Fact Sheet

Central Coast Regional Water Quality Control Board

Persistent Groundwater Nitrate Pollution Linked to Ongoing Agricultural Activities in the Central Coast Region

Introduction

Groundwater quality in many parts of the Central Coast region is severely impaired by nitrate contamination, primarily resulting from agricultural discharges. Data collected by the Central Coast Regional Water Quality Control Board (Central Coast Water Board) shows that nitrogen is often applied and discharged at rates far exceeding levels protective of groundwater quality. This fact sheet summarizes recent data and analyses that demonstrate how ongoing agricultural practices continue to impact groundwater quality, with nitrate pollution remaining a persistent and worsening problem.

Two key lines of evidence support this conclusion:

- **Groundwater Age and Nitrate Source Tracking:** A study by Lawrence Livermore National Laboratory[1] found that young groundwater—recharged in recent decades—frequently exceeds the maximum contaminant level (MCL) for nitrate, directly linking current agricultural activities to ongoing groundwater pollution.
- **Nitrate Trends in On-Farm Domestic Wells:** Trend analyses of on-farm domestic wells reveal that a substantially greater number of wells show increasing nitrate concentrations over time compared to those with decreasing trends. Because domestic wells are typically shallow, their nitrate concentrations primarily reflect recent agricultural discharges.

Together, these findings underscore the urgent need for effective regulatory measures to address nitrate pollution from ongoing agricultural activities and to protect groundwater quality for current and future users.

Extent and Severity of Nitrate Contamination

Groundwater pollution by nitrate is both widespread and severe throughout the Central Coast region, affecting a significant number of wells and groundwater users. Recent

[1] Comprehensive Isotopic Analyses of Sources, Flow Paths, and Geochemical Processes Affecting Nitrate in Central Coast Groundwater, Lawrence Livermore National Laboratory, 2020: https://water.llnl.gov/sites/water/files/2021-02/CCWB_LLNL_report_final.pdf

sampling data from on-farm domestic wells in 2024 show that exceedance rates for the maximum contaminant level (MCL) for nitrate range from 28% to 59% in subbasins with intensive agricultural production. In many cases, nitrate concentrations are two or more times higher than the MCL, posing a substantial risk to drinking water quality and public health.

Figures 1 and 2 illustrate the prevalence and magnitude of nitrate contamination in domestic wells, highlighting need for regulatory action to address ongoing agricultural sources of nitrate.

