

MEMORANDUM

To: Tom Moore, Western Governors' Association
From: Abby Hoats, James Russell, and Alison Pollack
Date: 11 August 2005
Subject: Spatial Allocation Surrogates for WRAP Oil and Gas Emissions

Introduction

The purpose of this Technical Memorandum is to summarize the development of spatial allocation surrogates for oil and gas emissions in the WRAP states. Surrogates were needed for two modeling domains:

36 km
 Origin (-2736, -2088)
 NX = 148, NY = 112

12 km
 Origin (-2376, -936)
 NX = 207, NY = 186

As outlined in Table 1, twelve oil and gas emission source categories were assigned to one of four different surrogate categories designed to represent the location of emissions. The oil, gas and water production surrogates were based on production data at known well locations, while the drill rig surrogate was based solely on the number and location of wells drilled.

Table 1. Emission sources and surrogate categories.

Source	SCC	Allocation Surrogate	Surrogate Code
Drill rigs	2310000220	Drill Rigs	688
Oil well - heaters	2310010100	Oil Production	686
Oil well - tanks	2310010200	Oil Production	686
Oil well - pneumatic devices	2310010300	Oil Production	686
Compressor engines	2310020600	Gas Production	685
Gas well - heaters	2310021100	Gas Production	685
Gas well - pneumatic devices	2310021300	Gas Production	685
Gas well - dehydration	2310021400	Gas Production	685
Gas well - completion	2310021500	Gas Production	685
CBM pump engines	2310023000	Water production at CBM wells	687
Gas well - tanks, uncontrolled	2310030210	Gas Production	685
Gas well - tanks, controlled	2310030220	Gas Production	685

Methods

Latitude and longitude coordinates for oil and gas wells and drill rigs were obtained for the WRAP states, except California. The locations of all wells and drill rigs are shown in Figure 1. Also displayed are the boundaries of the Tribal lands of the Arapahoe and Shoshone of the Wind River Reservation, Assiniboine and Sioux of the Fort Peck Reservation, Jicarilla Apache, Navajo, Southern Ute and Ute Mountain Ute. Note that neither Washington nor Idaho had any wells in the database.

Once the well locations were known, creation of the surrogates took place in several steps, and relied on the use of ArcINFO GIS software.

1. All wells and drill rigs were labeled with the appropriate grid cell IJ values for both the 36 and 12 km domains.
2. For each individual well, the oil, gas and water production values were divided by the total oil, gas and water production values corresponding to the county in which the well was located. This division resulted in determination of the fraction of a county's total production taking place at each well. In the case of drill rigs, the number of drills, rather than the production values, were used.
3. For each unique grid cell / county combination with wells, each well's production fractions were summed to create the surrogate value. This step was repeated for both domains separately.

