

Black Hills National Forest
Noxious Weeds Ecological Risk Assessment Report

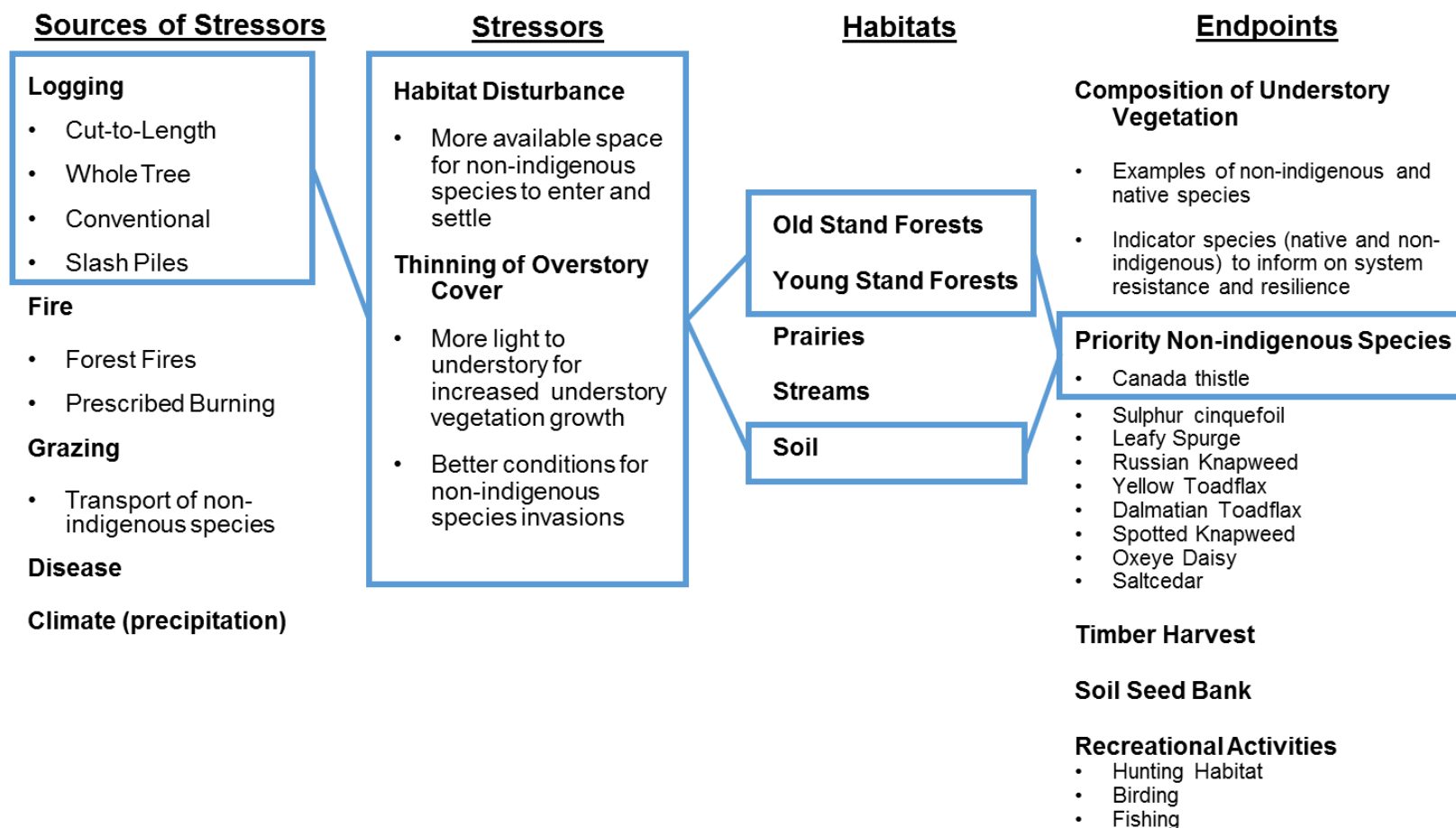
APPENDICES

- Appendix A.** Draft Conceptual Models for the BBNF Ecological Risk Assessment.
- Appendix B.** Bayesian Networks for All Regions and Years.
- Appendix C.** Input Frequencies for All Input Variables, Regions, and Years.
- Appendix D.** CPTs and Supporting Materials; Including List of References.
- Appendix E.** Complete Sensitivity Analysis and Influence Analysis Results.

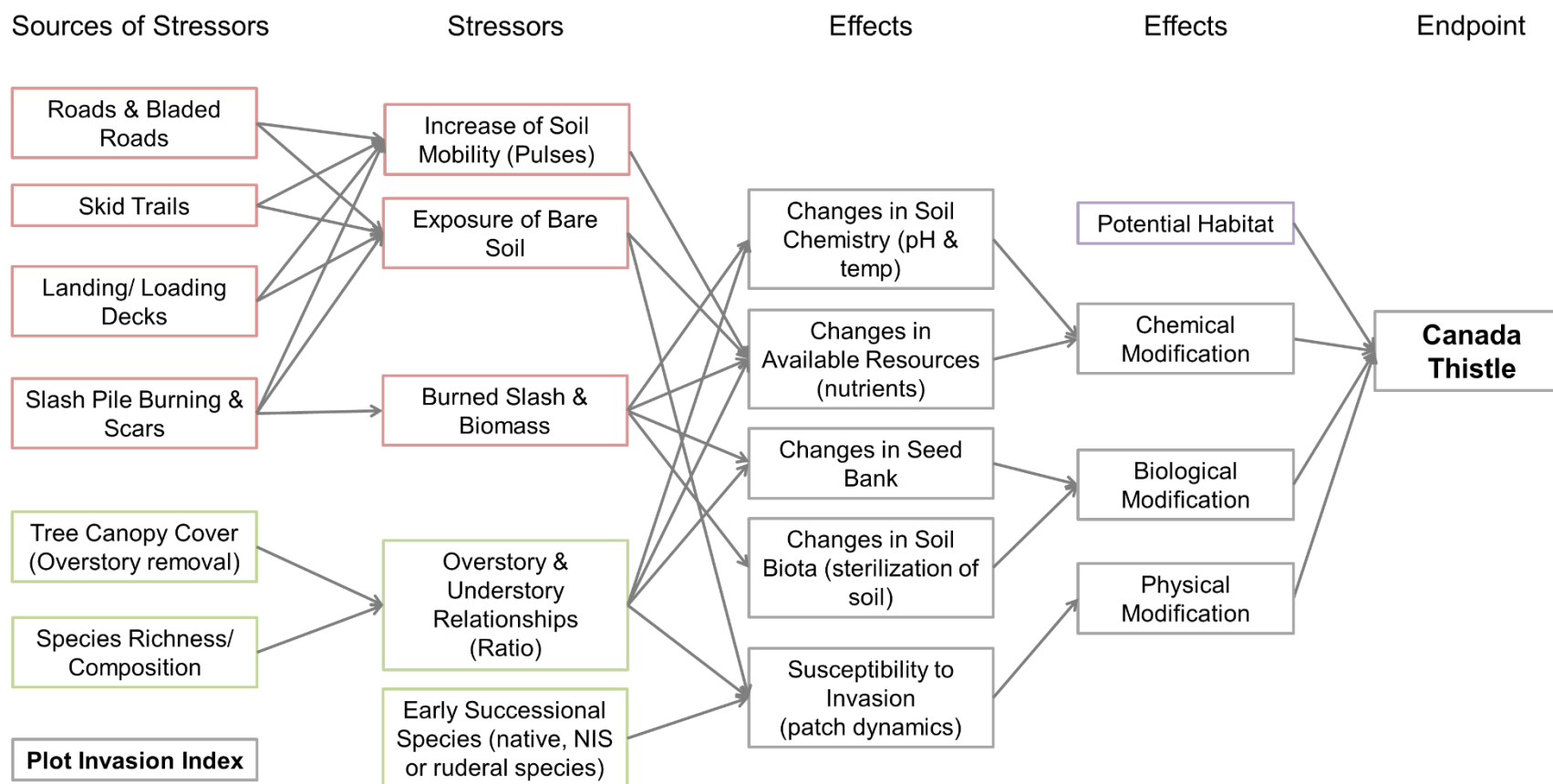
December 11, 2015

Appendix A Draft Conceptual Models for the BHNF NIS Ecological Risk Assessment.

BHNF Risk Assessment – Relative Risk Model
November 2014

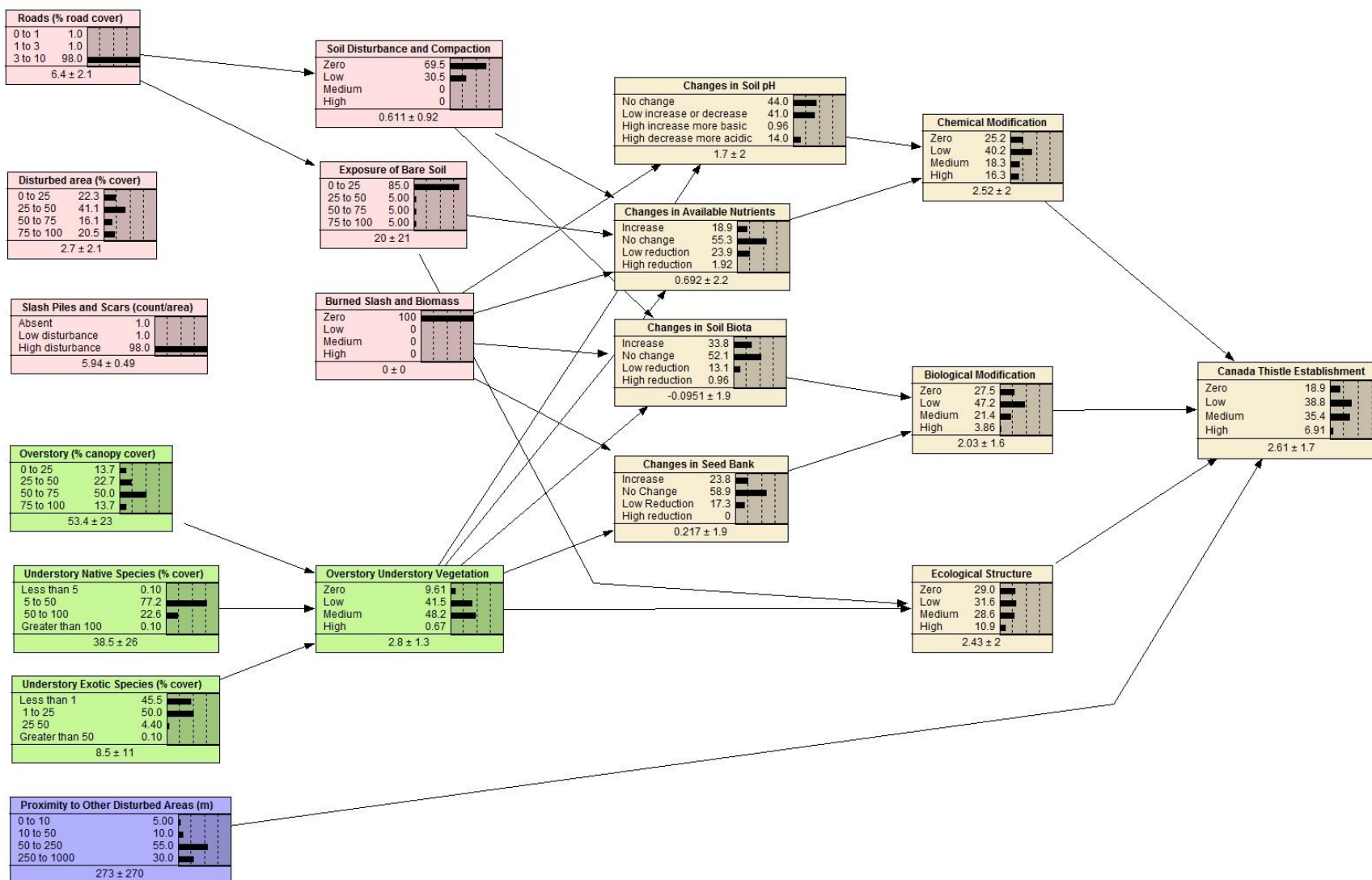


Appendix A.1 Draft Conceptual model from November 2014. The blue boxes denote the portion of the model that became the focus of the ERA after communications between USFS and WWU during November - December 2014.

