Overview of the OSU Stream Hydrology Trailer Program

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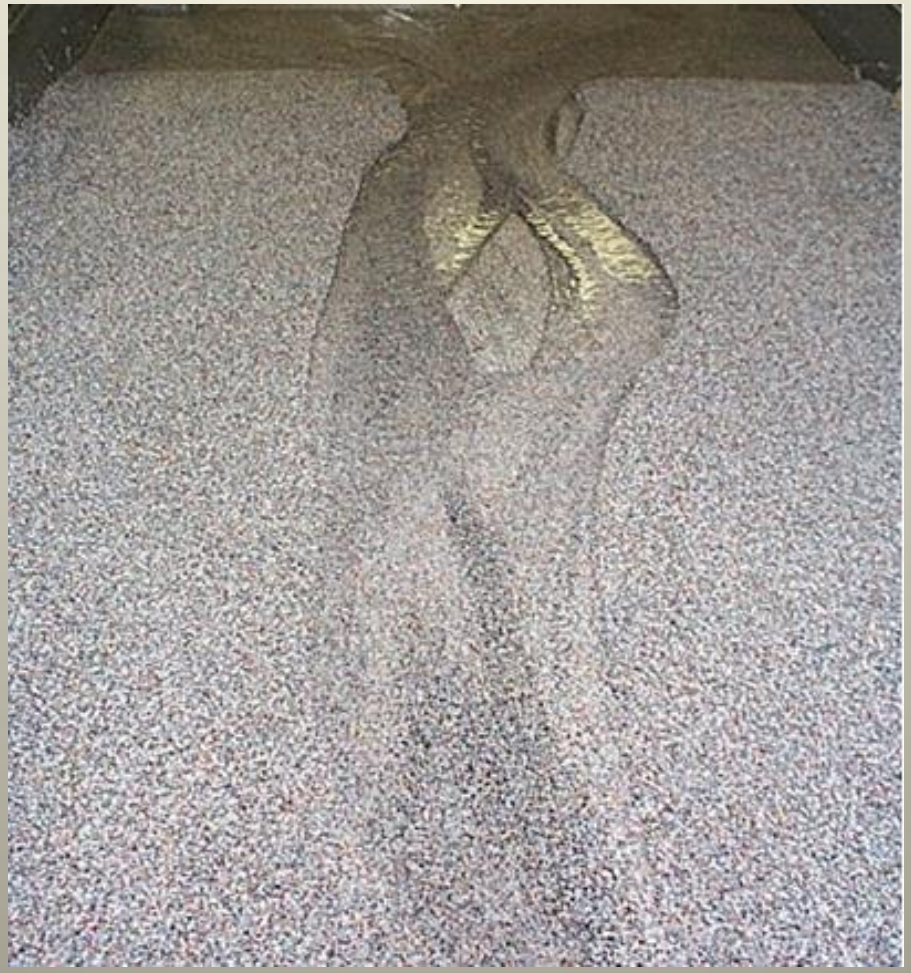
What are stream trailers?



A four by eight foot pan, a bed of plastic grit, a hidden reservoir and a pump to recirculate water. I call them fluvial geomorphic **sandboxes**. “Sandboxes” because they are fun and playfully engaging. But out of the play comes real learning with important applications. My favorite trailer lessons are those in which the water is allowed to shape the land because the results are so surprisingly varied and beautiful. Perhaps you remember the famous quote of Heraclitus, “You cannot step twice into the same river, for other waters are continually flowing on.”

Making It Happen

- Biosystems and Agricultural Engineering
- 4-H and Youth Development
- Oklahoma Cooperative Extension Service
- Natural Resource Ecology and Management

- EPA funding
- State funding for Cooperative Extension

The program is the result of efforts by many different folks at OSU and across the state. Funding came in the form of a grant from EPA and later state funds for Cooperative Extension. The trailers bear the 4-H logo and are used primarily with youth audiences but adults are also reached at the same time.

