Irrigation Water Testing & Interpretation

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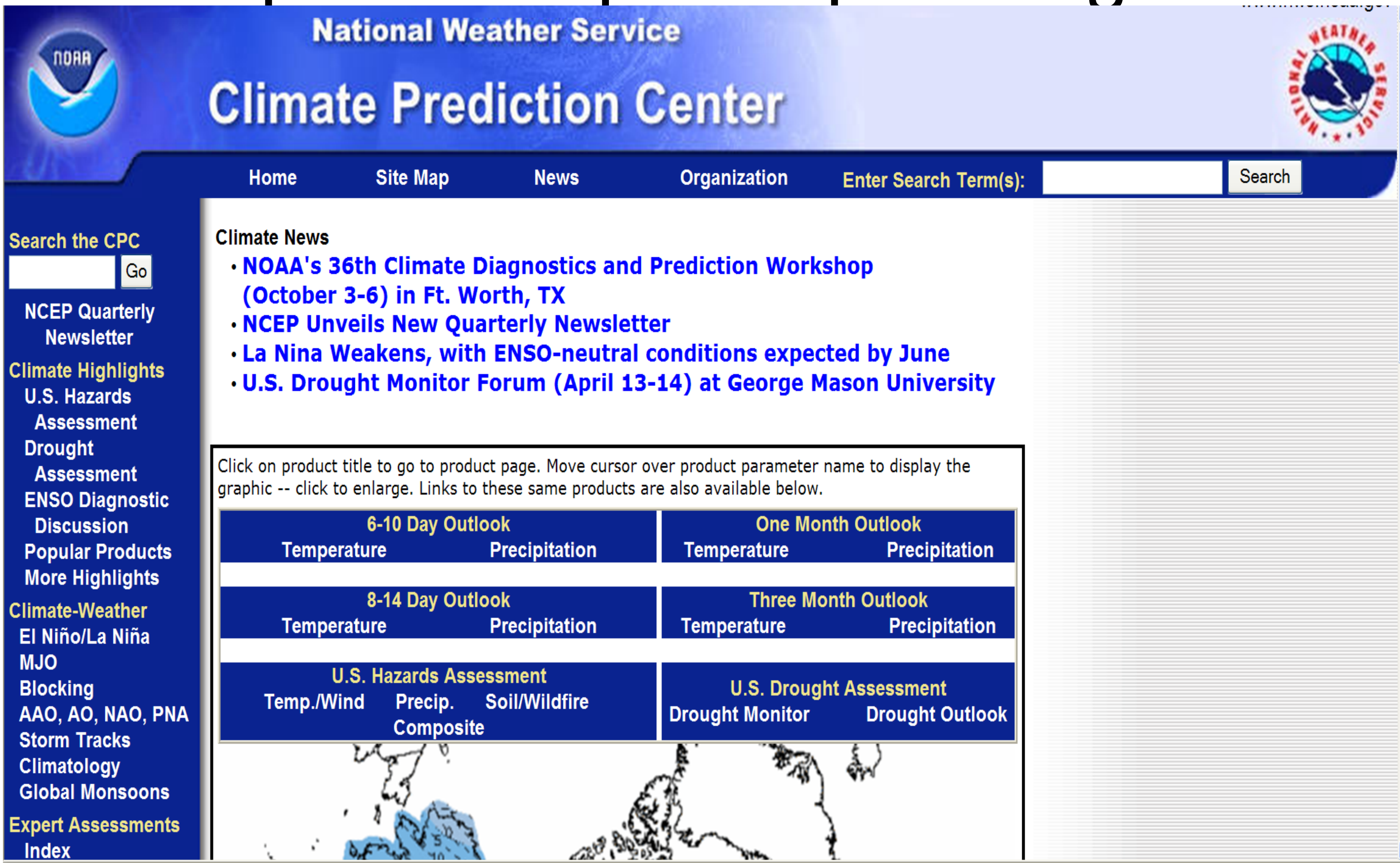
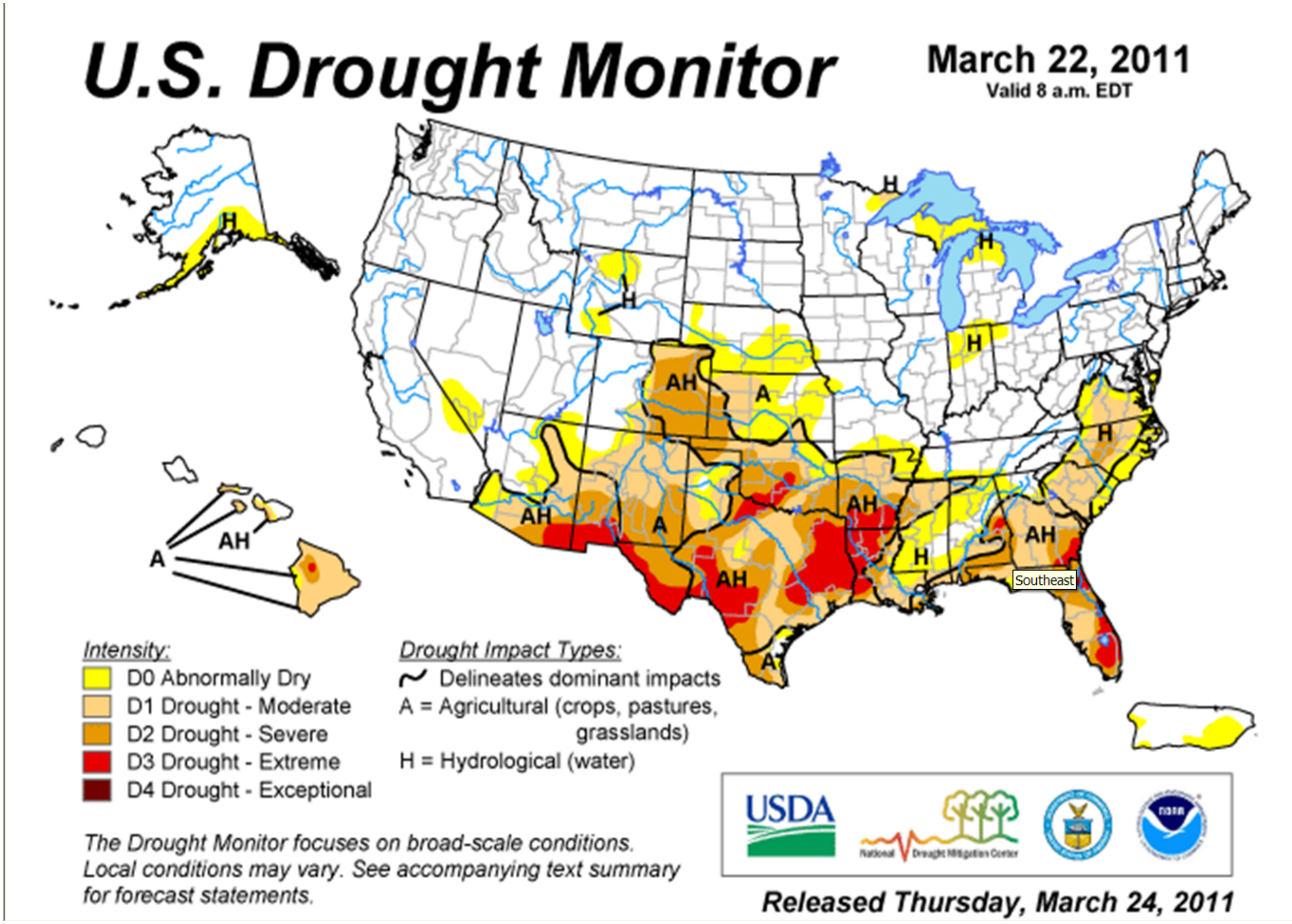
Research Specialist

