the plant below ground (kgN/ha).	double False
BelowGroundWt	kg/ha	Dry matter weight of the plant below ground (kgDM/ha).	double False
CanopyType		Canopy type identifier.	String True

Name	Units	Type	Settable?
CO2EffectExponent	-	Exponent controlling the CO2 effect on N requirements (>0.0).	True
CO2EffectMinimum	0-1	Minimum value for the CO2 effect on N requirements (0-1).	True



Name	Units	Type	Settable?
CO2EffectOffsetFactor	ppm	Scaling double parameter for the CO2 effects on N requirements (ppm).	True
CO2EffectScaleFactor	ppm	Scaling double parameter for the CO2 effect on photosynthesis (ppm).	True

Name	Units	Type	Settable?
ColdFullTemperature	oC	Temperature for full cold effect on photosynthesis, growth stops (oC).	True
ColdOnsetTemperature	oC	Onset double temperature for cold effects on photosynthesis (oC).	True

Name	Units	Type	Settable?
ColdRecoverySumDD	oCd	Cumulative degrees for recovery from cold stress (oCd).	True
ColdRecoveryTReference	oC	Reference temperature for recovery from cold stress (oC).	True

Name	Units	Type	Settable?
CoverDead	0-1	Fraction of soil covered by dead tissues (0-1).	False
CoverGreen	0-1	Plant's green cover (0-1).	False
CoverTotal	0-1	Plant's total cover (0-1).	False

Name	Units	Type	Settable?
CultivarNames		List of cultivar names (not used by AgPasture).	String False
DeadTissue		Dead tissues from all above ground organs.	<a href="#">TissuesHelper</a> True
DefoliatedDigestibility		Digestibility of defoliated material (0-1).	False

Name	Units	Type	Settable?
DefoliationFactorTurnover	0-1	Defoliation factor for tissue turnover (0-1).	False
DegreesDayForGermination	oCd	Cumulative degrees-day needed for seed germination (oCd).	True
DemandAtLuxuryN	kg/ha	Amount of N required with luxury uptake (kgN/ha).	False

Name	Units	Type	Settable?
DemandAtOptimumN	kg/ha	Amount of N required for optimum growth (kgN/ha).	False
Depth	mm	Average canopy depth (mm).	False
DetachmentDroughtCoefficient	-	Coefficient controlling detachment rate as function of moisture (>0.0).	True

Name	Units	Type	Settable?
DetachmentDroughtEffectMin	0-1	Minimum effect of drought on detachment rate (0-1).	True
DetachmentRefRateShoot	0-1	Reference daily detachment rate for dead tissues (0-1).	True



Name	Units	Type	Settable?
DevelopingTissue		Developing TissuesHelper tissues from all above ground organs.	True
DigestibilityFactorShootDetachment		Digestibility factor for shoot tissue detachment (0- 1).	False
EmergingTissue		Emerging TissuesHelper tissues from all above ground organs.	True

Name	Units	Type	Settable?
FixedN	kg/ha	Amount of atmospheric N fixed by symbiosis (kgN/ha).	False
FractionGrowthToLeaf	0-1	Fraction of new shoot growth allocated to leaves (0-1).	False

Name	Units	Type	Settable?
FractionGrowthToRoot	0-1	Fraction of new growth allocated to roots (0-1).	False
FractionGrowthToShoot	0-1	Fraction of new growth allocated to shoot (0-1).	False

Name	Units	Type	Settable?
FractionLeafDMFactor	kg/ha	Shoot DM when allocation to leaves is midway maximum and minimum (kgDM/ha).	True

Name	Units	Type	Settable?
FractionLeafDMThreshold	kg/ha	Shoot DM at which allocation of new growth to leaves start to decrease (kgDM/ha).	True

Name	Units	Type	Settable?
FractionLeafExponent	0.0	Exponent of the function controlling the DM allocation to leaves (>0.0).	True
FractionLeafMaximum	0-1	Maximum target allocation of new growth to leaves (0-1).	True

Name	Units	Type	Settable?
FractionLeafMinimum	0-1	Minimum target allocation of new growth to leaves (0- 1).	True
FractionPAR	0-1	Fraction of radiation that is photosynthetically active (0- 1).	True

Name	Units	Type	Settable?
FractionToStolon	0-1	Fraction of new shoot growth to be allocated to stolons (0-1).	True
FRGR	0-1	Plant growth limiting factor, supplied to MicroClimate for calculating potential transpiration.	False



Name	Units	Type	Settable?
FVPD	0-1	Effect of vapour pressure on growth (used by micromet) (0-1).	False
GlfCO2	0-1	Growth limiting factor due to variations in atmospheric CO2 (0-1).	False

Name	Units	Type	Settable?
GlfColdDamage	0-1	Growth limiting factor due to cold damage stress (0-1).	False

