

# Canoe & kayak registrations in Ohio 2016 to 2019 - A spatial analysis

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## **Abstract**

This report contains an overview of the spatial distribution of paddle boat registrations in Ohio between January 2016 and March 2019. Its purpose is to provide empirical evidence that can support decision making by the Ohio Department of Natural Resources in its efforts to improve education and recreational opportunities at Ohio's scenic rivers. The original data used in the analysis was provided by the ODNR Scenic Rivers Program.

# Canoe & kayak registrations in Ohio 2016-19

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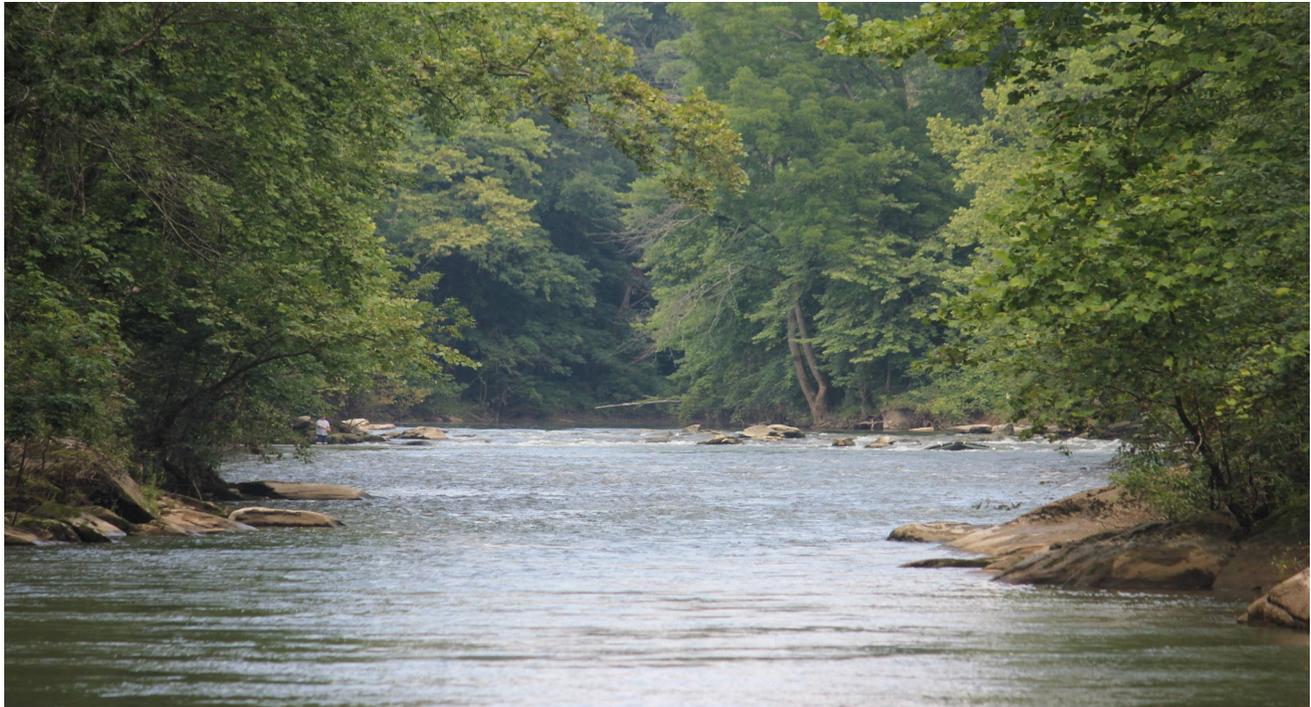
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# Paddle boat registration data

## A spatial analysis

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*A brook can be a friend in a special way. It talks to you with splashy gurgles. It cools your toes and lets you sit quietly beside it when you don't feel like speaking.*

(Joan Walsh Anglund, *A Friend is Someone Who Likes You*)

