THE SOCIAL GEOGRAPHY OF SOUTHERN WYOMING
Important Places, Development, and Natural Resource Management

Photo: Ken Driese

SOCIAL MAPS

- In Wyoming, we know where to find natural resources. We can follow pronghorns, elk and deer on their seasonal migrations. But we have not had the same information about which places ***people*** care about and why.

- We created social maps for 3 counties (*see pages 8-14*) and describe that process in this report. People agreed on important places and where development should occur – **a collective social vision** – highlighting the value of expanding social mapping to other counties or statewide.

- Social maps could be used to ***inform local planning***, such as comprehensive plans, siting new development, and prioritizing locations for future recreation, conservation, and water projects.

KEY SURVEY FINDINGS

- We surveyed residents of Albany, Carbon, and Sweetwater counties in 2010. Most participants reported that **fish and wildlife habitat, availability of water, and open spaces and scenic views** are extremely or very important to them.

- Water is very important to people for agriculture and recreation. Most participants were very ***concerned about the possibility of future drought***, but very few participants felt that their communities are prepared for future droughts.

- Many participants perceive that wind energy development may enhance the economic sustainability of family farms and ranches, but there was some **concern about the potential negative effects of wind developments** on wildlife populations and access to some lands for recreation.

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WHY WE NEED MAPS OF PLACES IMPORTANT TO PEOPLE

Wyoming and other western states are challenged with balancing growing demands for energy and residential development with the protection of wildlife habitat, water, open spaces, and working farms and ranches. To achieve this balance, planners and decision-makers must consider a wide variety of data and perspectives and engage diverse stakeholders. For decisions about land uses in specific places, maps are powerful tools and are widely available to represent features such as wildlife populations and energy resources.

Maps link social values to actionable places

However, maps showing places that are important to people and where they would prefer new development to occur do not exist. Social maps provide graphical insight into community perceptions and values and provide concrete locations with which to verify general social perceptions and trends.

We created maps of places important to people in southern Wyoming for recreation, agriculture, wildlife and other reasons and maps of preferences for wher new energy and residential development should occur. This was accomplished through a mapping survey that also included questions about values and knowledge, as well as perceptions related to water issues and wind energy development. The resulting maps link important social values to actionable places, engaged local residents in planning for the future, and provide a collective vision of which places are most important. Social maps provide new information about the values and needs of residents that can contribute to local planning and inform decision-making related to balancing development with land and water protection. We demonstrate in this report how social maps can be used to plan for and make decisions related to land use, through examples related to wind energy development siting and water management.

THE SOUTHERN WYOMING STUDY AREA

The survey was completed in Albany, Carbon, and Sweetwater counties in southern Wyoming. This area was chosen because of ongoing and anticipated changes related to energy development.

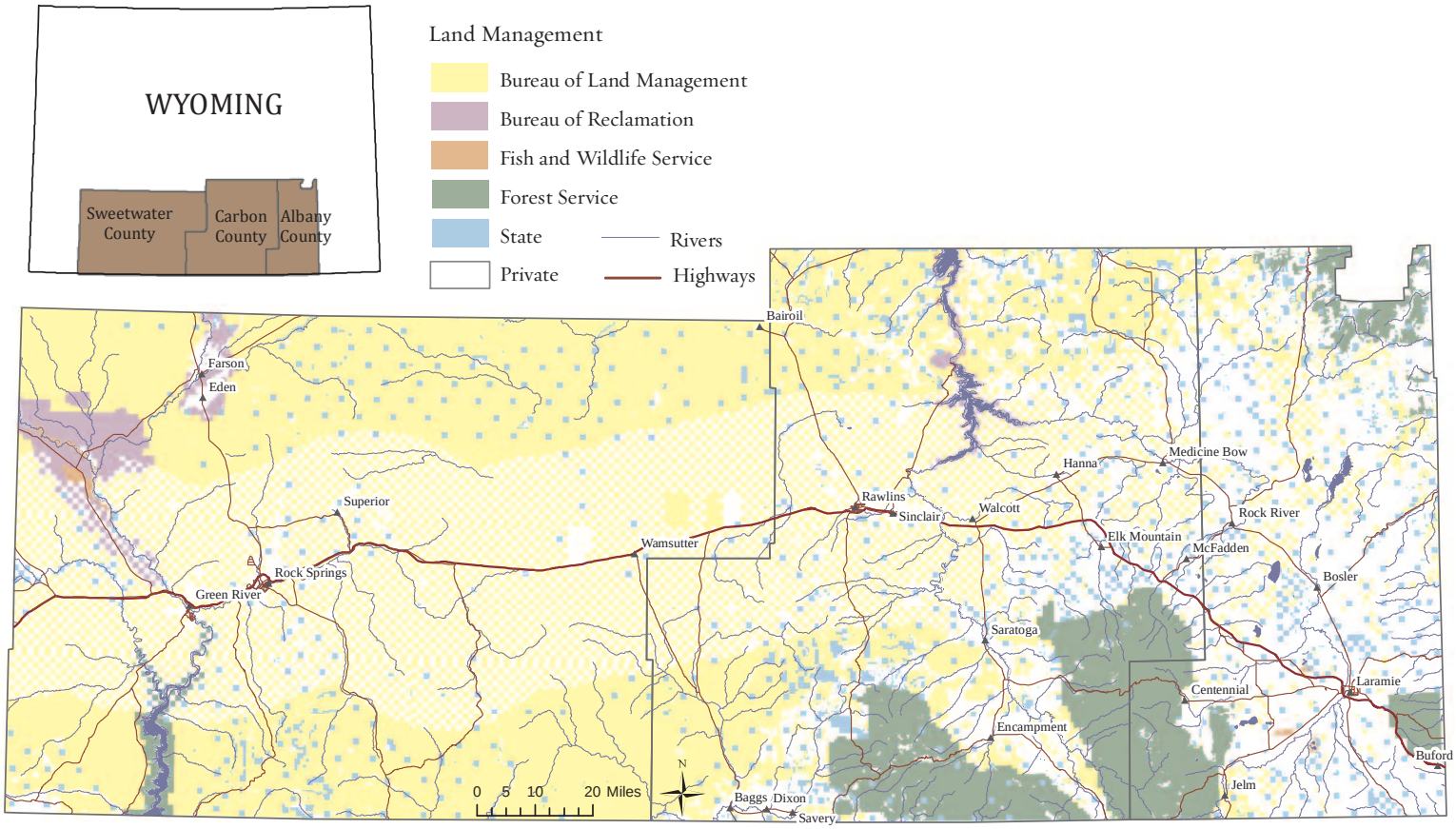


Photo: Russell Schnitzer

MAPPING SURVEY

We collected data using an internet-based survey and provided the option to complete a paper survey, to avoid excluding people without convenient internet access. The survey included a mapping exercise, followed by a series of questions assessing knowledge about and perceived importance of the attributes mapped, demographic information, and perceptions related to water issues and wind energy development. The survey was administered by The Nature Conservancy's Wyoming Chapter, in cooperation with the William D. Ruckelshaus Institute of Environment and Natural Resources at the University of Wyoming. Information at Central Washington University. The survey can be viewed at http://www.wyomingvalues.us (access code 101-0101). Participants could drag and drop as many map markers as desired for each attribute. The paper maps displayed terrain, land tenure, major roads, streams and rivers, and towns. Participants were provided with a labeled sticker sheet with six stickers available per attribute and six extra stickers to use for any attribute. Sticker locations were digitized into GIS files.

We mailed invitation letters to 2000 randomly-selected residents in late March 2010. Numbers of invitations were distributed equally among the three counties and were proportional to population levels within each census tract. The invitation included the internet address for the survey and a unique access code. A postage-paid return postcard was enclosed, providing the options to request a paper version of the survey or to decline participation entirely. Multiple reminders were mailed to those who did not respond.

Attributes included in the mapping survey

Important places for:
agriculture, recreation, wildlife habitat protection, water, open space, and economic opportunities

Preferences for development:
where new wind energy, oil/gas, and residential development are preferred

Knowledge of conditions:
water quality & abundance, land condition, and wildlife abundance

For the mapping exercise, participants were asked to place map markers for 16 different attributes that represented important places, development preferences and knowledge of natural resource conditions. The internet-based survey used the GoogleMaps/Earth application programming interface and allowed participants to zoom and pan and view the maps in multiple views (e.g., terrain, map, satellite). The website was created by the Center for Spatial

SURVEY PARTICIPATION

Approximately 10% of 1961 deliverable surveys were completed, with similar response rates among the three counties. 75% of participants lived in one of four major towns – Green River, Laramie, Rawlins, or Rock Springs – which is consistent with population distribution. 81% lived in a town, 12% within five miles of a town, and 8% more than five miles from a town. The mapping activity was completed by 198 people, 98 via the internet and 100 via paper. The additional survey questions were completed by 191 people, 85 via the internet and 106 via paper.


Photo: Russell Schnitzer

To identify reasons for lack of participation and possible response bias, we completed a phone survey of non-participants and compared participant demographics to census and other datasets. Of 45 people who were invited but did not participate, most did not participate for reasons unrelated to the survey content (64%). For example, they did not remember receiving the survey, thought it was junk mail, or did not have time. The other 36% provided reasons related to survey content, including not feeling knowledgeable enough (20%), not understanding the survey (13%) and perceiving a conflict of interest related to their employment (2%). Lack of convenient internet access was an issue for 15% of those who completed the entire phone survey (n=34), and another 6% (2 of 34) reported that the two groups leading the survey affected their decision. Men completed the survey at a higher proportion than their representation in the survey sample(Table 1). Participants had lived in their current county fewer years on average than non-participants. There was no difference in age, employment status, or in the proportion of people with a high school degree; however, a greater proportion of survey participants had a 4-yr college degree (Table 1). An employment rate of 67% was reported by participants, the same proportion reported by the census for the counties studied. The remaining participants were retired (26%), students (3%), homemakers (2%), and unemployed (2%).

