Identifying Schools with Access to the Missouri River

A Community Engagement Lab

prepared for

Missouri River Relief

Columbia, Missouri

and

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Miami University

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by

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Introduction

Fostering a sense of place can be considered an essential task of environmental education. A strong sense of place has been correlated with environmentally-responsible behavior and childhood developmental stages (Kudryavsev et al., 2012a; Sobel, 1999; Bott, Cantrill, & Myers, 2003). Environmental education programs should therefore reflect the most important components of their local environment, rather than use cookie-cutter curriculum content as is, if they are to nurture true connection to specific place. In any state it flows through, a clear keystone of the landscape is the Missouri River.

The Missouri River, which runs from headwaters in North Dakota to join with Mississippi River in St. Louis, is one of the big rivers of North America. As a landscape feature, it could be considered a charismatic megafeature, just as certain animals that capture the public's imagination have been called "charismatic megafauna" or "cinderella species" (Smith et al., 2012). It has been a center of music, art, industry and trade, as well as outdoors recreation and valuable ecosystems. As a result, the Missouri River possesses a prominence in regional life that requires inclusion in local environmental education programs, and has the potential to be a tool to draw people into an environmental message.

A non-profit called Missouri River Relief (MRR), based out of Columbia, Missouri, has taken on the mission of fostering engagement with the Missouri River and improving its care. Inspired by Chad Pregracke's "Living Lands and Waters" barge clean-up crew on the Mississippi, massive community trash clean-ups are MRR's trademark event (J. Barrows, personal communication, Nov 18, 2015). But they also have sponsored concerts and film festivals, day-on-the-river school programs and camps, and scientific talks. As a newly-arrived educator in Missouri, I saw MRR as an essential organization to know if I was to be involved in environmental education in our region. I reached out to the group to see if my coursework could support their mission.

By meeting with staff and attending meetings of the MRR education committee, which is made up of invested community volunteers, I learned that Missouri River Relief is currently working on strengthening their environmental education programming, including hiring an education coordinator and reviving the education committee. A key

new initiative is to write a Missouri River curriculum that can be used by teachers independently of MRR staff. In November, MRR received an EPA environmental education grant to develop the curriculum, and has been in discussion with the Columbia Public Schools administration about teacher-leaders in the district who could assist in developing and implementing such a curriculum. Supporting this curriculum with a map and by soliciting teacher feedback became the focus of my collaboration.

Mapping as a tool for curriculum promotion

I asked MRR about ways that mapping could benefit the communities of the Missouri River. They brought up a need to identify schools that are geographically closest to the river. A map of schools within a limited radius of the river identifies priority audiences to target when rolling out the Missouri River curriculum currently in development.

Choosing schools adjacent to the Missouri River as the curriculum's target audience has two rationales. To understand these rationales, we must understand that sense of place can be considered to have two components: place attachment and place meaning (Kudryavsev et al., 2012).

First, communities along the river have a great deal of history intertwined with the river. The curriculum will be designed to be used by teachers independently, allowing MRR's message to reach more schools than MRR could personally take onto the river for experiential programming with its staff. The drawback to this is that students experiencing the curriculum will not have the powerful experience of visiting the river firsthand under MRR's facilitation. By choosing communities where students are more likely to have experienced the river directly, it seems probable that MRR will have greater success with their environmental message taking root than in communities that have no pre-existing attachment to the river. Instead of having to create attachment and meaning from scratch, MRR can work in areas where attachment may already exist, and use the curriculum to modify the meanings attached to the river to include more pro-environmental and ecological meanings. Kudryavtsev, Krasny, and Stedman's (2012b) research suggests that

environmental education programs may be more effective at nurturing ecological place meaning than place attachment, although Semken and Freeman (2008) found that place-based science classes can influence both place meaning and place attachment.

Pre-existing place attachment is helpful not just in the students we aim to reach, but also in the teachers and administrators who choose whether or not to use the curriculum in the first place. Ernst (2009) found that the best predictor of whether an environmental education program was utilized in a classroom was the teacher's pre-existing environmental literacy and values; teachers in communities along the river may be more likely to have experienced the river, and therefore might be more highly interested in actually using the curriculum. Research such that of Treiman et al. (2014) indicates that recreation is a primary use of the river by the public, especially boating, fishing, and relaxing on the riverside, with an economic value of around $20 million a year. This and personal experience leads me to conclude that recreation is one of the primary pre-existing meanings associated with the Missouri, and that it is reasonable to expect that a significant number of teachers in river towns have had recreational experiences on the river. This seems like a good starting place from which to expand on meanings attached to the river to include environmental stewardship. Navigability, flood control and agricultural use of flood plains are other examples of competing meanings around the river that may pre-exist in communities along the river; historical policy has required the U.S. Army Corps of Engineers to prioritize navigability over endangered species protection in its management decisions (Graham & Lindemann, 2005).

