

Pesticides in Surface Water, Bottom Sediment, Crayfish, and Shallow Ground Water in Las Vegas Valley Area, Carson River Basin, and Truckee River Basin, Nevada and California, 1992-95

The Las Vegas Valley, and the Carson River and Truckee River Basins (fig. 1) include the most populous areas in Nevada. Although water and bottom sediment from these areas have been analyzed for pesticides during the past 30 years, different analytical methods have been used in different studies, and few pesticides have been tested for or detected at levels of concern. Data on file at the U.S. Geological Survey (USGS) indicate that (1) the pesticides that were detected most frequently also were used the most, and (2) tests were never made for many of the pesticides used in Nevada.

Historically, pesticide monitoring in Nevada has been infrequent because of sparse agriculture and related pesticide applications and few indications of large-scale environmental problems. However, rapid population growth and changing land and water use in these urbanizing areas have increased the potential for contamination of water resources by pesticides. Because of this increased potential, the USGS investigated the three study areas from 1992 through 1995 to identify types and quantities of pesticides in surface water, bottom sediment, crayfish, and shallow ground water.

During the study, surface-water samples were collected May through August 1994. Site 1 on Las Vegas Wash (fig. 2) was sampled from April 1993 through March 1995. Single samples of bottom sediment, crayfish, and shallow ground water were collected. Surface- and ground-water samples were analyzed for 84 pesticide compounds, more than twice the number in past studies. The method detection limits or estimated minimum reporting levels for pesticides in water samples were at or below 0.05 µg/L (micrograms per liter). Bottom-sediment and crayfish samples were analyzed only for organochlorine pesticides; estimated minimum reporting levels ranged from 1 to 500 µg/kg (micrograms per kilogram).

The three areas discussed in this report constitute the Nevada Basin and Range study unit (NVBR), which is 1 of 60 river-basin scale study areas of the USGS National Water-Quality Assessment (NAWQA) Program. The NAWQA Program is an effort to describe water-quality conditions for a large part of the Nation's streams and aquifers. This fact sheet summarizes the results of pesticide data collected by NVBR personnel.