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## Summary of the dataset

Initial number of records: 194,418

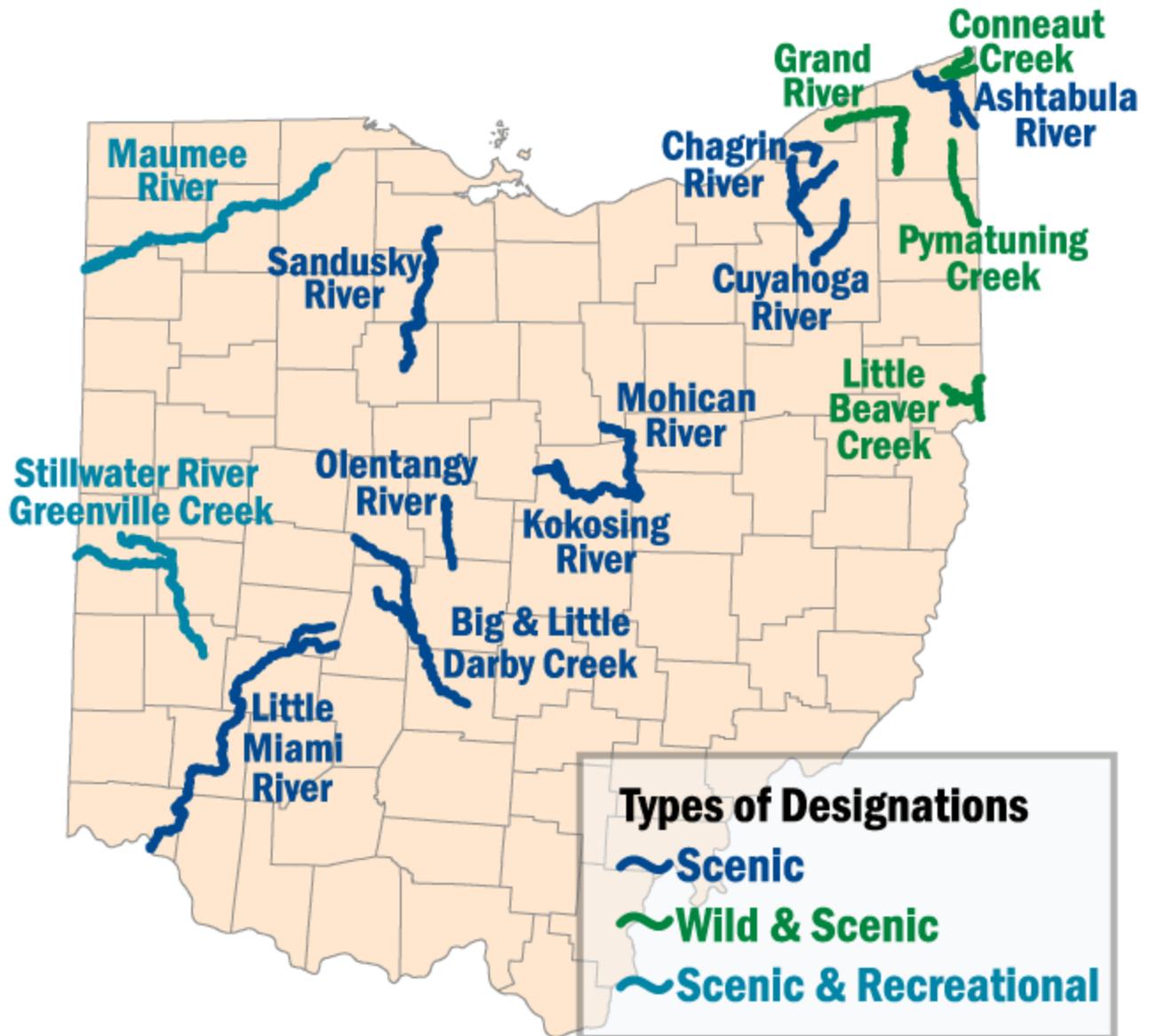
Number of duplicate addresses removed: 56,476

Unique addresses used in the analysis: 137,942

Unique addresses from Ohio: 136,967

Unique addresses outside of Ohio: 975

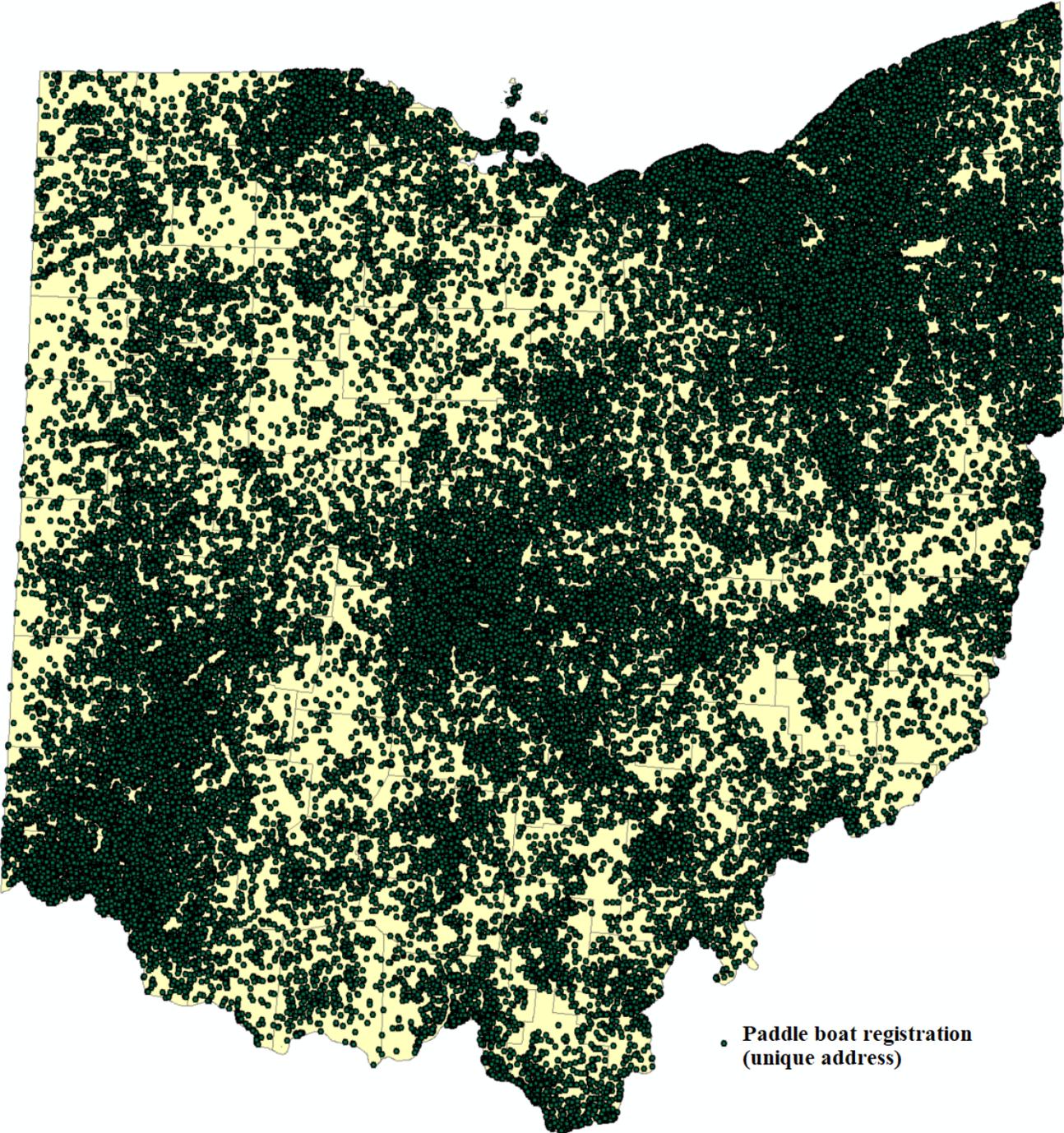
Registration period: Jan 28, 2016 – Mar 12, 2019



