IMPORTANT INFORMATION ABOUT THIS WORKBOOK
Risk Map Workbook

Please Select Your Area (e.g. Northeastern Area): **Alaska**

There are four general worksheets followed by 15 empty model sheets. Fill out the empty sheets. If you need additional sheets, please start a new file to keep the number of model worksheets to 15 in each file.

If more than 1 file is needed, please update this secton with the correct numbers: This is file 1 of 1

Worksheets:

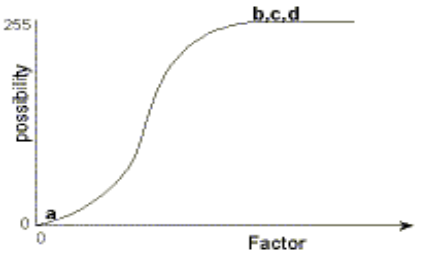
README	This worksheet
Curves	Curve graphics
Risk Rankings	Tool for assisting in developing scales
Citations	Listing and status of models for interior west
Base Sheet	Empty base sheet

Filling out the Model Worksheets

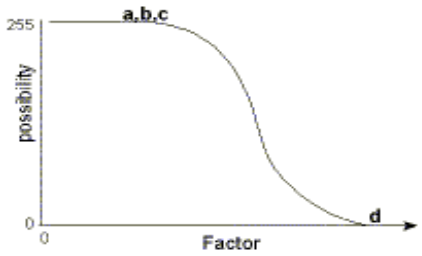
The area in blue on the top of the worksheet is for your use and is not printed. The format has changed slightly from the previous versions.

Risk Agent(s):	Common name of the risk agent, e.g. Spruce budworm
Host(s):	Host tree species, e.g. Balsam fir
Model Extent:	Extent, e.g. Northeastern or list certain ecoregions If the list of ecoregions is too long for this field, enter them in the comments and put a note in the model extent, such as "Certain IW ecoregions - see comments".
Max Percent Mortality:	Maximum threshold expected (in percent)
Susceptibility/Vulnerability	Enter the Rank for each (or one if only one used) and the Weights will calculate.
Criteria	Enter the criteria following the same rules as the previous worksheets. *Note for rare exceptions (such as the inverse S-3 and S-4) where two sets of A,B,C,D risk values are needed for one criteria, delete the "Criteria X" from the cell. You will have to renumber the remaining criteria.
Criteria Rank/Weight	Enter the Rank value, the Weight will calculate automatically.
Constraints	List any model constraints, if applicable
Comments	Area for information not covered in other fields
Citations	Enter the full citation details (publication, communication, model developer, etc) on the **Citations** worksheet and assign a number. On the model spreadsheet, enter the citation number in this area. Two example citations are shown, replace with your citations.
Model Certainity	Select the model certainity/source from the dropdown list.

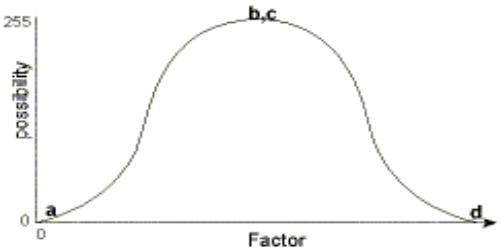
Sigmoidal Membership Functions



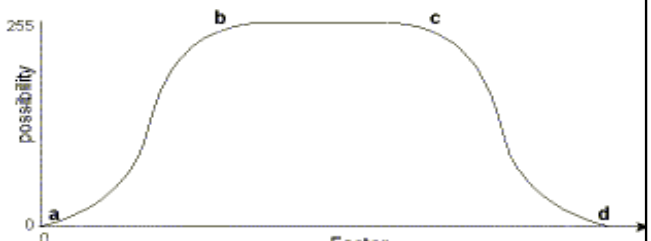
Graph **S-1**



Graph **S-2**

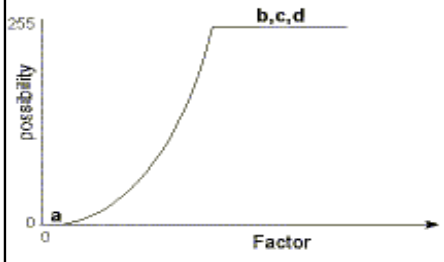


Graph **S-3**

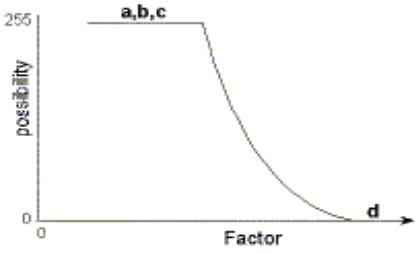


Graph **S-4**

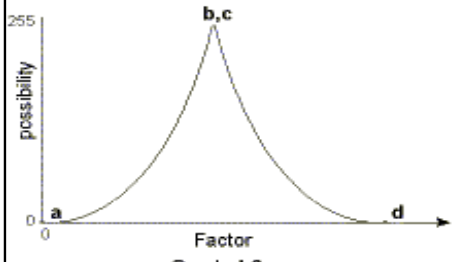
J-Shaped Membership Functions



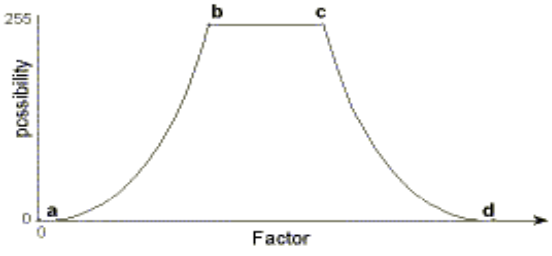
Graph **J-1**



Graph **J-2**



Graph **J-3**



Graph **J-4**

Risk/Mortality Scaling Tool

To obtain eleven class values (for risk values, mortality thresholds), enter the risk begins and risk peaks values. Equal interval classes will be calculated.