TABLE 1. Similarities and differences in characteristics of randomly-selected study area residents who did and did not participate in the survey

Characteristic	Participants	Non-participants	Are the two groups different? [a]
Female	31%, n=191	44%, n=1796	Yes (χ^2, $p< 0.01$)
Male	69%, n=191	56%, n=1796	Yes (χ^2, $p< 0.01$)
Average age	53(1.0[b]), n=189	54(0.8[b]), n=432	No (t-test, $p=0.50$)
High school degree	98%, n=191	94%, n=34	No (Fisher, $p=0.17$)
4-yr college degree	43%, n=191	21%, n=34	Yes (χ^2, $p = 0.01$)
Avg. years in the county	30(1.5[b]), n=190	38(3.6[b]), n=34	Yes (Wilcoxon, $p=0.03$)

[a] To test for differences between participants and non-participants, we used chi-square (χ^2) or Fisher's tests for proportional data and t-tests or Wilcoxon rank sum tests for continuous data.
[b] Standard error around the average values.

PERCEPTIONS ABOUT WATER ISSUES AND WIND ENERGY DEVELOPMENT

Most participants expressed that the long-term availability of water to support agriculture is very important (Table 2). Most participants were very concerned about the possibility of future drought, but very few felt that their communities are prepared for future droughts. For more than half of participants, water was very important for their recreational activities. Most participants perceived that new wind farms will greatly or somewhat enhance the economic sustainability of family farms and ranches. Nearly half of participants perceived that new wind farms will greatly or somewhat decrease wildlife populations, while almost 40% perceived that new wind farms will greatly or somewhat decrease their access to public and private lands where they currently recreate (Table 2).

TABLE 2. Summary of participant perceptions related to water issues and wind development

Survey question	Average score (standard error)	Results summary
How important to you is the long-term availability of water to support agriculture?	3.14 (0.07)[a]	Extremely or very important: 72%
How concerned are you about the possibility of future droughts?	2.94 (0.07)[a]	Extremely or very concerned: 69%
How important is water for your recreational activities?	2.82 (0.08)[a]	Extremely or very important: 59%
How prepared do you feel your community is to adapt to less water if droughts occur?	1.17 (0.06)[a]	Extremely or very prepared: 5%
Generally, how do you think new wind farms may affect the economic sustainability of family farms and ranches?	0.93 (0.07)[b]	Greatly or somewhat enhance: 68% Greatly or somewhat decrease: 6%
How do you think new wind farms may affect wildlife populations?	-0.65 (0.06)[b]	Greatly or somewhat increase: 3% Greatly or somewhat decrease: 44%
How do you think new wind farms may affect your ability to access public or private lands where you currently recreate?	-0.43 (0.08)[b]	Greatly or somewhat increase: 14% Greatly or somewhat decrease: 38%

[a]Scale of 0 to 4, where 0 = not at all important, concerned, or prepared and 4 = extremely important, concerned, or prepared
[b]Scale of -2 to 2, where -2 = greatly decrease, 2 = greatly increase, and 0 = not affected


Photo: Ed Orth

VALUES AND KNOWLEDGE OF PARTICIPANTS

Participants were asked to describe how important each of seven values were to them on a scale of not at all important (0) to extremely important (4) and to rate their knowledge and understanding of six issues on a scale of none (0) to excellent (4). Most participants reported that fish and wildlife habitat, availability of water, and open spaces and scenic views were extremely or very important (Figure 1). Economic opportunity was the least important value, with 56% of participants indicating that this value was extremely or very important. Self-reported knowledge was greatest for fish and wildlife habitat and similar for water quality and quantity (Figure 2). Level of knowledge did not differ significantly among the other issues. We included a selection of these questions in our phone survey of non-participants (n=34). The importance of working farms and ranches, fish and wildlife habitat, and availability of water did not differ between participants and non-participants, but economic opportunities were more important to non-participants (Figure 1). Participants had greater self-described knowledge concerning wind development and fish and wildlife habitat than did non-participants (Figure 2).

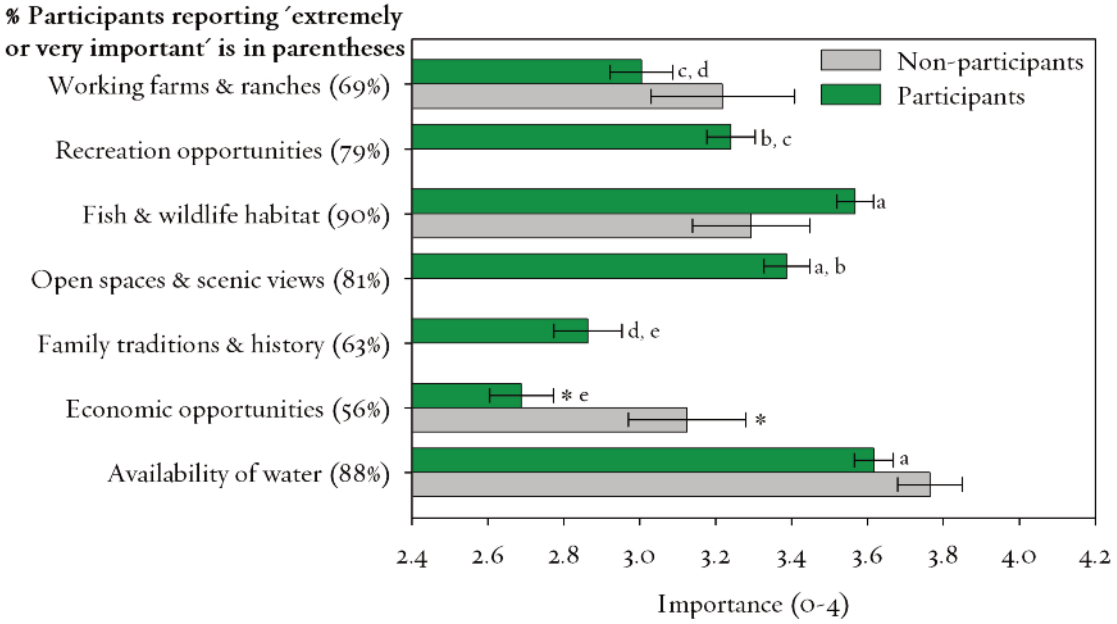


FIGURE 1.
The relative importance of values to survey participants and non-participants. Significant differences[1] among participant's average importance scores are indicated by letters; values that do not share the same letter are different. Differences between participants and non-participants are indicated by an asterisk.

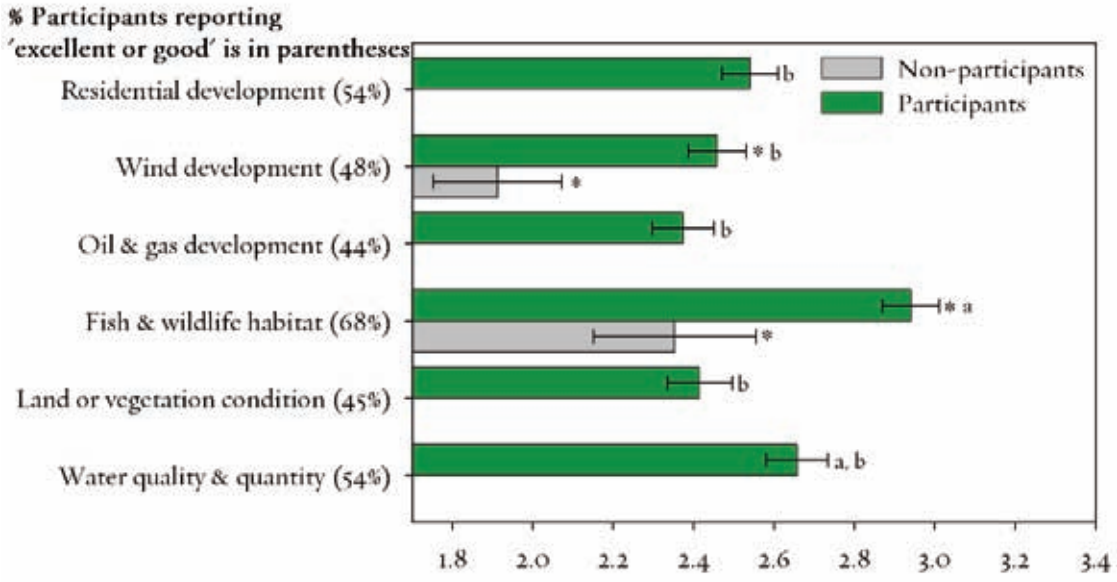


FIGURE 2.
The relative knowledge of issues, as reported by survey participants and non-participants. Significant differences[1] among participant's average knowledge scores are indicated by letters; issues that do not share the same letter are different. Differences between participants and non-participants are indicated by an asterisk.

[1]We used Tukey-Kramer HSD tests to identify differences in mean scores among the seven values or six issues.

MAPS OF IMPORTANT PLACES, DEVELOPMENT PREFERENCES AND LOCAL KNOWLEDGE

A total of 6020 points were mapped by 198 participants, with an average of 30 points per participant. Each participant placed three to five markers, on average, for each attribute. Recreation was mapped by the greatest proportion of participants, followed by water and habitat protection (Table 3). The least mapped 'important place' attribute was family traditions. Of the three types of development, preferences for wind energy development were mapped most frequently. Attributes representing knowledge of conditions were mapped infrequently overall, with the exception of abundant wildlife (Table 3).