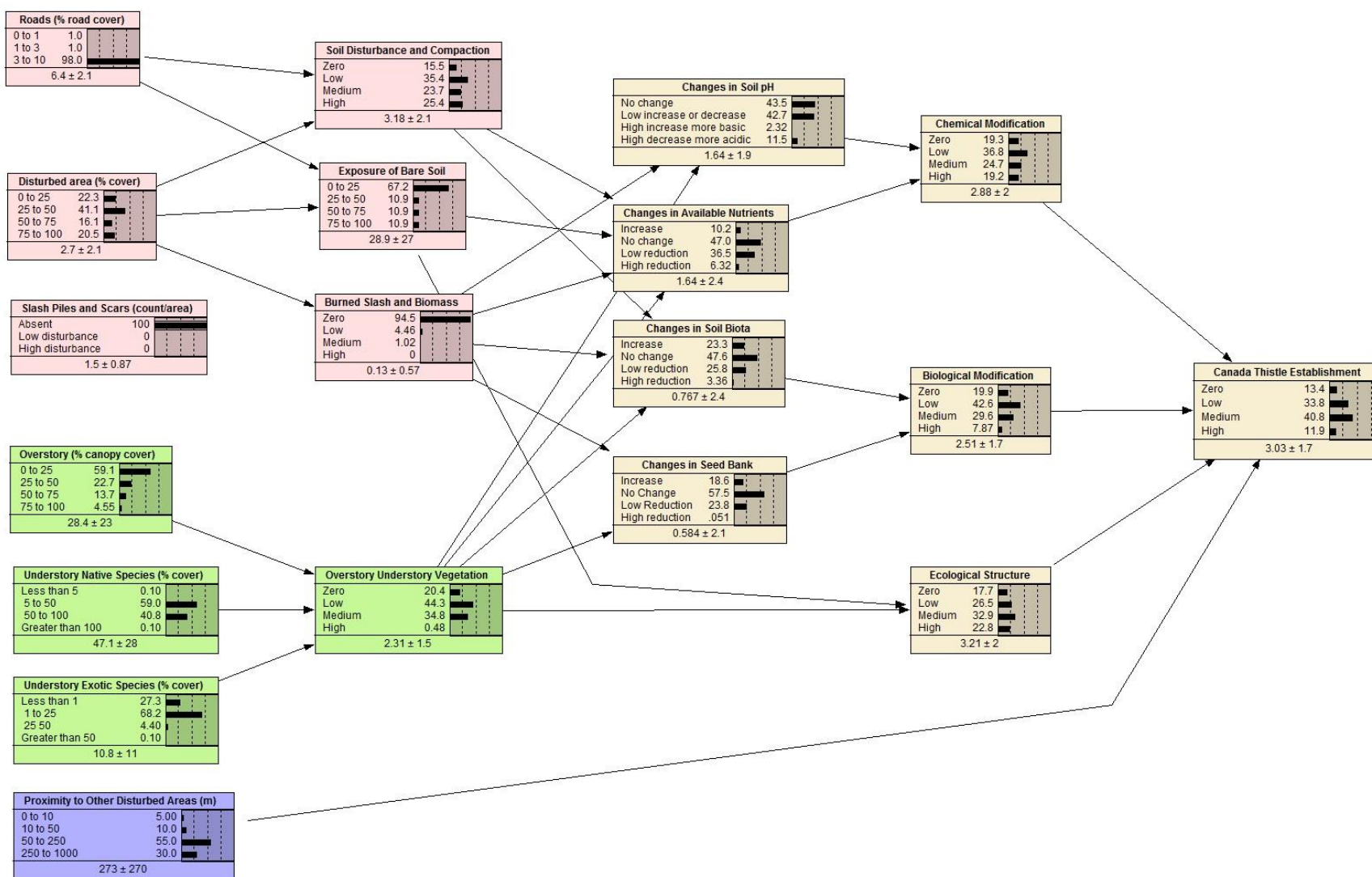


Appendix A.2. Draft Conceptual model from February 2014. Some revisions to the structure of the model and variable titles occurred between February 2015 and August 2015 in order to better incorporate the data received from USFS; the relationships between variables remained the same. The final conceptual model is included in the main document (Figure 3).

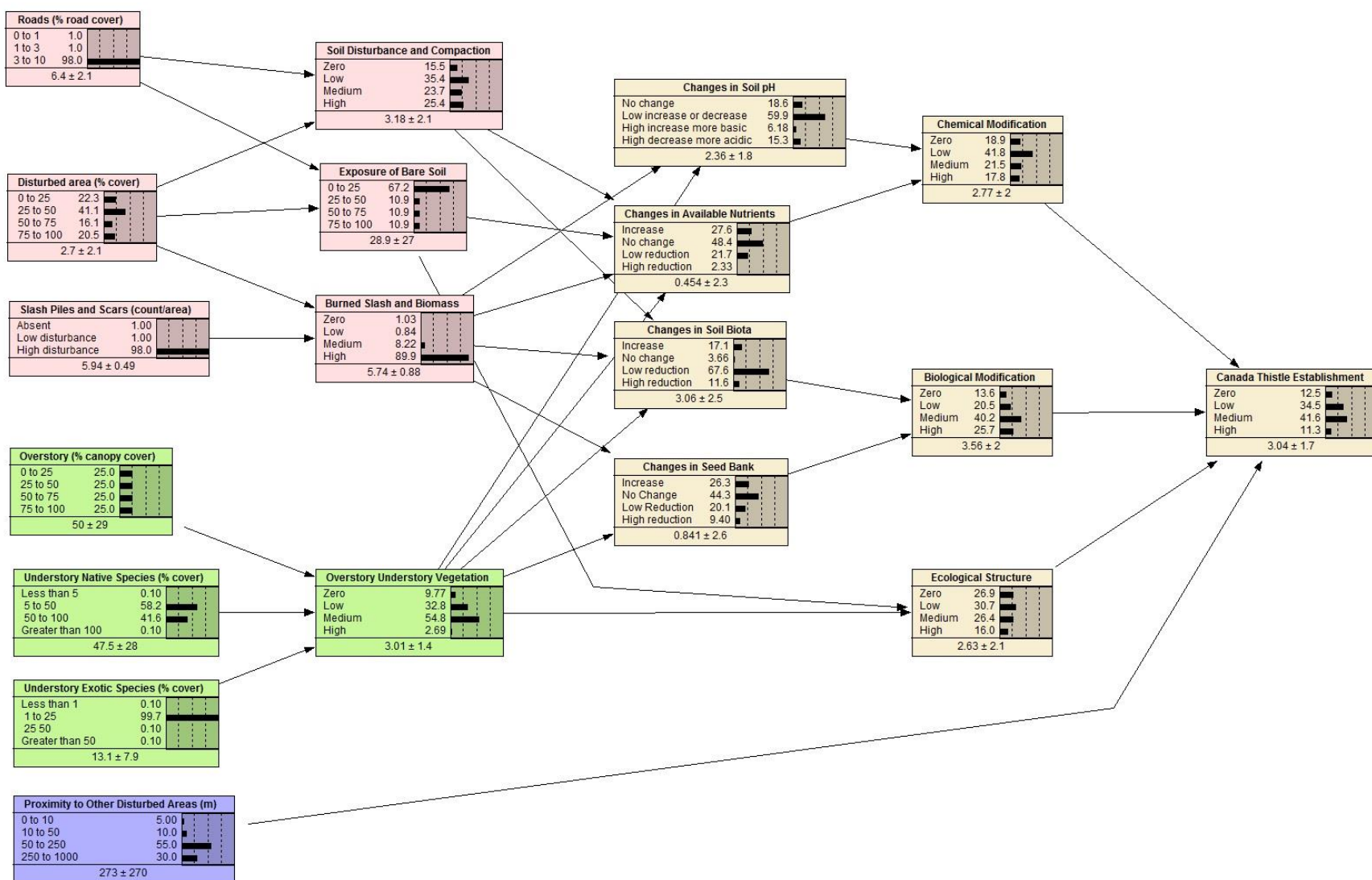
Appendix B. Bayesian networks for all regions and years.