History

Colorado?

Kansas Game and Fish

OSU Trailer #1 built – 1995?

OSU Trailers 2,3, and 4 – 1999

OSU Trailers 5 and 6 – 2008

Texas Utah Alabama D.C.

OSU did not invent the stream trailer concept. We got the idea from Kansas. What we did do however was develop lessons and refine the design of the trailers. Our successful innovations have been adopted by a number of other states.

Newest Versions

Our two latest trailers which feature improved outlet filtration and a width narrow enough to fit through a standard double wide door.

Current Lessons and Venues

- The importance of riparian vegetation
- Why stream channels meander
- Floodplains, Sediment fate
- County Extension Educators – outdoor classrooms, county fairs
- School Teachers
- Other agency professionals

Landowners and future landowners need to understand that riparian trees, shrubs and other deep rooted native plants are essential to allowing streambanks to stand up to the cutting power of flowing water. Secondly, because streams never run straight, it is unwise to cut across meanders. In addition, floodplains need to be recognized and viewed as beneficial as long as we have been wise enough to not build there. Last, when there is severe erosion there is also a problem with the sediment accumulating elsewhere, such as mid-channel bars or reducing the volume of our reservoirs.

Our primary instructors are Extension Educators with the Cooperative Extension Service, but we also encourage others to become trained and use the trailers. Other users include school teachers and local, state and federal agencies.

Riparian Vegetation

We simulate riparian vegetation using plastic foliage attached to window screen. Typically we will install “vegetation” on one meander, leave another meander unvegetated and then observe the difference in stream bank erosion, channel widening, and fish habitat in the form of scour holes, shade and depth for cooler water etc.

Upstream Flooding Problem?

If you have a problem situation, the stream trailer may be able to duplicate what is happening or can happen. Here we see how upstream bank armoring leads to downstream flooding and property damage.

Limitations

- Dyes for simulating contaminants
- Runoff
- Flooding

There are some things which the stream trailers do *not* do well. People sometimes suggest the use of dyes to simulate contamination of water by various fertilizers, pesticides, antifreeze etc. Because the water in the trailers recirculates, this is not practical. There is also a problem with trying to simulate runoff – the plastic grit is too porous. Likewise it is not impossible but difficult to simulate floods.

Understanding Streams NREM-9208

OKLAHOMA COOPERATIVE EXTENSION SERVICE NREM-9208

Understanding Streams

Marley Beem
Assistant Extension Specialist

This discussion aims to give landowners the essential information needed to understand how streams work. Further information, including a deeper look at the underlying principles, can be found in the references listed at the end. See the glossary at the end for detailed descriptions of the underlined words.

Oklahoma Cooperative Extension Fact Sheets are also available on our website at: **http://osufacts.okstate.edu**

What Streams Do

Streams have two mechanical functions. The first is to transport water from higher to lower elevations. The second is to transport sediment - earthen materials better known as rock, sand, silt, and clay. In a healthy stream, the amount of sediment being picked up and moved downstream is equal to the amount being deposited in the stream. In unhealthy streams, this balance is lacking; either too much sediment is being deposited or too much erosion is occurring. Excess deposition is usually indicated by the presence of unstable islands or mid-channel sediment bars. Excess channel erosion is indicated by rapid deepening or widening of the channel. Tell-tale signs are high, freshly eroded banks with exposed roots, or deeply incised channels. Both excess deposition and excess erosion may occur in the same channel reach (Figure 1).

Energy

The movement of water and sediment through a stream system involves kinetic energy. The faster the stream flows, the greater the power it has to erode and carry sediment. As children, many of us played with a flowing garden hose to dig holes in the ground, so we have an intuitive understanding of the cutting power of flowing water. Nature provides four ways of keeping this erosive power in check.