	Input Value	Classes	Scaled Value
Risk Begins (0):	***20***	20	0
		28	1
		36	2
		44	3
		52	4
		60	5
		68	6
		76	7
		84	8
		92	9
Risk Peaks (10):	***100***	100	10

Citation List - Alaska

No.	Citation
1	Baker, B.H.; Kemperman, J.A. 1974. Spruce beetle effects on a white spruce stand in Alaska. J. For. 72:423-425.
2	Day KR and Kidd NAC. Green spruce aphid population dynamics: effects of climate, weather and regulation. In: Day KR, Halldórsson G, Harding S, Straw NA, eds. The Green Spruce Aphid in Western Europe: Ecology, Status, Impacts and Prospects for Management. Technical Paper 24. Edinburgh: Forestry Commission; 1998;41-52
3	Day KR, Halldórsson G, Harding S, Straw NA. The Green Spruce Aphid in Western Europe: Ecology, Status, Impacts and Prospects for Management. Technical Paper 24. Edinburgh: Forestry Commission. 1998
4	Eglitis, Andris. 1989. Permanent plots for monitoring spruce mortality in the Yakutat Forelands. USDA Forest Service, State and Private Forestry. Technical Report R10-89-16.17p.
5	Harris, A.S. 1989. Wind in the Forests of Southeast Alaska and Guides for Reducing Damage. USDA Forest Service. Pacific Northwest Research Station. GTR PNW-GTR-244. 63p.
6	Hennon, P.,D'Amore, D., Wittwer, D., Johnson, A., Schaberg, P., Hawley, G., Beier, C., Sink, S., Juday, G. 2006. Climate Warming, Reduced Snow, and Freezing Injury Could Explain the Demise of Yellow-cedar in Southeast Alaska, USA. Draft
7	Hennon, P.E.; Hansen E.M.; Shaw, C.G. III. 1990. Dynamics of decline and mortality of *Chamaecyparis nootkatensis* in southeast Alaska. Can. J. Bot. 68:651-662.
8	Hennon, P.E.; Harris, A.S. 1997. Annotated bibliography of *Chamaecyparis nootkatensis* . Gen. Tech. Rep. PNW-GTR-413. Portland, OR: U.S. Dep. Agric., Pacific Northwest Research Station. 112 p.
9	Hennon, P.; Shaw, Charles G. III. 1997. The Enigma of Yellow-cedar Decline: What is Killing These Defensive, Long-lived Trees in Alaska? Journal of Forestry. 95(12): 4-10.
10	Hennon, P.E.; Shaw, C.G. III; Hansen, E.M. 1990. Dating decline and mortality of *Chamaecyparis nootkatensis* in southeast Alaska. Forest Sci. 36:502-515.
11	Hennon, P.E.; Shaw, C.G. III; Hansen, E.M. 1990. Symptoms and fungal associations of declining *Chamaecyparis nootkatensis* in southeast Alaska. Plant Disease 74:267-273.
12	Holms, J.C.; Ruth, D.S. 1968. Spruce aphid in British Columbia, For. Pest Leaf. 16, For. Res. Lab. Can. For. Serv., Victoria, B.C. 5 p.
13	Holsten, E.H., Hennon, P.E., Trummer, L.M. and M. Schultz. 2001. Insects and Diseases of Alaskan Forests. USDA Forest Service, Alaska Region. R10-TP-87. 242 p.
14	Holsten, E.H., R.A.Werner, and R.L. DeVelice. 1995. Effects of a spruce beetle (Coleoptera: Scolytidae) outbreak and fire on Lutz spruce in Alaska. Environmental Entomologist. 24:1539-1547.
15	Josepheson, Roy. 2004. Forest Land Use Plan/Preliminary Decision for the Big-Boulder Sticks timber sale. ADL107179. State of Alaska, Dept. of Natural Resouces, Division of Forestry. 11p.
16	Kramer, Marc G., A.J. Hansen, M.L. Taper, and E.J. Kissinger. 2001. Abiotic controls on long-term windthrow disturbance and temperate rain forest dynamics in southeast Alaska. Ecology: 82(10). Pp. 2749-2768.
17	Lynch AM. Fate and characteristics of *Picea* damaged by *Elatobium abietinum* (Walker) (Homoptera: Aphididae) in the White Mountains of Arizona. Western North American Naturalist 2004; 64:7-17
18	Lynch, A.M. and M.E. Schultz. 2005. Weather factors associated with spruce aphid (Elatobium abietinum Walker) outbreaks in southeast Alaska. (Abst.) p144. In: Proceedings of the Western Forest Insect Work Conference. March 29- April 1, 2005. Victoria, B.C. 174pp.
19	Powell, W. and W.H. Parry. 1976. Effects of temperature on overwintering populations of the green spruce aphid *Elatobium abietinum* . Ann. Appl Biol. 82: 209-219.
20	Reynolds, K.M.; Holsten, E.H. 1994. Estimating priorities of risk factors for spruce beetle outbreaks. Can. J. For. Res. Vol. 24:3027-
21	Reynolds, K.M.; Holsten E.H. 1997. SBexpert user guide (Version 2.0): A knowledge-based decision-support system for spruce beetle management. USDA For. Serv. Pac. Northwest Research Station, General Technical Report PNW-GTR-401. 62 p.
22	Schultz, Mark E. 2001. Changing Forest Structure and Composition in Glacier Bay National Park Long-term Spruce Beetle Mortality Plots. USDA Forest Service. R10-TP-93. 16p.
23	Schultz, M.E., Holsten, E. 2001. Spruce and Giant Conifer Aphids. USDA Forest Service, Alaska Region. Forest Health Protection Leaflet R10-TP-96. 1 p.
24	Schultz, M.E. and D.T. Wittwer. 2003. Taku River Spruce Beetle Permanent Plots: A Seventeen Year Evaluation. USDA Forest Service. R10-TP-116. 12p.
25	Shaw, C.G. III; Eglitis A.E.; Laurent T.H.; Hennon, P.E. 1985. Decline and mortality of *Chamaecyparis nootkatensis* in southeast Alaska—a problem of long duration, but unknown cause. Plant Disease 69:13-17.
26	USDA Forest Service. 2005. Forest Health Conditions in Alaska – 2004, A Forest Health Protection Report. USDA Forest Service, Alaska Region. R10-PR-03. 96 p.
27	USDA Forest Service. 2005. Forest Insect and Disease Conditions in Alaska – 1998, A Forest Health Protection Report. USDA Forest Service, Alaska Region. R10-TP-74. 57 p.
28	Werner, R.A. 1978. The spruce beetle in Alaska forests. USDA For. Serv. PNW Res. 8 p.
29	Werner, R.A.; Baker, B.H; Rush, P.A. 1977. The spruce beetle in white spruce forests of Alaska. USDA For. Serv. Gen. Tech. Rep. PNW-61. 13 p.