National Climate Prediction Center
http://www.cpc.ncep.noaa.gov/



http://drought.unl.edu/dm/monitor.html



Return to U.S. Drought Monitor   Return to Region

The data cutoff for Drought Monitor maps is Tuesday at 7 a.m. Eastern Standard Time. The maps, which are based on analysis of the data, are released each Thursday at 8:30 a.m. Eastern Time.

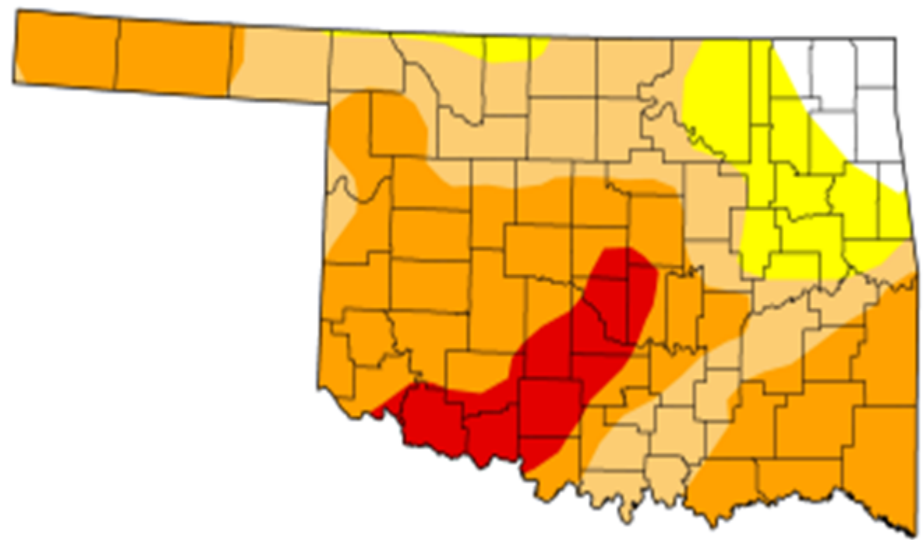
U.S. Drought Monitor

March 22, 2011
Valid 7 a.m. EST

Oklahoma

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	4.38	95.62	83.58	54.46	8.78	0.00
Last Week (03/15/2011 map)	4.40	95.60	82.84	35.79	1.86	0.00
3 Months Ago (12/21/2010 map)	14.73	85.27	38.09	0.85	0.00	0.00
Start of Calendar Year (12/28/2010 map)	13.82	86.18	47.90	1.50	0.00	0.00
Start of Water Year (09/28/2010 map)	66.28	33.72	4.21	0.00	0.00	0.00
One Year Ago (03/16/2010 map)	100.00	0.00	0.00	0.00	0.00	0.00



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

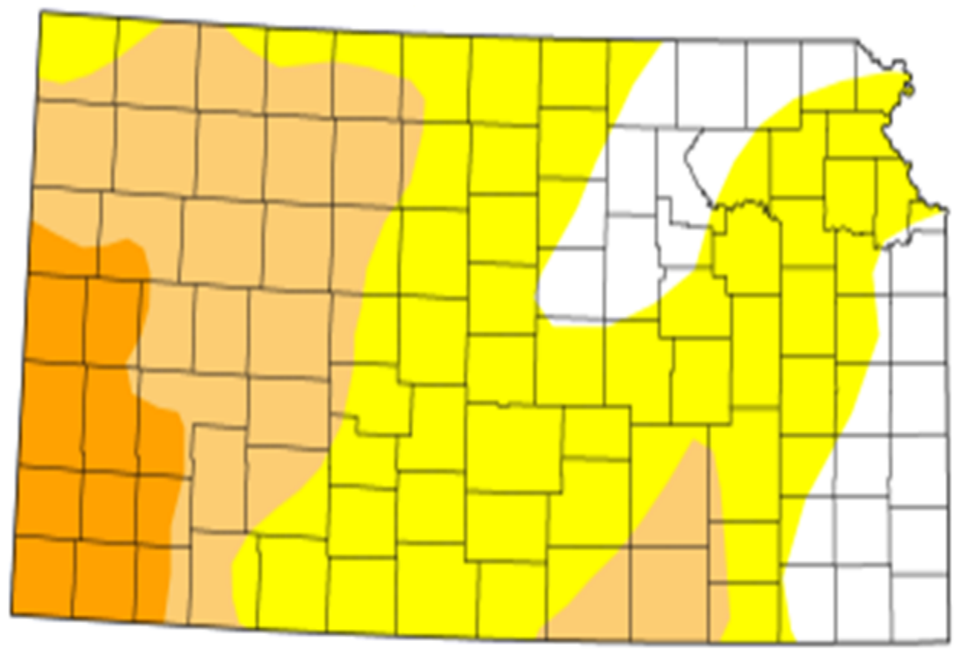
U.S. Drought Monitor

March 22, 2011
Valid 7 a.m. EST

Kansas

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	16.51	83.49	36.99	9.75	0.00	0.00
Last Week (03/15/2011 map)	26.06	73.94	33.06	5.46	0.00	0.00
3 Months Ago (12/21/2010 map)	25.23	74.77	33.40	3.48	0.00	0.00
Start of Calendar Year (12/28/2010 map)	17.82	82.18	43.85	3.48	0.00	0.00
Start of Water Year (09/28/2010 map)	83.23	16.77	0.00	0.00	0.00	0.00
One Year Ago (03/16/2010 map)	100.00	0.00	0.00	0.00	0.00	0.00