Name	Units	Type	Settable?
GlfGeneric	0-1	<p data-bbox="566 140 725 164">Generic double</p> <p data-bbox="566 204 647 228">growth</p> <p data-bbox="566 268 651 292">limiting</p> <p data-bbox="566 331 636 355">factor</p> <p data-bbox="566 395 613 419">that</p> <p data-bbox="566 459 696 483">represents</p> <p data-bbox="566 523 595 547">an</p> <p data-bbox="566 587 667 611">arbitrary</p> <p data-bbox="566 651 674 675">limitation</p> <p data-bbox="566 715 591 738">to</p> <p data-bbox="566 778 669 802">potential</p> <p data-bbox="566 842 647 866">growth</p> <p data-bbox="566 906 602 930">(0-</p> <p data-bbox="566 970 602 994">1).</p> <p data-bbox="566 1034 618 1058">This</p> <p data-bbox="566 1098 636 1121">factor</p> <p data-bbox="566 1161 607 1185">can</p> <p data-bbox="566 1225 595 1249">be</p> <p data-bbox="566 1289 624 1313">used</p> <p data-bbox="566 1353 591 1377">to</p> <p data-bbox="566 1417 669 1441">describe</p> <p data-bbox="566 1481 607 1505">the</p> <p data-bbox="566 1544 647 1568">effects</p> <p data-bbox="566 1600 591 1596">of</p> <p data-bbox="566 1664 647 1596">drivers</p>	True

Name	Units	Type	Settable?
GlfHeatDamage	0-1	Growth limiting factor due to heat damage stress (0-1).	False
GlfNContent	0-1	Growth limiting factor due to variations in plant N concentration (0-1).	False

Name	Units	Type	Settable?
GlfNSupply	0-1	Growth limiting factor due to soil N availability (0-1).	False
GlfRadnIntercept	0-1	Growth limiting factor due to variations in intercepted radiation (0-1).	False

Name	Units	Type	Settable?
GlfSoilFertility	0-1	Generic double growth limiting factor that represents an arbitrary soil limitation (0- 1). This factor can be used to describe the effect of limitation in nutrients	True

Name	Units	Type	Settable?
GlfTemperature	0-1	Growth limiting factor due to variations in air temperature (0-1).	False
GlfWaterLogging	0-1	Growth limiting factor due to water logging (0-1).	False

Name	Units	Type	Settable?
GlfWaterSupply	0-1	Growth limiting factor due to water deficit (0-1).	False
GPP	kg/ha	Gross primary productivity (kgC/ha).	False
GrossPotentialGrowthWt	kg/ha	Gross potential growth rate (kgDM/ha).	False



Name	Units	Type	Settable?
GrossPotentialPhotosynthesisC	kg/ha	Gross potential photosynthetic rate, after considering damages, in carbon equivalent (kgC/ha).	False
GrowthRespirationCoefficient	0-1	Growth respiration coefficient (0-1).	True

Name	Units	Type	Settable?
GrowthTEffectExponent	-	Curve double parameter for growth response to temperature (>0.0).	True
GrowthTminimum	oC	Minimum double temperature for growth (oC).	True
GrowthToptimum	oC	Optimum double temperature for growth (oC).	True
Gsmax	m/s	Maximum double stomatal conductance (m/s).	True

Name	Units	Type	Settable?
Harvestable		Dry <a href="#">AGPBiomass</a> matter and N available for harvesting (kgDM/ha).	False
HarvestableDead		Dead <a href="#">AGPBiomass</a> dry matter and N available for harvesting.	False

Name	Units	Type	Settable?
HarvestableLive		Live dry matter and N available for harvesting. <a href="#">AGPBiomass</a>	False
HarvestedDigestibility	0-1	Average digestibility of harvested material (0-1).	False

Name	Units	Type	Settable?
HarvestedFraction	0-1	Fraction of aboveground dry matter actually harvested (0-1).	False
HarvestedME	MJ/kg	Average metabolisable energy concentration of harvested material (MJ/kgDM).	False

Name	Units	Type	Settable?
HarvestedN	kg/ha	Amount of N removed by harvest (kg/ha).	False
HarvestedNConc	kg/kg	Average N concentration in harvested material (kgN/kgDM).	False

Name	Units	Type	Settable?
HarvestedWt	kg/ha	Amount of plant dry matter removed by harvest (kgDM/ha).	False
HeatFullTemperature	oC	Temperature for full heat effect on photosynthesis, growth stops (oC).	True

Name	Units	Type	Settable?
HeatOnsetTemperature	oC	Onset double temperature for heat effects on photosynthesis (oC).	True
HeatRecoverySumDD	oCd	Cumulative degrees-day for recovery from heat stress (oCd).	True



Name	Units	Type	Settable?
HeatRecoveryTReference	oC	Reference double temperature for recovery from heat stress (oC).	True
Height	mm	Average double canopy height (mm).	False
HerbageGrowthWt	kg/ha	Net double herbage growth rate (above ground) (kgDM/ha).	False

Name	Units	Type	Settable?
initialDMFractionsForbs		Initial double fractions of DM for each plant part in forbs (0-1).	True

Name	Units	Type	Settable?
initialDMFractionsGrasses		Initial double fractions of DM for each plant part in grasses (0-1).	True

Name	Units	Type	Settable?
initialDMFractionsLegumes		Initial double fractions of DM for each plant part in legumes (0-1).	True
InitialRootDepth	mm	Initial double rooting depth (mm).	True
InitialRootDM	kgDM/ha	Initial double below ground DM weight (kgDM/ha).	True

Name	Units	Type	Settable?
InitialShootDM	kgDM/ha	Initial above ground DM weight (kgDM/ha).	True
InterceptedRadn	MJ/m <sup>2</sup> /day	Radiation intercepted by the plant's canopy (MJ/m <sup>2</sup> /day).	True
IsAlive	true/false	Flag signalling whether plant is alive (true/false).	False