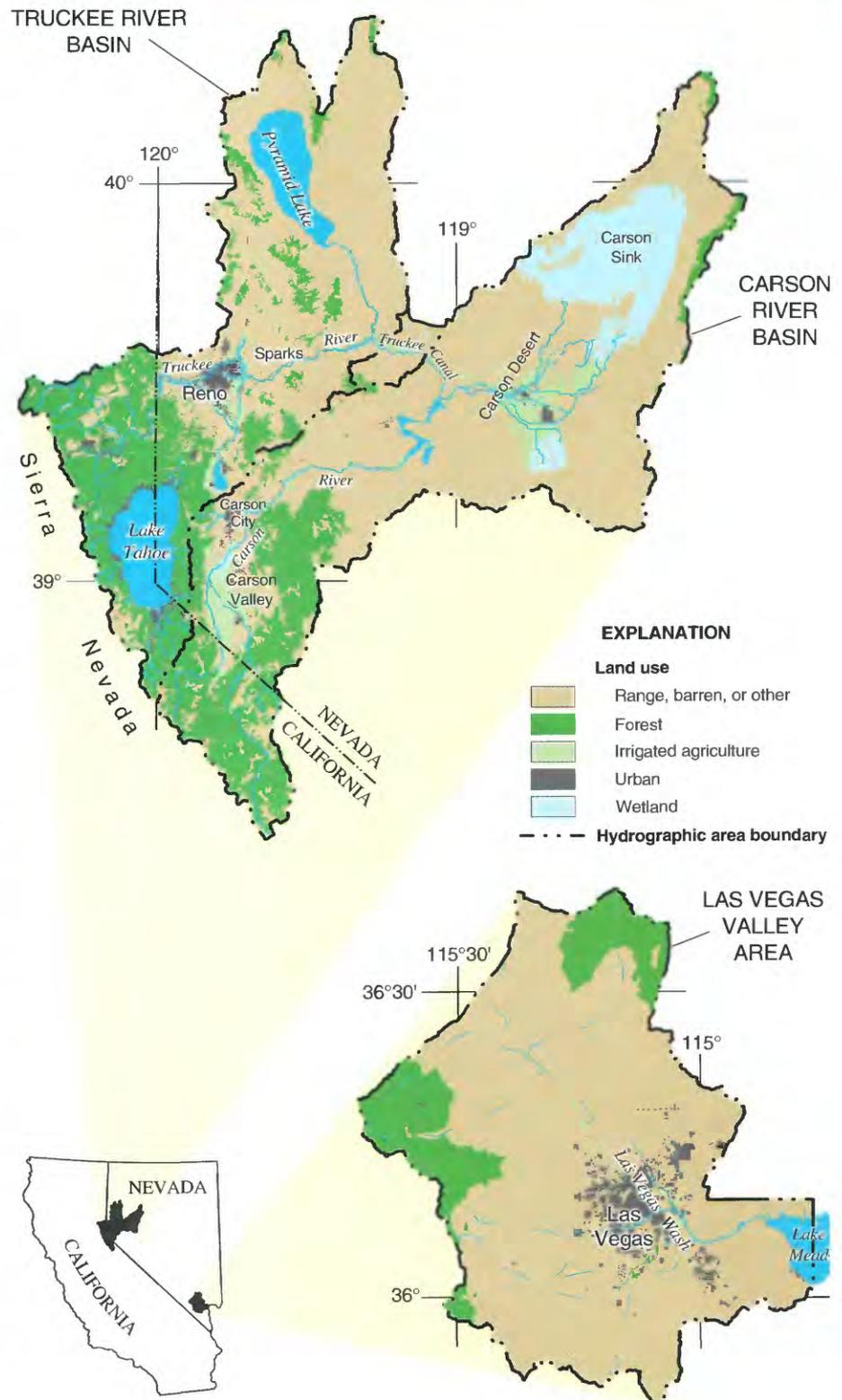


Figure 1. Location and land use of the Las Vegas Valley area, and the Carson River and Truckee River Basins. Land use from U.S. Geological Survey digital data, 1:250,000 scale; 1973-83.

SURFACE WATER

Las Vegas Wash is perennial from Las Vegas to Lake Mead because of urban drainage and effluent from sewage treatment plants. Water samples were collected at sites 1 and 3 on the mainstem of the Wash and at site 2 on the Las Vegas Wasteway, a channel that carries treated sewage effluent to the Wash (fig. 2, tables 1 and 2). Four insecticides (carbofuran, chlorpyrifos, diazinon, and malathion) and four herbicides (atrazine, pendimethalin, prometon, and simazine) were present at all three sites. Simazine was present in samples from site 1 at concentrations up to 10 µg/L, exceeding the U.S. Environmental Protection Agency's (EPA) maximum contaminant level (MCL) of 4 µg/L (U.S. Environmental Protection Agency, 1995) for safe drinking water.

The Carson River flows approximately 290 miles from headwater areas in the Sierra Nevada to its terminus in Carson Sink. Water samples were collected at sites 6-9 and 11 on the Carson River, and at site 10 on an irrigation canal (fig. 3, tables 1 and 2). Pesticides were present in samples from five of six sites sampled. The herbicide pebulate was present at site 7, a forested headwater reach, and site 11, an irrigated agriculture reach. The

