

Appendix M

GAMS Programming Code for the Wik Forestry Goal Programming Model


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1 $Title Goal Programming Model of Forestry Opportunities for Wik people on Cape York Peninsula ;
2 *$offlisting
3 *Option SysOut = on;
4 Option solprint = on;
5
6 Sets
7 ForType Forest types /FT1, FT2, FT3, FT4, FT5/
8 ForTTL Forest tenure-title-location combinations /ASwNO, ASwNTnAR, ASwNTsAR, ASwML7032, CSwML7024/
9 HabTree Habitat tree regimes /HRN, HR5, HR8/
10 ForZones Forest management zones / FilterFor, HarvestFor/
11 LogType Log types in forest /ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld/
12 ProdType Product types milled / GOSwSap, GOSwoSap /
13 Species Commercially important timber species /DSK, MBW, CKI/
14
15 ForActs Forestry activities /ForManOut, ForManWik, ForManWikX, Harvest1, Harvest2, Haul, PMillOC, TptGOS_OC, XtraTruck, XTptGOS_OC, Pol
esChem, PMillIT, Mill_2200, Mill_4400, Mill_11000, Mill_20000, X_2200, X_4400, X_11000, X_20000, SoakTreat, SoakTreatX, VacTreat7, VacTrea
t12, VacTreat24, VacT7X, VacT12X, VacT24X, Stripping, StrippingX, AirDry, SolarDry, Combo8Dry, Combo24Dry, Combo40Dry, Floor1050, Floor394
0, FloorX1050, FloorX3940, SSFurn, SSFurnX/
16 BinForActs (ForActs) Forestry activities that enter model in binary form /ForManOut, ForManWik, TptGOS_OC, XtraTruck, PolesChem, PMillIT
, Mill_2200, Mill_4400, Mill_11000, Mill_20000, SoakTreat, VacTreat7, VacTreat12, VacTreat24, Stripping, Floor1050, Floor3940, SSFurn/
17 IntForActs (ForActs) Forestry activities that enter model in integer form / ForManWikX, Harvest1, Harvest2, Haul, PMillOC, XTptGOS_OC, X
_2200, X_4400, X_11000, X_20000, SoakTreatX, VacT7X, VacT12X, VacT24X, StrippingX, AirDry, SolarDry, Combo8Dry, Combo24Dry, Combo40Dry, Fl
oorX1050, FloorX3940, SSFurnX/
18
19 Bld_Mac_Eq Buildings machinery and equipment (capital) categories / Vehicle, Office, Other/
20 Time Time periods / Y0*Y29 /
21 Sens Parameter multipliers for the sensitivity analysis /Level/;
22
23 Table VolPerha (ForTTL, ForType, LogType, Species, ForZones, HabTree) "multiplier for Volume of all logs per hectare on all forest types
and tenures"
24 (FilterFor,HarvestFor).(HRN,HR5,HR8)
25 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).
26 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
27 Pole_9_5, Pole_8_0, ex_Lnd_Bld).(DSK,MBW,CKI) 1;
28
29 Table AreaofFor (ForTTL,ForType,ForZones,HabTree) "multiplier for Area of all forest types on all tenures"
30 (FilterFor,HarvestFor).(HRN,HR5,HR8)
31 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5) 1;
32
33 Table GOSrec (LogType,Species) sensitivity parameter for recovery % of GOS timber from Log volume
34 (DSK,MBW,CKI)
35 (ex_A-Saw,ex_B-Saw,A_Lnd_Bld,B_Lnd_Bld,Pole_12_5,Pole_11_0,Pole_9_5,Pole_8_0,ex_Lnd_Bld) 0 ;
36
37 Table StrApprec (LogType,Species) sensitivity parameter recovery % of appearance timber from GOS volume
38 (DSK,MBW,CKI)
39 (ex_A-Saw,ex_B-Saw,A_Lnd_Bld,B_Lnd_Bld,Pole_12_5,Pole_11_0,Pole_9_5,Pole_8_0,ex_Lnd_Bld) 0 ;
40
41 Scalar Disc discount rate / 0.07 /;

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42
43 Parameter MktPriceRd (Sens) "multiplier for Market price of roundwood products including stumpage and logs to outsiders" /Level 1/;
44 Parameter MktPriceSn (Sens) "multiplier for Market price of all sawnwood products" /Level 0/;
45
46 Parameter LabourEf (Sens) "multiplier for the efficiency of Wik labour" /Level 1/;
47 Parameter NLOppCosts (Sens) "multiplier for Non labour opeating costs" /Level 1/;
48 Parameter LabourCst (Sens) "multiplier for labour costs" /Level 1/;
49
50 Parameters
51   Year(Time) Period to discount values used to calculate annuity multiplier
52     /Y0 0, Y1 1, Y2 2, Y3 3, Y4 4, Y5 5, Y6 6, Y7 7, Y8 8, Y9 9, Y10 10, Y11 11,
53     Y12 12, Y13 13, Y14 14, Y15 15, Y16 16, Y17 17, Y18 18, Y19 19, Y20 20,
54     Y21 21, Y22 22, Y23 23, Y24 24, Y25 25, Y26 26, Y27 27, Y28 28, Y29 29/ ;
55
56 Table ForArea (ForTTL,ForType,ForZones,HabTree) Forest area in hectares by land tenure-title-location forest type and forest zone
57   FilterFor.(HRN,HR5,HR8) HarvestFor.(HRN,HR5,HR8)
58 ASwNO.FT1           600           8500
59 ASwNTnAR.FT1       1000          45000
60 ASwNTsAR.FT1       1600          57600
61 ASwML7032.FT1      2400         133200
62 CSwML7024.FT1       800          89500
63 ASwNO.FT2           2100          42900
64 ASwNTnAR.FT2       1400          21500
65 ASwNTsAR.FT2       2800          78700
66 ASwML7032.FT2       200           4500
67 CSwML7024.FT2        0            200
68 ASwNO.FT3           0              0
69 ASwNTnAR.FT3        200           2600
70 ASwNTsAR.FT3       4200          61200
71 ASwML7032.FT3       100            0
72 CSwML7024.FT3        0              0
73 ASwNO.FT4           0              0
74 ASwNTnAR.FT4        0              0
75 ASwNTsAR.FT4        0              0
76 ASwML7032.FT4        0            165
77 CSwML7024.FT4        0              0
78 ASwNO.FT5           0              0
79 ASwNTnAR.FT5        0            200
80 ASwNTsAR.FT5        0              0
81 ASwML7032.FT5        0            700
82 CSwML7024.FT5        0            500 ;
83
84 Table MinRot (ForTTL,ForType,ForZones,HabTree) Minimum rotation period outside mining leases and minimum investment period on mining
    leases
85   FilterFor.(HRN,HR5,HR8) HarvestFor.(HRn,HR5,HR8)
86 ASwNO.(FT1,FT2,FT3,FT4,FT5) 100 100
87 ASwNTnAR.(FT1,FT2,FT3,FT4,FT5) 100 100
88 ASwNTsAR.(FT1,FT2,FT3,FT4,FT5) 100 100

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89 ASwML7032.(FT1,FT2,FT3,FT4,FT5)      30              30
90 CSwML7024.(FT1,FT2,FT3,FT4,FT5)      30              30 ;
91
92 Table HabTreeLim (ForTTL,ForType,ForZones,HabTree) Sets area of forest available to harvest by habitat tree requirements across land
tenures in study region
93
94 ASwNO.(FT1,FT2,FT3,FT4,FT5)           0              0              0              1
95 ASwNtnAR.(FT1,FT2,FT3,FT4,FT5)        0              0              0              1
96 ASwNTsAR.(FT1,FT2,FT3,FT4,FT5)        0              0              0              1
97 ASwML7032.(FT1,FT2,FT3,FT4,FT5)       0              0              1              0
98 CSwML7024.(FT1,FT2,FT3,FT4,FT5)       0              0              1              0;
99
100 Parameter SusRotArea (ForTTL,ForType,ForZones,HabTree) Sustainable forest area that can be harvested each year by Habitat tree
requirements ;
101     SusRotArea (ForTTL,ForType,ForZones,HabTree) = (ForArea (ForTTL,ForType,ForZones,HabTree) * AreaofFor(ForTTL,ForType,ForZones,Hab
Tree)) / MinRot (ForTTL,ForType,ForZones,HabTree) * HabTreeLim(ForTTL,ForType,ForZones,HabTree) ;
102
103
104 Table TimberRes (ForTTL,ForType,LogType,Species,ForZones,HabTree) Timber volumes m3 per hectare by log type by species by forest type and
habitat tree regime
105
106 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.ex_A-Saw.DSK           0.54              0.54              0.54
107 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.ex_A-Saw.MBW           0              0              0
108 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.ex_A-Saw.CKI           0.15              0.15              0.15
109 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.ex_B-Saw.DSK           6.49              4.87              4.2
110 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.ex_B-Saw.MBW           2.51              2.19              1.86
111 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.ex_B-Saw.CKI           0.25              0.22              0.22
112 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.A_Lnd_Bld.DSK          2.92              2.54              2.27
113 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.A_Lnd_Bld.MBW           0              0              0
114 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.A_Lnd_Bld.CKI           0.24              0.22              0.18
115 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.B_Lnd_Bld.DSK           0              0              0
116 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.B_Lnd_Bld.MBW           1.85              1.66              1.3
117 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.B_Lnd_Bld.CKI           0              0              0
118 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.Pole_12_5.DSK           0.17              0.09              0.09
119 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.Pole_11_0.DSK           0.63              0.29              0.29
120 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.Pole_9_5.DSK            1              0.87              0.56
121 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.Pole_8_0.DSK           0.66              0.43              0.38
122 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.ex_Lnd_Bld.DSK           0.3              0.3              0.3
123 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.ex_Lnd_Bld.MBW           0.18              0.18              0.18
124 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1.ex_Lnd_Bld.CKI           0              0              0
125 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.ex_A-Saw.DSK            0              0              0
126 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.ex_A-Saw.MBW            0              0              0
127 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.ex_A-Saw.CKI            0              0              0
128 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.ex_B-Saw.DSK            0.3              0.3              0.3
129 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.ex_B-Saw.MBW            1.04              0.48              0.35
130 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.ex_B-Saw.CKI            0.28              0.28              0.19
131 (ASwNO,ASwNtnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.A_Lnd_Bld.DSK           0              0              0

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132	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.A_Lnd_Bld.MBW	0	0	0
133	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.A_Lnd_Bld.CKI	0	0	0
134	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.B_Lnd_Bld.DSK	0	0	0
135	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.B_Lnd_Bld.MBW	0.65	0	0
136	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.B_Lnd_Bld.CKI	0	0	0
137	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.Pole_12_5.DSK	0	0	0
138	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.Pole_11_0.DSK	0	0	0
139	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.Pole_9_5.DSK	0	0	0
140	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.Pole_8_0.DSK	0	0	0
141	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.ex_Lnd_Bld.DSK	0	0	0
142	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.ex_Lnd_Bld.MBW	0	0	0
143	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2.ex_Lnd_Bld.CKI	0	0	0
144	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.ex_A-Saw.DSK	0.07	0.02	0.02
145	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.ex_A-Saw.MBW	0	0	0
146	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.ex_A-Saw.CKI	0.07	0.07	0.07
147	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.ex_B-Saw.DSK	1.16	0.87	0.74
148	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.ex_B-Saw.MBW	5.98	4.6	3.74
149	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.ex_B-Saw.CKI	0.13	0.13	0.13
150	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.A_Lnd_Bld.DSK	0.2	0.2	0.04
151	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.A_Lnd_Bld.MBW	0	0	0
152	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.A_Lnd_Bld.CKI	0.04	0.04	0.04
153	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.B_Lnd_Bld.DSK	0	0	0
154	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.B_Lnd_Bld.MBW	2.61	2.08	1.61
155	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.B_Lnd_Bld.CKI	0	0	0
156	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.Pole_12_5.DSK	0	0	0
157	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.Pole_11_0.DSK	0	0	0
158	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.Pole_9_5.DSK	0	0	0
159	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.Pole_8_0.DSK	0	0	0
160	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.ex_Lnd_Bld.DSK	0.03	0.03	0.03
161	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.ex_Lnd_Bld.MBW	0	0	0
162	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3.ex_Lnd_Bld.CKI	0	0	0
163	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.ex_A-Saw.DSK	0	0	0
164	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.ex_A-Saw.MBW	0	0	0
165	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.ex_A-Saw.CKI	0	0	0
166	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.ex_B-Saw.DSK	2.13	1.32	1.32
167	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.ex_B-Saw.MBW	0.76	0.44	0
168	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.ex_B-Saw.CKI	0	0	0
169	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.A_Lnd_Bld.DSK	0	0	0
170	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.A_Lnd_Bld.MBW	0	0	0
171	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.A_Lnd_Bld.CKI	0	0	0
172	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.B_Lnd_Bld.DSK	0	0	0
173	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.B_Lnd_Bld.MBW	0.67	0	0
174	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.B_Lnd_Bld.CKI	0	0	0
175	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.Pole_12_5.DSK	0	0	0
176	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.Pole_11_0.DSK	0	0	0
177	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.Pole_9_5.DSK	0	0	0
178	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.Pole_8_0.DSK	0	0	0
179	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.ex_Lnd_Bld.DSK	2.01	1.83	1.83

180	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.ex_Lnd_Bld.MBW	0.41	0.41	0.41
181	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4.ex_Lnd_Bld.CKI	0	0	0
182	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.ex_A-Saw.DSK	0	0	0
183	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.ex_A-Saw.MBW	0	0	0
184	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.ex_A-Saw.CKI	0	0	0
185	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.ex_B-Saw.DSK	7.29	5.49	5.01
186	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.ex_B-Saw.MBW	1.64	1.64	1.64
187	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.ex_B-Saw.CKI	0	0	0
188	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.A_Lnd_Bld.DSK	2.92	2.24	1.77
189	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.A_Lnd_Bld.MBW	0	0	0
190	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.A_Lnd_Bld.CKI	0	0	0
191	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.B_Lnd_Bld.DSK	0	0	0
192	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.B_Lnd_Bld.MBW	1.52	1.52	1.1
193	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.B_Lnd_Bld.CKI	0	0	0
194	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.Pole_12_5.DSK	0	0	0
195	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.Pole_11_0.DSK	0	0	0
196	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.Pole_9_5.DSK	0.71	0.71	0.71
197	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.Pole_8_0.DSK	0	0	0
198	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.ex_Lnd_Bld.DSK	0	0	0
199	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.ex_Lnd_Bld.MBW	0	0	0
200	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5.ex_Lnd_Bld.CKI	0	0	0

201

202 **Table** MinHarPHa (ForTTL,ForType,ForZones,HabTree) Timber volumes m3 per hectare by log type by forest type and habitat tree regime
 203 (FilterFor,HarvestFor).(HRN,HR5,HR8)

204	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT1	2
205	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT2	2
206	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT3	2
207	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT4	2
208	(ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).FT5	2 ;

209

210

211 **Parameter** SetUpJob (BinForActs) Off and on country jobs CAFTEs created by forestry activity

212	/ ForManOut	0
213	ForManWik	3
214	TptGOS_OC	0.2
215	XtraTruck	0
216	PolesChem	1.5
217	PMillIT	4
218	Mill_2200	3
219	Mill_4400	12
220	Mill_11000	16
221	Mill_20000	25
222	SoakTreat	0
223	VacTreat7	0
224	VacTreat12	0
225	VacTreat24	0
226	Stripping	0
227	Floor1050	0

```

228   Floor3940      0
229   SSFurn         0/;
230
231 Parameter SetUpJobs (BinForActs);
232       SetUpJobs (BinForActs) = SetUpJob(BinForActs)/LabourEf('Level');
233
234 Parameter XtraJob (IntForActs) Extra jobs per unit of XJobs off and on country created beyond setup by forestry activities
235 / ForManWikX    1
236   Harvest1      2
237   Harvest2      3
238   Haul          1
239   PMilLOC       1.5
240   XTptGOS_OC    0.2
241   X_2200        0.0067
242   X_4400        0.0053
243   X_11000       0.0037
244   X_20000       0.00227
245   SoakTreatX    0.00114
246   VacT7X       0.0006
247   VacT12X      0.00052
248   VacT24X      0.00026
249   StrippingX    0.0014
250   AirDry        0
251   SolarDry      0.0022
252   Combo8Dry     0.0017
253   Combo24Dry   0.001
254   Combo40Dry   0.00083
255   FloorX1050   0.00571
256   FloorX3940   0.00152
257   SSFurnX      0.06667/;
258
259 Parameter XtraJobs (IntForActs);
260       XtraJobs (IntForActs) = XtraJob (IntForActs)/ LabourEf('Level');
261
262 Parameter OnCJob (BinForActs) On country jobs only CAFTEs created by forestry activity
263 / ForManOut     2
264   ForManWik     2
265   TptGOS_OC     0.2
266   XtraTruck     0
267   PolesChem     0
268   PMillIT       0
269   Mill_2200     0
270   Mill_4400     0
271   Mill_11000   0
272   Mill_20000   0
273   SoakTreat     0
274   VacTreat7     0
275   VacTreat12   0