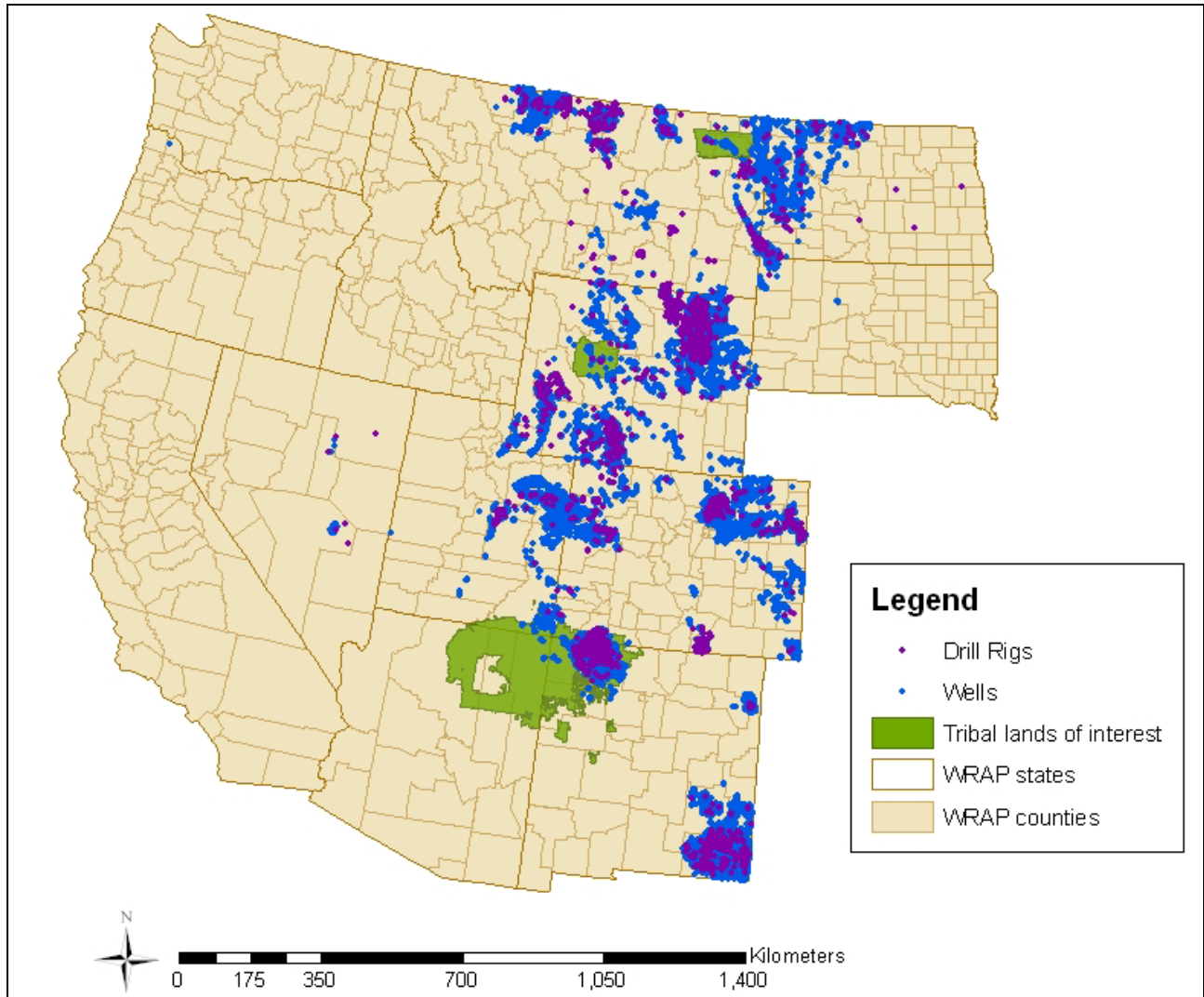


Figure 1. Locations of wells and drill rigs.

The surrogate values for each grid cell / county combination were reformatted to comply with the SMOKE emissions processor AGPRO file format. A separate file for each modeling domain was created, and a single accompanying SMOKE AGREF file was created for use with either domain. The purpose of the AGREF file, which is shown in Table 2, is to define the relationship between the 3-digit codes chosen to represent each of the four surrogate categories in the AGPRO file and the SCC codes for the twelve oil and gas emission categories to be allocated with these surrogates. This file also specifies which county/state/county (COSTCY) should use the given cross-reference. In this case, COSTCY is set to 000000 to indicate that all states and counties can use these cross-references.

Table 2. SMOKE gridding surrogate cross-reference (AGREF) file.

COSTCY	SCC	CODE
000000	2310000220	686
000000	2310010100	688
000000	2310010200	686
000000	2310010300	686
000000	2310020600	686
000000	2310021100	685
000000	2310021300	685
000000	2310021400	685
000000	2310021500	685
000000	2310023000	687
000000	2310030210	685
000000	2310030220	685

Results

To display the surrogates, each grid cell / county surrogate value was multiplied by the county's total production, and then production was summed for each grid cell. Figures 2 through 5 depict the four different 36 km domain surrogate values; Figures 6 through 9 depict the 12 km domain surrogate values.

