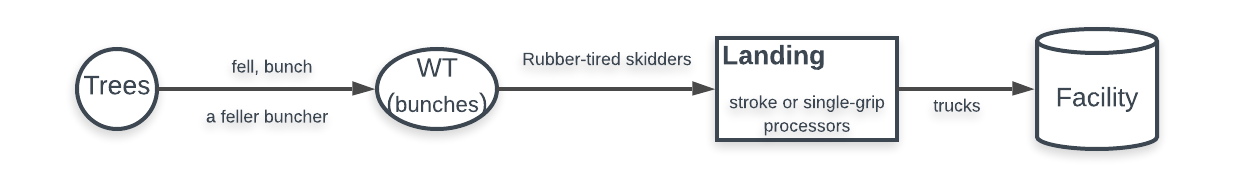
# Ground-Based Mech WT



## **INTERFACE PAGE**

Input (test data entered)





Output



## **INPUTS**

### Inputs



### Inputs for Cut Trees



**All cells highlighted in blue are the inputs entered in interface page.**

CT – Chip Trees

SLT – Small Log Trees (<=80 ft3)

LLT – Large Log Trees (>80 ft3)

SL – Small Trees (<=80 ft3)

ALT – All Log Trees

AT – All Trees

Removals – Removals, trees/acre

TreeVol – Tree Volume, ft3

RemovalsST = RemovalsCT + RemovalsSLT

RemovalsALT = RemovalsSLT + RemovalsLLT

Removals = RemovalsCT + RemovalsSLT + RemovalsLLT

#### Tree Volume Per Acre for Small Trees

VolPerAcreCT = RemovalsCT \* TreeVolCT

VolPerAcreSLT = RemovalsSLT \* TreeVolSLT

VolPerAcreLLT = RemovalsLLT \* TreeVolLLT

VolPerAcreST = VolPerAcreCT + VolPerAcreSLT

TreeVolST = IF(RemovalsST>0,VolPerAcreST/RemovalsST,0)

#### Tree Volume Per Acre for All Log Trees

VolPerAcreALT = VolPerAcreSLT + VolPerAcreLLT

TreeVolALT = IF(RemovalsALT>0,VolPerAcreALT/RemovalsALT,0)

#### Tree Volume Per Acre for All Trees

VolPerAcre = VolPerAcreCT + VolPerAcreSLT + VolPerAcreLLT

TreeVol = IF(Removals>0,VolPerAcre/Removals,0)

### Other Assumptions



### Calculated Intermediates



#### DBH

DBHCT – DBH for chip trees, in

DBHSLT – DBH for small log trees, in

DBHLLT – DBH for large log trees, in

DBHST – DBH for small trees, in

DBHALT – DBH for all log trees, in

DBH – DBH for all trees, in

DBHCT

=IF(TreeVolCT>0,IF(ISNUMBER(UserSpecDBHCT),UserSpecDBHCT,SQRT((TreeVolCT+3.675)/0.216)),0)

DBHSLT =IF(TreeVolSLT>0,IF(ISNUMBER(UserSpecDBHSLT),UserSpecDBHSLT,SQRT((TreeVolSLT+3.675)/0.216)),0)

DBHLLT =IF(TreeVolLLT>0,IF(ISNUMBER(UserSpecDBHLLT),UserSpecDBHLLT,SQRT((TreeVolLLT+3.675)/0.216)),0)

DBHST = IF(TreeVolST>0,SQRT((RemovalsCT\*DBHCT^2+RemovalsSLT\*DBHSLT^2)/RemovalsST),0)

DBHALT =IF(TreeVolALT>0,SQRT((RemovalsSLT\*DBHSLT^2+RemovalsLLT\*DBHLLT^2)/RemovalsALT),0)

DBH= SQRT((RemovalsCT\*DBHCT^2+RemovalsALT\*DBHALT^2)/Removals)

