

APPENDIX 1.

Score of the effect of stand management options on relative susceptibility to biotic and abiotic hazards.

Aquitaine – *Pinus pinaster*

Action	Option	Hazards				
		Defoliator	Stem borer	wind	fire	Root rot
<i>Close-to-Nature</i>						
site conditions	sand dune	1.25	0.75	0.5	0.5	0.75
site preparation	harrowing	1	1	1	0.75	1
stand composition	mixed	0.5	0.75	1	0.75	0.5
genetic material	no	1	1	1	1	1
regeneration type	natural + seeding	1	0.75	0.75	1.25	1
cleaning	mechanical	1.25	1	1	0.75	1
thinning-pruning	selective	1	1	1.25	1.25	1.25
harvesting	shelterwood > 80 years	1.25	1	1.25	1.25	1.25
<i>Combined objectives</i>						
site conditions	sand dunes	1.25	0.75	0.5	0.5	0.75
site preparation	strip ploughing, harrowing, low fertilization, weed control	1	1.25	1	0.5	1
stand composition	pure - even-aged	1.5	1.25	1	1.25	1.5
genetic material	no	1	1	1	1	1
regeneration type	seeding + planting	1	1.25	1.25	0.75	1
cleaning	mechanical, before each thinning	1.25	1.25	1	0.5	1
thinning-pruning	3-4 thinnings, removing 30% of trees, pruning	1	1.5	1.5	0.75	1.5
harvesting	clear cut at 80 years	1.25	1	1.25	0.75	1.5
<i>Intensive even-aged</i>						
site conditions	mesophylous podzols	0.75	1.25	1.25	1.25	1
site preparation	full ploughing, harrowing, drainage, cleaning, fertilization P60, chemical weed control	1	1.5	0.75	0.5	1.25
stand composition	pure, even-aged	1.5	1.25	1	1.25	1.5
genetic material	improved varieties	1	1.25	1.25	1	1
regeneration type	planting 1250t/ha	1	1.5	1.5	0.75	1
cleaning	mechanical, or chemical, before thinnings	1.25	1.25	1	0.5	1
thinning-pruning	pruning, 3-4 thinnings, removing 33% of trees	1	1.5	1.5	0.5	1.5
harvesting	clear cut at 45 years	1.5	1	1.5	0.5	1.5
<i>Wood biomass</i>						
site conditions	most fertile	1	1.5	0.75	1.25	1
site preparation	full ploughing, harrowing, drainage, cleaning, fertilization P80, weed control	1	1.5	1.25	0.5	1.25
stand composition	pure, even-aged	1.5	1.25	1	1.25	1.5
genetic material	improved varieties	1	1.25	1.25	1	1
regeneration type	planting 2500t/ha	1	0.75	0.75	1.25	1.25
cleaning	mechanical, chemical	1.25	1.25	1	0.5	1
thinning-pruning	1-2 heavy thinnings	1	1.25	1.5	0.75	1.25
harvesting	clear cut at 15-30 years	1.5	1	1.5	0.5	1.5

