



## 1 AGPWhiteClover

### Properties (Outputs)

Name	Description	Unit	Type	Settable?
AboveGround	Get above ground biomass	g/m2	IBiomass	False
AboveGround	Dead N	kg/ha	double	False
AboveGround	Dead DM	kg/ha	double	False
AboveGround	Get below ground biomass	g/m2	IBiomass	False
AboveGround	Live N	kg/ha	double	False
AboveGround	Live DM	kg/ha	double	False
AboveGround	N	kg/ha	double	False
AboveGround	N Conc	kg/kg	double	False
AboveGround	Organs		List< PastureAboveGroundOrgan >	True
AboveGround	Wt	kg/ha	double	False
Albedo	Canopy albedo, fraction of sun light reflected (0-1).	0-1	double	True
Assimilate	Amount of assimilate available to be damaged.		double	False
BasePotential	Photosynthetic rate, before damages, in carbon equivalent (kgC/ha).	kg/ha	double	False
BelowGround	Live N	kg/ha	double	False

Name	Description	Unit	Type	Settable?
BelowGroundDryMatter	Dry matter weight of live tissues below ground (kgDM/ha).	kg/ha	double	False
BelowGroundN	Amount of N in the plant below ground (kgN/ha).	kg/ha	double	False
BelowGroundWDM	Wet matter weight of the plant below ground (kgDM/ha).	kg/ha	double	False
CO2EffectExp	Exponent controlling the CO2 effect on N requirements (>0.0).	-	double	True
CO2EffectMin	Minimum value for the CO2 effect on N requirements (0-1).	0-1	double	True
CO2EffectOffSet	Offset parameter for the CO2 effects on N requirements (ppm).	ppm	double	True
CO2EffectScale	Scale parameter for the CO2 effect on photosynthesis (ppm).	ppm	double	True
ColdFullTemp	Temperature for full cold effect on photosynthesis, growth stops (oC).	oC	double	True
ColdOnsetTemp	Onset temperature for cold effects on photosynthesis (oC).	oC	double	True
ColdRecoverySumD	Cumulative degrees for recovery from cold stress (oCd).	oCd	double	True
ColdRecoveryRef	Reference temperature for recovery from cold stress (oC).	oC	double	True
CoverDead	Fraction of soil covered by dead tissues (0-1).	0-1	double	False
CoverGreen	Plant's green cover (0-1).	0-1	double	False
CoverTotal	Plant's total cover (0-1).	0-1	double	False
CultivarNames	List of cultivar names (not used by AgPasture).		String	False
DeadTissue	Dead tissues from all above ground organs.		<a href="#">TissuesHelp</a>	True
DefoliatedDigest	Digestibility of defoliated material (0-1).		double	True
DegreesDayFC	Cumulative degrees-day needed for seed germination (oCd).	oCd	double	True
DemandAtLux	Amount of N required with luxury uptake (kgN/ha).	kg/ha	double	False
DemandAtOpt	Amount of N required for optimum growth (kgN/ha).	kg/ha	double	False
Depth	Average canopy depth (mm).	mm	double	False

Name	Description	Unit	Type	Settable?
DetachmentD	Coefficient controlling detachment rate as function of moisture (>0.0).	-	double	True
DetachmentD	Min Effect of drought on detachment rate (0-1).	0-1	double	True
DetachmentR	Residual daily detachment rate for dead tissues (0-1).	0-1	double	True
DevelopingTis	Developing tissues from all above ground organs.		TissuesHelper	True
EmergingTissu	Emerging tissues from all above ground organs.		TissuesHelper	True
FixedN	Amount of atmospheric N fixed by symbiosis (kgN/ha).	kg/ha	double	False
FractionGrowt	Fraction of new shoot growth allocated to leaves (0-1).	0-1	double	False
FractionGrowt	Fraction of new growth allocated to roots (0-1).	0-1	double	False
FractionGrowt	Fraction of new growth allocated to shoot (0-1).	0-1	double	False
FractionLeafD	Factor DM when allocation to leaves is midway maximum and minimum (kgDM/ha).	kg/ha	double	True
FractionLeafD	Threshold at which allocation of new growth to leaves start to decrease (kgDM/ha).	kg/ha	double	True
FractionLeafE	Exponent of the function controlling the DM allocation to leaves (>0.0).	0.0	double	True
FractionLeafM	Maximum target allocation of new growth to leaves (0-1).	0-1	double	True
FractionLeafM	Minimum target allocation of new growth to leaves (0-1).	0-1	double	True
FractionPAR	Fraction of radiation that is photosynthetically active (0-1).	0-1	double	True
FractionToSto	Fraction of new shoot growth to be allocated to stolons (0-1).	0-1	double	True
FRGR	Plant growth limiting factor, supplied to MicroClimate for calculating potential transpiration.	0-1	double	False
FVPD	Effect of vapour pressure on growth (used by micromet) (0-1).	0-1	double	False
GlfCO2	Growth limiting factor due to variations in atmospheric CO2 (0-1).	0-1	double	False
GlfColdDama	Growth limiting factor due to cold damage stress (0-1).	0-1	double	False