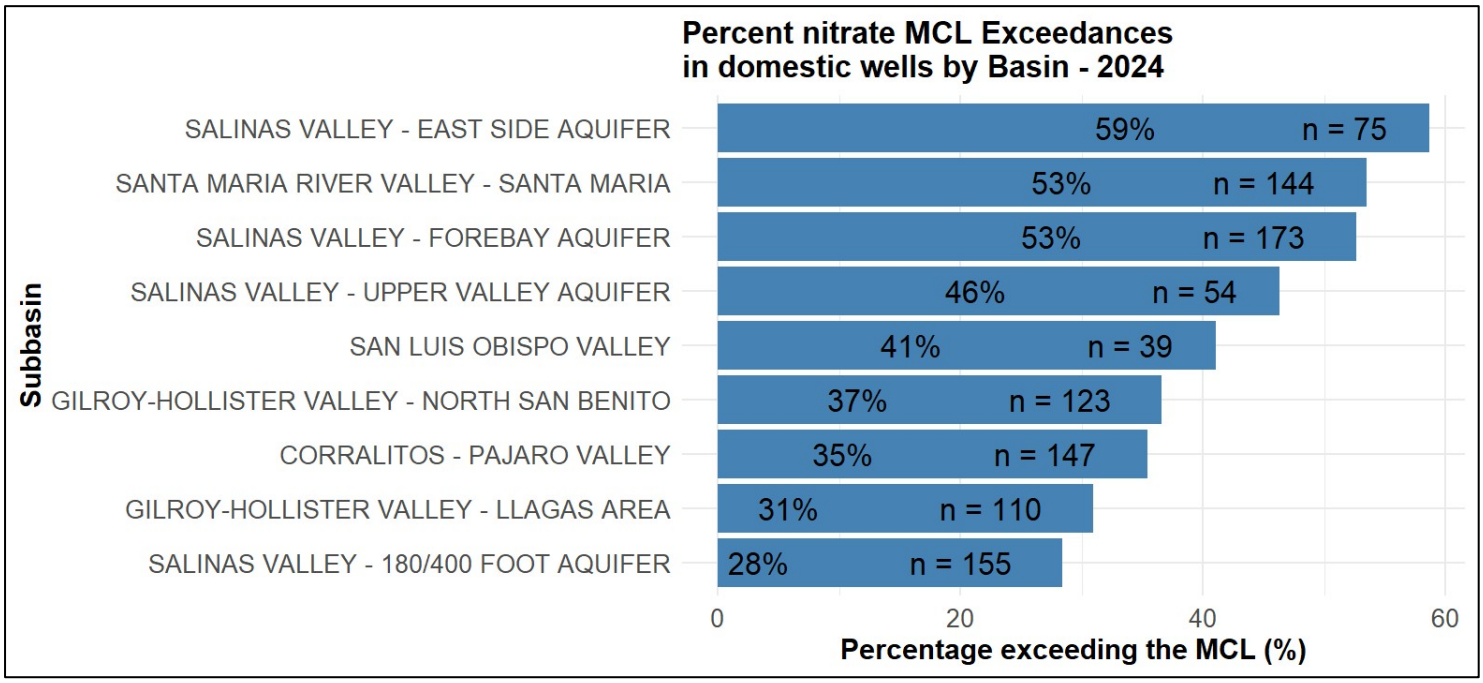

Figure 1. Percentage of on-farm domestic wells sampled in 2024 that exceed the maximum contaminant level (MCL) for nitrate in select subbasins of the Central Coast region. The figure highlights the widespread nature of nitrate contamination, with exceedance rates ranging from 28% to 59% in areas with intensive agricultural production. The number of wells sampled in each subbasin is indicated by "n".