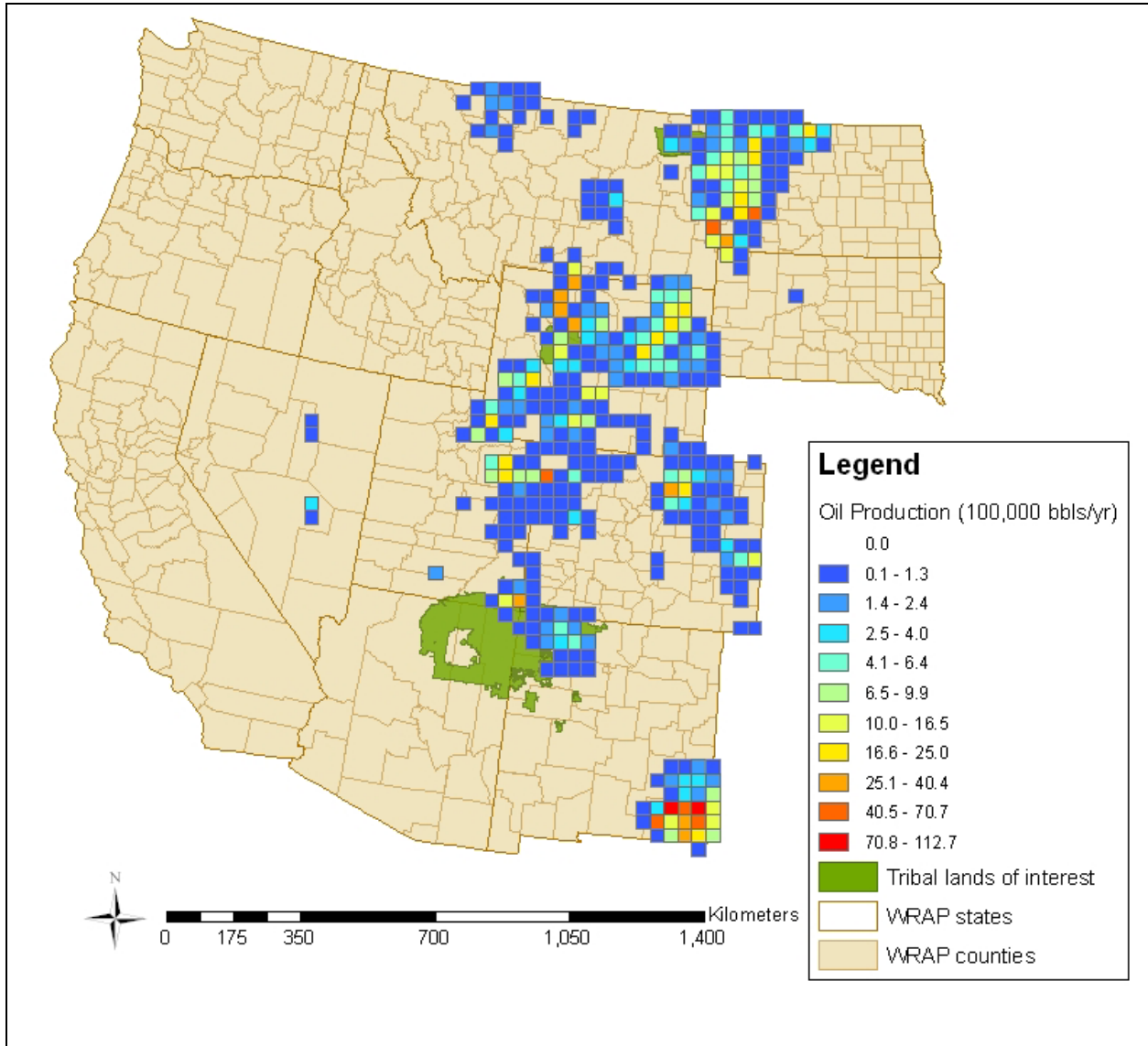


Figure 2. Oil production surrogates for the 36 km domain.