The first way streams protect themselves is the growth of deep or densely rooted, water loving plants along the stream channel. This streamside area is known as the riparian zone (Figure 2). These deep and dense root networks hold the riparian soil together. Although this protective zone of vegetation may be damaged from time to time, one of the great benefits of this network of riparian trees, shrubs and grasses is that it is self-repairing. When some plants are lost, others grow in their place.

The second way streams act to dissipate the erosive energy of flowing water is by changing their pattern or meandering (Figure 3). By forming curves the distance the water travels is increased, the slope is decreased, and the water's velocity slows as a result. It is normal for stream and river channels to slowly move over time. If one could watch a stream from the air over a period of several lifetimes, it would appear as if it were a writhing snake. This is one reason why construction of homes and other structures close to streams should be discouraged.

Figure 1. **A high cut bank in the background and a mid-channel sediment bar in the foreground indicate that this stream is out of balance. The undercutting and collapse of streambanks contributes excess sediment to the stream. As that sediment forms mid-channel bars, stream flow is directed against the banks causing more undercutting and collapse.** (Photo credit: Mike Smolen)

Figure 2. **Healthy riparian zones are alive with trees, shrubs or other deep-rooted plants that resist the cutting power of the flowing water and protect streambanks from erosion.** (With permission by Wendy Kroeker, artist, and Manitoba Association for Community Arts Councils Inc.)

Division of Agricultural Sciences and Natural Resources • Oklahoma State University

- Streams transport water and sediment
- Destructive Energy
  - Riparian trees brush etc
  - Meandering
  - Flooding

NREM-9208 can be used to supplement a stream trailer presentation. It takes the approach of looking at streams from a mechanical point of view and gives a practical understanding of why streams need to be protected in order to maintain proper functioning.

