

Appendix G Crop, Salinity, and Modeling Data (Chapter 7)

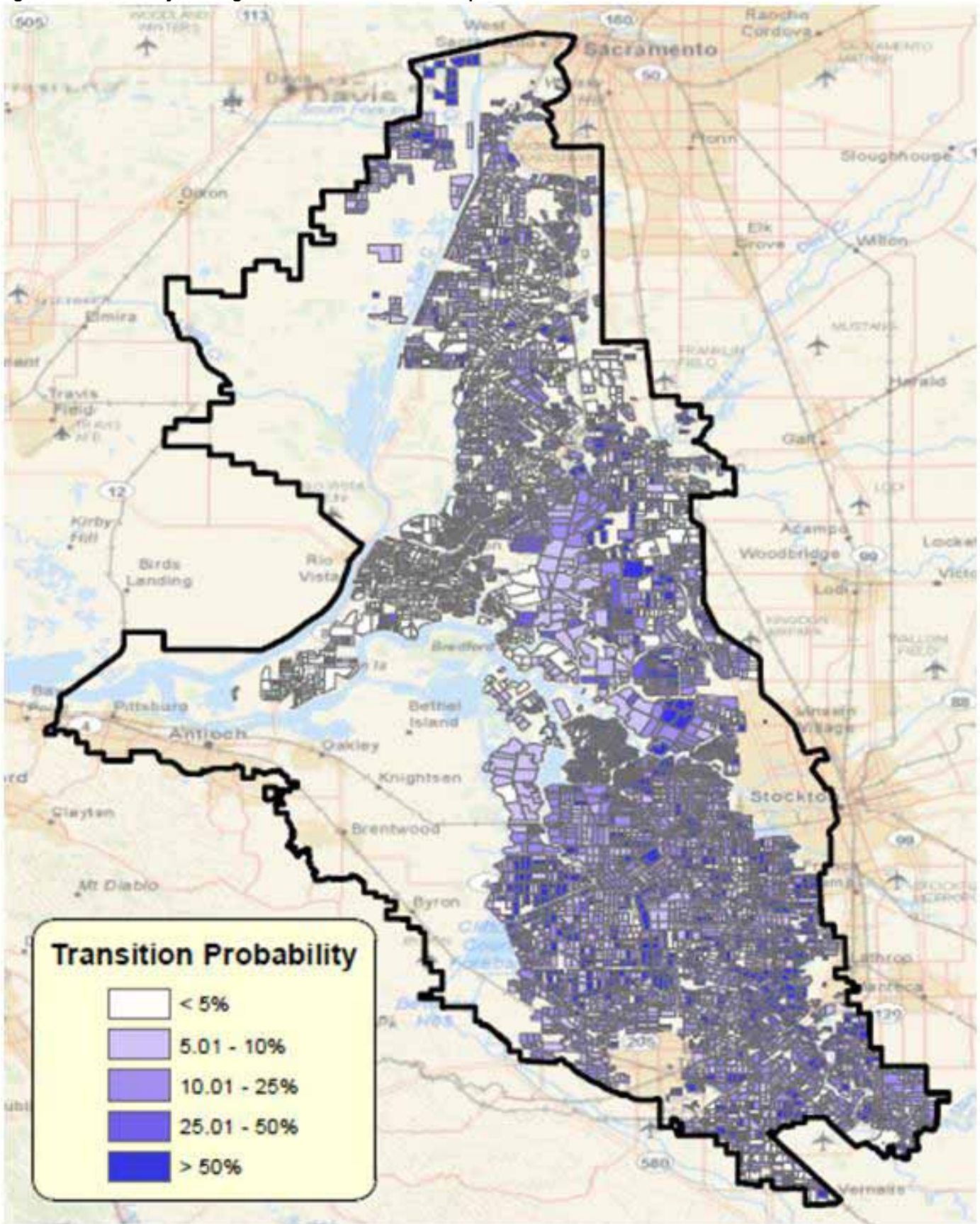
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Figure G-1 Probability of Long-run Transition to Truck Crops¹



