1 AGPRyegrass

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Describes a generic below ground organ of a pasture species.

Describes a root tissue of a pasture species.

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Parameters (Inputs)

Name	Description	Units	Type	Value
Albedo	Gets or sets the canopy albedo for this plant (0-1).	0-1	double	0.26
ColdFullTemperature	Temperature for full cold effect on photosynthesis, growth stops (oC).	oC	double	-5

Name	Description	Units	Type	Value
ColdOnsetTemperature	Onset temperature for cold effects on photosynthesis (oC).	oC	double	1
ColdRecoverySumDD	Cumulative degrees for recovery from cold stress (oCd).	oCd	double	25
ColdRecoveryTReference	Reference temperature for recovery from cold stress (oC).	oC	double	0
DegreesDayForGermination	Cumulative degrees-day needed for seed germination (oCd).	oCd	double	125
DetachmentRateShoot	Reference daily detachment rate for dead tissues (0-1).	0-1	double	0.08
FractionLeafDMFactor	Shoot DM when allocation to leaves is midway maximum and minimum (kgDM/ha).	kg/ha	double	2000
FractionLeafDMThreshold	Shoot DM at which allocation of new growth to leaves start to decrease (kgDM/ha).	kg/ha	double	500
FractionLeafExponent	Exponent of the function controlling the DM allocation to leaves (>0.0).	>0.0	double	3
FractionLeafMaximum	Maximum target allocation of new growth to leaves (0-1).	0-1	double	0.7
FractionLeafMinimum	Minimum target allocation of new growth to leaves (0-1).	0-1	double	0.7
FractionToStolon	Fraction of new shoot growth to be allocated to stolons (0-1).	0-1	double	0
GlfGeneric	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	1
GlfSoilFertility	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	1
GrowthRespirationCoefficient	Growth respiration coefficient (0-1).	0-1	double	0.25

Name	Description	Units	Type	Value
GrowthTEffectExponent	Curve parameter for growth response to temperature (>0.0).	-	double	1.7
GrowthTminimum	Minimum temperature for growth (oC).	oC	double	1
GrowthToptimum	Optimum temperature for growth (oC).	oC	double	20
Gsmax	Gets or sets the maximum stomatal conductance (m/s).	m/s	double	0.011
HeatFullTemperature	Temperature for full heat effect on photosynthesis, growth stops (oC).	oC	double	35
HeatOnsetTemperature	Onset temperature for heat effects on photosynthesis (oC).	oC	double	28
HeatRecoverySumDD	Cumulative degrees-day for recovery from heat stress (oCd).	oCd	double	30
HeatRecoveryTReference	Reference temperature for recovery from heat stress (oC).	oC	double	25
Leaf.DeadTissue.DigestibilityCellWall	The digestibility of cell walls (0-1).		double	0.2
Leaf.DeadTissue.FractionNLuxuryRemobilisable	The fraction of luxury N remobilisable per day (0-1).		double	0
Leaf.DevelopingTissue.DigestibilityCellWall	The digestibility of cell walls (0-1).		double	0.7
Leaf.EmergingTissue.DigestibilityCellWall	The digestibility of cell walls (0-1).		double	0.9
Leaf.EmergingTissue.FractionSugarNewGrowth	The sugar fraction on new growth, i.e. soluble carbohydrate (0-1).		double	0.5
Leaf.MatureTissue.DigestibilityCellWall	The digestibility of cell walls (0-1).		double	0.6
Leaf.NConcMaximum	Gets or sets the maximum N concentration, for luxury uptake (kg/kg).		double	0.05
Leaf.NConcMinimum	Gets or sets the minimum N concentration, structural N (kg/kg).		double	0.012
Leaf.NConcOptimum	Gets or sets the N concentration for optimum growth (kg/kg).		double	0.04
LightExtinctionCoefficient	Light extinction coefficient (0-1).	0-1	double	0.5

Name	Description	Units	Type	Value
LiveLeavesPerTiller	Number of live leaves per tiller (-).	-	double	3
MaintenanceRespirationCoefficient	Maintenance respiration coefficient (0-1).	0-1	double	0.03
MaximumNFixation	Maximum fraction of N demand supplied by biologic N fixation (0-1).	0-1	double	0
MaxRootAllocation	Maximum fraction of DM growth allocated to roots (0-1).	0-1	double	0.25
MaxStemEffectOnLAI	Maximum fraction of stem tissue used when computing green LAI (0-1).	0-1	double	1
MinimumGreenWt	Minimum above ground green DM, leaf and stems (kgDM/ha).	kg/ha	double	100
MinimumNFixation	Minimum fraction of N demand supplied by biologic N fixation (0-1).	0-1	double	0
MinimumWaterFreePorosity	Minimum 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	-1
NDillutionCoefficient	Exponent to modify the effect of N deficiency on plant growth (>0.0).	-	double	0.25
PhotosyntheticPathway	Species metabolic pathway of C fixation during photosynthesys (C3/C4).		PhotosynthesisPathwayType	C3
PlantHeightExponent	Exponent controlling shoot height as function of DM weight (>1.0).	>1.0	double	2.8
PlantHeightMassForMax	DM weight above ground for maximum plant height (kgDM/ha).	kg/ha	double	10000
PlantHeightMaximum	Maximum plant height (mm).	mm	double	300
PlantHeightMinimum	Minimum plant height (mm).	mm	double	50
PlantType	Gets a value indicating how leguminous a plant is		String	AGPRyegrass
PreferenceForGreenOverDead	Relative preference for live over dead material during graze (>0.0).	-	double	1