There is a secondary rationale for choosing to prioritize schools nearest the river. From the point of view of place-based education, knowledge of the Missouri River should be a basic part of literacy in students who live near it, right up there with the alphabet and multiplication tables. If there are students living within 20 miles of the river who do not have any pre-existing experiences, attachment or meaning associated with the Missouri, connecting these students to such a keystone feature seems like a priority in the fight against experiential extinction (Miller, 2005). Furthermore, teachers and classes will have a greater ability to use the curriculum as a springboard to further community service,

projects, or field trips connected to the river if their communities are adjacent to the river, opening an opportunity for genuine culture change in the direction of greater connection to place. Increased attachment to the river could have conservation impact: Khorshed (2011) found that place attachment to rivers, in particular depth of experience with and proximity to a river, correlated with increased support for ecosystem restoration projects.

Teacher participation

As I hashed out the details of the map of riverside schools with Columbia's environmental enthusiasts, our conversation reflected concerns about how to create and promote a curriculum that will actually be put into use by teachers. While considering which schools we wanted to reach, we concluded that we needed a conversation with teachers about potential obstacles to effective use of a Missouri River curriculum.

As a participatory corollary to the map, I developed questions for a teacher focus group on the river curriculum. Research indicates that keys factors in teacher adoption of environmental curricula include the attitudes of teachers and administrators towards the environment; evidence of positive educational outcomes; and perception of environmental topics as applicable to academic standards, rather than a curricular 'extra' (Ernst, 2009; Ernst, 2012; University of Maryland Survey Research Center, 2000). These barriers could potentially be mitigated by good planning and input by teachers. The results from teacher focus groups, alongside information on the geographical relationship between schools and the river, could provide clues as to where and how the river curriculum will be put to strongest use.

Mapping Methods

I met with the education coordinator for Missouri River Relief to discuss her intentions for the river curriculum, the map of schools near the river, and MRR's relationships with schools. The map will also receive feedback from the education committee in January. In this informal interview, I asked her about the Missouri River curriculum she was creating; MRR's educational goals; the kinds of relationships MRR is interested in building with schools; and the scope of information that is needed for the

curriculum's release. This information brought the content of the map into more precise focus.

MRR is interested in offering the curriculum to schools along the entire Missouri River, a very large area. The initial curriculum will be for grade 4, with plans to create middle and high school curriculums in the future. Due to limited resources for helping schools take trips to the river, and varied school environments, the lessons will all be possible to do in the classroom, with options for outdoor components included. As such, physical barriers to river access are less of a concern than I originally thought; the main concern is simply the ability and interest of teachers to make the Missouri River a curriculum unit. With teachers' engagement in mind, we agreed that we were most interested in reaching areas where the Missouri River was close enough that it could be part of the community's sense of place. Based on our experience with school field trips, we estimated that a trip to the river should take no more than 30 minutes.

Based on these plans for the curriculum, we decided to include elementary, middle and high schools on the map, noted with distinct markers. I used "The Common Core of Data 2013 - 2014" from the U.S. Department of Education's National Center for Education Statistics for data on public school location, phone number, grade level, and other demographic information. In ArcGIS, I created a twenty-mile buffer along the Missouri River. I overlaid the buffer with the common core data to create a map of all public schools. Twenty miles proved to be an appropriate distance, enough to include most of the Kansas City and St. Louis metropolitan areas without arbitrarily excluding some schools, but not so large as to include towns that would require a significant trip to reach the Missouri. I found 2421 schools within 20 miles of the Missouri River (fig. 1). The complete map can be found at http://arcg.is/1SsOXcm. Using the online ArcGIS viewer allows you to zoom in and out of areas of interest, and click on the school markers to view more information about the school (fig. 3).

Fig. 1: Complete view of the map of all public schools within 20-miles of the Missouri River. The 1.5-mile and 0.5 mile buffers are not visible at this scale. Interactable map at http://arcg.is/1SsOXcm.