¹ For high resolution image see <http://forecast.pacific.edu/desp-figs.html>

Table G-1 Detailed Crop Acreage

Four Counties		Sacramento		San Joaquin		Solano		Yolo	
<i>Crop</i>	<i>Acreage</i>	<i>Crop</i>	<i>Acreage</i>	<i>Crop</i>	<i>Acreage</i>	<i>Crop</i>	<i>Acreage</i>	<i>Crop</i>	<i>Acreage</i>
Corn	101,746	Corn	21,656	Corn	73,187	Pastureland	12,013	Grape, Wine	9,194
Alfalfa	77,470	Alfalfa	10,896	Alfalfa	47,840	Alfalfa	10,405	Alfalfa	8,330
Wheat	30,612	Grape, Wine	8,293	Tomato	20,671	Wheat	6,786	Wheat	4,320
Grape, Wine	28,148	Pear	5,159	Wheat	15,024	Corn	5,330	Pastureland	4,140
Tomato	25,559	Wheat	4,481	Grape, Wine	9,133	Safflower	2,637	Safflower	2,785
Pastureland	22,302	Pastureland	3,932	Asparagus	6,479	Rangeland	2,103	Rice	2,701
Safflower	9,844	Tomato	1,744	Bean, Dried	5,348	Sudangrass	1,975	Tomato	2,435
Asparagus	7,135	Safflower	1,575	Rice	3,745	Grape, Wine	1,528	Corn	1,573
Rice	7,112	Cherry	1,286	Almond	3,273	Oat	718	Ryegrass	1,462
Pear	5,843	Potato	789	Safflower	2,847	Tomato	709	Cucumber	761
Bean, Dried	5,348	Oat	720	Walnut	2,576	Sorghum	646	Triticale	477
Oat	3,699	Rice	666	Oat	2,259	Triticale	631	Pear	347
Almond	3,273	Asparagus	656	Pastureland	2,216	Ryegrass	484		
Cucumber	3,164	Sorghum	412	Potato	2,156	Turf	414		
Potato	2,944	Apple	371	Cucumber	2,079	Barley	354		
Turf	2,721			Turf	1,920	Sunflower	342		
Walnut	2,640			Pumpkin	1,820	Cucumber	324		
Ryegrass	2,415			Forage Hay/Silage	1,509	Pear	316		
Sudangrass	2,415			Grape	1,301				
Rangeland	2,415			Blueberry	1,129				
Pumpkin	2,415			Bean, Lima	1,079				
Cherry	2,415			Watermelon	968				
Forage Hay/Silage	2,415			Herb, Spice	848				
Grape	2,415			Olive	565				
Sorghum	2,415			Ryegrass	365				
Triticale	2,415			Cherry	334				
Bean, Lima	2,415								
Blueberry	2,415								
Watermelon	2,415								
Herb, Spice	2,415								
Apple	2,415								
Barley	2,415								
Olive	2,415								
Sunflower	2,415								