```



```

276   VacTreat24  0
277   Stripping   0
278   Floor1050  0
279   Floor3940  0
280   SSFurn     0/;
281
282 Parameter OnCJobs (BinForActs);
283         OnCJobs (BinForActs)= OnCJob (BinForActs)/ LabourEf('Level');
284
285 Parameter XtraOnCJo (IntForActs) Extra jobs per unit of Xjobs on country created beyond setup by forestry activity
286
287 / ForManWikX 0.75
288   Harvest1    2
289   Harvest2    3
290   Haul        1
291   PMilloc    1.5
292   XTptGOS_OC 0.2
293   X_2200     0
294   X_4400     0
295   X_11000    0
296   X_20000    0
297   SoakTreatX 0
298   VacT7X     0
299   VacT12X    0
300   VacT24X    0
301   StrippingX 0
302   AirDry     0
303   SolarDry   0
304   Combo8Dry  0
305   Combo24Dry 0
306   Combo40Dry 0
307   FloorX1050 0
308   FloorX3940 0
309   SSFurnX    0/;
310
311 Parameter XtraOnCJob (IntForActs);
312         XtraOnCJob (IntForActs)= XtraOnCJo (IntForActs)/ LabourEf('Level');
313
314 Parameter VehicCost (Time) Capital (set-up) costs in dollars for four wheel drive vehicles
315
316 /Y0   35000, Y4  28000, Y9  28000, Y14  28000, Y19  28000, Y24  28000, Y29  -7000/;
317
318 Parameter BRVehicle (BinForActs) Annual variable costs of operating four wheel drive vehicles by forestry activity
319
320 / ForManOut   6240
321   ForManWik   6240 /;
322
323 Parameter IRVehicle (IntForActs) Annual variable costs of operating four wheel drive vehicles by forestry activity

```

```

324 / ForManWikX 6240
325 Harvest1 3120
326 Harvest2 3120
327 Haul 0
328 PMilloc 3120 /;
329

```

330 **Table** BAssetCost (Time,BinForActs) Capital (set-up) costs in dollars for all buildings equipment and machinery except four-wheel drive vehicles

```

331
332      ForManOut  ForManWik  TptGOS_OC  XtraTruck  PolesChem  PMillIT  Mill_2200  Mill_4400  Mill_11000  Mill_20000  SoakTreat
333  VacTreat7  VacTreat12  VacTreat24  Stripping  Floor1050  Floor3940  SSFurn
334  Y0  40000  40000  70000  70000  500000  24000  1200000  2000000  3800000  4800000  0
335  260000  500000  600000  10000  900000  1100000  600000
336  Y4  34000  34000  0  0  0  0  0  0  0  0  0  0
337  0  0  0  0  0  0  0
338  Y9  34000  34000  60000  60000  0  24000  0  0  0  0  0  0
339  0  0  10000  0  0  0  0
340  Y14  34000  34000  0  0  100000  0  250000  417000  790000  1000000  0
341  50000  100000  100000  0  200000  200000  150000
342  Y19  34000  34000  60000  60000  0  24000  0  0  0  0  0  0
343  0  0  10000  0  0  0  0
344  Y24  34000  34000  0  0  0  0  0  0  0  0  0  0
345  0  0  0  0  0  0  0
346  Y29  -6000  -6000  -10000  -10000  0  0  0  0  0  0  0  0
347  0  0  0  0  0  0  0;

```

340
341 **Table** IAssetCost (Time,IntForActs) Capital (set-up) costs in dollars for all buildings equipment and machinery except four-wheel drive vehicles

```

342      ForManWikX  Harvest1  Harvest2  Haul  PMilloc  XTptGOS_OC  X_2200  X_4400  X_11000  X_20000  SoakTreatX  VacT7X
343  VacT12X  VacT24X  AirDry  StrippingX  SolarDry  Combo8Dry  Combo24Dry  Combo40Dry  FloorX1050  FloorX3940  SSFurnX
344  Y0  0  40000  40000  150000  14000  0  0  0  0  5000  0  0
345  0  2560  0  35000  65000  110000  165000  0  0  0  0
346  Y4  0  0  0  0  0  0  0  0  0  0  0  0
347  0  0  0  0  0  0  0  0  0  0  0  0
348  Y9  0  35000  35000  110000  14000  0  0  0  0  5000  0  0
349  0  0  0  0  0  0  0  0  0  0  0  0
350  Y14  0  0  0  0  0  0  0  0  0  0  0  0
351  0  800  0  35000  65000  110000  165000  0  0  0  0  0
352  Y19  0  35000  35000  110000  14000  0  0  0  0  5000  0  0
353  0  0  0  0  0  0  0  0  0  0  0  0
354  Y24  0  0  0  0  0  0  0  0  0  0  0  0
355  0  0  0  0  0  0  0  0  0  0  0  0
356  Y29  0  -5000  -5000  -40000  0  0  0  0  0  0  0  0
357  0  0  0  0  0  0  0  0  0  0  0  0 ;

```

```

350
351 *Present value of uneven flows of money
352 Parameter PV(Time) Present value of $1 at Year(Time);
353      PV(Time) = 1/(1+Disc)**Year(Time);

```

```

354 *Present value of an annuity
355
356 Parameter An(Time) Present value of an ordinary annuity of $1;
357 An(Time) = 1/((1 + Disc)**Year(Time));
358
359 Parameter Annuity Present value of an ordinary annuity of $1 over 30 years;
360 Annuity = sum(Time, An(Time))/1000000;
361
362 display Annuity;
363
364 Parameter PVVehicle Present value of the capital cost of a single vehicle over 30 investment period;
365 PVVehicle = sum (Time, PV(Time)*VehicCost(Time))/1000000;
366
367 Parameter PVBAAsset Present value of the capital cost of Binary forestry activities the forest management office over 30 year investment
period;
368 PVBAAsset(BinForActs) = sum (Time, PV(Time)*BAAssetCost(Time,BinForActs))/1000000 ;
369
370 Parameter PVIAsset Present value of the capital cost of Integer forestry activities the forest management office over 30 year investment
period;
371 PVIAsset(IntForActs) = sum (Time, PV(Time)*IAssetCost(Time,IntForActs))/1000000 ;
372
373 *Labour details
374 Scalar CDEP Assumed level of CDEP wages per worker currently 200 per week and does not account for other costs of CDEP expressed in
dollars per annum/10400/;
375 Scalar Labourcost Labour cost including all on costs per CAFTE per annum /22810/;
376 Scalar FMoppexp Forest management operating expenses expressed as a percentage of labour cost /0.05/;
377
378 Table PermExtRoy (ForTTL,ForType,ForZones,HabTree) "2004 permission to invite outsiders to harvest timber and demand royalties from them
for the privalege"
379 (FilterFor,HarvestFor).(HRN,HR5,HR8)
380 ASwNO.(FT1,FT2,FT3,FT4,FT5) 0
381 ASwNTnAR.(FT1,FT2,FT3,FT4,FT5) 1
382 ASwNTsAR.(FT1,FT2,FT3,FT4,FT5) 1
383 ASwML7032.(FT1,FT2,FT3,FT4,FT5) 0
384 CSwML7024.(FT1,FT2,FT3,FT4,FT5) 0 ;
385
386 *Table PermExtRoy (ForTTL,ForType,LogType,Species,ForZones,HabTree) "Future permission following declaration of Aboriginal freehold to
invite outsiders to harvest timber and demand royalties from them for the privalege"
387 * (FilterFor,HarvestFor).(HRN,
HR5,HR8)
388 *ASwNO.(FT1,FT2,FT3,FT4,FT5).
389 *(ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
390 * (DSK,MBW,CKI) 1
391 *ASwNTnAR.(FT1,FT2,FT3,FT4,FT5).
392 *(ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
393 * (DSK,MBW,CKI) 1
394 *ASwNTsAR.(FT1,FT2,FT3,FT4,FT5).
395 *(ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).

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396 *                                     (DSK,MBW,CKI)                                1
397 *ASwML7032.(FT1,FT2,FT3,FT4,FT5).
398 *(ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
399 *                                     (DSK,MBW,CKI)                                1
400 *CSwML7024.(FT1,FT2,FT3,FT4,FT5).
401 *(ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
402 *                                     (DSK,MBW,CKI)                                0
403 *
404
405 Table ForestNAR (ForTTL,ForType,ForZones,HabTree) "Forest north of the Archer River outside mining leases"
406           (FilterFor,HarvestFor).(HRN,HR5,HR8)
407 ASwNO.(FT1,FT2,FT3,FT4,FT5)           1
408 ASwNTnAR.(FT1,FT2,FT3,FT4,FT5)       1
409 ASwNTsAR.(FT1,FT2,FT3,FT4,FT5)       0
410 ASwML7032.(FT1,FT2,FT3,FT4,FT5)      0
411 CSwML7024.(FT1,FT2,FT3,FT4,FT5)      0 ;
412
413 Table ForestSAR (ForTTL,ForType,ForZones,HabTree) "Forest north of the Archer River outside mining leases"
414           (FilterFor,HarvestFor).(HRN,HR5,HR8)
415 ASwNO.(FT1,FT2,FT3,FT4,FT5)           0
416 ASwNTnAR.(FT1,FT2,FT3,FT4,FT5)       0
417 ASwNTsAR.(FT1,FT2,FT3,FT4,FT5)       1
418 ASwML7032.(FT1,FT2,FT3,FT4,FT5)      0
419 CSwML7024.(FT1,FT2,FT3,FT4,FT5)      0 ;
420
421 Table HaulCost (ForTTL,ForType,LogType,Species,ForZones,HabTree) "Haulage cost in $/m3/km"
422                                     (FilterFor,HarvestFor).(HRN,HR5,
HR8)
423 ASwNO.(FT1,FT2,FT3,FT4,FT5).
424 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
425                                     (DSK,MBW,CKI)                                0.274
426 ASwNTnAR.(FT1,FT2,FT3,FT4,FT5).
427 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
428                                     (DSK,MBW,CKI)                                0.274
429 ASwNTsAR.(FT1,FT2,FT3,FT4,FT5).
430 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
431                                     (DSK,MBW,CKI)                                0.274
432 ASwML7032.(FT1,FT2,FT3,FT4,FT5).
433 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
434                                     (DSK,MBW,CKI)                                0.274
435 CSwML7024.(FT1,FT2,FT3,FT4,FT5).
436 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
437                                     (DSK,MBW,CKI)                                0.274 ;
438
439 Table HaulDist (ForTTL,ForType,LogType,Species,ForZones,HabTree) "Haulage distance km"
440                                     (FilterFor,HarvestFor).(HRN,HR5,
HR8)
441 ASwNO.(FT1,FT2,FT3,FT4,FT5).

```

442 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
 443 (DSK,MBW,CKI) 75
 444 ASwNTnAR.(FT1,FT2,FT3,FT4,FT5).
 445 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
 446 (DSK,MBW,CKI) 65
 447 ASwNTsAR.(FT1,FT2,FT3,FT4,FT5).
 448 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
 449 (DSK,MBW,CKI) 75
 450 ASwML7032.(FT1,FT2,FT3,FT4,FT5).
 451 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
 452 (DSK,MBW,CKI) 60
 453 CSwML7024.(FT1,FT2,FT3,FT4,FT5).
 454 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
 455 (DSK,MBW,CKI) 70 ;
 456

457 **Table** MillSuit (LogType,Species) Suitability of harvested log types for sawmilling

458 (DSK,MBW,CKI)

459 ex_A-Saw 1
 460 ex_B-Saw 1
 461 A_Lnd_Bld 1
 462 B_Lnd_Bld 1
 463 Pole_12_5 1
 464 Pole_11_0 1
 465 Pole_9_5 1
 466 Pole_8_0 1
 467 ex_Lnd_Bld 0;

468
 469 **Table** PoleSuit (LogType,Species) Suitability of harvested logs for electricity poles

470 DSK MBW CKI

471 ex_A-Saw 0 0 0
 472 ex_B-Saw 0 0 0
 473 A_Lnd_Bld 0 0 0
 474 B_Lnd_Bld 0 0 0
 475 Pole_12_5 1 0 0
 476 Pole_11_0 1 0 0
 477 Pole_9_5 1 0 0
 478 Pole_8_0 1 0 0
 479 ex_Lnd_Bld 0 0 0 ;

480
 481 **Table** P12_5Suit (LogType,Species) freight electricity poles

482 DSK MBW CKI

483 ex_A-Saw 0 0 0
 484 ex_B-Saw 0 0 0
 485 A_Lnd_Bld 0 0 0
 486 B_Lnd_Bld 0 0 0
 487 Pole_12_5 1 0 0
 488 Pole_11_0 0 0 0
 489 Pole_9_5 0 0 0

```

490 Pole_8_0      0      0      0
491 ex_Lnd_Bld   0      0      0 ;
492
493 Table P11_0Suit (LogType,Species) freight electricity poles
494           DSK   MBW   CKI
495 ex_A-Saw     0      0      0
496 ex_B-Saw     0      0      0
497 A_Lnd_Bld   0      0      0
498 B_Lnd_Bld   0      0      0
499 Pole_12_5   0      0      0
500 Pole_11_0   1      0      0
501 Pole_9_5    0      0      0
502 Pole_8_0    0      0      0
503 ex_Lnd_Bld  0      0      0 ;
504
505 Table P9_5Suit (LogType,Species) freight electricity poles
506           DSK   MBW   CKI
507 ex_A-Saw     0      0      0
508 ex_B-Saw     0      0      0
509 A_Lnd_Bld   0      0      0
510 B_Lnd_Bld   0      0      0
511 Pole_12_5   0      0      0
512 Pole_11_0   0      0      0
513 Pole_9_5    1      0      0
514 Pole_8_0    0      0      0
515 ex_Lnd_Bld  0      0      0 ;
516
517 Table P8_0Suit (LogType,Species) freight electricity poles
518           DSK   MBW   CKI
519 ex_A-Saw     0      0      0
520 ex_B-Saw     0      0      0
521 A_Lnd_Bld   0      0      0
522 B_Lnd_Bld   0      0      0
523 Pole_12_5   0      0      0
524 Pole_11_0   0      0      0
525 Pole_9_5    0      0      0
526 Pole_8_0    1      0      0
527 ex_Lnd_Bld  0      0      0 ;
528
529 Table LandSuit (LogType,Species) Suitability of harvested logs for landscape and building poles
530           (DSK,MBW,CKI)
531 ex_A-Saw     0
532 ex_B-Saw     0
533 A_Lnd_Bld   1
534 B_Lnd_Bld   1
535 Pole_12_5   1
536 Pole_11_0   1
537 Pole_9_5    1

```

```

538 Pole_8_0          1
539 ex_Lnd_Bld       1 ;
540
541 Table NLHarCost1 (ForTTL,ForType,LogType,Species,ForZones,HabTree) Non labour harvesting costs in dollars per cubic metre of log
excluding four-wheel drive vehicle costs
542                                     (FilterFor,HarvestFor).(HRN,HR5,HR8)
543 (ASwNO,ASwNThAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).
544 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
545 Pole_9_5, Pole_8_0, ex_Lnd_Bld).(DSK,MBW,CKI)
546                                     10.45 ;
547 Table NLHarCost2 (ForTTL,ForType,LogType,Species,ForZones,HabTree)
548                                     (FilterFor,HarvestFor).(HRN,HR5,HR8)
549 (ASwNO,ASwNThAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).
550 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
551 Pole_9_5, Pole_8_0, ex_Lnd_Bld).(DSK,MBW,CKI)
552                                     8.25 ;
553 Table NLPMillCst (ForTTL,ForType,LogType,Species,ForZones,HabTree) Non labour portable sawmilling costs in dollars per cubic metre of log
four wheel drive and labour accounted for elsewhere
554                                     (FilterFor,HarvestFor).(HRN,HR5,HR8)
555 (ASwNO,ASwNThAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).
556 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
557 Pole_9_5, Pole_8_0, ex_Lnd_Bld).(DSK,MBW,CKI)
558                                     10.7 ;
559 Table NLPMITCst (LogType,Species) Non labour portable sawmilling costs in dollars per cubic metre of log four wheel drive and labour
accounted for elsewhere
560                                     (DSK,MBW,CKI)
561 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
562 Pole_9_5, Pole_8_0, ex_Lnd_Bld)
563                                     11.7 ;
564 Table NLPoleLand (LogType,Species) Non labour electricity and landscape pole chemical treatment cost
565                                     (DSK,MBW,CKI)
566 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
567 Pole_9_5, Pole_8_0, ex_Lnd_Bld)
568                                     33.80 ;
569 Table NL22_44Cst (LogType,Species) Non labour portable sawmilling costs in dollars per cubic metre of log four wheel drive and labour
accounted for elsewhere
570                                     (DSK,MBW,CKI)
571 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
572 Pole_9_5, Pole_8_0, ex_Lnd_Bld)
573                                     21.6 ;
574 Table NL11_20Cst (LogType,Species) Non labour portable sawmilling costs in dollars per cubic metre of log four wheel drive and labour
accounted for elsewhere
575                                     (DSK,MBW,CKI)
576 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
577 Pole_9_5, Pole_8_0, ex_Lnd_Bld)
578                                     19.3 ;
579 Table NLSoakCst (LogType,Species) "Non labour costs for soaking chemical treatment method $/m3 GOS"
580                                     (DSK,MBW,CKI)

