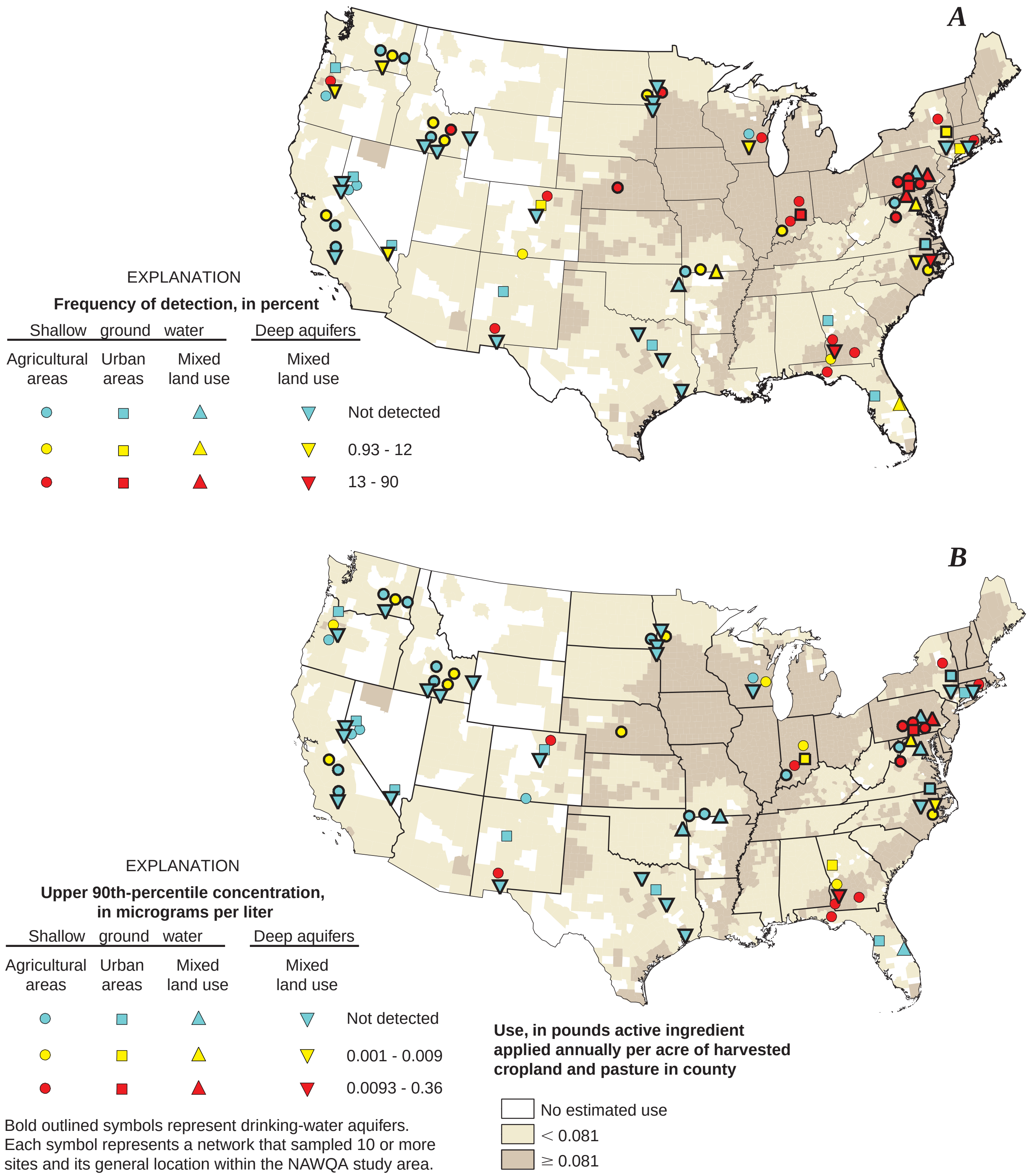

Figure 25. Metolachlor occurrence in ground water for the NAWQA study in relation to agricultural use (A) Frequencies of detection. (B) Upper 90th-percentile concentrations. See figures 3 and 4 for areas sampled.