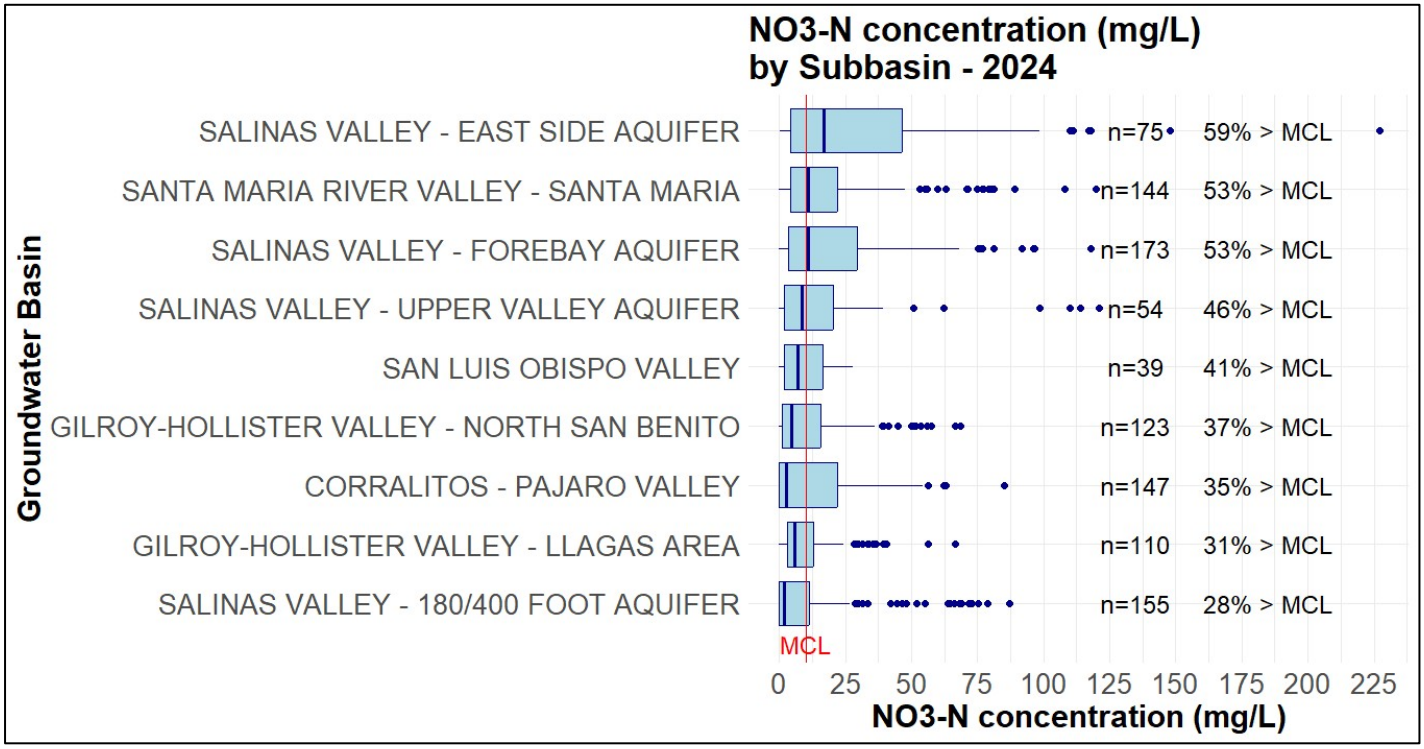

Figure 2. Box-and-whisker plot showing the distribution of nitrate concentrations measured in on-farm domestic wells in 2024. The figure illustrates the range and variability of nitrate levels, with many wells exceeding the maximum contaminant level (MCL), particularly in subbasins with intensive agricultural activity. The number of wells sampled in each subbasin is indicated by "n".

Tracing the Sources and Timing of Groundwater Nitrate Contamination

To better understand the origins and timing of nitrate contamination in Central Coast groundwater, the Central Coast Water Board commissioned a study by Lawrence Livermore National Laboratory. This study used groundwater age dating and isotopic analysis to identify when and from where nitrate pollution entered the aquifers.

The results show that elevated nitrate concentrations have been leaching into groundwater since at least the 1950s, with high levels present in both older and younger groundwater. Notably, y**oung groundwater—recharged in recent decades—frequently exceeds the maximum contaminant level (MCL) for nitrate**, directly linking ongoing agricultural practices to current groundwater pollution. **Isotopic data and records of nitrogen application confirm that fertilizer use on agricultural lands is the predominant source** of nitrate impairment in the region.

Figure 3 illustrates the age distribution of nitrate concentrations, highlighting that nitrate pollution is not only a legacy issue but also an active and persistent problem driven by recent agricultural activities.