```

581 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
582 Pole_9_5, Pole_8_0, ex_Lnd_Bld) 19 ;
583

584 **Table** NLVac7Cst (LogType,Species) "Non labour costs for Vac 7 chemical treatment method \$/m3 GOS"
585 (DSK,MBW,CKI)

586 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
587 Pole_9_5, Pole_8_0, ex_Lnd_Bld) 21 ;
588

589 **Table** NLV12_24C (LogType,Species) "Non labour costs for Vac 12 and 24 chemical treatment method \$/m3 GOS"
590 (DSK,MBW,CKI)

591 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
592 Pole_9_5, Pole_8_0, ex_Lnd_Bld) 24 ;
593

594 **Table** NLStripCst (LogType,Species) "Non labour stripping costs for sawn timber \$/m3 GOS"
595 (DSK,MBW,CKI)

596 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
597 Pole_9_5, Pole_8_0, ex_Lnd_Bld) 9.1 ;
598

599 **Table** NLAirACst (LogType,Species) "Non labour costs -Opportunity Costs- of air-drying appearance timber \$/m3 GOS"
600 (DSK,MBW,CKI)

601 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
602 Pole_9_5, Pole_8_0, ex_Lnd_Bld) 0 ;
603

604 **Table** NLAirSCst (LogType,Species) "Non labour costs + Opportunity Costs of air-drying structural timber \$/m3 GOS (Can't air-dry
structural timber to 12% MC, so no Opp cost compared with kilns)"
605 (DSK,MBW,CKI)

606 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
607 Pole_9_5, Pole_8_0, ex_Lnd_Bld) 0 ;
608

609 **Table** NLSolACst (LogType,Species) "Non labour costs of solar drying appearance timber \$/m3 GOS"
610 (DSK,MBW,CKI)

611 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
612 Pole_9_5, Pole_8_0, ex_Lnd_Bld) 15.1 ;
613

614 **Table** NLSolSCst (LogType,Species) "Non labour costs of solar drying structural timber \$/m3 GOS"
615 (DSK,MBW,CKI)

616 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
617 Pole_9_5, Pole_8_0, ex_Lnd_Bld) 19.4 ;
618

619 **Table** NLComACst (LogType,Species) "Non labour costs of combination drying appearance timber \$/m3 GOS"
620 (DSK,MBW,CKI)

621 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
622 Pole_9_5, Pole_8_0, ex_Lnd_Bld) 22.9 ;
623

624 **Table** NLComSCst (LogType,Species) "Non labour costs of combination drying structural timber \$/m3 GOS"
625 (DSK,MBW,CKI)

626 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
627 Pole_9_5, Pole_8_0, ex_Lnd_Bld) 30 ;


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628
629 Table OppAirACst (LogType,Species) "Opportunity Costs of air-drying appearance timber $/m3 GOS/discount rate"
630                                     (DSK,MBW,CKI)
631 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
632  Pole_9_5, Pole_8_0, ex_Lnd_Bld)                                     461.5;
633
634 Table OppAirSCst (LogType,Species) "Opportunity Costs of air-drying structural timber $/m3 GOS /discount rate"
635                                     (DSK,MBW,CKI)
636 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
637  Pole_9_5, Pole_8_0, ex_Lnd_Bld)                                     365.8 ;
638
639 Table OppSolACst (LogType,Species) "Opportunity Costs of solar drying appearance timber $/m3 GOS/discount rate"
640                                     (DSK,MBW,CKI)
641 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
642  Pole_9_5, Pole_8_0, ex_Lnd_Bld)                                     249.2;
643
644 Table OppSolSCst (LogType,Species) "Opportunity Costs of solar drying structural timber $/m3 GOS /discount rate"
645                                     (DSK,MBW,CKI)
646 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
647  Pole_9_5, Pole_8_0, ex_Lnd_Bld)                                     497.9;
648
649 Table OppComACst (LogType,Species) "Opportunity costs of combination drying appearance timber $/m3 GOS/discount rate"
650                                     (DSK,MBW,CKI)
651 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
652  Pole_9_5, Pole_8_0, ex_Lnd_Bld)                                     219.8;
653
654 Table OppComSCst (LogType,Species) "Opportunity costs of combination drying structural timber $/m3 GOS/discount rate"
655                                     (DSK,MBW,CKI)
656 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
657  Pole_9_5, Pole_8_0, ex_Lnd_Bld)                                     418.8;
658
659 Scalar NLDockCst "Cost of docking appearance and structural timber $/m3GOS" /25/;
660 Scalar NLwoSapCst "Extra cost of milling timber without sap $/m3log" /5/;
661
662 Table NLF1050Cst (LogType,Species) "Non labour costs of dry milling flooring in the 1050 m3 per annum facility $/m3 GOS"
663                                     (DSK,MBW,CKI)
664 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
665  Pole_9_5, Pole_8_0, ex_Lnd_Bld)                                     75 ;
666
667 Table NLF3940Cst (LogType,Species) "Non labour costs of dry milling flooring in the 3940 m3 per annum facility $/m3 GOS"
668                                     (DSK,MBW,CKI)
669 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0,
670  Pole_9_5, Pole_8_0, ex_Lnd_Bld)                                     135 ;
671
672 Scalar NLFurnCst "Non labour costs of furniture"/ 290 /;
673
674 Table GOSRwSap (LogType,Species) GOS recovery % from log volume
675         DSK   MBW   CKI

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676 ex_A-Saw      0.40  0.40  0.40
677 ex_B-Saw      0.35  0.35  0.35
678 A_Lnd_Bld     0.40  0.40  0.40
679 B_Lnd_Bld     0.35  0.35  0.35
680 Pole_12_5     0.40
681 Pole_11_0     0.40
682 Pole_9_5      0.40
683 Pole_8_0      0.40
684 ex_Lnd_Bld           ;
685
686 Table GOSRwoSap (LogType,Species) GOS recovery % from log volume
687           DSK   MBW   CKI
688 ex_A-Saw      0.35  0.35  0.35
689 ex_B-Saw      0.30  0.30  0.30
690 A_Lnd_Bld     0.35  0.35  0.35
691 B_Lnd_Bld     0.30  0.30  0.30
692 Pole_12_5     0.35
693 Pole_11_0     0.35
694 Pole_9_5      0.35
695 Pole_8_0      0.35
696 ex_Lnd_Bld           ;
697
698 Table StructRec (LogType,Species) recovery % of structural timber from GOS volume
699           DSK   MBW   CKI
700 ex_A-Saw      0.8   0.15  0.8
701 ex_B-Saw      0.8   0.15  0.8
702 A_Lnd_Bld     0.8   0.15  0.8
703 B_Lnd_Bld     0.8   0.15  0.8
704 Pole_12_5     0.8
705 Pole_11_0     0.8
706 Pole_9_5      0.8
707 Pole_8_0      0.8
708 ex_Lnd_Bld           ;
709
710 Table OneOnStRec (LogType,Species) Use as a multiplier to get from structural timber volume to GOS volume
711           DSK       MBW       CKI
712 ex_A-Saw      1.25   6.6666667   1.25
713 ex_B-Saw      1.25   6.6666667   1.25
714 A_Lnd_Bld     1.25   6.6666667   1.25
715 B_Lnd_Bld     1.25   6.6666667   1.25
716 Pole_12_5     1.25
717 Pole_11_0     1.25
718 Pole_9_5      1.25
719 Pole_8_0      1.25
720 ex_Lnd_Bld           ;
721
722 Table AppearRec (LogType,Species) recovery % of appearance timber from GOS volume
723           DSK   MBW   CKI

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724 ex_A-Saw      0.7  0.4  0.7
725 ex_B-Saw      0.7  0.4  0.7
726 A_Lnd_Bld    0.7  0.4  0.7
727 B_Lnd_Bld    0.7  0.4  0.7
728 Pole_12_5    0.7
729 Pole_11_0    0.7
730 Pole_9_5     0.7
731 Pole_8_0     0.7
732 ex_Lnd_Bld           ;
733
734 Table OneOnApRec (LogType,Species) Use as a multiplier to get from appearance timber volume to GOS volume
735           DSK      MBW      CKI
736 ex_A-Saw    1.4285714    2.5    1.4285714
737 ex_B-Saw    1.4285714    2.5    1.4285714
738 A_Lnd_Bld   1.4285714    2.5    1.4285714
739 B_Lnd_Bld   1.4285714    2.5    1.4285714
740 Pole_12_5   1.4285714
741 Pole_11_0   1.4285714
742 Pole_9_5    1.4285714
743 Pole_8_0    1.4285714
744 ex_Lnd_Bld           ;
745
746 Table SelectRec (LogType,Species) recovery % of select appearance timber from GOS volume
747           DSK      MBW      CKI
748 ex_A-Saw           0.35
749 ex_B-Saw
750 A_Lnd_Bld           0.35
751 B_Lnd_Bld
752 Pole_12_5
753 Pole_11_0
754 Pole_9_5
755 Pole_8_0
756 ex_Lnd_Bld           ;
757
758 Table SelectSuit(LogType,Species) suitability of boards to produce select timber
759           DSK      MBW      CKI
760 ex_A-Saw           1
761 ex_B-Saw
762 A_Lnd_Bld           1
763 B_Lnd_Bld
764 Pole_12_5
765 Pole_11_0
766 Pole_9_5
767 Pole_8_0
768 ex_Lnd_Bld           ;
769
770
771 Table SelectXRec (LogType,Species) "recovery % of xtra appearance timber from GOS volume when the aim is select appearance (gives total

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recovery of 70%"
772          DSK   MBW   CKI
773 ex_A-Saw          0.35
774 ex_B-Saw
775 A_Lnd_Bld          0.35
776 B_Lnd_Bld
777 Pole_12_5
778 Pole_11_0
779 Pole_9_5
780 Pole_8_0
781 ex_Lnd_Bld          ;
782
783 Table FloorRec (LogType,Species) "recovery % of strip flooring timber from appearance volume"
784          DSK   MBW   CKI
785 ex_A-Saw          0.65 0.65 0.65
786 ex_B-Saw          0.65 0.65 0.65
787 A_Lnd_Bld          0.65 0.65 0.65
788 B_Lnd_Bld          0.65 0.65 0.65
789 Pole_12_5          0.65
790 Pole_11_0          0.65
791 Pole_9_5           0.65
792 Pole_8_0           0.65
793 ex_Lnd_Bld          ;
794
795 Table FurnRec (LogType,Species) "recovery % of furniture timber from appearance or structural volume"
796          DSK   MBW   CKI
797 ex_A-Saw          0.65 0.65 0.65
798 ex_B-Saw          0.65 0.65 0.65
799 A_Lnd_Bld          0.65 0.65 0.65
800 B_Lnd_Bld          0.65 0.65 0.65
801 Pole_12_5          0.65
802 Pole_11_0          0.65
803 Pole_9_5           0.65
804 Pole_8_0           0.65
805 ex_Lnd_Bld          ;
806
807 Table StumpValue (ForTTL,ForType,LogType,Species,ForZones,HabTree) Stumpage values or royalties paid in dollars per cubic metre to Wik
people from outsider harvesting teams
808
809 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).ex_A-Saw.DSK          (FilterFor,HarvestFor).(HRN,HR5,HR8)          40
810 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).ex_A-Saw.MBW          40
811 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).ex_A-Saw.CKI          20
812 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).ex_B-Saw.DSK          20
813 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).ex_B-Saw.MBW          20
814 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).ex_B-Saw.CKI          20
815 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).A_Lnd_Bld.DSK          40
816 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).A_Lnd_Bld.MBW          40
817 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).A_Lnd_Bld.CKI          40

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818 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).B_Lnd_Bld.DSK 20
819 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).B_Lnd_Bld.MBW 20
820 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).B_Lnd_Bld.CKI 20
821 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).Pole_12_5.DSK 106
822 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).Pole_11_0.DSK 90
823 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).Pole_9_5.DSK 74
824 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).Pole_8_0.DSK 59
825 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).ex_Lnd_Bld.DSK 20
826 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).ex_Lnd_Bld.MBW 20
827 (ASwNO,ASwNTnAR,ASwNTsAR,ASwML7032,CSwML7024).(FT1,FT2,FT3,FT4,FT5).ex_Lnd_Bld.CKI 20 ;
828
829 Parameter Royalty (ForTTL,ForType,LogType,Species,ForZones,HabTree) "Royalty payable to DPI";
830 Royalty (ForTTL,ForType,LogType,Species,ForZones,HabTree) = StumpValue (ForTTL,ForType,LogType,Species,ForZones,HabTree) * 0.5;
831
832 Table PayRoyalty (ForTTL,ForType,LogType,Species,ForZones,HabTree) Stumpage values or royalties paid in dollars per cubic metre to Wik
people from outsider harvesting teams
833 (FilterFor,HarvestFor).(HRN,HR5,
HR8)
834 ASwNO.(FT1,FT2,FT3,FT4,FT5).
835 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
836 (DSK,MBW,CKI) 1
837 ASwNTnAR.(FT1,FT2,FT3,FT4,FT5).
838 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
839 (DSK,MBW,CKI) 0
840 ASwNTsAR.(FT1,FT2,FT3,FT4,FT5).
841 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
842 (DSK,MBW,CKI) 0
843 ASwML7032.(FT1,FT2,FT3,FT4,FT5).
844 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
845 (DSK,MBW,CKI) 1
846 CSwML7024.(FT1,FT2,FT3,FT4,FT5).
847 (ex_A-Saw, ex_B-Saw, A_Lnd_Bld, B_Lnd_Bld, Pole_12_5, Pole_11_0, Pole_9_5, Pole_8_0, ex_Lnd_Bld).
848 (DSK,MBW,CKI) 1 ;
849
850 Table TPoleVal (LogType,Species) "Market price of treated poles $/m3"
851 DSK MBW CKI
852 ex_A-Saw 0 0 0
853 ex_B-Saw 0 0 0
854 A_Lnd_Bld 0 0 0
855 B_Lnd_Bld 0 0 0
856 Pole_12_5 547 0 0
857 Pole_11_0 513 0 0
858 Pole_9_5 464 0 0
859 Pole_8_0 483 0 0
860 ex_Lnd_Bld 0 0 0 ;
861
862 Table TLandVal (LogType,Species) "Market price of treated poles $/m3"
863 DSK MBW CKI

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864 ex_A-Saw      0    0    0
865 ex_B-Saw      0    0    0
866 A_Lnd_Bld    260  0   260
867 B_Lnd_Bld    0    0    0
868 Pole_12_5    260  0    0
869 Pole_11_0    260  0    0
870 Pole_9_5     260  0    0
871 Pole_8_0     260  0    0
872 ex_Lnd_Bld   260  260  260 ;
873
874 Parameter GOSval (Species) GOS market prices by species /DSK 600, MBW 600, CKI 600/;
875 Parameter StructVal (Species) Treated (or sapwood free) and seasoned structural timber market value/ DSK 1400, MBW 1400, CKI 1400/;
876 Parameter AppearVal (Species) Treated (or sapwood free) and seasoned appearance timber market value/ DSK 1600, MBW 1600, CKI 2000/;
877 Parameter SelectVal (Species) Treated (or sapwood free) and seasoned select timber market value/ DSK 0, MBW 0, CKI 0/;
878 Parameter FloorVal (Species) Treated (or sapwood free) and seasoned and dressed strip flooring timber market value/ DSK 2750, MBW 2750, C
KI 4000/;
879 Scalar FurnVal "Furniture value per table" / 2250 /;
880
881 Variables
882 Z Sum of goal program to be minimised
883 *Forest management
884 ManageFor Permission variable that ensures forest management activity undertaken before anything else
885 * OutHar Permission for outsiders to harvest within the study region
886
887 BForActs (BinForActs) Binary permission variables for forestry activities
888 IForActs (IntForActs) Integer permission variables for forestry activities
889 XVehicles (IntForActs) Extra vehicles after setup
890 *Harvesting
891 LogTypeHar (ForTTL,ForType,ForZones,HabTree) Log types harvested
892 AreaHarOut (ForTTL,ForType,ForZones,HabTree) Area harvested annually by outsider harvest teams
893 AreaHWik1 (ForTTL,ForType,ForZones,HabTree) Forest area harvested annually by 1 cutting team Wik harvest teams
894 AreaHWik2 (ForTTL,ForType,ForZones,HabTree) Forest area harvested annually by 2 cutting team Wik harvest teams
895 MaxWikVol1 (ForTTL,ForType,LogType,Species,ForZones,HabTree) Max volume of timber harvestable under W1 regime
896 MaxWikVol2 (ForTTL,ForType,LogType,Species,ForZones,HabTree) Max volume of timber harvestable under W2 regime
897 HarvVol1 (ForTTL,ForType,LogType,Species,ForZones,HabTree) actual volume of timber harvested under W1 regime
898 HarvVol2 (ForTTL,ForType,LogType,Species,ForZones,HabTree) actual volume of timber harvested under W2 regime
899 MaxOutVol (ForTTL,ForType,LogType,Species,ForZones,HabTree) Max volume of timber harvestable by outsiders
900 OutVol (ForTTL,ForType,LogType,Species,ForZones,HabTree) actual volume of timber harvested by outsiders
901 UndHarPen1 (ForTTL,ForType,ForZones,HabTree) Penalty for harvesting less than 10 m3 per hectare in wik harvest regime 1
902 UndHarPen2 (ForTTL,ForType,ForZones,HabTree) Penalty for harvesting less than 10 m3 per hectare in wik harvest regime 2
903 UndHarPenO (ForTTL,ForType,ForZones,HabTree) Penalty for harvesting less than 10 m3 per hectare by outsiders
904
905
906 *Portable milling on country and haul
907 PMOCVol (ForTTL,ForType,LogType,Species,ForZones,HabTree) Volume of logs harvested and then portable milled on country
908 HaulVol (ForTTL,ForType,LogType,Species,ForZones,HabTree) Volume of logs harvested and then hauled to town or market
909 *Treated electricity poles, landscape and building poles
910 TPoleVol (LogType,Species) volume of logs hauled to town are then treated to become treated electricity poles