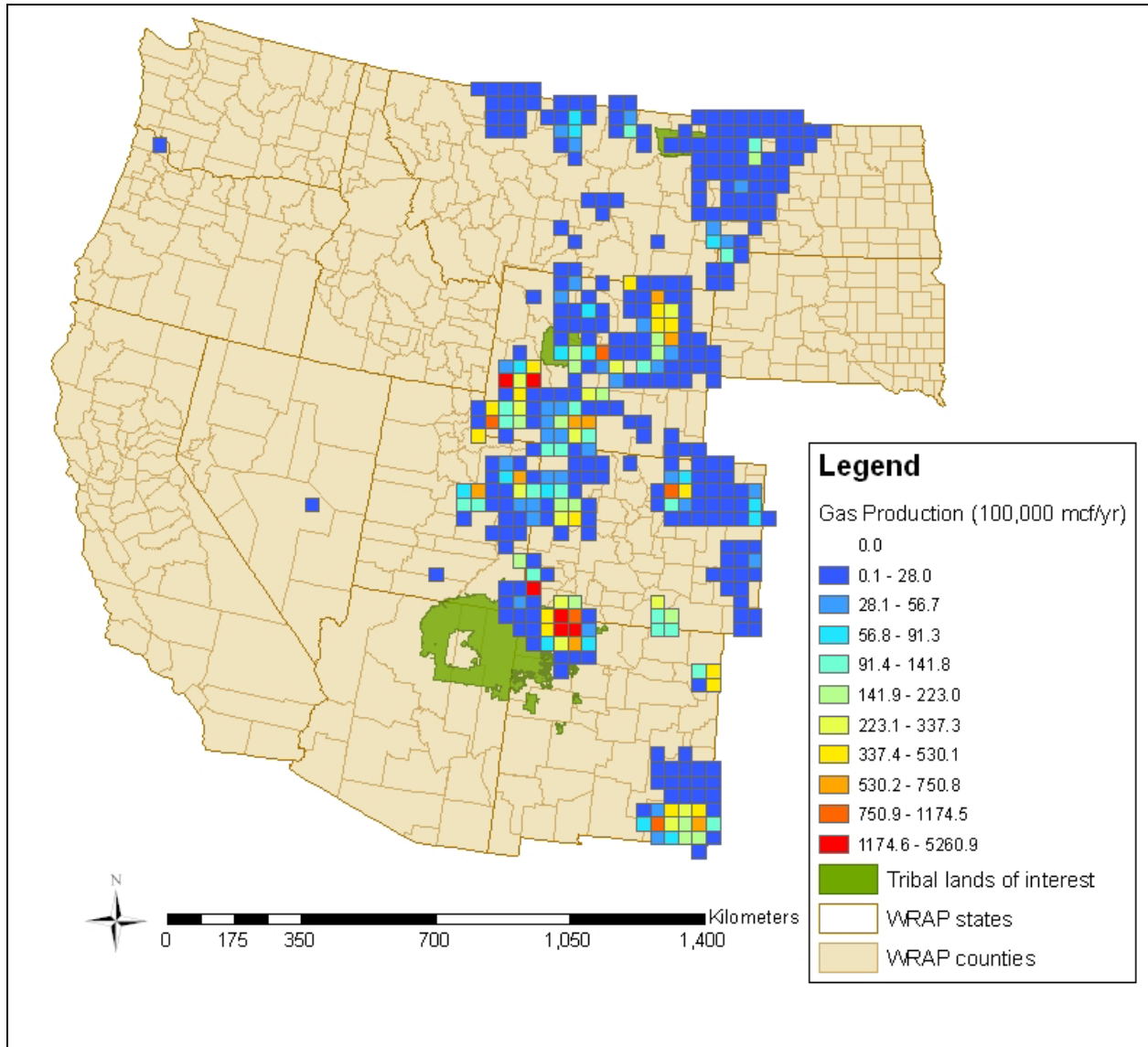


Figure 3. Gas production surrogates for the 36 km domain.

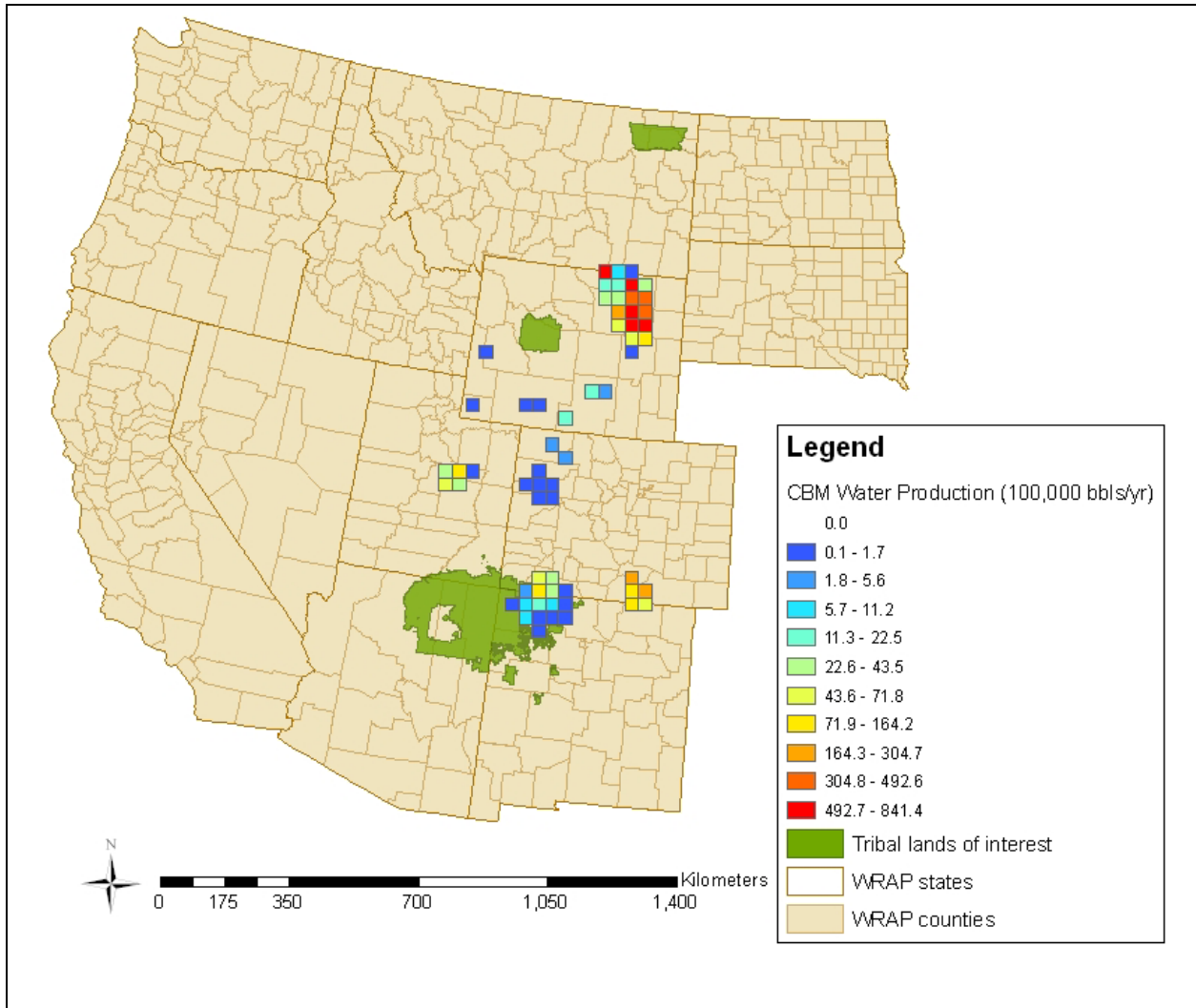


Figure 4. CBM well water production surrogates for the 36 km domain.

