

Table 1. Annual potential regional reduction in water use through the adoption of wireless sensor irrigation networks (WSIN) for ornamental production. Water reductions are reported using a 50% and 100% adoption scenario, and assuming a 50% reduction in water use once WSIN are adopted at an operation.

Region	Operation type	Annual reduction in water use (million gallons) ²	
		50% adoption	100% adoption
Appalachian	Greenhouse	328.5	657.0
	Container	1,681.3	3,362.6
	Field	1,000.9	2,001.8
Midwest	Greenhouse	620.2	1,240.3
	Container	1,556.8	3,113.6
	Field	926.8	1,853.6
Mountain/South-central/Great Plains	Greenhouse	1,007.4	2,014.8
	Container	4,790.3	9,580.6
	Field	8,046.5	16,092.9
Northeast	Greenhouse	435.9	871.8
	Container	949.6	18,99.23
	Field	1,595.2	3,190.3
Pacific	Greenhouse	1,424.0	2,848.0
	Container	13,335.6	26,671.1
	Field	7,939.0	15,878.1
Southeast	Greenhouse	2,626.2	5,252.4
	Container	6,598.3	13,196.5
	Field	3,928.1	7,856.2
All regions	Greenhouse	6,442.2	12,884.4
	Container	28,911.8	57,823.6
	Field	23,436.5	46,872.9
	Total	58,790.4	117,580.9
² 1 gal.= 3.785412 L			

Table 2. Annual potential regional reduction in Carbon Dioxide (CO₂) emissions (Mg) by using wireless sensor irrigation networks. Annual CO₂ reductions are based on a 50% reduction in pumping volumes, for 50% and 100% of ornamental operations.

Region	Operation type	Annual reduction in CO ₂ emissions (tons) ²	
		50% adoption	100% adoption
Appalachian	Greenhouse	229	457
	Container	1,171	2,341
	Field	697	1,394
Midwest	Greenhouse	343	687
	Container	861	1,723
	Field	44	88
Mountain/South-central/Great Plains	Greenhouse	617	1,233
	Container	4,926	9,852
	Field	2,933	5,865
Northeast	Greenhouse	352	704
	Container	1,289	2,577
	Field	767	1,534
Pacific	Greenhouse	1,028	2,057
	Container	9,632	19,263
	Field	5,734	11,468
Southeast	Greenhouse	1,861	3,720
	Container	4,674	9,348
	Field	2,782	5,564
All regions	Greenhouse	4,429	8,859
	Container	22,552	45,104
	Field	12,958	25,914
	Total	39,939	79,879
² 1 ton = 0.9071847 Mg			

Table 5. Potential reductions in annual nitrogen (N) and phosphorus (P) runoff for ornamental production with adoption of wireless sensor irrigation networks. Two adoption rates (50% and 100%), and 2 emissions reduction rates conservative (Table 3), and optimistic (Table 4) were used. Note: P values are not reported for field operations because reliable data for P runoff could not be obtained outside of Maryland.