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911 TLandVol (LogType,Species) volume of logs hauled to town are then treated to become treated landscape and building poles
 912 **Milling in town*
 913 Sawmill Permission to sawmill timber
 914 PMillVol(LogType,Species) Volume of timber portable milled in town
 915 Vol2200 (LogType,Species)
 916 Vol4400 (LogType,Species)
 917 Vol11000 (LogType,Species)
 918 Vol20000 (LogType,Species)
 919 MITVol (LogType,Species) Volume of logs hauled to town are then sawmilled
 920 Xtra_2200 extra volume milled beyond threshold level for 2200 m3 max volume mill
 921 Xtra_4400 extra volume milled beyond threshold level for 4400 m3 max volume mill
 922 Xtra_11000 extra volume milled beyond threshold level for 11000 m3 max volume mill
 923 Xtra_20000 extra volume milled beyond threshold level for 20000 m3 max volume mill
 924 **GOS Recovery*
 925 SawwS_OC(LogType,Species) Volume of logs sawn with sap by portable mill on country
 926 SawwoS_OC(LogType,Species) Volume of logs sawn without sap by portable mill on country
 927 SawwS_IT(LogType,Species) Volume of logs sawn with sap by mill in town
 928 SawwoS_IT(LogType,Species) Volume of logs sawn without sap by mill in town
 929 GOSwS_OC (LogType,Species) Volume of GOS timber produced with sapwood from portable sawmilling on country
 930 GOSwoS_OC (LogType,Species) Volume of GOS timber produced without sapwood from portable sawmilling on country
 931 GOSwS_IT (LogType,Species) Volume of GOS timber produced with sapwood in town
 932 GOSwoS_IT (LogType,Species) Volume of GOS timber produced without sapwood in town
 933 **Destination of GOS timber milled on country*
 934 MktPMOCwS(LogType,Species) Volume of GOS timber milled on country with sapwood sent to GOS market
 935 MktPMOCwoS (LogType,Species) Volume of GOS timber milled on country without sapwood sent to GOS market
 936 ChmPMOCwS (LogType,Species) Volume of GOS timber milled on country with sapwood sent to chemical treatment
 937 ChmPMOCwoS (LogType,Species) Volume of GOS timber milled on country without sapwood sent to chemical treatment
 938 SeaPMOCwoS(LogType,Species) Volume of GOS timber milled on country without sapwood sent for seasoning
 939 **Destination of GOS timber milled in town*
 940 MktMITwS(LogType,Species) Volume of GOS timber milled in town with sapwood sent to GOS market
 941 MktMITwoS (LogType,Species) Volume of GOS timber milled in town without sapwood sent to GOS market
 942 ChmMITwS (LogType,Species) Volume of GOS timber milled in town with sapwood sent to chemical treatment
 943 ChmMITwoS (LogType,Species) Volume of GOS timber milled in town without sapwood sent to chemical treatment
 944 SeaMITwoS(LogType,Species) Volume of GOS timber milled in town without sapwood sent for seasoning
 945 **Chemical treatment of sawn timber*
 946 SoakVol (LogType,Species) Total volume of sawn timber treated by method
 947 Vac7Vol (LogType,Species)
 948 Vac12Vol (LogType,Species)
 949 Vac24Vol (LogType,Species)
 950 **Seasoning sawn timber*
 951 AppearST(LogType, Species) Volume of appearance timber seasoned
 952 StructST(LogType, Species) Volume of structural timber seasoned
 953 AppearAir(LogType, Species) Volume of appearance timber that is air-dried
 954 AppearSol(LogType, Species) Volume of appearance timber that is solar kiln dried
 955 AppearCom8(LogType, Species) "Volume of appearance timber that is combo dried in 8 m3 kiln"
 956 AppearCo24(LogType, Species) "Volume of appearance timber that is combo dried in 24 m4 kiln"
 957 AppearCo40(LogType, Species) "Volume of appearance timber that is combo dried in 40 m3 kiln"
 958 StructAir(LogType, Species) "Volume of structural timber that is air dried"

959 StructSol(LogType, Species) "Volume of structural timber that is solar kiln dried"
 960 StructCom8(LogType, Species) "Volume of structural timber that is combo dried in 8 m3 kiln"
 961 StructCo24(LogType, Species) "Volume of structural timber that is combo dried in 24 m3 kiln"
 962 StructCo40(LogType, Species) "Volume of structural timber that is combo dried in 40 m3 kiln"
 963 RecAppearT(LogType, Species) "Volume of Appearance timber recovered from GOS"
 964 RecSelect(LogType, Species) "Volume of select timber recovered from GOS"
 965 RecStructT(LogType, Species) "Volume of Structural timber recovered from GOS"
 966 Appear(LogType, Species) Volume of appearance timber as opposed to select timber
 967 Select1(LogType, Species) Volume of select timber as opposed to appearance timber
 968 Select2(LogType, Species)
 969 AppearMkt(LogType, Species) Distribution of appearance timber to market
 970 StructMkt (LogType, Species) Distribution of structural timber to market
 971 Flooring (LogType, Species) Distribution of appearance timber to flooring plant in nominal dimensions
 972 FurnitA (LogType, Species) Distribution of appearance timber to furniture manufacturing plant
 973 FurnitS (LogType, Species) Distribution of structural timber to furniture manufacturing plant
 974 **Strip flooring*
 975 RecFloor (LogType, Species) Recovery of strip flooring from appearance timber
 976 F1050Vol(LogType, Species) Volume of floor boards going through the 1050 facility
 977 F3940Vol (LogType, Species) Volume of floor boards going through the 3940 facility
 978
 979 **Freight*
 980 SawFreight number of freight trucks transporting sawn timber
 981 P12Freight number of freight trucks transporting 12.5 m poles
 982 P11Freight
 983 P9Freight
 984 P8Freight
 985 LndFreight
 986 FurFreight number of freight trucks transporting furniture components
 987 Xsaw9 Sawn timber with 9.5 m poles
 988 Xfur9 Furniture with 9.5 m poles
 989 Xsaw8 sawn timber with 8.0 m poles
 990 Xfur8 Furniture with 8.0 m poles
 991 XfurL
 992 XsawL
 993 NumFreight Total number of freight trucks per year
 994 DS52 first 52 freight trucks in dry season
 995 DSg52 next 104 freight trucks in dry season
 996 WS52 first 52 freight trucks in wet season
 997 Wsg52 next 104 freight trucks in wet season
 998
 999 **Cost variables*
 1000 NLVCForMan Non labour variable costs of forest management 5% of labour costs
 1001 Penalty "penalty for harvesting less than 10 m3/ha"
 1002 NonLabVarC Non labour variable costs of production for all forestry sectors except forest management
 1003 LabCost PV of total labour cost
 1004 VehicRCost PV vehicle running costs
 1005 VehicCCost PV of capital costs of vehicles
 1006 AssetCost PV of cost of assets

1007 Freight PV of cost of freight to market
1008 CapitalReq Capital required to establish industry
1009 Insurance PV of insurance cost for the forestry industry in Aurukun Shire
1010
1011 **Revenue variables*
1012 Stumpage PV of logs sold at stump to outsiders
1013 ElectPoles
1014 LandPoles
1015 GOSBoards
1016 SelectCKI
1017 Appearance
1018 Structural
1019 StripFloor
1020 Furniture
1021 **Harvesting*
1022 LogAreas(ForTTL,ForType,ForZones) Areas logged
1023 **Goals*
1024 **Don't think I need this one : SUJobs (BinForActs) Total number of jobs created setting up activities*
1025 Xworkers (IntForActs) Extra forestry worker groups created beyond setup jobs
1026 NPVund Underachievement of NPV goal
1027 AllJobund Underachievement of All jobs goal
1028 OnCJobund Underachievement of On Country jobs goal
1029 HarvSAund Underachievement of no harvesting south of the Archer River goal
1030 HarvNAund Underachievement of no harvesting north of the Archer River outside of mining leases ;
1031
1032 **Positive variables** NPVund, HarvSAund, AllJobund, OnCJobund, Xworkers, AreaHarOut, AreaHWik1,
1033 AreaHWik2, MaxWikVol1, MaxWikVol2, HarvVol1, HarvVol2, MaxOutVol, OutVol,
1034 PMOCVol, HaulVol, TPoleVol, TLandVol, MITVol, Sawmill
1035 Xtra_2200, PMillVol, Vol2200, Vol4400, Vol11000, Vol20000,
1036 Xtra_4400, Xtra_11000, Xtra_20000, SawwS_OC, SawwoS_OC,
1037 SawwS_IT, SawwoS_IT, GOSwS_OC, GOSwoS_OC, MktPMOCwS, MktPMOCwoS,
1038 ChmPMOCwS, ChmPMOCwoS, SeaPMOCwoS, GOSwS_IT, GOSwoS_IT, MktMITwS,
1039 MktMITwoS, ChmMITwS, ChmMITwoS, SeaMITwoS, SoakVol, Vac7Vol, Vac12Vol,
1040 Vac24Vol, AppearST, StructST, AppearAir, AppearSol, AppearCom8,
1041 AppearCo24, AppearCo40, StructAir, StructSol, StructCom8, StructCo24,
1042 StructCo40, RecAppearT, RecSelect, RecStructT, Appear, Select1, Select2,
1043 F1050Vol, F3940Vol, RecFloor, FurnitS, FurnitA, Flooring, StructMkt,
1044 AppearMkt, SawFreight, Pl2Freight, Pl1Freight, P9Freight, P8Freight, LndFreight,
1045 FurFreight, Xsaw9, Xfur9, Xsaw8, Xfur8, XsawL, XfurL, DS52, DSg52, WS52, WSg52 ;
1046
1047 **Binary variables** ManageFor, BForActs, LogTypeHar ;
1048 **Integer variables** XVehicles, IForActs;
1049
1050 **Equations**
1051
1052 Obj Objective function
1053 **Goals*
1054 TotJobs Total number of jobs created (CAFTEs)

1055 OnCtyJobs Jobs created on country
1056 SouthArch Area harvested south of the Archer River
1057 OffMLnArch Area harvested outside of mining leases north of the Archer River
1058 NPV Net present value
1059
1060 **Hard Constraints*
1061 **Harvesting*
1062 PermManag Permission to manage forests
1063 HowHarv How Wik people harvest the resource
1064 XtraVeh Necessitates the purchase of additional vehicles for forest management
1065 Xtraman Requirement for additional forest managers beyond setup
1066 HarvTeams1 Requires number of 1 cutting team crews to equal IForActs
1067 HarvTeams2 Requires number of 2 cutting team crews to equal IForActs
1068 HarvTeams1a
1069 HarvTeams1b
1070 HarvVehic1 Requires one vehicle per 1 cutting team crew
1071 HarvVehic2 Requires two vehicles per 1 cutting team crew
1072
1073 **Log harvesting constraints*
1074 AreaConst (ForTTL,ForType,LogType,Species,ForZones,HabTree) Limits total forest area logged in any one year to SusRotArea
1075 VolConW1 (ForTTL,ForType,LogType,Species,ForZones,HabTree) Maximum volume that can be harvested from the area harvested in W1 teams
1076 VolConW1a (ForTTL,ForType,LogType,Species,ForZones,HabTree) ensures that the actual harvested volume does not exceed the max
1077 VolConW1b (ForTTL,ForType,ForZones,HabTree) "ensures at least 2m3/ha are harvested"
1078 VolConW1c (ForTTL,ForType,ForZones,HabTree) "penalises harvesting less than 10m3 per hectare"
1079 VolConW2 (ForTTL,ForType,LogType,Species,ForZones,HabTree) Maximum volume that can be harvested from the area harvested in W2 teams
1080 VolConW2a (ForTTL,ForType,LogType,Species,ForZones,HabTree) ensures that the actual harvested volume does not exceed the max
1081 VolConW2b (ForTTL,ForType,ForZones,HabTree) "ensures at least 2m3/ha are harvested"
1082 VolConW2c (ForTTL,ForType,ForZones,HabTree) "penalises harvesting less than 10m3 per hectare"
1083 VolConOut (ForTTL,ForType,LogType,Species,ForZones,HabTree) Maximum volume that can be harvested from the area harvested by outsiders
1084 VolConOuta (ForTTL,ForType,LogType,Species,ForZones,HabTree) ensures that the actual harvested volume does not exceed the max
1085 VolConOutb (ForTTL,ForType,ForZones,HabTree) "ensures at least 2m3/ha are harvested"
1086 VolConOutc (ForTTL,ForType,ForZones,HabTree) "penalises harvesting less than 10m3 per hectare"
1087
1088 PermHarvOh Permission for outsiders to harvest forests max 10000 m3 per annum
1089 PermHarvOl Permission for outsiders to harvest forests min 2000 m3 per annum
1090 PermHarvW1 Permission for Wik 1 cutting team harvest crews to harvest forests
1091 PermHarW1a Ensures min volume is cut to sustain the employment generated in harvesting
1092 PermHarW1b
1093 PermHarvW2 Permission for Wik 2 cutting team harvest crews to harvest forests
1094 PermHarW2a Ensures min volume is cut to sustain the employment generated in harvesting
1095 PermHarW2b
1096 PermOutHar (ForTTL,ForType,LogType,Species,ForZones,HabTree) Limits area that Wik people can invite outsiders to harvest according to assumed property rights regime
1097
1098 **Portable sawmilling and log haulage on country*
1099 LimPMOC Limits number of portable sawmills on country to no more than 10
1100 PermHaul Permission to haul logs to town or log market
1101 PermTsptGO Permission to transport GOS boards from portable mills on country to town