Name	Units	Type	Settable?
IsC4		Flag boolean indicating whether the biomass is from a c4 plant or not	False
IsReadyForHarvesting		Flag boolean whether the crop is ready for harvesting.	False

Name	Units	Type	Settable?
LAI	m <sup>2</sup> /m <sup>2</sup>	Leaf Area Index of live tissues (m <sup>2</sup> /m <sup>2</sup> ).	True
LAIDead	m <sup>2</sup> /m <sup>2</sup>	Leaf Area Index of dead tissues (m <sup>2</sup> /m <sup>2</sup> ).	False

Name	Units	Type	Settable?
LAIGreen	m <sup>2</sup> /m <sup>2</sup>	Leaf Area Index of green tissues (m <sup>2</sup> /m <sup>2</sup> ).	True
LAITotal	m <sup>2</sup> /m <sup>2</sup>	Leaf Area Index of whole canopy, live + dead tissues (m <sup>2</sup> /m <sup>2</sup> ).	False



Name	Units	Type	Settable?
Leaf		Holds info about state of leaves (DM and N). <a href="#">PastureAboveGroundOrgan</a>	True
LeafDeadN	kg/ha	Amount of N in dead leaves (kgN/ha).	False

Name	Units	Type	Settable?
LeafDeadWt	kg/ha	Dry matter weight of dead leaves (kgDM/ha).	double False
LeafLiveN	kg/ha	Amount of N in live leaves (kgN/ha).	double False
LeafLiveWt	kg/ha	Dry matter weight of live leaves (kgDM/ha).	double False

Name	Units	Type	Settable?
LeafN	kg/ha	Amount of N in the plant's leaves (kgN/ha).	False
LeafNConc	kg/kg	Average N concentration in plant's leaves (kgN/kgDM).	False
LeafNumberFactorTurnover	0-1	Leaf Number factor for tissue turnover (0-1).	False

Name	Units	Type	Settable?
LeafWt	kg/ha	Dry matter weight of plant's leaves (kgDM/ha).	False
LightExtinctionCoefficient	0-1	Light extinction coefficient (0-1).	True

Name	Units	Type	Settable?
LightProfile		Light CanopyEnergyBalanceInterceptio... profile for this plant, interception calculated by MicroClimate (W/m <sup>^</sup> 2). This contains the intercepted radiation for each layer of the canopy.	True

Name	Units	Type	Settable?
LitterDepositionN	kg/ha	Amount of N in detached dead material deposited onto soil surface (kgN/ha).	False

Name	Units	Type	Settable?
LitterDepositionWt	kg/ha	Dry double matter weight of detached dead material deposited onto soil surface (kgDM/ha).	False
LiveLeavesPerTiller	-	Number of live leaves per tiller (- ).	True

Name	Units	Type	Settable?
MaintenanceRespirationCoefficient	Percent	Maintenance respiration coefficient (0-1).	True
Material		A list of material (biomass) that can be damaged.	False
MatureTissue		Mature tissues from all above ground organs.	True



Name	Units	Type	Settable?
MaximumNFixation	0-1	Maximum fraction of N demand supplied by biologic N fixation (0-1).	True
MaxRootAllocation	0-1	Maximum fraction of DM growth allocated to roots (0-1).	True

Name	Units	Type	Settable?
MaxStemEffectOnLAI	0-1	Maximum fraction of stem tissue used when computing green LAI (0-1).	True
MinimumGreenLeafProp	0-1	Leaf proportion in the minimum green Wt (0-1).	True

Name	Units	Type	Settable?
MinimumGreenRootProp	0-1	Minimum double root amount relative to minimum green Wt (>0.0).	True
MinimumGreenWt	kg/ha	Minimum double above ground green DM, leaf and stems (kgDM/ha).	True

Name	Units	Type	Settable?
MinimumNFixation	0-1	Minimum double fraction of N demand supplied by biologic N fixation (0-1).	True

Name	Units	Type	Settable?
MinimumWaterFreePorosity	0-1	Minimum double water-free pore space for growth with no limitations (0-1). A negative value indicates that porosity at DUL will be used.	True

Name	Units	Type	Settable?
MoistureFactorRootTurnover	0-1	Moisture factor for root tissue turnover (0-1).	False
MoistureFactorShootDetachment	0-1	Moisture factor for shoot tissue detachment (0-1).	False
MoistureFactorShootTurnover	0-1	Moisture factor for shoot tissue turnover (0-1).	False

Name	Units	Type	Settable?
NAPP	kg/ha	Net above-ground primary productivity (kgC/ha).	False
NBPP	kg/ha	Net below-ground primary productivity (kgC/ha).	False

Name	Units	Type	Settable?
NDilutionCoefficient	-	Exponential to modify the effect of N deficiency on plant growth (>1.0).	True
NetGrowthN	kg/ha	Amount of N in new growth (kgN/ha).	False



Name	Units	Type	Settable?
NetGrowthWt	kg/ha	Net, or actual, plant growth rate (kgDM/ha).	False
NetPotentialGrowthAfterNutrientStress	kg/ha	Net potential growth rate after nutrient stress (kgDM/ha).	False

Name	Units	Type	Settable?
NetPotentialGrowthAfterWaterWt	kg/ha	Net potential growth rate after water stress (kgDM/ha).	False
NetPotentialGrowthWt	kg/ha	Net potential growth rate, after respiration (kgDM/ha).	False