Ohio's Scenic, Wild, and Recreational Rivers

## Spatial distribution of registration data

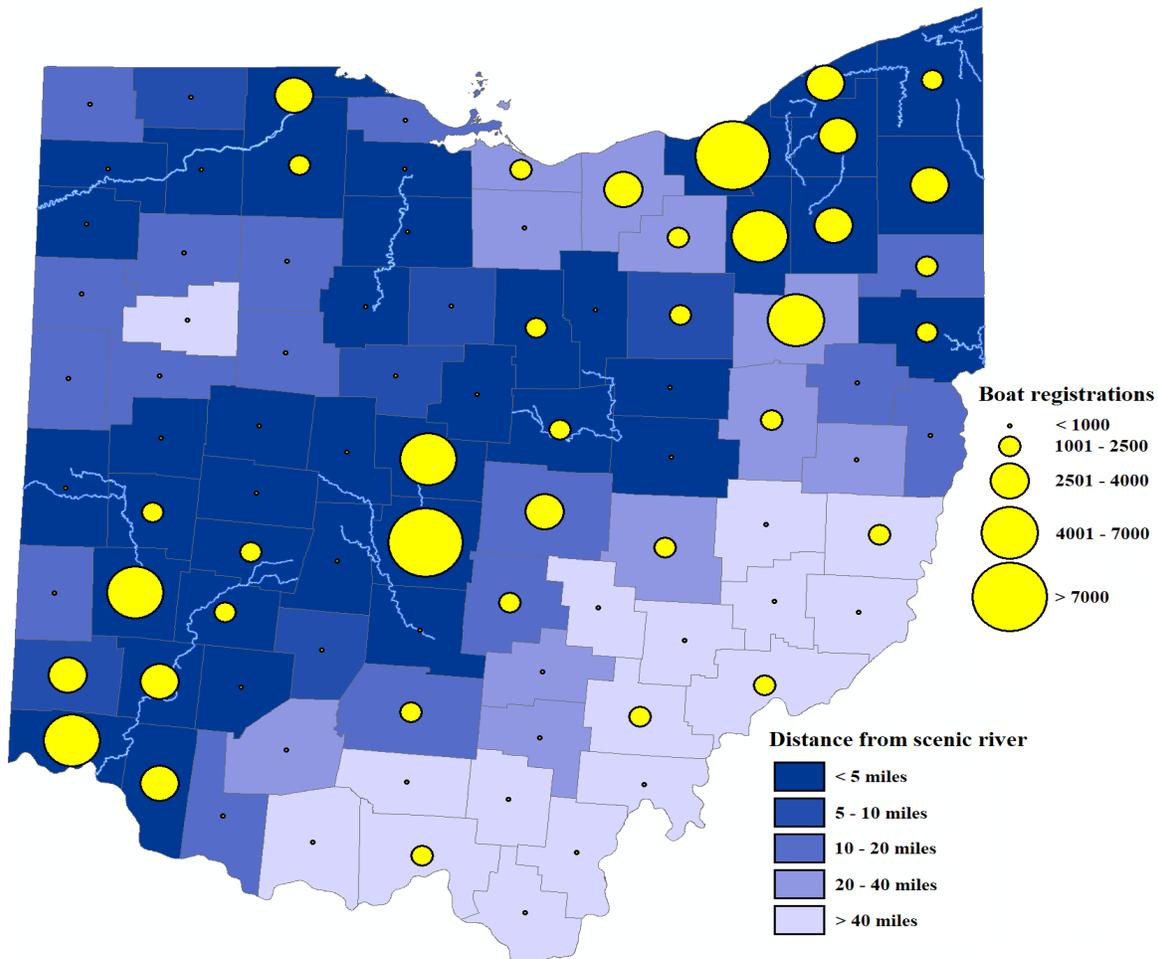
The figure below shows the spatial distribution of the 136,967 unique addresses used in the analysis. It shows that, overall, paddle boat registrations are higher in places where population density is higher. In the next pages of this report, we will explore this spatial distribution in more detail, including some exceptions to this general rule of registrations following population. In particular, we are interested in demonstrating that the proximity to a scenic river is also a major control of the spatial distribution of paddle boat registrations in Ohio.



## Registrations by county and their distances from a scenic river

The figure below shows a multiple attribute map combining two sets of data. The **graduated circles** represent paddle boat registrations by county. Larger circles indicate counties with higher number of individual registrations. The **graduated colors** represent distances between registrant addresses and the closest scenic river. Darker shades represent counties where the registrants are within a shorter distance of a scenic river. The location of Ohio's scenic rivers are also shown in the map.