Name	Description	Units	Type	Value
PreferenceForLeafOverStems	Relative preference for leaf over stem-stolon material during graze (>0.0).	-	double	1
R50	Gets or sets the R50 factor (W/m^2).	W/m^2	double	200
ReferencePhotosyntheticRate	Reference leaf CO_2 assimilation rate for photosynthesis (mg CO_2/m^2Leaf/s).	mg/m^2/s	double	1
ReproSeasonAllocationCoeff	Coefficient controlling the increase in shoot allocation during reproductive growth as function of latitude (-).	-	double	0.1
ReproSeasonMaxAllocationIncrease	Maximum increase in Shoot-Root ratio during reproductive growth (0-1).	0-1	double	0.5
ReproSeasonReferenceLatitude	Reference latitude determining timing for reproductive season (degrees).	degrees	double	41
ReproSeasonTimingCoeff	Coefficient controlling the time to start the reproductive season as function of latitude (-).	-	double	0.14
RespirationTReference	Reference temperature for maintenance respiration (oC).	oC	double	20
Root.KNH4	Ammonium uptake coefficient.		double	0.01
Root.KNO3	Nitrate uptake coefficient.		double	0.02
Root.MaximumNUptake	Maximum daily amount of N that can be taken up by the plant (kg/ha).		double	10
Root.NConcMaximum	Gets or sets the maximum N concentration, for luxury uptake (kg/kg).		double	0.025
Root.NConcMinimum	Gets or sets the minimum N concentration, structural N (kg/kg).		double	0.006
Root.NConcOptimum	Gets or sets the N concentration for optimum growth (kg/kg).		double	0.02
Root.ReferenceKSuptake	Reference value of Ksat for water availability function.		double	15
Root.ReferenceRLD	Reference value for root length density for the Water and N availability.		double	5

Name	Description	Units	Type	Value
Root.RootBottomDistributionFactor	Factor for root distribution; controls where the function is zero below maxRootDepth.		double	1.05
Root.RootDepthMaximum	Maximum rooting depth (mm).		double	1000
Root.RootDepthMinimum	Minimum rooting depth (mm).		double	50
Root.RootDistributionDepthParam	Depth from surface where root proportion starts to decrease (mm).	mm	double	90
Root.RootDistributionExponent	Exponent controlling the root distribution as function of depth (>0.0).	-	double	3.2
Root.RootElongationRate	Daily root elongation rate at optimum temperature (mm/day).	mm/day	double	25
Root.SpecificRootLength	Specific root length (m/gDM).		double	100
ShootMaxEffectOnLAI	Maximum aboveground biomass for considering stems when computing LAI (kgDM/ha).	kg/ha	double	1000
ShootRootGlfFactor	Maximum effect that soil GLFs have on Shoot-Root ratio (0-1).	0-1	double	0.5
SoilSaturationEffectMax	Maximum reduction in plant growth due to water logging (saturated soil) (0-1).	0-1	double	0.1
SoilSaturationRecoveryFactor	Maximum daily recovery rate from water logging (0-1).	0-1	double	0.25
SpeciesFamily	Gets or sets the family type for this plant species (grass/legume/forb).	-	PlantFamilyType	Grass
SpecificLeafArea	Specific leaf area (m^2/kgDM).	m^2/kg	double	20
Stem.DeadTissue.DigestibilityCellWall	The digestibility of cell walls (0-1).		double	0.2
Stem.DeadTissue.FractionNLuxuryRemobilisable	The fraction of luxury N remobilisable per day (0-1).		double	0
Stem.DevelopingTissue.DigestibilityCellWall	The digestibility of cell walls (0-1).		double	0.7
Stem.EmergingTissue.DigestibilityCellWall	The digestibility of cell walls (0-1).		double	0.9
Stem.EmergingTissue.FractionSugarNewGrowth	The sugar fraction on new growth, i.e. soluble carbohydrate (0-1).		double	0.5