Name	Units	Type	Settable?
NFixationCostC	kg/ha	N fixation costs expressed in carbon equivalent (kgC/ha).	double False
NitrogenUptake		Amount of nitrogen taken up (kg/ha).	double False
NPP	kg/ha	Net primary productivity (kgC/ha).	double False

Name	Units	Type	Settable?
Organs		List of organs that can be damaged. IOrganDamage	False
PhotosynthesisCurveFactor	J/kg/s	Photosynthesis curvature parameter (J/kg/s).	True
PhotosyntheticEfficiency	mg CO <sub>2</sub> /J	Leaf double photosynthetic efficiency (mg CO <sub>2</sub> /J).	True

Name	Units	Type	Settable?
PhotosyntheticPathway		SpeciesPhotosynthesisPathwayType metabolic pathway of C fixation during photosynthesis (C3/C4).	True
PlantHeightExponent	1.0	Exponent controlling shoot height as function of DM weight (>1.0).	True

Name	Units	Type	Settable?
PlantHeightMassForMax	kg/ha	DM weight above ground for maximum plant height (kgDM/ha).	True
PlantHeightMaximum	mm	Maximum plant height (mm).	True
PlantHeightMinimum	mm	Minimum plant height (mm).	True

Name	Units	Type	Settable?
PlantStatus	-	Flag signalling the plant status (dead, alive, etc.).	False

Name	Units	Type	Settable?
PlantType		Flag String indicating the type of plant (currently the name of the species) This used to be a marker for 'how leguminous' a plant was	True



Name	Units	Type	Settable?
Population		Plant population. double	False
PotentialEP	mm	Potential evapotranspiration, as calculated by MicroClimate (mm). double	True
PreferenceForGreenOverDead	-	Relative preference for live over dead material during graze (>0.0). double	True

Name	Units	Type	Settable?
PreferenceForLeafOverStems	-	Relative preference for leaf over stem-stolon material during graze (>0.0).	True
R50	W/m <sup>2</sup>	Solar radiation at which stomatal conductance decreases to 50% (W/m <sup>2</sup> ).	True

Name	Units	Type	Settable?
RadiationTopOfCanopy	MJ/m <sup>2</sup> /day	Radiation on top of the plant's canopy (MJ/m <sup>2</sup> /day).	True
ReferenceCO2	ppm	Reference CO2 concentration for photosynthesis (ppm).	True

Name	Units	Type	Settable?
ReferencePhotosyntheticRate	mg/m <sup>2</sup> /s	Reference leaf CO2 assimilation rate for photosynthesis (mg CO2/m <sup>2</sup> Leaf/s).	True
RelativeTurnoverEmerging	-	Relative turnover rate for emerging tissues (>0.0).	True

Name	Units	Type	Settable?
RemobilisableLuxuryN	kg/ha	Amount of luxury N potentially remobilisable (kgN/ha).	False
RemobilisableSenescedN	kg/ha	Amount of senesced N potentially remobilisable (kgN/ha).	False
RemobilisedLuxuryN	kg/ha	Amount of luxury N actually remobilised (kgN/ha).	False

Name	Units	Type	Settable?
RemobilisedSenescedC	kg/ha	Remobilised carbon from senesced tissues (kgC/ha).	False
RemobilisedSenescedN	kg/ha	Amount of senesced N actually remobilised (kgN/ha).	False

Name	Units	Type	Settable?
ReproSeasonAllocationCoeff	-	Coefficient controlling the increase in shoot allocation during reproductive growth as function of latitude (- ).	True

Name	Units	Type	Settable?
ReproSeasonDurationCoeff	-	Coefficient controlling the duration of the reproductive season as function of latitude (- ).	True



Name	Units	Type	Settable?
ReproSeasonMaxAllocationIncrease		Maximum increase in Shoot- Root ratio during reproductive growth (0- 1).	True

Name	Units	Type	Settable?
ReproSeasonOnsetDurationFactor	None	Proportion of the onset phase of shoulder period with reproductive growth effect (0-1).	True
ReproSeasonReferenceLatitude	degrees	Reference latitude determining timing for reproductive season (degrees).	True

Name	Units	Type	Settable?
ReproSeasonShouldersLength	Factor	Ratio double  between the length of shoulders and the period with full reproductive growth effect  (- ).	True

Name	Units	Type	Settable?
ReproSeasonTimingCoeff	-	Coefficient controlling the time to start the reproductive season as function of latitude (- ).	True

Name	Units	Type	Settable?
RespirationExponent	-	Exponent controlling the effect of temperature on respiration (>1.0).	True
RespirationLossC	kg/ha	Respiration costs expressed in carbon equivalent (kgC/ha).	False
RespirationTReference	oC	Reference temperature for maintenance respiration (oC).	True

Name	Units	Type	Settable?
Root		Root organ of this plant. <a href="#">PastureBelowGroundOrgan</a>	False
RootDepth	mm	Average depth of root zone (mm).	False

Name	Units	Type	Settable?
RootDetachedN	kg/ha	Amount of N in detached dead roots added to soil FOM (kgN/ha).	False

Name	Units	Type	Settable?
RootDetachedWt	kg/ha	Dry matter weight of detached dead roots added to soil FOM (kgDM/ha).	False
RootFrontier	-	Soil layer at bottom of root zone ().	False



Name	Units	Type	Settable?
RootGrowthWt	kg/ha	Net root growth rate (kgDM/ha).	False
RootN	kg/ha	Amount of N in the plant's roots (kgN/ha).	False
RootNConc	kg/kg	Average N concentration in plant's roots (kgN/kgDM).	False