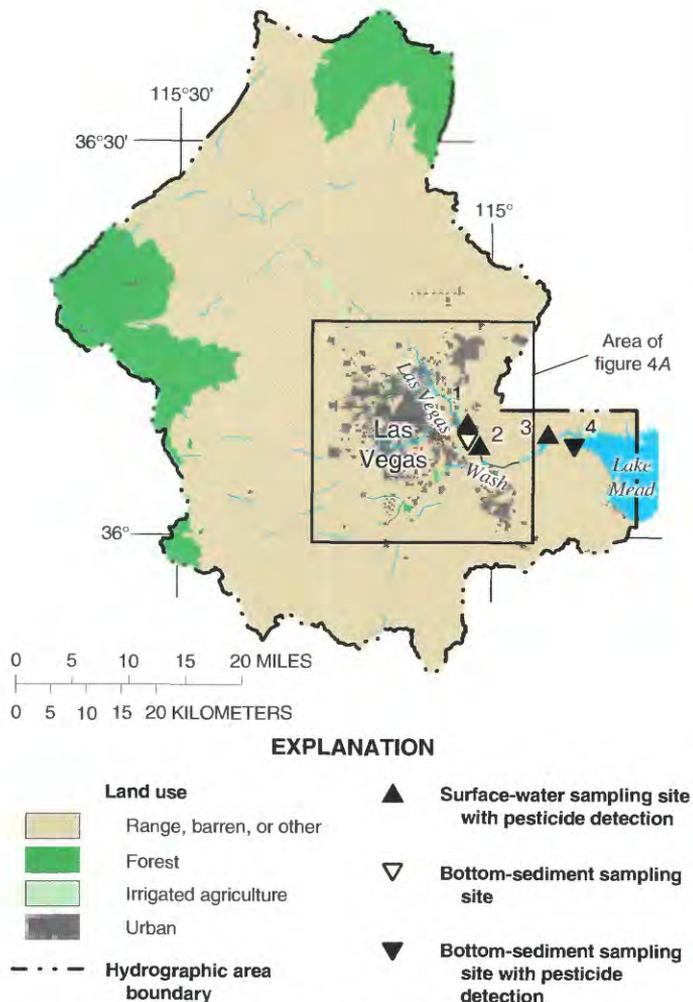


Figure 2. Surface-water and bottom-sediment sampling sites for pesticides in the Las Vegas Valley area. Site numbers refer to table 1.



Automatic sampling device installed at Las Vegas Wash. Sample bottles are enclosed in refrigeration unit to preserve pesticide samples until they are processed (photograph by Kenneth J. Covay, U.S. Geological Survey).

Table 1. Surface-water site number, station name, and sample type for pesticide study, 1992-95

Abbreviations: SW, surface water; BS, bottom sediment; C, crayfish

Site no. (figs. 2 and 3)	Station name	Sample type
Las Vegas Valley Area		
1	Las Vegas Wash below Flamingo Wash, Nev.	SW, BS, C
2	Las Vegas Wasteway near Las Vegas Wash, Nev.	SW
3	Las Vegas Wash below Lake at Las Vegas, Nev.	SW
4	Las Vegas Bay, Lake Mead, near Gypsum Wash, Nev.	BS
Carson River Basin		
5	East Fork Carson River below Markleeville, Calif.	BS, C
6	East Fork Carson River near Gardnerville, Nev.	SW, BS, C
7	West Fork Carson River at Woodfords, Calif.	SW
8	Carson River at Deer Run Rd., Nev.	SW, BS, C
9	Carson River near Fort Churchill, Nev.	SW, BS, C
10	Stillwater Point Reservoir Diversion Canal, Nev.	SW
11	Carson River at Tarzyn Rd. near Fallon, Nev.	SW, BS
Truckee River Basin		
12	Upper Truckee River at South Lake Tahoe, Calif.	SW, BS, C
13	Truckee River at Farad, Calif.	SW, BS, C
14	Truckee River near Sparks, Nev.	SW, BS, C
15	North Truckee Drain at Kleppe Lane near Sparks, Nev.	SW
16	Steamboat Creek at Clearwater Way near Reno, Nev.	SW
17	Reno-Sparks Sewage Treatment Plant Outfall, Nev.	SW
18	Truckee River at Lockwood, Nev.	BS, C
19	Truckee River at Clark, Nev.	SW, BS, C
20	Truckee River near Nixon, Nev.	SW, BS, C

insecticide diazinon was present at site 8, downstream from Carson City. The insecticide carbofuran was present at site 9, a range reach. Several pesticides were present at site 10 in the drainage of the Carson Desert agricultural area. The herbicides atrazine, deethyl atrazine (a degradation product of atrazine), simazine, prometon, and pebulate were present in samples from two or more sites (table 2).

The Truckee River flows about 190 miles from its headwaters in Lake Tahoe Basin to its terminus in Pyramid Lake. Water samples were collected on the Upper Truckee River at site 12; on the mainstem of the Truckee River at sites 13, 14, 19, and 20; at tributary sites 15 and 16; and on the Reno-Sparks sewage-treatment plant outfall at site 17 (fig. 3, tables 1 and 2). Pesticides were present in samples from seven of the eight sites. DCPA was the only pesticide present at site 13, in a forested headwater reach. Pesticides were most abundant at sites downstream from the Reno-Sparks urban area and in the Reno-Sparks sewage-treatment plant outfall. The pesticides 2,4-D, atrazine, carbaryl, DCPA, deethyl atrazine, diazinon, malathion, prometon, and simazine were present in samples from two or more sites (table 2).