I then created additional buffers of 1.5 miles and 0.5 miles to either side of the river, to investigate whether any schools are located within walking distances of the river. I found 230 schools within 1.5 miles and 57 schools within 0.5 miles of the river (fig. 2), including one elementary school in Jefferson City, which is near MRR's office in Columbia. However, upon further investigation of the map, these categories may not be a reliable as hoped. The shapefile of the Missouri River is rougher and less detailed than the actual course of the river; looking at the basemap, it was clear that many of the schools within the 1.5 and 0.5 mile buffers were actually some distance closer or farther to the river (fig. 3). This is not important for the broad inclusiveness of the 20-mile buffer. But it is relevant for finding schools within walking distance of the river, as school groups of children tend to walk slowly and may not actually be able to reach the river on a given day if the school is slightly farther from the river than anticipated. The intention for these smaller buffers is for MRR to target these schools for particular outreach and potential field trips in addition to implementing the curriculum, because transportation and adequate time in the day is

currently a major barrier to MRR creating the kinds of hands-on river experiences it would like to provide to schools. Still, these buffers do identify schools that are notably closer to the river, and it may be feasible to investigate the schools manually within these buffers to identify schools that are genuinely within walking distance.

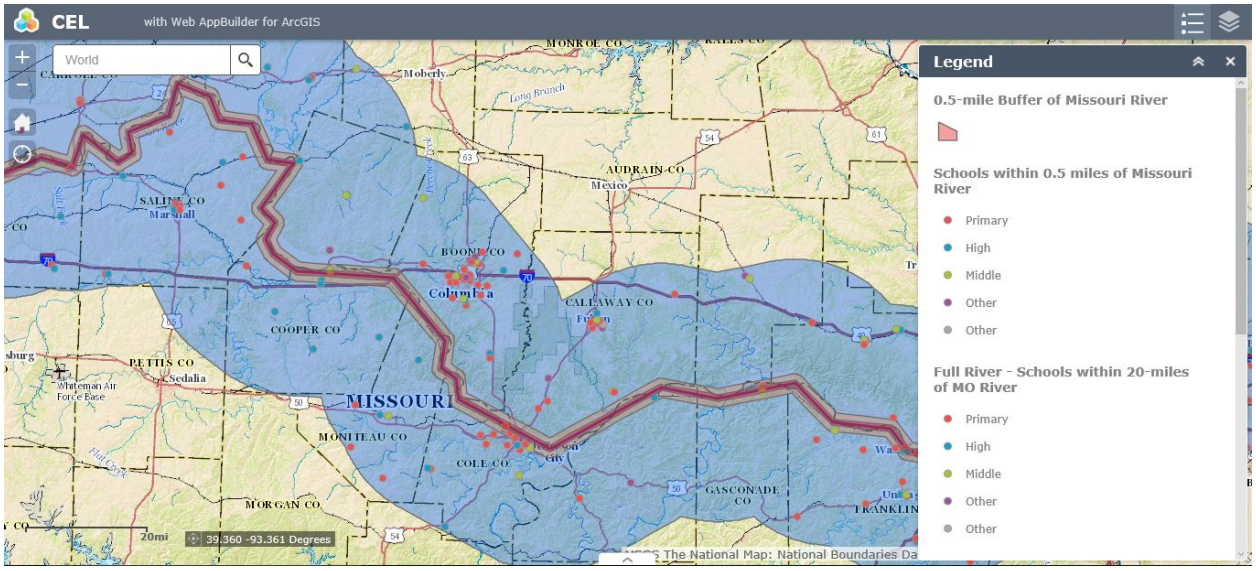

Fig. 2: Detailed view of the map, showing schools within the twenty-mile buffer (blue), 1.5-mile buffer (orange), and 0.5-mile buffer (red). Interactable map at http://arcg.is/1SsOXcm.

