Idaho's Nitrate Areas of Concern

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Idaho's major agencies that deal with water—the Idaho Department of Environmental Quality (IDEQ), the Idaho Department of Water Resources (IDWR), and the Idaho State Department of Agriculture (ISDA)—have identified 25 geographic areas within the state that have elevated concentrations of nitrates in aquifers (groundwater) (Fig. 1). Over the past 50 years within each of these 25 geographic areas, human activities have contributed to the elevated nitrate concentrations in groundwater.

Why Should I Be Concerned?

Nearly 95 percent of Idaho residents rely on groundwater as their source of drinking water. Idaho's nitrate areas of concern are found in 23 counties throughout the state. Over 38 percent of the state's population lives in these 25 nitrate priority areas. High levels of nitrates in water supplies have been linked to health concerns in humans (see "Health Concerns").

If you live in one of the 25 nitrate areas of concern your agricultural and/or domestic (septic systems) operations may be required to comply with best management practices (BMPs). A BMP is a practice or combination of practices determined to be the most effective practical means of preventing or reducing pollution. A BMP must be technically and economically feasible as well as socially acceptable.

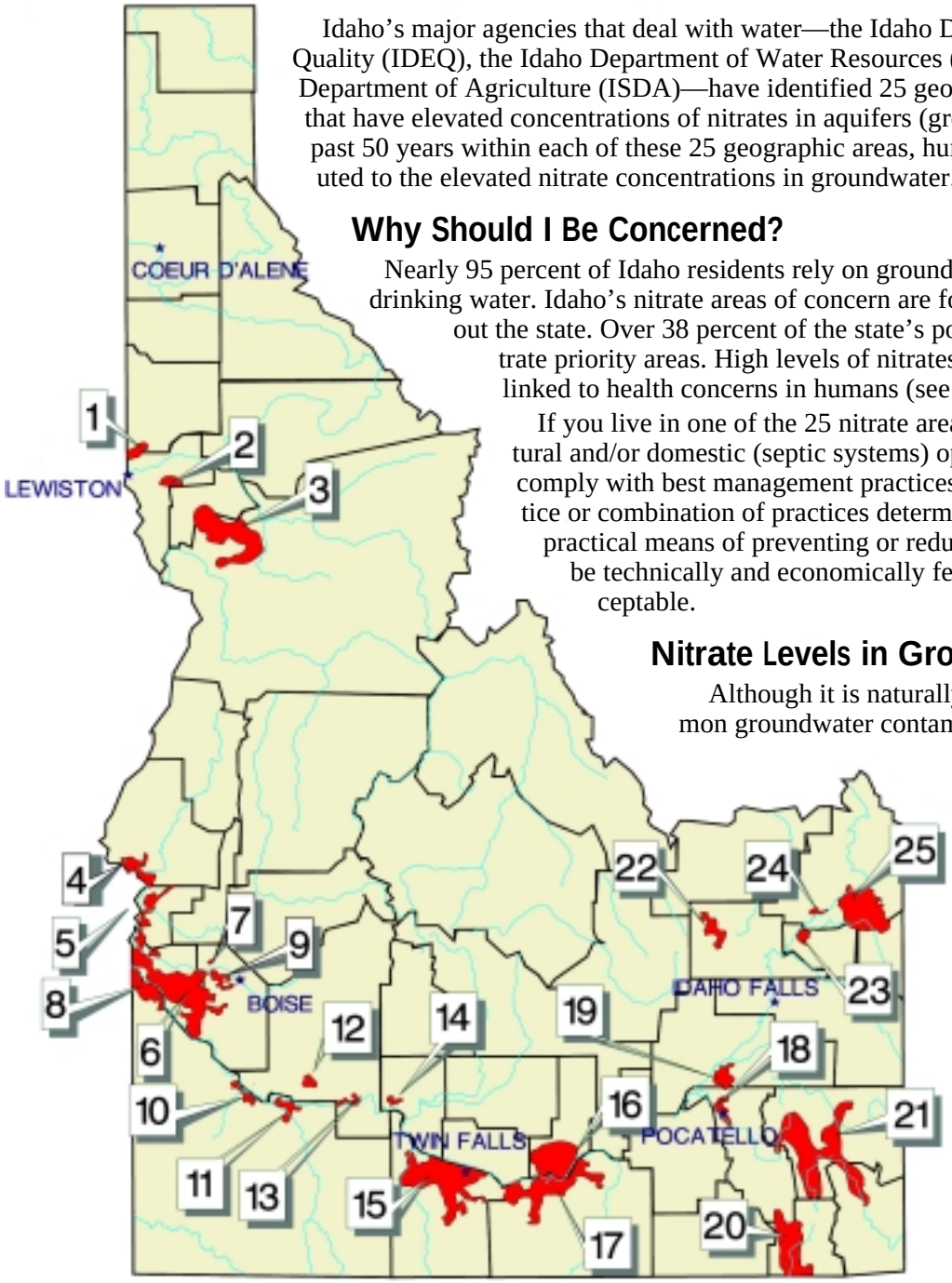

Fig. 1. Idaho's 25 nitrate areas of concern. The areas are: (1) Genesee/Cow Creek; (2) Lapwai Creek; (3) Camas Prairie; (4) Weiser; (5) Payette; (6) Lower Boise/Canyon County; (7) Eagle/Star; (8) Homedale/Marsing; (9) Boise/Meridian; (10) Grandview; (11) Bruneau; (12) Mountain Home; (13) Hammett; (14) Bliss; (15) Twin Falls; (16) Rupert; (17) Burley/Marsh Creek; (18) Pocatello; (19) Fort Hall; (20) Preston/Cache Valley; (21) Soda Springs/Bear River; (22) Mud Lake; (23) Hibbard; (24) St. Anthony; and (25) Ashton/Drummond/Teton.

Nitrate Levels in Groundwater