TABLE 3. Summary of participation in the mapping activity

Mapped Attribute	Number participants (% total)	Number points (% total)
Important places		
Recreation	166 (84)	838 (14)
Water	140 (71)	470 (8)
Habitat protection	131 (66)	597 (10)
Open space	124 (63)	494 (8)
Agriculture	110 (56)	501 (8)
Economic	96 (48)	345 (6)
Family traditions	89 (45)	244 (4)
Special places	83 (42)	216 (4)
Development preferences		
Wind development	106 (54)	406 (7)
Residential development	91 (46)	317 (5)
Oil/gas development	75 (38)	284 (5)
Knowledge of conditions		
Abundant wildlife	107 (54)	452 (8)
Good water resource	80 (40)	268 (4)
Water shortage	70 (35)	222 (4)
Good land condition	62 (31)	210 (3)
Poor land condition	50 (25)	156 (3)

Photo: Scott Copeland

We created a 2-km resolution 'hotspot' map for each attribute that represented where the highest density of points occurred. Here we provide an overview of methods used to create these maps; detailed technical methods will appear in a related scientific publication. Before creating the maps, we tested whether the points associated with each attribute were distributed randomly or if they occurred in clusters, because randomly distributed points would indicate lack of agreement among participants and a lack of hotspots. All attributes except 'poor land condition' exhibited a clustered pattern and were mapped. For each of the 15 attributes we calculated overall density (hotspots) from the individual points using the kernel density method in ArcGIS. This method fits a smoothly curved surface over each point to calculate density per unit area. The value is highest at the point location and diminishes with increasing distance until reaching zero at the extent of a specified search radius. We identified 0.02 points/km^2 as a minimum density to include as part of the hotspot maps. This was the density at which approximately 80% of the points were captured by hotspots, on average, across all attributes. The social hotspot maps are displayed on pages 8 to 14.

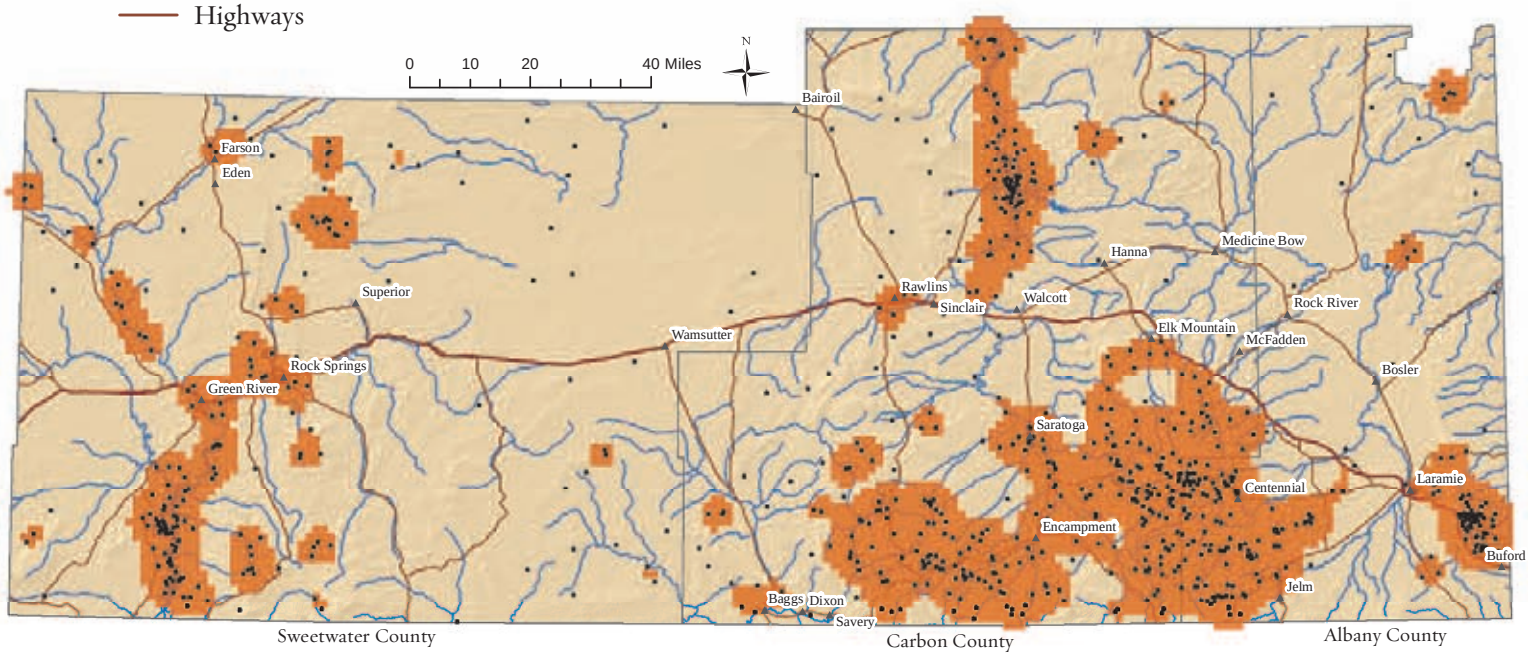
Photo: Ken Driese

HOTSPOT MAPS - IMPORTANT PLACES

Recreation hotspots
Recreation map points
Rivers
Highways

Recreation

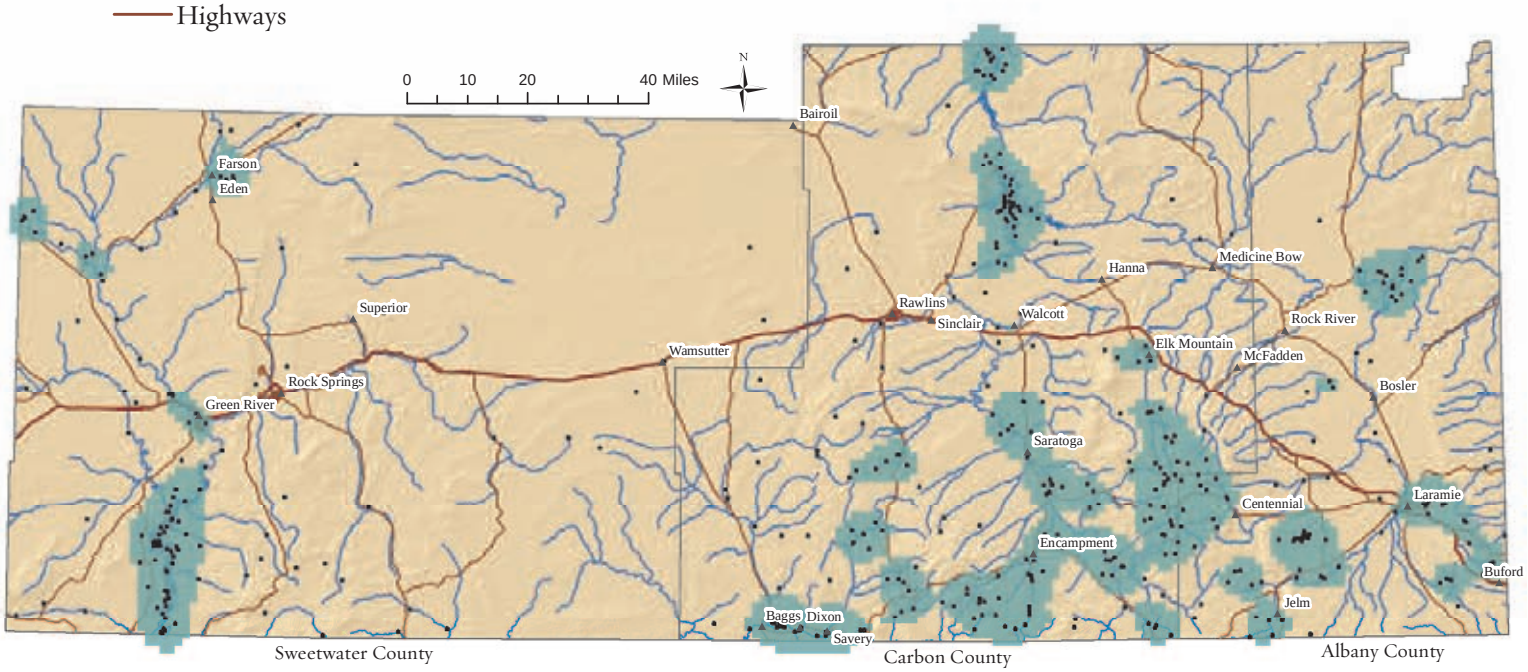
It is important to maintain outdoor recreation opportunities in these places.



Water hotspots
Water map points
Rivers
Highways

Water

These places are important sources of water.