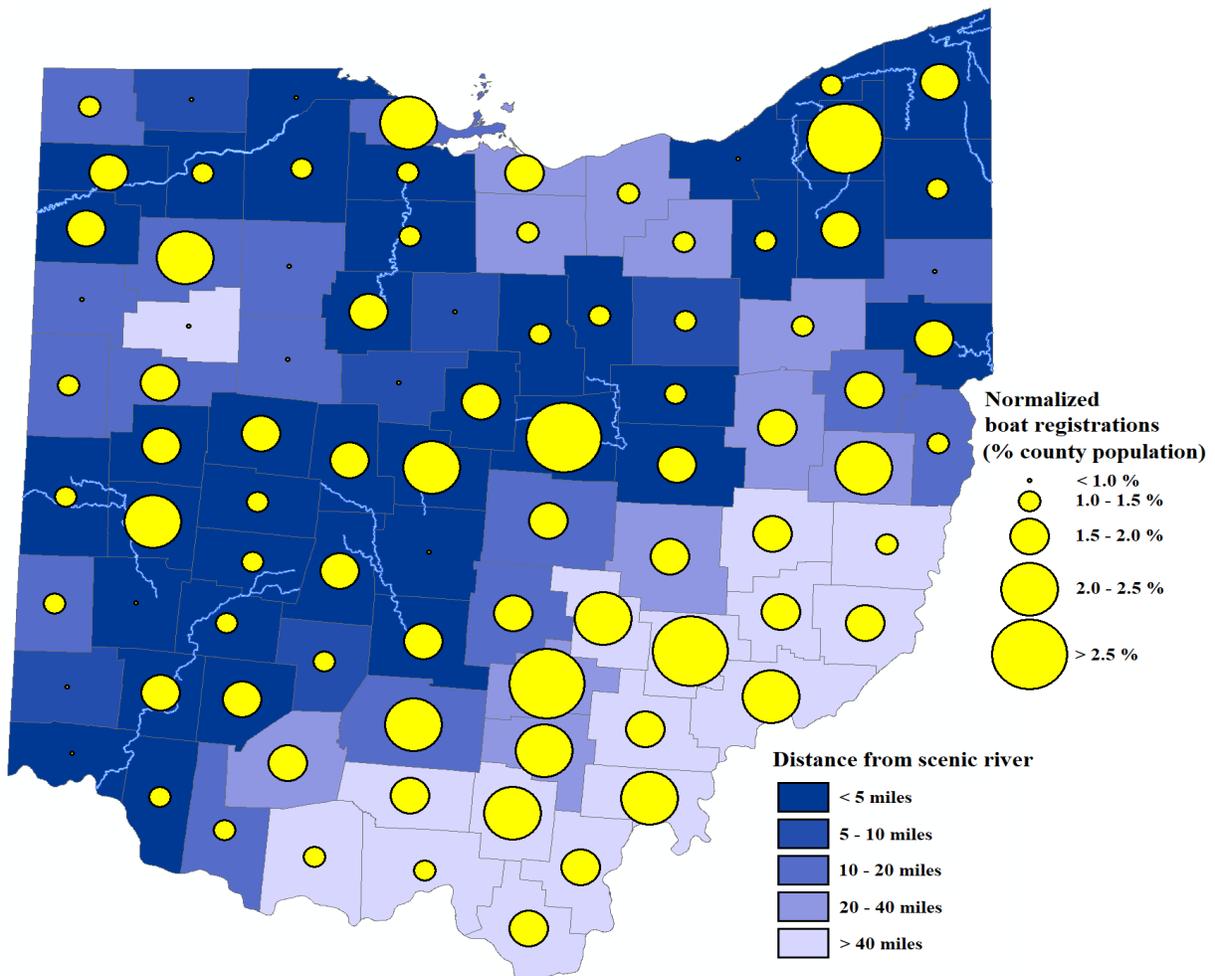
This map confirms that the highest number of registrations do occur in counties with the largest population density. The three most densely populated counties – Franklin, Cuyahoga, and Hamilton counties – with a combined population of 3.32 million people (or 28.6% of the state's population), are home to three of the four highest registration numbers: 11,858, 7,236, and 5,070 registrations respectively. But these counties also contain, within their borders, at least one scenic river. In addition, some of the counties among the **top-10 in the number of registrations** are **NOT** among the **top-10 in population**. These counties include Delaware (16<sup>th</sup> in population; 6<sup>th</sup> in boat registration), Warren (12<sup>th</sup> in population; 8<sup>th</sup> in boat registration), and Lake (11<sup>th</sup> in population; 9<sup>th</sup> in boat registration). These counties have over 3,300 registrations each, and all have at least one scenic river within their borders. In fact, 7 of the top-10 registration counties have at least one scenic river within their borders, the only exceptions being Summit (6491 registrations), Stark (4173 registrations), Lorain (3284 registrations).



Thus, in order to further explore the **impact of proximity to a scenic river on the number of registrations**, we created a new map with the same information as the previous one but, this time, we normalized the number of registrations from each county by its total population. In this new map (shown below), the graduated circles represent the **percentage of the population in each county that have registered a paddle boat**.