#### Tree Height

HeightCT

=IF(TreeVolCT>0,IF(ISNUMBER(UserSpecHeightCT),UserSpecHeightCT,-20+24\*SQRT(DBHCT)),0)

HeightSLT

=IF(TreeVolSLT>0,IF(ISNUMBER(UserSpecHeightSLT),UserSpecHeightSLT,-20+24\*SQRT(DBHSLT)),0)

HeightLLT

=IF(TreeVolLLT>0,IF(ISNUMBER(UserSpecHeightLLT),UserSpecHeightLLT,-20+24\*SQRT(DBHLLT)),0)

HeightST = IF(TreeVolST>0,(RemovalsCT\*HeightCT+RemovalsSLT\*HeightSLT)/RemovalsST,0)

HeightALT = IF(TreeVolALT>0,(RemovalsSLT\*HeightSLT+RemovalsLLT\*HeightLLT)/RemovalsALT,0)

Height = IF(TreeVol>0,(RemovalsCT\*HeightCT+RemovalsALT\*HeightALT)/Removals,0)

#### Wood Density

**If wood density for chip trees, small log trees or large log trees is not specified by users, then it is 50 lb/ft3 as default.**

WoodDensityCT =IF(UserSpecWDCT>0,UserSpecWDCT,50)

WoodDensitySLT =IF(UserSpecWDSLT>0,UserSpecWDSLT,50)

WoodDensityLLT =IF(UserSpecWDLLT>0,UserSpecWDLLT,50)

WoodDensityST =IF(VolPerAcreST>0,(WoodDensityCT\*VolPerAcreCT+WoodDensitySLT\*VolPerAcreSLT)/VolPerAcreST,0)

WoodDensityALT =IF(VolPerAcreALT>0,(WoodDensitySLT\*VolPerAcreSLT+WoodDensityLLT\*VolPerAcreLLT)/VolPerAcreALT,0)

WoodDensity =(WoodDensityCT\*VolPerAcreCT+WoodDensityALT\*VolPerAcreALT)/VolPerAcre

#### Hardwood Fraction

**If hardwood fraction for chip trees, small log trees or large log trees is not specified by users, then it is 0 as default.**

HdwdFractionCT =IF(ISNUMBER(User-SpecHFCT), User-SpecHFCT,0)

HdwdFractionSLT =IF(ISNUMBER(User-SpecHFSLT), User-SpecHFSLT,0)

HdwdFractionLLT =IF(ISNUMBER(User-SpecHFLLT), User-SpecHFLLT,0)

HdwdFractionST =IF(VolPerAcreST>0,(HdwdFractionCT\*VolPerAcreCT+HdwdFractionSLT\*VolPerAcreSLT)/VolPerAcreST,0)

HdwdFractionALT =IF(VolPerAcreALT>0,(HdwdFractionSLT\*VolPerAcreSLT+HdwdFractionLLT\*VolPerAcreLLT)/VolPerAcreALT,0)

HdwdFraction =(HdwdFractionCT\*VolPerAcreCT+HdwdFractionALT\*VolPerAcreALT)/VolPerAcre

#### Butt Diameter

#### Logs Per Tree

**Logs per chip tree was assumed as 1.**

LogsPerTreeCT = 1

LogsPerTreeSLT= (-0.43+0.678\*SQRT(DBHSLT))

LogsPerTreeLLT= (-0.43+0.678\*SQRT(DBHLLT))

LogsPerTreeST =(LogsPerTreeCT\*RemovalsCT+LogsPerTreeSLT\*RemovalsSLT)/RemovalsST

LogsPerTreeALT =IF(RemovalsALT=0,0,((LogsPerTreeSLT\*RemovalsSLT+LogsPerTreeLLT\*RemovalsLLT)/RemovalsALT))

LogsPerTree =(LogsPerTreeCT\*RemovalsCT+LogsPerTreeALT\*RemovalsALT)/Removals

#### Log Volume

LogVolST =TreeVolST/LogsPerTreeST

LogVolALT =IF(RemovalsALT=0,0,TreeVolALT/LogsPerTreeALT)

LogVol =TreeVol/LogsPerTree

#### CTL Logs Per Tree

For the Mech WT system, no idea about what the following CTL values used for?