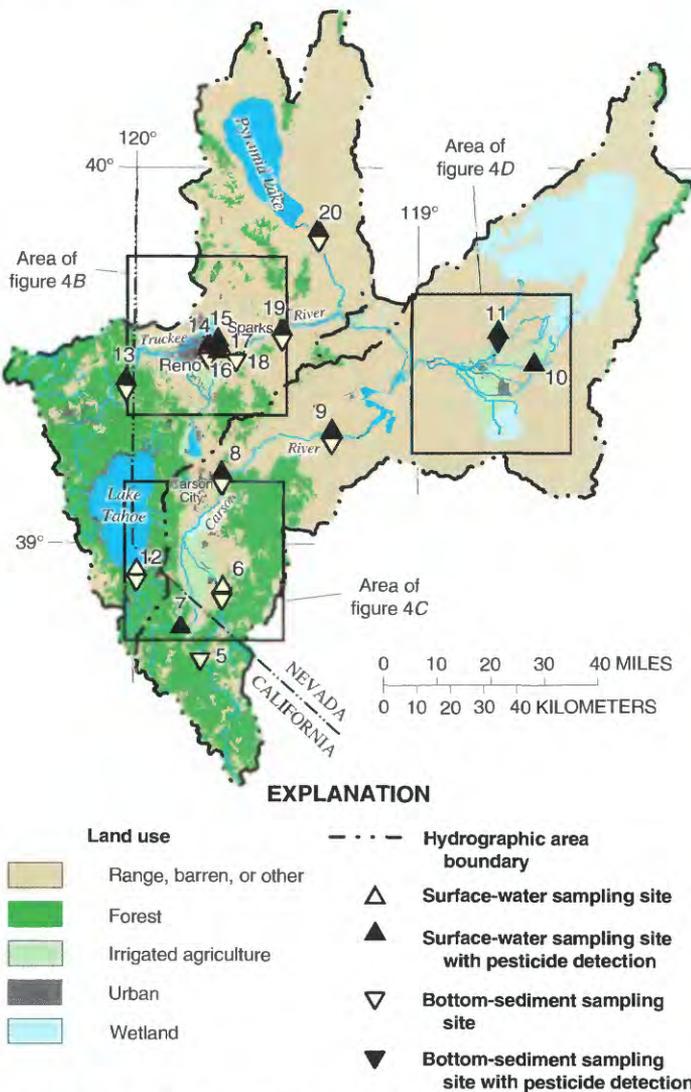


Figure 3. Surface-water and bottom-sediment sampling sites for pesticides in the Carson River and Truckee River Basins. Site numbers refer to table 1.

In summary, pesticides were detected in surface water from 15 of 17 sites sampled. Detections were most frequent downstream from urban and agricultural areas and least frequent downstream from forested headwater and range areas. The most frequently detected herbicides were simazine (12 sites), atrazine (11 sites), prometon (10 sites), and deethyl atrazine (9 sites). The most frequently detected insecticide was diazinon (9 sites). Except for simazine in a sample from site 1, pesticide concentrations were below the EPA MCL's for safe drinking water.

BOTTOM SEDIMENT

Bottom-sediment samples for organochlorine pesticide analyses were collected from Las Vegas Wash (site 1) and Lake Mead (site 4) (fig. 2, table 1). Metabolites of the pesticide DDT—*o,p'*-DDD (1.5 µg/kg dry weight), *p,p'*-DDE (1.8 µg/kg), and *o,p'*-DDE (4.3 µg/kg)—were present only in the sample from site 4. Of the five sites sampled in Carson River Basin, only site 11 had a pesticide detection (*p,p'*-DDE) (fig. 3, table 1). No pesticides were detected at the six sites in the Truckee River Basin.