Although it is naturally occurring, nitrate is a common groundwater contaminant in the U.S. The severity of nitrate contamination is hard to assess, but most researchers agree that nitrate concentrations in unpolluted groundwater seldom exceed 1.0 part per million (ppm) nitrate-nitrogen (NO_3-N). Conversely, NO_3-N values greater than 2.0 ppm indicates that human activities have put nitrate into groundwater. The higher the NO_3-N value above 2.0 ppm the greater the adverse impact on water quality by human activities.

Health Concerns

Human—Humans ingest nitrate in food and water. In older children and adults, nitrate is ingested, absorbed from the digestive tract, and excreted rapidly in the urine. Healthy human adults can consume nitrate with little if

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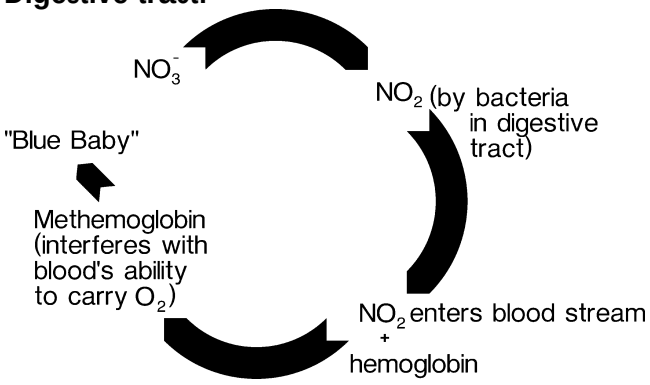


Fig. 2. Conversion of nitrate in the digestive tract of an infant (less than six months old).

any known short-term adverse effects. The health effects of chronic, long-term consumption of high levels of nitrate are uncertain. They are the subject of several current research studies.

Infants younger than 6 months of age are believed to be susceptible to nitrate poisoning. Bacteria present in their digestive systems at birth can change nitrate to toxic nitrite (NO_2) (Fig. 2). Newborn infants have little acid in their digestive tracts, and they depend on these bacteria to help digest food. Generally, by the time infants reach 6 months of age, hydrochloric acid levels increase in their stomachs and kill most of the bacteria that convert nitrate to nitrite.

Once formed, the nitrite is absorbed and enters the bloodstream. There it reacts with the oxygen-carrying hemoglobin to form a new compound called methemoglobin. This compound interferes with the blood's ability to carry oxygen. As oxygen levels decrease, babies may show signs of suffocation. This condition is called "methemoglobinemia," better known as "blue baby syndrome."