Name	Description	Units	Type	Value
Stem.MatureTissue.DigestibilityCellWall	The digestibility of cell walls (0-1).		double	0.6
Stem.NConcMaximum	Gets or sets the maximum N concentration, for luxury uptake (kg/kg).		double	0.025
Stem.NConcMinimum	Gets or sets the minimum N concentration, structural N (kg/kg).		double	0.006
Stem.NConcOptimum	Gets or sets the N concentration for optimum growth (kg/kg).		double	0.02
Stolon.DeadTissue.DigestibilityCellWall	The digestibility of cell walls (0-1).		double	0.2
Stolon.DeadTissue.FractionNLuxuryRemobilisable	The fraction of luxury N remobilisable per day (0-1).		double	0
Stolon.DevelopingTissue.DigestibilityCellWall	The digestibility of cell walls (0-1).		double	0.7
Stolon.EmergingTissue.DigestibilityCellWall	The digestibility of cell walls (0-1).		double	0.9
Stolon.EmergingTissue.FractionSugarNewGrowth	The sugar fraction on new growth, i.e. soluble carbohydrate (0-1).		double	0.5
Stolon.FractionStanding	Proportion of organ DM that is standing, available to harvest (0-1).		double	0
Stolon.MatureTissue.DigestibilityCellWall	The digestibility of cell walls (0-1).		double	0.6
Stolon.NConcMaximum	Gets or sets the maximum N concentration, for luxury uptake (kg/kg).		double	0
Stolon.NConcMinimum	Gets or sets the minimum N concentration, structural N (kg/kg).		double	0
Stolon.NConcOptimum	Gets or sets the N concentration for optimum growth (kg/kg).		double	0
StolonEffectOnLAI	Fraction of stolon tissue used when computing green LAI (0-1).	0-1	double	0
TargetShootRootRatio	Target, or ideal, shoot-root ratio (>0.0).	-	double	4
TissueTurnoverRateRoot	Reference daily DM turnover rate for root tissues (0-1).	0-1	double	0.02
TissueTurnoverRateShoot	Reference daily DM turnover rate for shoot tissues (0-1). This is closely related to the leaf appearance rate.	0-1	double	0.05

Name	Description	Units	Type	Value
TurnoverDefoliationCoefficient	Coefficient of function increasing the turnover rate due to defoliation (>0.0).	-	double	0.5
TurnoverDefoliationRootEffect	Effect of defoliation on root turnover rate relative to stolon (0-1).	0-1	double	0.1
TurnoverDroughtEffectMax	Maximum increase in tissue turnover due to water deficit (>0.0).	-	double	1
TurnoverDroughtThreshold	Minimum GLFwater without effect on tissue turnover (0-1).	0-1	double	0.5
TurnoverTemperatureExponent	Exponent of function for temperature effect on tissue turnover (>0.0).	-	double	1
TurnoverTemperatureMin	Minimum temperature for tissue turnover (oC).	oC	double	2
TurnoverTemperatureRef	Reference temperature for tissue turnover (oC).	oC	double	20
UseColdStressFactor	Enable photosynthesis reduction due to cold damage is enabled (yes/no).	yes/no	YesNoAnswer	yes
UseHeatStressFactor	Enable photosynthesis reduction due to heat damage (yes/no).	yes/no	YesNoAnswer	yes
UseReproSeasonFactor	Adjust Shoot:Root ratio to mimic DM allocation during reproductive season (perennial species)?.	yes/no	YesNoAnswer	yes

Properties (Outputs)

Name	Description	Units	Type	Settable?
AboveGround	Get above ground biomass	g/m2	Biomass	False
AboveGroundDeadN	Gets the amount of N in dead tissues above ground (kgN/ha).	kg/ha	double	False
AboveGroundDeadWt	Gets the dry matter weight of dead tissues above ground (kgDM/ha).	kg/ha	double	False
AboveGroundHarvestable	Get above ground biomass	g/m2	Biomass	False

Name	Description	Units	Type	Settable?
AboveGroundLiveN	Gets the amount of N in live tissues above ground (kgN/ha).	kg/ha	double	False
AboveGroundLiveWt	Gets the dry matter weight of live tissues above ground (kgDM/ha).	kg/ha	double	False
AboveGroundN	Gets the amount of N in the plant above ground (kgN/ha).	kg/ha	double	False
AboveGroundNConc	Gets the average N concentration in the plant above ground (kgN/kgDM).	kg/kg	double	False
AboveGroundOrgans	Above ground organs.		List< PastureAboveGroundOrgan >	True
AboveGroundWt	Gets the dry matter weight of the plant above ground (kgDM/ha).	kg/ha	double	False
AssimilateAvailable	Amount of assimilate available to be damaged.		double	False
BasePotentialPhotosynthesisC	Gets the base potential photosynthetic rate, before damages, in carbon equivalent (kgC/ha).	kg/ha	double	False
BelowGroundLiveN	Gets the amount of N in live tissues below ground (kgN/ha).	kg/ha	double	False
BelowGroundLiveWt	Gets the dry matter weight of live tissues below ground (kgDM/ha).	kg/ha	double	False
BelowGroundN	Gets the amount of N in the plant below ground (kgN/ha).	kg/ha	double	False
BelowGroundWt	Gets the dry matter weight of the plant below ground (kgDM/ha).	kg/ha	double	False
CO2EffectExponent	Exponent controlling the CO2 effect on N requirements (>0.0).	-	double	True
CO2EffectMinimum	Minimum value for the CO2 effect on N requirements (0-1).	0-1	double	True