CTLLogsPerTreeCT= MAX(1,2\*(-0.43+0.678\*SQRT(DBHCT)))

CTLLogsPerTree=MAX(1,2\*(-0.43+0.678\*SQRT(DBHST)))

#### CTL Log Volume

CTLLogVolCT=TreeVolCT/CTLLogsPerTreeCT

CTLLogVol=TreeVolST/CTLLogsPerTree

#### BFperCF

BFperCF=5 (not sure what it is)

#### Bole Weight

BoleWtCT =WoodDensityCT\*VolPerAcreCT/2000

BoleWtSLT =WoodDensitySLT\*VolPerAcreSLT/2000

BoleWtLLT =WoodDensityLLT\*VolPerAcreLLT/2000

BoleWtST =BoleWtCT+BoleWtSLT

BoleWtALT =BoleWtSLT+BoleWtLLT

BoleWt =BoleWtCT+BoleWtALT

#### Residue Weight

ResidueCT =UserSpecRFCT\*BoleWtCT

ResidueSLT =UserSpecRFSLT\*BoleWtSLT

ResidueLLT =UserSpecRFLLT\*BoleWtLLT

ResidueST =ResidueCT+ResidueSLT

ResidueALT =ResidueSLT+ResidueLLT

Residue =ResidueCT+ResidueALT

#### Manual Machine Size

ManualMachineSizeALT=MIN(1,TreeVolALT/MaxManualTreeVol)

ManualMachineSize=MIN(1,TreeVol/MaxManualTreeVol)

Again, for the Mech WT system, it doesn’t make sense that Manual related values were calculated in the FRCS spreadsheet. Perhaps it was just calculated with no meaning and also not involved in the later calculation.

#### Mechanized Machine Size

MechMachineSize=MIN(1,TreeVolST/MaxMechTreeVol)

#### Chipper Size

ChipperSize=MIN(1,TreeVolCT/MaxMechTreeVol)

#### NonSelfLevelCabDummy

NonSelfLevelCabDummy=IF(Slope<15,1,IF(Slope<35,1.75-0.05\*Slope,0))

I don’t know what NonSelfLevelCabDummy means

#### CSlopeFB&Harv (Mellgren 90)

CSlopeFB\_Harv =0.00015\*Slope^2+0.00359\*NonSelfLevelCabDummy\*Slope

#### CRemovalsFB&Harv (Mellgren 90)

CRemovalsFB\_Harv =MAX(0,0.66-0.001193\*RemovalsST\*2.47+5.357\*10^-7\*(RemovalsST\*2.47)^2)

#### CSlopeSkidForwLoadSize (Mellgren 90)

CSlopeSkidForwLoadSize =1-0.000127\*Slope^2

#### Chardwood

CHardwoodCT =1+HdwdCostPremium\*HdwdFractionCT

CHardwoodSLT =1+HdwdCostPremium\*HdwdFractionSLT

CHardwoodLLT =1+HdwdCostPremium\*HdwdFractionLLT

CHardwoodST =1+HdwdCostPremium\*HdwdFractionST

CHardwoodALT =1+HdwdCostPremium\*HdwdFractionALT

CHardwood =1+HdwdCostPremium\*HdwdFraction

## **OUTPUTS**

### System Product Summary

#### Amounts Recovered Per Acre



BoleVolCCF=VolPerAcre/100;

ResidueRecoveredPrimary – WT residue recovered as part of primary product, GT/ac

ResidueRecoveredOptional – Optional residue recovered, GT/ac

ResidueRecoveredPrimary=ResidueRecovFracWT\*ResidueCT

PrimaryProduct=BoleWt+ ResidueRecoveredPrimary

ResidueRecoveredOptional =IF(CalcResidues=1,(ResidueRecovFracWT\*ResidueSLT)+(ResidueRecovFracWT\*ResidueLLT),0)