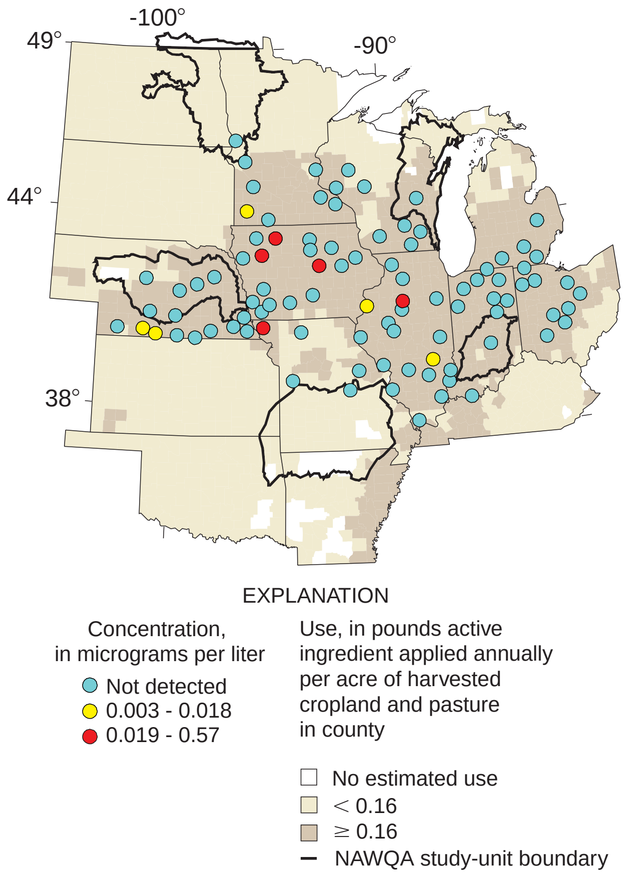

Figure 26. Concentrations of metolachlor in near-surface aquifers of the northern midcontinent for the 1992 sampling of the MWPS in relation to agricultural use.

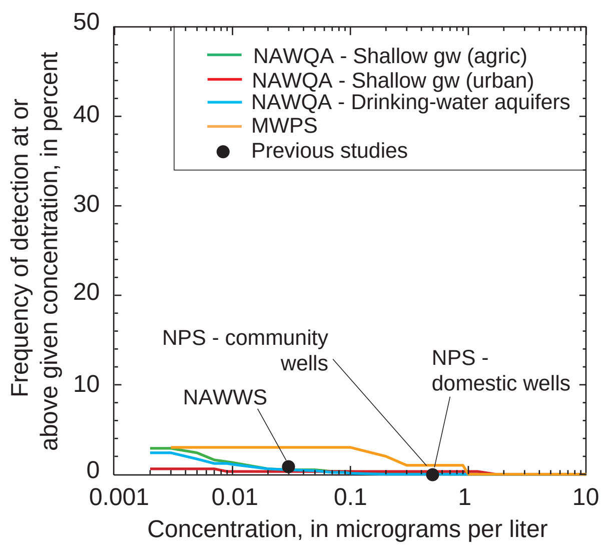

Figure 27. Frequencies of alachlor detection in ground water for the multistate studies in relation to reporting limits. See table 4 for full study names. gw, ground water; agric, agricultural.

each of these acetanilides, the relative frequencies of detection among parent and degradates (all adjusted to a common reporting limit of 0.20 µg/L) exhibited the same pattern, with ESA being detected most often, and the parent compound least often. During the Iowa statewide sampling, metolachlor ESA was detected at or above 0.20 µg/L more than seven times as frequently, and metolachlor OA nearly three times as frequently, as metolachlor itself (table 12).

Alachlor

Despite its considerable use in agricultural settings (table 2), alachlor was detected infrequently by the multistate studies (fig. 27), and at fewer than 10 percent of the sites sampled in most of the NAWQA ground-water networks (fig. 28). The low frequencies of detection by the NAWWS and NPS were in close agreement with the NAWQA results (fig. 27); alachlor detection frequencies during the MWPS were somewhat higher than those reported by the other investigations because of a relatively small number of detections in high-use areas.

The distribution of agricultural use of alachlor across the Nation (fig. 28) is similar to that of the other PMP acetanilide, metolachlor. Areas of highest use are primarily in the eastern Colorado Plateaus, High Plains, Central Lowland, northern Appalachian Plateaus, Adirondack and northern Piedmont provinces, St. Lawrence Valley, eastern Coastal Plain, and Mississippi Alluvial Plain. Consistent with the exclusively agricultural use of alachlor (table 2), most of the NAWQA sampling networks with detections of the herbicide were in agricultural areas with high use; alachlor was detected in only one of the urban LUSs (fig. 28*A*). As suggested earlier for this and the other exclusively agricultural herbicides, the detections of alachlor in this urban area may have been caused by either atmospheric or subsurface transport from nearby agricultural applications. Although some of the wells with alachlor detections during the MWPS (fig. 29) were located in regions of more intensive use, most of the high-use areas sampled, particularly those toward the east, had no detections.