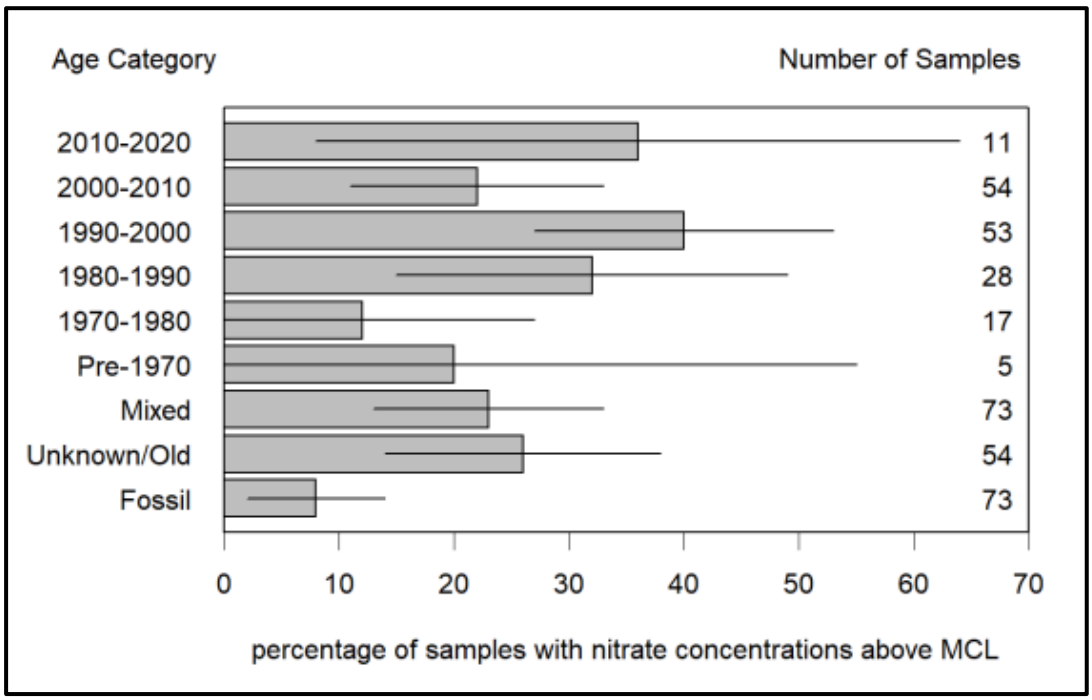

Figure 3. Age distribution of groundwater nitrate concentrations in the Central Coast region. The figure shows that young groundwater—recharged in recent decades—is frequently impacted by elevated nitrate levels, indicating that ongoing agricultural practices continue to pollute groundwater. Older groundwater with high nitrate concentrations may reflect legacy contamination from historic fertilizer use, but the presence of nitrate in young groundwater demonstrates that the agricultural nitrate problem is active and persistent. Figure from the Lawrence Livermore National Laboratory final report.

Trends in Nitrate Concentrations in On-Farm Domestic Wells

The Central Coast Water Board has conducted extensive analyses to evaluate how nitrate concentrations are changing over time in on-farm domestic wells. These analyses build upon previous work focused on municipal supply wells,[2] and provide important insights into the impacts of recent agricultural practices.

Domestic wells are typically screened at relatively shallow depths, making them particularly sensitive to changes in land use and agricultural discharges. As a result,

[2] Results of the 2018 trend analysis are described beginning on page 11 of the May 2018 staff report: https://www.waterboards.ca.gov/centralcoast/board_info/agendas/2018/may/item8/item8_stfrpt.pdf

nitrate concentrations in these wells serve as a useful indicator of the effects of current and near-current agricultural activities on groundwater quality.

Methods:
Since 2008, the Irrigated Lands Program has collected nitrate data from on-farm domestic wells. However, most wells have not been sampled continuously; the majority of the approximately 4,000 domestic wells sampled have sample records spanning only 2-4 years, due to changes in monitoring requirements and grower participation. For wells with at least three samples collected at least a year apart, trend analyses were performed using the Mann-Kendall test to determine whether nitrate concentrations are increasing or decreasing over time.

Key Findings:

- **Recent Data (2022–2025):** Trend analysis of wells sampled after the adoption of Ag Order 4.0 in 2021 shows that more wells exhibit increasing nitrate concentration trends than decreasing trends (Figure 4, Left), suggesting that groundwater quality is generally worsening. However, most wells have limited sample records (typically four or fewer samples), so these trends are not yet statistically significant. As additional data are collected in the coming years, more robust trend analyses will be possible.

- **Longer-Term Data (2011–2021):** Wells with longer sampling records provide clearer results. **More than twice as many domestic wells exhibit statistically significant increasing trends compared to those with decreasing trends** (Figure 4, Right). These increasing trends occur across a wide range of nitrate concentrations, indicating that wells currently in compliance with the MCL may be at risk of future exceedances, while wells already above the MCL are likely to worsen (Figure 5).

The geographic distribution of these trends shows that groundwater subbasins with intensive vegetable production have far more wells with increasing nitrate concentrations than decreasing concentrations (Figure 6 and Figure 7). This pattern aligns with nitrogen application and discharge data, which indicate higher nitrogen use in vegetable crops compared to other commodities.

Overall, the trend data from domestic wells highlight the ongoing and worsening impact of agricultural practices on groundwater quality in the Central Coast region, underscoring the need for effective regulatory measures to address nitrate pollution.