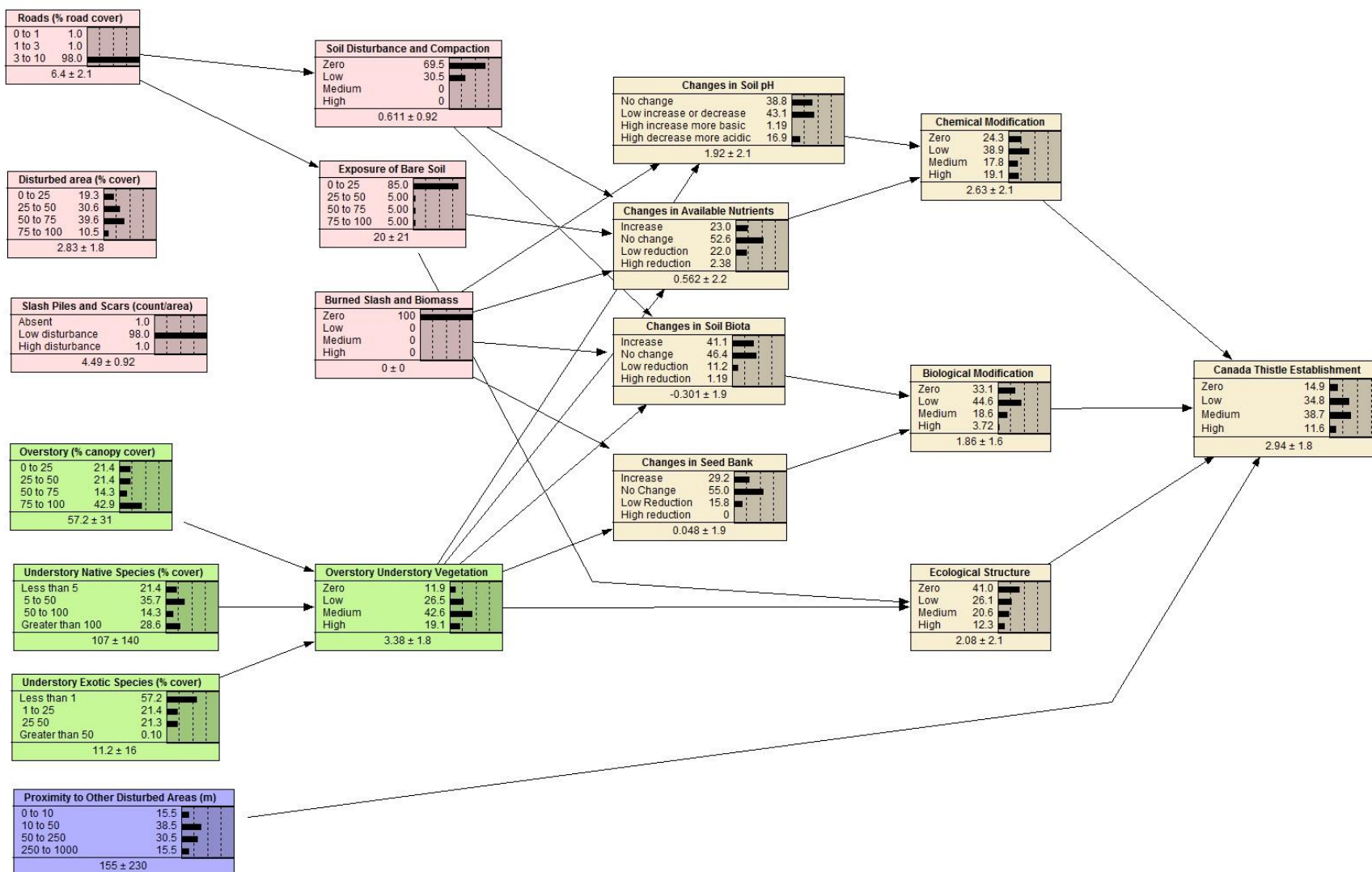
Appendix B.1 Dark Canyon Year 0.



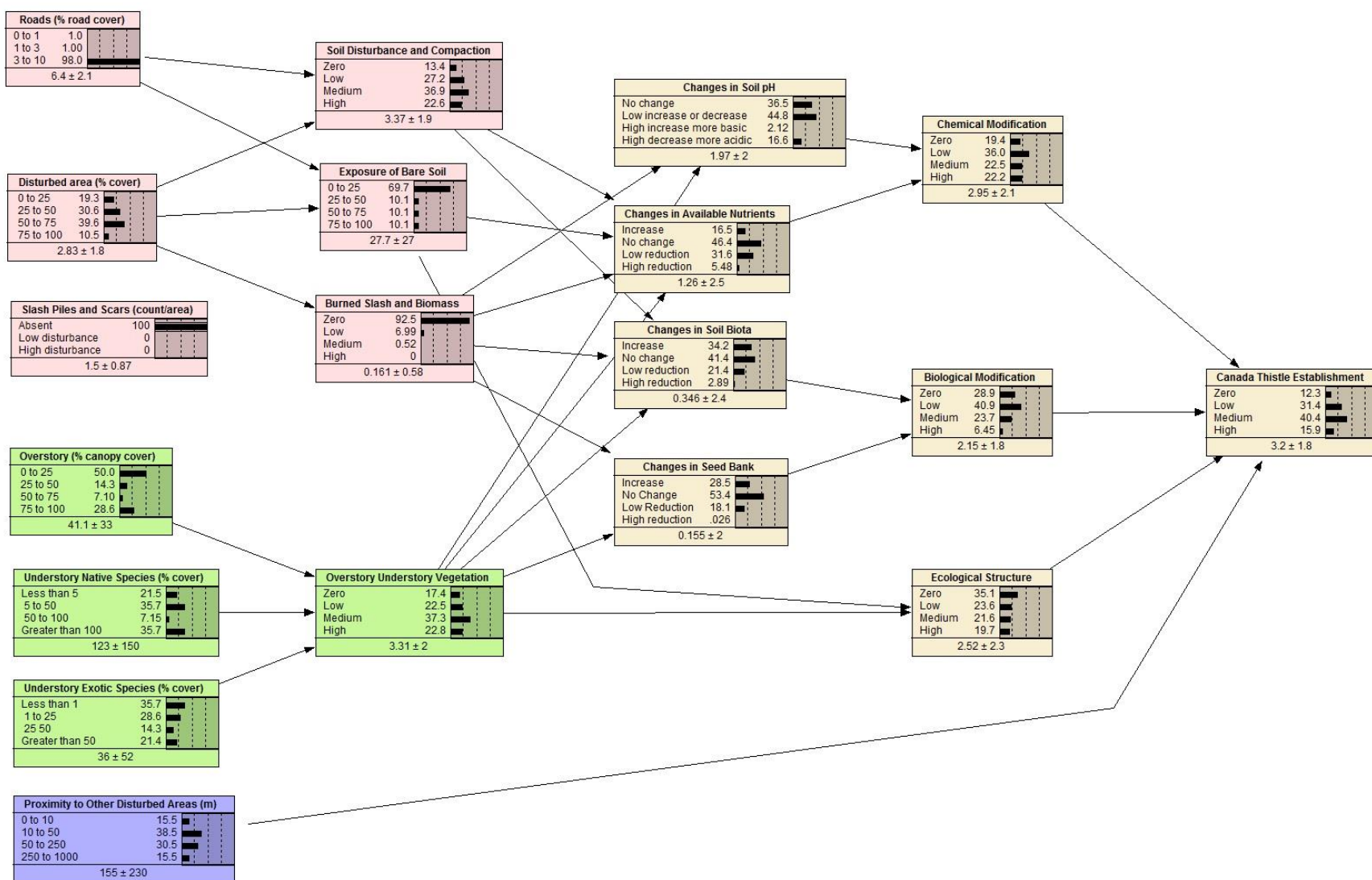
Appendix B.2 Dark Canyon Year 1.



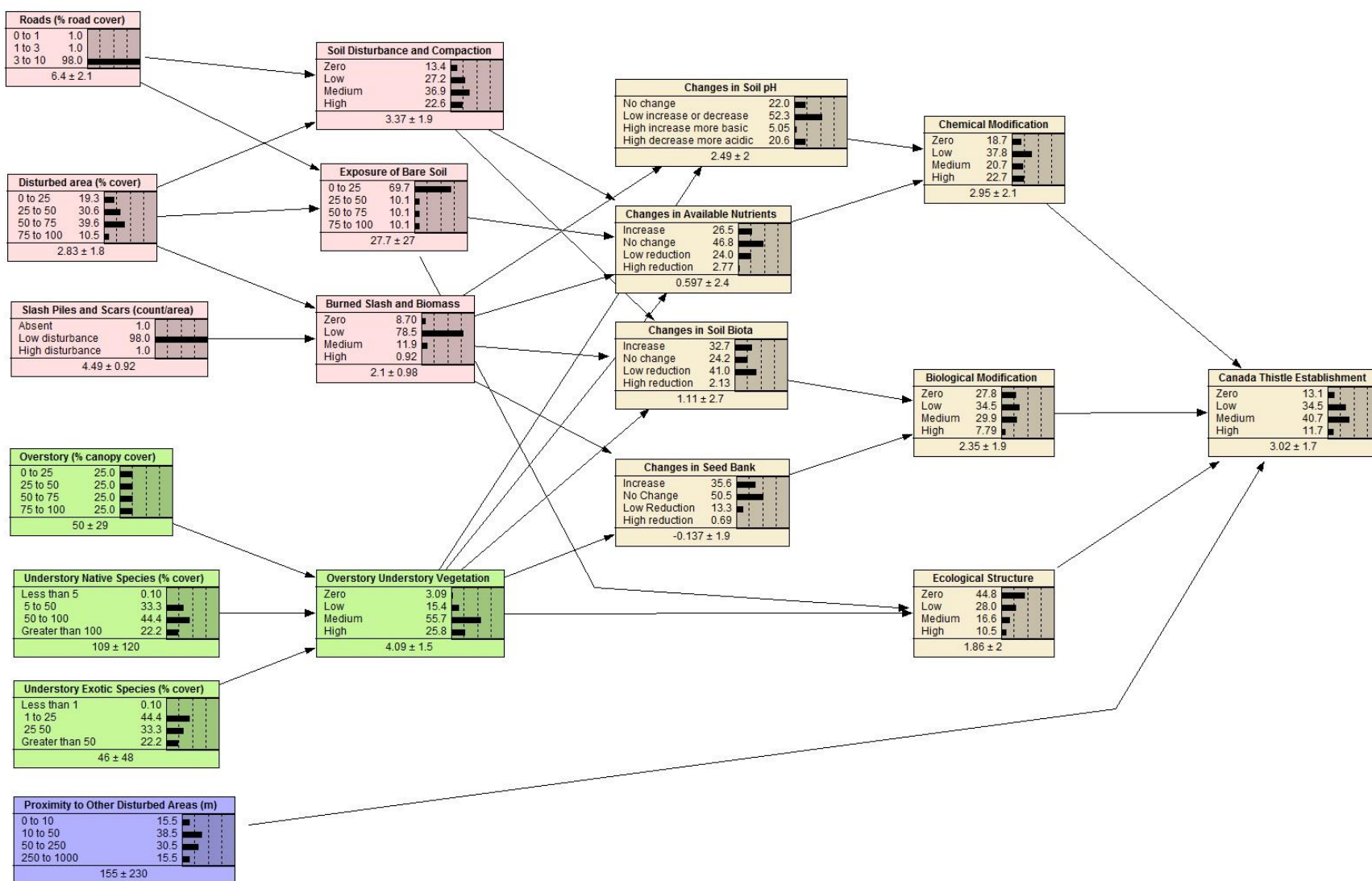
Appendix B.3 Dark Canyon Year 3.