Name	Description	Units	Type	Settable?
CO2EffectOffsetFactor	Scaling parameter for the CO2 effects on N requirements (ppm).	ppm	double	True
CO2EffectScaleFactor	Scaling parameter for the CO2 effect on photosynthesis (ppm).	ppm	double	True
CoverDead	Gets the fraction of soil covered by dead tissues (0-1).	0-1	double	False
CoverGreen	Gets the plant's green cover (0-1).	0-1	double	False
CoverTotal	Gets the total plant cover (0-1).	0-1	double	False
CultivarNames	Gets a list of cultivar names (not used by AgPasture).		String	False
DeadTissue	Dead tissues from all above ground organs.		TissuesHelper	True
DemandAtLuxuryN	Gets the amount of N required with luxury uptake (kgN/ha).	kg/ha	double	False
DemandAtOptimumN	Gets the amount of N required for optimum growth (kgN/ha).	kg/ha	double	False
Depth	Gets the canopy depth (mm).	mm	double	False
DetachmentDroughtCoefficient	Coefficient controlling detachment rate as function of moisture (>0.0).	-	double	True
DetachmentDroughtEffectMin	Minimum effect of drought on detachment rate (0-1).	0-1	double	True
DevelopingTissue	Developing tissues from all above ground organs.		TissuesHelper	True
DigestibilitiesCellWall	Digestibility of cell walls for each tissue age, emerging, developing, mature and dead (0-1).	0-1	double	True
EmergingTissue	Emerging tissues from all above ground organs.		TissuesHelper	True
FixedN	Gets the amount of atmospheric N fixed by symbiosis (kgN/ha).	kg/ha	double	False
FractionGrowthToLeaf	Gets the fraction of new shoot growth allocated to leaves (0-1).	0-1	double	False
FractionGrowthToRoot	Gets the fraction of new growth allocated to roots (0-1).	0-1	double	False

Name	Description	Units	Type	Settable?
FractionGrowthToShoot	Gets the fraction of new growth allocated to shoot (0-1).	0-1	double	False
FractionPAR	Gets or sets the fraction of radiation that is photosynthetically active (0-1).	0-1	double	True
FRGR	Plant growth limiting factor, supplied to MicroClimate for calculating potential transpiration.	0-1	double	False
FVPD	Gets the effect of vapour pressure on growth (used by micromet) (0-1).	0-1	double	False
GlfCO2	Gets the growth factor due to variations in atmospheric CO2 (0-1).	0-1	double	False
GlfColdDamage	Gets the growth factor due to cold damage stress (0-1).	0-1	double	False
GlfHeatDamage	Gets the growth factor due to heat damage stress (0-1).	0-1	double	False
GlfNContent	Gets the growth factor due to variations in plant N concentration (0-1).	0-1	double	False
GlfNSupply	Gets the growth limiting factor due to soil N availability (0-1).	0-1	double	False
GlfRadnIntercept	Gets the growth factor due to variations in intercepted radiation (0-1).	0-1	double	False
GlfTemperature	Gets the growth factor due to variations in air temperature (0-1).	0-1	double	False
GlfWaterLogging	Gets the growth limiting factor due to water logging (0-1).	0-1	double	False
GlfWaterSupply	Gets the growth limiting factor due to water deficit (0-1).	0-1	double	False
GPP	Gets the gross primary productivity (kgC/ha).	kg/ha	double	False
GrossPotentialGrowthWt	Gets the gross potential growth rate (kgDM/ha).	kg/ha	double	False
GrossPotentialPhotosynthesisC	Gets the gross potential photosynthetic rate, after considering damages, in carbon equivalent (kgC/ha).	kg/ha	double	False

Name	Description	Units	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	Gets the average digestibility of harvested material (0-1).	0-1	double	False
HarvestedFraction	Gets the fraction of available dry matter actually harvested ().	0-1	double	False
HarvestedME	Gets the average metabolisable energy concentration of harvested material (MJ/kgDM).	MJ/kg	double	False
HarvestedN	The amount of N removed by harvest (kg/ha).	kg/ha	double	False
HarvestedNConc	Gets the average N concentration in harvested material (kgN/kgDM).	kg/kg	double	False
HarvestedWt	The amount of plant dry matter removed by harvest (kgDM/ha).	kg/ha	double	False
Height	Gets the average canopy height (mm).	mm	double	False
HerbageGrowthWt	Gets the net herbage growth rate (above ground) (kgDM/ha).	kg/ha	double	False
initialDMFractionsForbs	Initial fractions of DM for each plant part in forbs (0-1).		double	True
initialDMFractionsGrasses	Initial fractions of DM for each plant part in grasses (0-1).		double	True
initialDMFractionsLegumes	Initial fractions 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
InterceptedRadn	Gets or sets the solar radiation intercepted by the plant's canopy (MJ/m^2/day).	MJ/m^2/day	double	True