Table G-2 Detailed Crop Revenue

Four Counties		Sacramento		San Joaquin		Solano		Yolo	
<i>Crop</i>	<i>Revenue</i>	<i>Crop</i>	<i>Revenue</i>	<i>Crop</i>	<i>Revenue</i>	<i>Crop</i>	<i>Revenue</i>	<i>Crop</i>	<i>Revenue</i>
Tomato	\$109,715,255	Pear	\$34,280,608	Tomato	\$91,977,539	Alfalfa	\$6,971,917	Grape, Wine	\$32,717,640
Grape, Wine	\$93,863,607	Grape, Wine	\$28,469,072	Corn	\$53,542,670	Grape, Wine	\$5,041,775	Tomato	\$9,283,547
Corn	\$74,505,498	Corn	\$15,330,601	Alfalfa	\$46,083,743	Corn	\$4,527,795	Alfalfa	\$5,470,726
Alfalfa	\$63,956,076	Tomato	\$6,014,468	Asparagus	\$45,501,571	Turf	\$3,606,354	Turf	\$4,395,957
Asparagus	\$50,050,037	Cherry	\$5,947,243	Grape, Wine	\$27,635,120	Wheat	\$3,499,199	Rice	\$2,284,791
Pear	\$36,746,649	Alfalfa	\$5,429,690	Potato	\$26,186,617	Turf	\$3,604,359	Pear	\$1,521,236
Turf	\$31,643,344	Asparagus	\$4,548,465	Blueberry	\$25,090,265	Tomato	\$2,439,702	Cucumber	\$1,451,254
Potato	\$27,942,370	Cucumber	\$3,523,604	Turf	\$22,106,352	Bean, Lima	\$1,291,819	Wheat	\$1,155,695
Blueberry	\$25,255,917	Wheat	\$2,191,725	Wheat	\$10,702,596	Sudangrass	\$1,202,696	Corn	\$1,104,432
Wheat	\$17,549,215	Watermelon	\$2,049,764	Almond	\$8,776,101	Pastureland	\$1,047,534	Safflower	\$912,391
Cherry	\$8,820,843	Potato	\$1,755,753	Walnut	\$8,170,505	Safflower	\$969,242	Apple	\$903,181
Almond	\$8,776,101	Turf	\$1,536,676	Pumpkin	\$7,859,092	Pear	\$835,798		
Walnut	\$8,243,817	Rice	\$1,075,162	Pepper, Fruiting	\$6,027,982	Sunflower	\$613,111		
Watermelon	\$7,953,590	Apple	\$776,153	Watermelon	\$5,870,140	Ryegrass	\$565,516		
Pumpkin	\$7,926,678			Grape	\$4,464,366				
Cucumber	\$7,867,194			Rice	\$4,159,499				
Rice	\$7,519,452			Bean, Dried	\$3,725,947				
Pepper, Fruiting	\$6,247,592			Oat	\$3,291,265				
Grape	\$4,469,535			Cherry	\$2,614,356				
Apple	\$4,455,826			Cucumber	\$2,483,396				
Oat	\$4,195,539			Apple	\$2,477,255				
Bean, Dried	\$3,990,318			Olive	\$1,648,258				
Safflower	\$3,312,014			Squash	\$1,611,384				
Bean, Lima	\$2,668,602			Bean, Lima	\$1,376,783				
Olive	\$2,173,405			Safflower	\$1,113,799				
Pastureland	\$2,117,336			Apricot	\$1,058,741				
Squash	\$1,633,464			Mustard	\$957,110				
Sudangrass	\$1,398,634			Onion	\$892,043				
Apricot	\$1,075,470			Potato Seed	\$663,095				
Ryegrass	\$1,023,582								
Mustard	\$957,367								
Sunflower	\$954,434								
Onion	\$892,684								
Potato Seed	\$663,095								
Sorghum	\$662,718								
Onion Seed	\$581,993								
Cabbage	\$514,890								

Note:

[1] Kern County crop report value used for turf acreage, as no Delta counties report turf separately from other nursery crops.

Table G-3 Detailed Crop Categories

Deciduous	Field	Grain	Pasture	Truck		Vineyard
Almond	Alfalfa	Barley	Clover	Artichoke	Onion	Grape
Apple	Bean, Dried	Oat	Forage	Asparagus	Onion, Green	Grape, Wine
Apricot	Corn	Rye	Pastureland	Bean, Lima	Parsley	
Cherry	Mustard	Safflower	Ryegrass	Bean, Succulent	Peas	
Chestnut	Rice	Sorghum		Beet	Pepper, Fruiting	
Fig	Soybean	Triticale		Blueberry	Potato	
Kiwi	Sudangrass	Wheat		Broccoli	Pumpkin	
Nectarine	Sunflower			Cabbage	Radish	
Olive				Carrot	Spinach	
Peach				Celeriac	Squash	
Pear				Celery	Strawberry	
Pecan				Collard	Sugarbeet	
Pistachio				Cucumber	Sweet Basil	
Plum				Daikon	Sweet Corn	
Pluot				Eggplant	Swiss Chard	
Pomegranate				Fruit, Berry	Tomato	
Stone Fruit				Garlic	Turf	
Walnut				Herb, Spice	Turnip	
				Leek	Watermelon	
				Lettuce	Zucchini	
				Melon		

Table G-4 Detailed Salinity Data Summary Statistics, 2001-2010
Salinity Summary Statistics, 2001 - 2010