As with metolachlor, the relatively low frequencies with which alachlor has been detected in ground water during the two USGS multistate studies, despite its substantial use in many of the sampled areas, may be related to its comparatively high rate of transformation in aerobic soil (table 3). This hypothesis is supported by the statistically significant

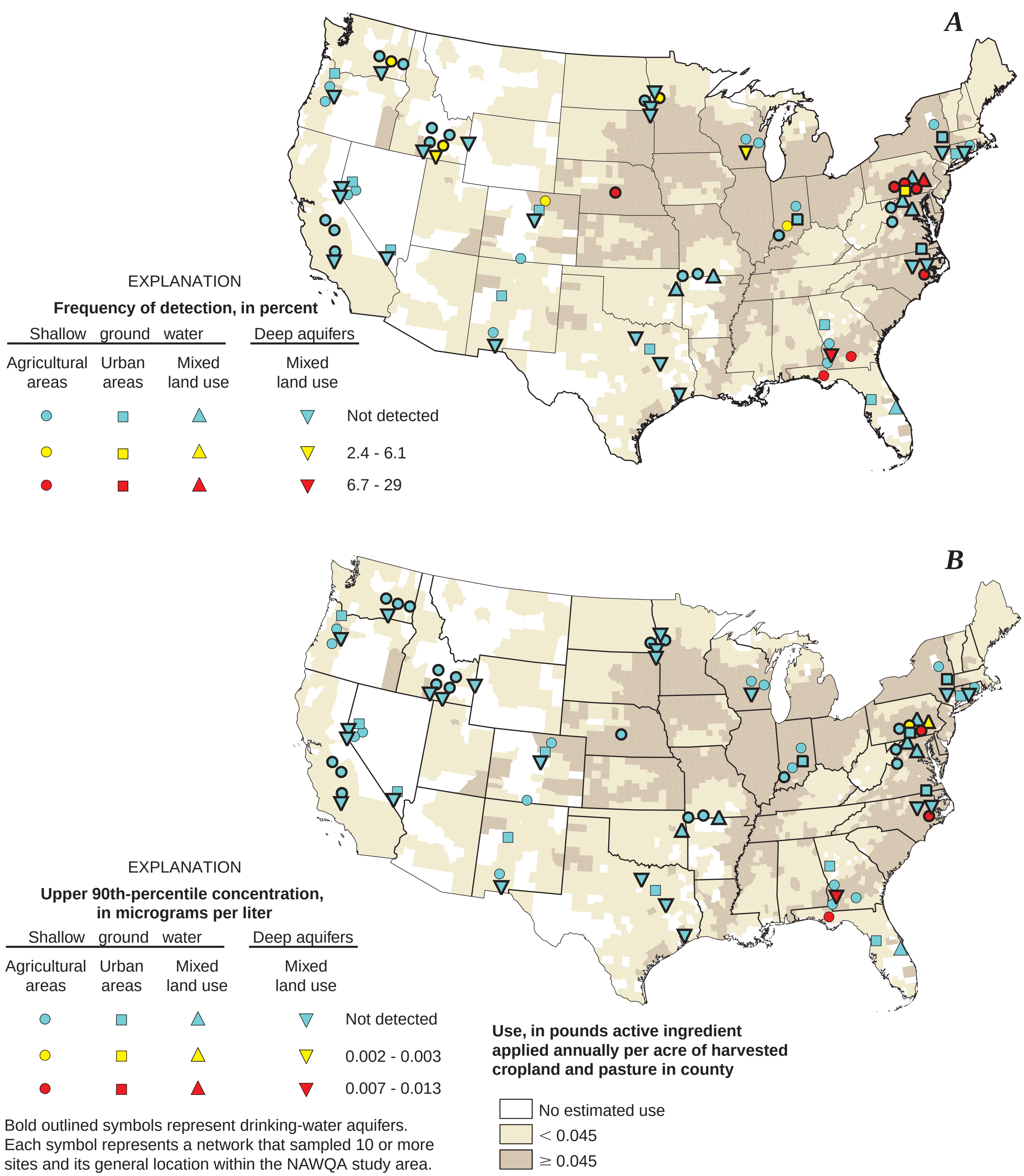

Figure 28. Alachlor occurrence in ground water for the NAWQA study in relation to agricultural use (A) Frequencies of detection. (B) Upper 90th-percentile concentrations. See figures 3 and 4 for areas sampled.