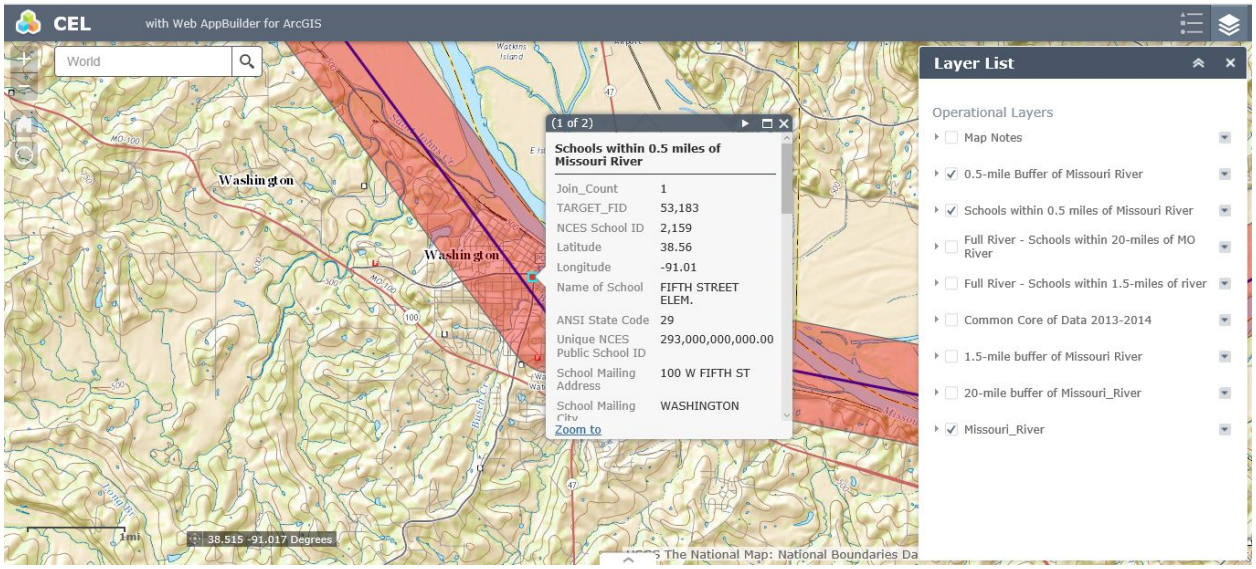

Fig. 3: Example of a school (Fifth Street Elementary) located within the 0.5-mile buffer (red) created in ArcGIS. You can see that the school is farther from the actual Missouri River than it is from the ArcGIS shapefile representing the river. In this case, visual confirmation confirms

that this specific school is still within walking distance of the actual river. A portion of the data available about this school is displayed in the bubble. Interactable map at http://arcg.is/1SsOXcm.

Finally, I downloaded tables listing all school data for schools within the twenty-mile, 1.5-mile and 0.5-mile buffers. These tables, which can be managed in excel, will be essential for contacting schools and promoting the curriculum to them efficiently, since the alternative is poring through the map and clicking on each school by hand. These tables can be viewed online here.

Focus Group Methods

For teacher input on the curriculum content, the MRR education coordinator and board members want to take advantage of and nurture MRR's nascent partnership with Columbia Public Schools' science division. Columbia Public Schools runs a group of elementary school teachers who have been identified as leaders in science education; they meet regularly, receive targeted professional development, and influence science education at their schools. We selected this teacher-leader group as an ideal group for feedback on the curriculum, due to their presumed greater enthusiasm for improving science education, influence in their schools, and existing commitment to reflect critically on educational practice. MRR will also lead one of their professional development sessions on the river, hopefully generating excitement about river education that will inspire them to promote the curriculum in their schools.

I developed a list of questions to guide a conversation amongst teachers in the elementary school leadership group about their curricular needs and what would get them to actually use a Missouri River curriculum. Once the questions have been reviewed with MRR's education committee, MRR staff and I can conduct a focus group with the teacher-leader group. The initial questions are intended to be broad questions about their curriculum, classrooms, and school culture, without overly leading them, then following up with questions directly about the Missouri River as a curriculum theme. The conversation will similarly be conducted initially without showing them any examples of the lessons to

avoid biasing teachers, but draft ideas for the curriculum will be shown later in the discussion to get direct feedback.

Topics (with possible follow-up questions) that we will address in the meeting are:

1. What are your greatest curriculum needs currently? How could a Missouri River unit support your existing curriculum needs?
2. Where do you get most of your lesson plans?
    a. Do you currently use any environmental or locally-centered curricula? What do you like about them?
    b. What do you look for in a good lesson plan for your classroom?
    c. What pedagogical approaches are you interested in?
3. How do you or the teachers you work with currently incorporate the environment or local topics into your classroom? What are you interested in incorporating?
4. What are your administrators' attitudes towards environmental education in your class?
5. What are your associations with the Missouri River? What would you expect to find in a Missouri River centered unit? What would you want in a Missouri River unit?
6. What would keep you from using a Missouri River unit?
7. Please give us your feedback on what is useful and not useful in these sample lessons.