Portugal – *Eucalyptus sp.*

Action	Option	Hazards				
		Leaf beetle	Gall insect	Leaf rust	Stem canker	Fire
Close-to-Nature						
site conditions	Atlantic climate, elevation < 450m	1	1.25	1.25	0.75	1
site preparation	Stump destruction and harrowing for woody debris	1	1	1	0.75	1
stand composition	mixed	0.75	0.5	0.5	0.5	0.5
genetic material	no	1	1	1	1	1
regeneration type	natural	0.75	0.75	0.75	0.75	0.75
cleaning	Ocasionaly; mechanical	1	0.75	0.75	1	1.25
thinning-pruning	Selective	0.75	0.75	0.75	0.75	0.75
harvesting	shelterwood >15 years	1	0.75	0.75	1.25	1
Combined objectives						
site conditions	Atlantic climate, elevation < 450m	1	1.25	1.25	0.75	1
	Stump destruction and harrowing for woody debris incorporation if a stand had					
site preparation	previously been there and/or ripping.	1	1	1	0.75	1
stand composition	mixed even-aged or uneven	1	0.75	0.75	0.75	0.5
genetic material	no	1	1	1	1	1
regeneration type	To favour the conversion to mixed stands	1	0.75	0.75	0.75	0.75
	Ocasionaly to ensure that the light/shade conditions are adequate to establish/maintain a					
cleaning	mixed stand	1	0.75	0.75	1	1.25
	Ocasionaly to ensure that the light/shade conditions are adequate to establish/maintain a					
thinning-pruning	mixed stand	1	1	0.75	1	0.75
harvesting	clear cut at 12 years	1.25	1.25	1	1	0.75
Intensive even-aged						
site conditions	Atlantic climate, elevation < 450m	1	1.25	1.25	0.75	1
	Stump destruction and harrowing for woody debris incorporation if a stand had					
site preparation	previously been there and/or ripping. Fertilization at planting: 30g/plant of NPK slow					
stand composition	release fertilizer + 175g/plant of a phosphorus fertilizer. Mechanical fertilization with					
genetic material	NPK fertilizer at year 2.	0.75	1.25	0.75	1	1
	pure, even-aged	1.25	1.5	1.25	1.25	1.25
regeneration type	no	1	1	1	1	1
	Planting: spacing of 4m x 2m (final density ~1200 trees/ha)Beating up: 6 months after					
cleaning	planting to replace dead trees (15%)	1.25	1.25	1	1	1
	Mechanical weed control (mechanical fertilization and weed control are done at the same					
thinning-pruning	time in a single operation)	1	1	1	0.75	0.75
	If necessary, thinning after insects or fungi attacks also after intense night frosts and/or					
harvesting	Botrytis cinerea attacks	1	1	0.75	0.75	0.75
	Cuttings are performed in order to minimize the visual/ecological effects of clear-felling					
		1.25	1.25	1.25	1	1
Wood biomass						
site conditions	Atlantic climate, elevation < 450m	1	1.25	1.25	0.75	1
	Stump destruction and harrowing for woody debris incorporation if a stand had					
site preparation	previously been there and/or ripping. Fertilization: 30g/plant of NPK slow release					
stand composition	fertilizer + 175g/plant of a phosphorus fertilizer. Mechanical fertilization with NPK					
genetic material	fertilizer at year 1	0.75	1.25	0.75	1	1
regeneration type	pure, even-aged	1.25	1.5	1.25	1.25	1.25
cleaning	no	1	1	1	1	1
thinning-pruning	Planting: spacing of 0.3 m x 0.9 m (final density ~37000 trees/ha)	1.25	1.25	1	1	1.25
harvesting	no	1	0.75	0.75	1	1.25
	clear cut at 5 years	0.75	0.75	1	0.5	0.5

Baden Wuerttemberg – *Picea abies*

Action	Option	Hazards				
		Bark beetle	Root rot	Wind	Snow	Game
<i>Close-to-Nature</i>						
site conditions	adequate sites	0.5	0.5	0.5	1	1
site preparation	no	1	1	1	1	1
stand composition	mixed	0.5	1	1.25	1	0.5
genetic material	no	1	1	1	1	1
regeneration type	natural	0.75	0.75	0.75	1	0.5
cleaning	mechanical weed control	1.25	1	1	1	0.5
thinning-pruning	4 thinnings with 80m3 max	0.75	0.75	0.75	0.75	1
harvesting	target diameter harvest <120 years	0.75	1.25	1	1.25	1
<i>Combined objectives</i>						
site conditions	adequate sites	0.5	0.5	0.5	1	1
site preparation	no	1	1	1	1	1
stand composition	mixed	0.5	1	1.25	1	1.25
genetic material	no	1	1	1	1	1
regeneration type	natural	0.75	0.75	0.75	1	0.75
cleaning	mechanical weed control	1	1	1	1	0.5
thinning-pruning	3 - 4 thinnings with 80m3 max	0.75	0.75	0.75	0.5	0.75
harvesting	target diameter harvest 120 - 140 years	0.75	1.25	1	1.25	1.25
<i>Intensive even-aged</i>						
site conditions	various sites from adequate to less adequate	1.25	1.25	0.5	1	1
site preparation	liming	1	1	1	1	1
stand composition	mixed less than 20%	1.5	0.75	1	1	1.5
genetic material	genetically improved	1.25	1.25	1	1	1
regeneration type	planting 2 x 3m	1	1	1	1	1.25
cleaning	mechanical weed control	1.25	1	1	1	1.5
thinning-pruning	3 - 4 thinnings with 80m3 max	1.25	0.75	1	1.25	1
harvesting	clear cut (<0.5ha); 70 -110 years	1	0.75	1	1.25	1.5
<i>Wood biomass</i>						
site conditions	all sites	1.25	1.25	0.5	1	1
site preparation	liming & fertilization	1	1	1	1	1
stand composition	mixed less than 20%	1.5	0.75	1	1	1.5
genetic material	genetically improved	1.25	1.25	1	1	1
regeneration type	planting 2 x 3m	1	1	1	1	1.5
cleaning	mechanical weed control	1.25	1	1	1	1.5
thinning-pruning	2 thinning; 80m3	1.25	0.75	1.25	1.25	1.25
harvesting	clear cut (<0.5ha); 50 - 80 years	1	0.75	1	1.25	1.5