Name	Description	Unit	Type	Settable?
GlifGeneric	Generic growth limiting factor that represents an arbitrary limitation to potential growth (0-1).  This factor can be used to describe the effects of drivers such as disease, etc.	0-1	double	True
GlifHeatDamage	Growth limiting factor due to heat damage stress (0-1).	0-1	double	False
GlifNContent	Growth limiting factor due to variations in plant N concentration (0-1).	0-1	double	False
GlifNSupply	Growth limiting factor due to soil N availability (0-1).	0-1	double	False
GlifRadIntercept	Growth limiting factor due to variations in intercepted radiation (0-1).	0-1	double	False
GlifSoilFertility	Generic growth limiting factor that represents an arbitrary soil limitation (0-1).  This factor can be used to describe the effect of limitation in nutrients other than N.	0-1	double	True
GlifTemperature	Growth limiting factor due to variations in air temperature (0-1).	0-1	double	False
GlifWaterLogging	Growth limiting factor due to water logging (0-1).	0-1	double	False
GlifWaterSupply	Growth limiting factor due to water deficit (0-1).	0-1	double	False
GPP	Gross primary productivity (kgC/ha).	kg/ha	double	False
GrossPotentialGrowth	Gross potential growth rate (kgDM/ha).	kg/ha	double	False
GrossPotentialPhotosynthesis	Photosynthesis photosynthetic rate, after considering damages, in carbon equivalent (kgC/ha).	kg/ha	double	False
GrowthRespiration	Growth respiration coefficient (0-1).	0-1	double	True
GrowthTEffect	Exponential parameter for growth response to temperature (>0.0).	-	double	True
GrowthTmin	Minimum temperature for growth (oC).	oC	double	True
GrowthTopt	Optimum temperature for growth (oC).	oC	double	True
Gsmax	Maximum stomatal conductance (m/s).	m/s	double	True

Name	Description	Unit	Type	Settable?
Harvestable	Dry matter and N available for harvesting (kgDM/ha).		AGPBiomass	False
HarvestableDead	Dead dry matter and N available for harvesting.		AGPBiomass	False
HarvestableLive	Live dry matter and N available for harvesting.		AGPBiomass	False
HarvestedDigestibility	Average digestibility of harvested material (0-1).	0-1	double	False
HarvestedFraction	Fraction of available dry matter actually harvested (0-1).	0-1	double	False
HarvestedME	Average metabolisable energy concentration of harvested material (MJ/kgDM).	MJ/kg	double	False
HarvestedN	Amount of N removed by harvest (kg/ha).	kg/ha	double	False
HarvestedNC	Average N concentration in harvested material (kgN/kgDM).	kg/kg	double	False
HarvestedWt	Amount of plant dry matter removed by harvest (kgDM/ha).	kg/ha	double	False
HeatFullTemp	Temperature for full heat effect on photosynthesis, growth stops (oC).	oC	double	True
HeatOnsetTemp	Onset temperature for heat effects on photosynthesis (oC).	oC	double	True
HeatRecoveryCumDD	Cumulative degrees-day for recovery from heat stress (oCd).	oCd	double	True
HeatRecoveryReference	Reference temperature for recovery from heat stress (oC).	oC	double	True
Height	Average canopy height (mm).	mm	double	False
HerbageGrowthRate	Herbage growth rate (above ground) (kgDM/ha).	kg/ha	double	False
initialDMFractionForbs	Fraction of DM for each plant part in forbs (0-1).		double	True
initialDMFractionGrasses	Fraction of DM for each plant part in grasses (0-1).		double	True
initialDMFractionLegumes	Fraction of DM for each plant part in legumes (0-1).		double	True
InitialRootDepth	Initial rooting depth (mm).	mm	double	True
InitialRootDM	Initial below ground DM weight (kgDM/ha).	kgDM/ha	double	True
InitialShootDM	Initial above ground DM weight (kgDM/ha).	kgDM/ha	double	True