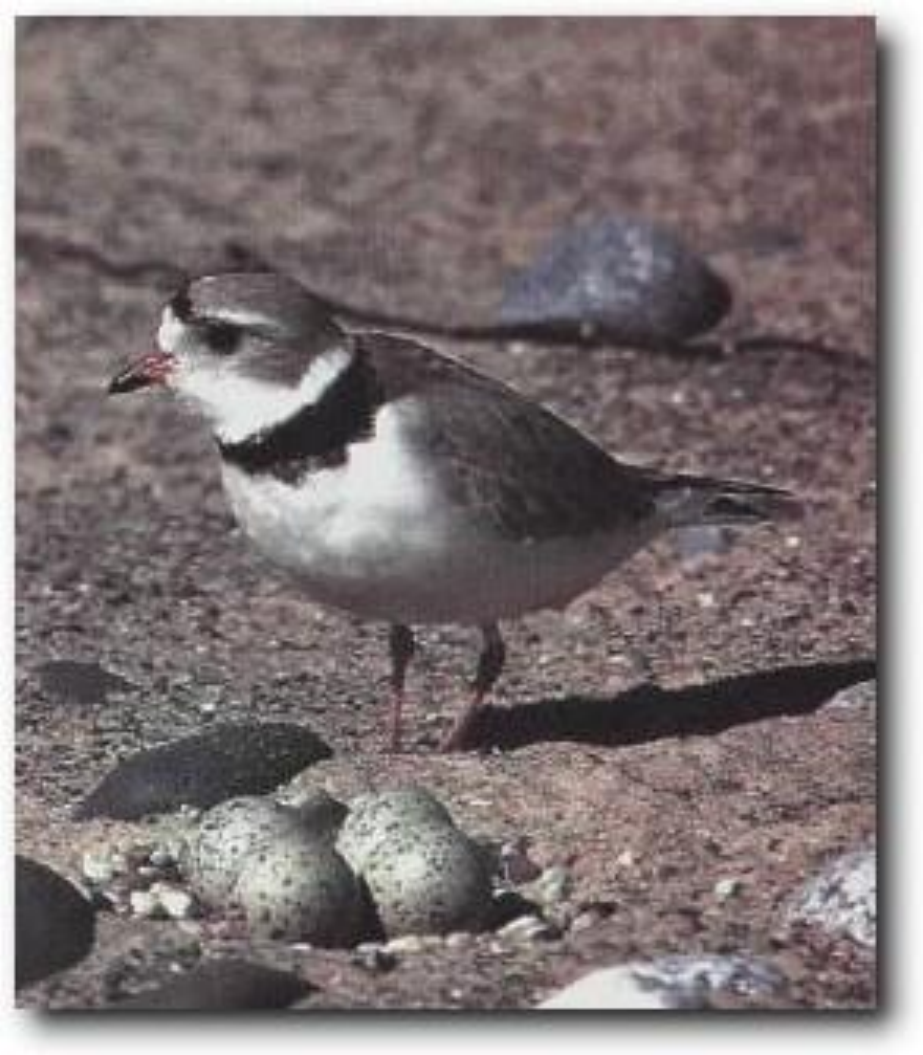
ODWC Streams Management Program

One of our informal cooperators is the Oklahoma Department of Wildlife Conservation. You may know that they have been responsible for restoring several streams in the state. When they put on an educational booth their preference is to use a stream trailer to be able to show what healthy streams look like in comparison to degrading streams.

Future Engineers?

Taking advantage of the stream trailer's natural attractiveness, teachers sometimes turn students loose to explore and learn. There is much potential to be developed along this line.

Piping Plover Habitat



This threatened shorebird uses mid-channel bars for nesting. Some years ago seniors in the Department of Biosystems and Ag Engineering were given the challenge of coming up with structures to help protect these needed mid-channel bars. Not only did they design structures on paper but they used a stream trailer to test them!

Flooding

Some communities have areas which experience flooding problems. Stream trailers have been used to good effect in demonstrating to local decision makers the problems inherent in some unwise approaches that are sometimes suggested.