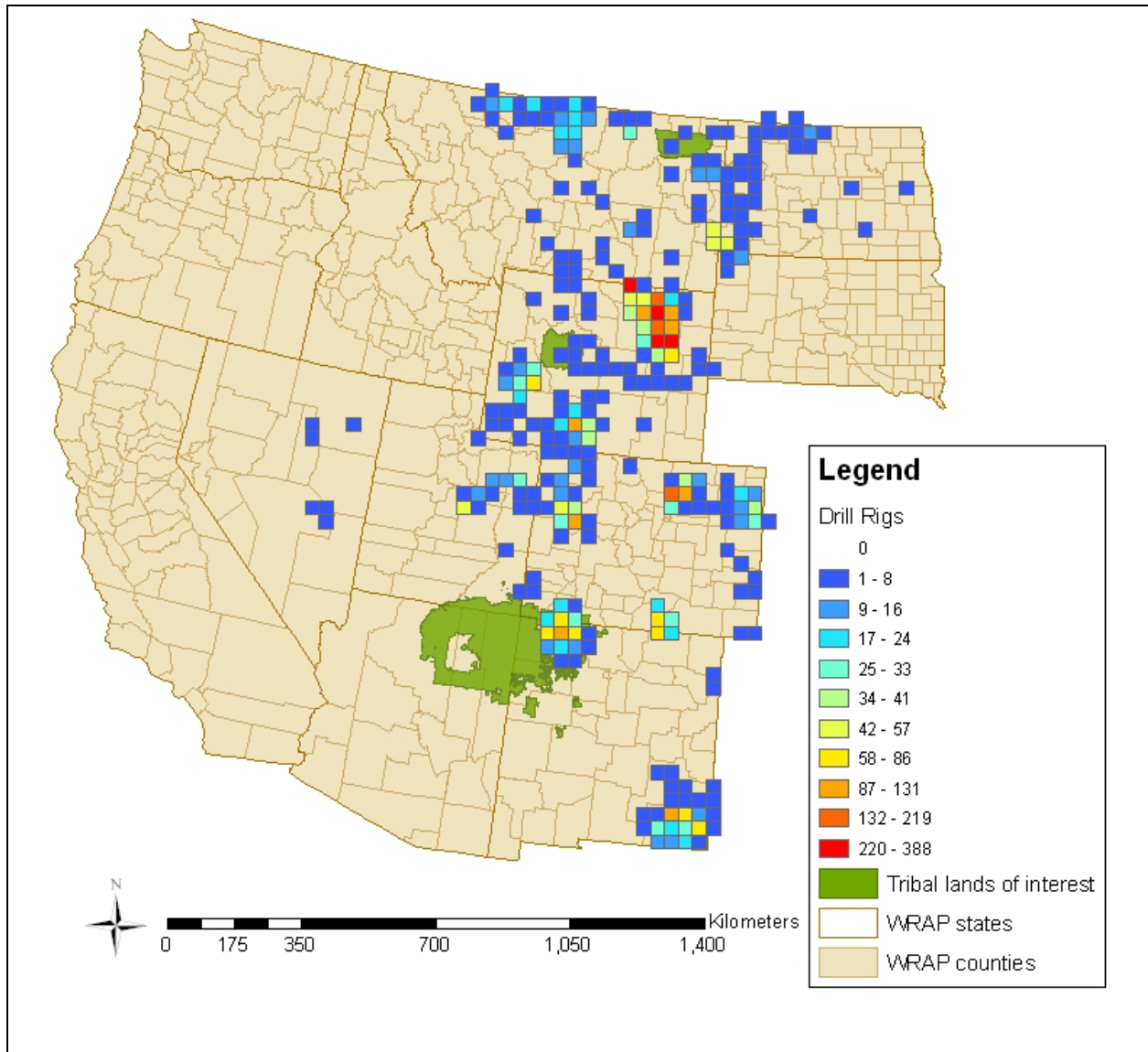


Figure 5. Drill rig surrogates for the 36 km domain.