Entire Delta

Year	Observations	Mean	Std. Dev.
2001	7708	338.50	231.29
2002	7708	327.56	220.37
2003	7708	288.60	170.55
2004	7708	330.83	206.94
2005	7708	279.60	150.68
2006	7708	261.38	151.56
2007	7708	364.72	214.13
2008	7708	403.11	282.51
2009	7708	331.44	192.04
2010	7708	283.00	132.02

By Conservation Zone

Conservation Zone 1

Year	Observations	Mean	Std. Dev.
2001	507	435.36	107.98
2002	507	408.44	104.00
2003	507	362.27	83.54
2004	507	382.63	87.39
2005	507	413.10	98.70
2006	507	449.71	110.42
2007	507	363.15	71.50
2008	507	422.57	87.16
2009	507	382.05	80.01
2010	507	391.90	79.84

Conservation Zone 2

Year	Observations	Mean	Std. Dev.
2001	225	193.89	131.27
2002	225	188.25	121.19
2003	225	171.77	94.15
2004	225	188.08	113.77
2005	225	182.99	112.82
2006	225	186.88	125.16
2007	225	195.44	92.75
2008	225	231.01	101.14
2009	225	196.70	94.72
2010	225	187.61	97.44

Conservation Zone 3

Year	Observations	Mean	Std. Dev.
2001	1585	196.25	90.83
2002	1585	190.43	83.93
2003	1585	163.79	56.42
2004	1585	203.39	79.08
2005	1585	177.75	62.74
2006	1585	169.65	71.37
2007	1585	204.40	63.85
2008	1585	223.68	68.54
2009	1585	189.47	62.22
2010	1585	175.86	57.25

Conservation Zone 4

Year	Observations	Mean	Std. Dev.
2001	565	151.20	62.76
2002	565	142.80	51.26
2003	565	135.27	27.63
2004	565	162.31	44.16
2005	565	142.46	11.39
2006	565	125.49	19.73
2007	565	173.67	43.13
2008	565	188.99	47.19

Conservation Zone 5

Year	Observations	Mean	Std. Dev.
2001	1426	274.73	200.33
2002	1426	248.72	157.79
2003	1426	166.83	52.59
2004	1426	263.50	159.64
2005	1426	168.91	48.05
2006	1426	148.55	53.65
2007	1426	247.11	119.12
2008	1426	297.62	245.05
2009	1426	214.98	101.44
2010	1426	183.74	58.66

Conservation Zone 6

Year	Observations	Mean	Std. Dev.
2001	1099	433.14	141.47
2002	1099	410.68	145.38
2003	1099	359.71	158.66
2004	1099	404.66	148.49
2005	1099	283.79	81.10
2006	1099	236.16	63.94
2007	1099	398.38	83.68
2008	1099	434.76	87.69
2009	1099	374.82	87.88
2010	1099	349.93	81.59

Conservation Zone 7

Year	Observations	Mean	Std. Dev.
2001	1987	458.23	128.88
2002	1987	465.99	136.62
2003	1987	455.73	128.03
2004	1987	463.44	134.20
2005	1987	432.41	116.52
2006	1987	407.77	124.67
2007	1987	606.75	70.38
2008	1987	645.52	76.15
2009	1987	537.28	84.42
2010	1987	409.90	43.31

Conservation Zone 8

Year	Observations	Mean	Std. Dev.
2001	300	421.35	125.50
2002	300	403.27	132.65
2003	300	377.24	142.19
2004	300	401.84	133.72
2005	300	387.61	135.02
2006	300	376.16	140.81
2007	300	434.53	137.22
2008	300	457.21	132.91

By Restoration Opportunity Area

Cache Slough

Year	Observations	Mean	Std. Dev.
2001	301	385.59	162.37
2002	301	365.19	151.03
2003	301	317.87	125.17
2004	301	344.79	132.37
2005	301	357.13	150.75
2006	301	383.06	170.88
2007	301	325.63	111.50
2008	301	387.36	126.97
2009	301	337.78	123.43
2010	301	339.39	127.28

Cosumnes/Mokelumne

Year	Observations	Mean	Std. Dev.
2001	153	119.81	1.45
2002	153	116.92	3.67
2003	153	123.27	1.38
2004	153	141.97	5.87
2005	153	140.07	3.74
2006	153	114.96	7.87
2007	153	152.62	3.21
2008	153	164.69	3.51
2009	153	121.17	13.07
2010	153	131.80	0.88