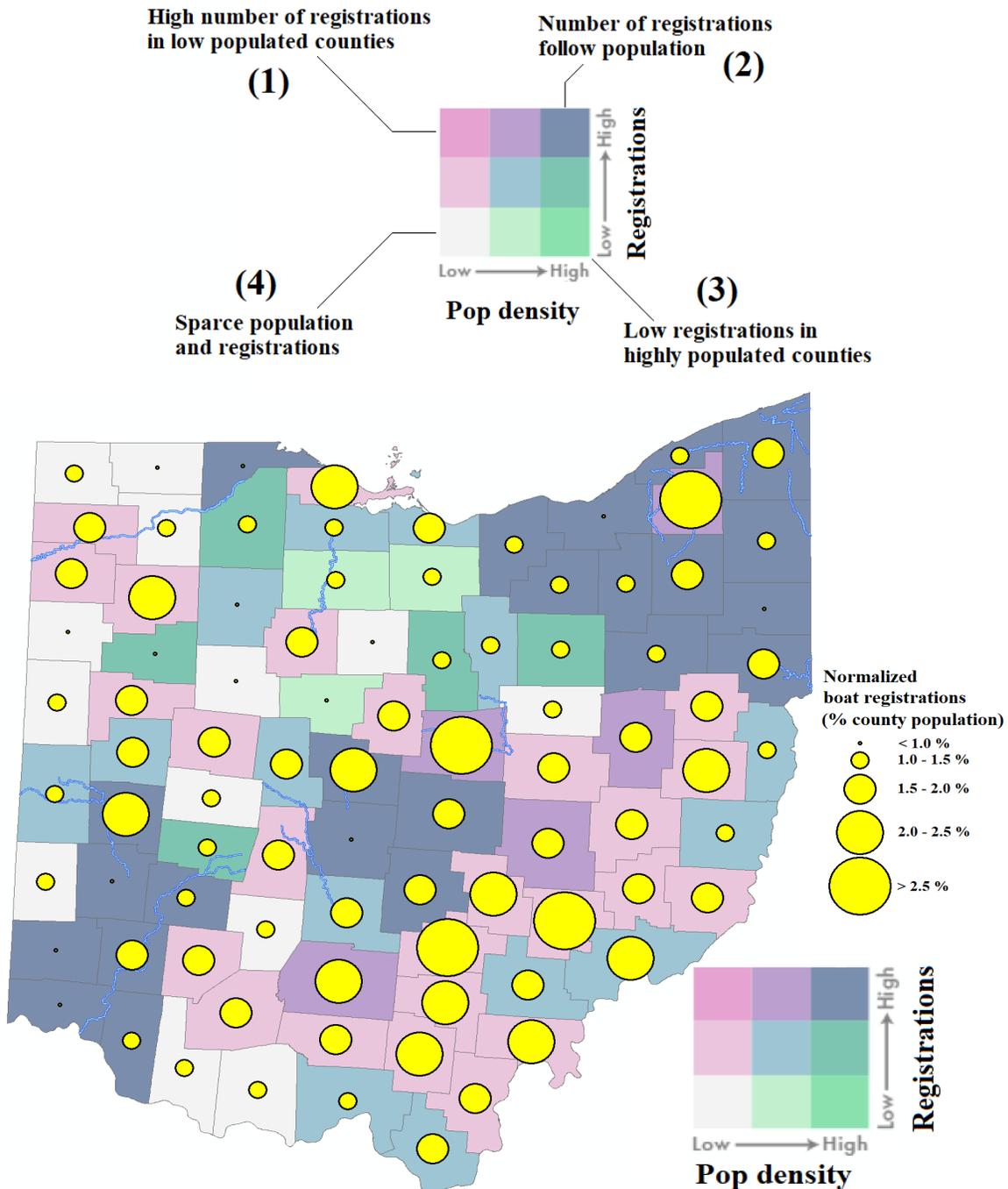
When the population effect is removed, the impact of proximity to a scenic river on the number of registrations becomes clear, as evidenced in the counties surrounding the Maumee Scenic River (in the northwest region), the Stillwater/Greenville Scenic River System (central-west region), the Big & Little Darby Scenic Rivers (south-central region), the Mohican and Kokosing Scenic Rivers (north-central region), the Little Beaver Scenic River (central-east region), and the scenic rivers in the north-eastern region of the state. Most counties surrounding these scenic rivers have **relatively high percentage of registrations compared to their total population**. In contrast, the most populous counties (Franklin, Cuyahoga, and Hamilton) have strikingly low registrations compared to their total population.

This map also shows that the southeast region of the state has a **relatively high number of registration in low populated counties**, even though there are no scenic rivers in that region. Counties along the **Muskingum River Water Trail** (Coshocton, Muskingum, Morgan, and Washington) show particularly higher percentages of boat registrations relative to their population.

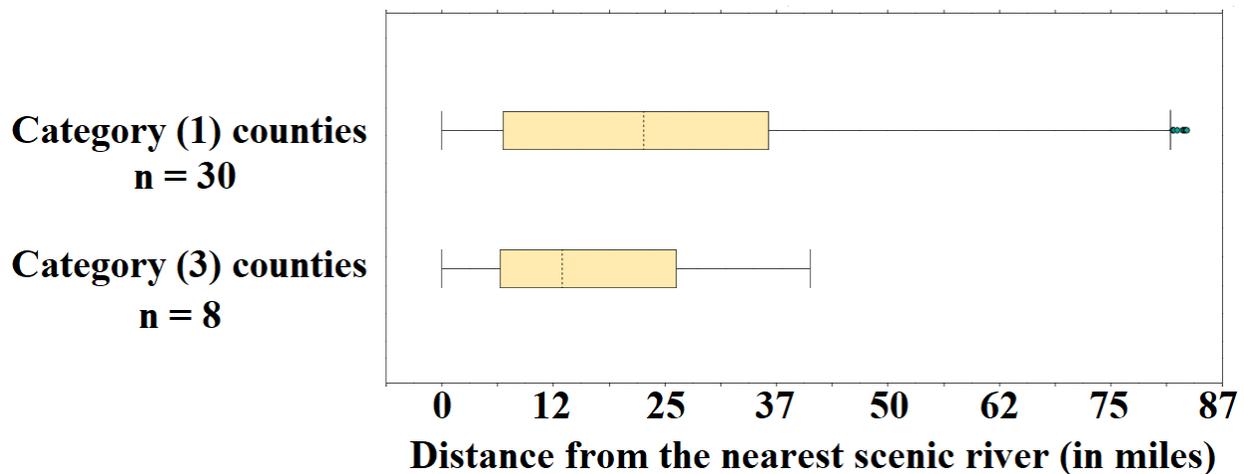


## Are paddle boat registrations simply following population trends?

Another way to separate the effect of population density on the spatial distribution of paddle boat registrations is through a 9-class bivariate map (below). This map shows the relationship between the number of registrations in each county and the county's population density. It allows us to group counties into four major categories: (1) counties with **high rates of registrations** compared to their population; (2) counties where **registrations follow population** (high registration and high population density); (3) counties where **registrations are proportionally rare** (low registrations for a relatively high population density); and (4) counties in which both **registrations and population are low**.