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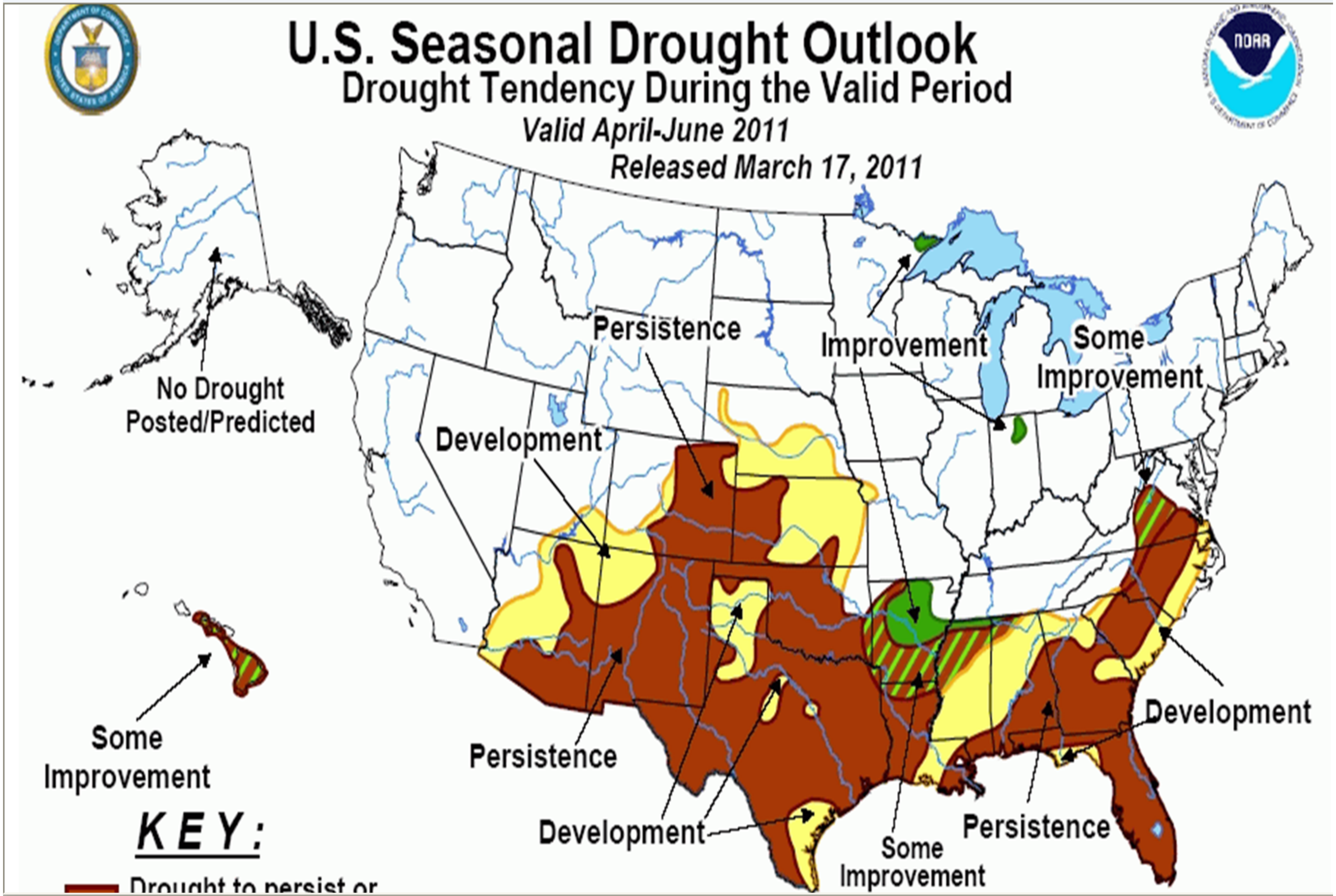
U.S. Seasonal Drought Outlook
Drought Tendency During the Valid Period
Valid April-June 2011
Released March 17, 2011
No Drought
Posted/Predicted
Development
Persistence
Improvement
Some
Improvement
Some
Improvement
Persistence
Development
Development
Some
Improvement
Persistence
Development
KEY:
Drought to persist or

Inches to gallons

- How much water does it take if you apply just ¼ inch of water to 30 acres of fairways, 2 acres of tees and 3 acres of greens (35 acres total) in one night?
- Given: 27,154 gallons per acre inch.
- Answer: 237,598 gallons of water in one night!

ARM & HAMMER
THE STANDARD OF PURITY
Pure
Baking Soda
For Baking, Cleaning & Deodorizing
Another Bright Idea!
Scratchless Cleaning
NET WT. 8 OZ. (227g)
Change Every
3 Months

Irrigation Water Quality

- Suitability for use as an irrigation water source for turfgrass
- Irrigation water characteristics influence turfgrass growth and development
- Characteristics influence soil physical or chemical properties and will influence turf
- What's dissolved?
- What's suspended?

Soil Salinity Management Testing

- Determines if soil chemistry is conducive for optimal plant growth from a “chemistry perspective”
- Can tell if conditions are right for soil chemistry problems to occur
- Is not a measure of plant health
- Is not a measure of altered soil physical properties (not a measure of infiltration rate)

Oklahoma State University
Soil, Water and Forage Lab

Irrigation Water Test - $15.00

- Na – sodium
- Ca – calcium
- Mg – magnesium
- K – potassium
- B – boron
- Cl – chloride
- NO_3 – nitrate nitrogen
- SO_4 – sulfate
- CO_3^{-2} – carbonate
- HCO_3^{-} - bicarbonate
- pH – hydrogen ion concentration
- EC – electrical conductivity
- SAR – sodium absorption ratio
- TSS – total soluble salts,
- Hardness
- Alkalinity

From Harivandi. 1999.

