

Appendix A, Crop Parameters Used in CropSyst for Various Crop Types

Crop name	alfalfa seed	alfalfa	apple	barley	bean dry	canola	cherry
Harvested part	grain	leaf	fruit	grain	grain	grain	fruit
Photosynthetic pathway	C3	C3	C3	C3	C3	C3	C3
Life cycle	perennial	perennial	perennial	annual	annual	annual	perennial
Stem type	herbaceous	herbaceous	woody	herbaceous	herbaceous	herbaceous	woody
Growth parameters							
Radiation-Use Efficiency at high VPD (g/MJ PAR)	1.70	1.70	2.80	2.80	2.50	1.80	2.70
Water-Use Efficiency at 1 kPa (g/kg)	2.90	2.90	4.80	4.80	4.30	3.10	4.80
Slope of Water-Use Efficiency function of VPD	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Leaf water potential that begins reducing canopy expansion (J/kg)	-1000	-1000	-800	-1000	-1000	-1000	-800
Leaf water potential that stops canopy expansion (J/kg)	-1300	-1300	-1200	-1300	-1300	-1300	-1200
Optimum daily mean temperature for growth °C	8	8	10	8	8	8	10
Canopy cover parameters							
Initial canopy ground cover (0-1, unitless)	0.050000001	0.050000001	0.050000001	0.050000001	0.050000001	0.050000001	0.050000001
Maximum canopy cover (0-1, unitless)	0.85	0.85	0.50	0.80	0.75	0.80	0.50
Green canopy cover at maturity	0.20	0.20	0.50	0.30	0.20	0.40	0.50
Total canopy cover at maturity (green and senesced)	0.70	0.70	0.50	0.70	0.70	0.70	0.50
Maximum canopy height (m)	0.70	0.70	3.00	1.00	0.40	0.60	3.00
Root Parameters							
Maximum root depth (m)	1.80	1.80	0.80	1.50	0.70	1.50	1.50
Root sensitivity to stress	0.200000003	0.200000003	0	0.200000003	0.200000003	0.200000003	0
Root length at emergence (cm)	150.00	150.00	0.00	12.00	7.00	19.20	0.00
Phenology Parameters							
Base temperature for development (°C)	5	5	5	3	4	1	5
Maximum temperature for development (°C)	25	25	25	25	25	25	25
Thermal time at emergence or fruit tree bud break (°C-days)	0	0	130	24	50	70	120
Thermal time at flowering (°C-days)	850	850	70	630	574	720	50
Thermal time at end of canopy growth (°C-days)	800	800	240	600	813	750	450
Thermal time at grain filling, root bulking or fruit growth (°C-days)	950	950	200	680	670	760	470
Thermal time at physiological maturity or end of season (°C-days)	1500	1500	1800	1115	1366	1700	1250
Thermal time at senescence (°C-days)	1000	1000	2000	720	1047	900	1400

Technical Report for the Columbia River Basin Long-Term Water Supply and Demand Forecast 2011

Appendix A

Crop name	alfalfa seed	alfalfa	apple	barley	bean dry	canola	cherry
Harvested part	grain	leaf	fruit	grain	grain	grain	fruit
Photosynthetic pathway	C3	C3	C3	C3	C3	C3	C3
Life cycle	perennial	perennial	perennial	annual	annual	annual	perennial
Stem type	herbaceous	herbaceous	woody	herbaceous	herbaceous	herbaceous	woody
Transpiration Parameters							
ET coefficient at complete canopy ground cover	1.23	1.23	1.10	1.14	1.18	1.18	1.10
Maximum water uptake (mm/day)	13	13	12	13	12	12	12
Leaf water potential at the onset of stomatal closure (J/kg)	-1300	-1300	-1300	-1300	-1000	-1200	-1000
Wilting leaf water potential (J/kg)	-2000	-2000	-2000	-2000	-1500	-2000	-1500
Harvest Parameters							
Unstressed harvest index	0.00	0.85	0.00	0.45	0.45	0.24	0.00
Maximum fraction of carbon translocated to grains	0.00	0.00	0.00	0.35	0.30	0.20	0.00
Dormancy Parameters							
Day of year to start searching for beginning of dormancy	330	330	330				330
Minimum number of days in dormancy (1=no dormancy)	90	90	90	1	1	1	90
Dormancy threshold temperature	5	5	5				5
Fruit tree chill requirement (number of hours below 10 °C)			800				800
Fruit Parameters							
Maximum fresh fruit load mass (kg/ha)			39200				22000
Fraction of total solids in fruit			0.30				0.25

Technical Report for the Columbia River Basin Long-Term Water Supply and Demand Forecast 2011