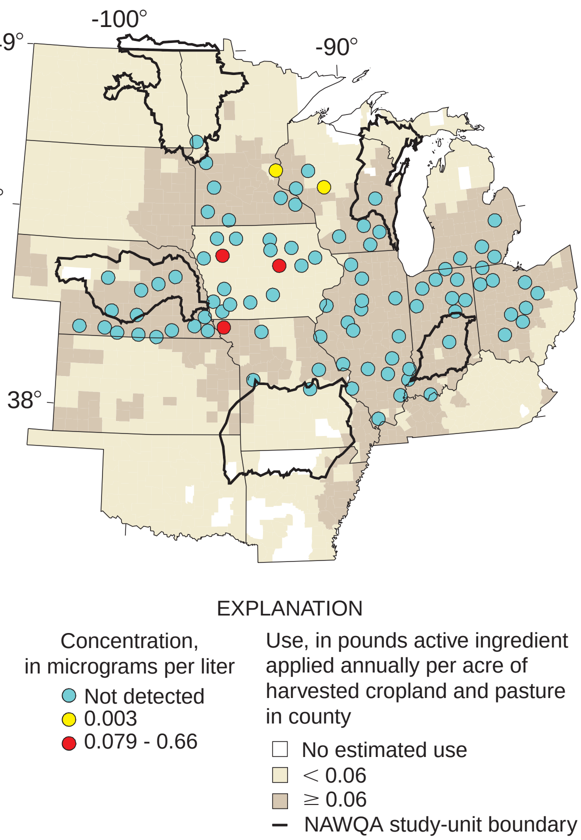

Figure 29. Concentrations of alachlor in near-surface aquifers of the northern midcontinent for the 1992 sampling of the MWPS in relation to agricultural use.

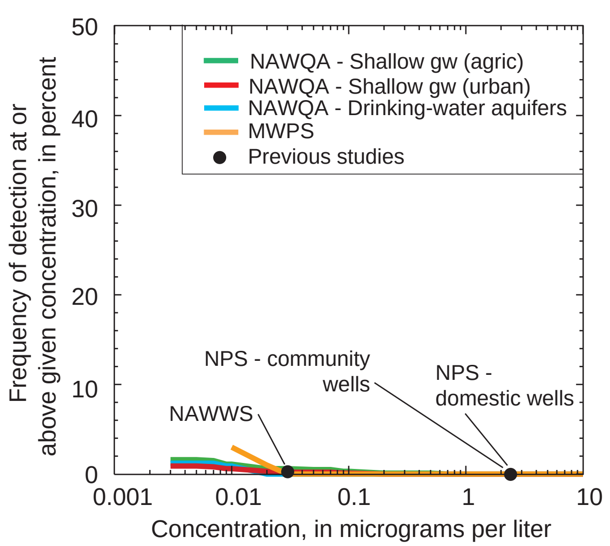

Figure 30. Frequencies of cyanazine detection in ground water for the multistate studies in relation to reporting limits. See table 4 for full study names. gw, ground water; agric, agricultural.

correlation observed (and discussed earlier) between herbicide detection frequencies and aerobic soil half-life for the NAWQA data, and by the considerably higher frequencies with which the two principal products of alachlor transformation have been detected in ground water, relative to the parent compound (tables 11 and 12, and fig. 12). As with the other two acetanilides examined (metolachlor and acetochlor), these products are the corresponding ethanesulfonic acid (alachlor ESA) and oxanilic acid (alachlor OA).

Calculations using the data provided by Kolpin and others (1996c) indicate that during the MWPS, alachlor ESA was detected at or above 0.10 µg/L in ground water 15 times more frequently than alachlor in 1993, and 25 times more frequently than alachlor in 1994. During the statewide sampling of ground water in Iowa, alachlor ESA was detected at or above 0.20 µg/L nearly 50 times as frequently as alachlor itself (table 12). Similarly, a more compound-specific chemical analysis by Baker and others (1993) of some of the samples collected and analyzed during the Cooperative Private Well-Testing Program, or CPWTP (table 4), indicated that most of the immunoassay detections originally attributed to alachlor during the CPWTP may actually have been caused by the presence of alachlor ESA, rather than the parent compound. In addition to alachlor ESA, results from the Iowa statewide sampling indicate that alachlor OA may also be detected in ground water more frequently than its parent compound; during the Iowa study, alachlor OA was detected at or above 0.20 µg/L nearly 20 times as frequently as alachlor (table 12). Another alachlor degradate, 2,6-diethylaniline, was also detected in ground water by both the NAWQA and MWPS investigations (table 11), but the MWPS data indicate that it is much less commonly encountered than alachlor ESA.

Cyanazine

Frequencies of cyanazine detection were consistently low for all of the multistate studies that examined its occurrence, the results from the NAWWS and NPS investigations showing close agreement in this regard with those from NAWQA and the MWPS (fig. 30). Agricultural use of this herbicide (fig. 31*A*) is most intensive in the Central Valley of California, the southeastern Basin and Range Province, the High Plains, the central and eastern parts of the Central Lowland, the northeastern parts of the Appalachian Plateaus and the Valley and Ridge and Piedmont provinces, the Adirondack province, the St. Lawrence Valley, New England, most of the southeastern Coastal Plain except for Florida, and the Mississippi Alluvial Plain.