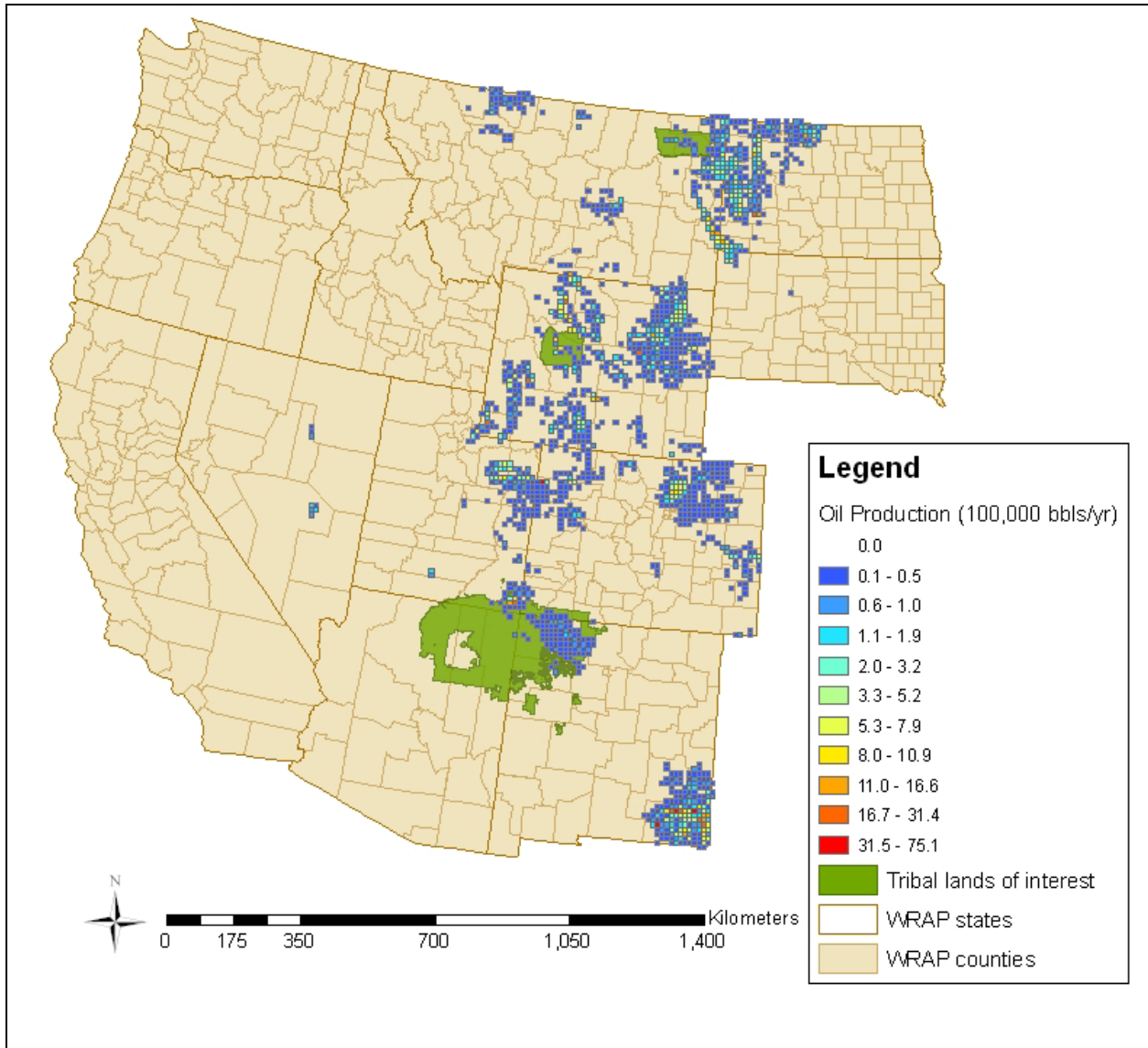


Figure 6. Oil production surrogates for the 12 km domain.