Austria – *Picea abies*

Action	Option	Hazards				
		Brak beetle	Sawfly	Game	Wind	Snow
<i>Close-to-Nature</i>						
site conditions	Mountainous areas	1	0.5	1	1	1.25
site preparation	no	1	1	1	1	1
stand composition	mixed spruce forest, uneven-aged	0.75	0.75	0.75	0.5	1
genetic material	no	1	1	1	1	1
regeneration type	natural	1	1	0.5	1	1
cleaning	no	1	0.5	0.5	1	1
thinning-pruning	selective	0.75	1.25	1	1	1
harvesting	selective	1	1	1	1.25	1.25
<i>Combined objectives</i>						
site conditions	Mountainous and low mountain range stands	1.25	1	1	1	1.5
site preparation	no	1	1	1	1	1
stand composition	pure - uneven-aged	1.25	1.25	1.25	1.25	1.25
genetic material	no	1	1	1	1	1
regeneration type	planting and natural	1	1.25	1	1	1
cleaning	slash removal, no weed control	0.75	0.75	0.5	1	1
thinning-pruning	several moderate thinning operations in the course of the rotation period	0.75	1	0.75	0.75	0.75
harvesting	strip and femel system	1.25	1.25	1.25	1.25	1.25
<i>Intensive even-aged</i>						
site conditions	lowland and low mountain range stands	1.5	1.25	1	1.5	1
site preparation	no	1	1	1	1	1
stand composition	pure, even-aged	1.5	1.5	1.5	1.5	1.5
genetic material	no	1	1	1	1	1
regeneration type	planting (and natural)	1	1.25	1.25	1	1
cleaning	slash removal, weed control	0.75	1.5	1.5	1	1
thinning-pruning	several moderate thinning operations in the course of the rotation period	0.75	1	1	0.75	0.75
harvesting	clear cut at 80 years (max. area 2ha)	1.5	1.25	1.5	1.5	1.25
<i>Wood biomass</i>						
site conditions	lowland stands	1.5	1.5	1	1.5	1
site preparation	fertilization, weed control	1.25	1.25	1	1	1.25
stand composition	pure, even-aged	1.5	1.5	1.5	1.5	1.5
genetic material	no	1	1	1	1	1
regeneration type	planting	1	1.25	1.5	1	1
cleaning	slash removal, weed control	0.75	1.5	1.5	1	1
thinning-pruning	1-2 heavy thinnings	1.25	1.25	1.25	1.25	0.5
harvesting	clear cut at 40 years	0.5	1.5	1.5	1.5	1.25