Appendix A

Crop name	generic berry	generic vegetable	grain corn	hops	juice grape	lentil	mint	oat
Harvested part	fruit	biomass	grain	cones	fruit	grain	leaf	grain
Photosynthetic pathway	C3	C3	C4	C3	C3	C3	C3	C3
Life cycle	indeterminate	annual	annual	perennial	perennial	annual	perennial	annual
Stem type	herbaceous	herbaceous	herbaceous	herbaceous	herbaceous	herbaceous	herbaceous	herbaceous
Growth parameters								
Radiation-Use Efficiency at high VPD (g/MJ PAR)	2.80	2.80	3.60	2.80	2.80	2.00	3.20	2.80
Water-Use Efficiency at 1 kPa (g/kg)	4.80	4.80	8.00	4.80	4.80	3.40	5.50	4.80
Slope of Water-Use Efficiency function of VPD	0.60	0.60	0.50	0.60	0.60	0.60	0.60	0.60
Leaf water potential that begins reducing canopy expansion (J/kg)	-1000	-1000	-1000	-1000	-800	-1000	-1000	-1000
Leaf water potential that stops canopy expansion (J/kg)	-1300	-1300	-1300	-1300	-1200	-1300	-1300	-1300
Optimum daily mean temperature for growth °C	8	8	12	12	10	8	8	8
Canopy cover parameters								
Initial canopy ground cover (0-1, unitless)	0.050000001	0.050000001	0.050000001	0.050000001	0.050000001	0.050000001	0.050000001	0.050000001
Maximum canopy cover (0-1, unitless)	0.50	0.60	0.92	0.85	0.80	0.75	0.97	0.80
Green canopy cover at maturity	0.50	0.20	0.50	0.70	0.80	0.20	0.97	0.30
Total canopy cover at maturity (green and senesced)	0.50	0.60	0.70	0.80	0.80	0.70	0.97	0.70
Maximum canopy height (m)	1.00	0.40	2.20	5.00	2.00	0.40	0.80	1.00
Root Parameters								
Maximum root depth (m)	1.20	0.50	1.80	1.50	1.00	0.60	1.00	1.50
Root sensitivity to stress	0.5	0.5	0.200000003	0	0	0.200000003	0	0.200000003
Root length at emergence (cm)	12.00	5.00	12.00	150.00	10.00	7.00	1.00	12.00
Phenology Parameters								
Base temperature for development (°C)	3	3	5	5	5	4	5	3
Maximum temperature for development (°C)	25	25	30	30	30	25	30	25
Thermal time at emergence or fruit tree bud break (°C-days)	96	96	80	0	200	50	0	24
Thermal time at flowering (°C-days)	350	350	1442	930	370	574	1100	630
Thermal time at end of canopy growth (°C-days)	960	960	1350	977	850	813	700	600
Thermal time at grain filling, root bulking or fruit growth (°C-days)	365	365	1589	970	1400	670	2000	680
Thermal time at physiological maturity or end of season (°C-days)	2150	2150	1820	2218	2000	1366	1250	1115
Thermal time at senescence (°C-days)	1096	1096	1650	2000	1900	1047	1300	720

Technical Report for the Columbia River Basin Long-Term Water Supply and Demand Forecast 2011

Appendix A

Crop name	generic berry	generic vegetable	grain corn	hops	juice grape	lentil	mint	oat
Harvested part	fruit	biomass	grain	cones	fruit	grain	leaf	grain
Photosynthetic pathway	C3	C3	C4	C3	C3	C3	C3	C3
Life cycle	indeterminate	annual	annual	perennial	perennial	annual	perennial	annual
Stem type	herbaceous	herbaceous	herbaceous	herbaceous	herbaceous	herbaceous	herbaceous	herbaceous
Transpiration Parameters								
ET coefficient at complete canopy ground cover	1.05	0.90	1.25	1.11	1.10	1.13	1.23	1.14
Maximum water uptake (mm/day)	10	10	13	14	12	12	14	13
Leaf water potential at the onset of stomatal closure (J/kg)	-800	-800	-1100	-1300	-1300	-1000	-1300	-1300
Wilting leaf water potential (J/kg)	-1200	-1200	-1600	-2000	-2000	-1500	-2000	-2000
Harvest Parameters								
Unstressed harvest index	0.00	0.90	0.50	0.10	0.00	0.43	1.00	0.35
Maximum fraction of carbon translocated to grains	0.00	0.00	0.45	0.00	0.00	0.30	0.00	0.30
Dormancy Parameters								
Day of year to start searching for beginning of dormancy	330	0		330	330		330	
Minimum number of days in dormancy (1=no dormancy)	30	0	1	90	90	1	90	1
Dormancy threshold temperature	5	0		5	5		5	
Fruit tree chill requirement (number of hours below 10 °C)					100			
Fruit Parameters								
Maximum fresh fruit load mass (kg/ha)					34375			
Fraction of total solids in fruit					0.16			