Table 2. Pesticide and maximum concentration in surface-water samples, 1993-95

Site no. (figs. 2 and 3)	No. of samples	Pesticide and concentration (micrograms per liter)
Las Vegas Valley Area		
1	68	2,4-D, 0.33; alachlor, 0.013; atrazine, 0.095; carbaryl, 0.11; carbofuran, 0.026; chlorpyrifos, 0.16; DCPA, 0.045; deethyl atrazine, 0.008; diazinon, 0.46; dichlorprop, 0.10; dieldrin, 0.026; diuron, 13; linuron, 0.25; malathion, 0.38; methomyl, 0.14; metolachlor, 0.10; metribuzin, 0.093; oryzalin, 1.7; pendimethalin, 0.05; prometon, 4.2; simazine, 10; tebuthiuron, 0.061; terbacil, 0.072; trifluralin, 0.015
2	4	atrazine, 0.009; carbofuran, 0.16; chlorpyrifos, 0.059; cyanazine, 0.031; diazinon, 0.18; malathion, 0.10; pendimethalin, 0.014; prometon, 0.17; simazine, 0.60
3	5	atrazine, 0.005; α-BHC, 0.022; carbofuran, 0.051; chlorpyrifos, 0.025; cyanazine, 0.039; diazinon, 0.14; diuron, 1.4; fonofos, 0.007; malathion, 0.033; pendimethalin, 0.009; prometon, 0.34; simazine, 0.26
Carson River Basin		
6	4	no detection
7	4	pebulate, 0.009
8	8	atrazine, 0.029; diazinon, 0.032; deethyl atrazine, 0.010; prometon, 0.005; simazine, 0.005
9	4	atrazine, 0.005; carbofuran, 0.033; simazine, 0.003
10	4	2,4-D, 1.5; atrazine, 0.008; cyanazine, 0.028; deethyl atrazine, 0.008; EPTC, 0.016; prometon, 0.058; simazine, 0.007
11	4	atrazine, 0.003; deethyl atrazine, 0.005; pebulate, 0.009; simazine, 0.005
Truckee River Basin		
12	4	no detection
13	4	DCPA, 0.001
14	4	atrazine, 0.005; deethyl atrazine, 0.001; malathion, 0.067
15	4	atrazine, 0.012; carbaryl, 0.017; diazinon, 0.014; deethyl atrazine, 0.016; prometon, 0.009; simazine, 0.035
16	4	2,4-D, 0.12; atrazine, 0.003; aldicarb sulfone, 0.07; carbaryl, 0.034; deethyl atrazine, 0.002; diazinon, 0.03; metribuzin, 0.005; prometon, 0.12; simazine, 0.086
17	4	carbaryl, 0.11; chlorpyrifos, 0.021; DCPA, 0.001; diazinon, 0.36; deethyl atrazine, 0.01; lindane, 0.033; malathion, 0.019; prometon, 0.049; simazine, 0.083
19	8	2,4-D, 0.19; atrazine, 0.005; carbaryl, 0.006; DCPA, 0.001; <i>p,p'</i> -DDE, 0.003; diazinon, 0.041; deethyl atrazine, 0.007; prometon, 0.027; simazine, 0.013
20	4	diazinon, 0.011; prometon, 0.007; simazine, 0.004

Table 3. Pesticide and maximum concentration in urban and agricultural shallow ground-water sites sampled, 1993-95

Site no. (fig. 4)	Station no.	Pesticide and concentration (micrograms per liter)
Las Vegas Valley Area Urban Wells		
1	360921115093601	prometon, 0.011
2	360838115101801	oryzalin, 0.080; simazine, 0.015
3	360852115060901	simazine, 0.022
4	360821115025001	atrazine, 0.026
5	360735115105201	prometon, 0.006
6	360648115084901	atrazine, 0.008; tebuthiuron 0.035
7	360640115070401	atrazine, 0.045; prometon, 0.004
8	360605115052501	prometon, 0.018
9	360647115044001	prometon, 0.065
Reno-Sparks Area Urban Wells		
10	393328119432001	atrazine, 0.021
11	393257119441401	atrazine, 0.009; deethyl atrazine, 0.003; prometon, 0.007; simazine, 0.051
12	393211119472901	simazine, 0.016
13	393022119444301	atrazine, 0.016; deethyl atrazine, 0.010; simazine, 0.033
14	393206119425301	atrazine, 0.013; deethyl atrazine, 0.040
15	393139119493401	atrazine, 0.003; deethyl atrazine, 0.005
16	393132119482201	deethyl atrazine, 0.004
17	393123119452301	atrazine, 0.006; deethyl atrazine, 0.005; diazinon, 0.010; prometon, 4.0; simazine, 1.1
18	393017119533101	atrazine, 0.10; deethyl atrazine, 0.049
19	393045119500701	atrazine, 0.018; deethyl atrazine, 0.032
20	393055119482001	atrazine, 0.002; deethyl atrazine, 0.003
21	393032119473501	deethyl atrazine, 0.004
22	393033119465401	deethyl atrazine, 0.090
23	392937119452601	p,p'-DDE, 0.002
24	392917119464901	diuron, 0.010
25	392855119462301	prometon, 0.013; terbacil, 0.034
26	392744119464601	atrazine, 0.032; p,p'-DDE, 0.002; diazinon, 0.007; prometon, 0.040; simazine, 0.088
27	392554119455801	prometon, 0.023; simazine, 0.029
28	392459119433701	simazine, 0.14
Carson Valley Agricultural Wells		
29	390137119452601	atrazine, 0.018; deethyl atrazine, 0.006; simazine, 0.13
30	390009119472701	atrazine, 1.2; deethyl atrazine, 0.032; simazine, 0.022
31	395948119464401	atrazine, 0.006; bromacil, 0.020; simazine, 0.008
32	385834119464101	simazine, 0.059
33	385430119422401	atrazine, 0.020; deethyl atrazine, 0.005
Carson Desert Agricultural Wells		
34	393214118421701	deethyl atrazine, 0.003; simazine, 0.005
35	392948118561101	acetochlor, 0.023; simazine, 0.011
36	392735118484501	simazine, 0.016