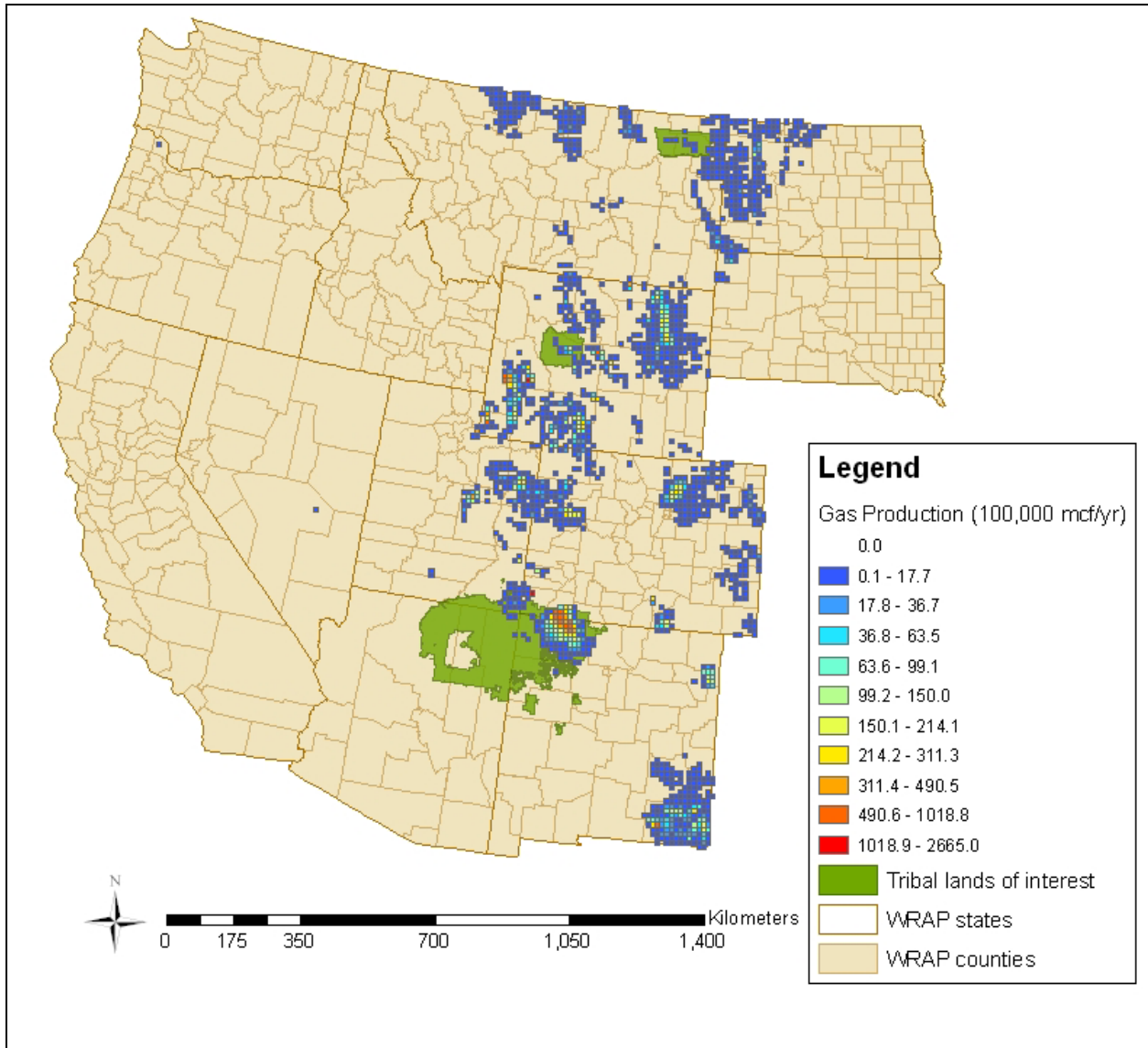


Figure 7. Gas production surrogates for the 12 km domain.