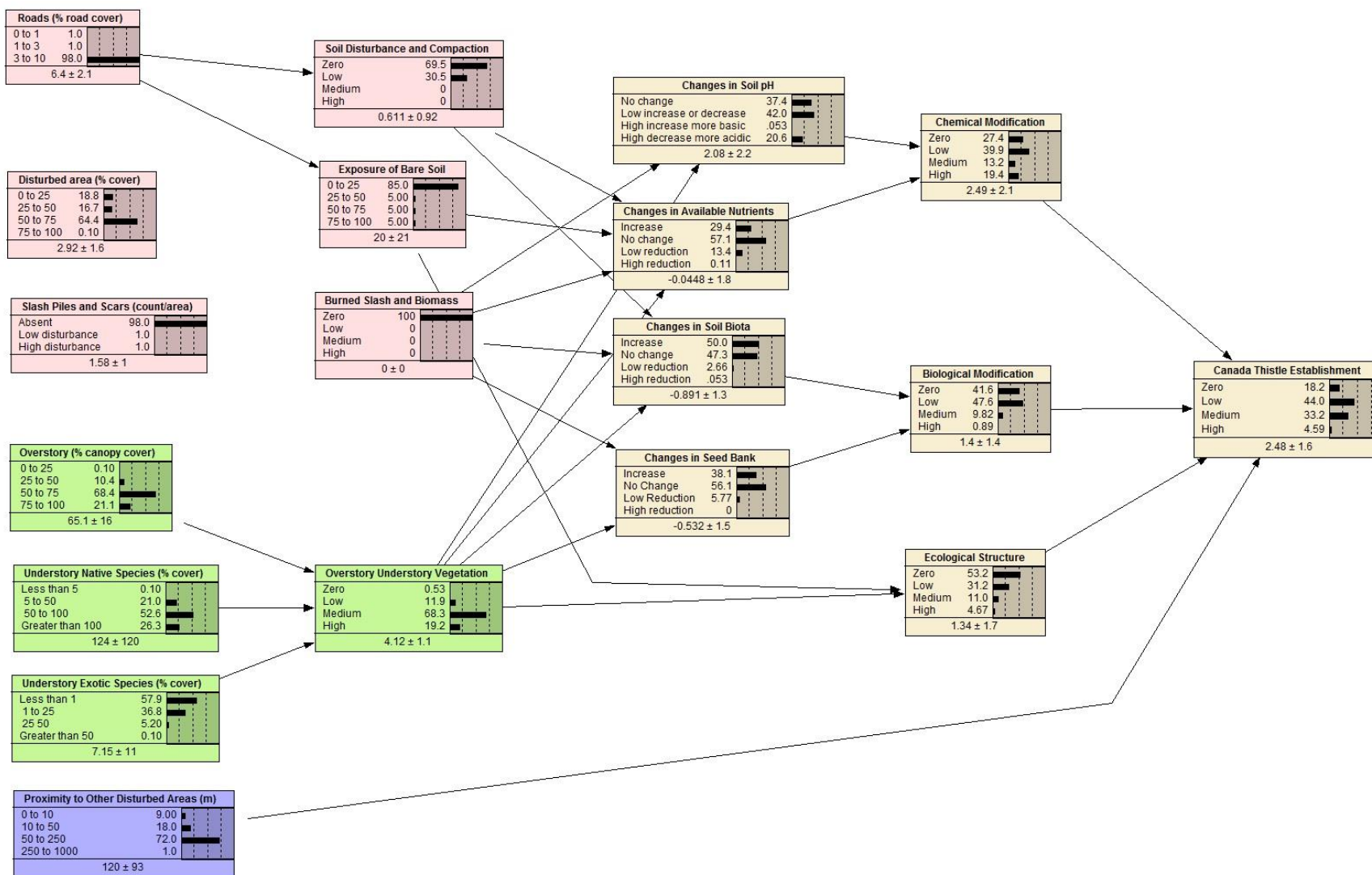
Appendix B.4 Thrall Year 0.



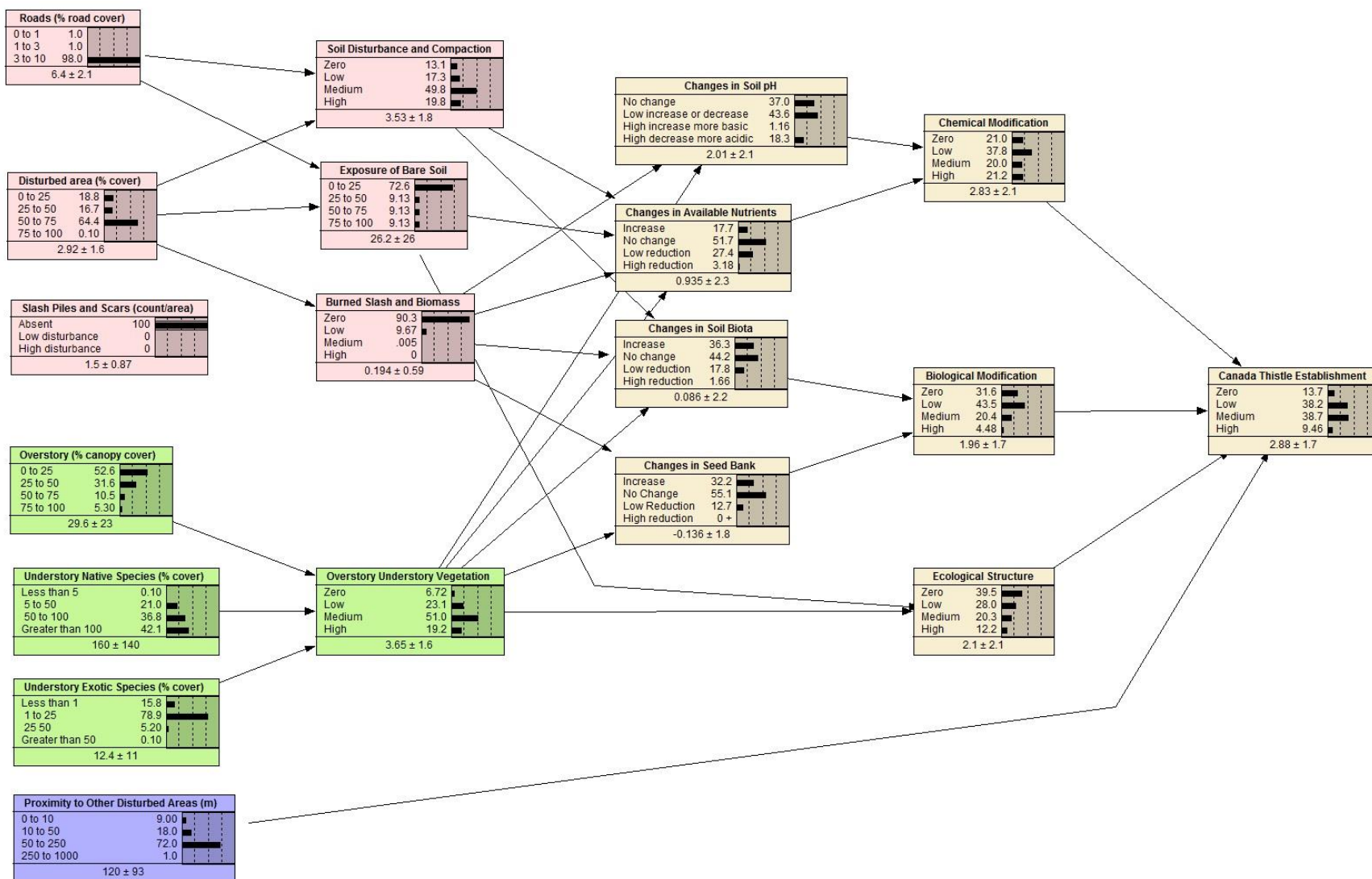
Appendix B.5 Thrall Year 1.



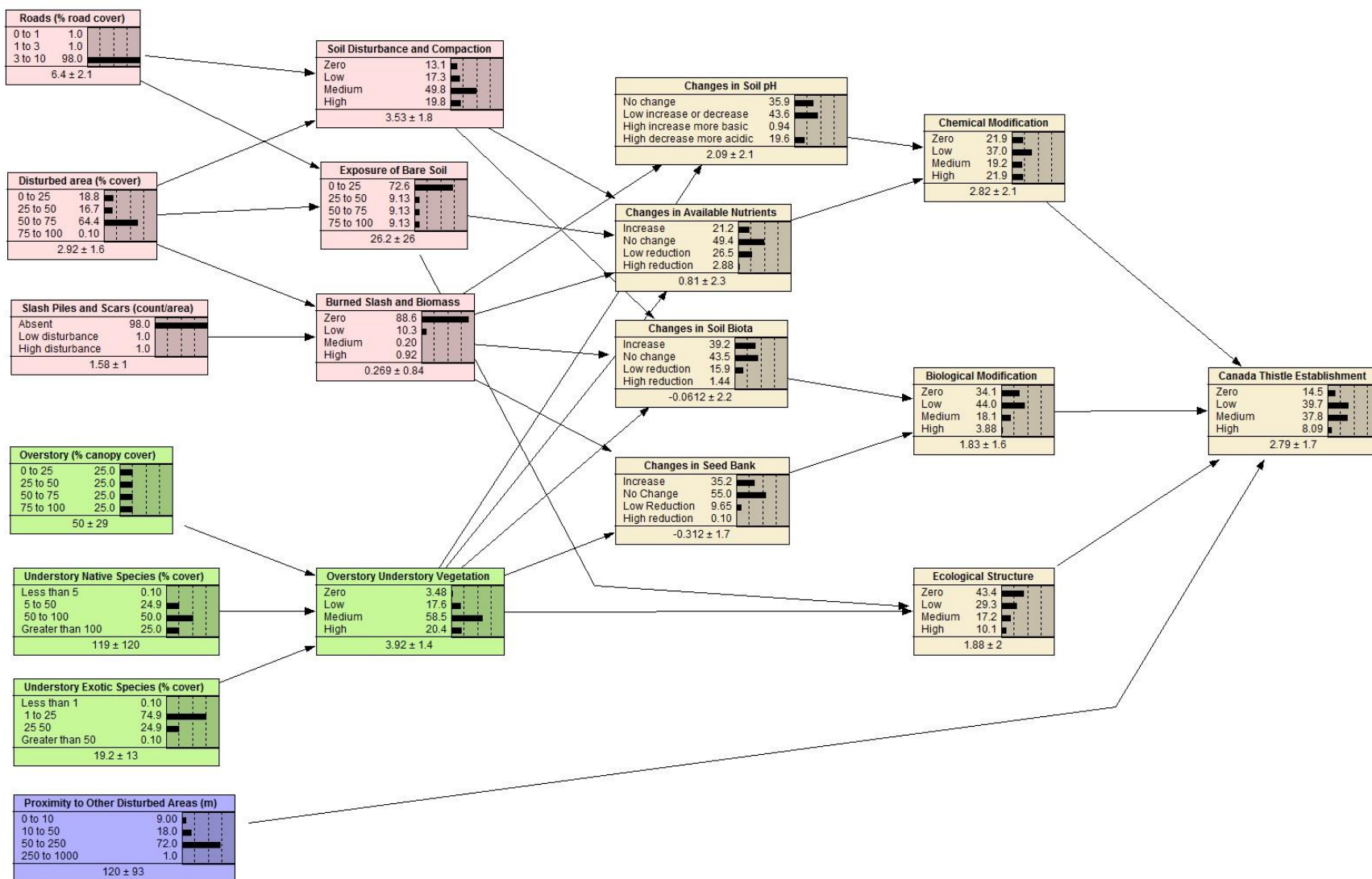
Appendix B.6 Thrall Year 3.