Risk Model Worksheet - Alaska

Risk Agent(s):	AlaskaYellow-Cedar Decline	**Host(s):**	Alaska-Yellow-Cedar
Model Extent:	Alexander Archipelago	**Max Percent Mortality:**	25%

Susceptibility

Rank/Weight		Criterion	Risk Begins (a)	Risk Peaks (b)	Risk Decreases (c)	Risk Ends (d)	Curve	Rank	Weight
	0%								
Criteria 1									
Criteria 2									
Criteria 3									
Criteria 4									
Criteria 5									
Criteria 6									
Criteria 7									
Criteria 8									
Criteria 9									
Criteria 10									

Vulnerability

Rank/Weight		Criterion	Risk Begins (a)	Risk Peaks (b)	Risk Decreases (c)	Risk Ends (d)	Curve	Rank	Weight
1	100%								
Criteria 1		Decline	Low/Medium	High	High	High	Linear	1	40%
Criteria 2		Elevation	0 ft	450 ft	550 ft	1000 ft	S-4	1/2	20%
Criteria 3		Latitude	52 degrees	58 degrees	58 degrees	58 degrees	Linear	1/2	20%
Criteria 4		Aspect	0 degrees	180 degrees	180 degrees	360 degrees	S-3	1/4	10%
Criteria 5		Canopy Closure	40	60	60	100	S-4	1/4	10%
Criteria 6									
Criteria 7									
Criteria 8									
Criteria 9									
Criteria 10									

Constraints	Must be within 5 km of decline centers (use as a mask).
Comments	Recent work has suggested that this decline phenomina is closely tied to climate change, temperature and snow cover in the spring.
Citations	6,7,8,9,10,11,25,26
Model Certainity	2 - Literature/Research Based

Risk* of Mortality

Alaska Yellow-Cedar Decline on Alaska Yellow-Cedar

Mortality Ceiling of 25%

0 50 100 200 300

Miles

Legend

Level of risk for host

- 0 - 2 Little or no risk
- 3 - 4 Low risk
- 5 - 6 Medium risk
- 7 - 10 High risk

Printing Date: October 29, 2007

*Risk of experiencing mortality at a given threshold over a 15 year period.

Percent Contribution*

Alaska Yellow-Cedar Decline on Alaska Yellow-Cedar

0 50 100 200 300
Miles

Legend

Percent contribution

- 0 - 25
- 26 - 50
- 51 - 75
- 76 - 100

Printing Date: October 29, 2007

*Percent contribution to composite basal area loss attributed to the individual risk agent.

Risk Model Worksheet - Alaska

Risk Agent(s):	Heart Rot/Root Rot	**Host(s):**	Paper/Gray Birch
Model Extent:		**Max Percent Mortality:**	80%