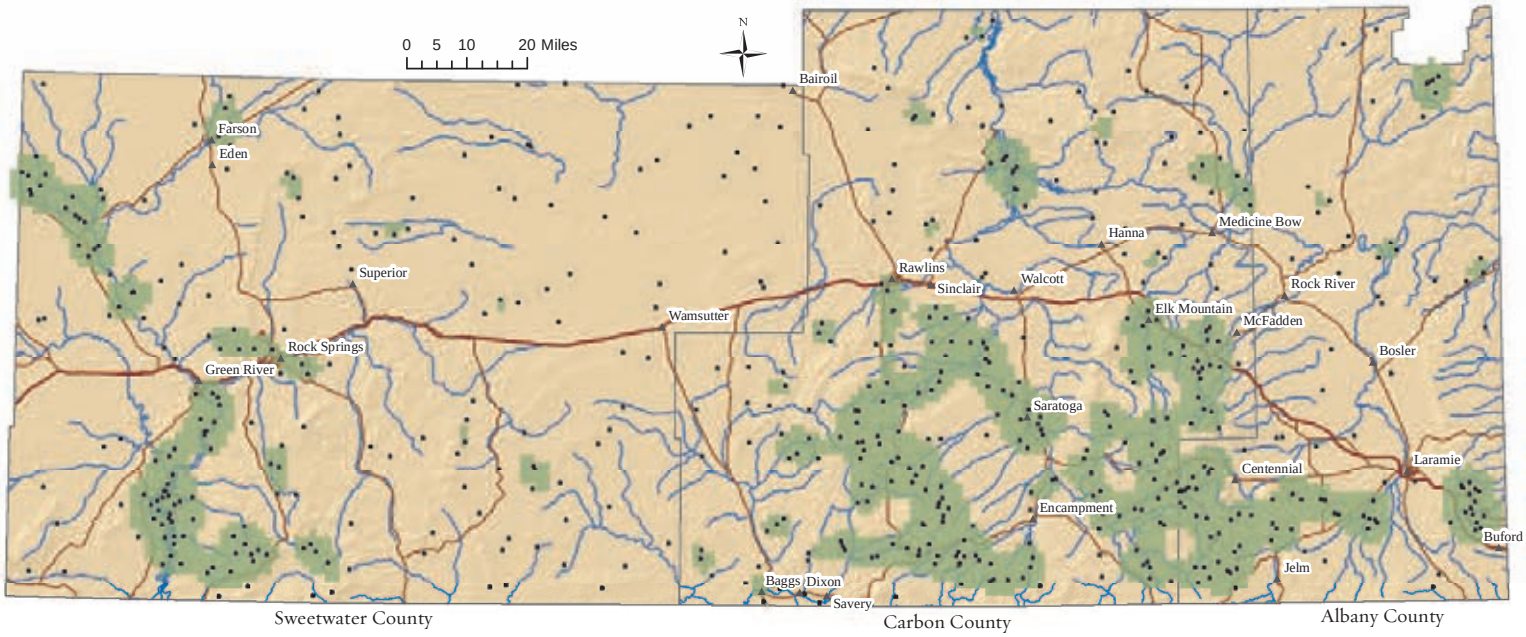


HOTSPOT MAPS - IMPORTANT PLACES

Habitat protection hotspots
Recreation map points
Rivers
Highways

Habitat Protection

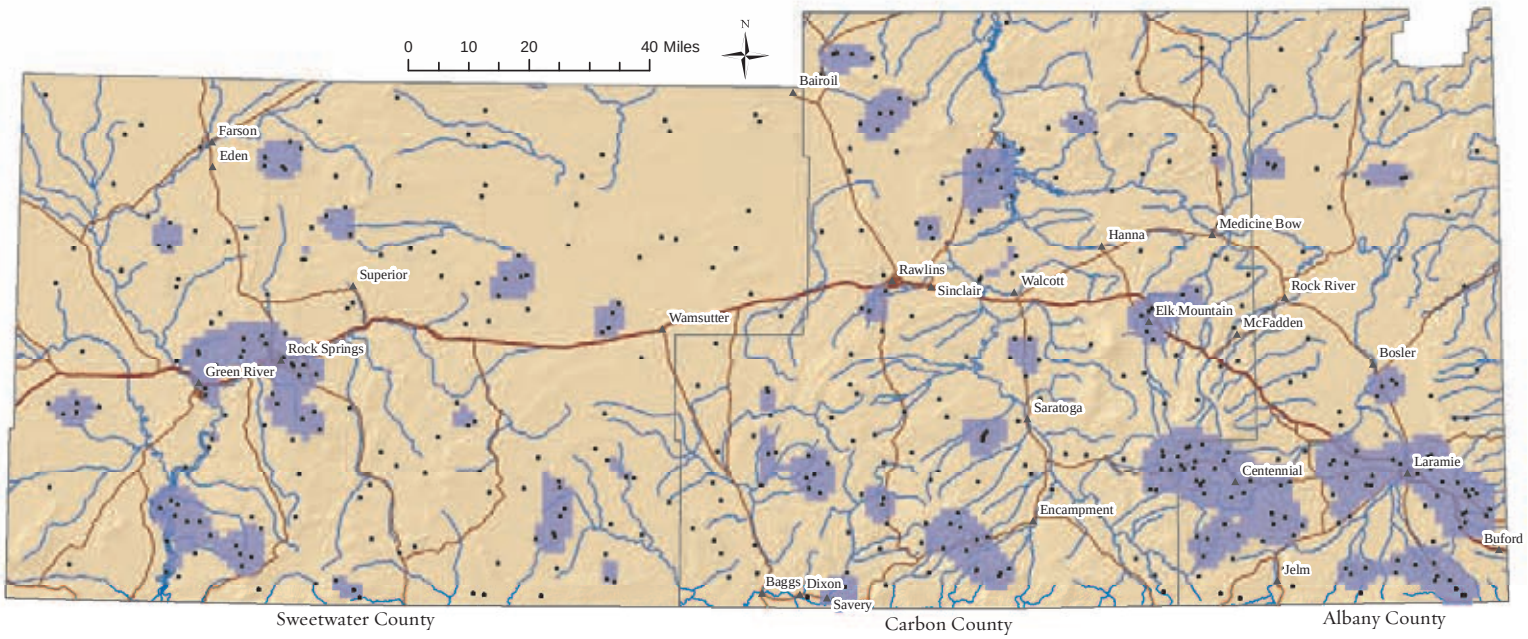
It is important to protect fish and wildlife habitat in these places.



Open space hotspots
Open space map points
Rivers
Highways

Open Space

It is important to maintain wide open spaces and scenic views in these places.