There were no counties in the extreme case of **category (1) – extremely HIGH registration rate in a LOW population county**. Nevertheless, 5 counties – Geauga (pop: 93389; regist: 2537), Knox (pop: 60921; regist: 1834), Tuscarawas (pop: 92582; regist: 1701), Ross (pop: 78064; regist: 1690), and Muskingum (pop: 86074; regist: 1543) – reported **HIGH registration rates at intermediate population densities**, and another 25 counties – including Madison (pop: 43435; regist: 850), Clinton (pop: 42040; regist: 723), Coshocton (pop: 36901; regist: 718), Putnam (pop: 34499; regist: 692), and Defiance (pop: 39037; regist: 639) – reported **intermediate registration rates at LOW population densities**. There is a total of 24,428 registrations in these 30 counties, and over 75% of them are **within 36 miles of a scenic river** (see box-plot graph below). The average distance from these registrants to the nearest scenic river is 23.6 miles. Based on the number of paddle boat registrations in these counties, it is reasonable to assume that there is already significant awareness of the scenic rivers in these locations, and/or reasonable access to paddling opportunities.

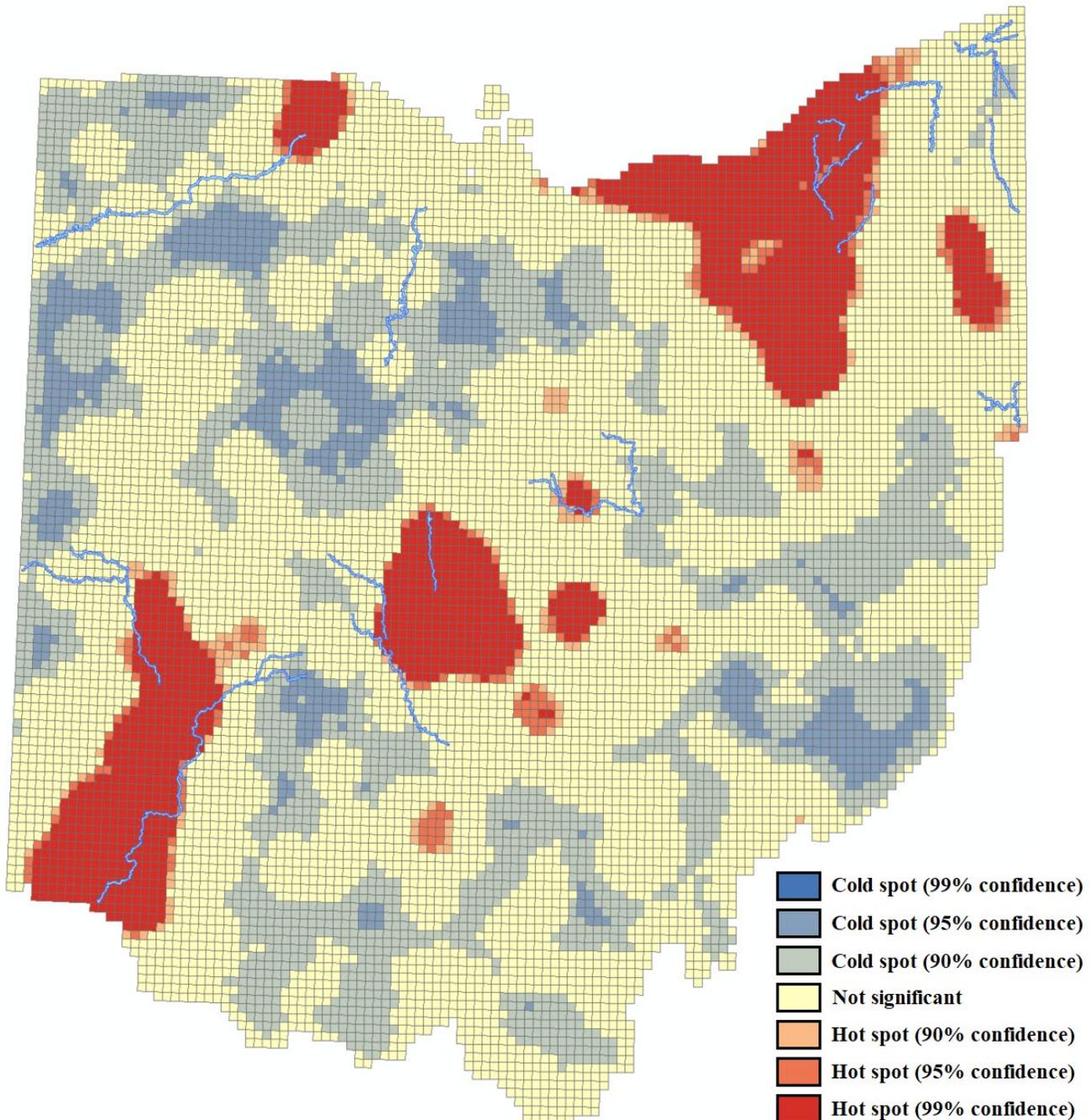


There were also no counties at the other extreme, in **category (3) – extremely LOW registration rates in a HIGH population county**. Nevertheless, 3 counties – Marion (pop: 66501; regist: 496), Huron (pop: 59626; regist: 633), and Seneca (pop: 56745; regist: 669) – reported **LOW registration rates at intermediate population densities**, and another 5 counties – Clark (pop: 138333; regist: 1464), Wood (pop: 125488; regist: 1447), Richland (pop: 124475; regist: 1330), Wayne (pop: 114520; regist: 1306), and Allen (pop: 106331; regist: 926) – reported **intermediate registration rates at HIGH population densities**. There is a total of 8,255 registrations in those 8 counties, and over 75% of them are **within 26 miles of a scenic river** (box-plot graph above). The average distance from these registrants to the nearest scenic river is 13.7 miles. The relatively low number of paddle boat registrations in these counties show that more work needs to be done in order to raise awareness of the scenic rivers and the recreational opportunities they provide.