Name	Units	Type	Settable?
RootWt	kg/ha	Dry matter weight of plant's roots (kgDM/ha).	False
RootWtFraction	-	Proportion of root biomass in each soil layer (0-1).	False

Name	Units	Type	Settable?
ShootMaxEffectOnLAI	kg/ha	Maximum aboveground biomass for considering stems when computing LAI (kgDM/ha).	True
ShootRootGlfFactor	0-1	Maximum effect that soil GLFs have on Shoot-Root ratio (0-1).	True

Name	Units	Type	Settable?
SoilAvailableN	kg/ha	Amount of plant available N in the soil (kgN/ha).	False
SoilDemandN	kg/ha	Amount of N demanded from the soil (kgN/ha).	False

Name	Units	Type	Settable?
SoilNH4Available	kg/ha	Amount of plant available NH4-N in each soil layer (kgN/ha).	False
SoilNH4Uptake	kg/ha	Amount of NH4-N taken up from each soil layer (kgN/ha).	False

Name	Units	Type	Settable?
SoilNO3Available	kg/ha	Amount of plant available NO3-N in each soil layer (kgN/ha).	False
SoilNO3Uptake	kg/ha	Amount of NO3-N taken up from each soil layer (kgN/ha).	False

Name	Units	Type	Settable?
SoilSaturationEffectMax	0-1	Maximum reduction in plant growth due to water logging (saturated soil) (0-1).	True
SoilSaturationRecoveryFactor	0-1	Maximum daily recovery rate from water logging (0-1).	True

Name	Units	Type	Settable?
SoilUptakeN	kg/ha	Amount of N taken up from the soil (kgN/ha).	False
SpeciesFamily	-	Family type for this plant species (grass/legume/forb).	True
SpecificLeafArea	m <sup>2</sup> /kg	Specific leaf area (m <sup>2</sup> /kgDM).	True



Name	Units	Type	Settable?
Stage	-	Index for the plant development stage. 0 = germinating, 1 = vegetative, 2 = reproductive, negative for dormant/not sown.	False

Name	Units	Type	Settable?
Standing		Standing dry matter and N (kgDM/ha). AGPBiomass	False
StandingDead		Standing dead dry matter and N (kgDM/ha). AGPBiomass	False
StandingLive		Standing live dry matter and N (kgDM/ha). AGPBiomass	False

Name	Units	Type	Settable?
Stem		Holds info about state of sheath/stems (DM and N). <a href="#">PastureAboveGroundOrgan</a>	True
StemDeadN	kg/ha	Amount of N in dead stems and sheath (kgN/ha). double	False

Name	Units	Type	Settable?
StemDeadWt	kg/ha	Dry matter weight of dead stems and sheath (kgDM/ha).	double False
StemLiveN	kg/ha	Amount of N in live stems and sheath (kgN/ha).	double False

Name	Units	Type	Settable?
StemLiveWt	kg/ha	Dry matter weight of alive stems and sheath (kgDM/ha).	False
StemN	kg/ha	Amount of N in the plant's stems and sheath (kgN/ha).	False

Name	Units	Type	Settable?
StemNConc	kg/kg	Average N concentration in plant's stems (kgN/kgDM).	False
StemWt	kg/ha	Dry matter weight of plant's stems and sheath (kgDM/ha).	False

Name	Units	Type	Settable?
Stolon		Holds <a href="#">PastureAboveGroundOrgan</a> info about state of stolons (DM and N).	True
StolonEffectOnLAI	0-1	Fraction of stolon tissue used when computing green LAI (0- 1).	True

Name	Units	Type	Settable?
StolonN	kg/ha	Amount of N in the plant's stolons (kgN/ha).	False
StolonNConc	kg/kg	Average N concentration in plant's stolons (kgN/kgDM).	False
StolonWt	kg/ha	Dry matter weight of plant's stolons (kgDM/ha).	False



Name	Units	Type	Settable?
TargetShootRootRatio	-	Target or ideal, shoot- root ratio (>0.0).	True
TemperatureFactorRespiration	0-1	Temperature factor for respiration (0- 1).	False
TemperatureFactorTurnover	0-1	Temperature factor for tissue turnover (0- 1).	False

Name	Units	Type	Settable?
TissueTurnoverRefRateRoot	0-1	Referencable daily DM turnover rate for root tissues (0-1).	True

Name	Units	Type	Settable?
TissueTurnoverRefRateShoot	0-1	Referable daily DM turnover rate for shoot tissues (0-1). This is closely related to the leaf appearance rate.	True

Name	Units	Type	Settable?
TotalC	kg/ha	Total amount of C in the plant (kgC/ha).	double False
TotalN	kg/ha	Total amount of N in the plant (kgN/ha).	double False

Name	Units	Type	Settable?
TotalWt	kg/ha	Total dry matter weight of plant (kgDM/ha).	False

Name	Units	Type	Settable?
TurnoverDefoliationCoefficient	-	Coefficient of function increasing the turnover rate due to defoliation (>0.0). Controls the spread of the effect of time, the smaller the more spread	True

Name	Units	Type	Settable?
TurnoverDefoliationEffectMin	/day	Minimum double significant daily effect of defoliation on tissue turnover rate (0-1).	True

Name	Units	Type	Settable?
TurnoverDefoliationEffectOnRoots	0.1	Coefficient adjusting the effect of defoliation on root turnover rate (0- 1).	True