The major symptom of methemoglobinemia is bluish skin color, most noticeably around the eyes and mouth. Death can occur when 70 percent of the hemoglobin has been converted to methemoglobin. Treatment must begin quickly.

Infant deaths from methemoglobinemia, sometimes called "blue baby syndrome," are rare. Some documented deaths have been linked to high levels of nitrate in well water. Doctors now recommend using bottled or treated water to make formula for infants when nitrate levels exceed the U.S. Public Health Service drinking water standard of 10 parts per million (ppm NO_3-N) (Table 1). Pregnant women should also use bottled water if NO_3-N levels in the drinking water source exceed 10 ppm.

Interpretation, Testing, and Treatment

In general, groundwater containing less than 10 ppm NO_3-N is safe to drink (Table 1). Surveys conducted by regulatory agencies in Idaho have indicated that upwards of 96 percent of the private wells in Idaho are safe for drinking based on the 10.0 ppm

Table 1. Guidelines for use of water with known nitrate content.

Nitrate-Nitrogen (NO_3-N)	Nitrate (NO_3)	Interpretation*
(ppm)	(ppm)	
0 to 10	0 to 44	Safe for humans and livestock.
11 to 20	45 to 88	Generally safe for human adult and livestock. Do not use for human infants.
21 to 40	89 to 176	Short-term use acceptable for human adults and all livestock unless food or feed sources are very high in nitrate. Long-term use could be risky. Do not use for human infants.
41 to 100	177 to 440	Moderate to high risk for human adults and young livestock. Probably acceptable for mature livestock if feed is low in nitrate. Do not use for human infants.
over 100	over 400	Do not use.

*Interpretations are primarily based on short-term effects. Chronic, long-term risks are not fully understood.

NO_3-N standard. An additional 3 percent of private wells contain between 10 and 20 ppm NO_3-N. Water from these wells is safe for human adults but should not be given to infants. Less than 1 percent of the private wells in the state contain more than 20 ppm NO_3-N.

If nitrate is suspected in well water used by humans or livestock for drinking, begin a routine water sampling and testing program to monitor nitrate levels. Nitrate is detectable in water only by chemical testing. It is colorless, odorless, and tasteless. In Idaho, the Department of Health and Welfare, the University of Idaho, and private testing laboratories can test for nitrate.

Most laboratories usually report nitrate content in parts per million (ppm) of nitrate-nitrogen (NO_3-N). Occasionally, a lab will report results in ppm NO_3. To interpret the results, you must know the form in which they are reported. To convert NO_3-N to NO_3, multiply by 4.4. For example, 10 ppm NO_3-N equals 44 ppm NO_3.

Some water treatment systems remove nitrates from water. The most commonly used systems contain anion exchange columns. For information on certified treatment systems that remove nitrate contact the National Sanitation Foundation (www.nsf.org). *Boiling water will not remove nitrates but rather will concentrate them.*

What Causes the Nitrate Priority Designation?

The IDEQ evaluated nitrate monitoring data collected from wells collected through various programs conducted by IDEQ, IDWR, and ISDA over the past decade. The 25 areas in this publication are known as nitrate areas of concern. They also are referred to as group one nitrate priority areas, which have the fol-

lowing commonalities: (1) nitrate monitoring data were collected, and (2) at least 50 percent of the well samples evaluated contained NO_3-N values higher than 2.0 ppm, AND/OR at least 25 percent of the well samples evaluated contained NO_3-N values higher than 5.0 ppm. This criteria was based on 1998 sampling.

Geographical Information Systems (GIS) software was used to draw boundaries for each geographic area. The 25 nitrate areas of concern are currently being prioritized for educational, BMP implementation, and regulatory action. The four criteria used for prioritizing are: (1) population within areas of concern, (2) current nitrate levels in groundwater, (3) nitrate trends in groundwater (increasing, decreasing, no trend), and (4) other beneficial uses of the groundwater. Once the 25 areas are prioritized public input will be sought. It is estimated that the final priority ranking will be released to the public and become part of state policy by July 2002.

Idaho's Nitrate Areas of Concern

The 25 nitrate areas of concern are identified in Fig. 1 and Table 2. The identified areas are dispersed throughout the state and range in size from 1,700 to 311,000 acres. Some areas are sparsely populated, although 230,000 people live in the Boise/Meridian (#9) area of concern. Agriculture is the dominant land use in 23 of the 25 areas of concern. Two areas are dominantly urban.