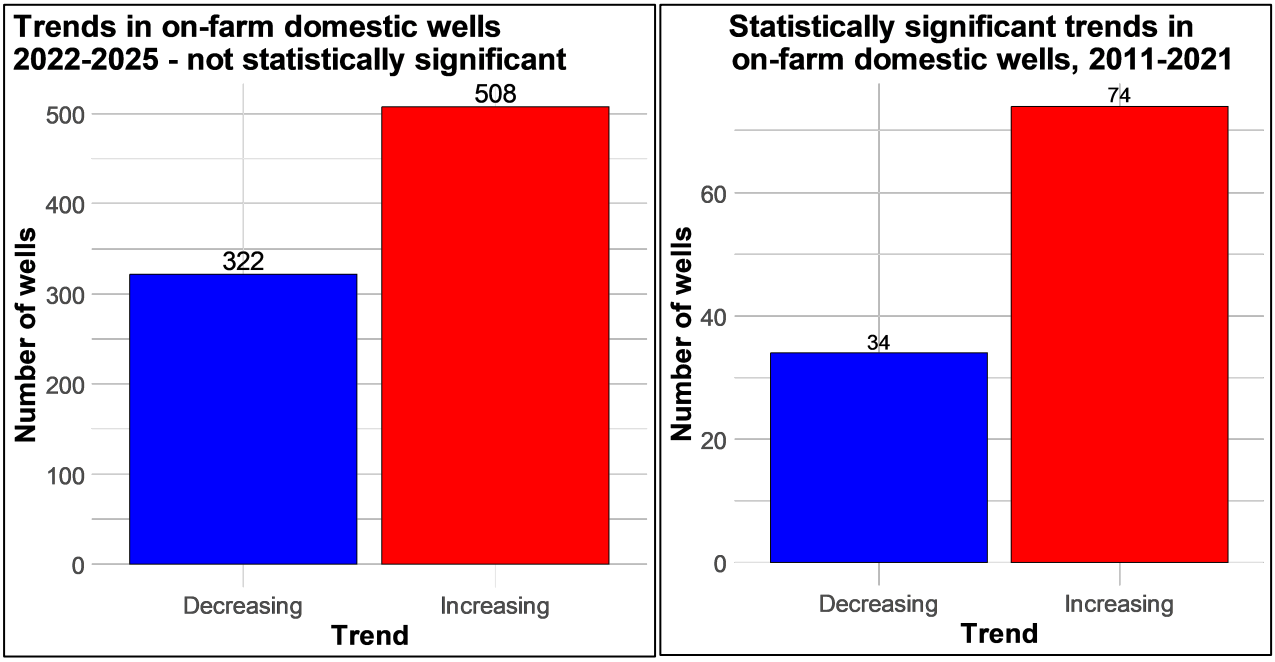

Figure 4. Trends in nitrate concentrations in on-farm domestic wells. Left: Non-statistically significant trends from wells sampled between 2022 and 2025, showing more increasing than decreasing trends, though most wells have limited data. Right: Statistically significant trends from wells sampled between 2011 and 2021, based on more robust sampling records, offering clearer insight into long-term groundwater quality changes.

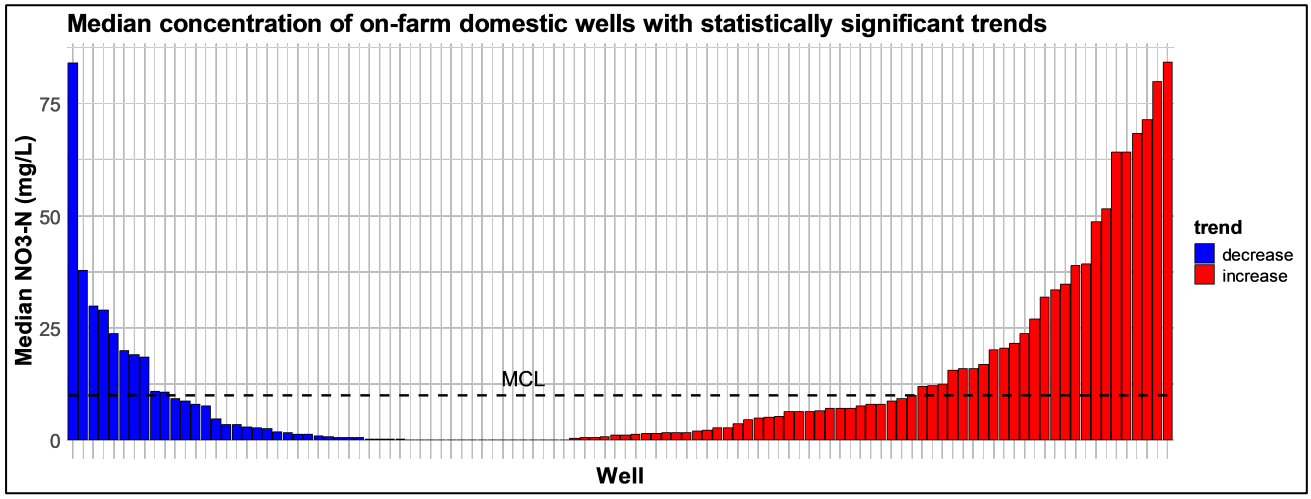

Figure 5. Median nitrate concentration in on-farm domestic wells with statistically significant trends. The figure demonstrates that increasing trends are observed in wells with a wide range of concentrations. Wells that are currently below the MCL may exceed the MCL in the future and wells that exceed the MCL will experience worsening degradation.