CONCLUSIONS

Pesticides in small concentrations were present in the surface- and ground-water systems of the three study areas. The herbicides atrazine, deethyl atrazine, prometon, and simazine, and the insecticide diazinon were found in both surface- and ground-water samples. The percent of ground-water sites in urban areas affected by pesticides (28 percent in Las Vegas and 68 percent in Reno-Sparks) is somewhat greater than in agricultural areas (25 percent in Carson Valley and 30 percent in Carson Desert). The variety of pesticides detected in surface- and ground-water samples was greater in urban areas than in those from agricultural areas. Metabolites of DDT were detected only in bottom sediment from Las Vegas Bay (site 4) and Carson River (site 11). Only the herbicide simazine was found to exceed the EPA MCL for safe drinking water in one surface-water sample from Las Vegas Wash (site 1).

—Kathryn C. Kilroy and Sharon A. Watkins

REFERENCES

- Covay, K.J., Banks, J.M., Bevans, H.E., and Watkins, S.A., 1996, *Environmental and hydrologic settings of the Las Vegas Valley area and the Carson and Truckee River Basins, Nevada and California*: U.S. Geological Survey Water-Resources Investigations Report 96-4087, 72 p.
- U.S. Environmental Protection Agency, 1995, *Drinking water standards and health advisories table*: Washington, D.C., U.S. Environmental Protection Agency, August 1995, 25 p.

This fact sheet is a product of the National Water-Quality Assessment (NAWQA) Program. The Nevada Basin and Range is 1 of 60 areas distributed throughout the Nation that are being studied by the NAWQA Program to (1) provide a nationally consistent description of current water-quality conditions; (2) define long-term trends in water quality; and (3) identify, describe, and explain, as possible, the major factors that affect observed water-quality conditions and trends.

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CRAYFISH

Crayfish were sampled for organochlorine pesticides at 11 sites (table 1). No organochlorine pesticides were detected in any of the crayfish samples.

SHALLOW GROUND WATER

Shallow ground water (less than 100 ft [feet] below land surface) was sampled in the Las Vegas and Reno-Sparks urban areas, and in the Carson Valley and Carson Desert agricultural areas (fig. 4, table 3). These samples were collected to determine which pesticides enter ground water as a result of human activities associated with land use. Shallow monitoring wells were either installed by NAWQA personnel or selected from available monitoring wells operated by other agencies. None of the wells are used for domestic or public water supplies.

Urban Ground Water

Ground water in shallow aquifers was sampled at 32 sites in the Las Vegas urban area (fig. 4A, table 3). Depth of wells sampled ranged from 11 to 84 ft. Pesticides were present in water samples from nine sites in the central and southeastern parts of the area. Samples from three of the nine sites had more than one pesticide present. Atrazine, prometon, and simazine were detected most frequently, but at concentrations only slightly above the detection limits or minimum reporting levels.

Ground water in shallow aquifers was sampled at 28 sites in the Reno-Sparks urban area (fig. 4B, table 3). Depth of wells sampled ranged from 15 to 78 ft. Pesticides were present in samples from 19 sites throughout the area. Samples from 11 of the 19 sites had more than one pesticide present. Atrazine, deethyl atrazine, prometon, and simazine were detected most frequently.

In summary, pesticides were present in samples from 28 of 60 urban shallow ground-water sites. The herbicides atrazine (13 sites), deethyl atrazine (11 sites), prometon (10 sites), and simazine (9 sites) were detected in both urban areas. All detections were less than the EPA MCL's for safe drinking water.