1102 PermXTptGO Permission to transport extra GOS boards from portable mills on country to town
1103 GOSTruck "Need for extra truck to transport GOS timber from portable sawmills on country. Prevent xtra trucks when not needed"
1104 GOSTrucka Second constraint affecting the need for extra truck to transport GOS timber from portable sawmills on country
1105 DestFelled (ForTTL,ForType,LogType,Species,ForZones,HabTree) Destination of felled logs
1106 SuitPMOC (LogType,Species) Logs suitable for portable sawmilling
1107 HaulVolLC Lower constraint on volume of timber that can be hauled with available haulage trucks designed so that haulage crews aren't
there just for the sake of employment
1108 HaulVolUC Upper constraint on volume of timber that can be hauled with available haulage trucks
1109 PMOCVolUC Upper constraint on volume of timber that can be portable milled on country
1110 PMOCVolLC Lower constraint on volume of timber that can be portable milled on country
1111 PMOCTeams Teams of portable sawmillers on country
1112 HaulTeams Teams of haulage trucks
1113 GOSTeams Employment created carting GOS boards from portable sawmills on country to town
1114
1115 **GOS recovery equations*
1116 PMOCSaw (LogType,Species) Volume of logs portable milled on country to produce GOS with or without sapwood
1117 PMOCGOSwS (LogType,Species) Volume of GOS boards with sapwood milled on country
1118 PMOCGOSwoS (LogType,Species) Volume of GOS boards without sapwood milled on country
1119 MITGOSwS (LogType,Species) Volume of GOS boards with sapwood milled in town
1120 MITGOSwoS (LogType,Species) Volume of GOS boards without sapwood milled in town
1121 MillingIT (LogType,Species) Volume of logs milled in town to produce GOS timber with or without sapwood
1122 **Destination of GOS volumes*
1123 DesPMOCwS (LogType,Species) destination of GOS timber with sapwood milled on country
1124 DesPMOCwoS (LogType,Species) destination of GOS timber without sapwood milled on country
1125 DesMITwS (LogType,Species) destination of GOS timber with sapwood milled in town
1126 DesMITwoS (LogType,Species) destination of GOS timber without sapwood milled in town
1127
1128 ** In town activities*
1129 PermTPoles permission to treat volume of electricity and landscape poles
1130 SuitPole (LogType,Species) permission to treat particular log types as poles
1131 LogSortIT (LogType,Species) distribution of hauled logs between forestry activities conducted in town
1132 SuitLnd (LogType,Species) permission to treat particular log types as landscape poles
1133 PermMill Permission to mill timbers in town
1134 PermMilla
1135 SuitMIT (LogType,Species) Logs suitable for sawmilling in town
1136 MaxPMIT Maximum volume of logs per annum that can be milled with a portable sawmill in town
1137 Min2200 Minimum volume that can be milled by fixed mill with max capacity of 2200 m3 per annum
1138 Min4400 Minimum volume that can be milled by fixed mill with max capacity of 4400 m3 per annum
1139 Min11000 Minimum volume that can be milled by fixed mill with max capacity of 11000 m3 per annum
1140 Min20000 Minimum volume that can be milled by fixed mill with max capacity of 20000 m3 per annum
1141 MaxT2200 Max total volume milled and permission to mill
1142 MaxT4400 Max total volume milled and permission to mill
1143 MaxT11000 Max total volume milled and permission to mill
1144 MaxT20000 Max total volume milled and permission to mill
1145 SetIFor1
1146 SetIFor2
1147 SetIFor3
1148 SetIFor4

1149 VolMill (LogType, Species) Volume of timber milled in town
1150 VolMilla
1151 VolMillb
1152 VolMillc
1153 VolMilld
1154 VolMille
1155 XMillJobs1 Multiplier for jobs created with volume above threshold in fixed site mill 2200 vol
1156 XMillJobs2 Multiplier for jobs created with volume above threshold in fixed site mill 4400 vol
1157 XMillJobs3 Multiplier for jobs created with volume above threshold in fixed site mill 11000 vol
1158 XMillJobs4 Multiplier for jobs created with volume above threshold in fixed site mill 20000 vol
1159
1160 **Chemical treatment of sawn timber*
1161 PermTreat Permission to chemically treat sawn timber constraint 1
1162 PermTreat1 Permission to chemically treat sawn timber constraint 2
1163 PermSoak Permission to chemically treat additional loads of sawn timber via soaking method constraint 1
1164 PermSoak1 Permission to chemically treat additional loads of sawn timber via soaking method constraint 2
1165 PermSoak2
1166 PermSoak3
1167 VolTreat (LogType, Species) Total volume of sawn timber chemically treated annually
1168 PermVac7 Permission to chemically treat sawn timber via Vac 7 method
1169 PermVac12 Permission to chemically treat sawn timber via Vac 12 method
1170 PermVac24 Permission to chemically treat sawn timber via Vac 24 method
1171 SoakJobs CAFTEs created by soaking timber
1172 Vac7Jobs CAFTEs created by Vac 7
1173 Vac12Jobs CAFTEs created by Vac 12
1174 Vac24Jobs CAFTEs created by Vac 24
1175
1176 **Stripping*
1177 StripVol Volume of timber stripped out
1178 Stripjobs Sets xtra workers value
1179
1180 **Seasoning*
1181 SeasVol(LogType,Species) Volume of timber seasoned by structural and appearance timber
1182 * SelVolUC
1183 PermSeas Makes sure there is timber to season before switching on seasoning methods
1184 PermSeas1 Makes sure timber is stripped out prior to seasoning
1185 PermSeas2
1186 AppSeas (LogType, Species) Appearance timbers seasoned
1187 StrSeas (LogType, Species) Structural timbers seasoned
1188 PermAir "limits floor space of air drying sheds to 2000 m2"
1189 * PermAir1 limits volume air-dried
1190 ShedSize Shed size required for seasoned volume
1191 PermSolar limits volume solar kiln dried
1192 PermCom8 limits volume combo dried
1193 PermCom24 limits volume combo dried
1194 PermCom40 limits volume combo dried
1195 AirDryJobs
1196 SolarJobs sets xtra work value

1197 Combo8Job
1198 Combo24Job
1199 Combo40Job
1200 DisAppear (LogType, Species) Distribution of appearance timber
1201 DisAppear1 (LogType,Species)
1202 RecSel(LogType, Species) Recovery of select timber
1203 RecSela
1204 RecAppear(LogType,Species) Recovery of appearance timber
1205 RecStruct(LogType,Species) Recovery of structural timber
1206 DistStruct (LogType,Species)
1207
1208 **Strip flooring*
1209
1210 PermFloor1 Permission constraint limiting Wi people to one type of floorboard manufacturing plant
1211 PermFloor2
1212 PermFloor3
1213 PermFloor4
1214 PermFloor5 (LogType,Species) Ensures all flooring is kiln dried
1215 FloorOut(LogType, Species) recovery opf floorboards from appearance timber inputs
1216 F1050Jobs jobs created by floorboard manufacture in plant with 1050 m3 annual capacity
1217 F3940Jobs jobs created by floorboard manufacture in plant with 3940 m3 annual capacity
1218 **Furniture*
1219 FurnJobs Jobs created in furniture component manufacture
1220 PermFurn Permission to manufacture furniture components
1221 PermFurn1 (Species) Composition of furniture components
1222 Tables Number of whole table components manufactured annually
1223 **Freight*
1224 FreightP12 number of freight trucks carrying 12 12.5 m poles
1225 FreightP11 number of freight trucks carrying 12 11.0 m poles
1226 FreightP9 number of freight trucks carrying 12 9.5 m poles
1227 FreightP8 number of freight trucks carrying 12 8.0 m poles
1228 FreightLnd number of freight trucks carrying 24 landscape poles
1229 FreightSaw number of freight trucks carrying 20 m3 of sawn timber
1230 FreightFur number of freight trucks carrying 20 sets of table components
1231 FreightM9 number of freight trucks carrying 12 9.5 m poles also carrying sawn timber and furniture
1232 FreightM8 number of freight trucks carrying 12 8.0 m poles also carrying sawn timber and furniture
1233 FreightML number of freight trucks carrying 24 landscape poles also carrying sawn timber and furniture
1234 FreightC1 constraints affecting number of trucks in any one year
1235 FreightC2 constraints affecting number of trucks in any one year
1236 FreightC3 constraints affecting number of trucks in any one year
1237 FreightC4 constraints affecting number of trucks in any one year
1238 FreightTim Season of year freight trucks operating
1239 FreightNum Number of freight trucks required
1240
1241 **Quantity demanded constraints*
1242 DemGOS quantity of GOS boards demanded constraint
1243 DemAppear "Maximum quantity of appearance timber demanded per annum m3"
1244

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1245 *Intermediate steps in getting to final NPV statement
1246 *Costs
1247   NLVMan   "Non-labour variable costs of forest management 5% of labour costs"
1248   Harv10Pen "Penalty for harvesting less than 10m3/ha"
1249   NLVCProd Non-labour variable costs of production excluding four-wheel drive vehicle running costs for all industry segments except
         forest management
1250   LabCostEq PV of total labour cost
1251   VehRCostEq PV of total vehicle running costs
1252   VehCCostEq PV of total vehicle capital costs
1253   AssetCEq  PV of cost of assets
1254   FreightCst PV of freight cost
1255   CapitalCon Capital constraint
1256   CapitalCo1
1257   InsureCost PV of insurance costs
1258
1259 *Revenues
1260   StumpSales PV of sales of timber at the stump to outsider harvesting crews
1261   GOSSales  PV of GOS boards sold
1262   LandSales
1263   PoleSales
1264   ApearSales PV of sales of appearance timber
1265   SelecSales PV of Select CKI boards sold
1266   StrucSales PV of structural boards sold
1267   FloorSales PV of strip flooring sales
1268   FurnSales  PV of furniture component sales ;
1269
1270 *=====
1271 * Programming Equations
1272 *=====
1273 * Forest Management
1274
1275   PermManag .. BForActs('ForManOut') + BForActs('ForManWik') - (1 * ManageFor)
1276               =l= 0;
1277
1278   HowHarv .. IForActs('Harvest1') + IForActs('Harvest2') - (10 * BForActs
1279               ('ForManWik')) =l= 0;
1280
1281   Xtraman .. (IForActs('Harvest1') + IForActs('Harvest2') - 1) - Xworkers
1282               ('ForManWikX') =e= 0 ;
1283   XtraVeh .. ((IForActs('Harvest1') + IForActs('Harvest2') - 1)/2) -
1284               XVehicles('ForManWikX') =l= 0;
1285
1286 *Forest harvesting
1287
1288   HarvTeams1 .. Xworkers('Harvest1') =e= 1/3000 * sum(ForTTL, sum(ForType, sum
1289               (LogType, sum (Species, sum(ForZones, sum(HabTree,HarvVoll
1290               (ForTTL,ForType,LogType,Species,ForZones,HabTree)))))) ;
1291

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1292 HarvTeams2 .. Xworkers('Harvest2') =e= 1/6000 * sum(ForTTL, sum(ForType, sum
1293 (LogType, sum(Species, sum(ForZones, sum(HabTree,HarvVol2
1294 (ForTTL,ForType,LogType,Species,ForZones,HabTree))))));
1295
1296 HarvTeams1a .. Xworkers('Harvest1') =l= IForActs('Harvest1');
1297 HarvTeams1b .. Xworkers('Harvest2') =l= IForActs('Harvest2');
1298 HarvVehic1 .. XVehicles('Harvest1') =e= IForActs('Harvest1');
1299 HarvVehic2 .. XVehicles('Harvest2') =e= 2*IForActs('Harvest2');
1300
1301 AreaConst(ForTTL,ForType,LogType,Species,ForZones,HabTree) ..
1302 (AreaHarOut (ForTTL,ForType,ForZones,HabTree)+
1303 AreaHWik1 (ForTTL,ForType,ForZones,HabTree)+
1304 AreaHWik2 (ForTTL,ForType,ForZones,HabTree)) =l=
1305 SusRotArea (ForTTL,ForType,ForZones,HabTree);
1306
1307 VolConW1 (ForTTL,ForType,LogType,Species,ForZones,HabTree) ..
1308 TimberRes (ForTTL,ForType,LogType,Species,ForZones,HabTree)
1309 * VolPerha (ForTTL, ForType, LogType, Species, ForZones, HabTree) *
1310 AreaHWik1 (ForTTL,ForType,ForZones,HabTree) =e= MaxWikVol1
1311 (ForTTL,ForType,LogType,Species,ForZones,HabTree);
1312
1313 VolConW1a (ForTTL,ForType,LogType,Species,ForZones,HabTree)..
1314 HarvVol1 (ForTTL,ForType,LogType,Species,ForZones,HabTree) =l=
1315 MaxWikVol1 (ForTTL,ForType,LogType,Species,ForZones,HabTree);
1316
1317 VolConW1b (ForTTL,ForType,ForZones,HabTree)..
1318 sum(LogType,sum(Species,HarvVol1 (ForTTL,ForType,LogType,Species,
1319 ForZones,HabTree))) /2 =g= AreaHWik1 (ForTTL,ForType,ForZones,
1320 HabTree);
1321
1322 VolConW1c (ForTTL,ForType,ForZones,HabTree)..
1323 AreaHWik1 (ForTTL,ForType,ForZones,HabTree) * 4.49 - (sum(LogType,sum(Species,HarvVol1 (ForTTL,ForType,LogType,Species,
1324 ForZones,HabTree)))) =e= UndHarPen1 (ForTTL,ForType,ForZones,HabTree);
1325
1326 VolConW2 (ForTTL,ForType,LogType,Species,ForZones,HabTree) ..
1327 TimberRes (ForTTL,ForType,LogType,Species,ForZones,HabTree) *
1328 VolPerha (ForTTL, ForType, LogType, Species, ForZones, HabTree) *
1329 AreaHWik2 (ForTTL,ForType,ForZones,HabTree) =e= MaxWikVol2
1330 (ForTTL,ForType,LogType,Species,ForZones,HabTree);
1331
1332 VolConW2a (ForTTL,ForType,LogType,Species,ForZones,HabTree)..
1333 HarvVol2 (ForTTL,ForType,LogType,Species,ForZones,HabTree) =l=
1334 MaxWikVol2 (ForTTL,ForType,LogType,Species,ForZones,HabTree);
1335
1336 VolConW2b (ForTTL,ForType,ForZones,HabTree)..
1337 sum(LogType,sum(Species, HarvVol2 (ForTTL,ForType,LogType,Species,
1338 ForZones,HabTree))) /2 =g= AreaHWik2 (ForTTL,ForType,ForZones,HabTree);
1339

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1340 VolConW2c (ForTTL,ForType,ForZones,HabTree)..
1341     AreaHWik2 (ForTTL,ForType,ForZones,HabTree) * 4.49 - (sum(LogType,sum(Species,HarvVol2 (ForTTL,ForType,LogType,Species,
1342     ForZones,HabTree)))) =e= UndHarPen2 (ForTTL,ForType,ForZones,HabTree);
1343
1344 VolConOut (ForTTL,ForType,LogType,Species,ForZones,HabTree) ..
1345     TimberRes (ForTTL,ForType,LogType,Species,ForZones,HabTree) *
1346     VolPerha (ForTTL, ForType, LogType, Species, ForZones, HabTree) *
1347     AreaHarOut (ForTTL,ForType,ForZones,HabTree) =e= MaxOutVol
1348     (ForTTL,ForType,LogType,Species,ForZones,HabTree);
1349
1350 VolConOuta (ForTTL,ForType,LogType,Species,ForZones,HabTree)..
1351     OutVol (ForTTL,ForType,LogType,Species,ForZones,HabTree) =l=
1352     MaxOutVol (ForTTL,ForType,LogType,Species,ForZones,HabTree);
1353
1354 VolConOutb (ForTTL,ForType,ForZones,HabTree) ..
1355     sum(LogType,sum(Species, OutVol (ForTTL,ForType,LogType,Species,
1356     ForZones,HabTree)))) /2 =g= AreaHarOut(ForTTL,ForType,ForZones,
1357     HabTree);
1358
1359 VolConOutc (ForTTL,ForType,ForZones,HabTree) ..
1360     AreaHarOut (ForTTL,ForType,ForZones,HabTree) * 4.49 - (sum(LogType,sum(Species,OutVol (ForTTL,ForType,LogType,Species,
1361     ForZones,HabTree)))) =e= UndHarPen0 (ForTTL,ForType,ForZones,HabTree);
1362
1363
1364 PermHarvOh .. sum(ForTTL, sum(ForType, sum( LogType, sum (Species, sum
1365     (ForZones, sum(HabTree,OutVol (ForTTL,ForType,LogType,
1366     Species,ForZones,HabTree)))))) =l= BForActs('ForManOut') *
1367     10000;
1368
1369 PermHarvOl .. sum(ForTTL, sum(ForType, sum( LogType, sum (Species, sum
1370     (ForZones, sum(HabTree,OutVol (ForTTL,ForType,LogType,
1371     Species,ForZones,HabTree)))))) =g= BForActs('ForManOut') * 500;
1372
1373 PermHarvWl .. sum(ForTTL, sum(ForType, sum( LogType, sum (Species, sum
1374     (ForZones,sum(HabTree, HarvVoll (ForTTL,ForType,LogType,
1375     Species,ForZones,HabTree)))))) =l= IForActs('Harvest1') * 3000 * LabourEf('Level');
1376
1377 PermHarw1a .. sum(ForTTL, sum(ForType, sum( LogType, sum (Species, sum
1378     (ForZones, sum(HabTree, HarvVoll (ForTTL,ForType,LogType,
1379     Species,ForZones,HabTree)))))) =g= (IForActs('Harvest1')-1) *
1380     3000 *LabourEf('Level') ;
1381
1382 PermHarw1b .. sum(ForTTL, sum(ForType, sum( LogType, sum (Species, sum
1383     (ForZones,sum(HabTree,AreaHWik1 (ForTTL,ForType,
1384     ForZones,HabTree)))))) =g= IForActs('Harvest1');
1385
1386 PermHarvW2 .. sum(ForTTL, sum(ForType, sum( LogType, sum (Species, sum
1387     (ForZones,sum(HabTree, HarvVol2 (ForTTL,ForType,LogType,