Name	Description	Units	Type	Settable?
IsAlive	Gets the flag signalling whether plant is alive (true/false).	true/false	boolean	False
IsC4	Gets a value indicating whether the biomass is from a c4 plant or not		boolean	False
IsReadyForHarvesting	Flag whether the crop is ready for harvesting.		boolean	False
LAI	Gets the LAI of live tissues (m^2/m^2).	m^2/m^2	double	True
LAIDead	Gets the leaf area index of dead tissues (m^2/m^2).	m^2/m^2	double	False
LAIGreen	Gets the leaf area index of green tissues (m^2/m^2).	m^2/m^2	double	True
LAITotal	Gets the total LAI, live + dead (m^2/m^2).	m^2/m^2	double	False
Leaf	Holds info about state of leaves (DM and N).		PastureAboveGroundOrgan	True
LeafDeadN	Gets the amount of N in dead leaves (kgN/ha).	kg/ha	double	False
LeafDeadWt	Gets the dry matter weight of dead leaves (kgDM/ha).	kg/ha	double	False
LeafLiveN	Gets the amount of N in live leaves (kgN/ha).	kg/ha	double	False
LeafLiveWt	Gets the dry matter weight of live leaves (kgDM/ha).	kg/ha	double	False
LeafN	Gets the amount of N in the plant's leaves (kgN/ha).	kg/ha	double	False
LeafNConc	Gets the average N concentration in plant's leaves (kgN/kgDM).	kg/kg	double	False
LeafWt	Gets the dry matter weight of plant's leaves (kgDM/ha).	kg/ha	double	False
LightProfile	Gets or sets the light profile for this plant, as calculated by MicroClimate (W/m^2). This is the intercepted radiation for each layer of the canopy.		CanopyEnergyBalanceInterceptio...	True
LitterDepositionN	Gets the amount of N in detached dead material deposited onto soil surface (kgN/ha).	kg/ha	double	False
LitterDepositionWt	Gets the dry matter weight of detached dead material deposited onto soil surface (kgDM/ha).	kg/ha	double	False
MatureTissue	Mature tissues from all above ground organs.		TissuesHelper	True

Name	Description	Units	Type	Settable?
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
MinimumGreenLeafProp	Leaf proportion in the minimum green Wt (0-1).	0-1	double	True
MinimumGreenRootProp	Minimum root amount relative to minimum green Wt (>0.0).	0-1	double	True
MoistureFactorTurnover	Gets the moisture factor for tissue turnover (0-1).	0-1	double	False
NAPP	Gets the net above-ground primary productivity (kgC/ha).	kg/ha	double	False
NBPP	Gets the net below-ground primary productivity (kgC/ha).	kg/ha	double	False
NetGrowthN	Gets the amount of N in new growth (kgN/ha).	kg/ha	double	False
NetGrowthWt	Gets the net, or actual, plant growth rate (kgDM/ha).	kg/ha	double	False
NetPotentialGrowthAfterNutrientWt	Gets the net potential growth rate after nutrient stress (kgDM/ha).	kg/ha	double	False
NetPotentialGrowthAfterWaterWt	Gets the net potential growth rate after water stress (kgDM/ha).	kg/ha	double	False
NetPotentialGrowthWt	Gets the net potential growth rate, after respiration (kgDM/ha).	kg/ha	double	False
NFixationCostC	Gets the n fixation costs expressed in carbon equivalent (kgC/ha).	kg/ha	double	False
NFixingCostFactor	Respiration cost factor due to the activity of symbiont bacteria (kgC/kgN fixed).	kg/kg	double	True
NPP	Gets the net primary productivity (kgC/ha).	kg/ha	double	False
NThresholdsForRoots	N concentration thresholds for roots, optimum, minimum and maximum (kgN/kgDM).	kg/kg	double	True
NuptakeSWFactor	Exponent of function determining soil extractable N.	-	double	True
Organs	A list of organs that can be damaged.		IOrganDamage	False

Name	Description	Units	Type	Settable?
PhotosynthesisCurveFactor	Gets or sets the photosynthesis curvature parameter (J/kg/s).	J/kg/s	double	True
PhotosyntheticEfficiency	Gets or sets the leaf photosynthetic efficiency (mg CO2/J).	mg CO2/J	double	True
PlantStatus	Gets the plant status (dead, alive, etc.).	-	String	False
Population	Plant population.		double	False
PotentialEP	Potential evapotranspiration, as calculated by MicroClimate (mm).	mm	double	True
RadiationTopOfCanopy	Gets or sets the radiance on top of the plant's canopy (MJ/m^2/day).	MJ/m^2/day	double	True
ReferenceCO2	Reference CO2 concentration for photosynthesis (ppm).	ppm	double	True
RelativeTurnoverEmerging	Relative turnover rate for emerging tissues (>0.0).	-	double	True
RemobilisableLuxuryN	Gets the amount of luxury N potentially remobilisable (kgN/ha).	kg/ha	double	False
RemobilisableSenescedN	Gets the amount of senesced N potentially remobilisable (kgN/ha).	kg/ha	double	False
RemobilisedLuxuryN	Gets the amount of luxury N actually remobilised (kgN/ha).	kg/ha	double	False
RemobilisedSenescedC	Gets the remobilised carbon from senesced tissues (kgC/ha).	kg/ha	double	False
RemobilisedSenescedN	Gets the amount of senesced N actually remobilised (kgN/ha).	kg/ha	double	False
ReproSeasonDurationCoeff	Coefficient controlling the duration of the reproductive season as function of latitude (-).	-	double	True
ReproSeasonOnsetDurationFactor	Proportion of the onset phase of shoulder period with reproductive growth effect (0-1).	0-1	double	True
ReproSeasonShouldersLengthFactor	Ratio between the length of shoulders and the period with full reproductive growth effect (-).	-	double	True