Name	Description	Unit	Type	Settable?
InterceptedRadiation	Radiation intercepted by the plant's canopy (MJ/m <sup>2</sup> /day).	MJ/m <sup>2</sup> /day	double	True
IsAlive	Flag signalling whether plant is alive (true/false).	true/false	boolean	False
IsC4	Flag indicating whether the biomass is from a c4 plant or not		boolean	False
IsReadyForHarvesting	Flag indicating whether the crop is ready for harvesting.		boolean	False
LAI	Leaf Area Index of live tissues (m <sup>2</sup> /m <sup>2</sup> ).	m <sup>2</sup> /m <sup>2</sup>	double	True
LAIDead	Leaf Area Index of dead tissues (m <sup>2</sup> /m <sup>2</sup> ).	m <sup>2</sup> /m <sup>2</sup>	double	False
LAIGreen	Leaf Area Index of green tissues (m <sup>2</sup> /m <sup>2</sup> ).	m <sup>2</sup> /m <sup>2</sup>	double	True
LAITotal	Leaf Area Index of whole canopy, live + dead tissues (m <sup>2</sup> /m <sup>2</sup> ).	m <sup>2</sup> /m <sup>2</sup>	double	False
Leaf	Holds info about state of leaves (DM and N).		PastureAboveGroundOrgan	True
LeafDeadN	Amount of N in dead leaves (kgN/ha).	kg/ha	double	False
LeafDeadWt	Dry matter weight of dead leaves (kgDM/ha).	kg/ha	double	False
LeafLiveN	Amount of N in live leaves (kgN/ha).	kg/ha	double	False
LeafLiveWt	Dry matter weight of live leaves (kgDM/ha).	kg/ha	double	False
LeafN	Amount of N in the plant's leaves (kgN/ha).	kg/ha	double	False
LeafNConc	Average N concentration in plant's leaves (kgN/kgDM).	kg/kg	double	False
LeafWt	Dry matter weight of plant's leaves (kgDM/ha).	kg/ha	double	False
LightExtinctionCoefficient	Light extinction coefficient (0-1).	0-1	double	True
LightProfile	Light profile for this plant, interception calculated by MicroClimate (W/m <sup>2</sup> ).  This contains the intercepted radiation for each layer of the canopy.		CanopyEnergyBalanceInterceptio...	True

Name	Description	Unit	Type	Settable?
LitterDeposition	Amount of N in detached dead material deposited onto soil surface (kgN/ha).	kg/ha	double	False
LitterDeposition	Dry matter weight of detached dead material deposited onto soil surface (kgDM/ha).	kg/ha	double	False
LiveLeavesPerTiller	Number of live leaves per tiller (-).	-	double	True
MaintenanceRespirationCoefficient	Maintenance respiration coefficient (0-1).	0-1	double	True
Material	A list of material (biomass) that can be damaged.		Damageable Biomass	False
MatureTissue	Mature tissues from all above ground organs.		Tissues Help	True
MaximumFractionAvailable	Maximum fraction of water or N in the soil that is available to plants.  This is used to limit the amount taken up and avoid issues with very small numbers	0-1	double	True
MaximumNFixation	Maximum fraction of N demand supplied by biologic N fixation (0-1).	0-1	double	True
MaxRootAllocation	Maximum fraction of DM growth allocated to roots (0-1).	0-1	double	True
MaxStemEffectiveness	Maximum fraction of stem tissue used when computing green LAI (0-1).	0-1	double	True
MinimumGreenLeafProportion	Leaf proportion in the minimum green Wt (0-1).	0-1	double	True
MinimumGreenRootProportion	Root proportion amount relative to minimum green Wt (>0.0).	0-1	double	True
MinimumGreenWt	Minimum above ground green DM, leaf and stems (kgDM/ha).	kg/ha	double	True
MinimumNFixation	Minimum fraction of N demand supplied by biologic N fixation (0-1).	0-1	double	True
MinimumWaterFreePorosity	Water-free pore space for growth with no limitations (0-1).  A negative value indicates that porosity at DUL will be used.	0-1	double	True
MoistureFactor	Moisture factor for tissue turnover (0-1).	0-1	double	False
NAPP	Net above-ground primary productivity (kgC/ha).	kg/ha	double	False