Region	Operation type	Conservative scenario				Optimistic scenario			
		50% adoption		100% adoption		50% adoption		100% adoption	
		Pounds of N reduced [‡]	Pounds of P reduced [‡]	Pounds of N reduced [‡]	Pounds of P reduced [‡]	Pounds of N reduced [‡]	Pounds of P reduced [‡]	Pounds of N reduced [‡]	Pounds of P reduced [‡]
Appalachian	Greenhouse	1,689	2,039	3,380	4,079	2,471	2,471	4,943	4,943
	Container	40,256	24,760	80,513	49,520	88,564	54,474	177,128	108,946
	Field	728	---	1,453	---	1,164	---	2,326	---
Midwest	Greenhouse	3,591	4,960	7,183	9,921	5,254	7,258	10,505	14,513
	Container	66,229	39,571	132,458	79,139	145,703	87,054	291,407	174,108
	Field	1,338	---	2,676	---	2,143	---	4,284	---
Mountain/ South-central Great Plains	Greenhouse	5,794	704,1.6	11,587	14,083	8,477	10,302	16,951	20,602
	Container	140,514	87,731	281,025	175,461	309,127	193,008	618,255	386,014
	Field	1,616	---	3,234	---	2,586	---	5,174	---
Northeast	Greenhouse	2,247	3,120	4,491	6,239	3,285	4,564	6,570	9,125
	Container	94,966	55,649	189,932	111,296	208,925	122,427	417,850	244,852
	Field	174	---	348	---	278	---	556	---
Pacific	Greenhouse	17,663	24,868	35,329	49,736	25,840	36,378	51,681	72,757
	Container	72,073	46,932	144,147	93,864	158,563	103,251	317,124	206,502
	Field	1,594	---	3,186	---	2,549	---	5,099	---
Southeast	Greenhouse	17,260	21,270	34,522	42,543	25,249	31,116	50,501	62,232
	Container	153,459	82,790	306,916	165,582	337,609	182,141	675,216	364,280
	Field	1,448	---	2,895	---	2,317	---	4,632	---
All regions	Greenhouse	48,246	63,301	96,492	126,600	70,577	92,087	141,153	184,176
	Container	567,496	337,432	1,134,991	674,865	1,248,492	742,351	2,496,981	1,484,701
	Field	6,896	---	13,794	---	11,034	---	22,070	---
	Total	622,638	400,732	1,245,277	801,465	1,330,102	834,438	2,660,205	1,668,877
[‡] 1 lb = 0.4535924 Kg									

Majsztrik, J., D King, and E. Price. 2014. Understanding the public benefits of sensor networks. *In*: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas, and J.D. Lea-Cox (Eds.). Published online at: <https://myelms.umd.edu/courses/1110348> 17p.

Table 6. Total magnitude of potential yearly environmental benefits of wireless sensor irrigation networks by region (assuming 100% adoption). Reductions in nitrogen (N) and phosphorus (P) emissions are based on a conservative scenario (Table 3), or an optimistic scenario (Table 4).

Region	Operation type	Total sales (million \$) ^z	Reduction in water use (million gal.) ^y	Reduction in carbon dioxide emissions (ton) ^x	Conservative scenario		Optimistic scenario	
					Reduction in N runoff (lb) ^w	Reduction in P runoff (lb) ^w	Reduction in N runoff (lb) ^w	Reduction in P runoff (lb) ^w
Appalachian	Greenhouse	\$123.5	657.1	457.46	3,380	4,079	4,943	4,943
	Container	\$423.4	3,362.6	2,341.31	80,513	49,520	177,128	108,946
	Field	\$497.7	2,001.8	1,394.42	1,453	---	2,326	---
Midwest	Greenhouse	\$172.8	1,240.4	686.74	7,183	9,921	10,505	14,513
	Container	\$1,230.0	3,113.6	1,722.91	132,458	79,139	291,407	174,108
	Field	\$526.5	1,853.6	88.18	2,676	---	4,284	---
Mountain/ South-central/ Great Plains	Greenhouse	\$261.5	2,014.8	1,233.49	11,587	14,083	16,951	20,602
	Container	\$1,230.0	9,580.6	9,852.46	281,025	175,461	618,255	386,014
	Field	\$526.5	16,092.9	5,865.40	3,234	---	5,174	---
Northeast	Greenhouse	\$103.70	871.8	704.38	4,491	6,239	6,570	9,125
	Container	\$1,367.8	1,899.3	2,577.20	189,932	111,296	417,850	244,852
	Field	\$149.4	3,190.3	1,534.42	348	---	556	---
Pacific	Greenhouse	\$1,096.4	2,848.0	2,056.91	35,329	49,736	51,681	72,757
	Container	\$1,263.7	26,671.1	19,262.88	144,1467	93,864	317,124	206,502
	Field	\$1,113.6	15,878.0	11,468.44	3,186	---	5,099	---
Southeast	Greenhouse	\$461.2	5,252.4	3,720.30	34,522	42,543	50,501	62,232
	Container	\$896.5	13,196.5	9,347.60	306,916	165,582	675,216	364,280
	Field	\$543.9	7,856.2	5,564.47	2,895	---	4,632	---
All regions	Greenhouse	\$2,219.0	12,884.4	8,859.27	96,492	126,600	141,153	184,176
	Container	\$6,411.4	57,823.5	45,104.36	1,134,991	674,865	2,496,981	1,484,701
	Field	\$3,357.5	46,872.9	25,914.23	13,794	---	22,070	---
	Total	\$11,987.9	117,580.8	79,878.97	1,245,277	801,465	2,660,205	1,668,878