South Delta

Year	Observations	Mean	Std. Dev.
2001	810	521.98	91.69
2002	810	528.22	101.70
2003	810	515.75	100.32
2004	810	525.59	100.12
2005	810	490.09	95.32
2006	810	466.72	111.60
2007	810	583.65	103.49
2008	810	619.11	106.90
2009	810	514.93	97.66
2010	810	416.35	40.84

West Delta

Year	Observations	Mean	Std. Dev.
2001	79	442.17	244.12
2002	79	400.12	203.37
2003	79	196.72	50.55
2004	79	425.81	215.01
2005	79	191.16	40.88
2006	79	161.57	20.60
2007	79	355.18	153.28
2008	79	441.50	267.77

Table G-5 Input Data Summary

Variable	Description	Units	Mean	Standard Deviation	Min	25th Percentile	75th Percentile	Max
ec	May-August Electroconductivity Average, 2001 - 2010	micro Siemens / cm	353.24	159.81	128.53	199.93	501.33	1932.84
acres	Field Acreage	Acres	49.9	59.81	0.01	21.92	58.18	2072.52
soil	Soil Storie Index	0-100 Point Scale	49.43	16.08	0	38	64	100
elev	Elevation	Feet	3.11	7.47	-4	0	3	56
tmax	Avg. Annual Maximum Temp.	Degrees Celsius	23.4	0.22	22.47	23.33	23.55	23.64
slope	Slope	Decimal Degrees	0.14	0.59	0	0	0	5.28
year	Annual Fixed Effects							
conzone	Conservation Zone Fixed Effects							

Table G-6 Alternative Salinity Model Specifications

Specification	Independent Variables Included
1	Salinity
2	Salinity, Time and Regional Fixed Effects
3	Salinity, Time and Regional Fixed Effects, Field Acreage
Final	Salinity, Time and Regional Fixed Effects, Field Acreage, Geophysical Characteristics

Table G-7 Likelihood Ratio Test of Alternative Salinity Model Specifications vs. Final

Specification No.	Degrees of Freedom	Test Statistic
1	94	9937.26 ***
2	30	3240.00 ***
3	25	2718.54 ***

*, **, and *** indicates significance at the 90%, 95%, and 99% level, respectively.

Table G-8 Estimated Crop Category Salinity Elasticities by Model Specification

	Specification 1	Specification 2	Specification 3	Final Specification
Deciduous	-0.0650 (0.0496)	-1.4435 *** (0.1008)	-1.5347 *** (0.1017)	-0.5289 *** (0.1124)
Field	0.0484 *** (0.0122)	0.2623 *** (0.0216)	0.2937 *** (0.0217)	0.2034 *** (0.0226)
Grain	-0.1101 *** (0.0292)	0.7319 *** (0.0509)	0.7028 *** (0.0511)	0.6744 *** (0.0510)
Pasture	-0.2508 *** (0.0668)	0.3437 *** (0.1247)	0.3789 *** (0.1248)	0.8140 *** (0.1241)
Truck	0.3766 *** (0.0195)	-0.3957 *** (0.0364)	-0.4287 *** (0.0367)	-0.6150 *** (0.0381)
Vineyard	-2.5644 *** (0.0652)	-1.4846 *** (0.1259)	-1.4555 *** (0.1260)	-0.6047 *** (0.1333)

Standard errors are reported in parentheses.

*, **, and *** indicates significance at the 90%, 95%, and 99% level, respectively.

Table G-9 Multinomial Logit Estimation Results - Specification 1
ML Estimation Results - Specification 1

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Crop Category	Deciduous	Field	Grain	Pasture	Truck	Vineyard
10-Year Average Electroconductivity (mS/cm)		0.0003 **	-0.0001	-0.0005 **	0.0013 ***	-0.0071 ***
	BASE OUTCOME	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Constant		2.1207 ***	1.0309 ***	-0.3793 ***	1.1129 ***	2.1629 ***
		(0.0583)	(0.0647)	(0.0902)	(0.0617)	(0)

Deciduous is the base outcome.