Action	Option	Hazards				
		Sawfly	Weevil	Root rot	Game	Wind
<i>Close-to-Nature</i>						
site conditions	above medium	0.75	0.75	1.25	0.75	1.25
site preparation	no	1	1	1	1	1
stand composition	mixed	1	1	1	1	1
genetic material	no	1	1	1	1	1
regeneration type	natural + planting	1	0.75	0.75	0.5	0.75
cleaning	1-2 times	1	1	1	1	1
thinning-pruning	selective, 1-2 times	1	1	0.75	1	1
harvesting	clearcut > 100 years	1	1	1	1	1.25
<i>Combined objectives</i>						
site conditions	adequate for Scots pine	1	1	1	1	1
site preparation	no	1	1	1	1	1
stand composition	mixed	1	1	1	1	1
genetic material	no	1	1	1	1	1
regeneration type	planting	1	1	1	1	1
cleaning	1-2 times	1	1	1	1	1
thinning-pruning	1-2 selective thinning in both medium and adult phase	1	1	0.75	1	1
harvesting	clear cut at >100 years, limit 2 ha	1	1	1	1	1
<i>Intensive even-aged</i>						
site conditions	adequate for Scots pine	1	1	1	1	1
site preparation	no	1	1	1	1	1
stand composition	pure, even-aged	1.25	1.25	1.25	1.25	1.25
genetic material	no	1	1	1	1	1
regeneration type	planting 8-10 thous./ha	1	1	1	1	1
cleaning	1-2 times	1	1	1	1	1
thinning-pruning	1-2 selective thinning in both medium and adult phase	1	1	0.75	1	1
harvesting	clear cut at 90-100 years, limit 6 ha	1	1.25	1.25	1.25	1.25
<i>Wood biomass</i>						
site conditions	fertile	0.75	0.75	1.25	0.75	1.25
site preparation	Mechanical, physical and chemical	0.75	0.75	1.25	1	1
stand composition	pure, even-aged	1.25	1.25	1.25	1.25	1.25
genetic material	improved varieties	0.75	0.75	0.75	1	0.75
regeneration type	planting 8-10 thous./ha	1	1	1	1	1
cleaning	schematic reduction	1	1	1	1	1
thinning-pruning	schematic reduction	1	1	1.25	1	1.25
harvesting	clear cut at 50-60 years, no area limit	0.75	1.5	1.25	1.25	1.25

Action	Option	Hazards				
		Weevil	Bark beetle	Root rot	Game	Wind
<i>Close-to-Nature</i>						
site conditions	average	0.75	0.75	1.25	0.75	0.75
site preparation	no	1.25	1	0.75	1	1
stand composition	pine-dominated	0.5	0.75	1	1	0.75
genetic material	no	1	1	1	1	1
regeneration type	natural + planting	0.75	1	1	1	0.75
cleaning	once	1	1	1.25	1.25	0.75
thinning-pruning	selective, 1-2 times	1	1.25	1.25	1	1.25
harvesting	clearcut > 100 years	1.5	1.25	1.25	1	1.25
<i>Combined objectives</i>						
site conditions	adequate for Scots pine	1	1	0.75	1	0.75
site preparation	soil scarification	1.25	1	0.75	1	1
stand composition	pine-dominated	0.5	0.75	0.75	0.75	0.75
genetic material	no	1	1	1	1	1
regeneration type	planting	1	1	1.25	1.25	1.25
cleaning	once	1	1	1.25	1.25	1
thinning-pruning	1-2 selective thinnings, no pruning	1	1.25	1.25	1	1.25
harvesting	clear-cut at >100 years, < 5 ha in size	1.25	1.25	1.25	1	1.25
<i>Intensive even-aged</i>						
site conditions	adequate for Scots pine	1	1	0.75	1	1
site preparation	soil scarification	1.25	1	0.75	1	1
stand composition	pure, even-aged	1.25	1.25	1.25	1.25	1.25
genetic material	selected seed sources	1	1	1	1	1
regeneration type	planting 2500 per ha	1.5	1	1.25	1.25	1
cleaning	once	1	1.25	1.25	1.25	0.75
thinning-pruning	1-2 selective thinning in both medium and adult phase	1	1.25	1.25	1	1.25
harvesting	clear-cut at ca 100 years, > 5 ha	1.5	1.5	1.25	1	1.25
<i>Wood biomass</i>						
site conditions	above average	0.75	0.75	1.25	0.75	0.75
site preparation	soil scarification	0.5	1	1.25	1	1
stand composition	pure, even-aged	1.25	1.25	1.25	1.25	1.25
genetic material	selected seed sources	1	1	1	1	0.75
regeneration type	planting 2500 per ha	1.5	1	1.25	1.25	1.25
cleaning	no	1	1	1.25	1	1
thinning-pruning	one thinning, no pruning	1	1.25	1.25	1	1.25
harvesting	clear clear-cut at 60-80 years, no area limit	1.5	1.25	1.25	1	1.25