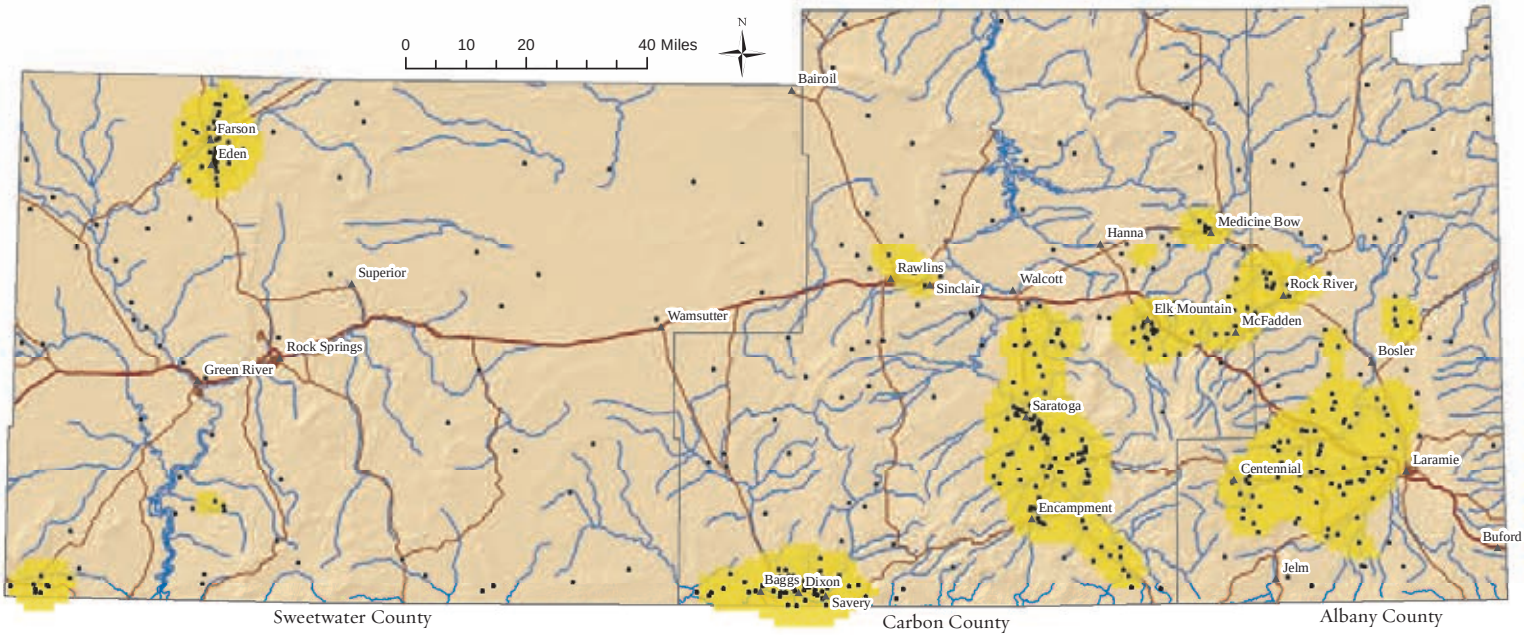


HOTSPOT MAPS - IMPORTANT PLACES

Agriculture hotspots
Agriculture map points
Rivers
Highways

Agriculture

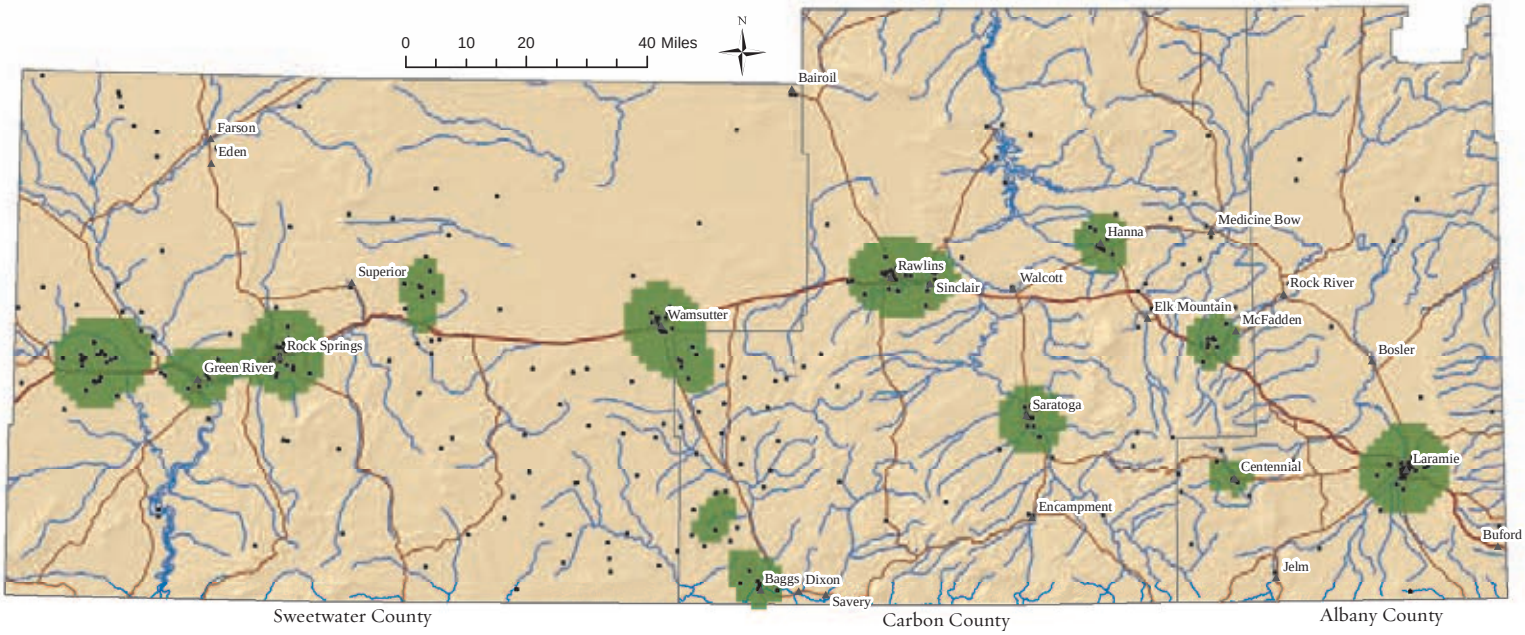
It is important to maintain working farms and ranches in these places.



Economic hotspots
Economic map points
Rivers
Highways

Economic

These places are important because of the economic opportunities they provide.

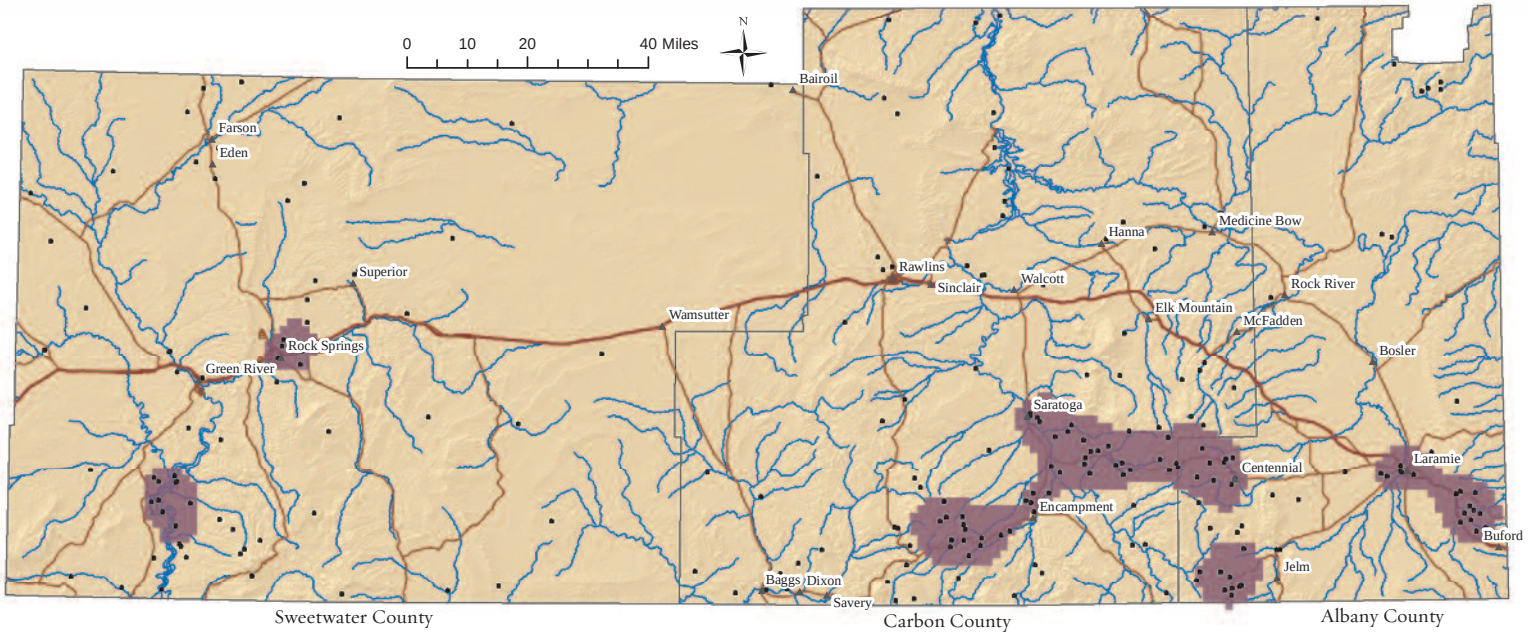


HOTSPOT MAPS - IMPORTANT PLACES / DEVELOPMENT PREFERENCES

Family tradition hotspots
Family tradition map points
Rivers
Highways

Family traditions

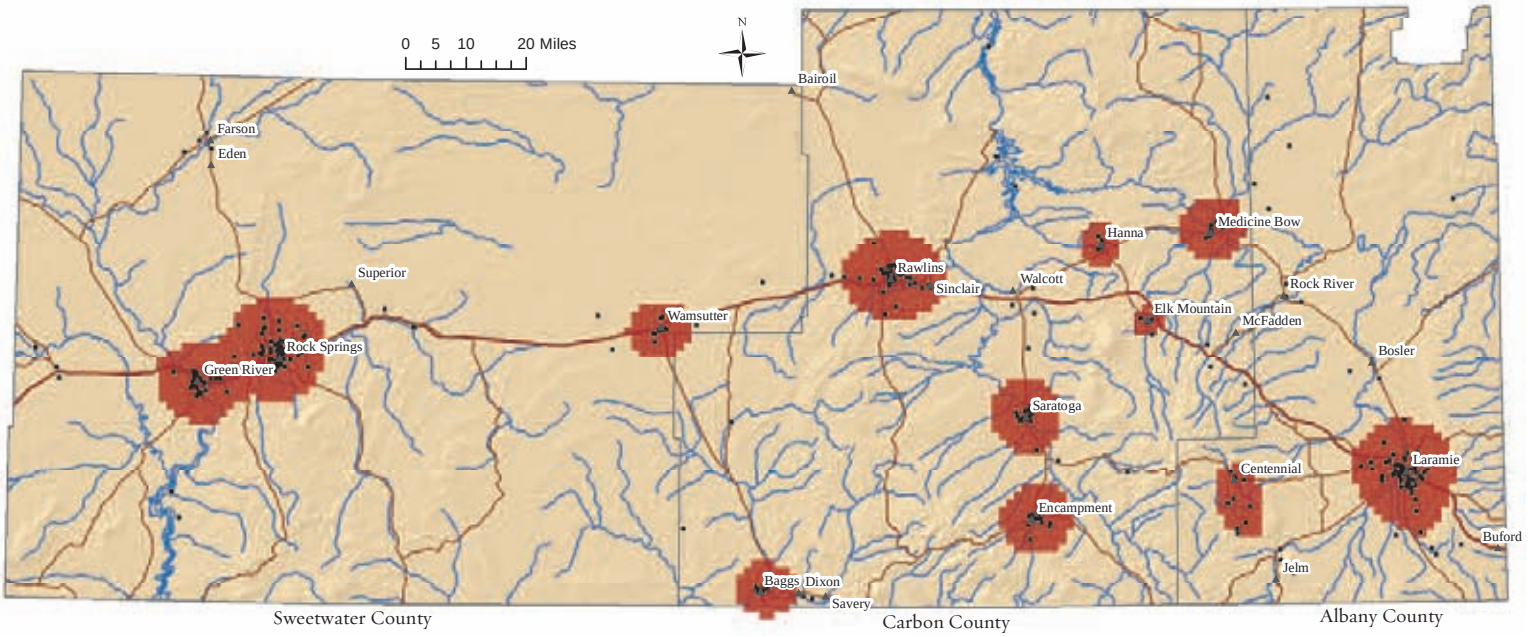
These places are important to the traditions and history of my family.