Standard errors are reported in parentheses.

*, **, and *** indicates significance at the 90%, 95%, and 99% level, respectively.

Table G-10 Multinomial Logit Estimation Results - Specification 2
ML Estimation Results - Specification 2

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Crop Category	Deciduous	Field	Grain	Pasture	Truck	Vineyard
10-Year Average Electroconductivity (mS/cm)		0.0048 ***	0.0062 ***	0.0051 ***	0.0030 ***	-0.0001
	BASE OUTCOME	(0.0003)	(0.0003)	(0.0005)	(0.0003)	(0.0005)
Constant		2.6173 ***	1.4257 **	2.2219 ***	0.7805	-21.8104
		(0.6001)	(0.6105)	(0.6349)	(0.6842)	(34150)

Deciduous is the base outcome.

Standard errors are reported in parentheses.

*, **, and *** indicates significance at the 90%, 95%, and 99% level, respectively.

Table G-11 Multinomial Logit Estimation Results - Specification 3
ML Estimation Results - Specification 3

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Crop Category	Deciduous	Field	Grain	Pasture	Truck	Vineyard
10-Year Average Electroconductivity (mS/cm)		0.0018 ***	0.0063 ***	0.0054 ***	0.0031 ***	0.0002
	BASE OUTCOME	(0.0003)	(0.0003)	(0.0005)	(0.0003)	(0.0005)
Acres		0.0143 ***	0.0108 ***	0.0158 ***	0.0113 ***	0.0146 ***
	BASE OUTCOME	(0.0010)	(0.0010)	(0.0011)	(0.0010)	(0.0010)
Constant		1.8255 ***	0.8944	1.3209 **	0.2255	-24.0655
		(0.6022)	(0.6126)	(0.6378)	(0.6859)	(70449)

Deciduous is the base outcome.

Standard errors are reported in parentheses.

*, **, and *** indicates significance at the 90%, 95%, and 99% level, respectively.

Table G-12 Multinomial Logit Estimation Results – Final Specification

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Crop Category	Deciduous	Field	Grain	Pasture	Truck	Vineyard
10-Year Average Electroconductivity (mS/cm)	B	0.0021 *** (0.0003)	0.0034 *** (0.0004)	0.0038 *** (0.0005)	-0.0002 (0.0004)	-0.0002 (0.0005)
Acres	A	0.0160 *** (0.0010)	0.0125 *** (0.0010)	0.0176 *** (0.0011)	-0.1053 *** (0.0032)	-0.0316 *** (0.0044)
Soil	E	-0.0128 *** (0.0016)	-0.0111 *** (0.0018)	-0.0488 *** (0.0028)	0.0132 *** (0.0010)	0.0166 *** (0.0010)
Elevation	O	-0.0938 *** (0.0029)	-0.0754 *** (0.0034)	-0.0705 *** (0.0054)	-0.0049 *** (0.0017)	0.0160 *** (0.0019)
Max Temp.	T	-1.7494 *** (0.2103)	-1.0668 *** (0.2243)	-2.8749 *** (0.2980)	-0.5160 ** (0.2231)	1.6602 *** (0.2922)
Slope	O	-0.0681 * (0.0371)	0.0312 (0.0404)	0.0856 (0.0635)	-0.0539 (0.0395)	0.0276 (0.0474)
Constant	E	45.1877 *** (5.0033)	28.6584 *** (5.3336)	72.0774 *** (7.0376)	14.6193 *** (5.3081)	-66.6759 (652517)

Deciduous is the base outcome.

Standard errors are reported in parentheses.

*, **, and *** indicates significance at the 90%, 95%, and 99% level, respectively.

Table G-13 Estimated Salinity Elasticities by Crop Categories

Deciduous	-0.5289 *** (0.1124)
Field	0.2034 *** (0.0226)
Grain	0.6744 *** (0.0510)
Pasture	0.8140 *** (0.1241)
Truck	-0.6150 *** (0.0381)
Vineyard	-0.6047 *** (0.1333)

Standard errors are reported in parentheses.

*, **, and *** indicates significance at the 90%, 95%, and 99% level, respectively.