Technical Report for the Columbia River Basin Long-Term Water Supply and Demand Forecast 2011

Appendix A

Crop name	other fruit tree	pasture seed	pasture	pea green	pea seed	pea	potato
Harvested part	fruit	grain	leaf	grain	grain	grain	tuber
Photosynthetic pathway	C3	C3	C3	C3	C3	C3	C3
Life cycle	perennial	perennial	perennial	annual	annual	annual	annual
Stem type	woody	herbaceous	herbaceous	herbaceous	herbaceous	herbaceous	herbaceous
Growth parameters							
Radiation-Use Efficiency at high VPD (g/MJ PAR)	2.80	1.50	1.50	2.60	2.60	2.60	3.40
Water-Use Efficiency at 1 kPa (g/kg)	4.80	2.50	2.50	4.50	4.50	4.50	5.80
Slope of Water-Use Efficiency function of VPD	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Leaf water potential that begins reducing canopy expansion (J/kg)	-800	-1000	-1000	-1000	-1000	-1000	-700
Leaf water potential that stops canopy expansion (J/kg)	-1200	-1300	-1300	-1300	-1300	-1300	-1000
Optimum daily mean temperature for growth °C	10	8	8	8	8	8	8
Canopy cover parameters							
Initial canopy ground cover (0-1, unitless)	0.050000001	0.050000001	0.050000001	0.050000001	0.050000001	0.050000001	0.050000001
Maximum canopy cover (0-1, unitless)	0.50	0.70	0.70	0.80	0.80	0.80	0.95
Green canopy cover at maturity	0.50	0.20	0.20	0.05	0.05	0.05	0.70
Total canopy cover at maturity (green and senesced)	0.50	0.50	0.50	0.70	0.70	0.70	0.70
Maximum canopy height (m)	3.00	0.50	0.50	0.50	0.70	0.70	0.60
Root Parameters							
Maximum root depth (m)	0.80	1.50	1.50	0.70	0.70	0.70	0.60
Root sensitivity to stress	0	0.5	0.5	0.200000003	0.200000003	0.200000003	0.3
Root length at emergence (cm)	0.00	15.00	15.00	7.00	7.00	7.00	12.00
Phenology Parameters							
Base temperature for development (°C)	5	5	5	4	4	4	3
Maximum temperature for development (°C)	25	25	25	25	25	25	25
Thermal time at emergence or fruit tree bud break (°C-days)	130	0	0	75	75	75	100
Thermal time at flowering (°C-days)	70	850	850	545	545	545	1500
Thermal time at end of canopy growth (°C-days)	240	800	800	720	720	720	1350
Thermal time at grain filling, root bulking or fruit growth (°C-days)	200	950	950	635	635	635	1200
Thermal time at physiological maturity or end of season (°C-days)	1800	1500	1500	1328	1328	1328	2100
Thermal time at senescence (°C-days)	2000	1000	1000	780	780	780	1600

Technical Report for the Columbia River Basin Long-Term Water Supply and Demand Forecast 2011
 Appendix A

Crop name	other fruit tree	pasture seed	pasture	pea green	pea seed	pea	potato
Harvested part	fruit	grain	leaf	grain	grain	grain	tuber
Photosynthetic pathway	C3	C3	C3	C3	C3	C3	C3
Life cycle	perennial	perennial	perennial	annual	annual	annual	annual
Stem type	woody	herbaceous	herbaceous	herbaceous	herbaceous	herbaceous	herbaceous
Transpiration Parameters							
ET coefficient at complete canopy ground cover	1.10	1.23	1.23	1.10	1.18	1.18	1.18
Maximum water uptake (mm/day)	12	13	13	12	12	12	13
Leaf water potential at the onset of stomatal closure (J/kg)	-1300	-1300	-1300	-1000	-1000	-1000	-800
Wilting leaf water potential (J/kg)	-2000	-2000	-2000	-1500	-1500	-1500	-1200
Harvest Parameters							
Unstressed harvest index	0.00	0.00	0.85	0.45	0.45	0.45	0.80
Maximum fraction of carbon translocated to grains	0.00	0.00	0.00	0.20	0.30	0.20	0.00
Dormancy Parameters							
Day of year to start searching for beginning of dormancy	330	330	330				
Minimum number of days in dormancy (1=no dormancy)	90	90	90	1	1	1	1
Dormancy threshold temperature	5	5	5				
Fruit tree chill requirement (number of hours below 10 °C)	800						
Fruit Parameters							
Maximum fresh fruit load mass (kg/ha)	72000						
Fraction of total solids in fruit	0.30						