Name	Description	Unit	Type	Settable?
NBPP	Net below-ground primary productivity (kgC/ha).	kg/ha	double	False
NDilutionCoefficient	Exponent to modify the effect of N deficiency on plant growth (>1.0).	-	double	True
NetGrowthN	Amount of N in new growth (kgN/ha).	kg/ha	double	False
NetGrowthWt	Net, or actual, plant growth rate (kgDM/ha).	kg/ha	double	False
NetPotentialGrowthAfterN	Net potential growth rate after nutrient stress (kgDM/ha).	kg/ha	double	False
NetPotentialGrowthAfterWater	Net potential growth rate after water stress (kgDM/ha).	kg/ha	double	False
NetPotentialGrowthR	Net potential growth rate, after respiration (kgDM/ha).	kg/ha	double	False
NFixationCostC	N fixation costs expressed in carbon equivalent (kgC/ha).	kg/ha	double	False
NFixingCostF	Respiration cost factor due to the activity of symbiont bacteria (kgC/kgN fixed).	kg/kg	double	True
NitrogenUptake	Amount of soil water taken up (mm).		double	True
NPP	Net primary productivity (kgC/ha).	kg/ha	double	False
NuptakeSWFactor	Exponent of function determining soil extractable N.	-	double	True
Organs	List of organs that can be damaged.		IOrganDamage	False
PhotosynthesisCO2Curvature	CO2 fixation curvature parameter (J/kg/s).	J/kg/s	double	True
PhotosynthesisEfficiency	Leaf photosynthetic efficiency (mg CO2/J).	mg CO2/J	double	True
PhotosynthesisPathway	Species metabolic pathway of C fixation during photosynthesis (C3/C4).		PhotosynthesisPathwayType	True
PlantHeightExponent	Exponent controlling shoot height as function of DM weight (>1.0).	1.0	double	True
PlantHeightMaxDM	DM weight above ground for maximum plant height (kgDM/ha).	kg/ha	double	True
PlantHeightMax	Maximum plant height (mm).	mm	double	True
PlantHeightMin	Minimum plant height (mm).	mm	double	True



Name	Description	Unit	Type	Settable?
PlantStatus	Flag signalling the plant status (dead, alive, etc.).	-	String	False
PlantType	Flag indicating the type of plant (currently the name of the species)  This used to be a marker for 'how leguminous' a plant was (in PMF and Stock). In AgPasture there is the parameter SpeciesFamily flagging whether a species is a grass or a legume...		String	True
Population	Plant population.		double	False
PotentialEP	Potential evapotranspiration, as calculated by MicroClimate (mm).	mm	double	True
PreferenceForRelativeOverDead	Preference for live over dead material during graze (>0.0).	-	double	True
PreferenceForRelativeOverStem	Preference for leaf over stem-stolon material during graze (>0.0).	-	double	True
R50	Solar radiation at which stomatal conductance decreases to 50% (W/m <sup>2</sup> ).	W/m <sup>2</sup>	double	True
RadiationTopOfCanopy	Radiation on top of the plant's canopy (MJ/m <sup>2</sup> /day).	MJ/m <sup>2</sup> /day	double	True
ReferenceCO2	Reference CO2 concentration for photosynthesis (ppm).	ppm	double	True
ReferencePhotosyntheticRate	Reference leaf CO2 assimilation rate for photosynthesis (mg CO2/m <sup>2</sup> Leaf/s).	mg/m <sup>2</sup> /s	double	True
RelativeTurnoverRate	Relative turnover rate for emerging tissues (>0.0).	-	double	True
RemobilisableLuxuryN	Amount of luxury N potentially remobilisable (kgN/ha).	kg/ha	double	False
RemobilisableSenescedN	Amount of senesced N potentially remobilisable (kgN/ha).	kg/ha	double	False
RemobilisedLuxuryN	Amount of luxury N actually remobilised (kgN/ha).	kg/ha	double	False
RemobilisedSenescedC	Amount of C from senesced tissues (kgC/ha).	kg/ha	double	False
RemobilisedSenescedN	Amount of N from senesced N actually remobilised (kgN/ha).	kg/ha	double	False