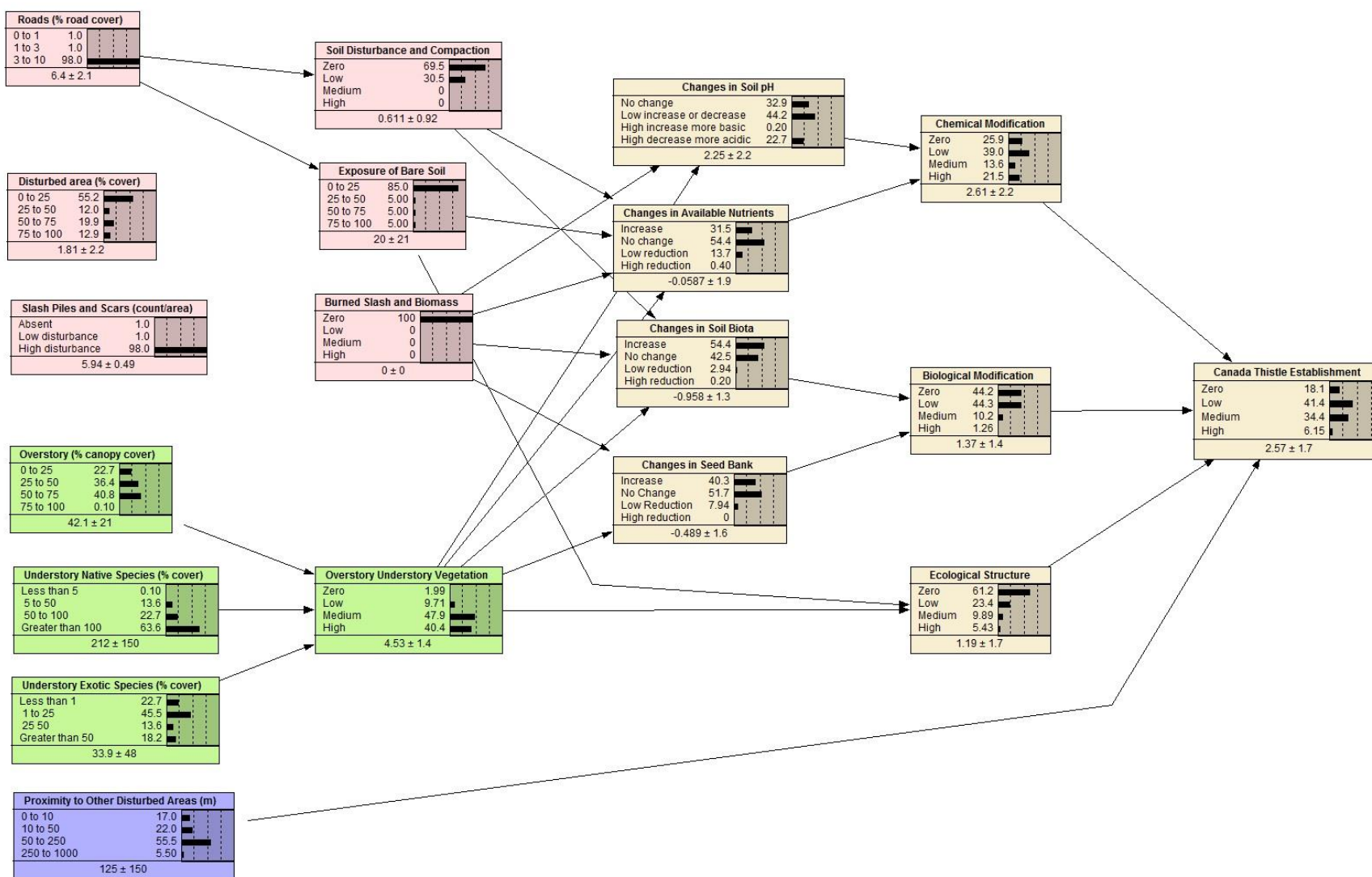
Appendix B.7 Mercedes Year 0.



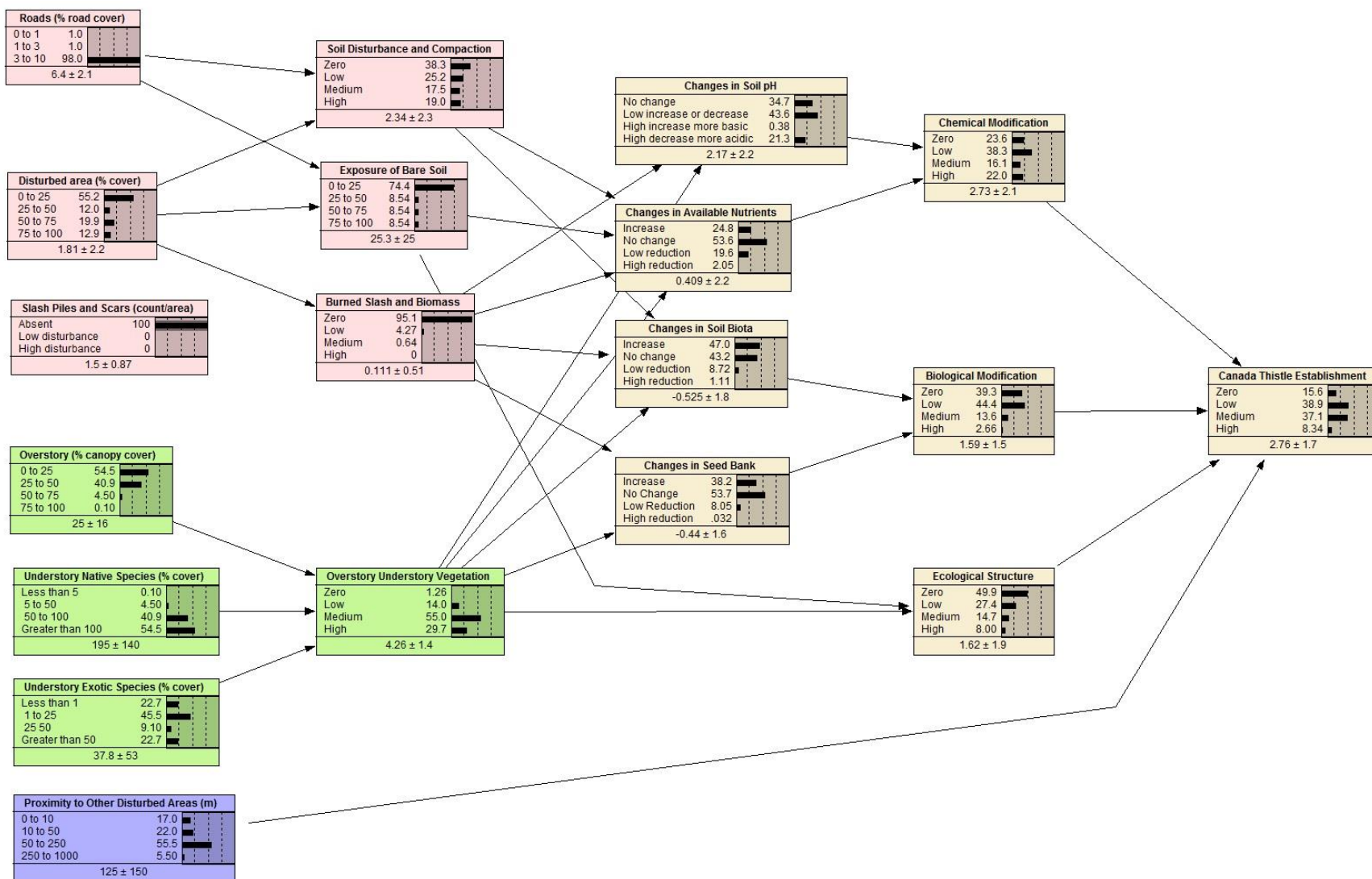
Appendix B.8 Mercedes Year 1.



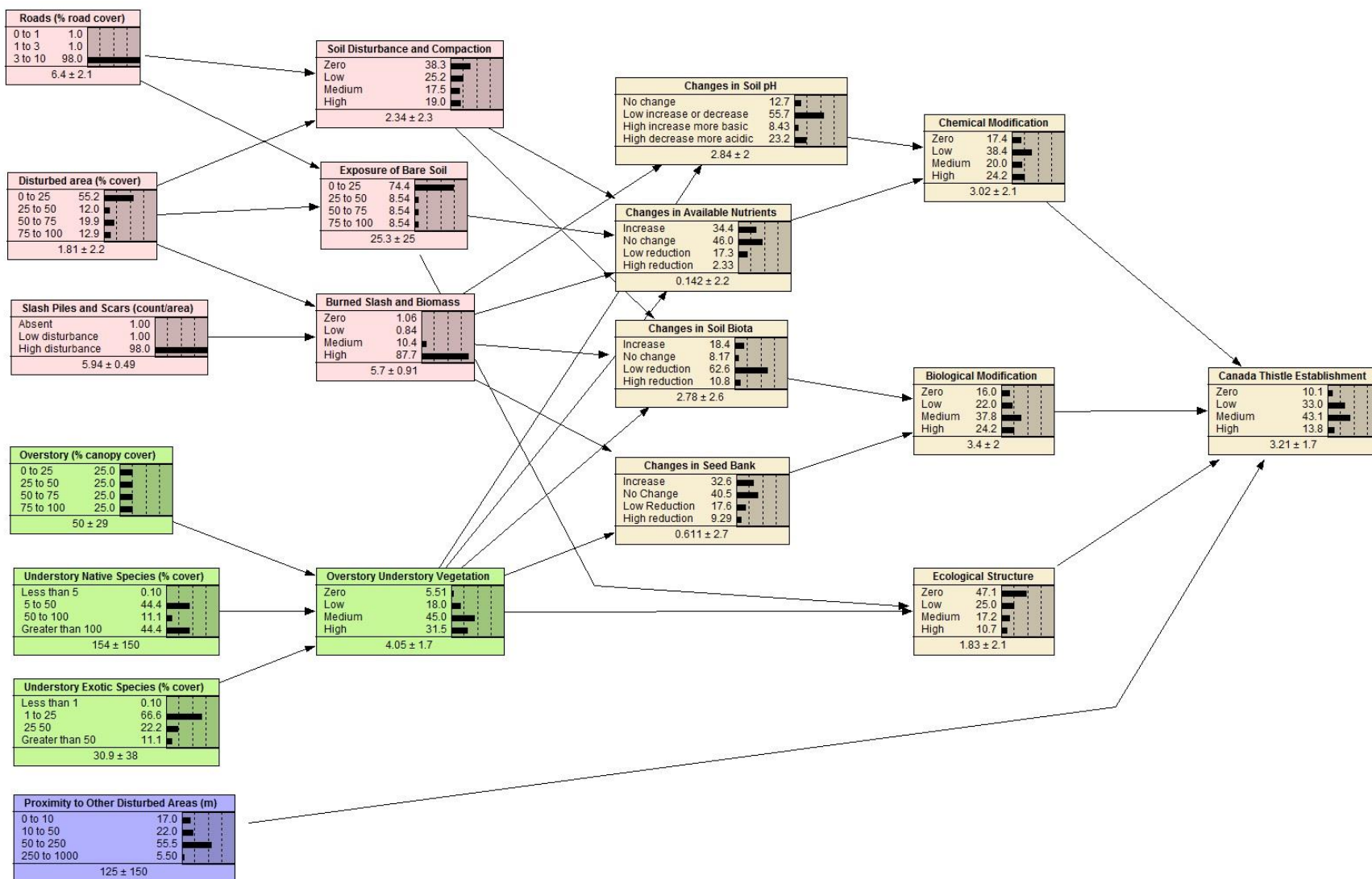
Appendix B.9 Mercedes Year 3.