Among the 50 remaining counties, 23 were classified as **category (2) – HIGH registration rates at HIGH population densities** – while 13 were classified as **category (4) – LOW registration rates at LOW population densities**. The last 14 counties placed at the center of the 9-class palette, showing **intermediate registration rates at intermediate population densities**.

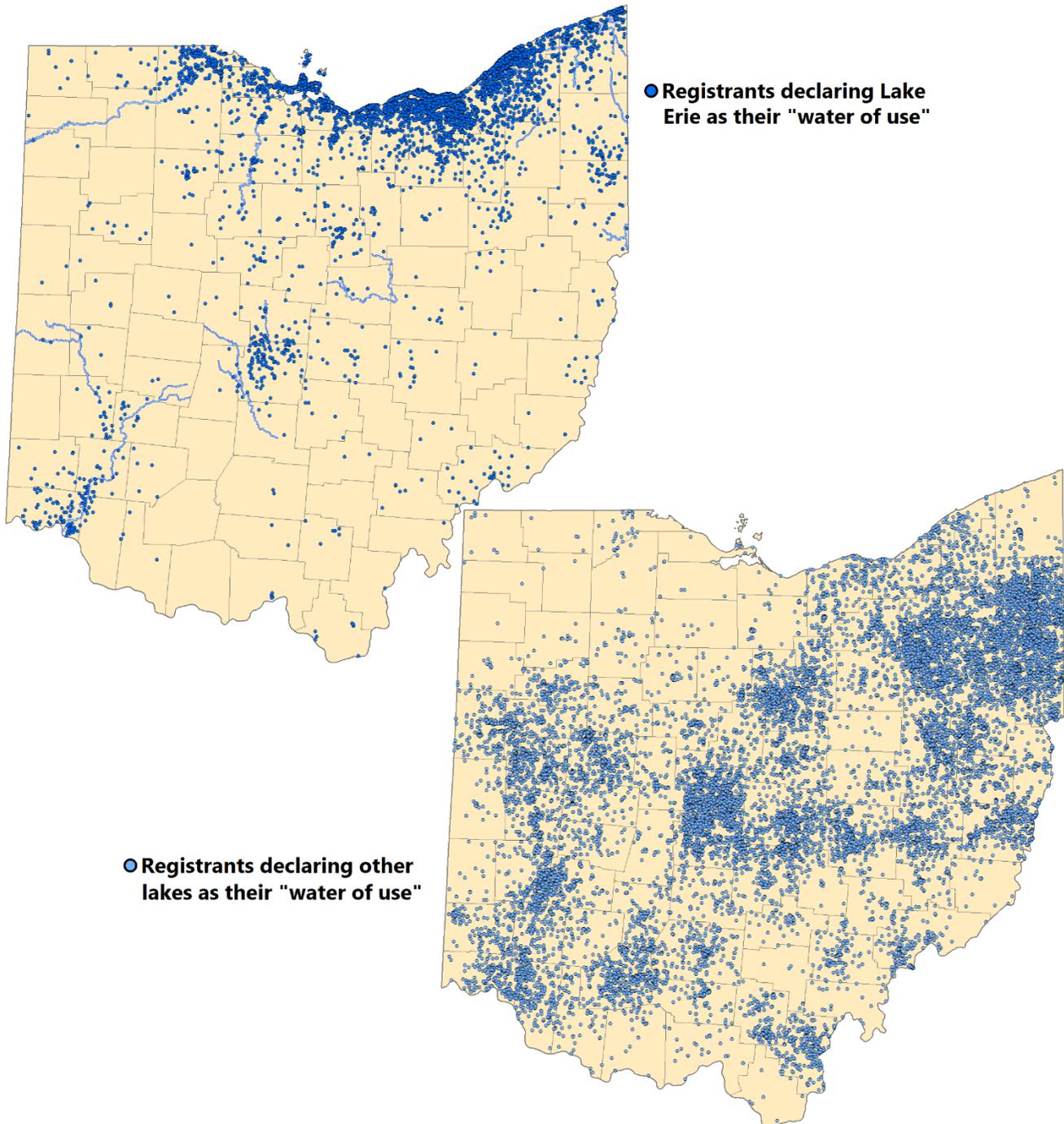
## Hot-Spot Analysis: Are there statistically significant spatial clusters?

Hot-Spot Analysis helps identify the locations of statistically significant **clusters of high values** (hot spots) and **low values** (cold spots). In the case of boating registration data, the analysis looks for spatial aggregation based on the geolocation of each registrant. The map below shows the results of the hot spot analysis on the boat registration data. Not surprisingly, the highest concentration of registrations occurs on the most densely populated areas of the state. This analysis also shows areas where there is relatively low number of registrations (cold spots) and these areas could be targets for concerted educational efforts to raise awareness of the scenic rivers and its associated educational opportunities.