TotalPrimaryAndOptional=PrimaryProduct+ ResidueRecoveredOptional

TotalPrimaryProductsAndOptionalResidues=PrimaryProduct+ResidueRecoveredOptional

#### Amounts Unrecovered and Left within the Stand Per Acre



GroundFuel – Activity fuels (residues) on the ground, GT/ac

PiledFuel – Piled activity fuels (residues), GT/ac

GroundFuel =ResidueLLT+ResidueST\*(1-ResidueRecovFracWT)

ResidueLLT not times 1-ResidueRecovFracWT???

#### Amounts Unrecovered and Left at the Landing



PiledFuel=IF(CalcResidues=1,0,ResidueSLT\*ResidueRecovFracWT)

No LLT residue Piled?

TotalResidues

=ResidueRecoveredPrimary+ResidueRecoveredOptional+ResidueUncutTrees+GroundFuel+PiledFuel

### System Cost Elements

#### For Primary Products (boles & WT residues), $/CCF of material treated by the activity



#### For Optional Residues, $/GT of additional residue recovered



Chip Loose Residues: from log trees <=80 cf

=CostChipLooseRes\*CollectOption\*InLimits1

Residue Move-In Costs, $/GT = =0\*CalcMoveIn\*CalcResidues\*InLimits1

What is the point of residue move-in costs?

#### For All Products, $/ac



ChipLooseResiduesFromLogTreesLess80cf=CostChipLooseRes\*CalcResidues\*ResidueRecoveredOptional\*InLimits1

FellAndBunchTreesLess80cf=CostFellBunch\*VolPerAcreST/100\*InLimits1;

ManualFellLimbBuckTreesLarger80cf=CostManFLBLLT\*VolPerAcreLLT/100\*InLimits1;

SkidBunchedAllTrees=CostSkidBun\*VolPerAcre/100\*InLimits1;

ProcessLogTreesLess80cf=CostProcess\*VolPerAcreSLT/100\*InLimits1;

LoadLogTrees=CostLoad\*VolPerAcreALT/100\*InLimits1;

ChipWholeTrees=CostChipWT\*VolPerAcreCT/100\*InLimits1;

Stump2Truck4PrimaryProductWithoutMovein=FellAndBunchTreesLess80cf+ManualFellLimbBuckTreesLarger80cf+SkidBunchedAllTrees+ProcessLogTreesLess80cf+LoadLogTrees+ChipWholeTrees

Movein4PrimaryProduct=MoveInCosts!G39\*CalcMoveIn\*BoleVolCCF\*InLimits1

OntoTruck4ResiduesWoMovein=ChipLooseResiduesFromLogTreesLess80cf

Movein4Residues =0\*CalcMoveIn\*CalcResidues\*ResidueRecoveredOptional\*InLimits1System Cost Summaries

TotalPerAcre=Stump2Truck4PrimaryProductWithoutMovein+Movein4PrimaryProduct+OntoTruck4ResiduesWoMovein+Movein4Residues

TotalPerBoleCCF=TotalPerAcre/BoleVolCCF

TotalPerGT=TotalPerAcre/TotalPrimaryProductsAndOptionalResidues

### Limits



ExceededMaxTreeVol (0=no,1=yes)

=IF(OR(TreeVolCT>AvgTreeSizeLimit4Chipping,TreeVolSLT>AvgTreeSizeLimit4Processing,TreeVolLLT>AvgTreeSizeLimit4ManualFellLimbBuck,TreeVolALT>AvgTreeSizeLimit4loading,TreeVol>AvgTreeSize4GrappleSkidding),1,0)

ExceededMaxSkidSlope (0=no, 1=yes) = =IF(Slope>SkiddingLimit,1,0)

InLimits1=IF(OR(ExceededMaxLLT=1,ExceededMaxTreeVol=1,ExceededMaxSkidSlope=1,ExceededMaxYardingDist=1),NA(),1)