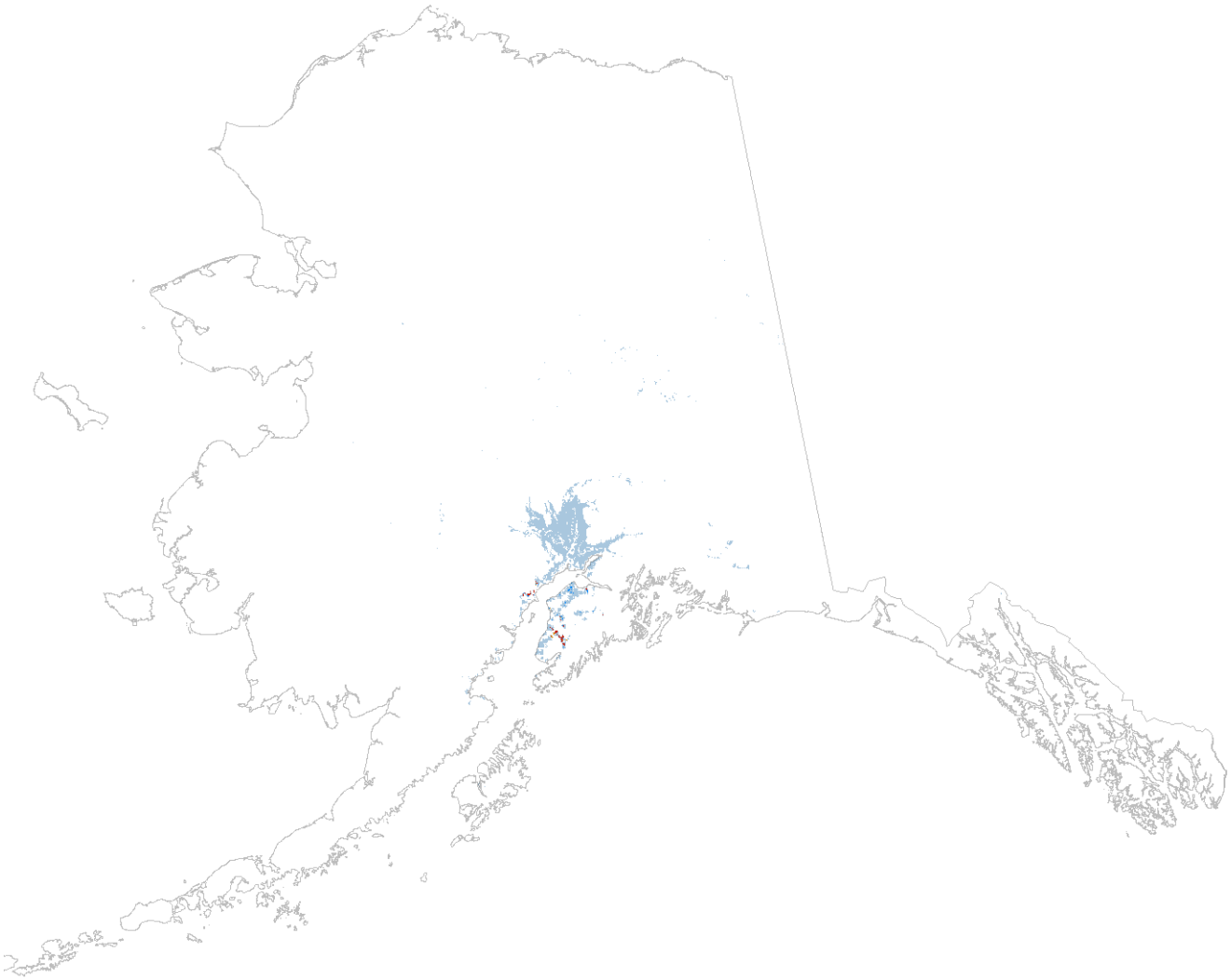
Susceptibility

Rank/Weight 1	50%	Criterion	Risk Begins (a)	Risk Peaks (b)	Risk Decreases (c)	Risk Ends (d)	Curve	Rank	Weight
Criteria 1		Spruce Mortality	1	10	10	10	J-1	1	50%
Criteria 2		Vulnerability	1	10	10	10	Linear	1	50%
Criteria 3									
Criteria 4									
Criteria 5									
Criteria 6									
Criteria 7									
Criteria 8									
Criteria 9									
Criteria 10									

Vulnerability

Rank/Weight 1	50%	Criterion	Risk Begins (a)	Risk Peaks (b)	Risk Decreases (c)	Risk Ends (d)	Curve	Rank	Weight
Criteria 1		Percent White spruce	60%	65%	70%	80%	S-4	1	25%
Criteria 2		Percent Paper Birch	5%	23%	35%	39%	S-4	1	25%
Criteria 3		Spruce Mortality (all agents - last 15 years)	presence	presence	eser presence	absence	Linear	1	25%
Criteria 4		Birch QMD	6	10	27	20	S-4	1	25%
Criteria 5									
Criteria 6									
Criteria 7									
Criteria 8									
Criteria 9									
Criteria 10									

Constraints	constrained to the southcentral area of Alaska, the location where the large scale beetle mortality and birch habitat intersect. Note a birch type map is not well defined for the state of Alaska.
Comments	Calculate Vulnerability first since it is a criterion for Susceptibility.
Citations	14,26
Model Certainity	3 - Informed Professional Judgement



Risk* of Mortality
Heart Rot/Root Rot on Paper/Gray Birch

Mortality Ceiling of 80%

0 50 100 200 300
Miles

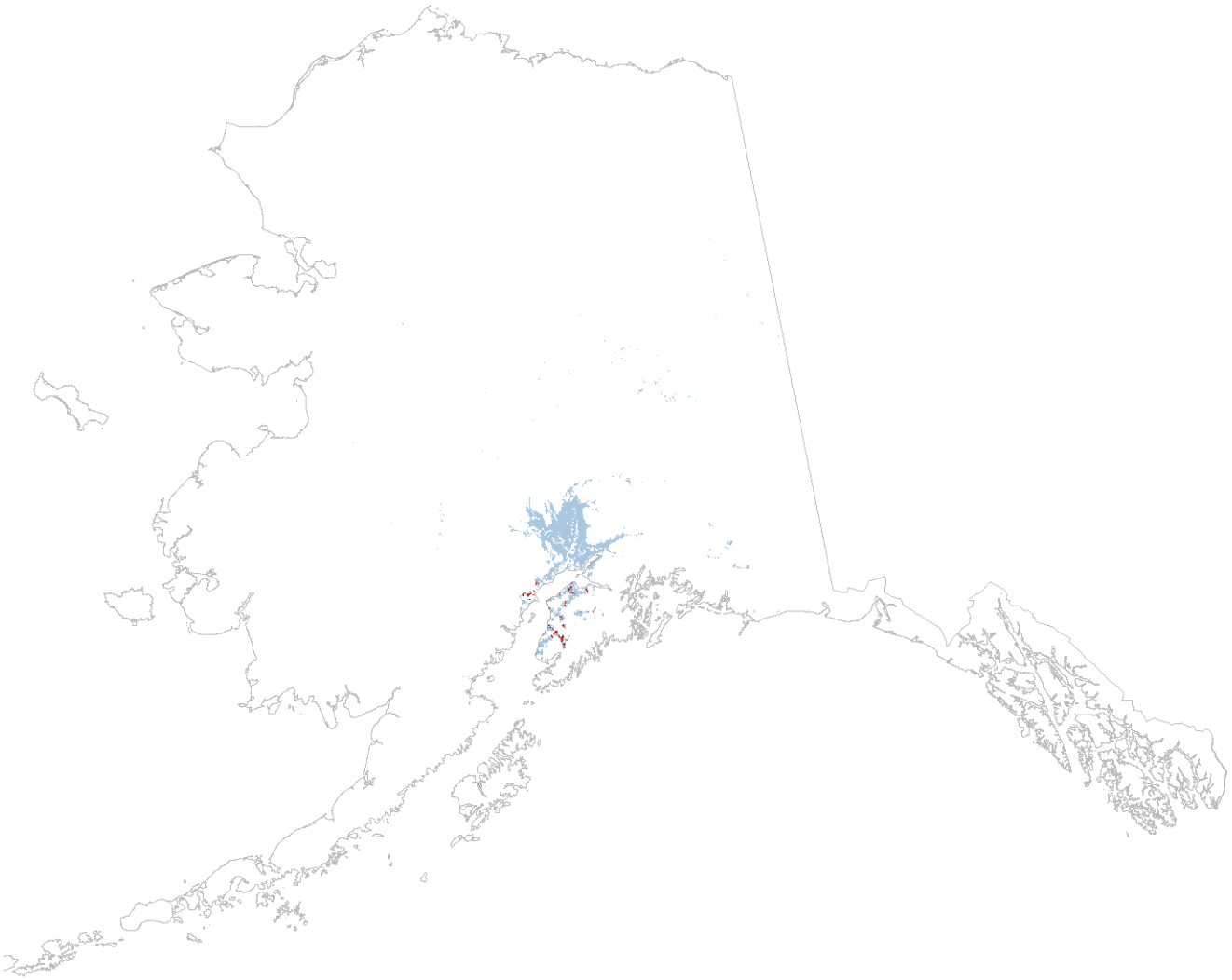
Legend

Level of risk for host

- 0 - 2 Little or no risk
- 3 - 4 Low risk
- 5 - 6 Medium risk
- 7 - 10 High risk

Printing Date: October 29, 2007

*Risk of experiencing mortality at a given threshold over a 15 year period.