Name	Units	Type	Settable?
TurnoverDefoliationMultiplier	-	Coefficient of function increasing the turnover rate due to defoliation (>0.0). Converts the fraction of biomass removed into potential increase in turnover.	True

Name	Units	Type	Settable?
TurnoverDroughtEffectMax	-	Maximum increase in tissue turnover due to water deficit (>0.0).	True
TurnoverDroughtExponent	-	Exponent of function for the effect of GLFwater on tissue turnover (>1.0).	True

Name	Units	Type	Settable?
TurnoverDroughtThreshold	0-1	Minimum GLFwater without effect on tissue turnover (0-1).	True
TurnoverRateDeadShoot	0-1	Turnover rate for dead shoot tissues (leaves and stem) (0-1).	False

Name	Units	Type	Settable?
TurnoverRateLiveShoot	0-1	Turnover rate for live shoot tissues (leaves and stem) (0- 1).	False
TurnoverRateRoots	0-1	Turnover rate for roots tissues (0- 1).	False

Name	Units	Type	Settable?
TurnoverRateStolons	0-1	Turnover rate for stolon tissues (0-1).	False
TurnoverStockFactor	-	Factor increasing tissue turnover rate due to stock trampling (>0.0).	True

Name	Units	Type	Settable?
TurnoverTemperatureExponent	-	Exponent of function for temperature effect on tissue turnover (>0.0).	True
TurnoverTemperatureMin	oC	Minimum temperature for tissue turnover (oC).	True
TurnoverTemperatureRef	oC	Reference temperature for tissue turnover (oC).	True

Name	Units	Type	Settable?
UseColdStressFactor	yes/no	EnableYesNoAnswer photosynthesis reduction due to cold damage is enabled (yes/no).	True
UseHeatStressFactor	yes/no	EnableYesNoAnswer photosynthesis reduction due to heat damage (yes/no).	True

Name	Units	Type	Settable?
UseReproSeasonFactor	yes/no	Adjust YesNoAnswer Shoot:Root ratio to mimic DM allocation during reproductive season (perennial species)?.	True
WaterAvailable	mm	Amount of plant available water in each soil layer (mm).	False



Name	Units	Type	Settable?
WaterDemand	mm	Amount of water demanded by the plant (mm).	True
WaterUptake		Amount of soil water taken up (mm).	False
Width	mm	Average canopy width (mm).	False

#### Links (Dependencies)

Name	Type	IsOptional?
microClimate	MicroClimate	False

Name	Type	IsOptional?
myClock	Clock	False
myMetData	IWeather	False
mySummary	ISummary	False
roots	List< <a href="#">PastureBelowGroundOrgan</a> >	False
soilPhysical	IPhysical	False
waterBalance	ISoilWater	False
zone	Zone	False

#### Events published

Name	Type
BiomassRemoved	Void BiomassRemoved (BiomassRemovedType Data)

#### Methods (callable from manager)

Name	Description
AddZone	void AddZone(String zoneName, double rootDepth, double rootDM)  <i>Add a zone where roots are to grow.</i>
EndCrop	void EndCrop()
EvaluateDigestibility	void EvaluateDigestibility()
EvaluateLAI	void EvaluateLAI()
GetNitrogenUptakeEstimates	ZoneWaterAndN GetNitrogenUptakeEstimates(SoilState soilstate)  *Gets the potential plant N uptake for each layer (mm). The model can only handle one root zone at present.*
GetWaterUptakeEstimates	ZoneWaterAndN GetWaterUptakeEstimates(SoilState soilstate)  *Gets the potential plant water uptake for each layer (mm). The model can only handle one root zone at present.*

Name	Description
Harvest	void Harvest(boolean removeBiomassFromOrgans) <i>Harvests the crop.</i>
KillCrop	void KillCrop(double fractionToKill) <i>Kills a fraction of this plant.</i>
ReduceCanopy	void ReduceCanopy(double deltaLAI) <i>Set the plant leaf area index.</i>
ReducePopulation	void ReducePopulation()
RemoveBiomass	Biomass RemoveBiomass(String type, double amount)  *Removes plant material, from all organ, based on an amount given.  Can be used to simulate a grazing event, with preferences for different organs.*
RemoveBiomass	Biomass RemoveBiomass(double amountToRemove, boolean doOutput)  <i>Removes a given amount of biomass (DM and N) from the plant.</i>
Reset	void Reset()
SetActualNitrogenUptakes	void SetActualNitrogenUptakes(ZoneWaterAndN zones)
SetActualWaterUptake	void SetActualWaterUptake(ZoneWaterAndN zones)

Name	Description
Sow	<p>void Sow(String cultivar, double population, double depth, double rowSpacing, double maxCover, double budNumber, double rowConfig, double seeds, int32 tillering, double ftn)</p> <p>*Sows the plant.</p> <p>For AgPasture species the sow parameters are not used, the command to sow simply enables the plant to grow. This is done by setting the plant status to 'alive'. From this point germination processes takes place and eventually emergence occurs. At emergence, plant DM is set to its default minimum value, allocated according to EmergenceFractions and with optimum N concentration. Plant height and root depth are set to their minimum values.*</p>

## 2 PastureAboveGroundOrgan

Describes a generic above ground organ of a pasture species.