Residential development hotspots
Residential development map points
Rivers
Highways

Residential Development

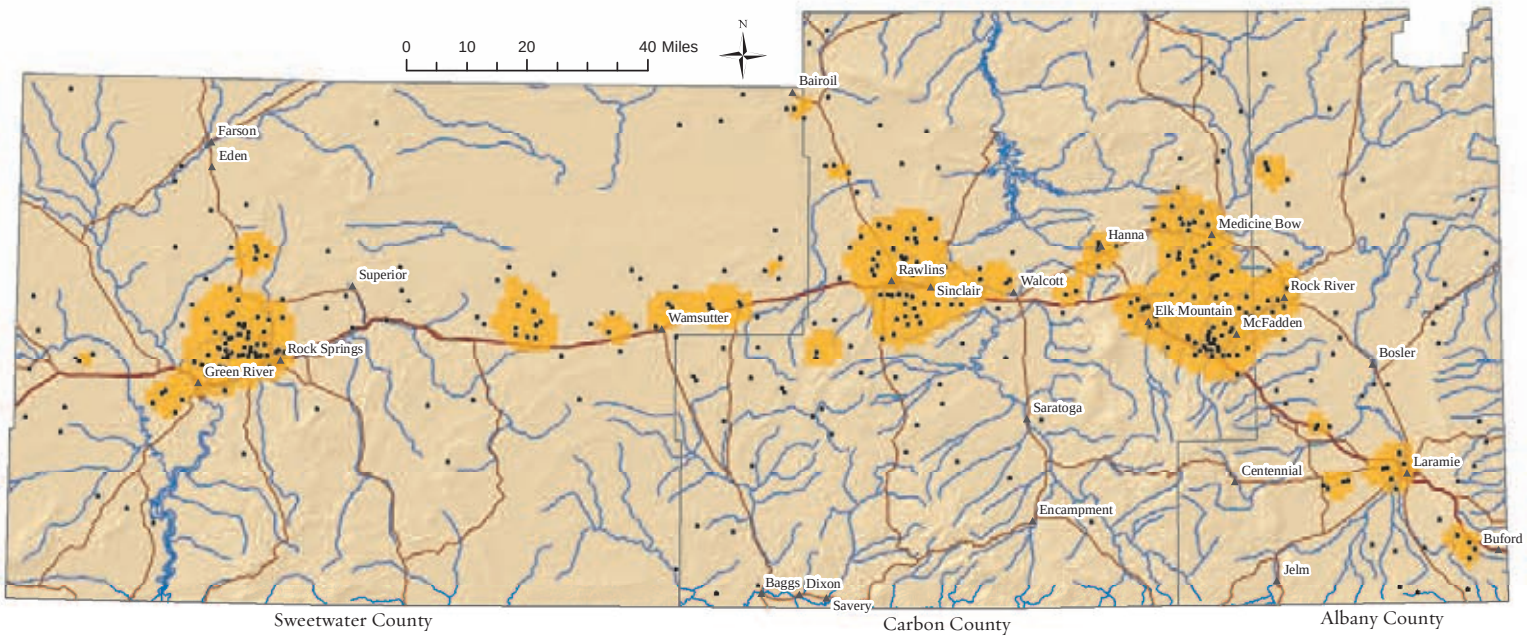
If new homes are built in these counties, these are the places where I would prefer that development to occur.



Wind development hotspots
Wind development map points
Rivers
Highways

Wind Development

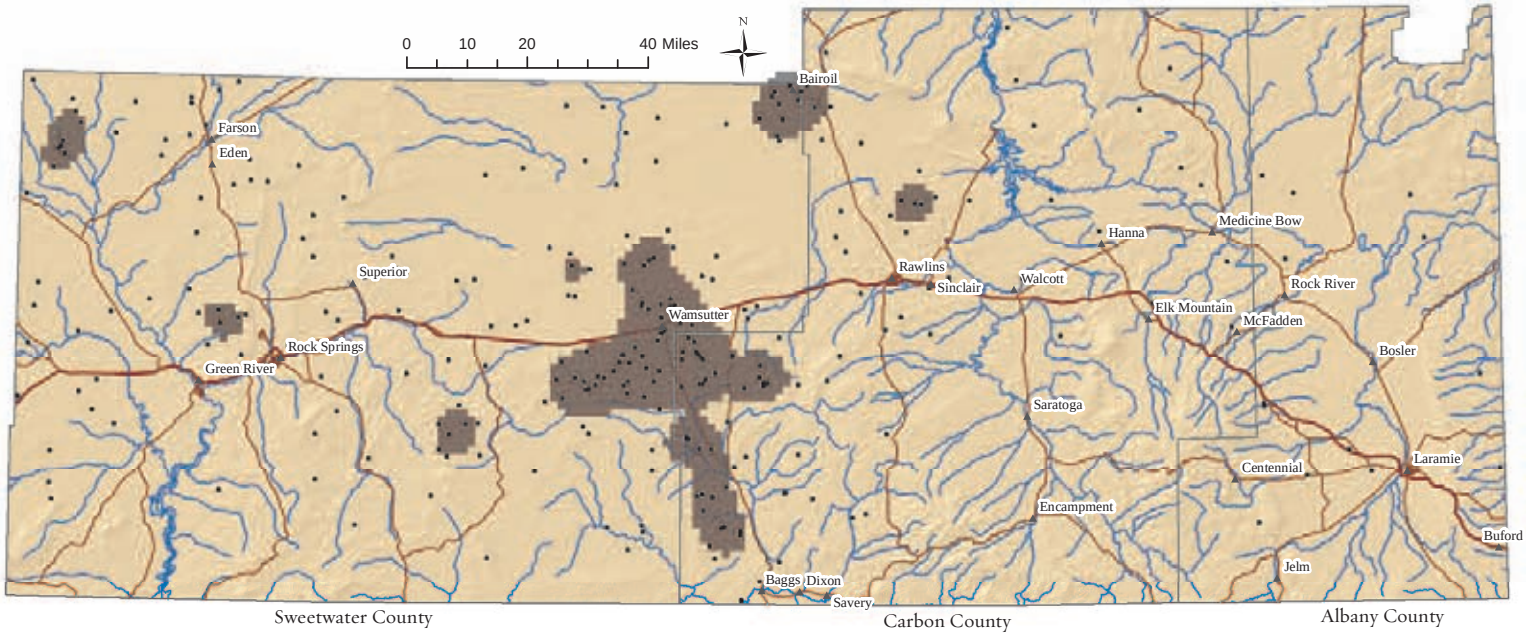
If new wind energy farms are built in these counties, these are the places where I would prefer that development to occur.



Oil/gas development hotspots
Oil/gas development map points
Rivers
Highways

Oil / Gas Development

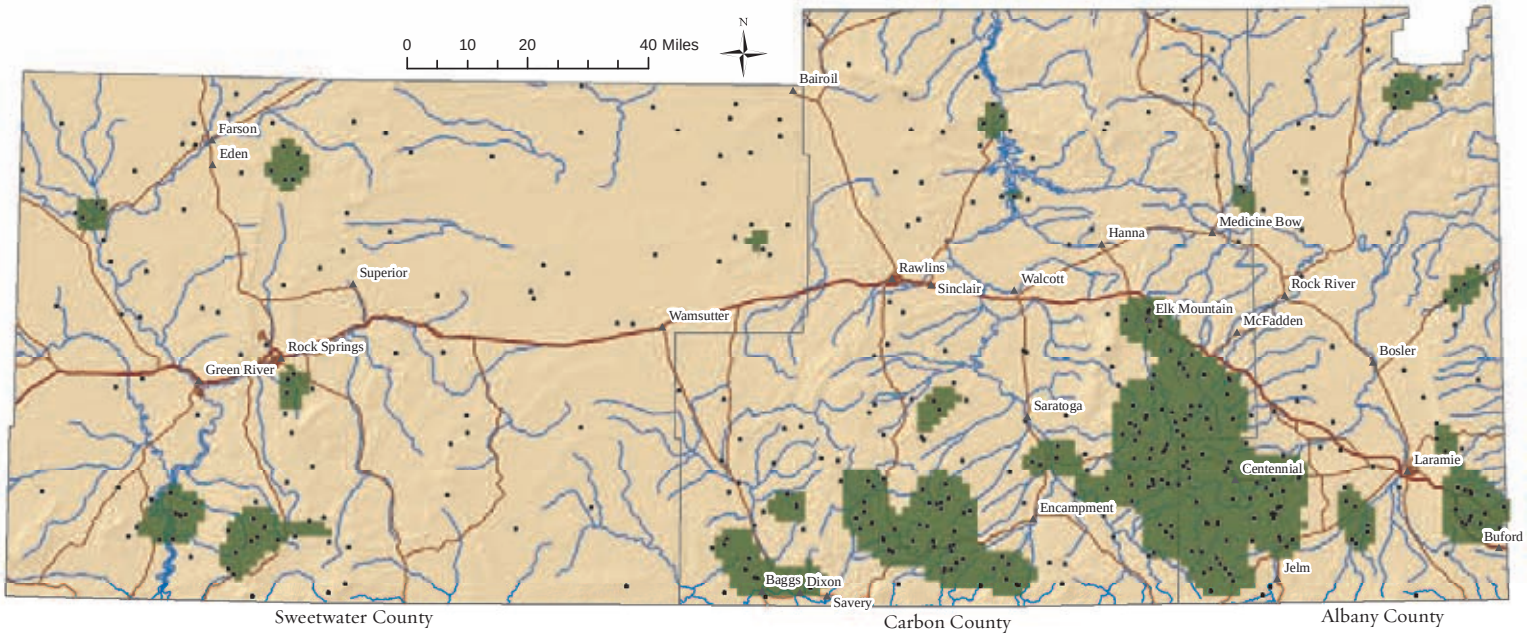
If new oil and gas wells are drilled in these counties, these are the places where I would prefer that development to occur.