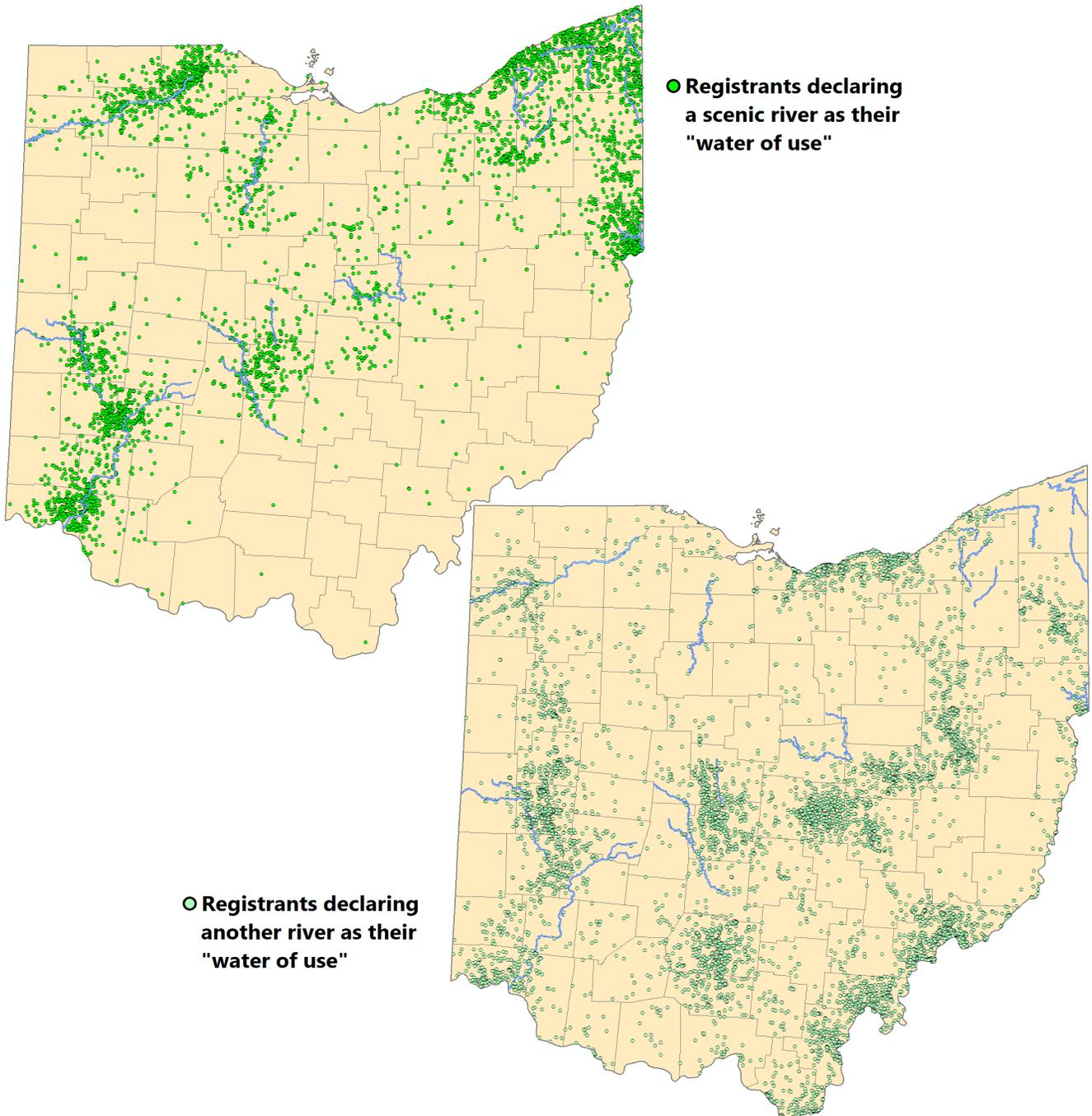


## Waters of Use: Where do they go to paddle?

One-third of paddle boat registrants (44,811) declared a primary “water of use”. Among these, **66% (29,504 registrants)** listed one of **Ohio’s lakes and reservoirs** as their primary paddling destination (maps below), with just over one-fifth (**6,580 registrants**) declaring **Lake Erie** as their primary paddling destination (top map). Other leading lake destinations for paddle boat registrants include **Indian Lake** (Logan County, 1696 registrants), **Mosquito Lake** (Trumbull County, 1613 registrants), **Portage Lakes** (Summit County, 1121 registrants), **Guilford Lake** (Columbiana County, 979 registrants), **Rocky Fork Lake** (Highland County, 929 registrants), and **Buckeye Lake** (Fairfield County, 928 registrants).



Another **34% (15,307)** of registrants declaring a “water of use” listed one of **Ohio’s rivers and streams** as their primary paddling destination, with one-third of them (**5,470 registrants**) declaring one of the 15 state scenic rivers as their main “water of use” (top map below). Among these rivers, the **Little Miami River** has the highest number of declared paddlers (1035 registrations), followed by the **Maumee River** (1006 registrations), the **Grand River** (693 registrations), the **Pymatuning River** (561 registrations), and the **Beaver Creek** (559 registrations). The vast majority of these registrants (97%) live within **30 miles of a scenic river**. Other streams/rivers that are popular among registered paddlers include: **Ohio River** (1601 registrations), **Great Miami River** (927 registrations), **Licking River** (671 registrations), **Tuscarawas River** (654 registrations), and **Paint Creek** (568 registrations).



## Proximity Analysis: How far are the registrations from a scenic river?

Proximity Analysis is used to determine the relationship between a selected location (or feature) and its neighbors. The map below shows the Euclidean distance (“the **shortest distance** between two points in a **straight line**”) from each unique address to its closest scenic river. The distances are indicated by the colored buffers (yellow = 10 mile; light-orange = 20 miles; dark-orange = 30 miles). This analysis indicates that **74%** of all paddle boat registrants live **within 30 miles of a scenic river**. Although actual travel times to the river from each address will be constrained by the available road network and traffic, this result suggests that proximity to the river may be an important consideration for users investing on a paddle boat and license. Also noteworthy is the fact that **47% of paddlers** that live **more than 30 miles** from a scenic river did not list these as their primary water of use.