Percent Contribution*

Heart Rot/Root Rot on Paper/Gray Birch

0 50 100 200 300
Miles

Legend

Percent contribution

- 0 - 25
- 26 - 50
- 51 - 75
- 76 - 100

Printing Date: October 29, 2007

*Percent contribution to composite basal area loss attributed to the individual risk agent.

Risk Model Worksheet - Alaska

Risk Agent(s): Northern Spruce Engraver Beetle

Host(s): White Spruce

Model Extent:

Max Percent Mortality: 100%

Susceptibility

Rank/Weight 0	0%	Criterion	Risk Begins (a)	Risk Peaks (b)	Risk Decreases (c)	Risk Ends (d)	Curve	Rank	Weight
Criteria 1									
Criteria 2									
Criteria 3									
Criteria 4									
Criteria 5									
Criteria 6									
Criteria 7									
Criteria 8									
Criteria 9									
Criteria 10									

Vulnerability

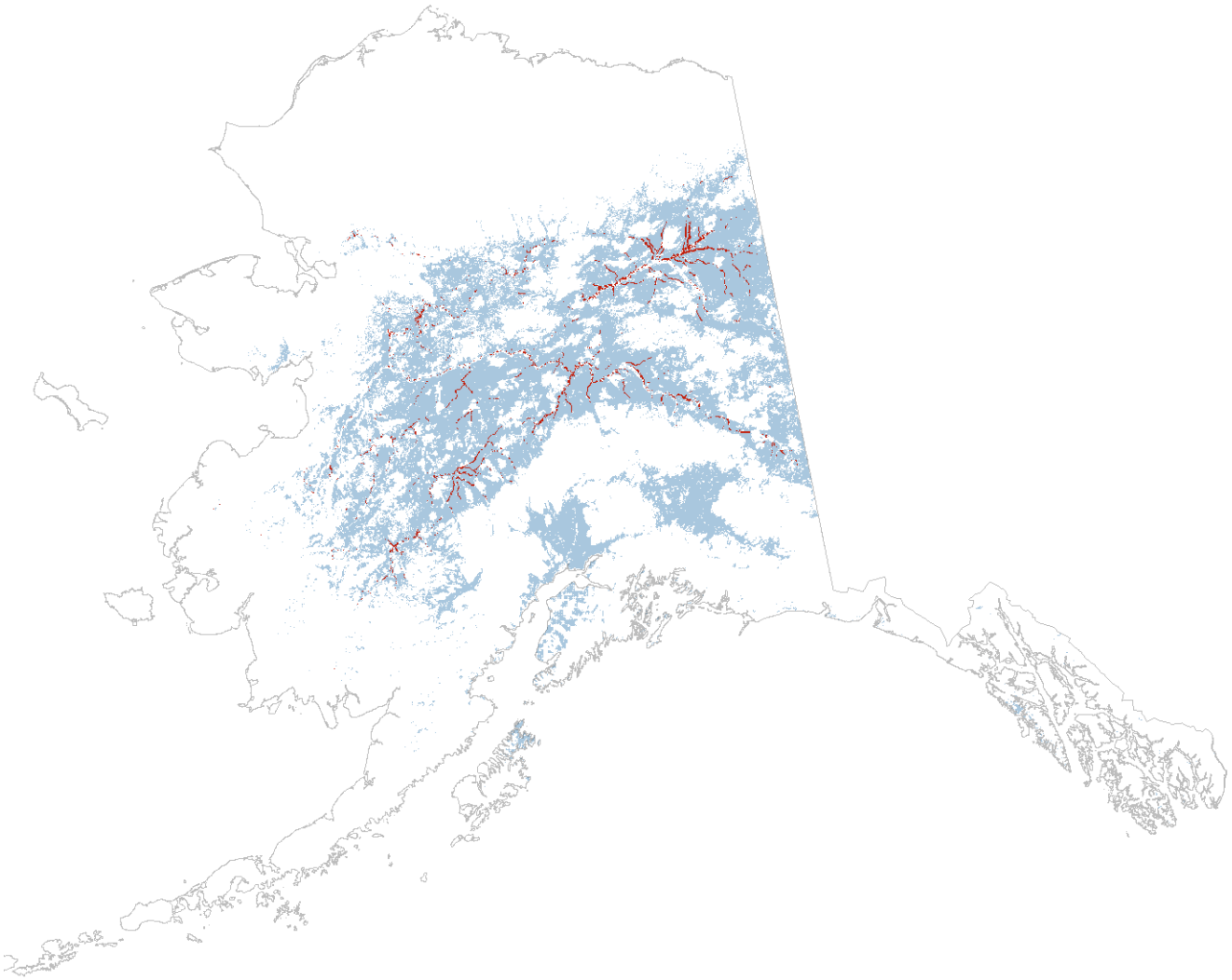
Rank/Weight 1	100%	Criterion	Risk Begins (a)	Risk Peaks (b)	Risk Decreases (c)	Risk Ends (d)	Curve	Rank	Weight
Criteria 1		Mean Slope(2% or less)	0%	0%	0%	2%	Linear	1	33%
Criteria 2		Slope (1% or less)	0%	0%	0%	1%	Linear	1	33%
Criteria 3		Distance to Major Streams (Stahler Stream Order 7+)	0 km	0 km	0 km	2 km	Linear	1	33%
Criteria 4		Distance to Minor Streams (Stahler Stream Order 5 - 6)	0 km	0 km	0 km	1 km			
Criteria 5									
Criteria 6									
Criteria 7									
Criteria 8									
Criteria 9									
Criteria 10									

Constraints	Presence of White Spruce

Comments	IPS beetles are a greater risk to the north where they outcompete spruce beetles.