Abundant wildlife hotspots
Abundant wildlife map points
Rivers
Highways

Abundant Wildlife

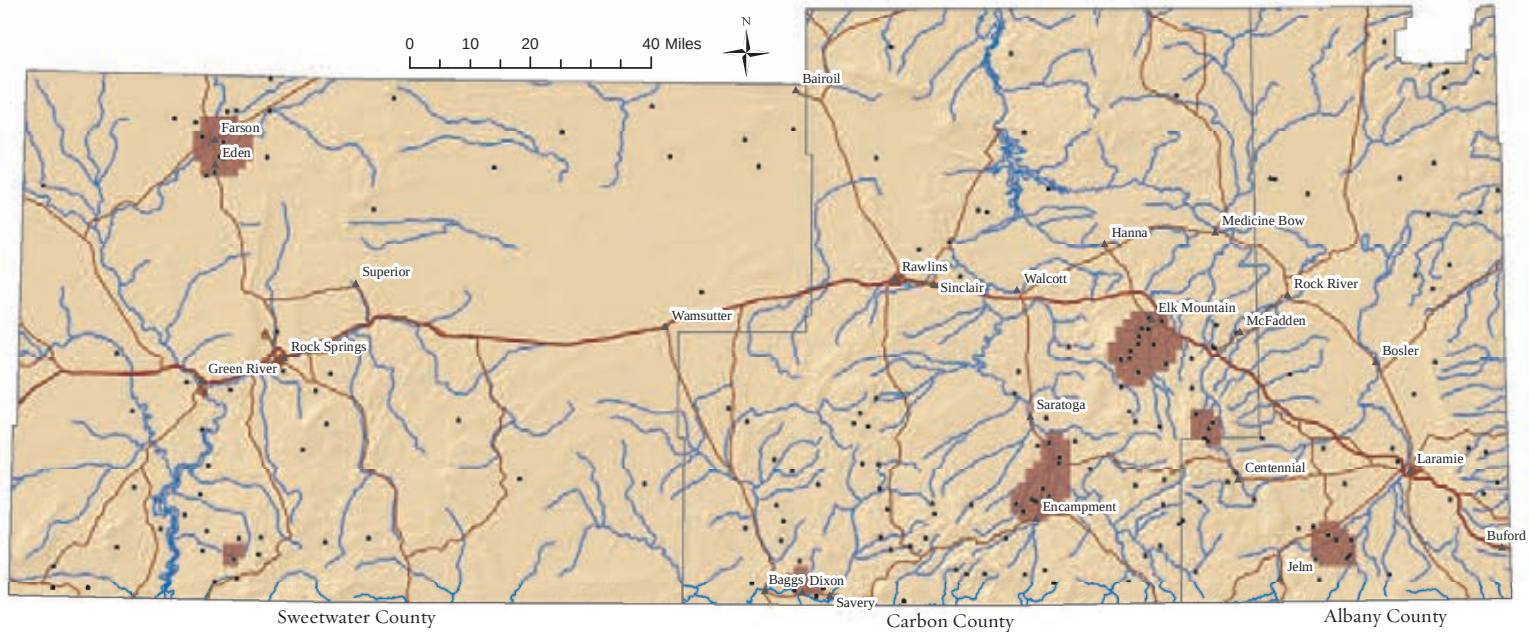
There are abundant wildlife populations in these places, such as large herds of antelope and deer and large numbers of birds and fish.



Good land condition hotspots
Good land condition map points
Rivers
Highways

Good Land Condition

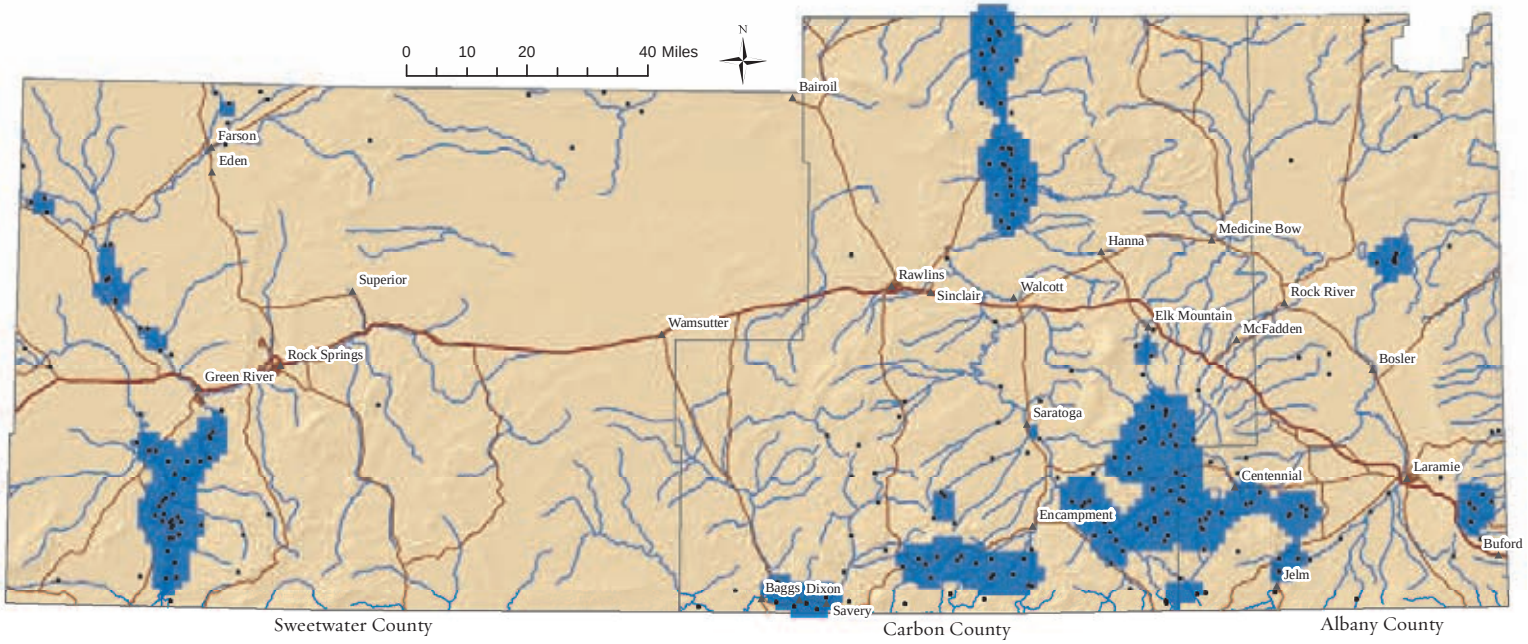
Lands in these places are in good condition. For example, there is little soil erosion, plenty of native vegetation, and good resources to support wildlife or livestock.



Good water resource hotspots
Good water resource map points
Rivers
Highways

Good Water Resource

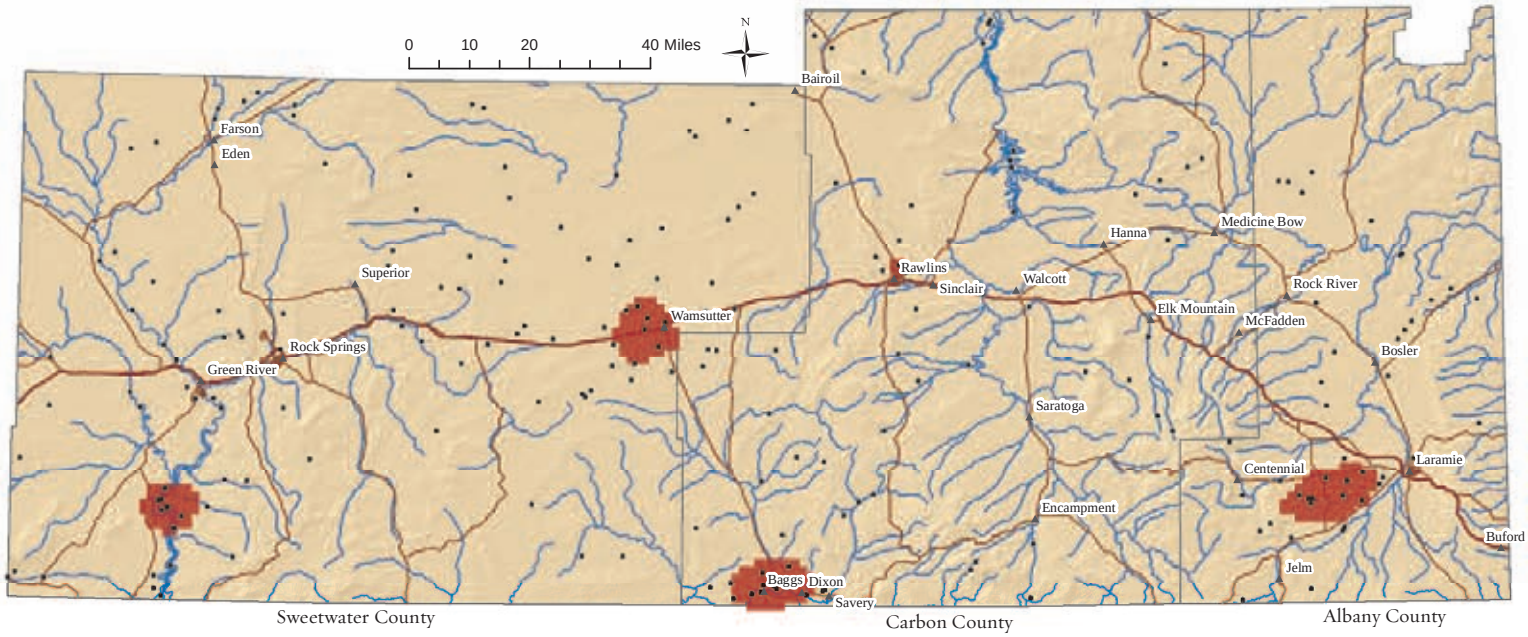
These streams, rivers, and lakes are in good condition. There is plentiful and good quality water for fish, wildlife, agriculture, and people.



Water shortage hotspots
Water shortage map points
Rivers
Highways

Water Shortage

There is not enough water in these places to keep up with demand for its use.