Name	Description	Units	Type	Settable?
RespirationLossC	Gets the respiration costs expressed in carbon equivalent (kgC/ha).	kg/ha	double	False
Root	The root object.		PastureBelowGroundOrgan	False
RootDepth	Gets the average depth of root zone (mm).	mm	double	False
RootDetachedN	Gets the amount of N in detached dead roots added to soil FOM (kgN/ha).	kg/ha	double	False
RootDetachedWt	Gets the dry matter weight of detached dead roots added to soil FOM (kgDM/ha).	kg/ha	double	False
RootFrontier	Gets the layer at bottom of root zone ().	-	int32	False
RootGrowthWt	Gets the net root growth rate (kgDM/ha).	kg/ha	double	False
RootN	Gets the amount of N in the plant's roots (kgN/ha).	kg/ha	double	False
RootNConc	Gets the average N concentration in plant's roots (kgN/kgDM).	kg/kg	double	False
RootWt	Gets the dry matter weight of plant's roots (kgDM/ha).	kg/ha	double	False
SoilAvailableN	Gets the amount of plant available N in the soil (kgN/ha).	kg/ha	double	False
SoilDemandN	Gets the amount of N demanded from the soil (kgN/ha).	kg/ha	double	False
SoilNH4Available	Gets the amount of plant available NH4-N in each soil layer (kgN/ha).	kg/ha	double	False
SoilNH4Uptake	Gets the amount of NH4-N taken up from each soil layer (kgN/ha).	kg/ha	double	False
SoilNO3Available	Gets the amount of plant available NO3-N in each soil layer (kgN/ha).	kg/ha	double	False
SoilNO3Uptake	Gets the amount of NO3-N taken up from each soil layer (kgN/ha).	kg/ha	double	False
SoilUptakeN	Gets the amount of N taken up from the soil (kgN/ha).	kg/ha	double	False

Name	Description	Units	Type	Settable?
Stage	Gets the 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
StemDeadN	Gets the amount of N in dead stems and sheath (kgN/ha).	kg/ha	double	False
StemDeadWt	Gets the dry matter weight of dead stems and sheath (kgDM/ha).	kg/ha	double	False
StemLiveN	Gets the amount of N in live stems and sheath (kgN/ha).	kg/ha	double	False
StemLiveWt	Gets the dry matter weight of alive stems and sheath (kgDM/ha).	kg/ha	double	False
StemN	Gets the amount of N in the plant's stems and sheath (kgN/ha).	kg/ha	double	False
StemNConc	Gets the average N concentration in plant's stems (kgN/kgDM).	kg/kg	double	False
StemWt	Gets the 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	True
StolonN	Gets the amount of N in the plant's stolons (kgN/ha).	kg/ha	double	False
StolonNConc	Gets the average N concentration in plant's stolons (kgN/kgDM).	kg/kg	double	False
StolonWt	Gets the 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

Name	Description	Units	Type	Settable?
TemperatureFactorRespiration	Gets the temperature factor for respiration (0-1).	0-1	double	False
TemperatureFactorTurnover	Gets the temperature factor for tissue turnover (0-1).	0-1	double	False
TotalC	Gets the total amount of C in the plant (kgC/ha).	kg/ha	double	False
TotalN	Gets the total amount of N in the plant (kgN/ha).	kg/ha	double	False
TotalWt	Gets the total dry matter weight of plant (kgDM/ha).	kg/ha	double	False
TurnoverDefoliationEffectMin	Minimum significant daily effect of defoliation on tissue turnover rate (0-1).	/day	double	True
TurnoverRateDeadShoot	Gets the turnover rate for dead shoot tissues (leaves and stem) (0-1).	0-1	double	False
TurnoverRateLiveShoot	Gets the turnover rate for live shoot tissues (leaves and stem) (0-1).	0-1	double	False
TurnoverRateRoots	Gets the turnover rate for roots tissues (0-1).	0-1	double	False
TurnoverRateStolons	Gets the 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
WaterAvailable	Gets the amount of plant available water in each soil layer (mm).	mm	double	False
WaterDemand	Gets or sets the amount of water demanded by the plant (mm).	mm	double	True
WaterUptake	Gets the amount of water taken up from each soil layer (mm).	mm	double	False
Width	Gets the width of the canopy (mm).	mm	double	False

Links (Dependencies)

Name	Type	IsOptional?
myClock	Clock	False
myMetData	IWeather	False

Name	Type	IsOptional?
mySummary	ISummary	False
roots	List< PastureBelowGroundOrgan >	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) *Add a zone where roots are to grow.*
EndCrop	void EndCrop()
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.*
Harvest	void Harvest()