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1388         Species,ForZones,HabTree)))))) =l= IForActs('Harvest2') * 6000 *LabourEf('Level');
1389
1390 PermHarW2a .. sum(ForTTL, sum(ForType, sum( LogType, sum (Species, sum
1391         (ForZones,sum(HabTree,HarvVol2 (ForTTL,ForType,LogType,
1392         Species,ForZones,HabTree)))))) =g= (IForActs('Harvest2')-1) *
1393         6000 * LabourEf('Level');
1394
1395 PermHarW2b .. sum(ForTTL, sum(ForType, sum( LogType, sum (Species, sum
1396         (ForZones,sum(HabTree,HarvVol2(ForTTL,ForType,LogType,Species,
1397         ForZones,HabTree)))))) =g= IForActs('Harvest2') * 3000 *LabourEf('Level');
1398
1399 PermOutHar (ForTTL,ForType,LogType,Species,ForZones,HabTree) ..
1400         AreaHarOut (ForTTL,ForType,ForZones,HabTree) =l=
1401         SusRotArea (ForTTL,ForType,ForZones,HabTree) *
1402         PermExtRoy (ForTTL,ForType,ForZones,HabTree);
1403
1404 *Portable sawmilling on country and log hauling
1405 DestFelled (ForTTL,ForType,LogType,Species,ForZones,HabTree) ..
1406         HaulVol(ForTTL,ForType,LogType,Species,ForZones,HabTree) +
1407         PMOCVol(ForTTL,ForType,LogType,Species,ForZones,HabTree) =e=
1408         HarvVol1 (ForTTL,ForType,LogType,Species,ForZones,HabTree) +
1409         HarvVol2 (ForTTL,ForType,LogType,Species,ForZones,HabTree) ;
1410
1411 SuitPMOC (LogType,Species) ..
1412         sum(ForTTL,sum(ForType,sum(ForZones,sum(HabTree,PMOCVol(ForTTL,
1413         ForType,LogType,Species,ForZones,HabTree) -
1414         ((HarvVol1 (ForTTL,ForType,LogType,Species,ForZones,HabTree) +
1415         HarvVol2 (ForTTL,ForType,LogType,Species,ForZones,HabTree)))))) *
1416         MillSuit (LogType,Species)) =l= 0 ;
1417
1418 LimPMOC .. IForActs('PMilloc') =l= 5;
1419
1420 PMOCVolUC .. IForActs('PMilloc') * 325 *LabourEf('Level') - sum(ForTTL, sum(ForType, sum(LogType,
1421         sum (Species, sum(ForZones, sum(HabTree, PMOCVol(ForTTL,ForType,
1422         LogType,Species,ForZones,HabTree)))))) =g= 0 ;
1423
1424 PMOCVolLC .. IForActs('PMilloc') * 325 *LabourEf('Level') - sum(ForTTL, sum(ForType, sum( LogType,
1425         sum (Species, sum(ForZones, sum(HabTree, PMOCVol (ForTTL,ForType,
1426         LogType,Species,ForZones,HabTree)))))) =l= 100 ;
1427
1428 PermTsptGO .. -10 * BForActs('TptGOS_OC') + IForActs('PMilloc') =l= 0;
1429
1430 PermXTptGO .. IForActs('XTptGOS_OC') - IForActs('PMilloc') + 1 =e= 0 ;
1431
1432 GOSTruck .. -6* BForActs('XtraTruck') + IForActs('PMilloc') =g= 0;
1433
1434 GOSTrucka .. -5* BForActs('XtraTruck') + IForActs('PMilloc') =l= 5;
1435

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1436 PermHaul .. -10 * (IForActs('Harvest1') + IForActs('Harvest2')) + IForActs
1437     ('Haul') =l= 0 ;
1438
1439 HaulVolUC .. IForActs('Haul') * 6000 *LabourEf('Level') - sum(ForTTL, sum(ForType, sum( LogType,
1440     sum (Species, sum(ForZones, sum(HabTree, HaulVol(ForTTL,ForType,
1441     LogType,Species,ForZones,HabTree)))))) =g= 0 ;
1442
1443 HaulVolLC .. IForActs('Haul') * 6000 *LabourEf('Level') - sum(ForTTL, sum(ForType, sum( LogType,
1444     sum (Species, sum(ForZones, sum(HabTree, HaulVol(ForTTL,ForType,
1445     LogType,Species,ForZones,HabTree) )))) =l= 5999 *LabourEf('Level') ;
1446
1447 PMOCTeams .. Xworkers('PMilloc') =e= sum(ForTTL, sum(ForType, sum( LogType,
1448     sum (Species, sum(ForZones, sum(HabTree, PMOCVol(ForTTL,ForType,
1449     LogType,Species,ForZones,HabTree)))))))/325;
1450
1451 HaulTeams .. Xworkers('Haul') =e= sum(ForTTL, sum(ForType, sum( LogType,
1452     sum (Species, sum(ForZones, sum(HabTree, HaulVol(ForTTL,ForType,
1453     LogType,Species,ForZones,HabTree)))))))/6000;
1454
1455 GOSTeams .. Xworkers('XTptGOS_OC') =e= IForActs('XTptGOS_OC');
1456
1457 *GOS recovery from log volume
1458 *Portable Mill on country
1459
1460 PMOCSaw (LogType,Species) .. sum(ForTTL, sum(ForType, sum(ForZones,
1461     sum(HabTree, PMOCVol(ForTTL,ForType,LogType,Species,ForZones,
1462     HabTree)))) =e= SawwS_OC(LogType,Species) + SawwoS_OC(LogType,
1463     Species);
1464
1465 PMOCGOSwS (LogType,Species) .. SawwS_OC(LogType,Species) * (GOSRwSap(LogType,
1466     Species)+ GOSrec (LogType,Species)) =e= GOSwS_OC (LogType,Species) ;
1467
1468 PMOCGOSwoS (LogType,Species) .. SawwoS_OC(LogType,Species) * (GOSRwoSap(LogType
1469     ,Species)+GOSrec(LogType,Species)) =e= GOSwoS_OC (LogType,Species);
1470
1471 DesPMOCwS (LogType,Species) .. GOSwS_OC (LogType,Species) =e= MktPMOCwS
1472     (LogType,Species) + ChmPMOCwS (LogType,Species);
1473
1474 DesPMOCwoS (LogType,Species) .. GOSwoS_OC (logType,Species) =e= MktPMOCwoS
1475     (LogType,Species) + ChmPMOCwoS (LogType,Species) + SeaPMOCwoS
1476     (LogType,Species);
1477
1478 *Sort logs in town
1479 LogSortIT (LogType,Species)..
1480     -1 * sum(ForTTL, sum(ForType, sum(ForZones, sum(HabTree, HaulVol
1481     (ForTTL,ForType,LogType,Species,ForZones,HabTree)))) ) +
1482     TPoleVol (LogType,Species) + TLandVol (LogType,Species) +
1483     MITVol (LogType,Species)=e=0;

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1484
1485 SuitMIT (LogType,Species) ..
1486     MITVol(LogType,Species)- (sum(ForTTL,sum(ForType,sum(ForZones,sum
1487     (HabTree,HaulVol(ForTTL,ForType,LogType,Species,ForZones,HabTree)))))*
1488     MillSuit (LogType,Species)) =l= 0;
1489
1490 SuitLnd (LogType,Species) ..
1491     -1* sum(ForTTL,sum(ForType,sum(ForZones,sum(HabTree,HaulVol
1492     (ForTTL,ForType,LogType,Species,ForZones,HabTree)))))*
1493     LandSuit (LogType,Species) + TLandVol(LogType,
1494     Species)=l=0 ;
1495
1496 SuitPole (LogType,Species) ..
1497     TPoleVol(LogType,Species) =l= sum(ForTTL,sum(ForType,sum(ForZones,
1498     sum(HabTree,HaulVol(ForTTL,ForType,LogType,Species,ForZones,
1499     HabTree)))) * PoleSuit (LogType,Species);
1500
1501 *Chemical treatment of poles and landscape poles
1502 PermTPoles .. -1*(BForActs('PolesChem') * 2880 * LabourEf('Level')) + sum(LogType,sum(Species,
1503     TPoleVol(LogType,Species) + TLandVol(LogType,Species))) =l= 0;
1504
1505 *Sawmilling in town
1506 PermMill .. BForActs('PMillIT') + BForActs('Mill_2200') + BForActs
1507     ('Mill_4400') + BForActs('Mill_11000') + BForActs('Mill_20000')
1508     =l= 1;
1509
1510 PermMilla .. BForActs('PMillIT') + BForActs('Mill_2200') + BForActs
1511     ('Mill_4400') + BForActs('Mill_11000') + BForActs('Mill_20000')=e=
1512     Sawmill;
1513
1514 MaxPMIT .. sum(LogType,sum (Species,MITVol(LogType,Species))) =l= Sawmill*
1515     20000 * LabourEf('Level') - (BForActs('PMillIT') * (20000 * LabourEf('Level') - (600*LabourEf('Level'))));
1516
1517 Min2200 .. -1 *(BForActs('Mill_2200') * 450) + sum(
1518     LogType, sum(Species, MITVol(LogType,Species))) =g= 0 ;
1519
1520 MaxT2200 .. sum(LogType,sum (Species, MITVol (LogType,Species))) =l=Sawmill *
1521     20000 * LabourEf('Level') - (BForActs('Mill_2200') * (20000 * LabourEf('Level') - (2200*LabourEf('Level'))));
1522
1523 Min4400 .. -1 * (BForActs('Mill_4400') * 2200) + sum
1524     (LogType,sum (Species,MITVol(LogType,Species))) =g= 0 ;
1525
1526 MaxT4400 .. sum(LogType,sum (Species,MITVol(LogType,Species))) =l=Sawmill *
1527     20000 * LabourEf('Level') - (BForActs('Mill_4400') * (20000 * LabourEf('Level') - (4400 * LabourEf('Level')))) ;
1528
1529 Min11000 .. -1 * (BForActs('Mill_11000') * 4400) +
1530     sum(LogType,sum (Species, MITVol(LogType,Species))) =g= 0 ;
1531

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1532 MaxT11000 .. sum(LogType,sum (Species, MITVol(LogType,Species))) =l=Sawmill *
1533     20000 * LabourEf('Level') - (BForActs('Mill_11000') * (20000 * LabourEf('Level') - (11000 * LabourEf('Level'))));
1534
1535 Min20000 .. -1 * (BForActs('Mill_20000') * 11000) +
1536     sum(LogType,sum (Species, MITVol(LogType,Species))) =g= 0 ;
1537
1538 MaxT20000 .. sum(LogType,sum (Species,MITVol(LogType,Species))) =l= Sawmill *
1539     20000 * LabourEf('Level') - (BForActs('Mill_20000') * 0);
1540
1541 VolMill (LogType, Species) .. MITVol (LogType,Species) =e= PMillVol (LogType,
1542     Species) + Vol2200 (LogType,Species) + Vol4400(LogType,Species) +
1543     Vol11000(LogType,Species) + Vol20000(LogType,Species);
1544
1545 VolMilla .. sum(LogType,sum(Species, PMillVol (LogType,Species))) =l= BForActs
1546     ('PMillIT') * 600 * LabourEf('Level');
1547 VolMillb .. sum(LogType,sum(Species, Vol2200 (LogType,Species))) =l= BForActs
1548     ('Mill_2200') * 2200 * LabourEf('Level');
1549
1550 VolMillc .. sum(LogType,sum(Species, Vol4400 (LogType,Species))) =l= BForActs
1551     ('Mill_4400') * 4400 * LabourEf('Level');
1552
1553 VolMilld .. sum(LogType,sum(Species, Vol11000 (LogType,Species))) =l= BForActs
1554     ('Mill_11000') * 11000 * LabourEf('Level');
1555 VolMille .. sum(LogType,sum(Species, Vol20000 (LogType,Species))) =l= BForActs
1556     ('Mill_20000') * 20000 * LabourEf('Level');
1557
1558 SetIFor1 .. IForActs('X_2200') =e=0;
1559 SetIFor2 .. IForActs('X_4400')=e=0;
1560 SetIFor3 .. IForActs('X_11000')=e=0;
1561 SetIFor4 .. IForActs('X_20000')=e=0;
1562
1563 XMillJobs1 .. Xworkers('X_2200') =e= sum(LogType,sum
1564     (Species, Vol2200 (LogType,Species)))-(BForActs('Mill_2200')*450)
1565     - 1*((sum(LogType,sum(Species, Vol2200 (LogType,Species))) -
1566     (sum(LogType,sum(Species, Vol2200 (LogType,Species)))/LabourEf('Level')))
1567     * (LabourEf('Level')-1));
1568
1569 XMillJobs2 .. Xworkers('X_4400') =e= sum(LogType,sum
1570     (Species,Vol4400 (LogType,Species)))-(BForActs('Mill_4400')* 2200)
1571     - 1*((sum(LogType,sum(Species, Vol4400 (LogType,Species))) -
1572     (sum(LogType,sum(Species, Vol4400 (LogType,Species)))/LabourEf('Level')))
1573     * (LabourEf('Level')-1));
1574
1575 XMillJobs3 .. Xworkers('X_11000') =e= sum(LogType,sum
1576     (Species,Vol11000(LogType,Species)))-(BForActs('Mill_11000')*4400)
1577     - 1*((sum(LogType,sum(Species, Vol11000 (LogType,Species))) -
1578     (sum(LogType,sum(Species, Vol11000 (LogType,Species)))/LabourEf('Level')))
1579     * (LabourEf('Level')-1));

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1580
1581 XMillJobs4 .. Xworkers('X_20000') =e= sum(LogType, sum (Species, Vol20000
1582 (LogType, Species))) - (BForActs('Mill_20000') * 11000)
1583 - 1 * ((sum(LogType, sum(Species, Vol20000 (LogType, Species))) -
1584 (sum(LogType, sum(Species, Vol20000 (LogType, Species))) / LabourEf('Level')))
1585 * (LabourEf('Level') - 1));
1586
1587 *GOS recovery from log volume
1588 *Mills in town
1589 MillingIT (LogType, Species) ..
1590 MITVol(LogType, Species) =e=
1591 SawwS_IT(LogType, Species) + SawwoS_IT(LogType, Species);
1592
1593 MITGOSwS (LogType, Species) .. SawwS_IT(LogType, Species) * (GOSRwSap(LogType,
1594 Species) + GOSrec(LogType, Species)) =e=
1595 GOSwS_IT (LogType, Species) ;
1596 MITGOSwoS (LogType, Species) .. SawwoS_IT(LogType, Species) * (GOSRwoSap(LogType,
1597 Species) + GOSrec(LogType, Species)) =e=
1598 GOSwoS_IT(LogType, Species);
1599
1600 DesMITwS (LogType, Species) .. GOSwS_IT (LogType, Species) =e= MktMITwS(LogType,
1601 Species) + ChmMITwS (LogType, Species);
1602 DesMITwoS (LogType, Species) .. GOSwoS_IT(LogType, Species) =e= MktMITwoS(LogType,
1603 Species) + ChmMITwoS (LogType, Species) +
1604 SeaMITwoS(LogType, Species);
1605
1606 *Chemical treatment of sawn timber
1607
1608 PermTreat .. BForActs('SoakTreat') + BForActs('VacTreat7') + BForActs
1609 ('VacTreat12') + BForActs('VacTreat24') =l= 1 ;
1610 PermTreat1 .. -1 * sum(LogType, sum(Species, ChmMITwS (LogType, Species) +
1611 ChmMITwoS (LogType, Species) + ChmPMOCwS (LogType, Species) +
1612 ChmPMOCwoS (LogType, Species))) + BForActs('SoakTreat') +
1613 BForActs('VacTreat7') + BForActs ('VacTreat12') +
1614 BForActs ('VacTreat24') =l= 0 ;
1615
1616 VolTreat (LogType, Species) .. ChmMITwS (LogType, Species) + ChmMITwoS
1617 (LogType, Species) + ChmPMOCwS (LogType, Species) +
1618 ChmPMOCwoS (LogType, Species) =e=
1619 SoakVol (LogType, Species) + Vac7Vol (LogType, Species) +
1620 Vac12Vol (LogType, Species) + Vac24Vol (LogType, Species) ;
1621
1622 PermSoak .. sum(LogType, sum(Species, SoakVol (LogType, Species))) =l=
1623 BForActs('SoakTreat') * 1400;
1624 PermSoak1 .. -10 * BForActs('SoakTreat') + IForActs('SoakTreatX') =l= 0 ;
1625 PermSoak2 .. IForActs('SoakTreatX') =g= (sum(LogType, sum(Species, SoakVol
1626 (LogType, Species)))) / 140;
1627 PermSoak3 .. IForActs('SoakTreatX') =l= ((sum(LogType, sum(Species, SoakVol