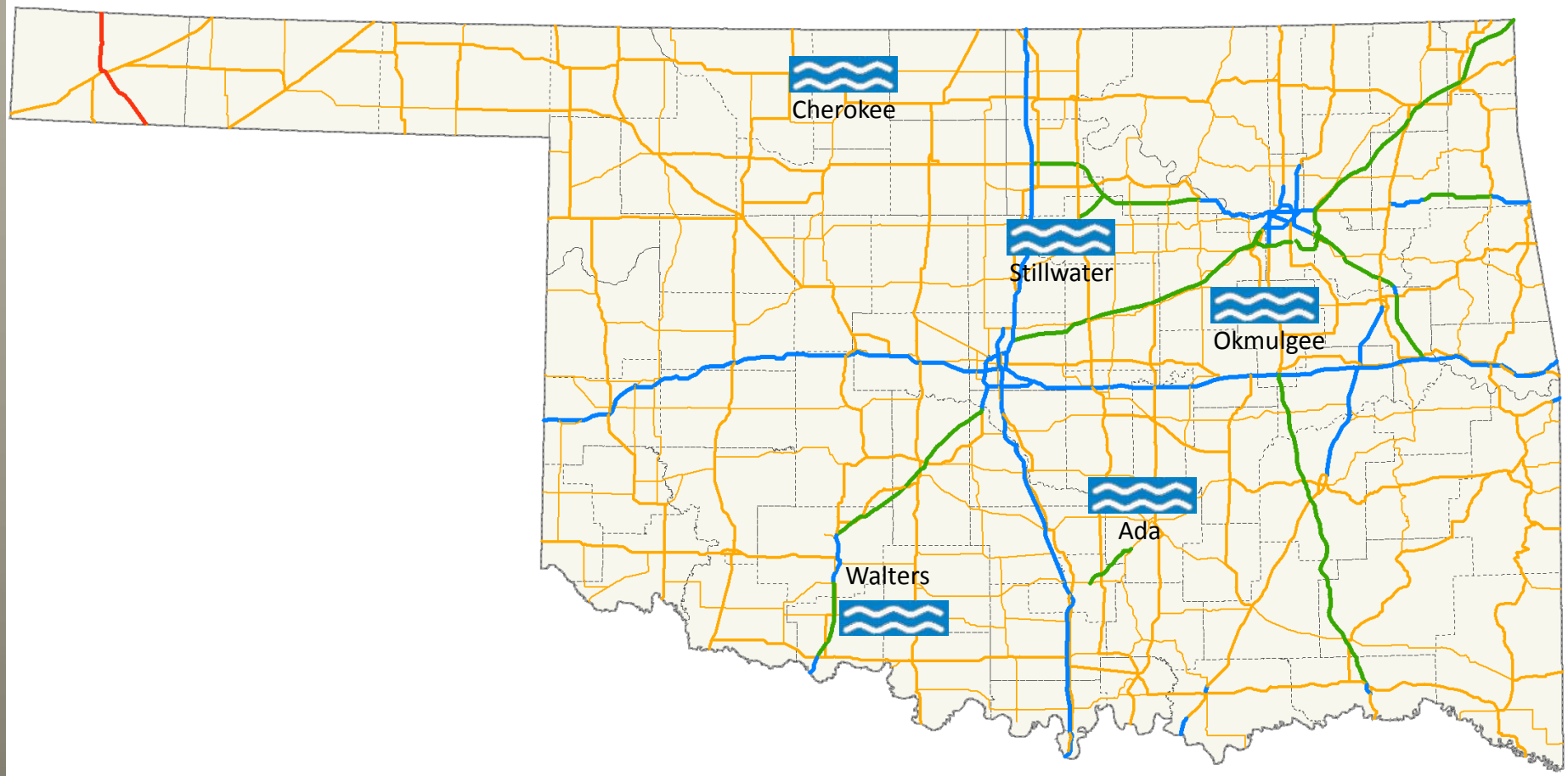
Other Potential Users

- Observe it in use
- Add on your comments
- Attend a training

  Schedule it for your events

The stream trailer program has a lot to offer other potential users. One way to get started exploring the possibilities is simply to get with your county Extension Office and watch it being used at Outdoor Classrooms and similar events. See if there is a way to piggyback your educational message unto such ongoing presentations. You are also encouraged to attend one of our stream trailer trainings to become a certified trailer user and then to go out and put on your own presentations. We hope that you will develop and share new teaching approaches that all trailer instructors can use.

Trailer Locations



Initial Point of Contact

Your County Extension Office

A full listing of educators who are certified to use a stream trailer:
http://waterquality.okstate.edu/files/stream_trailer/stream_trailer_educators.pdf

Northwest , Trailer #5
Tommy Puffinberger, Alfalfa County Cooperative Extension, **Cherokee**, OK
580 596-3131

Northeast, Trailer #2
Oklahoma Cooperative Extension Service, **Okmulgee**, OK
918 756-1958

Southeast, Trailer #3
Justin McDaniel, Pontotoc County Cooperative Extension, **Ada**, OK
580 332-2153

Southwest, Trailer #4
Pamela Varner, Cotton County Cooperative Extension, **Walters**, OK
580 875-3136

Central, Trailers #1 and #6
Marley Beem, Department of Natural Resource Ecology and Management, OSU, **Stillwater**, OK
405 744-3854

Conclusion

The trailers are naturally attractive to audiences of all ages and represent an innovative approach to educating the public which you should explore.

"…Here and there a cardinal flower thrusts a red spear skyward. At the head of the bar, purple ironweeds and pale pink joepyes stand tall against the wall of willows. And if you come quietly and humbly, as you should to any spot that can be beautiful only once, you may surprise a fox-red deer, standing knee high in the garden of his delight.

Do not return for a second view of the green pasture, for there is none. Either falling water has dried it out, or rising water has scoured the bar to its original austerity of clean sand. But in your mind you may hang up your picture, and also the hope that in some other summer, the mood to paint may come upon the river."

The Green Pasture
From "Aldo Leopold Papers," 15 August 1945.