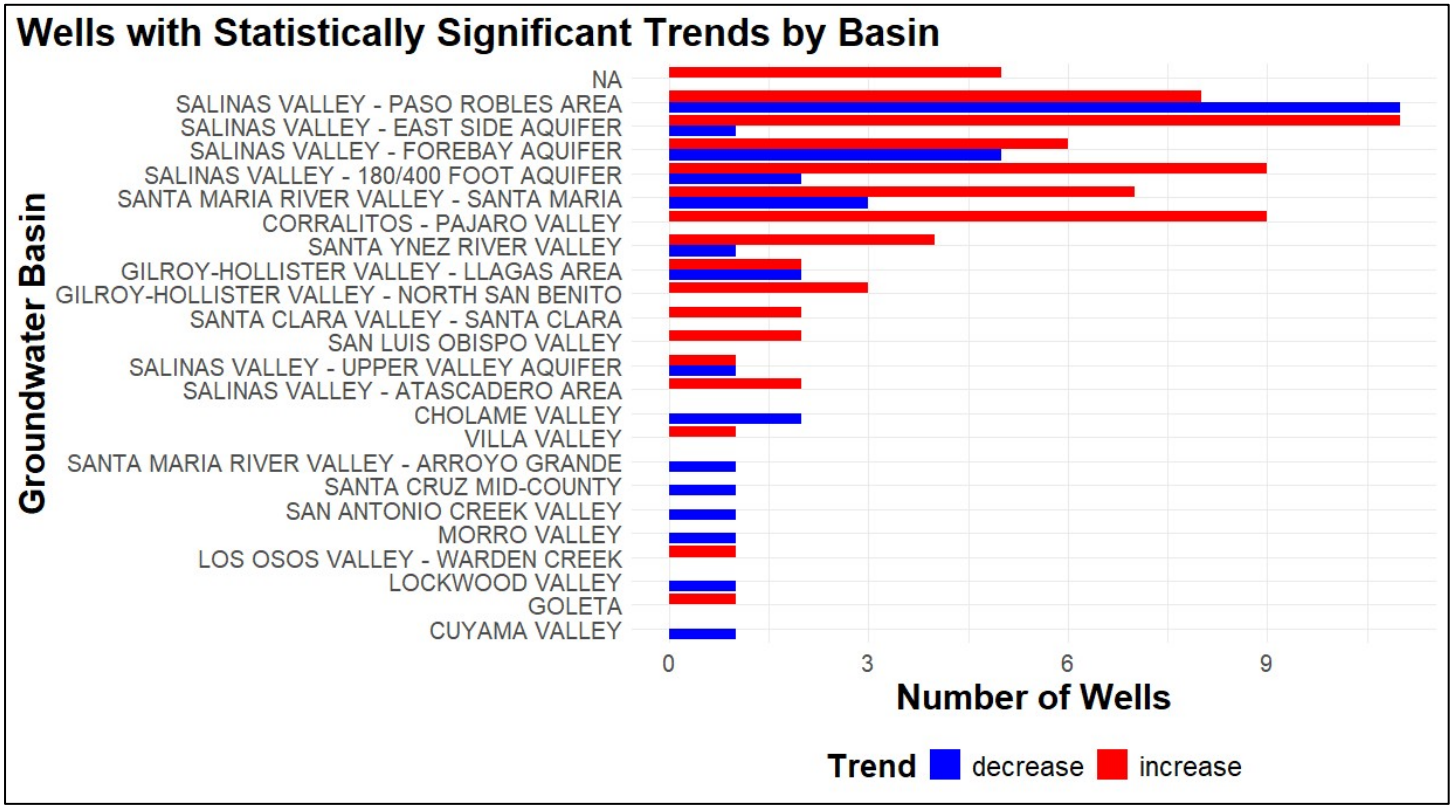

Figure 6. Spatial distribution of on-farm domestic wells with statistically significant increasing and decreasing nitrate concentration trends across groundwater subbasins in the Central Coast region. The figure highlights that subbasins with substantial vegetable crop production have more wells with increasing trends compared to decreasing trends. NA denotes not applicable, and is used for wells located outside of groundwater basins identified by the Department of Water Resources.