Citations	1,2,13,26,21,28,29

Model Certainity	3 - Informed Professional Judgement



Risk* of Mortality

Northern Spruce Engraver Beetle on White Spruce

Mortality Ceiling of 100%

0 50 100 200 300

Miles

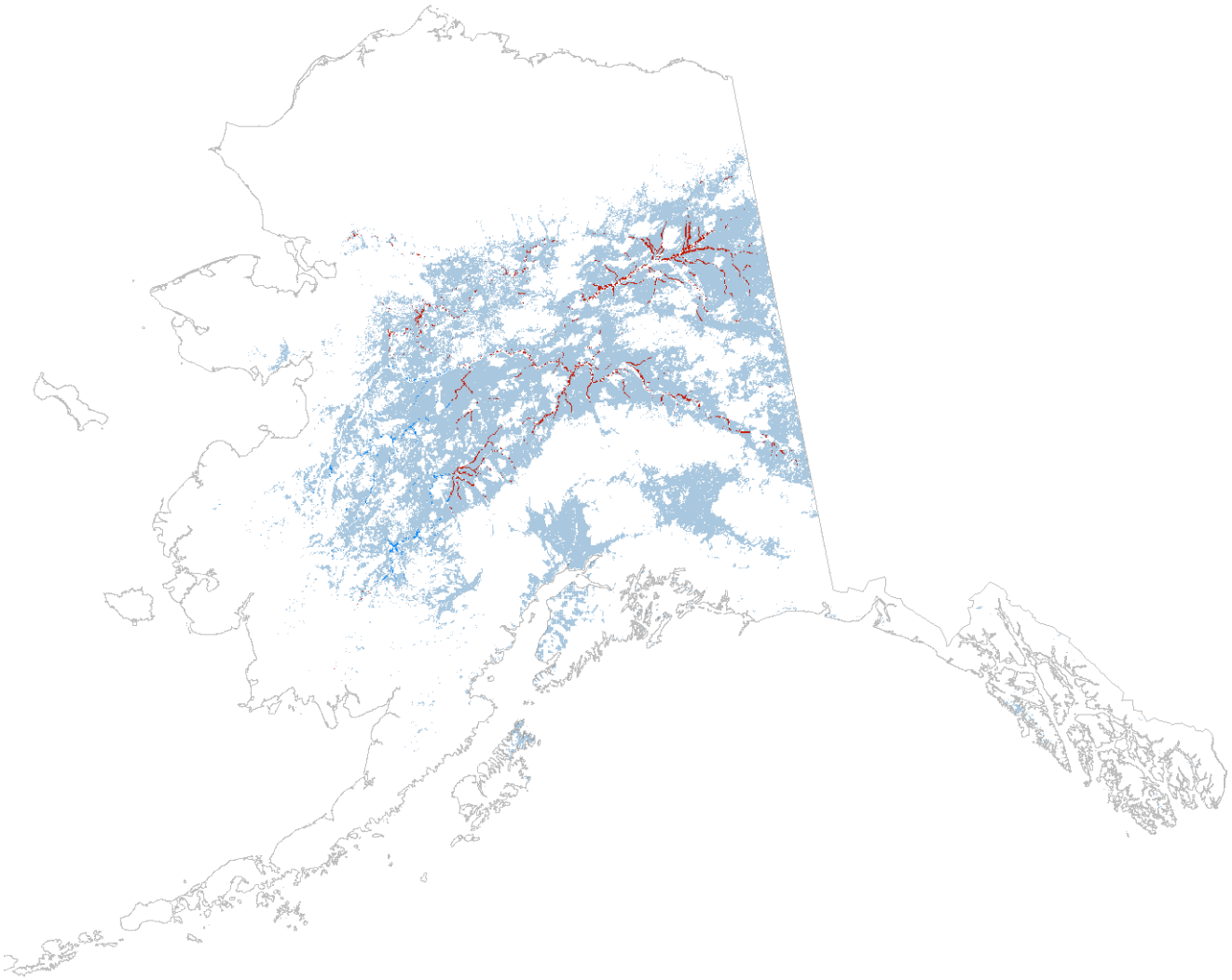
Legend

Level of risk for host

- 0 - 2 Little or no risk
- 3 - 4 Low risk
- 5 - 6 Medium risk
- 7 - 10 High risk

Printing Date: October 29, 2007

*Risk of experiencing mortality at a given threshold over a 15 year period.



Percent Contribution*

Northern Spruce Engraver Beetle on White Spruce

0 50 100 200 300
Miles

Legend

Percent contribution

- 0 - 25
- 26 - 50
- 51 - 75
- 76 - 100

Printing Date: October 29, 2007

*Percent contribution to composite basal area loss attributed to the individual risk agent.

Risk Model Worksheet - Alaska

Risk Agent(s):	Spruce Aphid	**Host(s):**	Sitka Spruce
Model Extent:		**Max Percent Mortality:**	2%

Susceptibility

Rank/Weight		Criterion	Risk Begins (a)	Risk Peaks (b)	Risk Decreases (c)	Risk Ends (d)	Curve	Rank	Weight
1	100%								
Criteria 1		Aspect	135	180	270	315	S-4	1	33%
Criteria 2		Minimum January Temperature (degrees F)	5	15	15	15	Linear	1/2	17%
Criteria 3		Elevation (ft)	0	0	0	700	Linear	1	33%
Criteria 4		BA	150	150	150	170	Linear	1/2	17%
Criteria 5									
Criteria 6									
Criteria 7									
Criteria 8									
Criteria 9									
Criteria 10									

Vulnerability

Rank/Weight		Criterion	Risk Begins (a)	Risk Peaks (b)	Risk Decreases (c)	Risk Ends (d)	Curve	Rank	Weight
	0%								
Criteria 1									
Criteria 2									
Criteria 3									
Criteria 4									
Criteria 5									
Criteria 6									
Criteria 7									
Criteria 8									
Criteria 9									
Criteria 10									

Constraints	1 km buffer of coastline.	**Comments**	
Citations	2,3,12,17,18,19,23,13,26,27	**Model Certainity**	4 - Expert Opinion

Risk* of Mortality
Spruce Aphid on Sitka Spruce

Mortality Ceiling of 2%

0 50 100 200 300
Miles

Legend

Level of risk for host

- 0 - 2 Little or no risk
- 3 - 4 Low risk
- 5 - 6 Medium risk
- 7 - 10 High risk

Printing Date: October 29, 2007

*Risk of experiencing mortality at a given threshold over a 15 year period.