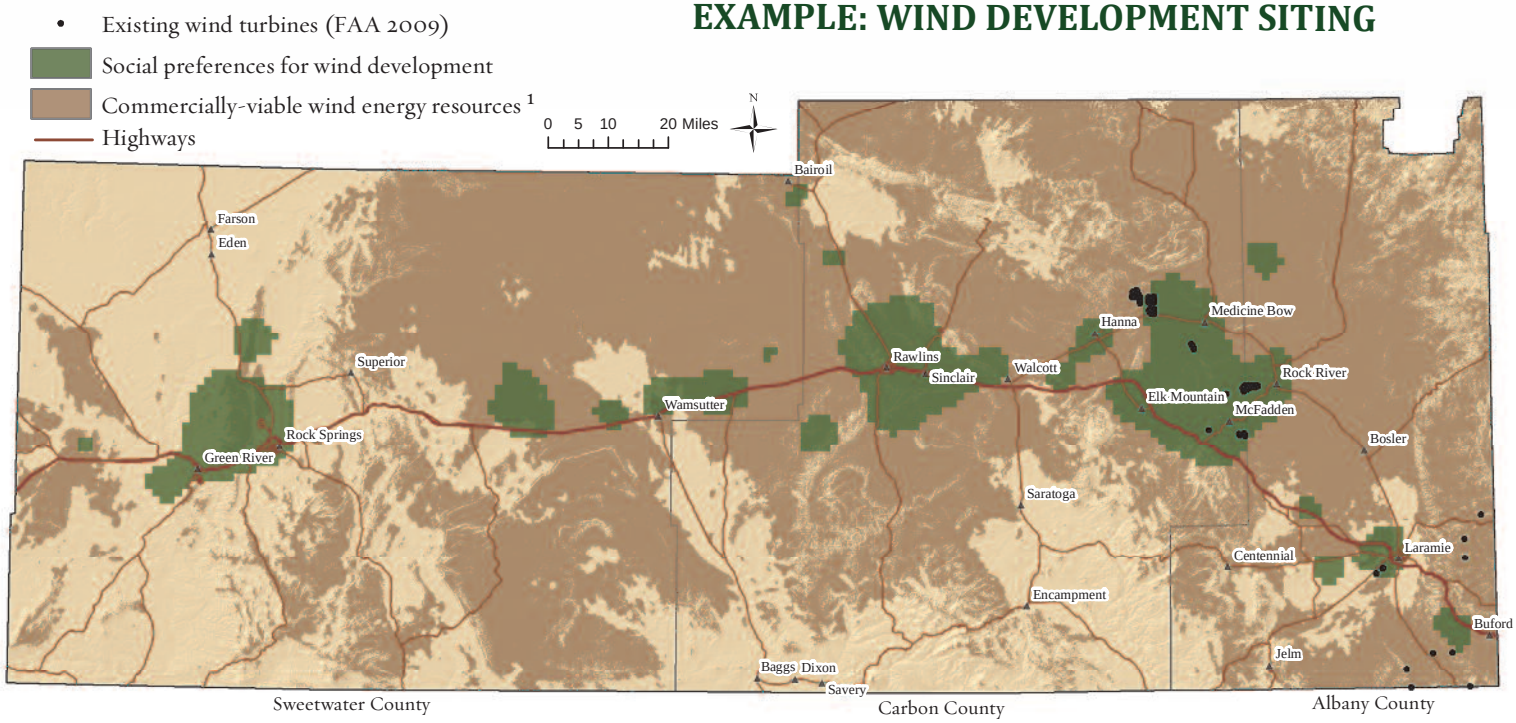


USING SOCIAL MAPS TO INFORM PLANNING AND DECISION-MAKING


Photo: Kerry B. Lloyd

The social maps created through this study link important social values to actionable places and provide a collective vision about land uses in specific places. This information is potentially valuable for local planning efforts, such as county comprehensive plans, siting of new development, and prioritizing locations of projects related to recreation, conservation, and water. We illustrate how social maps can inform decision-making through two examples that follow.

EXAMPLE: WIND DEVELOPMENT SITING



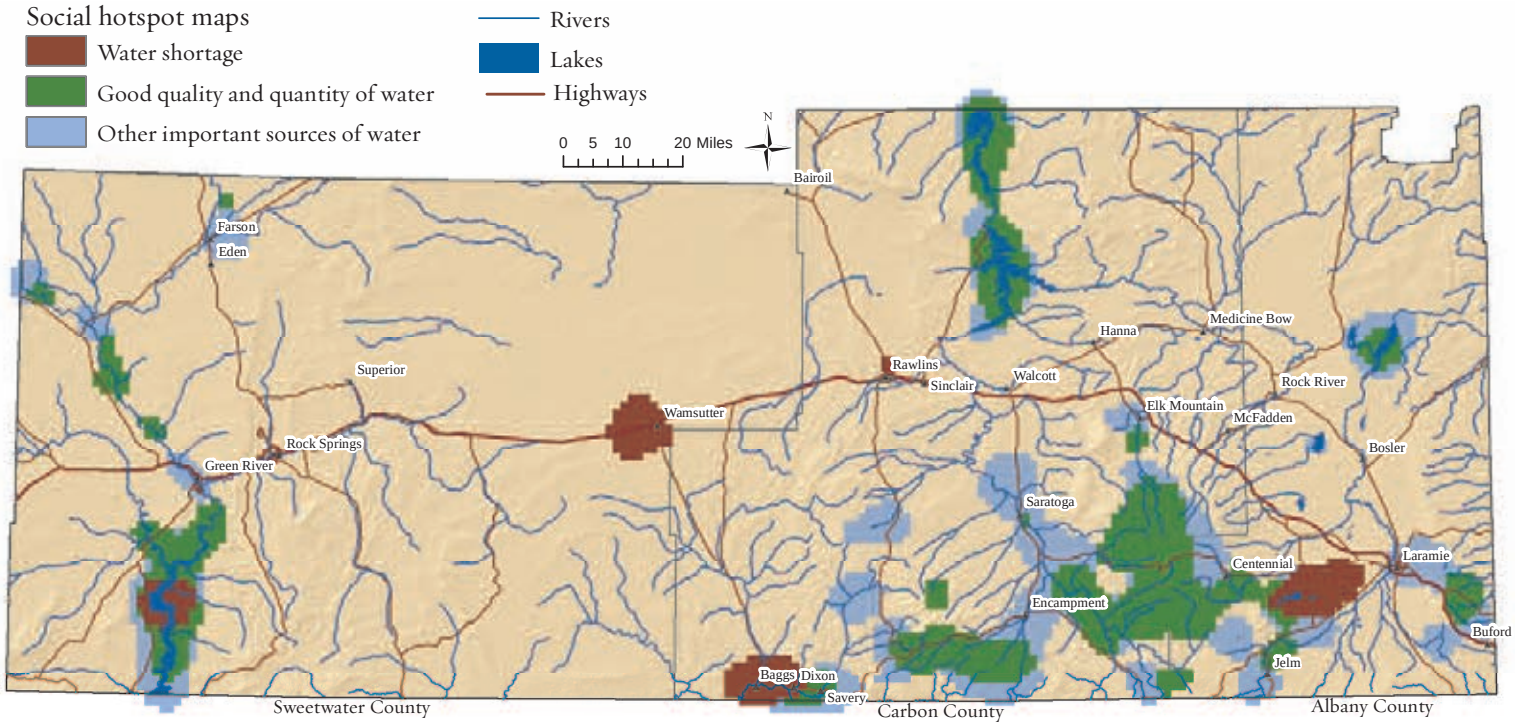
[1] Commercially-viable wind resources are defined as areas having a wind power class of 3 or higher according to the National Renewable Energy Laboratory and a percent slope of less than 20% (Western Governors' Association, Western Renewable Energy Zones report, 2009).

Wyoming has some of the best wind energy resources in the nation, and development of utility-scale wind farms has been rapidly increasing. This and previous studies have shown that people in Wyoming value open space, wildlife, and agriculture, all of which may be affected by industrial development. These social values, a history of economic "boom and bust" associated with energy development, and the potential financial rewards of development have all contributed to debate over the benefits and drawbacks of wind development.

Maps depicting social preferences for the siting of new wind development can help to inform counties, developers, and others where wind development may receive public support and where conflicts can be anticipated. The map above shows that wind development was generally preferred close to existing wind farms and along major highways (potential support). Many areas with commercial-quality wind resources lacked collective social preferences for wind development (potential conflict).


Photo: Paula Hunker

EXAMPLE: MANAGING WATER RESOURCES



Water is vital for sustainable communities, agricultural production, fish and wildlife habitat, economic development and recreation opportunities. Most of Wyoming's water comes from snowpack and mountain streams that supply not only Wyoming but also many other downstream states. Demand for water continues to grow, yet its availability may become more unpredictable or decrease with changes in climate and disturbance patterns in mountain watersheds. Management is and will continue to be important for this critical resource.

The map above shows that areas perceived as important sources of water include mountain streams, reservoirs, and lands irrigated for agricultural production. Water conservation activities that focus on maintaining quality resources may receive strong public support in these places (e.g., irrigation improvements, wetland restoration). Survey participants also identified places where water supply cannot meet demand, which could also inform priorities related to water conservation or storage.


Photo: Sharon O'Toole

ACKNOWLEDGEMENTS

We are grateful to the Wyoming residents who shared their time for this survey; without their help it would not have been possible to create the social maps presented here. We thank the Ruckelshaus Institute and Diana Hulme for their collaboration in designing and administering the survey, and Greg Brown and the Center for Spatial Information at Central Washington University for designing and hosting the internet version of the survey. Finally, we thank Dot Newton for her hard work turning paper map points into GIS files and for completing the follow-up phone survey of non-participants.

For more information about this study, please contact Amy Pocewicz at 307-335-2131 or apocewicz@tnc.org

Bibliographic citation:
Pocewicz, A., R. Schnitzer, M. Nielsen-Pincus (2010) *The social geography of southern Wyoming: important places, development, and natural resource management*, The Nature Conservancy, Lander, WY, 16pp. Available at www.nature.org/wyoscience