Name	Description	Unit	Type	Settable?
ReproSeasonAllocationCoeff	Controlling the increase in shoot allocation during reproductive growth as function of latitude (-).	-	double	True
ReproSeasonDurationCoeff	Controlling the duration of the reproductive season as function of latitude (-).	-	double	True
ReproSeasonMaxAllocationIncrease	Shoot-Root ratio during reproductive growth (0-1).	0-1	double	True
ReproSeasonOnsetDurationFactor	Onset phase of shoulder period with reproductive growth effect (0-1).	0-1	double	True
ReproSeasonReferenceLatitude	Reference latitude determining timing for reproductive season (degrees).	degrees	double	True
ReproSeasonShoulderLengthFactor	Shoulder length of shoulders and the period with full reproductive growth effect (-).	-	double	True
ReproSeasonStartCoeff	Controlling the time to start the reproductive season as function of latitude (-).	-	double	True
RespirationExponent	Exponent controlling the effect of temperature on respiration (>1.0).	-	double	True
RespirationLosses	Respiration costs expressed in carbon equivalent (kgC/ha).	kg/ha	double	False
RespirationTRReference	Reference temperature for maintenance respiration (oC).	oC	double	True
Root	Root organ of this plant.		PastureBelowGroundOrgan	False
RootDepth	Average depth of root zone (mm).	mm	double	False
RootDetachedN	Amount of N in detached dead roots added to soil FOM (kgN/ha).	kg/ha	double	False
RootDetachedDM	Dry matter weight of detached dead roots added to soil FOM (kgDM/ha).	kg/ha	double	False
RootFrontier	Soil layer at bottom of root zone ().	-	int32	False
RootGrowthWN	Net root growth rate (kgDM/ha).	kg/ha	double	False
RootN	Amount of N in the plant's roots (kgN/ha).	kg/ha	double	False
RootNConc	Average N concentration in plant's roots (kgN/kgDM).	kg/kg	double	False

Name	Description	Unit	Type	Settable?
RootWt	Dry matter weight of plant's roots (kgDM/ha).	kg/ha	double	False
RootWtFraction	Proportion of root biomass in each soil layer (0-1).	-	double	False
ShootMaxEff	Maximum aboveground biomass for considering stems when computing LAI (kgDM/ha).	kg/ha	double	True
ShootRootGlfEff	Maximum effect that soil GLFs have on Shoot-Root ratio (0-1).	0-1	double	True
SoilAvailableN	Amount of plant available N in the soil (kgN/ha).	kg/ha	double	False
SoilDemandN	Amount of N demanded from the soil (kgN/ha).	kg/ha	double	False
SoilNH4Available	Amount of plant available NH4-N in each soil layer (kgN/ha).	kg/ha	double	False
SoilNH4Uptake	Amount of NH4-N taken up from each soil layer (kgN/ha).	kg/ha	double	False
SoilNO3Available	Amount of plant available NO3-N in each soil layer (kgN/ha).	kg/ha	double	False
SoilNO3Uptake	Amount of NO3-N taken up from each soil layer (kgN/ha).	kg/ha	double	False
SoilSaturationEffect	Maximum reduction in plant growth due to water logging (saturated soil) (0-1).	0-1	double	True
SoilSaturationRecovery	Recovery rate from water logging (0-1).	0-1	double	True
SoilUptakeN	Amount of N taken up from the soil (kgN/ha).	kg/ha	double	False
SpeciesFamily	Family type for this plant species (grass/legume/forb).	-	PlantFamilyType	True
SpecificLeafArea	Specific leaf area (m <sup>2</sup> /kgDM).	m <sup>2</sup> /kg	double	True
Stage	Index for the plant development stage.  0 = germinating, 1 = vegetative, 2 = reproductive, negative for dormant/not sown.	-	int32	False
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
Stem	Holds info about state of sheath/stems (DM and N).		PastureAboveGroundOrgan	True