Appendix B.10 Powerpole Year 0.



Appendix B.11 Powerpole Year 1.



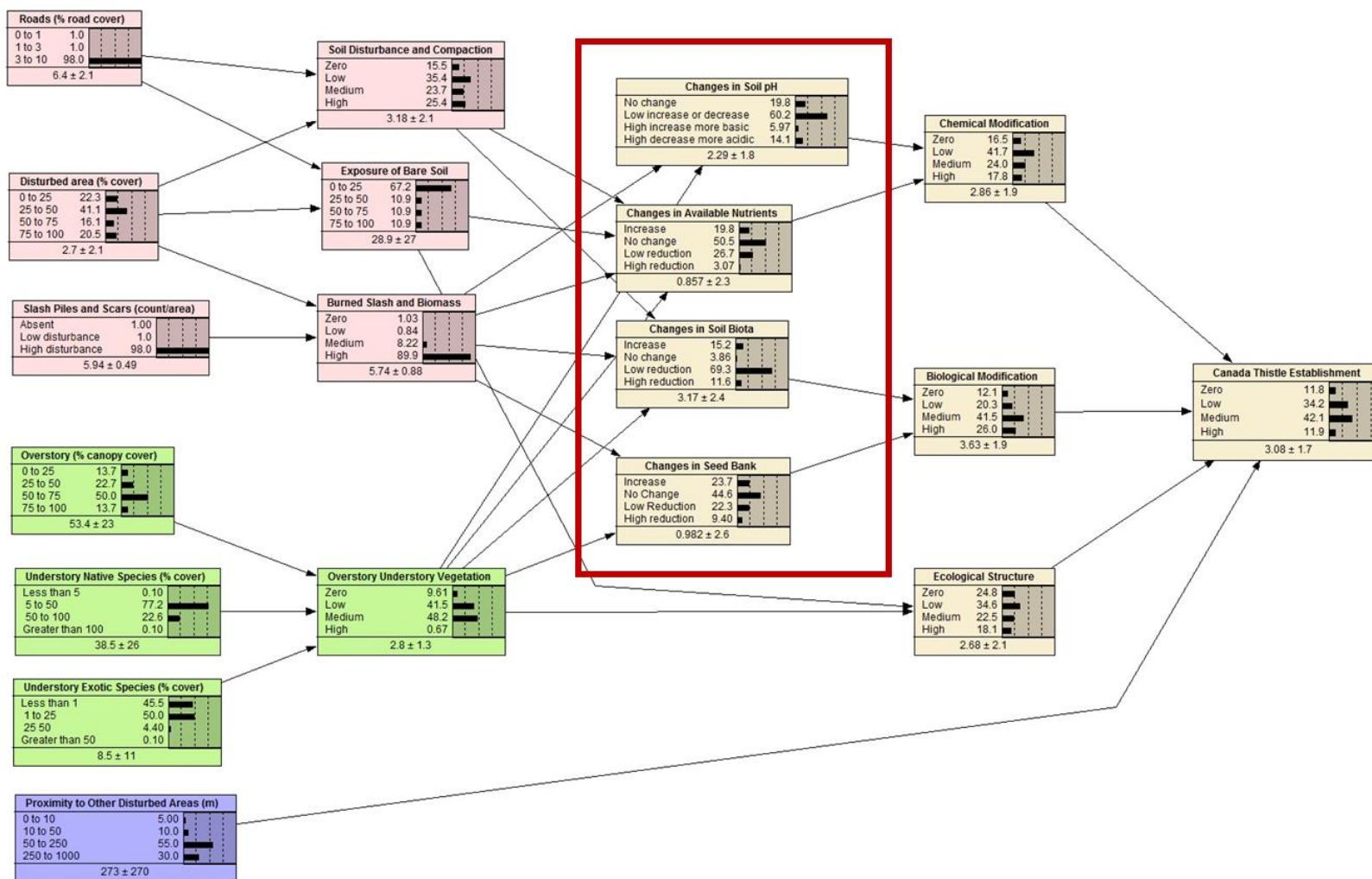
Appendix B.12 Powerpole Year 3.

Appendix C.1. Probability distributions for each model variable.

Input Variable	Rank	Dark Canyon			Mercedes			Powerpole			Thrall		
		Year			Year			Year			Year		
		0	1	3	0	1	3	0	1	3	0	1	3
Roads	0-1% cover	1	1	1	1	1	1	1	1	1	1	1	1
	1-3% cover	1	1	1	1	1	1	1	1	1	1	1	1
	3-10%cover	98	98	98	98	98	98	98	98	98	98	98	98
Disturbed Area	zero		22.3	22.3		18.8	18.8		55.2	55.2		19.3	19.3
	low		41.1	41.1		16.7	16.7		12.0	12.0		30.6	30.6
	medium		16.1	16.1		64.4	64.4		19.9	19.9		39.6	39.6
	high		20.5	20.5		0.1	0.1		12.9	12.9		10.5	10.5
Slash Piles and Scars	low			1.0			98.0			1.0			1.0
	medium			1.0			1.0			1.0			98.0
	high			98.0			1.0			98.0			1.0
Overstory Vegetation	zero	13.65	59.10	25.0	0.1	52.6	25.0	22.7	54.5	25.0	21.4	50.0	25.0
	low	22.7	22.70	25.0	10.4	31.6	25.0	36.4	40.9	25.0	21.4	14.3	25.0
	medium	50.0	13.65	25.0	68.4	10.5	25.0	40.8	4.5	25.0	14.3	7.1	25.0
	high	13.65	4.55	25.0	21.1	5.3	25.0	0.1	0.1	25.0	42.9	28.6	25.0
Understory Native Vegetation	zero	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	21.4	21.45	0.1
	low	77.2	59.0	58.2	21.0	21.0	24.9	13.6	4.5	44.4	35.7	35.7	33.30
	medium	22.6	40.8	41.6	52.6	36.8	50.0	22.7	40.9	11.1	14.3	7.15	44.40
	high	0.1	0.1	0.1	26.3	42.1	25.0	63.6	54.5	44.4	28.6	35.7	22.2
Understory Exotic Vegetation	zero	45.5	27.3	0.1	57.9	15.8	0.1	22.7	22.7	0.1	57.2	35.7	0.1
	low	50.0	68.2	99.7	36.8	78.9	74.9	45.5	45.5	66.6	21.4	28.6	44.40
	medium	4.4	4.4	0.1	5.2	5.2	24.9	13.6	9.1	22.2	21.3	14.3	33.30
	high	0.1	0.1	0.1	0.1	0.1	0.1	18.2	22.7	11.1	0.1	21.4	22.2
Proximity to Disturbed Areas	zero	5	5	5	9	9	9	17	17	17	15.5	15.5	15.5
	low	10	10	10	18	18	18	22	22	22	38.5	38.5	38.5
	medium	55	55	55	72	72	72	55.5	55.5	55.5	30.5	30.5	30.5
	high	30	30	30	1	1	1	5.5	5.5	5.5	15.5	15.5	15.5

Note: Without data for Overstory (percent canopy cover) Year 3, uniform input frequencies were assigned to this variable for all regions. When additional data become available the input frequencies can be updated.

Appendix D. Conditional Probability Tables and Supporting Information.



Appendix D.1 CPTs for effects nodes (see red box) differ for each year because the relative effect of a stressor is dependent on the time post-logging. The remaining CPTs are consistent for each year because the direct relationships between the variables do not change over time.

Appendix D.2. Descriptions of conditional probability tables with references.

Name	Inputs	Node Type	CPT Derivation	References
Soil Disturbance and Compaction	Roads Disturbed area	Stressor Node	Mathematical calculations Empirical evidence	Forman and Alexander 1998 Tinker et al. 1998 Williamson and Neilsen 2000 Buckley et al. 2003 Coats and Miller 1981
Exposure of Bare Soil	Roads Disturbed area	Stressor Node	Case file learning	Forman and Alexander 1998 Williamson and Nielson 2000 Buckley et al. 2003 Fowler et al. 2008
Burned Slash and Biomass	Disturbed area Slashing Piles	Stressor Node	Empirical evidence	Williamson and Nielson 2000 Haskins and Gehring 2004 Korb et al. 2004 Creech et al. 2012 Halpern et al. 2014
Overstory/Understory Relationship	Native Understory Exotic Understory Canopy Cover	Stressor Node	Mathematical calculations Empirical evidence	Wilson and Kachman 1999 Abella and Covington 2004
Changes in Soil pH	Burned Slash and Biomass Overstory/Understory	Effect Node	Empirical evidence	Arocena and Opio 2003 Korb et al. 2004 Esquilin et al. 2006 Deleon 2012
Changes in Available Nutrients	Soil Disturbance and Compaction Burned Slash and Biomass Exposure of Bare Soil Overstory/Understory	Effect Node	Empirical evidence	Lodhi and Killingbeck 1980 Covington and Harris 1983 Sackett and Covington 1984 White 1986a,b Hart et al. 1992 Busse 1996 Monleon et al. 1997 Johnson and Curtis 2001 Korb et al. 2004 Gundale et al. 2005 Esquilin et al. 2006

Changes in Soil Biota	Overstory/Understory Burned Slash and Biomass Soil Disturbance and Compaction	Effect Node	Empirical evidence	Lodhi and Killingbeck 1980 Callaway 2004 Korb 2004 Busse 2006
Changes in Seed Bank	Overstory/Understory Burned Slash and Biomass	Effect Node	Empirical evidence	Pratt et al. 1984 Thompson et al. 1996 Korb et al. 2004 Wienk et al. 2004 Abella et al. 2007 Creech et al. 2012
Chemical Modification	Changes in Soil pH Changes in Available Nutrients	Summary Node	Mathematical calculations Empirical evidence	Wilson Jr. 1979 Donald 1994 Sheley and Petroff 1999
Biological Modification	Changes in Soil Biota Changes in Seed Bank	Summary Node	Mathematical calculations Empirical evidence	Korb 2004 Wienk et al. 2004 Abella et al. 2007 Creech et al. 2012 Busse 2006
Ecological Structure	Overstory/Understory Exposure of Bare Soil	Summary Node	Mathematical calculations Empirical evidence	Munn et al. 1973 Gyssels et al. 2005 Denmead et al. 2008
Canada Thistle Establishment	Chemical Modification Biological Modification Ecological Structure Proximity to Other Disturbed Areas	Endpoint Node	Empirical evidence	Hamdoun 1972 Sheldon and Burrows 1973 Wilson Jr. 1979 Magnusson et al. 1987 Zimdahl et al. 1991 Ang et al. 1994 Donald 1994 Sheley and Petroff 1999 Edwards et al. 2000 Parendes and Jones 2000

Appendix D.3. Conditional probability table derivation Example 1: Empirical evidence.