Close to 500,000 people live in the 25 designated nitrate priority areas (Fig. 3). Two-thirds of these people live in Ada and Canyon counties. The 25 designated nitrate areas of concern cover 1,891,000 acres (Fig. 4). Over 37 percent of this land is found in southeastern Idaho. Based on population and affected acreage, northern Idaho is less impacted by nitrates in groundwater than the other three regions of the state.

Northern Idaho—Three nitrate areas of concern were identified in northern Idaho. Dryland agriculture is the predominant land use in the three identified priority areas. Approximately 2,100 people live in the three priority areas, which comprise 223,000 acres.

Southwestern Idaho—Ten nitrate areas of concern were identified in southwestern Idaho. Irrigated agriculture is the dominant land use in the identified priority areas; however, urban and range areas are embedded within several of the priority areas. Approximately 323,000 people live in the 10 priority areas, which encompass 435,000 acres.

Southcentral Idaho—Four nitrate areas of concern were identified in southcentral Idaho. Irrigated agriculture is the primary land use in the four identified priority areas. Approximately 85,000 people live in the four priority areas, which comprise 538,600 acres.

Table. 2. Idaho's 25 nitrate areas of concern (listed geographically from north to southeast).

Area	Name	Population	Size (acres)	% of wells >5.0 ppm	% of wells >2.0 ppm	Land use*
1	Genesee/Cow Creek	800	18,500	66.7	66.7	Agricluture (D)
2	Lapwai Creek	600	17,600	50.0	100.0	Agriculture (D)
3	Camas Prairie	700	187,000	51.7	77.5	Agriculture (D)
4	Weiser	5,800	31,500	72.3	87.5	Agriculture (I)
5	Payette	2,800	30,500	52.7	70.3	Agriculture (I)
6	Lower Boise/Canyon County	81,000	238,000	32.3	63.4	Agriculture (I)
7	Eagle/Star	100	1,700	57.9	57.9	Agriculture (I)
8	Homedale/Marsing	800	51,000	30.0	41.4	Agriculture (I)
9	Boise/Meridian	230,000	18,000	29.9	82.7	Urban, Ag (I)
10	Grandview	500	14,000	66.7	76.2	Agriculture (I)
11	Bruneau	100	24,300	40.0	50.0	Ag (I), Range
12	Mountain Home	300	11,200	34.8	73.9	Ag (I), Range
13	Hammett	1,700	14,400	33.3	60.0	Ag (I), Range
14	Bliss	50	6,800	38.9	66.7	Agriculture (I)
15	Twin Falls	48,000	245,000	49.8	93.4	Agriculture (I)
16	Rupert	25,100	116,800	44.1	77.5	Agriculture (I)
17	Burley/Marsh Creek	11,800	170,000	59.8	87.6	Agriculture (I)
18	Pocatello	63,500	22,600	25.8	87.1	Urban
19	Fort Hall	1,000	32,300	60.3	82.5	Agriculture (I)
20	Preston/Cache Valley	600	129,000	23.0	54.1	Agriculture (I)
21	Soda Springs/Bear River	6,000	311,000	22.4	61.8	Agriculture (I)
22	Mud Lake	523	36,400	40.5	67.6	Agriculture (I)
23	Hibbard	1,400	10,900	18.8	62.5	Agriculture (I)
24	St. Anthony	2,000	6,725	35.7	42.9	Agriculture (I)
25	Ashton/Drummond/Teton	1,700	146,200	74.1	95.0	Agriculture (D, I)

*D = Dryland; I = Irrigated

Southeastern Idaho—Eight nitrate areas of concern were identified in southeastern Idaho. Irrigated and dryland agriculture are the dominant land use in seven identified areas, while area 18 (Pocatello) is predominately urban. Approximately 77,000 people live in the eight priority areas, which comprise 695,000 acres.