### Properties (Outputs)

Name	Description	Units	Type	Settable?
Dead	Dead biomass. Used by STOCK (g/m2).		Biomass	True
DeadDigestibility	Digestibility of dead biomass. Used by STOCK (g/m2).		double	True
DeadTissue	Dead aboveground organ tissue.		GenericTissue	True
DevelopingTissue	Developing aboveground organ tissue.		GenericTissue	True
DigestibilityDead	Average digestibility of dead biomass.	kg/kg	double	False
DigestibilityLive	Average digestibility of live biomass.	kg/kg	double	False

Name	Description	Units	Type	Settable?
DigestibilityTotal	Average digestibility of all biomass.	kg/kg	double	False
DMDead	Dry matter in the dead tissues (kg/ha).	kg/ha	double	False
DMDeadHarvestable	Dry matter in the dead tissues (kg/ha).	kg/ha	double	False
DMDetached	DM detached from this organ (kg/ha).		double	False
DMGrowth	DM added to this organ via growth (kg/ha).		double	False
DMLive	Dry matter in the live (green) tissues (kg/ha).	kg/ha	double	True
DMLiveHarvestable	Harvestable dry matter in the live (green) tissues (kg/ha).	kg/ha	double	False
DMRemoved	DM removed from this tissue (kg/ha).		double	False
DMSenesced	DM senescing from this organ (kg/ha).		double	False
DMTotal	Total dry matter in this organ (kg/ha).	kg/ha	double	False
DMTotalHarvestable	Total harvestable dry matter (kg/ha).	kg/ha	double	False
EmergingTissue	Emerging aboveground organ tissue.		<a href="#">GenericTissue</a>	True

Name	Description	Units	Type	Settable?
FractionRemoved	Fraction of DM removed from organ.	kg/kg	double	False
IsAboveGround	Flag indicating whether the biomass is above ground or not.		boolean	False
Live	Return live biomass. Used by STOCK (g/m2).		Biomass	True
LiveDigestibility	Digestibility of live biomass. Used by STOCK (g/m2).		double	True
LiveTissue	Collection of live aboveground organ tissues.		List< <a href="#">GenericTissue</a> >	True
Material	A list of material (biomass) that can be damaged.		DamageableBiomass	False
MatureTissue	Mature aboveground organ tissue.		<a href="#">GenericTissue</a>	True
NConcDead	Average N concentration in dead tissues (kg/kg).	kg/kg	double	False
NConcLive	Average N concentration in the live tissues (kg/kg).	kg/kg	double	False
NConcTotal	Average total N concentration.	kg/kg	double	False
NDead	N amount in the dead tissues (kg/ha).	kg/ha	double	False

Name	Description	Units	Type	Settable?
NDeadHarvestable	N in the harvestable dry matter in the dead tissues (kg/ha).	kg/ha	double	False
NDetached	N detached from this organ (kg/ha).		double	False
NGrowth	N added to this organ via growth (kg/ha).		double	False
NLive	N in the live (green) tissues (kg/ha).	kg/ha	double	True
NLiveHarvestable	N in the harvestable dry matter in the live (green) tissues (kg/ha).	kg/ha	double	False
NLuxuryRemobilisable	Luxury N available for remobilisation (kg/ha).		double	False
NLuxuryRemobilised	Luxury N remobilised into new growth (kg/ha).		double	False
NRemoved	N removed from this tissue (kg/ha).		double	False
NSenesced	N senescing from this organ (kg/ha).		double	False
NSenescedRemobilisable	Senesced N available for remobilisation (kg/ha).		double	False
NSenescedRemobilised	Senesced N remobilised into new growth (kg/ha).		double	False

Name	Description	Units	Type	Settable?
NTotal	Total N in this tissue (kg/ha).	kg/ha	double	False
NTotalHarvestable	N in the total harvestable dry matter (kg/ha).	kg/ha	double	False
StandingDeadDigestibility	Standing live digestibility (0-1).		double	False
StandingDeadHerbageN	Standing dead herbage weight (kg/ha).	kg/ha	double	False
StandingDeadHerbageWt	Standing dead herbage weight (kg/ha).	kg/ha	double	False
StandingDigestibility	Digestibility of standing herbage.	kg/kg	double	False
StandingHerbageN	Standing herbage nitrogen (kg/ha).	kg/ha	double	False
StandingHerbageWt	Standing herbage weight (kg/ha).	kg/ha	double	False
StandingLiveDigestibility	Standing live digestibility (0-1).		double	False
StandingLiveHerbageN	Standing live herbage weight (kg/ha).	kg/ha	double	False
StandingLiveHerbageWt	Standing live herbage weight (kg/ha).	kg/ha	double	False

#### Links (Dependencies)

Name	Type	IsOptional?
species	<a href="#">PastureSpecies</a>	False
Tissue	List< <a href="#">GenericTissue</a> >	False



## Methods (callable from manager)

Name	Description
CalculateTissueTurnover	void CalculateTissueTurnover(double turnoverRate) <i>Computes the DM and N amounts turned over for all tissues.</i>
ClearDailyTransferredAmounts	void ClearDailyTransferredAmounts()
Initialise	void Initialise(double minimumLiveWt) <i>Initialise this organ instance (and tissues).</i>
KillOrgan	void KillOrgan(double fractionToRemove) <i>Kills part of the organ (transfer DM and N to dead tissue).</i>
RemoveBiomass	double RemoveBiomass(double liveToRemove, double deadToRemove, double liveToResidue, double deadToResidue) <i>Remove biomass from organ.</i>
SetBiomassState	void SetBiomassState(double emergingWt, double emergingN, double developingWt, double developingN, double matureWt, double matureN, double deadWt, double deadN) <i>Set this organ's biomass state.</i>
Update	boolean Update()

## 3 AGPBiomass

AgPasture class for holding a biomass weight, N content and digestibility.