Name	Description
KillCrop	void KillCrop(double fractionToKill) *Kills a fraction of this plant.*
ReduceCanopy	void ReduceCanopy(double deltaLAI) *Set the plant leaf area index.*
ReducePopulation	void ReducePopulation(double newPlantPopulation) *Reduce the plant population.*
ReduceRootLengthDensity	void ReduceRootLengthDensity(double deltaRLD) *Set the plant root length density.*
RemoveAssimilate	void RemoveAssimilate(double deltaAssimilate) *Remove an amount of assimilate from the plant.*
RemoveBiomass	void RemoveBiomass(String type, double amount) *Removes plant material simulating a graze event.*
RemoveBiomass	Biomass RemoveBiomass(double amountToRemove) *Removes a given amount of biomass (and N) from the plant.*
RemoveBiomass	void RemoveBiomass(String organName, String biomassRemoveType, OrganBiomassRemovalType biomassToRemove) *Remove biomass from an organ.*
Reset	void Reset()
SetActualNitrogenUptakes	void SetActualNitrogenUptakes(ZoneWaterAndN zones)
SetActualWaterUptake	void SetActualWaterUptake(ZoneWaterAndN zones)

Name	Description
Sow	void Sow(String cultivar, double population, double depth, double rowSpacing, double maxCover, double budNumber, double rowConfig) *Sows the plant. 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.*

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
DeadTissue	The mature tissue.		GenericTissue	True
DevelopingTissue	The developing tissue.		GenericTissue	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 biomas.	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
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

Name	Description	Units	Type	Settable?
DMSenesced	DM senescing from this organ (kg/ha).		double	False
DMTotal	Gets the 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.		GenericTissue	True
FractionStanding	Proportion of organ DM that is standing, available to harvest (0-1).		double	True
IsAboveGround	Gets a value indicating whether the biomass is above ground or not		boolean	False
Live	Return live biomass. Used by STOCK (g/m2).		Biomass	True
LiveTissue	Array of live tissue.		List< GenericTissue >	True
MatureTissue	The mature tissue.		GenericTissue	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	Gets or sets the maximum N concentration, for luxury uptake (kg/kg).		double	True
NConcMinimum	Gets or sets the minimum N concentration, structural N (kg/kg).		double	True
NConcOptimum	Gets or sets the N concentration for optimum growth (kg/kg).		double	True
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

Name	Description	Units	Type	Settable?
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
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	True
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?
Tissue	List< GenericTissue >	False

Methods (callable from manager)

Name	Description
CalculateTissueTurnover	void CalculateTissueTurnover(double turnoverRate) *Computes the DM and N amounts turned over for all tissues.*
DoCleanTransferAmounts	void DoCleanTransferAmounts()
DoKillOrgan	void DoKillOrgan(double fractionToRemove) *Kills part of the organ (transfer DM and N to dead tissue).*
DoResetOrgan	void DoResetOrgan()
Initialise	void Initialise(double minimumLiveWt) *Initialisation*
OnDoDailyInitialisation	void OnDoDailyInitialisation()
RemoveBiomass	void RemoveBiomass(OrganBiomassRemovalType biomassToRemove) *Remove biomass from organ*
Reset	void Reset(double emergingWt, double developingWt, double matureWt, double deadWt) *Reset this organ's state.*
ResetEmergence	void ResetEmergence(double emergingWt, double developingWt, double matureWt, double deadWt) *Reset this organ's state at emergence.*
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	Returns the root live tissue.		RootTissue	True
Depth	Gets or sets the rooting depth (mm).		double	True
KNH4	Ammonium uptake coefficient.		double	True

Name	Description	Units	Type	Settable?
KNO3	Nitrate uptake coefficient.		double	True
LengthDensity	Gets the root length density by volume (mm/mm^3).		double	False
Live	Returns the root live tissue.		RootTissue	True
MaximumNUptake	Maximum daily amount of N that can be taken up by the plant (kg/ha).		double	True
NConcMaximum	Gets or sets the maximum N concentration, for luxury uptake (kg/kg).		double	True
NConcMinimum	Gets or sets the minimum N concentration, structural N (kg/kg).		double	True
NConcOptimum	Gets or sets the N concentration for optimum growth (kg/kg).		double	True
NLiveRemobilisable	N remobilsed from live tissue.		double	False
ReferenceKSuptake	Reference value of Ksat for water availability function.		double	True
ReferenceRLD	Reference value for root length density for the Water and N availability.		double	True
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
RootDistributionDepthParam	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

Name	Type	IsOptional?
tissue	List< RootTissue >	False

Methods (callable from manager)

Name	Description
CurrentRootDistributionTarget	double CurrentRootDistributionTarget()
DetachRoots	void DetachRoots(double dryMatter, double nitrogen) *Detach roots.*
DoEndCrop	void DoEndCrop()
DoRootGrowthAllocation	void DoRootGrowthAllocation(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	double EvaluateTissueTurnover(double gamaR) *Computes the turnover rate.*
Initialise	void Initialise(Zone zone, double initialDM, double initialDepth, double minLiveDM) *Constructor, initialise tissues for the roots.*

Name	Description
IsInZone	boolean IsInZone(String zoneName)
	Return true if roots in this organ are in the specified zone.
PerformNutrientUptake	void PerformNutrientUptake(double no3Amount, double nh4Amount)
	Remove nutrients from soil - uptake.
PerformWaterUptake	void PerformWaterUptake(double amount)
	Remove water from soil - uptake.
RemobiliseDeadN	void RemobiliseDeadN(double fracRemobilised)
	Remobilse Dead N.
RemobiliseLiveN	void RemobiliseLiveN(double fracRemobilised)
	Remobilse N.
RemoveBiomass	void RemoveBiomass(String biomassRemoveType, OrganBiomassRemovalType biomassToRemove)
	Removes biomass from root layers when harvest, graze or cut events are called.
Reset	void Reset(double rootWt, double rootDepth)
	Reset this root organ's state.
Reset	void Reset()
RootDistributionTarget	double RootDistributionTarget()
SetNewGrowthAllocation	BiomassAndN SetNewGrowthAllocation(double dmToRoot, double nToRoot)
	Set new growth to root.