Table 3. Guidelines for the interpretation of water quality for irrigation

Potential irrigation problem	Unit of measure	Degree of restriction on use: None	Slight to moderate	Severe
Salinity				
ECw	dS/m	<0.7	0.7 to 3.0	>3.0
TDS	mg/L	<450	450 to 2,000	>2,000
Soil water infiltration				
(evaluate using ECw [dS/m] and SAR together)				
if SAR = 0 to 3 & ECw =		>0.7	0.7 to 0.2	<0.2
if SAR = 3 to 6 & ECw =		>1.2	1.2 to 0.3	<0.3
if SAR = 6 to 12 & ECw =		>1.9	1.9 to 0.5	<0.5
if SAR = 12 to 20 & ECw =		>2.9	2.9 to 1.3	<1.3
if SAR = 20 to 40 & ECw =		>5.0	5.0 to 2.9	<2.9
Specific ion toxicity				
Sodium (Na)				
root absorption	SAR	<3	3 to 9	>9
foliar absorption	meq/L	<3	>3	—
	mg/L	<70	>70	—
Chloride (Cl)				
root absorption	meq/L	<2	2 to 10	>10
	mg/L	<70	70 to 355	>355
foliar absorption	meq/L	<3	>3	—
	mg/L	<100	>100	—
Boron (B)	mg/L	<1.0	1.0 to 2.0	>2.0
Miscellaneous effects				
Bicarbonate (HCO_3)	meq/L	<1.5	1.5 to 8.5	>8.5
(unsightly foliar deposits)	mg/L	<90	90 to 500	>500
pH		normal range	6.5 to 8.4	
Residual chlorine (Cl_2)	mg/L	<1.0	1 to 5	>5

Salt tolerance varies in modern creeping bentgrass varieties

- Salt-tolerant cultivars included Mariner, Seaside II, Grand Prix, Seaside, 18th Green and Century.
- The least tolerant cultivars, suffering complete death after 10 weeks' exposure, were Avalon velvet bentgrass (*Agrostis canina*), Ambrosia colonial bentgrass (*Agrostis tenuis*) and creeping bentgrass cultivars SR1119, Regent, Putter, Penncross and Penn G-6.
- Source: Ken Marcum. 2000. GCM. http://www.gcsaa.org/gcm/2000/oct00/10salt.html

Oklahoma State University Soil, Water and Forage Lab

- **Salinity Management $15**
- (1:1 soil to water extraction) Na, Ca, Mg, K, B, EC, TSS (total soluble salts), SAR, Exchangeable sodium percentage (ESP), pH
- **Comprehensive Salinity $40.00**
- (Saturated paste extraction) Na, Ca, Mg, K, B, EC, TSS, SAR, ESP, pH, Cl-, CO3=, HCO3-, NO3-N, SO4=

Oakton Ec Testr 11
Model WD-35662-30
~ $81
http://www.4oakton.com

Measures 0 to 20 mS or 0 to 2000 uS with

Water Quality Issues, Impact and Management Response

Parameter	**Potential Impact**	**Mgmt Consideration**
Suspended Solids	Soil Sealing	Increased Coring
Total Nitrogen	Available at wrong time or excess quantity	Reduce fertilizations and what else?
Phosphorus & potassium	Runoff to ponds	Control runoff, monitor soil levels
Ca, Mg, Na	High SAR, Soil dispersal	Increase calcium apps
pH, carbonates, bicarbonates	Increased soil pH, nutrient availability	Acidification of water or alter nitrogen sources
Biochemical oxygen demand (BOD)	Depletes soil oxygen	Increased coring, aeration of soil
Total soluble salts (TSS), electrical conductivity	Accumulation of salts in root zone	Leaching with irrigation, aeration of soil
Boron (B), Chlorides (Cl), Sulfate (SO4)	Potential specific ion toxicity	Monitor and offset with fertility, leaching

Water Quality Issues, Impact and Management Response

Parameter	Potential Impact	Mgmt Consideration
Various Heavy Metals	Toxicity to turfgrass	Monitor and possibly precipitate with phosphorus
Certain toxic materials	Toxicity to plants	Monitor and leach, possibly treat with charcoal
Total fecal coliforms	Human pathogen	Monitor and isolate contact, improved water treatment

http://anrcatalog.ucdavis.edu/pdf/8009.pdf

PUBLICATION **8009**

Interpreting Turfgrass Irrigation Water Test Results

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The notion that water quality problems caused by soluble salts arise only—or even primarily—in regions with arid climates is far from the truth. For example, the excessive pumping of fresh water from wells in coastal areas can lead to saltwater intrusion problems. Even in high-rainfall areas the groundwater may contain significant levels of soluble salts derived from underground rock formations of marine origin. Moreover, increasing numbers of golf courses, parks, cemeteries, school campuses, industrial, and commercial turfed sites use potentially saline recycled municipal water for irrigation. The result of this breadth of use is that the effects of excess soluble salts are visible on turfgrass plantings in a wide range of climates. Water analysis and periodic monitoring have thus become key components of sound irrigation management.