Name	Description	Unit	Type	Settable?
StemDeadN	Amount of N in dead stems and sheath (kgN/ha).	kg/ha	double	False
StemDeadWt	Dry matter weight of dead stems and sheath (kgDM/ha).	kg/ha	double	False
StemLiveN	Amount of N in live stems and sheath (kgN/ha).	kg/ha	double	False
StemLiveWt	Dry matter weight of alive stems and sheath (kgDM/ha).	kg/ha	double	False
StemN	Amount of N in the plant's stems and sheath (kgN/ha).	kg/ha	double	False
StemNConc	Average N concentration in plant's stems (kgN/kgDM).	kg/kg	double	False
StemWt	Dry matter weight of plant's stems and sheath (kgDM/ha).	kg/ha	double	False
Stolon	Holds info about state of stolons (DM and N).		PastureAboveGroundOrgan	
StolonEffectOnFrAct	Fraction of stolon tissue used when computing green LAI (0-1).	0-1	double	True
StolonN	Amount of N in the plant's stolons (kgN/ha).	kg/ha	double	False
StolonNConc	Average N concentration in plant's stolons (kgN/kgDM).	kg/kg	double	False
StolonWt	Dry matter weight of plant's stolons (kgDM/ha).	kg/ha	double	False
SymbiontCostFactor	Respiration cost factor due to the presence of symbiont bacteria (kgC/kgC in roots).	kg/kg	double	True
TargetShootRootRatio	Target or ideal, shoot-root ratio (>0.0).	-	double	True
TemperatureFactorRespiration	Temperature factor for respiration (0-1).	0-1	double	False
TemperatureFactorTurnover	Temperature factor for tissue turnover (0-1).	0-1	double	False
TissueTurnoverRateRoot	Plant's daily DM turnover rate for root tissues (0-1).	0-1	double	True
TissueTurnoverRateShoot	Plant's daily DM turnover rate for shoot tissues (0-1). This is closely related to the leaf appearance rate.	0-1	double	True
TotalC	Total amount of C in the plant (kgC/ha).	kg/ha	double	False
TotalN	Total amount of N in the plant (kgN/ha).	kg/ha	double	False
TotalWt	Total dry matter weight of plant (kgDM/ha).	kg/ha	double	False

Name	Description	Unit	Type	Settable?
TurnoverDefoliationCoefficient	Defoliation coefficient function increasing the turnover rate due to defoliation (>0.0).	-	double	True
TurnoverDefoliationEffect	Minimum effect of defoliation on tissue turnover rate (0-1).	/day	double	True
TurnoverDefoliationRootEffect	Effect of defoliation on root turnover rate due to defoliation (0-1).	0-1	double	True
TurnoverDroughtEffect	Maximum increase in tissue turnover due to water deficit (>0.0).	-	double	True
TurnoverDroughtThreshold	Minimum soil water without effect on tissue turnover (0-1).	0-1	double	True
TurnoverRateDeadShoot	Turnover rate for dead shoot tissues (leaves and stem) (0-1).	0-1	double	False
TurnoverRateLiveShoot	Turnover rate for live shoot tissues (leaves and stem) (0-1).	0-1	double	False
TurnoverRateRoots	Turnover rate for roots tissues (0-1).	0-1	double	False
TurnoverRateStolons	Turnover rate for stolon tissues (0-1).	0-1	double	False
TurnoverStockFactor	Factor increasing tissue turnover rate due to stock trampling (>0.0).	-	double	True
TurnoverTemperatureExponent	Exponent function for temperature effect on tissue turnover (>0.0).	-	double	True
TurnoverTemperatureMinimum	Minimum temperature for tissue turnover (oC).	oC	double	True
TurnoverTemperatureReference	Reference temperature for tissue turnover (oC).	oC	double	True
UseColdStressFragile	Whether photosynthesis reduction due to cold damage is enabled (yes/no).	yes/no	YesNoAnswer	True
UseHeatStressFragile	Whether photosynthesis reduction due to heat damage (yes/no).	yes/no	YesNoAnswer	True
UseReproductiveSeasonShift	Shift Root:Root ratio to mimic DM allocation during reproductive season (perennial species)?.	yes/no	YesNoAnswer	True
WaterAvailable	Amount of plant available water in each soil layer (mm).	mm	double	False
WaterDemand	Amount of water demanded by the plant (mm).	mm	double	True

Name	Description	Units	Type	Settable?
WaterUptake	Amount of soil water taken up (mm).		double	False
Width	Average canopy width (mm).	mm	double	False

#### Links (Dependencies)

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()
GetNitrogenUptakeEstimates	ZoneWaterEstimate[] GetNitrogenUptakeEstimates(SoilState soilstate)  *Gets the potential plant N uptake for each layer (mm).  The model can only handle one root zone at present.*