The empirical evidence approach used data from peer reviewed literature, government reports, and site-specific information to derive the CPTs. These sources provided quantitative information on the relationships between the variables for each CPT. This information was translated into conditional probability distributions using the methods outlined by Marcot et al. (2006).

Example for Changes in Seed Bank node. For example, the CPT for Changes in Seed Bank was informed by studies on the effect of slash pile burning on seed bank composition and seed viability (Thompson et al. 1996, Korb et al. 2004, Abella et al. 2007, Creech et al. 2012). Creech et al. (2012) measured a 75% reduction in species richness and 97% reduction in mean seedling count of the soil seedbank after slash pile burning. Abella et al. (2007) measured comparable reductions in emergence abundance and species richness after slash pile burning. Thompson et al. (1996) documented Canada thistle germination rates of 2-20% when seeds were exposed to 56°C and 0% germination at 75°C and 100°C compared to control germination rates of 73%. Each of these results was incorporated into the conditional probability distributions for the Changes in Seed Bank node.

Appendix D Table D.3. CPT for Changes in Seed Bank node for models Years 0 and 1 in all regions.

Vegetation	Burn	Increase	No change	Low reduction	High reduction
zero	zero	0	50	50	0
zero	low	0	45	55	0
zero	medium	0	40	55	5
zero	high	0	35	55	10
low	zero	10	60	30	0
low	low	10	55	35	0
low	medium	10	50	35	5
low	high	10	45	35	10
medium	zero	40	60	0	0
medium	low	40	55	5	0
medium	medium	40	50	5	5
medium	high	40	45	5	10
high	zero	50	40	10	0
high	low	45	40	15	0
high	medium	45	35	15	5
high	high	40	30	20	10

Appendix D.4. Conditional probability table derivation Example 2: Case file learning.

By importing data directly into Netica, the software can “learn” from a collection of “cases” or observations to develop the CPT. Netica refers to this process as *parameter learning* (as opposed to *structure learning*, which would use case files to establish the structure of the BN). Netica tutorials provide instructions for how to execute *parameter learning* (Norsys Software Corp. 2014).

For cases in which there is no information, Netica will assign the combination or row a uniform distribution (e.g. 25% probability in each of the four states) (Norsys Software Corp. 2014). Depending on the objective of the modeling and the expert judgement of the modeler, these rows can either be left as uniform distributions or updated manually to reflect other knowledge of the system (Marcot et al. 2006, Norsys Software Corp. 2014). For example, the rows could be completed using empirical evidence from the scientific literature or other site-specific information that was not captured in the case file.

Example for Exposure of Bare Soil node.

The relationship between parent nodes 1) percent road cover and 2) percent disturbed area and the effect of these nodes on the child node Exposure of Bare Soil was defined by data from the BHNf using the machine learning function within Netica. Based on the USFS data, Netica created a CPT (Figure D.4A). There were no cases for Roads *absent*, resulting in uniform distributions for the first four rows. In this example, these rows were updated to reflect the information in the empirical literature (Forman and Alexander 1998, Buckley et al. 2003, Fowler et al. 2008). The number of significant figures in the CPT were also reduced. Both the original CPT from Netica and the final CPT are included below.

Appendix D Table D.4A CPT for Exposure of Bare Soil node from the case file learning function.

Road	Disturbance	Zero	Low	Medium	High
absent	zero	25.000	25.000	25.000	25.000
absent	low	25.000	25.000	25.000	25.000
absent	medium	25.000	25.000	25.000	25.000
absent	high	25.000	25.000	25.000	25.000
low	zero	70.000	10.000	10.000	10.000
low	low	72.727	9.091	9.091	9.091
low	medium	40.000	20.000	20.000	20.000
low	high	50.000	16.667	16.667	16.667
high	zero	86.364	4.545	4.545	4.545
high	low	70.000	10.000	10.000	10.000
high	medium	75.000	8.333	8.333	8.333
high	high	40.000	20.000	20.000	20.000

Appendix D Table D.4B CPT for Exposure of Bare Soil node for all years, all regions.

Road	Disturbance	Zero	Low	Medium	High
absent	zero	100	0	0	0
absent	low	85	5	5	5
absent	medium	70	10	10	10
absent	high	40	20	20	20
low	zero	70	10	10	10
low	low	70	10	10	10
low	medium	40	20	20	20
low	high	40	20	20	20
high	zero	85	5	5	5
high	low	70	10	10	10
high	medium	70	10	10	10
high	high	40	20	20	20

Appendix D.5. Conditional probability table derivation Example 2: Mathematical calculations with empirical evidence

The summary nodes were derived using calculations, as well as empirical evidence from the scientific literature. Using this approach, summary node ranks are summed results from the combination of the input node ranks using the numerical ranking scheme (0, 2, 4, 6). Rules were established for determining a conditional probability distribution (CPD) based on the sum of the parent values (see an example in Table D.5A). This method was used for all summary nodes (Biological Modification, Chemical Modification and Ecological Structure) though the set of rules differed between each of these to reflect the different relationships between the parent nodes. These rules are then used to complete the entire CPT for each node (Table D.5B). The CPTs for every summary node in the models are the same for risk regions and years.

Example for Ecological Structure node

The rules in Table D.5A describe the CPD for each row in the table based on the sum of the input ranks for Bare Soils and Understory/ Overstory Vegetation. Vegetation is inversely related to the Ecological Structure node- low percent cover of vegetation relates to an ecological structure that is highly susceptible to Canada thistle (represented as a High state for the Ecological Structure node). The sum of the input ranks determines the CPD. For example, a Low (2) for Bare Soil and a High for Vegetation (0) gives you a sum of 2. A Low for Bare Soil (2) and Zero for Vegetation (6) gives you an 8 (2+6). These rules were used to complete the CPT for Ecological Structure which is shown in Table D.5B.

Appendix D Table D.5A CPT rules for Ecological Structure node for all years, all regions

Sum of Parent Node Values	Child Node State			
	zero	low	med	high
0	100	0	0	0
2	60	40	0	0
4 (0+4)	10	30	60	0
4 (2+2)	10	70	20	0
6 (0+6)	0	10	20	70
6(2+4)	0	30	60	10
8 (2+6)	0	10	10	80
8 (4+4)	0	20	60	20
10	0	0	40	60
12	0	0	0	100

Appendix D Table D.5B CPT for Ecological Structure node for all years, all regions. The values in the green box are the values of the CPT.

Bare Soil		Vegetation		Summed Rank	Child Node State			
State	Rank	State	Rank		zero	low	med	high
zero	0	zero	6	6	0	10	20	70
zero	0	low	4	4	10	30	60	0
zero	0	med	2	2	60	40	0	0
zero	0	high	0	0	100	0	0	0
low	2	zero	6	8	0	10	10	80
low	2	low	4	6	0	30	60	10
low	2	med	2	4	10	70	20	0
low	2	high	0	2	60	40	0	0
med	4	zero	6	10	0	0	40	60
med	4	low	4	8	0	20	60	20
med	4	med	2	6	0	30	60	10
med	4	high	0	4	10	30	60	0
high	6	zero	6	12	0	0	0	100
high	6	low	4	10	0	0	40	60
high	6	med	2	8	0	10	10	80
high	6	high	0	6	0	10	20	70

Appendix E. Complete sensitivity analysis and influence analysis results.**Appendix E.1** Netica output for *Sensitivity to Findings* of Canada Thistle Establishment to all other nodes.**Dark Canyon Year 0**

Node	Variance	Percent	Mutual	Percent	Variance of
----	Reduction		Info		Beliefs
Ecological Structure	0.6243	21.5	0.17562	9.86	0.0130889
Proximity to Other Distu	0.2867	9.86	0.07724	4.34	0.0051780
Biological Modification	0.2682	9.22	0.07022	3.94	0.0047661
Chemical Modification	0.2576	8.86	0.06751	3.79	0.0044007
Overstory (% canopy cove	0.1182	4.07	0.03114	1.75	0.0018849
Understory Native Specie	0.05289	1.82	0.01376	0.773	0.0009483
Understory Exotic Specie	0.009316	0.32	0.00236	0.133	0.0001666
Roads (% road cover)	0.0002372	0.00816	0.00006	0.00339	0.0000041
Slash Piles and Scars (c 0		0	0.00000	0	0.0000000
Disturbed area (% cover)	0	0	0.00000	0	0.0000000

Dark Canyon Year 1

Ecological Structure	0.7324	24.2	0.20068	11.1	0.0138293
Biological Modification	0.3058	10.1	0.07728	4.27	0.0049125
Chemical Modification	0.2983	9.86	0.07504	4.14	0.0044715
Proximity to Other Distu	0.2614	8.65	0.06772	3.74	0.0043591
Understory Native Specie	0.123	4.07	0.03049	1.68	0.0018782
Overstory (% canopy cove	0.07693	2.54	0.01882	1.04	0.0012079
Disturbed area (% cover)	0.02378	0.787	0.00571	0.315	0.0003720
Understory Exotic Specie	0.009117	0.301	0.00220	0.121	0.0001422
Roads (% road cover)	7.31e-05	0.00242	0.00002	0.000961	0.0000012
Slash Piles and Scars (c 0		0	0.00000	0	0.0000000

Dark Canyon Year 3

Node	Variance	Percent	Mutual	Percent	Variance of
----	Reduction		Info		Beliefs
Ecological Structure	0.5459	18.8	0.15162	8.48	0.0101724
Biological Modification	0.2527	8.69	0.06520	3.65	0.0042972
Proximity to Other Distu	0.2519	8.66	0.06748	3.77	0.0043622
Chemical Modification	0.1695	5.83	0.04366	2.44	0.0026472
Overstory (% canopy cove	0.063	2.17	0.01605	0.898	0.0010764
Understory Native Specie	0.03928	1.35	0.01005	0.562	0.0006798
Disturbed area (% cover)	0.02692	0.925	0.00675	0.378	0.0004342
Slash Piles and Scars (c	0.00108	0.0371	0.00027	0.0151	0.0000182
Understory Exotic Specie	0.0001248	0.00429	0.00003	0.00181	0.0000023
Roads (% road cover)	9.125e-05	0.00314	0.00002	0.00129	0.0000015