6 GenericTissue

Describes a generic tissue of a pasture species.

Properties (Outputs)

Name	Description	Units	Type	Settable?
Digestibility	Digestibility of this tissue (kg/kg). Digestibility of sugars is assumed to be 100%.		double	True
DigestibilityCellWall	The digestibility of cell walls (0-1).		double	True
DigestibilityProtein	The digestibility of proteins (0-1).		double	True
DM	Dry matter.		IAGPBiomass	False
DMRemoved	DM removed from this tissue (kg/ha).		double	True
DMTransferedIn	DM transferred into this tissue (kg/ha).		double	True
DMTransferedOut	DM transferred out of this tissue (kg/ha).		double	True
FractionNLuxuryRemobilisable	The fraction of luxury N remobilisable per day (0-1).		double	True
FractionSugarNewGrowth	The sugar fraction on new growth, i.e. soluble carbohydrate (0-1).		double	True
NRemobilisable	N available for remobilisation (kg/ha).		double	True
NRemobilised	N remobilised into new growth (kg/ha).		double	True
NRemoved	N removed from this tissue (kg/ha).		double	True
NTransferedIn	N transferred into this tissue (kg/ha).		double	True
NTransferedOut	N transferred out of this tissue (kg/ha).		double	True

Links (Dependencies)

Name	Type	IsOptional?
species	PastureSpecies	False
surfaceOrganicMatter	SurfaceOrganicMatter	False

Methods (callable from manager)

Name	Description
AddBiomass	void AddBiomass(double dmAmount, double nAmount)
	Add biomass.
ClearDailyDeltas	void ClearDailyDeltas()
OnDoDailyInitialisation	void OnDoDailyInitialisation()
RemoveBiomass	void RemoveBiomass(double fractionToRemove, double fractionToSoil)
	Removes biomass from tissue.
Reset	void Reset(double dmAmount, double nAmount)
	Initialise tissue to the specified amount.
Update	void Update()

7 RootTissue

Describes a root tissue of a pasture species.

Properties (Outputs)

Name	Description	Units	Type	Settable?
DM	Amount of biomass.		IAGPBiomass	False
FractionWt	The dry matter fraction for each layer (0-1).		double	False
NRemobilisable	The amount of N available for remobilisation (kg/ha).		double	True

Links (Dependencies)

Name	Type	IsOptional?
nutrient	INutrient	False
soilPhysical	IPhysical	False
species	PastureSpecies	False

Methods (callable from manager)

Name	Description
AddBiomass	void AddBiomass(double dmToAdd, double nToAdd)
	Add biomass.
DailyReset	void DailyReset()
DetachBiomass	void DetachBiomass(double amountDM, double amountN)
	Adds a given amount of detached root material (DM and N) to the soil's FOM pool.
DetachBiomass	void DetachBiomass(double amountDM, double amountN)
	Adds a given amount of detached root material (DM and N) to the soil's FOM pool.
DoRemobiliseN	void DoRemobiliseN(double fraction)
	Removes a fraction of remobilisable N for use into new growth.
DoTissueTurnover	BiomassAndN DoTissueTurnover(double turnoverRate, int32 bottomLayer, RootTissue to, double nConc)
	Computes the DM and N amounts turned over for all tissues.
Initialise	void Initialise(double initialDMByLayer, double initialNByLayer)
	Initialise this root instance.
MoveFractionToTissue	void MoveFractionToTissue(double fractionToRemove, RootTissue toTissue)
	Move a fraction of the biomass from this tissue to another tissue.
RemoveBiomass	BiomassAndNLayered RemoveBiomass(double fractionToRemove, boolean sendToSoil)
	Remove a fraction of the biomass.
Reset	void Reset()
ResetTo	void ResetTo(double dmAmount)
	Reset tissue to the specified amount.
SetBiomassTransferIn	void SetBiomassTransferIn(double dm, double n)
	Set the biomass moving into the tissue.

Name	Description
SetBiomassTurnover	void SetBiomassTurnover(double turnoverDM, double turnoverN, int32 bottomLayer, double fractionWt) *Set the tissue turnover rates.*
SetNewGrowthAllocation	BiomassAndN SetNewGrowthAllocation(double dm, double n) *Set the new growth allocation for the day.*
Update	void Update()

8 BiomassAndN

Amount of biomass and nitrogen (kg/ha)

9 BiomassAndNLayered

Amount of biomass and nitrogen (kg/ha)