Percent Contribution*
Spruce Aphid on Sitka Spruce

0 50 100 200 300
Miles

Legend

Percent contribution

- 1 - 25
- 26 - 50
- 51 - 75
- 76 - 100

Printing Date: October 29, 2007

*Percent contribution to composite basal area loss attributed to the individual risk agent.

Risk Model Worksheet - Alaska

Risk Agent(s):	Spruce Beetle	**Host(s):**	Sitka Spruce
Model Extent:		**Max Percent Mortality:**	80%

Susceptibility

Rank/Weight		Criterion	Risk Begins (a)	Risk Peaks (b)	Risk Decreases (c)	Risk Ends (d)	Curve	Rank	Weight
0	0%								
Criteria 1									
Criteria 2									
Criteria 3									
Criteria 4									
Criteria 5									
Criteria 6									
Criteria 7									
Criteria 8									
Criteria 9									
Criteria 10									

Vulnerability

Rank/Weight		Criterion	Risk Begins (a)	Risk Peaks (b)	Risk Decreases (c)	Risk Ends (d)	Curve	Rank	Weight
1	100%								
Criteria 1		BA	175	250	250	250	Linear	1	25%
Criteria 2		Annual Precipitation	30	30	30	92	Linear	1	25%
Criteria 3		Aspect	90	135	180	225	S-4	1	25%
Criteria 4		July Mean Temperature	45	60	60	60	Linear	1	25%
Criteria 5									
Criteria 6									
Criteria 7									
Criteria 8									
Criteria 9									
Criteria 10									

Constraints	
Comments	Aspect is a risk factor for windthrow.
Citations	4,5,15,16,25,27,
Model Certainity	3 - Informed Professional Judgement

Risk* of Mortality
Spruce Beetle on Sitka Spruce

Mortality Ceiling of 80%

0 50 100 200 300
Miles

Legend

Level of risk for host

- 0 - 2 Little or no risk
- 3 - 4 Low risk
- 5 - 6 Medium risk
- 7 - 10 High risk

Printing Date: October 29, 2007

*Risk of experiencing mortality at a given threshold over a 15 year period.

Percent Contribution*
Spruce Beetle on Sitka Spruce

0 50 100 200 300
Miles

Legend

Percent contribution

- 0 - 25
- 26 - 50
- 51 - 75
- 76 - 100

Printing Date: October 29, 2007

*Percent contribution to composite basal area loss attributed to the individual risk agent.

Risk Model Worksheet - Alaska

Risk Agent(s):	Spruce Beetle	**Host(s):**	White spruce
Model Extent:		**Max Percent Mortality:**	100%

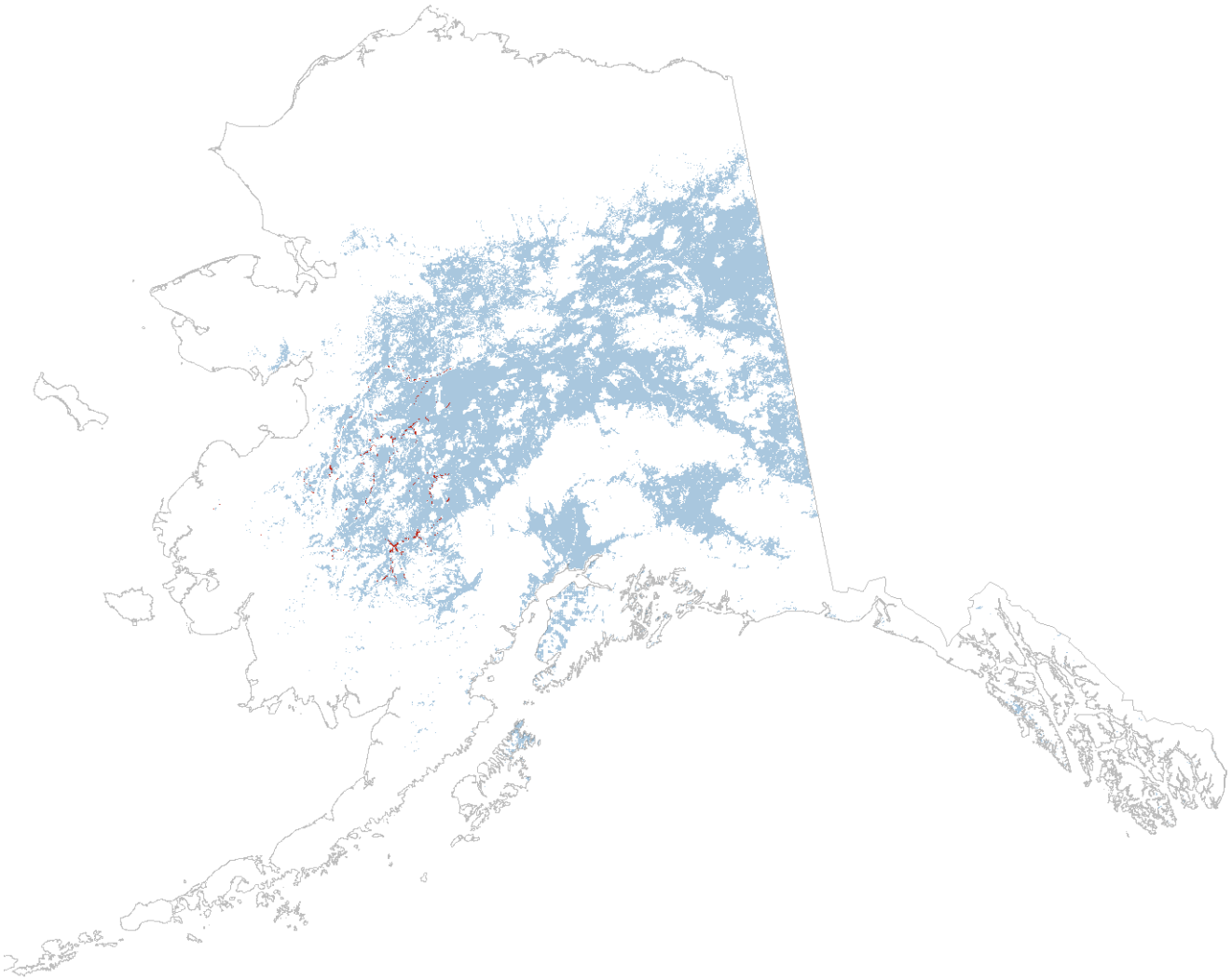
Susceptibility

Rank/Weight		Criterion	Risk Begins (a)	Risk Peaks (b)	Risk Decreases (c)	Risk Ends (d)	Curve	Rank	Weight
0	0%								
Criteria 1									
Criteria 2									
Criteria 3									
Criteria 4									
Criteria 5									
Criteria 6									
Criteria 7									
Criteria 8									
Criteria 9									
Criteria 10									