Technical Report for the Columbia River Basin Long-Term Water Supply and Demand Forecast 2011

Appendix A

Crop name	spring wheat	sugarbeet	sweet corn	walnut	wine grape	rand spring	winter wheat
Harvested part	grain	tuber	grain	fruit	fruit	grain	grain
Photosynthetic pathway	C3	C3	C4	C3	C3	C3	C3
Life cycle	annual	annual	annual	perennial	perennial	annual	annual
Stem type	herbaceous	herbaceous	herbaceous	woody	herbaceous	herbaceous	herbaceous
Growth parameters							
Radiation-Use Efficiency at high VPD (g/MJ PAR)	2.80	2.80	3.60	0.86	2.80	2.80	2.80
Water-Use Efficiency at 1 kPa (g/kg)	4.80	4.80	8.00	1.48	4.80	4.80	4.80
Slope of Water-Use Efficiency function of VPD	0.60	0.60	0.50	0.60	0.60	0.60	0.60
Leaf water potential that begins reducing canopy expansion (J/kg)	-1000	-1000	-1000	-800	-800	-1000	-1000
Leaf water potential that stops canopy expansion (J/kg)	-1300	-1500	-1300	-1200	-1200	-1300	-1300
Optimum daily mean temperature for growth °C	8	8	12	10	10	8	8
Canopy cover parameters							
Initial canopy ground cover (0-1, unitless)	0.050000001	0.050000001	0.050000001	0.050000001	0.050000001	0.050000001	0.050000001
Maximum canopy cover (0-1, unitless)	0.80	0.95	0.92	3.50	0.65	0.80	0.80
Green canopy cover at maturity	0.30	0.70	0.50	3.50	0.65	0.30	0.30
Total canopy cover at maturity (green and senesced)	0.70	0.60	0.70	0.50	0.65	0.70	0.70
Maximum canopy height (m)	1.00	0.50	2.20	3.00	1.20	1.00	1.00
Root Parameters							
Maximum root depth (m)	1.50	1.20	1.80	0.80	0.80	1.50	1.50
Root sensitivity to stress	0.2	0.3	0.200000003	0	0	0.200000003	0.200000003
Root length at emergence (cm)	12.00	12.00	12.00	0.00	10.00	12.00	12.00
Phenology Parameters							
Base temperature for development (°C)	3	1	5	5	5	0	0
Maximum temperature for development (°C)	25	30	30	25	30	25	25
Thermal time at emergence or fruit tree bud break (°C-days)	24	116	85	130	300	97	97
Thermal time at flowering (°C-days)	630	4000	842	70	400	1360	1360
Thermal time at end of canopy growth (°C-days)	600	1260	734	240	850	1200	1200
Thermal time at grain filling, root bulking or fruit growth (°C-days)	680	4000	905	200	1300	1420	1420
Thermal time at physiological maturity or end of season (°C-days)	1115	3059	1150	1800	1870	1990	1990
Thermal time at senescence (°C-days)	720	2530	1050	2000	1900	1540	1540

Technical Report for the Columbia River Basin Long-Term Water Supply and Demand Forecast 2011
 Appendix A

Crop name	spring wheat	sugarbeet	sweet corn	walnut	wine grape	rand spring	winter wheat
Harvested part	grain	tuber	grain	fruit	fruit	grain	grain
Photosynthetic pathway	C3	C3	C4	C3	C3	C3	C3
Life cycle	annual	annual	annual	perennial	perennial	annual	annual
Stem type	herbaceous	herbaceous	herbaceous	woody	herbaceous	herbaceous	herbaceous
Transpiration Parameters							
ET coefficient at complete canopy ground cover	1.14	1.23	1.20	1.15	1.10	1.19	1.19
Maximum water uptake (mm/day)	13	13	13	12	12	13	13
Leaf water potential at the onset of stomatal closure (J/kg)	-1300	-800	-1100	-1300	-1300	-1300	-1300
Wilting leaf water potential (J/kg)	-2000	-1200	-1600	-2000	-2000	-2000	-2000
Harvest Parameters							
Unstressed harvest index	0.45	0.50	0.50	0.00	0.00	0.45	0.45
Maximum fraction of carbon translocated to grains	0.35	0.00	0.45	0.00	0.00	0.40	0.40
Dormancy Parameters							
Day of year to start searching for beginning of dormancy				330	330		
Minimum number of days in dormancy (1=no dormancy)	1	1	1	30	90	1	1
Dormancy threshold temperature				5	5		
Fruit tree chill requirement (number of hours below 10 °C)				800	100		
Fruit Parameters							
Maximum fresh fruit load mass (kg/ha)				3363	15000		
Fraction of total solids in fruit				0.80	0.25		