Name	Description
GetWaterUptakeEstimates	<p>ZoneWaterAndN zones            GetWaterUptakeEstimates(SoilState soilstate)</p> <p>*Gets the potential plant water uptake for each layer (mm).            The model can only handle one root zone at present.*</p>
Harvest	void Harvest()
KillCrop	<p>void KillCrop(double fractionToKill)</p> <p><i>Kills a fraction of this plant.</i></p>
ReduceCanopy	<p>void ReduceCanopy(double deltaLAI)</p> <p><i>Set the plant leaf area index.</i></p>
ReducePopulation	<p>void ReducePopulation(double newPlantPopulation)</p> <p><i>Reduce the plant population.</i></p>
ReduceRootLengthDensity	<p>void ReduceRootLengthDensity(double deltaRLD)</p> <p><i>Set the plant root length density.</i></p>
RemoveAssimilate	<p>void RemoveAssimilate(double deltaAssimilate)</p> <p><i>Remove an amount of assimilate from the plant.</i></p>
RemoveBiomass	<p>void RemoveBiomass(String organName, String biomassRemoveType, OrganBiomassRemovalType biomassToRemove)</p> <p><i>Remove biomass from an organ.</i></p>
RemoveBiomass	<p>void RemoveBiomass(String type, double amount)</p> <p><i>Removes plant material simulating a graze event.</i></p>
RemoveBiomass	<p>void RemoveBiomass(double amountToRemove)</p> <p><i>Removes a given amount of biomass (and N) from the plant.</i></p>
Reset	void Reset()
SetActualSoilUptakes	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)</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	The mature tissue.		<a href="#">GenericTissue</a>	True
DevelopingTissue	The developing tissue.		<a href="#">GenericTissue</a>	True
DigestibilityDead	Average digestibility of dead biomass.	kg/kg	double	True
DigestibilityLive	Average digestibility of live biomass.	kg/kg	double	True
DigestibilityTotal	Average digestibility of all biomass.	kg/kg	double	True
DMDead	Dry matter in the dead tissues (kg/ha).	kg/ha	double	True
DMDeadHarvestable	Dry matter in the dead tissues (kg/ha).	kg/ha	double	True
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



Name	Description	Units	Type	Settable?
DMLiveHarvestable	Harvestable dry matter in the live (green) tissues (kg/ha).	kg/ha	double	True
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	True
DMTotalHarvestable	Total harvestable dry matter (kg/ha).	kg/ha	double	True
EmergingTissue	The emerging tissue.		<a href="#">GenericTissue</a>	True
FractionStanding	Proportion of organ DM that is standing, available to harvest (0-1).		double	True
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	Array of live tissue.		List< <a href="#">GenericTissue</a> >	True
MatureTissue	The mature tissue.		<a href="#">GenericTissue</a>	True
MinimumLiveDM	Minimum DM amount of live tissues (kg/ha).		double	True
NConcDead	Average N concentration in dead tissues (kg/kg).	kg/kg	double	True
NConcLive	Average N concentration in the live tissues (kg/kg).	kg/kg	double	True
NConcMaximum	Maximum N concentration, for luxury uptake (kg/kg).		double	True
NConcMinimum	Minimum N concentration, structural N (kg/kg).		double	True
NConcOptimum	N concentration for optimum growth (kg/kg).		double	True

Name	Description	Units	Type	Settable?
NConcTotal	Average N concentration.	kg/kg	double	True
NDead	N amount in the dead tissues (kg/ha).	kg/ha	double	True
NDeadHarvestable	N in the harvestable dry matter in the dead tissues (kg/ha).	kg/ha	double	True
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	True
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
NTotal	Total N in this tissue (kg/ha).	kg/ha	double	True
NTotalHarvestable	N in the total harvestable dry matter (kg/ha).	kg/ha	double	True
StandingDeadDigestibility	Standing live digestibility (0-1).		double	False
StandingDeadHerbageSN	Standing dead herbage weight (kg/ha).	kg/ha	double	False
StandingDeadHerbageSM	Standing dead herbage weight (kg/ha).	kg/ha	double	False
StandingDigestibility	Digestibility of standing herbage.	kg/kg	double	True
StandingHerbageN	Standing herbage nitrogen (kg/ha).	kg/ha	double	False
StandingHerbageWt	Standing herbage weight (kg/ha).	kg/ha	double	False