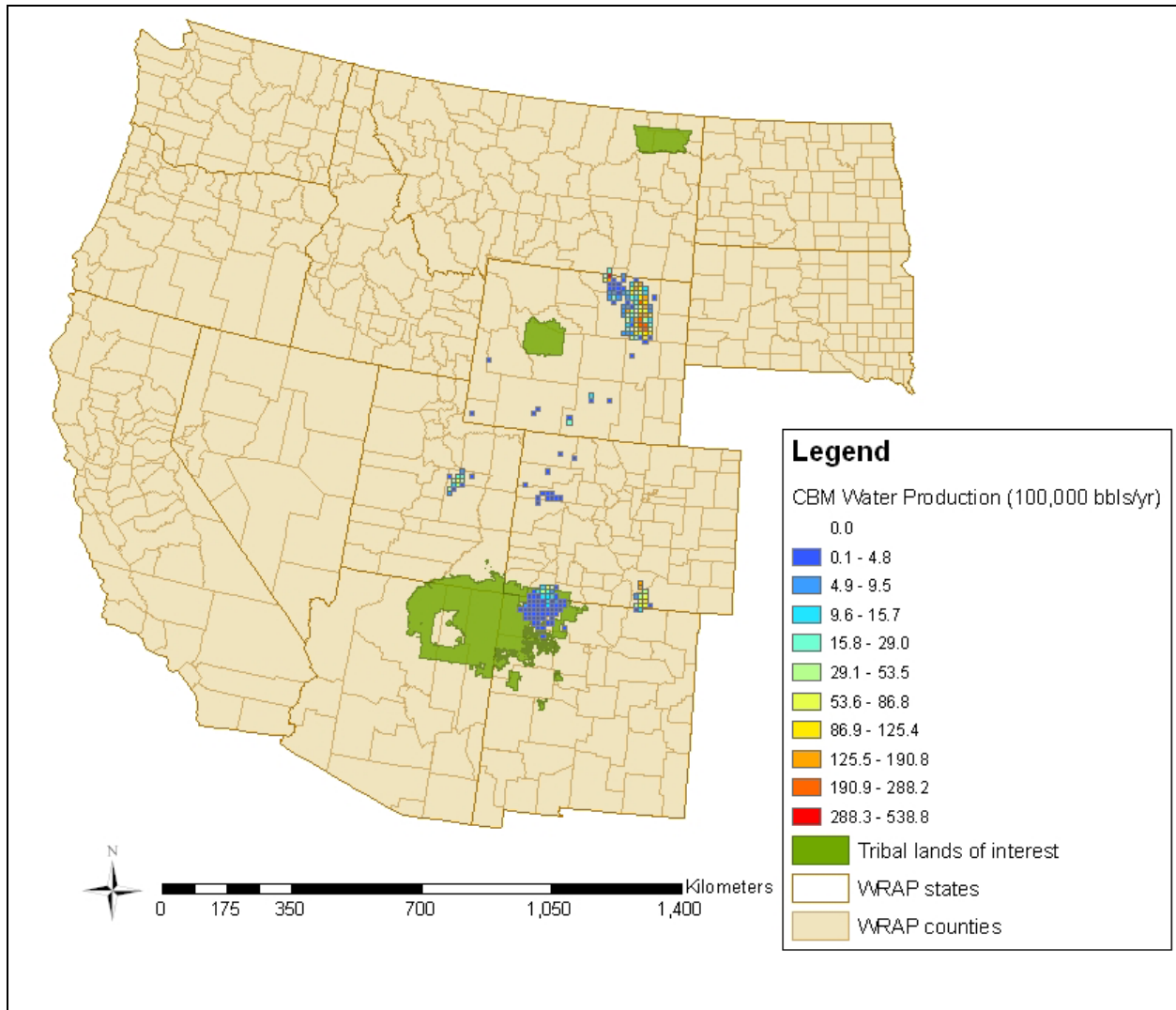


Figure 8. CBM well water production surrogates for the 12 km domain.

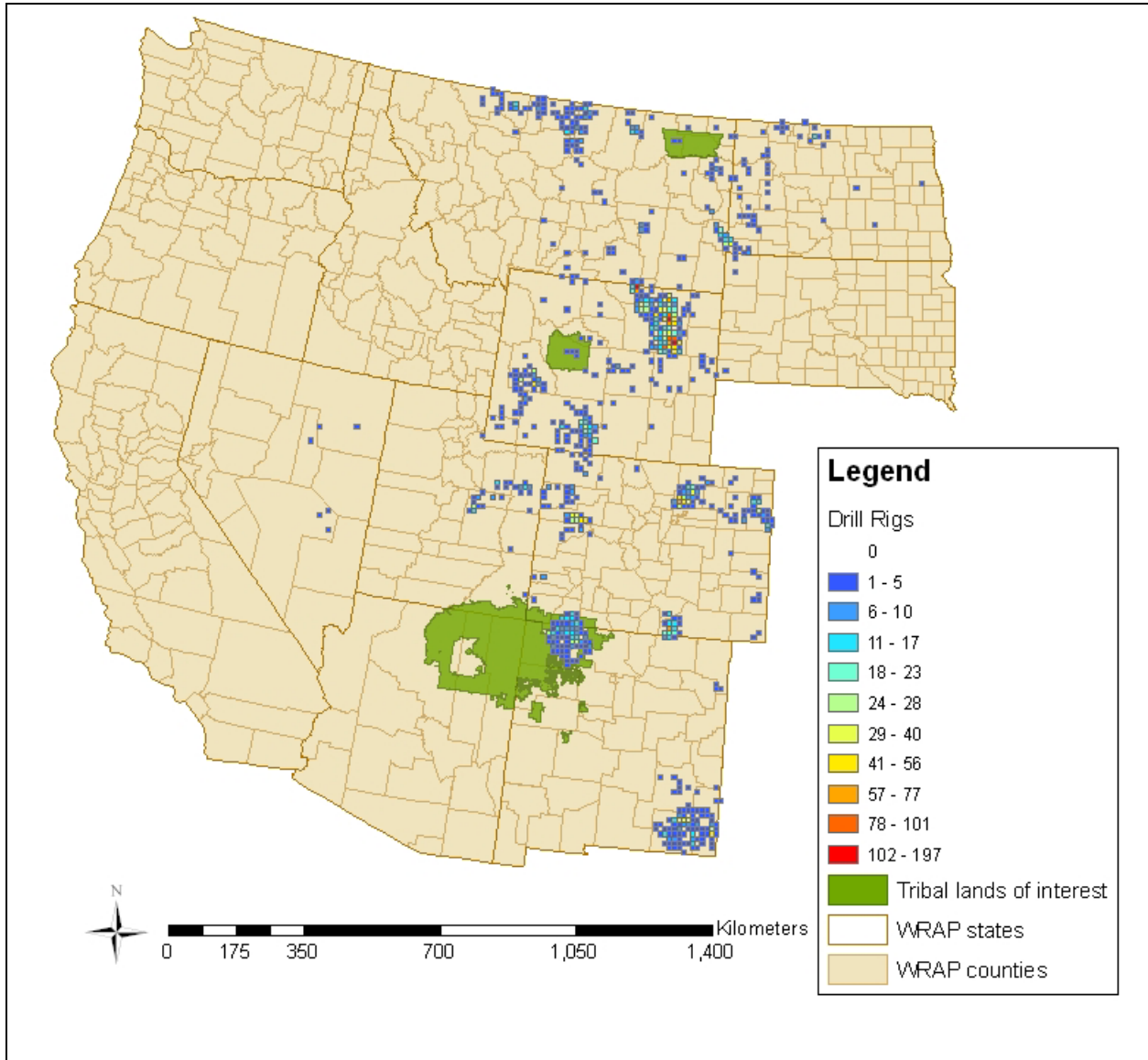


Figure 9. Drill rig surrogates for the 12 km domain.