Vulnerability

Rank/Weight		Criterion	Risk Begins (a)	Risk Peaks (b)	Risk Decreases (c)	Risk Ends (d)	Curve	Rank	Weight
1	100%								
Criteria 1		Latitude	61	61	61	65	Linear	1	25%
Criteria 2		Mean Slope (2% or less)	0%	0%	0%	2%	Linear	1	25%
Criteria 3		Slope (1% or less)	0%	0%	0%	1%	Linear	1	25%
Criteria 4		Distance to Major Streams (Stahler Stream Order 7+)	0 km	0 km	0 km	2 km	Linear	1	25%
Criteria 5		Distance to Minor Streams (Stahler Stream Order 5 - 6)	0 km	0 km	0 km	1 km			
Criteria 6		Longitude	155	155	155	165			
Criteria 7									
Criteria 8									
Criteria 9									
Criteria 10									

Constraints	Presence of White Spruce
Comments	Spruce beetle risk is highest in the south and in riparian areas of large rivers. In the north it is outcompeted by ips engraver beetles.
Citations	1,2,13,26,21,28,29
Model Certainity	3 - Informed Professional Judgement



Risk* of Mortality

Spruce Beetle on White Spruce

Mortality Ceiling of 100%

0 50 100 200 300

Miles

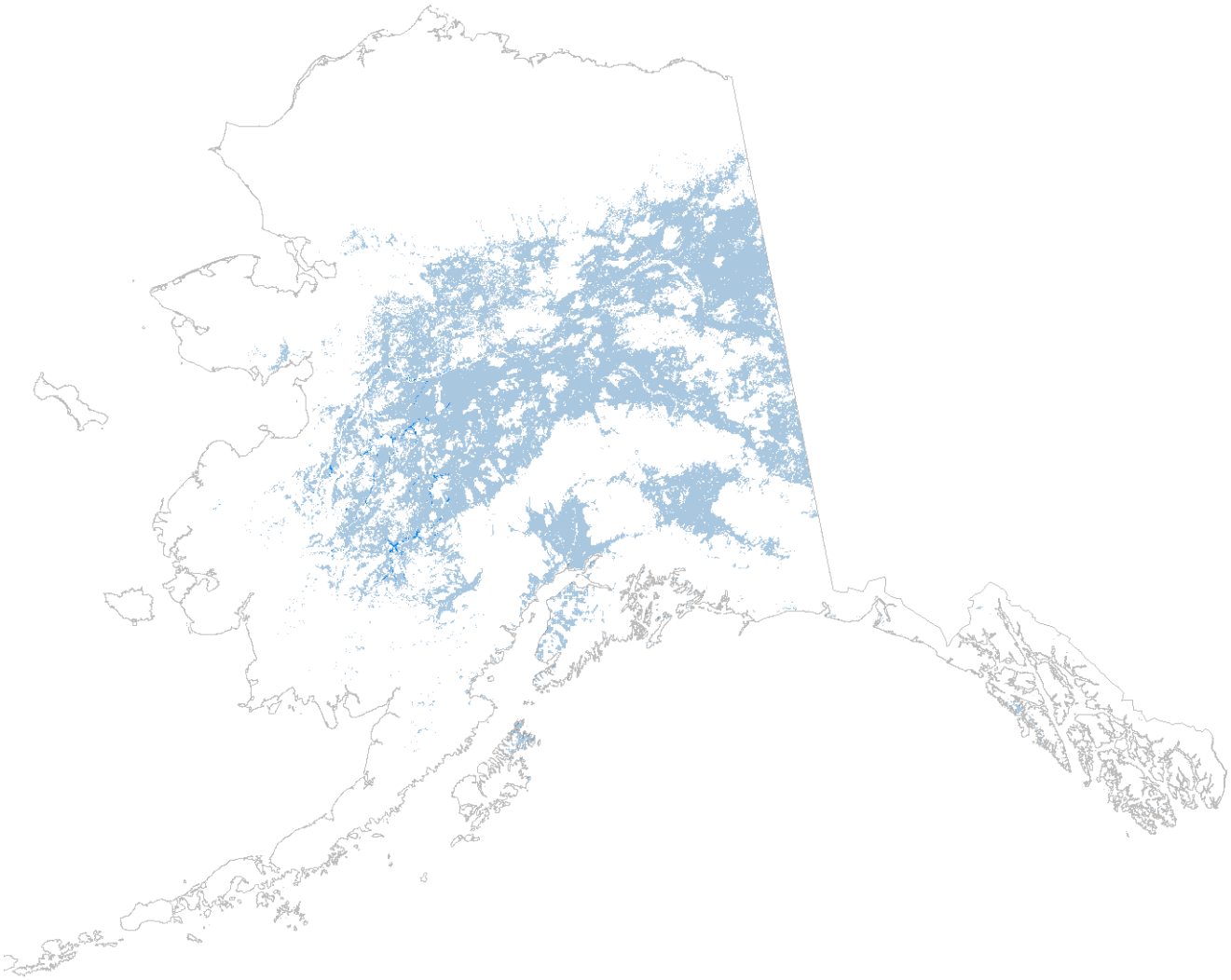
Legend

Level of risk for host

- 0 - 2 Little or no risk
- 3 - 4 Low risk
- 5 - 6 Medium risk
- 7 - 10 High risk

Printing Date: October 29, 2007

*Risk of experiencing mortality at a given threshold over a 15 year period.



Percent Contribution*

Spruce Beetle on White Spruce

0 50 100 200 300
Miles

Legend

Percent contribution

- 0 - 25
- 26 - 50
- 51 - 75
- 76 - 100

Printing Date: October 29, 2007

*Percent contribution to composite basal area loss attributed to the individual risk agent.