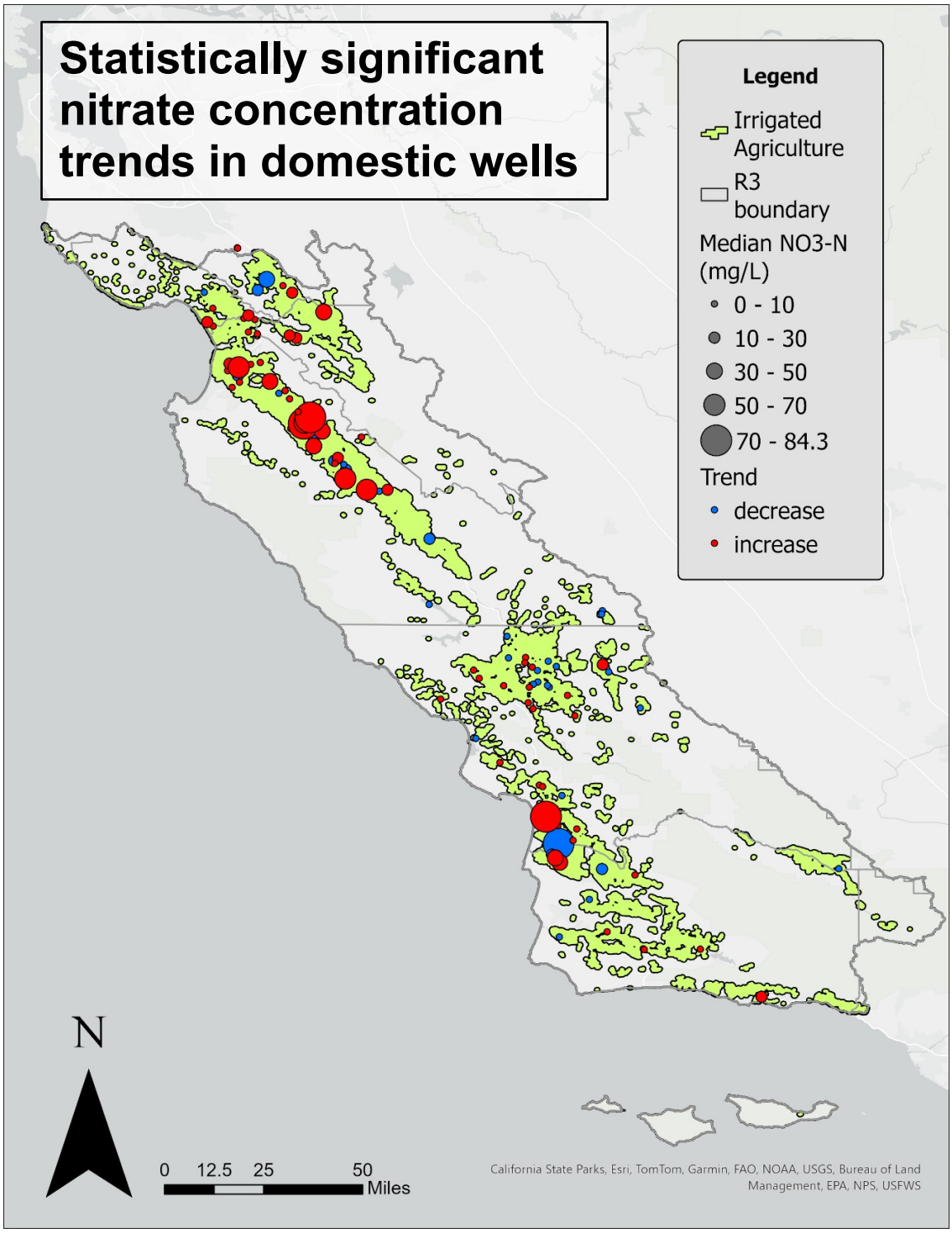

Figure 7. Map of statistically significant nitrate concentration trends in domestic wells across the Central Coast region. The figure provides an overview of the extent, magnitude, and direction of nitrate changes. R3 denotes region 3, the Central Coast Water Board's jurisdictional area.