Processing bottom sediment for analysis of organic compounds (left) and trace elements (right), Truckee River at Reno, September 1992 (photograph by Ronald P. Collins, U.S. Geological Survey).

Agricultural Ground Water

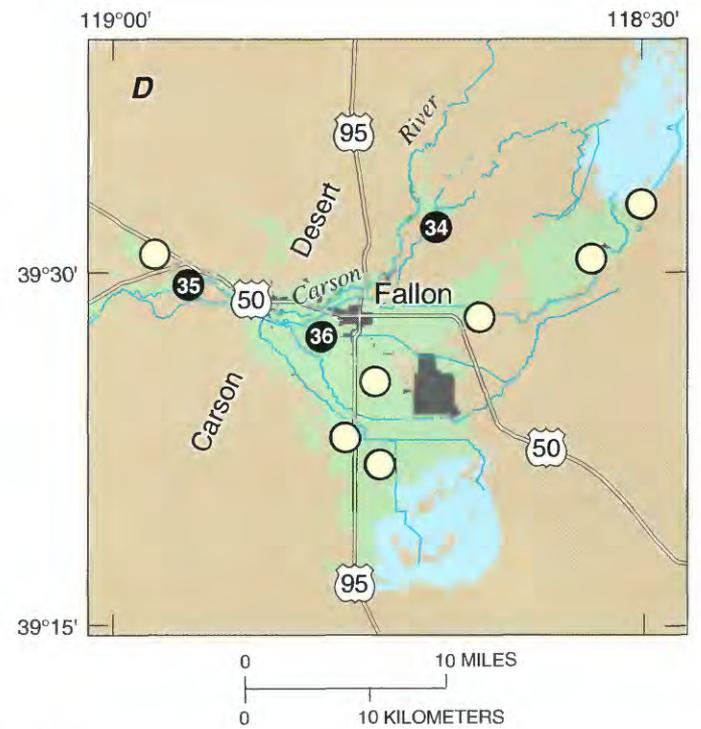
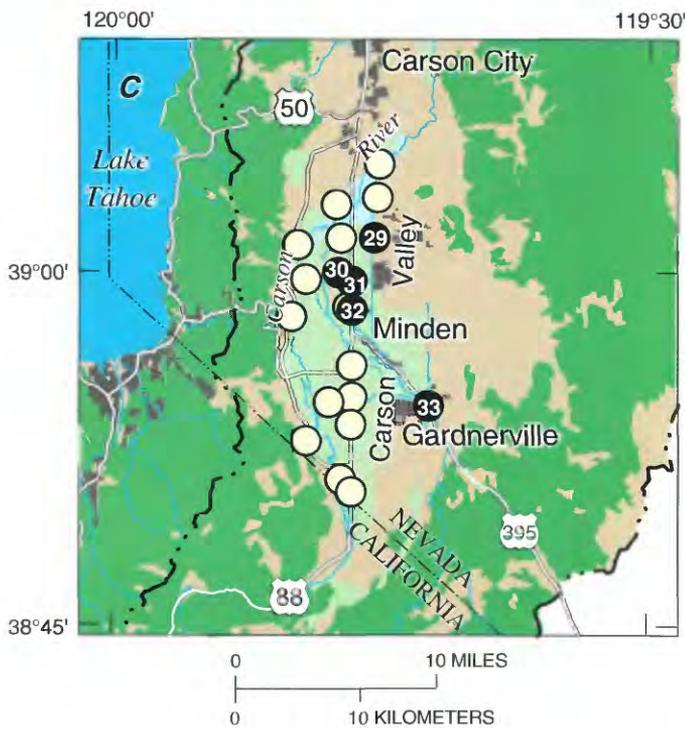
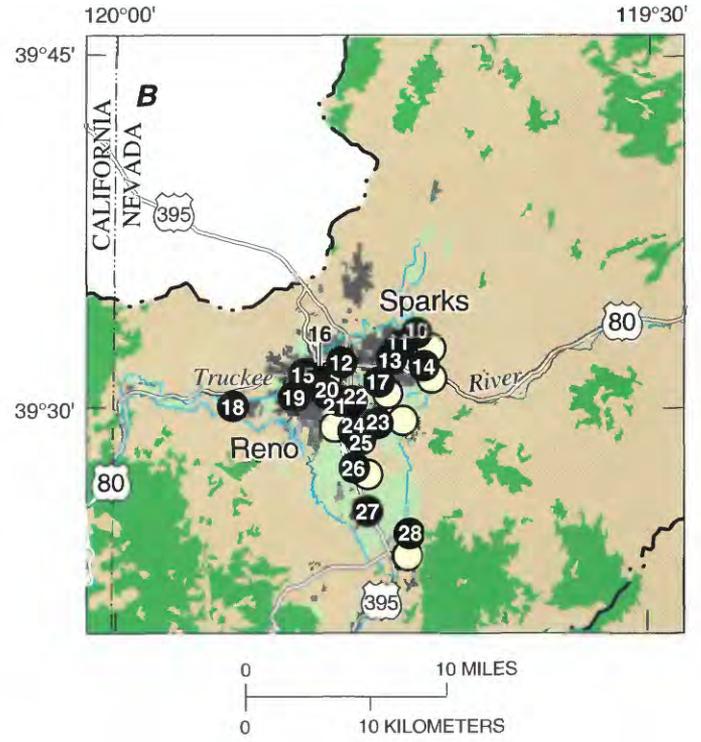
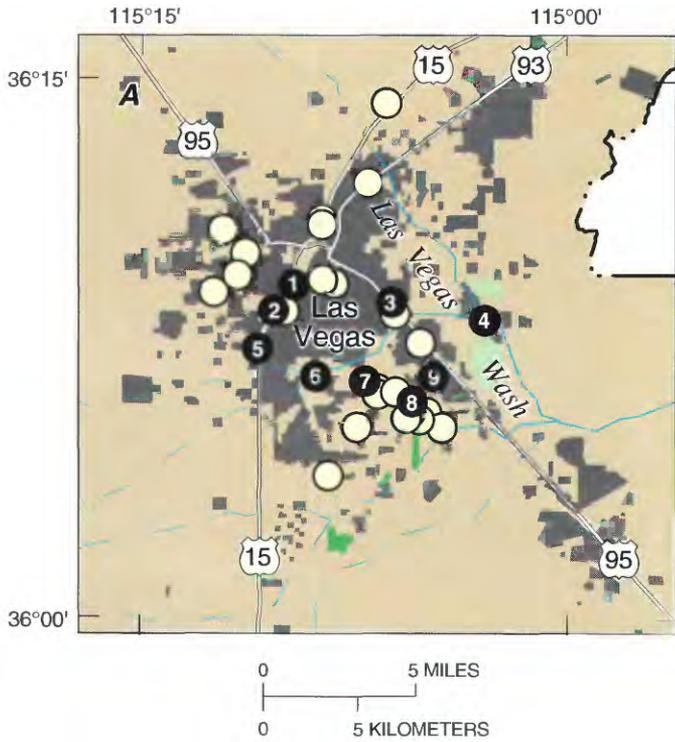
Ground water in shallow aquifers was sampled at 20 sites in Carson Valley agricultural areas (fig. 4C, table 3). Depth of wells sampled ranged from 11 to 35 ft. Pesticides were present in samples from five sites in the eastern part of Carson Valley. Samples from four of the five sites had more than one pesticide present. Atrazine, bromacil, deethyl atrazine, and simazine were detected at concentrations slightly above the detection limits or minimum reporting levels.

Ground water in shallow aquifers was sampled at 10 sites in Carson Desert agricultural areas (fig. 4D, table 3). Depth of wells sampled ranged from 11 to 28 ft. Pesticides were present at three sites in west-central Carson Desert. Simazine was detected at these three sites at concentrations slightly above the detection limits or minimum reporting levels.

In summary, pesticides were present in samples from 8 of 30 agricultural shallow ground-water sites. The herbicide simazine (7 sites) was found in both agricultural areas. The herbicide atrazine (four sites) was detected only in Carson Valley. All detections were less than the EPA MCL's for safe drinking water.



Installation of ground-water monitoring well by U.S. Geological Survey personnel, August 1993 (photograph by Kenneth J. Covay, U.S. Geological Survey).



EXPLANATION

Land use		
	Range, barren, or other	
	Irrigated agriculture	
	Forest	
	Urban	33
	Wetland	Ground-water sampling site with pesticide detection
		Hydrographic area boundary

Figure 4. Shallow ground-water sample sites in (A) Las Vegas urban area; (B) Reno-Sparks urban area; (C) Carson Valley agricultural area; and (D) Carson Desert agricultural area. Site numbers refer to table 3.