Action	Option	Hazards				
		Foliar disease	Weevil	Game	Wind	Fire
<i>Close-to-Nature</i>						
site conditions	podzol	1	1	1	1	1
site preparation	none	1	1	1	1	1
stand composition	mixed	1	0.75	1	1	0.75
genetic material	no	1	1	1	1	1
regeneration type	natural	1	1	1	1	0.5
cleaning	mechanical	1	1	0.75	1	1
thinning-pruning	selective	1	1	1	1	1
harvesting	shelterwood > 80 years	1	1	1	1	1
<i>Combined objectives</i>						
site conditions	podzol	1	1	1	1	1
site preparation	mounding / scarifying	1	0.75	1	1	1
stand composition	pure - even-aged	1.25	1	0.75	1.25	1
genetic material	no	1	1	1	1	1
regeneration type	planting 2500t/ha	0.75	1.25	1.25	1.25	1
cleaning	none	1.5	1	1	1	1.25
thinning-pruning	3-4 thinnings, removing 30% of trees, pruning	0.5	1	1	1.5	0.5
harvesting	clear cut at 80 years	0.75	1.5	1.25	0.5	0.5
<i>Intensive even-aged</i>						
site conditions	podzol	1	1	1	1	1
site preparation	mounding / scarifying	1	0.75	1	1	1
stand composition	pure, even-aged	1.25	1	0.75	1.25	1
genetic material	improved varieties	1	1	1	1	1
regeneration type	planting 1250t/ha	0.75	1.25	1.25	1.25	1
cleaning	mechanical, or chemical, before thinnings	0.5	1	1	1	1.25
thinning-pruning	pruning, 3-4 thinnings, removing 33% of trees	0.5	1	1	1.5	0.5
harvesting	clear cut at 45 years	0.75	1.5	1.25	0.5	0.5
<i>Wood biomass</i>						
site conditions	podzol	1	1	1	1	1
site preparation	mounding / scarifying	1	0.75	1	1	1
stand composition	pure, even-aged	1.25	1	0.75	1.25	1
genetic material	improved varieties	1	1	1	1	1
regeneration type	planting 2500t/ha	0.75	1.25	1.25	1.25	1
cleaning	mechanical, chemical	0.5	1	1	1	1.25
thinning-pruning	1-2 heavy thinnings	0.5	1	1	1.5	0.5
harvesting	clear cut at 15-30 years	0.75	1.5	1.25	0.5	0.5

Action	Option	Hazards				
		Aphid	Weevil	Game	Wind	Fire
<i>Close-to-Nature</i>						
site conditions	forest brown earths	1	1	1	1	1
site preparation	none	1	1	1	1	1
stand composition	mixed	1	0.75	1	1	0.75
genetic material	no	1	1	1	1	1
regeneration type	natural	1	1	1	1	1
cleaning	mechanical	1	1	1	0.75	1
thinning-pruning	selective	1	0.75	1	1	0.75
harvesting	shelterwood > 80 years	1	1	1	1	1
<i>Combined objectives</i>						
site conditions	gleyed mineral soil	1	1	1	1	1
site preparation	mounding / scarifying	1	0.75	1	1	1
stand composition	pure - even-aged	1.25	1	0.75	1.25	1
genetic material	improved varieties	1	1	1	1	1
regeneration type	planting 2500t/ha	1	1.25	1.25	1	1
cleaning	none	1	1	1	1	1
thinning-pruning	3-4 thinnings, removing 30% of trees	1	1	1	1.5	0.5
harvesting	clear cut at 45-55 years	0.5	1.5	1.25	0.5	0.5
<i>Intensive even-aged</i>						
site conditions	forest brown earths	1	1	1	1	1
site preparation	mounding / scarifying	1	0.75	1	1	1
stand composition	pure, even-aged	1.25	1	0.75	1.25	1
genetic material	improved varieties	1	1	1	1	1
regeneration type	planting 2500t/ha	1	1.25	1.25	1	1
cleaning	none	1	1	1	1	1
thinning-pruning	3-4 thinnings, removing 33% of trees	1	1	1	1.5	0.5
harvesting	clear cut at 45-65 years	0.5	1.5	1.25	0.5	0.5
<i>Wood biomass</i>						
site conditions	gleyed mineral soil	1	1	1	1	1
site preparation	scarifying	1	0.75	1	1	1
stand composition	pure, even-aged	1.25	1	0.75	1.25	1
genetic material	improved varieties	1	1	1	1	1
regeneration type	planting 3000t/ha	1	1.25	1.25	1	1
cleaning	none	1	1	1	1	1
thinning-pruning	none	1	1	1	1.5	1
harvesting	clear cut at 15-30 years	0.5	1.5	1.25	0.5	0.5