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1628         (LogType,Species))))/140)+1;
1629
1630 PermVac7 .. sum(LogType, sum(Species,Vac7Vol (LogType,Species))) =l=
1631 BForActs('VacTreat7') * 1680 * LabourEf('Level');
1632 PermVac12 .. sum(LogType, sum(Species,Vac12Vol (LogType,Species))) =l=
1633 BForActs('VacTreat12') * 2880 * LabourEf('Level');
1634 PermVac24 .. sum(LogType, sum(Species,Vac24Vol (LogType,Species))) =l=
1635 BForActs('VacTreat24') * 5760 * LabourEf('Level');
1636
1637 SoakJobs .. Xworkers('SoakTreatX') =e= sum(LogType, sum(Species,SoakVol
1638 (LogType,Species)));
1639 Vac7Jobs .. Xworkers('VacT7X') =e= sum(LogType, sum(Species,Vac7Vol
1640 (LogType,Species)));
1641 Vac12Jobs .. Xworkers('VacT12X') =e= sum(LogType, sum(Species,Vac12Vol
1642 (LogType,Species)));
1643 Vac24Jobs .. Xworkers('VacT24X') =e= sum(LogType, sum(Species,Vac24Vol
1644 (LogType,Species)));
1645 *Stripping
1646 StripVol .. -1*(sum(LogType, sum(Species,SoakVol(LogType,Species) + Vac7Vol
1647 (LogType,Species)+ Vac12Vol(LogType,Species)+ Vac24Vol(LogType,
1648 Species) + SeaMITwoS(LogType,Species) + SeaPMOCwoS(LogType,Species
1649 ))) + BForActs('Stripping') * 99999 =g= 0 ;
1650
1651 Stripjobs .. Xworkers('StrippingX') =e= (sum(LogType, sum(Species,SoakVol
1652 (LogType,Species) + Vac7Vol(LogType,Species)+ Vac12Vol(LogType,
1653 Species)+ Vac24Vol(LogType,Species) + SeaMITwoS(LogType,Species) +
1654 SeaPMOCwoS(LogType,Species))) ;
1655
1656 *Seasoning
1657 SeasVol(LogType,Species) .. SoakVol(LogType,Species) + Vac7Vol(LogType,
1658 Species)+ Vac12Vol(LogType,Species)+ Vac24Vol(LogType,Species) +
1659 SeaMITwoS(LogType,Species) + SeaPMOCwoS(LogType,Species)
1660 =e= AppearST(LogType, Species) + StructST(LogType, Species);
1661
1662 PermSeas .. sum(LogType, sum(Species,SoakVol(LogType,Species) + Vac7Vol
1663 (LogType,Species)+ Vac12Vol(LogType,Species)+ Vac24Vol(LogType,
1664 Species) + SeaMITwoS(LogType,Species) + SeaPMOCwoS(LogType,Species)
1665 )) - IForActs('Airdry') - IForActs('Solardry') - IForActs
1666 ('Combo8Dry') - IForActs('Combo24Dry') - IForActs('Combo40Dry')
1667 =g= 0 ;
1668 PermSeas1 .. -1*(BForActs('Stripping') * 99999) + IForActs('Airdry') +
1669 IForActs('Solardry') + IForActs('Combo8Dry') + IForActs
1670 ('Combo24Dry') + IForActs('Combo40Dry') =l= 0;
1671
1672 PermSeas2 .. -1*(BForActs('Stripping') * 10) +
1673 IForActs('Solardry') + IForActs('Combo8Dry') + IForActs
1674 ('Combo24Dry') + IForActs('Combo40Dry') =l= 0;
1675

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1676 AppSeas(LogType, Species) .. AppearST(LogType, Species) =e= AppearAir(LogType,
1677     Species) + AppearSol(LogType, Species) + AppearCom8(LogType,
1678     Species) + AppearCo24(LogType, Species) + AppearCo40(LogType,
1679     Species);
1680
1681 StrSeas(LogType, Species) .. StructST(LogType, Species) =e= StructAir(LogType,
1682     Species) + StructSol(LogType, Species) + StructCom8(LogType,
1683     Species) + StructCo24(LogType, Species) + StructCo40(LogType,
1684     Species);
1685
1686 PermAir .. ((sum(LogType, sum(Species, AppearAir(LogType, Species))) * 51) +
1687     (sum(LogType, sum(Species, StructAir(LogType, Species) + StructSol
1688     (LogType, Species) + StructCom8(LogType, Species) + StructCo24
1689     (LogType, Species) + StructCo40(LogType, Species))) * 41) +
1690     (sum(LogType, sum(Species, AppearSol(LogType, Species) + AppearCom8
1691     (LogType, Species) + AppearCo24(LogType, Species) + AppearCo40
1692     (LogType, Species))) * 22))/64 =l= 4000;
1693
1694 ShedSize .. IForActs('AirDry') =e= ((sum(LogType, sum(Species, AppearAir
1695     (LogType, Species))) * 51) + (sum(LogType, sum(Species, StructAir
1696     (LogType, Species) + StructSol(LogType, Species) +
1697     StructCom8(LogType, Species) + StructCo24(LogType, Species) +
1698     StructCo40(LogType, Species))) * 41) + (sum(LogType, sum(Species,
1699     AppearSol(LogType, Species) + AppearCom8(LogType, Species) +
1700     AppearCo24(LogType, Species) + AppearCo40(LogType, Species))) *
1701     22))/64/40 ;
1702
1703 PermSolar .. sum(LogType, sum(Species, AppearSol(LogType, Species))) +
1704     (sum(LogType, sum(Species, StructSol(LogType, Species))) *1.97 )
1705     =l= IForActs('Solardry') * 128;
1706 PermCom8 .. sum(LogType, sum(Species, AppearCom8(LogType, Species))) +
1707     (sum(LogType, sum(Species, StructCom8(LogType, Species))) *1.81 )
1708     =l= IForActs('Combo8dry') * 197;
1709 PermCom24 .. sum(LogType, sum(Species, AppearCo24(LogType, Species))) +
1710     (sum(LogType, sum(Species, StructCo24(LogType, Species))) *1.81)
1711     =l= IForActs('Combo24dry') * 591;
1712 PermCom40 .. sum(LogType, sum(Species, AppearCo40(LogType, Species))) +
1713     (sum(LogType, sum(Species, StructCo40(LogType, Species))) *1.81)
1714     =l= IForActs('Combo40dry') * 985;
1715
1716 AirDryJobs .. Xworkers('AirDry') =e= 0;
1717 SolarJobs .. Xworkers('Solardry') =e= sum(LogType, sum(Species, AppearSol
1718     (LogType, Species)) + (sum(LogType, sum(Species, StructSol
1719     (LogType, Species))) *1.5385) ;
1720 Combo8Job .. Xworkers('Combo8Dry') =e= sum(LogType, sum(Species, AppearCom8
1721     (LogType, Species)) + (sum(LogType, sum(Species, StructCom8
1722     (LogType, Species))) *1.4 );
1723 Combo24Job .. Xworkers('Combo24Dry') =e= sum(LogType, sum(Species, AppearCo24

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1724         (LogType, Species))) + (sum(LogType, sum(Species, StructCo24
1725         (LogType, Species))) *1.1667 );
1726 Combo40Job .. Xworkers('Combo40Dry') =e= sum(LogType, sum(Species, AppearCo40
1727         (LogType, Species))) + (sum(LogType, sum(Species, StructCo40
1728         (LogType, Species))) *1 );
1729
1730 DisAppear(LogType, Species) .. AppearST(LogType,Species) =e= Appear
1731         (LogType, Species) + Select1('ex_A-saw','CKI') +
1732         Select2('A_Lnd_Bld','CKI');
1733 RecSel(LogType, Species) .. RecSelect(LogType, Species) =e= (Select1
1734         ('ex_A-saw','CKI') + Select2('A_Lnd_Bld','CKI')) * SelectRec (LogType,Species);
1735
1736 RecSela .. sum(LogType,sum(Species, RecSelect(LogType,Species)))=1=28.57;
1737
1738 RecAppear(LogType,Species) .. RecAppearT(LogType, Species) =e= Appear
1739         (LogType, Species)* (AppearRec(LogType,Species)+ StrApprec (LogType,Species));
1740
1741 RecStruct(LogType,Species) .. RecStructT(LogType, Species) =e= StructST
1742         (LogType, Species)* (StructRec(LogType,Species)+StrApprec (LogType,Species)) ;
1743
1744 DisAppear1 (LogType,Species) .. RecAppearT(LogType, Species) =e= AppearMkt
1745         (LogType, Species) + Flooring (LogType, Species) + FurnitA
1746         (LogType, Species);
1747
1748 DistStruct (LogType,Species) .. RecStructT(LogType, Species) =e= StructMkt
1749         (LogType,Species) + FurnitS (LogType, Species);
1750
1751 *Strip flooring
1752 PermFloor1 .. BForActs('Floor1050') + BForActs('Floor3940') =1= 1;
1753 PermFloor5 (LogType,Species) ..
1754         Flooring(LogType,Species) =1=
1755         (AppearSol(LogType,Species)+AppearCom8(LogType,Species)+
1756         AppearCo24(LogType,Species)+AppearCo40(LogType,Species))*
1757         (AppearRec(LogType,Species)+ StrApprec (LogType,Species));
1758 PermFloor2 .. -1*(sum(LogType, sum(Species, Flooring (LogType, Species)))) +
1759         sum(LogType, sum(Species, F1050Vol(LogType,Species) + F3940Vol
1760         (LogType,Species))) =e= 0;
1761 PermFloor3 .. sum(LogType, sum(Species,F1050Vol(LogType,Species))) =1= 1050 *
1762         BForActs('Floor1050') * LabourEf('Level');
1763 PermFloor4 .. sum(LogType, sum(Species,F3940Vol(LogType,Species))) =1= 2500 *
1764         BForActs('Floor3940');
1765 *above: maximum demand for flooring not capacity of the flooring mill
1766
1767 FloorOut(LogType, Species) .. Flooring (LogType, Species) * FloorRec(LogType,
1768         Species) =e= RecFloor (LogType,Species);
1769 F1050Jobs .. Xworkers('FloorX1050') =e= sum(LogType, sum(Species, F1050Vol
1770         (LogType,Species))) ;
1771 F3940Jobs .. Xworkers('FloorX3940') =e= sum(LogType, sum(Species, F3940Vol

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1772         (LogType,Species)));
1773
1774 *Furniture
1775
1776 PermFurn .. -1 * (sum(LogType, sum(Species, FurnitA(LogType, Species) +
1777         FurnitS(LogType,Species))))+ 36 * BForActs('SSFurn') * LabourEf('Level') =g= 0;
1778 PermFurn1 (Species) .. sum(LogType, FurnitA(LogType, Species)) =e= sum
1779         (LogType,FurnitS(LogType,Species));
1780 Tables .. (sum(LogType, sum(Species,FurnitA(LogType, Species) + FurnitS
1781         (LogType,Species)))) / 0.4 =e= IForActs('SSFurnX')+ BForActs('SSFurn') * 20;
1782 FurnJobs .. Xworkers('SSFurnX') =e= (BForActs('SSFurn') * 20/LabourEf('Level')) + (IForActs('SSFurnX')/ LabourEf('Level'));
1783
1784 *Quantity demanded constraints
1785
1786 DemGOS .. sum(LogType, sum(species, MktPMOCwS(LogType,Species) + MktPMOCwoS
1787         (LogType,Species)+ MktMITwS(LogType,Species) + MktMITwoS
1788         (LogType,Species))) =l= 1000;
1789
1790 DemAppear .. sum(LogType, sum(species, AppearMkt(LogType,Species)))=l=600;
1791
1792 *Freight to Cairns
1793
1794 FreightP12 .. sum(LogType, sum(Species,TPoleVol (LogType,Species) *
1795         P12_5Suit (LogType,Species)))/21.6 =e= P12Freight;
1796
1797 FreightP11 .. sum(LogType, sum(Species, TPoleVol (LogType,Species)*
1798         P11_0Suit (LogType,Species)))/22.8 =e= P11Freight;
1799
1800 FreightP9 .. sum(LogType, sum(Species, TPoleVol (LogType,Species)*
1801         P9_5Suit (LogType,Species)))/18 =e= P9Freight;
1802
1803 FreightP8 .. sum(LogType, sum(Species, TPoleVol (LogType,Species)*
1804         P8_0Suit (LogType,Species)))/16.8 =e= P8Freight;
1805
1806 FreightLnd .. sum(LogType, sum(Species, TLandVol (LogType,Species))) / 16.8
1807         =e= LndFreight ;
1808
1809 FreightM9 .. -4 * P9Freight + Xsaw9 + Xfur9 =l= 0;
1810 FreightM8 .. -6 * P8Freight + Xsaw8 + Xfur8 =l= 0;
1811 FreightML .. -6 * LndFreight + XsawL + XfurL =l= 0;
1812
1813 FreightSaw .. (sum(LogType,sum(Species, MktPMOCwS(LogType,Species) +
1814         MktPMOCwoS(LogType,Species)+ MktMITwS(LogType,Species) +
1815         MktMITwoS(LogType,Species) + AppearMkt(LogType,Species) +
1816         StructMkt(LogType,Species) + RecFloor(LogType,Species) +
1817         RecSelect(LogType, Species)) - Xsaw9 - Xsaw8 - XsawL) /30 =e=
1818         SawFreight;
1819

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1820 FreightFur .. (IForActs('SSFurnX') - Xfur9 - Xfur8 - XfurL)/20 =e= FurFreight;
1821
1822 FreightNum .. P12Freight + P11Freight + P9Freight + P8Freight + LndFreight +
1823     SawFreight + FurFreight =e= NumFreight;
1824
1825 FreightTim .. NumFreight =e= DS52 + DSg52 + WS52 + WSg52;
1826 FreightC1 .. DS52 =l= 52;
1827 FreightC2 .. DSg52 =l= 104;
1828 FreightC3 .. WS52 =l= 52;
1829 FreightC4 .. WSg52 =l= 104;
1830
1831 *Breakdown of NPV goal
1832 *Costs
1833 NLVMan .. ((BForActs('ForManOut')* SetUpJobs('ForManOut') + BForActs
1834     ('ForManWik')* SetUpJobs('ForManWik') + Xworkers('ForManWikX'))*
1835     Labourcost*LabourCst('Level')*Annuity*0.05 * NLOppCosts ('Level')) - NLVForMan =e= 0 ;
1836
1837 Harv10Pen .. Penalty =e= -1 * 0.00002* (sum(ForTTL, sum(ForType, sum(
1838     ForZones, sum(HabTree, UndHarPenO (ForTTL, ForType, ForZones, HabTree)+
1839     UndHarPen1 (ForTTL, ForType, ForZones, HabTree)+
1840     UndHarPen2 (ForTTL, ForType, ForZones, HabTree))))));
1841
1842 NLVCPProd .. (sum(ForTTL, sum(ForType, sum( LogType, sum (Species, sum
1843     (ForZones, sum(HabTree, ((NLHarCost1 (ForTTL, ForType, LogType,
1844     Species, ForZones, HabTree) * HarvVol1 (ForTTL, ForType, LogType,
1845     Species, ForZones, HabTree)) + (NLHarCost2 (ForTTL, ForType, LogType,
1846     Species, ForZones, HabTree) * HarvVol2 (ForTTL, ForType, LogType,
1847     Species, ForZones, HabTree)) + (PMOCVol(ForTTL, ForType, LogType,
1848     Species, ForZones, HabTree) * NLPMillCst (ForTTL, ForType, LogType,
1849     Species, ForZones, HabTree))+ (HaulVol(ForTTL, ForType, LogType,
1850     Species, ForZones, HabTree)* HaulCost(ForTTL, ForType, LogType,
1851     Species, ForZones, HabTree)* HaulDist(ForTTL, ForType, LogType,
1852     Species, ForZones, HabTree)))))))))
1853 + (sum(ForTTL, sum(ForType, sum( LogType, sum (Species, sum
1854     (ForZones, sum(HabTree, (HarvVol1(ForTTL, ForType, LogType, Species,
1855     ForZones, HabTree)+ HarvVol2(ForTTL, ForType, LogType, Species,
1856     ForZones, HabTree)) * PayRoyalty(ForTTL, ForType, LogType, Species,
1857     ForZones, HabTree) * Royalty(ForTTL, ForType, LogType, Species,
1858     ForZones, HabTree)))))))))
1859 + sum(LogType, sum(Species, (TPoleVol(LogType, Species)* NLPoleLand
1860 (LogType, Species)) + (TLandVol(LogType, Species)* NLPoleLand
1861 (LogType, Species)) + (NLPMITCst(LogType, Species) *
1862 PMillVol(LogType, Species))+ (NL22_44Cst
1863 (LogType, Species)* Vol2200 (LogType, Species)) + (NL22_44Cst
1864 (LogType, Species)* Vol4400 (LogType, Species)) + (NL11_20Cst
1865 (LogType, Species)* Vol11000(LogType, Species)) + (NL11_20Cst
1866 (LogType, Species) * Vol20000(LogType, Species))
1867 + ( GOSwS_OC (LogType, Species) + GOSwoS_OC (LogType, Species) *