Water analysis by a commercial laboratory provides data on many parameters, some of which are of little significance for turfgrass irrigation. The most important parameters for turfgrass management are total concentration of soluble salts (salinity); sodium (Na) content; relative proportion of sodium to calcium (Ca) and magnesium (Mg) (Sodium Adsorption Ratio or SAR); chloride (Cl), boron (B), bicarbonate (HCO_3), and carbonate (CO_3) content; and pH. Other parameters that you are likely to find on a water test report and that you should review are nutrient content (nitrogen, phosphorus, and potassium), chlorine content, suspended solids, and turbidity, though none of these by itself plays a major role in determining the suitability of water for irrigation.

IMPORTANT TEST PARAMETERS

Salinity. All irrigation waters contain some dissolved mineral salts and chemicals. Some soluble salts are identified as nutrients and are beneficial to turfgrass growth; others may be phytotoxic or may become so when present in high concentrations. The rate at which salts accumulate to undesirable levels in a soil depends on their concentration in the irrigation water, the amount of water applied annually, annual precipitation (rain plus snow), and the soil's physical and chemical characteristics.

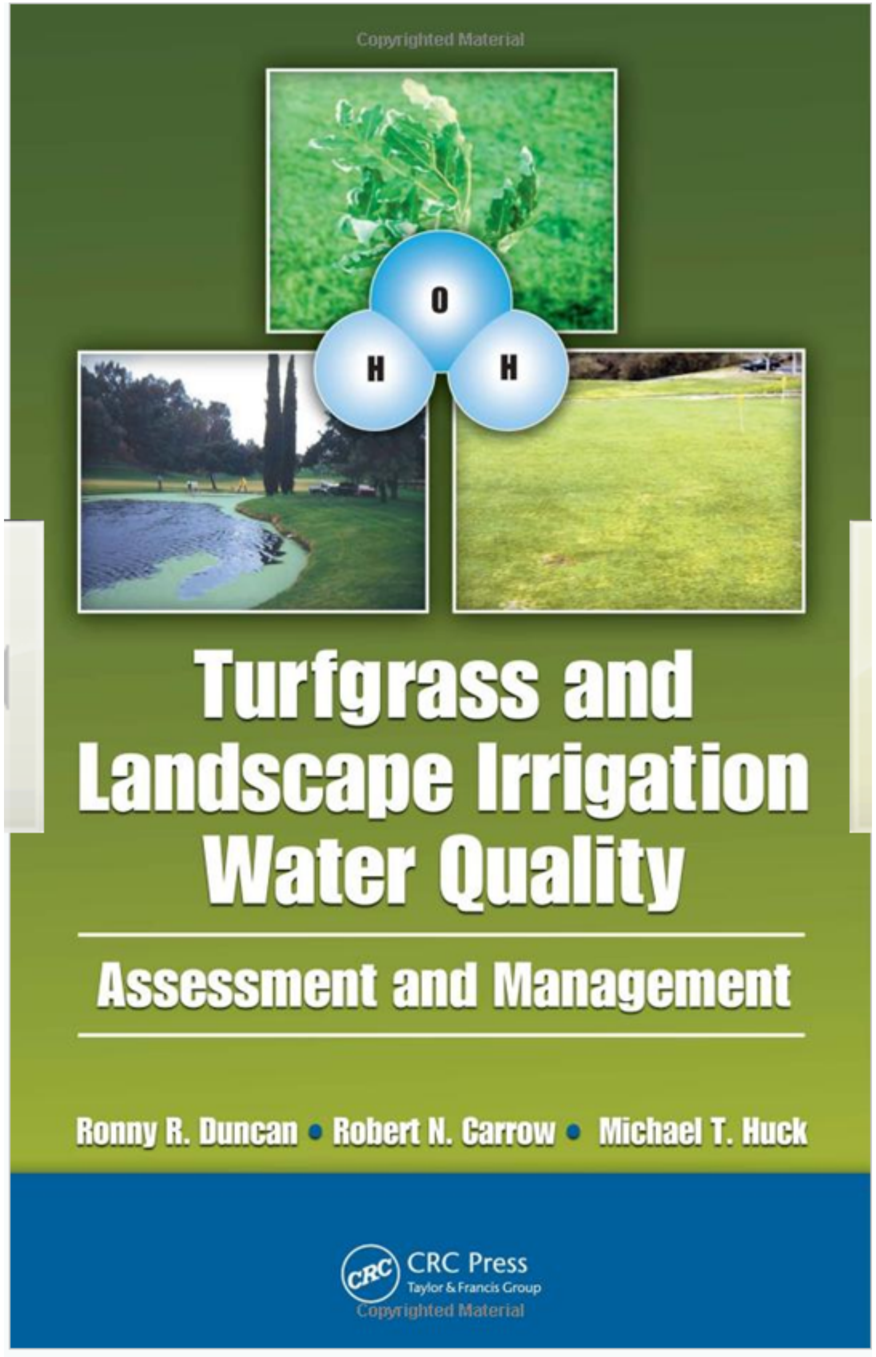
Different laboratories report water salinity in different ways: as Total Dissolved Solids (TDS) measured in parts per million (ppm) or milligrams per liter (mg/L), or as electrical conductivity (ECw) measured in millimhos per centimeter (mmhos/cm), micromhos per centimeter (µmhos/cm), decisiemens per meter (dS/m), or siemens per meter (S/m). Some labs may also report the individual components of salinity (e.g., sodium) in milliequivalents per liter (meq/L). You can use the following equations to convert results from one set of units to another, and so compare data from differently formatted reports:

(1) 1 ppm = 1 mg/L

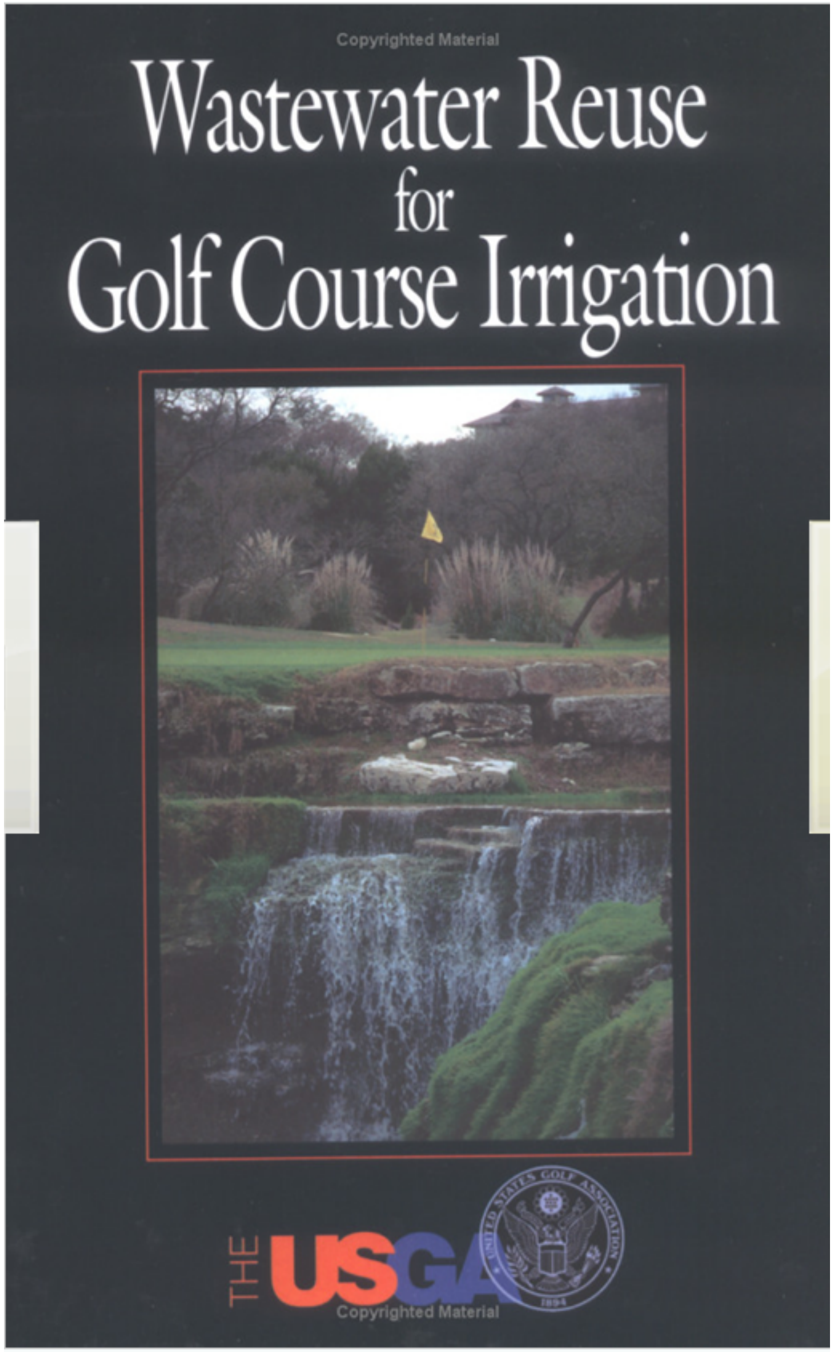
(2) 1 mg/L = meq/L × Equivalent Weight (see Table 1)

(3) 1 mmho/cm = 1 dS/m = 1,000 µmhos/cm = 0.1 S/m

Ali Harivandi. 1999. Interpreting Turfgrass Irrigation Water Test Results. Pub 8009. Univ of California.