Name	Description	Units	Type	Settable?
StandingLiveDigestibility	Standing live digestibility (0-1).		double	False
StandingLiveHerbageSN	Standing live herbage weight (kg/ha).	kg/ha	double	False
StandingLiveHerbageSN	Standing live herbage weight (kg/ha).	kg/ha	double	False

#### Links (Dependencies)

Name	Type	IsOptional?
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>
ClearDailyTransferPeriods	void ClearDailyTransferredAmounts()
Initialise	void Initialise(double minimumLiveWt) <i>Initialisation</i>
KillOrgan	void KillOrgan(double fractionToRemove) <i>Kills part of the organ (transfer DM and N to dead tissue).</i>
OnDoDailyInitialisation	void OnDoDailyInitialisation()
RemoveBiomass	void RemoveBiomass(OrganBiomassRemovalType biomassToRemove) <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
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	Root dead tissue.		RootTissue	True
Depth	Rooting depth (mm).		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

Name	Description	Units	Type	Settable?
Live	Root live tissue.		RootTissue	True
MaximumNUptake	Maximum daily amount of N that can be taken up by the plant (kg/ha).		double	True
NConcMaximum	Maximum N concentration, for luxury uptake (kg/kg).		double	True
NConcMinimum	Minimum N concentration, structural N (kg/kg).		double	True
NConcOptimum	N concentration for optimum growth (kg/kg).		double	True
NLiveRemobilisable	N remobilised from live tissue.		double	False
RootBottomDistributionFactor	Factor for root distribution; controls where the function is zero below maxRootDepth.		double	True
RootDepthMaximum	Maximum rooting depth (mm).		double	True
RootDepthMinimum	Minimum rooting depth (mm).		double	True
RootDistributionDepth	Depth from surface where root proportion starts to decrease (mm).	mm	double	True
RootDistributionExponent	Exponent controlling the root distribution as function of depth (>0.0).	-	double	True
RootElongationRate	Daily root elongation rate at optimum temperature (mm/day).	mm/day	double	True
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	CurrentRootDistributionTarget()

Name	Description
DetachRoots	void DetachRoots(double dryMatter, double nitrogen)  <i>Detach roots.</i>
DoRootGrowth	void DoRootGrowth(GrowthAllocation(double dGrowthRootDM, double dGrowthRootN)  *Computes the allocation of new growth to roots for each layer.  The current target distribution for roots changes whenever then 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.*
EvaluateRootElongation	void EvaluateRootElongation(double dGrowthRootDM, double detachedRootDM, double temperatureLimitingFactor)  *Computes the variations in root depth.  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.  - The effect of temperature was reduced (average between that of growth DM and one) as soil temp varies less than air*
EvaluateTissueTurnover	void EvaluateTissueTurnover(double gamaR)  <i>Computes the turnover rate.</i>
Initialise	void Initialise(Zone zone, double initialDM, double initialDepth, double minLiveDM)  <i>Constructor, initialise tissues for the roots.</i>
IsInZone	boolean IsInZone(String zoneName)  <i>Flag indicating whether roots are in the specified zone.</i>
PerformNutrientUptake	void PerformNutrientUptake(double no3Amount, double nh4Amount)  <i>Remove nutrients from soil - uptake.</i>
PerformWaterUptake	void PerformWaterUptake(double amount)  <i>Remove water from soil - uptake.</i>

Name	Description
RemobiliseDeadN	void RemobiliseDeadN(double fracRemobilised) <i>Remobilise N from live tissues.</i>
RemobiliseLiveN	void RemobiliseLiveN(double fracRemobilised) <i>Remobilise N from live tissues.</i>
RemoveBiomass	void RemoveBiomass(String biomassRemoveType, OrganBiomassRemovalType biomassToRemove) <i>Removes biomass from root layers when harvest, graze or cut events are called.</i>
Reset	void Reset(double rootWt, double rootDepth) *Reset this root organ's state. It is assumed that N is at optimum content.*
RootDistributionTarget	double TargetDistributionTarget()
SetBiomassState	void SetBiomassState(double rootWt, double rootN, double rootDepth) <i>Set this root organ's biomass state.</i>
SetNewGrowthAllocation	void SetNewGrowthAllocation(double dmToRoot, double nToRoot) <i>Set new growth to root.</i>