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1868         0.27 * 65)+(SoakVol (LogType,Species) * NLSoakCst(LogType,
1869         Species) + Vac7Vol(LogType,Species) * NLVac7Cst(LogType,Species) +
1870         Vac12Vol(LogType,Species) * NLV12_24C(LogType,Species) +
1871         Vac24Vol(LogType,Species) * NLV12_24C(LogType,Species)) +((SoakVol
1872         (LogType,Species) + Vac7Vol(LogType,Species)+ Vac12Vol(LogType,
1873         Species)+ Vac24Vol(LogType,Species) + SeaMITwoS(LogType,Species) +
1874         SeaPMOCwoS(LogType,Species)) * NLStripCst(LogType,Species)) +
1875         (AppearAir(logType, Species) * NLAirACst(LogType, Species)) +
1876         (StructAir(LogType, Species) * NLAirSCst (LogType, Species)) +
1877         (AppearSol(LogType, Species) * NLSolACst (LogType,Species)) +
1878         (StructSol(LogType,Species) * NLSolSCst(LogType, Species)) +
1879         ((AppearCom8(LogType, Species) + AppearCo24(LogType, Species) +
1880         AppearCo40(LogType,Species)) * NLComACst(LogType, Species)) +
1881         ((StructCom8(LogType,Species) + StructCo24(LogType,Species) +
1882         StructCo40(LogType,Species)) * NLComSCst(LogType,Species)) +
1883         (AppearAir(logType, Species) * OppAirACst(LogType, Species)*Disc) +
1884         (StructAir(LogType, Species) * OppAirSCst(LogType, Species)*Disc) +
1885         (AppearSol(LogType, Species) * OppSolACst(LogType,Species) *Disc) +
1886         (StructSol(LogType,Species) * OppSolSCst(LogType, Species)*Disc) +
1887         ((AppearCom8(LogType, Species) + AppearCo24(LogType, Species) +
1888         AppearCo40(LogType,Species)) * NLComACst(LogType, Species)*Disc) +
1889         ((StructCom8(LogType,Species) + StructCo24(LogType,Species) +
1890         StructCo40(LogType,Species)) * NLComSCst(LogType,Species)*Disc)+
1891         (F1050Vol (LogType,Species) * NLF1050Cst(LogType,Species)) +
1892         (F3940Vol(LogType,Species) * NLF3940Cst(LogType,Species))
1893         )) +
1894         (IForActs('SSFurnX') * NLFurnCst)
1895         + (sum(LogType, sum(Species, SawwoS_OC(LogType,Species) + SawwoS_IT
1896         (LogType,Species))) * NLwoSapCst) +
1897         (sum(LogType, sum(Species, (AppearMkt(LogType,Species)*OneOnApRec(LogType,Species)
1898         ) + (StructMkt(LogType,Species) * OneOnStRec (LogType,Species))))
1899         * NLDockCst)
1900         ) * NLOppCosts ('Level') * Annuity - NonLabVarC =e= 0;
1901
1902 LabCostEq .. (sum(BinForActs, BForActs(BinForActs) * SetUpJobs(BinForActs)) +
1903         sum(IntForActs, Xworkers(IntForActs)* XtraJobs(IntForActs)))
1904         * (Labourcost*Annuity*LabourCst('Level')) =e= LabCost;
1905
1906 VehRCostEq .. (sum(BinForActs, BForActs(BinForActs) * BRVehicle(BinForActs)) +
1907         sum(IntForActs, XVehicles(IntForActs)* IRVehicle(IntForActs))) * NLOppCosts ('Level') *
1908         Annuity =e= VehicRCost;
1909
1910 VehCCostEq .. (BForActs('ForManOut') + BForActs('ForManWik') + sum(IntForActs, XVehicles(IntForActs))) *
1911         PVVehicle =e= VehicCCost;
1912
1913 AssetCEq .. sum(BinForActs, BForActs(BinForActs) * PVBAsset(BinForActs)) +
1914         sum(IntForActs, IForActs(IntForActs) * PVIAsset(IntForActs)) =e= AssetCost;
1915

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1916 FreightCst .. (1700*DS52 + 3400*DSg52 + 3600*WS52 + 7200 *WSg52)* Annuity =e= Freight;
1917
1918 CapitalCon .. sum(BinForActs, BAssetCost('Y0',BinForActs) * BForActs(BinForActs)) +
1919 sum(IntForActs, IAssetCost('Y0',IntForActs) * IForActs(IntForActs)) +
1920 ((BForActs('ForManOut') + BForActs('ForManWik')+ sum(IntForActs, XVehicles(IntForActs))) *35000)
1921 =e= CapitalReq;
1922
1923 CapitalCo1 .. CapitalReq =l= 200000;
1924
1925 InsureCost .. CapitalReq * 0.0125 * Annuity =e= Insurance;
1926 *Revenues
1927 StumpSales .. sum(ForTTL, sum(ForType, sum(LogType, sum(Species, sum(ForZones,
1928 sum(HabTree, OutVol (ForTTL,ForType,LogType,Species,
1929 ForZones,HabTree) * StumpValue (ForTTL,ForType,LogType,Species,
1930 ForZones,HabTree)))))) * MktPriceRd ('Level') * Annuity * 0 =e= Stumpage ;
1931
1932 GOSSales .. sum(Species,sum(LogType,( MktPMOCwS(LogType,Species) + MktPMOCwoS
1933 (LogType,Species) + MktMITwS(LogType,Species) + MktMITwoS
1934 (LogType,Species))* GOSval (Species)) * MktPriceSn ('Level') *
1935 Annuity =e= GOSboards;
1936
1937 PoleSales .. sum(LogType, sum(Species,TPoleVol (LogType,Species) * TPoleVal
1938 (LogType,Species)))* MktPriceRd ('Level') * Annuity =e= ElectPoles ;
1939
1940 LandSales .. sum(LogType, sum(Species,TLandVol(LogType,Species)* TLandVal
1941 (LogType,Species)))* MktPriceRd ('Level') * Annuity =e= LandPoles ;
1942
1943 ApearSales .. sum(LogType,sum(Species, ApearMkt(LogType,Species) *
1944 ApearVal(Species))* MktPriceSn ('Level') * Annuity =e= Appearance;
1945
1946 SelecSales .. sum(Species,sum(LogType, RecSelect(LogType, Species)) *
1947 SelectVal(Species)) * MktPriceSn ('Level')* Annuity =e= SelectCKI;
1948
1949 StrucSales .. sum(LogType,sum(Species, StructMkt(LogType,Species) *
1950 StructVal(Species)) * MktPriceSn ('Level')* Annuity =e= Structural;
1951
1952 FloorSales .. sum(LogType,sum(Species, RecFloor(LogType,Species) *
1953 FloorVal(Species))) * MktPriceSn ('Level')* Annuity =e= StripFloor;
1954
1955 FurnSales .. IForActs('SSFurnX') * FurnVal * MktPriceSn ('Level')* Annuity =e= Furniture ;
1956 =====
1957 * Goals
1958 =====
1959 * NPV of the enterprise
1960
1961 NPV .. (((Penalty + Stumpage + ElectPoles + LandPoles + GOSboards + Appearance + SelectCKI + Structural + StripFloor + Furniture +(-1*(N
LVCForMan + NonLabVarC + LabCost +
1962 VehicRCost + VehicCCost + AssetCost + Insurance + Freight)))/14.668)*100) + NPVund =g= 100;

```

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1963
1964
1965 *Calculate total number of jobs created
1966
1967 TotJobs .. (((sum(BinForActs, BForActs(BinForActs) * SetUpJobs(BinForActs)) +
1968             sum(IntForActs, Xworkers(IntForActs) * XtraJobs(IntForActs)))/48.229)*100)
1969             + AllJobund =g= 100 ;
1970
1971 *Calculate number of jobs on country
1972
1973 OnCtyJobs .. (((sum(BinForActs, BForActs(BinForActs) * OnCJobs(BinForActs)) +
1974             sum(IntForActs, Xworkers(IntForActs) * XtraOnCJob(IntForActs)))/16.75)*100) +
1975             OnCJobund =g= 100 ;
1976
1977 *Harvesting south of the Archer River
1978
1979 SouthArch .. 100 - (((sum(ForTTL, sum(ForType, sum(ForZones,
1980             sum(HabTree, (AreaHarOut (ForTTL,ForType,ForZones,HabTree)+
1981             AreaHWik1 (ForTTL,ForType,ForZones,HabTree) +
1982             AreaHWik2 (ForTTL,ForType,ForZones,HabTree)) *
1983             ForestSAR(ForTTL,ForType,ForZones,HabTree)))))/1975)*100) +
1984             HarvSAund =g= 100 ;
1985
1986 *Harvesting north of the Archer River off mining leases
1987 OffMLnArch ..100 - (((sum(ForTTL, sum(ForType, sum(ForZones,
1988             sum(HabTree, (AreaHarOut (ForTTL,ForType,ForZones,HabTree)+
1989             AreaHWik1 (ForTTL,ForType,ForZones,HabTree) +
1990             AreaHWik2 (ForTTL,ForType,ForZones,HabTree)) *
1991             ForestNAR(ForTTL,ForType,ForZones,HabTree)))))/1207)*100) +
1992             HarvNAund =g= 100 ;
1993
1994 *=====
1995 * Objective
1996 *=====
1997
1998 Obj .. z =e= NPVund + AllJobund + OnCJobund + HarvSAund + HarvNAund;
1999
2000 Model ForOpps /all/;
2001
2002 Option iterlim = 1000000;
2003 Option reslim = 1000000;
2004 ForOpps.OptFile = 1;
2005
2006 Parameter Report1 (*,*) "Forestry Opportunity Goals";
2007 Parameter Report2 (*,*) "Forestry Opportunity Activities";
2008 Parameter Report3 (*,*) "Product Output";
2009
2010 solve ForOpps using MIP minimising z ;

```

```

2011
2012 *Achievement Levels
2013 Parameter NPVal;
2014     NPVal = Penalty.l + Stumpage.l + ElectPoles.l + LandPoles.l + GOSboards.l + Appearance.l +
2015     SelectCKI.l + Structural.l + StripFloor.l + Furniture.l +(-1*(NLVCFORMan.l +
2016     NonLabVarC.l + LabCost.l + VehicRCost.l + VehicCCost.l + AssetCost.l + Insurance.l +
2017     Freight.l));
2018
2019 Parameter AllJobs;
2020     AllJobs = sum(BinForActs, BForActs.l(BinForActs) * SetUpJobs(BinForActs)) +
2021     sum(IntForActs, Xworkers.l(IntForActs) * XtraJobs(IntForActs));
2022
2023 Parameter OCJobs;
2024     OCJobs = sum(BinForActs, BForActs.l(BinForActs) * OnCJobs(BinForActs)) +
2025     sum(IntForActs, Xworkers.l(IntForActs) * XtraOnCJob(IntForActs));
2026
2027 Parameter SouthCons;
2028     SouthCons= 1975 -(1975* (HarvSAund.l)/100);
2029
2030 Parameter NorthCons;
2031     NorthCons = 1207 - (1207* (HarvNAund.l)/100);
2032
2033 Parameter Royalties "Royalties paid to DPI";
2034     Royalties = (sum(ForTTL, sum(ForType, sum( LogType, sum (Species, sum
2035     (ForZones, sum(HabTree, (HarvVoll.l(ForTTL,ForType,LogType,Species,
2036     ForZones,HabTree)+ HarvVol2.l(ForTTL,ForType,LogType,Species,
2037     ForZones,HabTree)) * PayRoyalty(ForTTL,ForType,LogType,Species,
2038     ForZones,HabTree) * Royalty(ForTTL,ForType,LogType,Species,
2039     ForZones,HabTree)))))))*Annuity;
2040
2041 Parameter StumpVol (LogType,Species) "Volume of logs sold at the stump" ;
2042     StumpVol(LogType,Species) = sum(ForTTL, sum(ForType, sum(ForZones, sum(HabTree,
2043     OutVol.l (ForTTL,ForType,LogType,Species,ForZones,HabTree)))));
2044
2045 Parameter GOSsaleVol (LogType,Species) Volume of GOS timber sold;
2046     GOSsaleVol(LogType,Species) = MktPMOCwS.l(LogType,Species) +
2047     MktPMOCwoS.l(LogType,Species) + MktMITwS.l(LogType,Species) +
2048     MktMITwoS.l(LogType,Species);
2049
2050 Parameter Furnit(LogType,Species);
2051     Furnit(LogType,Species) = FurnitA.l(LogType,Species) + FurnitS.l
2052     (LogType,Species);
2053
2054 Report1 ('NPV', 'Base') = NPVal;
2055 Report1 ('AllJob', 'Base') = AllJobs ;
2056 Report1 ('OCJob', 'Base') = OCJobs ;
2057 Report1 ('SouthCon', 'Base') = SouthCons ;
2058 Report1 ('NorthCon', 'Base') = NorthCons ;

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2059 Report1 ('StumDPI','Base') = Royalties ;
2060 Report1 ('Capital','Base') = CapitalReq.1 ;
2061 Report2 (BinForActs,'Base') = BForActs.l(BinForActs) ;
2062 Report2 (IntForActs,'Base') = IForActs.l(IntForActs) ;
2063 Report3 ('StumpSale',Species) = sum(LogType,StumpVol (LogType,Species));
2064 Report3 ('Landscape',Species) = sum(LogType,TLandVol.l(LogType,Species));
2065 Report3 ('Poles',Species) = sum(LogType,TPoleVol.l(LogType,Species));
2066 Report3 ('GOS',Species) = sum(LogType,GOSsaleVol(LogType,Species)) ;
2067 Report3 ('Structural',Species) = sum(LogType,StructMkt.l(LogType,Species)) ;
2068 Report3 ('Appearance',Species) = sum(LogType,AppearMkt.l(LogType,Species)) ;
2069 Report3 ('StripFloor',Species) = sum(LogType,RecFloor.l (LogType,Species)) ;
2070 Report3 ('Furniture',Species) = sum(LogType,Furnit(LogType,Species));
2071
2072 Display Report1, Report2, Report3;
2073
2074 Parameter TotHarvAre (ForTTL,ForType) Total area harvested in scenario;
2075     TotHarvAre (ForTTL,ForType) = sum(ForZones,sum(HabTree,AreaHarOut.l
2076     (ForTTL,ForType,ForZones,HabTree)+ AreaHWik1.l (ForTTL,ForType,ForZones,
2077     HabTree)+ AreaHWik2.l (ForTTL,ForType,ForZones,HabTree));
2078
2079 Parameter TotHarvVol (ForTTL,ForType) Total volume harvested in scenario;
2080     TotHarvVol (ForTTL,ForType) = sum(LogType,sum(Species,sum(ForZones,
2081     sum(Habtree, HarvVol1.l (ForTTL,ForType,LogType,Species,ForZones,
2082     HabTree) + HarvVol2.l (ForTTL,ForType,LogType,Species,ForZones,HabTree)
2083     + OutVol.l (ForTTL,ForType,LogType,Species,ForZones,HabTree)))));
2084
2085 Parameter TotHarVols (ForTTL,ForType,Species) Total volume harvested in scenario by species;
2086     TotHarVols (ForTTL,ForType,Species) = sum(LogType,sum(ForZones,
2087     sum(Habtree, HarvVol1.l (ForTTL,ForType,LogType,Species,ForZones,
2088     HabTree) + HarvVol2.l (ForTTL,ForType,LogType,Species,ForZones,HabTree)
2089     + OutVol.l (ForTTL,ForType,LogType,Species,ForZones,HabTree)))));
2090
2091 Display TotHarvAre, TotHarvVol, TotHarVols;
2092
2093 Option AreaHarOut:1:2:2;
2094 Option AreaHWik1:1:2:2;
2095 Option AreaHWik2:1:2:2;
2096 Option OutVol:1:4:2;
2097 Option PMOCVol:1:4:2;
2098 Option HaulVol:1:4:2;
2099
2100 display AreaHarOut.l, AreaHWik1.l, AreaHWik2.l, OutVol.l, PMOCVol.l, GOSwS_OC.l,
2101     GOSwS_OC.l, HaulVol.l, MITVol.l, GOSwS_IT.l, GOSwS_IT.l;
2102
2103 Parameter BinJobs (BinForActs) Number of set up jobs;
2104     BinJobs (BinForActs) = BForActs.l(BinForActs) * SetUpJobs(BinForActs);
2105
2106 Parameter IntJobs (IntForActs) Number of extra jobs;

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```
2107         IntJobs (IntForActs) = Xworkers.l(IntForActs) * XtraJobs(IntForActs);
2108
2109 Display BinJobs, IntJobs,Annuity;
2110
2111 Parameter checkvol (LogType,Species);
2112 checkvol (LogType,Species) = StrApprec(LogType,Species) + AppearRec (LogType,Species);
2113 Display checkvol;
```