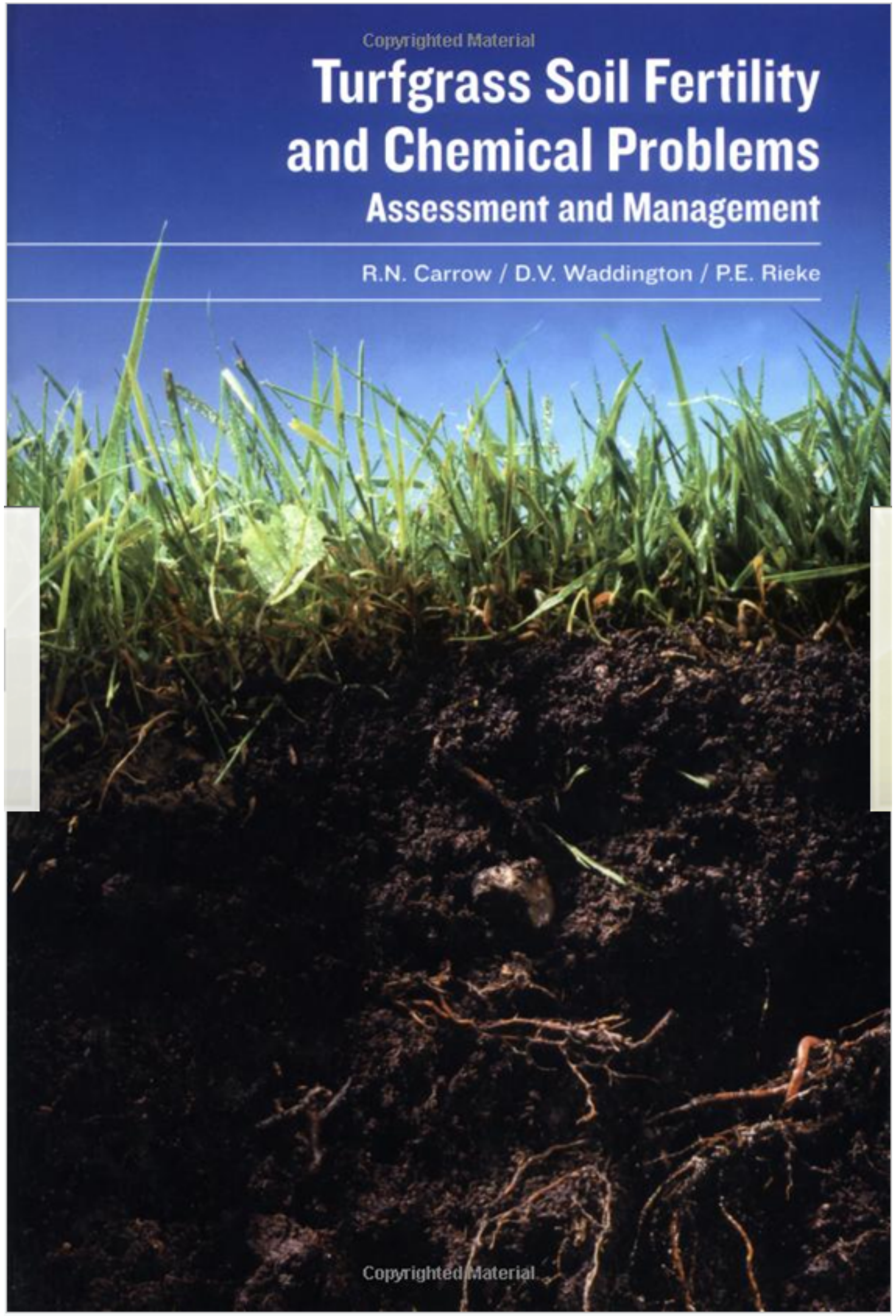


Ronny Duncan et al. 2009. Turfgrass and Landscape Irrigation Water Quality. CRC Press. ~ $94.00 New



1994. Wastewater Reuse for Golf Course Irrigation. Lewis Publishers.

~ $148 new
~ $60 used



Carrow, Waddington, Rieke. 2001. Turfgrass Soil Fertility and Chemical Properties. Ann Arbor Press.

~$104 new

~$96 used

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