^z Total sales are derived from U. S. Department of Agriculture (2010b).

^y1 gal.= 3.785412 L, ^x1 ton = 0.9071847 Mg, ^w1 lb = 0.4535924 Kg

Table 7. Potential environmental benefits of wireless sensor irrigation networks by region per million dollars of output per year. U.S. Total reflects total nationwide environmental benefits divided by national sales. Reductions in nitrogen (N) and phosphorus (P) emissions are based on a conservative scenario (Table 3), or an optimistic scenario (Table 4).

Region	Operation type	Total sales (million \$)	Reduction in water use (millions gal.) ^y	Reduction in CO ₂ emissions (ton) ^x	Conservative scenario		Optimistic scenario	
					Reduction in N runoff (lb) ^w	Reduction in P runoff (lb) ^w	Reduction in N runoff (lb) ^w	Reduction in P runoff (lb) ^w
Appalachian	Greenhouse	\$123.5	5.3	3.70	27.4	33.0	40.0	40.0
	Container	\$423.4	7.9	5.53	190.2	307.1	418.3	257.3
	Field	\$497.7	4.0	2.80	2.9	---	4.7	---
Midwest	Greenhouse	\$172.8	7.2	3.97	41.6	57.4	60.8	84.0
	Container	\$1,230.0	2.5	1.40	107.7	64.4	236.9	141.6
	Field	\$526.5	3.5	0.17	5.1	---	8.1	---
Mountain/ South-central/ Great Plains	Greenhouse	\$261.5	7.7	4.72	44.3	53.9	64.8	78.8
	Container	\$1,230.0	7.8	8.01	228.5	142.7	502.7	313.9
	Field	\$526.5	30.6	11.14	6.2	---	9.8	---
Northeast	Greenhouse	\$103.70	8.4	6.79	43.3	60.2	63.4	88.0
	Container	\$1,367.8	1.4	1.88	138.9	81.4	305.5	179.0
	Field	\$149.4	21.4	10.27	2.3	---	3.7	---
Pacific	Greenhouse	\$1,096.4	2.6	1.87	32.2	45.4	47.1	66.4
	Container	\$1,263.7	21.1	15.24	114.1	74.3	251.0	163.4
	Field	\$1,113.6	14.3	10.30	2.9	---	4.6	---
Southeast	Greenhouse	\$461.2	11.4	8.07	74.9	92.2	109.5	134.9
	Container	\$896.5	14.7	10.43	342.3	184.7	753.1	406.3
	Field	\$543.9	14.4	10.23	5.3	---	8.5	---
All regions	Greenhouse	\$2,219.0	2.9	3.99	43.5	57.1	63.6	83.0
	Container	\$6,411.4	4.5	7.03	177.0	105.3	389.5	231.6
	Field	\$3,357.5	7.0	7.72	4.1	---	6.57	---
	Total	\$11,987.9	4.9	6.66	103.9	66.9	221.9	139.2
^y 1 gal.= 3.785412 L, ^x 1 ton = 0.9071847 Mg, ^w 1 lb = 0.4535924 Kg								