### Properties (Outputs)

Name	Description	Units	Type	Settable?
Digestibility	Digestibility of biomass.	kg/kg	double	True
ME	Average metabolisable energy concentration of standing herbage (MJ/kgDM).	MJ/kg	double	False
N	N content of biomass.	kg/ha	double	True
NConc	N concentration.	kg/ha	double	False

Name	Description	Units	Type	Settable?
Wt	Dry matter weight.	kg/ha	double	True

## 4 TissuesHelper

Helper class for providing outputs from multiple tissues.

### Properties (Outputs)

Name	Description	Units	Type	Settable?
N	Nitrogen content (kg/ha).	kg/ha	double	False
Wt	Dry matter (kg/ha).	kg/ha	double	False

## 5 PastureBelowGroundOrgan

Describes a generic below ground organ of a pasture species.

### Properties (Outputs)

Name	Description	Units	Type	Settable?
Dead	Dead root tissue.		RootTissue	True
Depth	Rooting depth (mm).		double	True
DepthDistributionExponent	Exponent controlling the root distribution as function of depth (>0.0).	-	double	True
DepthDistributionParamBottom	Factor for root distribution; controls where the function is zero below maxRootDepth.		double	True
DepthDistributionParamTop	Factor for root distribution; depth from surface where root proportion starts to decrease (mm).	mm	double	True

Name	Description	Units	Type	Settable?
DMDetached	DM detached from this organ (kg/ha).		double	False
DMGrowth	DM added to this organ via growth (kg/ha).		double	False
DMRemoved	DM removed from this tissue (kg/ha).		double	False
DMSenesced	DM senescing from this organ (kg/ha).		double	False
ElongationRate	Daily root elongation rate at optimum temperature (mm/day).	mm/day	double	True
KNH4	Ammonium uptake coefficient (/ppm).		double	True
KNO3	Nitrate uptake coefficient (/ppm).		double	True
LengthDensity	Root length density by volume (mm/mm <sup>3</sup> ).		double	False
Live	Live root tissue.		<a href="#">RootTissue</a>	True
MaximumAllowedRootingDepth	Maximum rooting depth allowed by soil condition (mm).		double	True
MaximumNUptake	Maximum daily amount of N that can be taken up by the plant (kg/ha).		double	True
MaximumPotentialRootingDepth	Maximum potential rooting depth (mm).		double	True
MinimumRootingDepth	Minimum rooting depth (mm).		double	True

Name	Description	Units	Type	Settable?
NDetached	N detached from this organ (kg/ha).		double	False
NGrowth	N added to this organ via growth (kg/ha).		double	False
NRemoved	N removed from this tissue (kg/ha).		double	False
NSenesced	N senescing from this organ (kg/ha).		double	False
SpecificRootLength	Specific root length (m/gDM).		double	True

#### Links (Dependencies)

Name	Type	IsOptional?
species	PastureSpecies	False
Tissue	List<RootTissue>	False

#### Methods (callable from manager)

Name	Description
CurrentRootDistributionTarget	double CurrentRootDistributionTarget()
DoRootGrowthAllocation	<p>void DoRootGrowthAllocation(double rootDMToAdd, double rootNToAdd)</p> <p>*Computes the allocation of new growth to roots for each layer.</p> <p>The current target distribution for roots changes whenever the root depth changes, this is then used to allocate new growth to each layer within the root zone. The existing distribution is used on any DM removal, so it may take some time for the actual distribution to evolve to be equal to the target.*</p>

Name	Description
EvaluateRootElongation	<p>void EvaluateRootElongation(double dGrowthRootDM, double detachedRootDM, double temperatureLimitingFactor)</p> <p>*Computes the variations in root depth.</p> <p>Root depth will increase if it is smaller than maximumRootDepth and there is a positive net DM accumulation. The depth increase rate is of zero-order type, given by the RootElongationRate, but it is adjusted for temperature in a similar fashion as plant DM growth. Note that currently root depth never decreases.</p> <p>- The effect of temperature was reduced (average between that of growth DM and one) as soil temp varies less than air*</p>
Initialise	<p>void Initialise(Zone zone, double minimumLiveWt)</p> <p><i>Initialise this root instance (and tissues).</i></p>
IsInZone	<p>boolean IsInZone(String zoneName)</p> <p><i>Flag indicating whether roots are in the specified zone.</i></p>
PerformNutrientUptake	<p>void PerformNutrientUptake(double no3Amount, double nh4Amount)</p> <p><i>Remove nutrients from soil - uptake.</i></p>
PerformWaterUptake	<p>void PerformWaterUptake(double amount)</p> <p><i>Remove water from soil - uptake.</i></p>
RemoveBiomass	<p>double RemoveBiomass(double liveToRemove, double deadToRemove, double liveToResidue, double deadToResidue)</p> <p><i>Remove biomass from organ.</i></p>
RootDistributionTarget	<p>double RootDistributionTarget()</p>
SetBiomassState	<p>void SetBiomassState(double rootWt, double rootN, double rootDepth)</p> <p><i>Set this root organ's biomass state.</i></p>