Based on previous research, I anticipate that teachers will identify lack of time and a perceived lack of relevance to their required curriculum as key barriers to using a Missouri River curriculum (University of Maryland Survey Research Center, 2000; Ernst, 2009). MRR's curriculum can easily be created so that it aligns with existing state standards, but teachers may not perceive the curriculum's relevance at glance. As such, the discussion should be guided to find how the curriculum would best overlap with their existing needs, but also the best way to present the materials so that curious teachers could quickly perceive the unit's relevance.

This feedback on curriculum content will complement the map as a tool for designing the curriculum topics, pedagogical approaches, and content. The focus group will likely take place later this winter, once ideas for the curriculum have been drafted in more detail and MRR's education committee has had a chance to offer feedback on our focus group ideas. A few current or former public school teachers sit on the education committee, and may have more valuable ideas on appropriate questions to ask.

Discussion

The map of schools within 20 miles of the Missouri River, and the methods for teacher focus groups, provide tools that support Missouri River Relief's efforts to roll out a curriculum of lesson plans centered on the Missouri River. By receiving feedback from teachers and gaining a picture of our potential audience, we can develop the curriculum with an eye towards how it will be received and used, rather than simply writing down lessons that we simply like ourselves and believe *should* work for others as well. MRR will use the contact information from the map to coordinate invitations to access the curriculum once it is released. Staff is also making arrangements with the University of Missouri library to store it in their online repository, which will allow MRR to track information on how and where the curriculum is accessed. The map allowed us to create databases of schools, but a system for documenting outreach and responses from schools with that database will be a future step. MRR's previous education efforts have afforded staff direct contact with students, giving direct feedback on impact; this kind of broad outreach effort, which is enacted by teachers MRR has never met, will require more methodical documentation of curriculum use to get any idea of whether the curriculum is having impact. Focus groups with teachers will be conducted over this winter, and the curriculum should be ready for promotion by next summer.

This map benefits the entire community by facilitating greater opportunities for public school students to connect to the river. Students given the opportunity to use the curriculum may experience more relevant and hands-on STEM and social studies education. In turn, fostering a sense of place of the Missouri River in students will hopefully

encourage greater community stewardship of the river, river-centered community service, and other ecologically-beneficial human activities. However, in practice, the community that participated in the map-making is the community of river advocates -- staff at MRR, volunteer committee members, teacher focus groups, and volunteer educators who will directly use the map for directing education efforts. These various educators are the immediate community involved and invested in the map, but by consulting with teachers and other users on the curriculum creation process, the map can hopefully be put to use in a way that is not limited by the perspectives of MRR staff and volunteers.

This map encourages the field of environmental education to focus on regional and local features. Semkin and Freeman (2008) point out that place-based science teaching improves the relevance of science teaching and is intrinsic to certain science topics. Many established and successful environmental education curricula, like Project Learning Tree, Project WET, and Project WILD, are generic national curricula. While they help integrate environmental learning activities into classrooms that may not otherwise have them, they are missing a fundamental aspect of environmental education: a sense of place. Teachers need support in understanding and connecting to their local ecosystems if they are going to teach students to be ecologically literate citizens, and this is provided in most professional development programs. The Missouri River is a large enough region to make it efficient to develop curriculum specific to the river—after all, its corridor includes 2421 schools!—but is specific enough to authentically reflect something of those schools' locality.

Using GIS to target audiences for regional environmental education goals could be a tool for other organizations to take environmental education to a greater depth and nuance than one-size-fits-all curricula. GIS becomes helpful because the "region" relevant to environmental topics varies depending on the topic. For example, the 20-mile-wide Missouri River corridor ought to reach students in parts of both Missouri and South Dakota. But a prairie-centered curriculum ought to reach students in Missouri and Iowa but not South Dakota. Invasive species curricula are another example of how GIS could benefit environmental education outreach. I have seen generic invasive species lessons given to teachers who did not live near an area where that invasive species was present, for the

convenience of teaching the concept of "invasive species." Combining range maps of various invasive species with a library of lesson plans on specific invasive species (many of which already exist) would allow teachers to choose at a glance which lessons were relevant to them. Some teachers do not have the place-based ecological literacy themselves to know without guidance which species, ecosystems or topics are relevant to their homes.

Missouri River Relief's developing Missouri River curriculum puts sense of place at the center of curriculum development by its very topic, and we mapped out a place-based target audience accordingly. This curriculum and its geographically-based audience advances a form of environmental education that is more deeply aligned with environmental education's underlying principles of connection to natural places.

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