Thrall Year 0

Node	Variance	Percent	Mutual	Percent	Variance of
----	Reduction		Info		Beliefs
Ecological Structure	0.686	22	0.18274	9.99	0.0127819
Proximity to Other Distu	0.4496	14.4	0.11416	6.24	0.0080371
Biological Modification	0.3164	10.2	0.07912	4.32	0.0049837
Chemical Modification	0.2574	8.26	0.06318	3.45	0.0034355
Understory Native Specie	0.1734	5.56	0.04355	2.38	0.0024129
Overstory (% canopy cove	0.1066	3.42	0.02868	1.57	0.0014201
Understory Exotic Specie	0.01887	0.605	0.00491	0.268	0.0002493
Roads (% road cover)	0.0002538	0.00814	0.00006	0.00332	0.0000037
Slash Piles and Scars (c 0	0	0	0.00000	0	0.0000000
Disturbed area (% cover)	0	0	0.00000	0	0.0000000

Thrall Year 1

Node	Variance	Percent	Mutual	Percent	Variance of
----	Reduction		Info		Beliefs
Ecological Structure	0.8162	25.4	0.21404	11.6	0.0154852
Proximity to Other Distu	0.4235	13.2	0.10341	5.6	0.0065510
Biological Modification	0.3523	11	0.08543	4.63	0.0054954
Chemical Modification	0.2934	9.13	0.06966	3.77	0.0037051
Understory Native Specie	0.2099	6.53	0.05037	2.73	0.0028756
Overstory (% canopy cove	0.08219	2.56	0.02088	1.13	0.0010803
Understory Exotic Specie	0.03472	1.08	0.00857	0.464	0.0004516
Disturbed area (% cover)	0.01868	0.581	0.00423	0.229	0.0002539
Roads (% road cover)	0.0001523	0.00474	0.00003	0.00187	0.0000022
Slash Piles and Scars (c	0	0	0.00000	0	0.0000000

Thrall Year 3

Node	Variance	Percent	Mutual	Percent	Variance of
----	Reduction		Info		Beliefs
Ecological Structure	0.5043	16.9	0.13711	7.6	0.0092045
Proximity to Other Distu	0.4216	14.1	0.11091	6.15	0.0074970
Chemical Modification	0.1871	6.27	0.04733	2.62	0.0027339
Biological Modification	0.1788	5.99	0.04497	2.49	0.0026347
Understory Native Specie	0.03503	1.17	0.00902	0.5	0.0005147
Disturbed area (% cover)	0.02364	0.792	0.00592	0.328	0.0003350
Overstory (% canopy cove	0.0223	0.747	0.00581	0.322	0.0003222
Understory Exotic Specie	0.01093	0.366	0.00285	0.158	0.0001594
Slash Piles and Scars (c	0.0006411	0.0215	0.00016	0.00863	0.0000095
Roads (% road cover)	0.0001987	0.00666	0.00005	0.00282	0.0000029

Mercedes Year 0

Node	Variance	Percent	Mutual	Percent	Variance of
----	Reduction		Info		Beliefs
Ecological Structure	0.3252	12.7	0.09972	5.86	0.0074522
Proximity to Other Distu	0.2261	8.84	0.06752	3.97	0.0053882
Chemical Modification	0.2002	7.83	0.05989	3.52	0.0051297
Biological Modification	0.09588	3.75	0.02791	1.64	0.0020208
Understory Native Specie	0.03628	1.42	0.01070	0.629	0.0008923
Overstory (% canopy cove	0.006562	0.257	0.00210	0.124	0.0001403
Understory Exotic Specie	0.0008929	0.0349	0.00027	0.0158	0.0000210
Roads (% road cover)	0.0003686	0.0144	0.00013	0.00752	0.0000079
Slash Piles and Scars (c 0		0	0.00000	0	0.0000000
Disturbed area (% cover) 0		0	0.00000	0	0.0000000

Mercedes Year 1

Node	Variance	Percent	Mutual	Percent	Variance of
----	Reduction		Info		Beliefs
Ecological Structure	0.585	20.6	0.16972	9.56	0.0123329
Chemical Modification	0.24	8.46	0.06449	3.63	0.0044287
Proximity to Other Distu	0.2162	7.62	0.05833	3.29	0.0038062
Biological Modification	0.2161	7.62	0.05781	3.26	0.0039073
Understory Native Specie	0.1372	4.84	0.03704	2.09	0.0025417
Overstory (% canopy cove	0.01773	0.625	0.00495	0.279	0.0003365
Disturbed area (% cover)	0.009124	0.322	0.00237	0.133	0.0001702
Understory Exotic Specie	0.002188	0.0772	0.00060	0.0339	0.0000415
Roads (% road cover)	0.000329	0.0116	0.00009	0.00491	0.0000066
Slash Piles and Scars (c 0		0	0.00000	0	0.0000000

Mercedes Year 3

Node	Variance	Percent	Mutual	Percent	Variance of
----	Reduction		Info		Beliefs
Ecological Structure	0.4938	17.9	0.14513	8.26	0.0104975
Proximity to Other Distu	0.2153	7.8	0.05961	3.39	0.0040614
Chemical Modification	0.2093	7.58	0.05756	3.28	0.0042874
Biological Modification	0.1691	6.13	0.04605	2.62	0.0031794
Understory Native Specie	0.05323	1.93	0.01495	0.851	0.0010473
Overstory (% canopy cove	0.02929	1.06	0.00834	0.475	0.0005816
Disturbed area (% cover)	0.009365	0.339	0.00252	0.143	0.0001827
Understory Exotic Specie	0.003354	0.122	0.00097	0.055	0.0000680
Slash Piles and Scars (c	0.001228	0.0445	0.00032	0.0183	0.0000259
Roads (% road cover)	0.0003348	0.0121	0.00009	0.00527	0.0000070

Powerpole Year 0

Node	Variance	Percent	Mutual	Percent	Variance of
----	Reduction		Info		Beliefs
Proximity to Other Distu	0.3897	14.1	0.11118	6.35	0.0097884
Ecological Structure	0.362	13.1	0.10312	5.89	0.0069376
Chemical Modification	0.2046	7.42	0.05753	3.29	0.0043805
Biological Modification	0.1212	4.4	0.03294	1.88	0.0020463
Understory Native Specie	0.05973	2.17	0.01678	0.959	0.0010280
Overstory (% canopy cove	0.007398	0.268	0.00231	0.132	0.0001201
Understory Exotic Specie	0.00627	0.227	0.00185	0.106	0.0001088
Roads (% road cover)	0.0003669	0.0133	0.00011	0.00646	0.0000065
Slash Piles and Scars (c	0	0	0.00000	0	0.0000000
Disturbed area (% cover)	0	0	0.00000	0	0.0000000

Powerpole Year 1

Ecological Structure	0.4602	16.1	0.12849	7.23	0.0088044
Proximity to Other Distu	0.3742	13.1	0.10235	5.76	0.0077410
Chemical Modification	0.2233	7.8	0.05951	3.35	0.0040827
Biological Modification	0.1387	4.85	0.03616	2.03	0.0022992
Understory Native Specie	0.04606	1.61	0.01212	0.681	0.0008013
Disturbed area (% cover)	0.03992	1.39	0.01055	0.594	0.0006574
Understory Exotic Specie	0.008935	0.312	0.00235	0.132	0.0001662
Overstory (% canopy cove	0.003213	0.112	0.00085	0.0478	0.0000591
Roads (% road cover)	0.0002603	0.00909	0.00007	0.00401	0.0000045
Slash Piles and Scars (c 0	0	0	0.00000	0	0.0000000

Powerpole Year 3

Node	Variance	Percent	Mutual	Percent	Variance of
----	Reduction		Info		Beliefs
Ecological Structure	0.4383	15.3	0.12418	6.98	0.0091162
Proximity to Other Distu	0.3237	11.3	0.08864	4.98	0.0057332
Biological Modification	0.2085	7.27	0.05439	3.06	0.0035963
Chemical Modification	0.1375	4.8	0.03588	2.02	0.0022896
Understory Native Specie	0.03956	1.38	0.01093	0.614	0.0006652
Disturbed area (% cover)	0.02891	1.01	0.00756	0.425	0.0004544
Overstory (% canopy cove	0.02022	0.705	0.00567	0.318	0.0003218
Understory Exotic Specie	0.005454	0.19	0.00155	0.0871	0.0000880
Slash Piles and Scars (c	0.001666	0.0581	0.00042	0.0235	0.0000299
Roads (% road cover)	0.000194	0.00677	0.00005	0.00297	0.0000031

Appendix E. Table E.2 Influence analysis - Risk scores for Canada Thistle Establishment under Minimum and Maximum risk scenarios

Timber Sale	Minimum Risk Scenario			Maximum Risk Scenario		
	Year 0	Year 1	Year 3	Year 0	Year 1	Year 3
DC	0.968 +-1.3	0.968 +-1.3	1.04+-1.3	5.41 +- 1	5.53 +-0.92	5.51+-0.93
TH	0.968 +-1.3	0.968 +-1.3	1.04+-1.3	5.41 +- 1	5.53 +-0.92	5.51+-0.93
M	0.968 +-1.3	0.968 +-1.3	1.04+-1.3	5.41 +- 1	5.53 +- 0.92	5.51+-0.93
PP	0.968 +-1.3	0.968 +-1.3	1.04+-1.3	5.41 +- 1	5.53+-0.92	5.51+-0.93

Appendix E Table E.3 Influence analysis: Risk distributions for Canada Thistle Establishment under Minimum and Maximum risk scenarios and the Most Likely Scenario.

Risk Distribution	Minimum Risk Scenario			Most Likely Scenario			Maximum Risk Scenario		
	Year 0	Year 1	Year 3	Year 0	Year 1	Year 3	Year 0	Year 1	Year 3
Dark Canyon									
Zero	61.1	61.1	58.5	18.9	13.4	12.5	0.085	0.034	0.03
Low	29.4	29.4	31.3	38.8	33.8	34.5	2.32	1.42	1.44
Medium	9.51	9.51	10.3	35.4	40.8	41.6	24.8	20.7	21.3
High	0	0	0	6.91	11.9	11.3	72.8	77.8	77.2
Mercedes									
Zero	61.1	61.1	58.5	18.2	13.7	14.5	0.085	0.034	0.03
Low	29.4	29.4	31.3	44	38.2	39.7	2.32	1.42	1.44
Medium	9.51	9.51	10.3	33.2	38.7	37.8	24.8	20.7	21.3
High	0	0	0	4.59	9.46	8.09	72.8	77.8	77.2
Powerpole									
Zero	61.1	61.1	58.5	18.1	15.6	10.1	0.085	0.034	0.03
Low	29.4	29.4	31.3	41.4	38.9	33	2.32	1.42	1.44
Medium	9.51	9.51	10.3	34.4	37.1	43.1	24.8	20.7	21.3
High	0	0	0	6.15	8.34	13.8	72.8	77.8	77.2
Thrall									
Zero	61.1	61.1	58.5	14.9	12.3	13.1	0.085	0.034	0.03
Low	29.4	29.4	31.3	34.8	31.4	34.5	2.32	1.42	1.44
Medium	9.51	9.51	10.3	38.7	40.4	40.7	24.8	20.7	21.3
High	0	0	0	11.6	15.9	11.7	72.8	77.8	77.2