Implications of Nitrate Designation

Based on the types of human activities that are dominant in the 25 designated nitrate areas of concern it appears that both agriculture and waste water treatment (septic systems) will be targeted for implementation of BMPs. From an agricultural standpoint it appears that education programs targeted at introducing BMPs to improve nitrogen management efficiencies (that reduce nitrate leaching into groundwater) will be important. In these areas cost-share programs for improving nitrogen management may be developed. If education and cost-share programs for BMPs do not reduce nitrate introduction into groundwater, regulations such as the current ones requiring nutrient management plans on all Idaho dairies may someday be mandated for fertilizer use.

Septic system regulations may also be tightened in nitrate priority areas. Septic tanks need to be regularly maintained to prevent system failure, which could lead to nitrate loading of groundwater. Currently, septic system permits are required when the system is first put in; however, system maintenance is not currently regulated. Surveys conducted by the University of Idaho have shown that less than 25 percent of septic systems in rural areas of the state receive the recommended level of maintenance.

Summary

Twenty-five nitrate areas of concern have been identified in Idaho. Idaho residents living in these identified areas will be asked to implement best management practices (BMPs) over the next few years to protect valuable groundwater resources. Even though only a small percentage of wells in Idaho exceed the EPA drinking water standard of 10 ppm NO_3-N, the majority of wells in the 25 designated areas of concern have been impacted by human activities. The severity of nitrate contamination of groundwater in a designated area will likely determine if future nitrogen management will be voluntary or regulated.

This publication was prepared under the direction of the Education Subcommittee of the State of Idaho Groundwater Committee. Members of the subcommittee include Gary Bahr (Idaho State Department of Agriculture), Tony Bennett (Soil Conservation Commission), Biff Burley (Soil Conservation Commission), Warren Weihing (Idaho Department of Water Resources), Mike Thomas (Idaho Department of Environmental Quality), and Lee Brooks (USDA-NRCS). Representing the University of Idaho are Robert L. Mahler, water quality coordinator, UI Department of Plant, Soil and Entomological Sciences, Moscow, and Kristin E. Keith, extension educator/water at the UI's Caldwell R&E Center.

Fig. 3. A total of 487,100 people live in nitrate areas of concern in Idaho. Over two-thirds of these people live in southwestern Idaho.

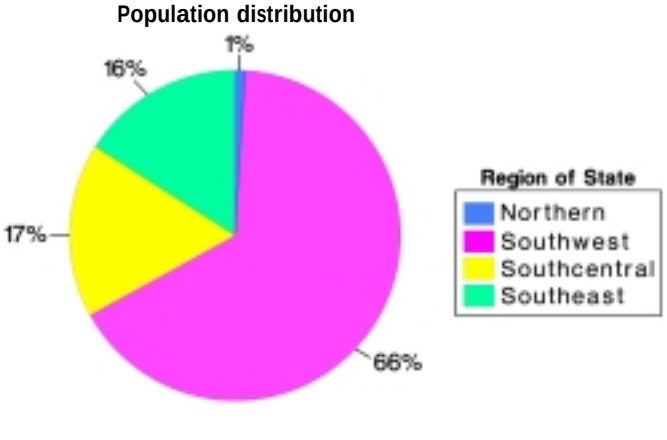
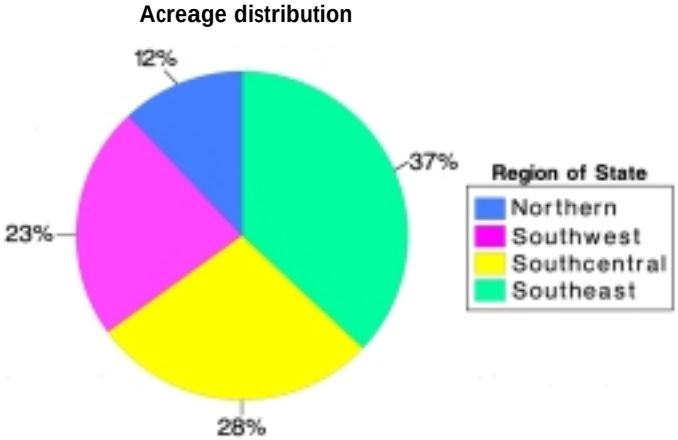


Fig. 4. A total of 1,891,000 acres of land are located in the 25 nitrate areas of concern. Thirty-seven percent of this impacted land is in southeastern Idaho.



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