The Sea Grant Files fresh news about fresh water.

JESSE: Hi I'm Jesse Schomberg, Today i'm here in the studio with Dr. Karen Gran associate professor in the department of earth and environmental sciences here at the University of Minnesota Duluth. Dr. Gran studies rivers as a fluvial geomorphologist. Welcome to the Sea Grant Files Karen.

KAREN: Thank you very much for having me.

JESSE: Perhaps you could explain it in your own words what you do.

KAREN: Sure, well the two words that you are hearing fluvial, means river and geomorphologist refers to the surface of the earth or rather people who study the surface of the earth.

JESSE: How did our north shore streams, the streams like the French, Sucker, Chester, and Lester. How did they form? It's a fairly young landscape with glaciers coming through here what 10 thousand years ago.

Karen: In this particular area, we had a large lake known as Glacial Lake Duluth. So it was a big feature. So if you think about rivers back then as they became uncovered by the ice they would actually flow into a lake 500 or 600 feet higher than modern Lake Superior. But then as the ice continued to retreat different outlets opened up for glacial lake duluth and the lake would drain and occupy a lower level and then it would drain again and occupy a lower level. At one point in time it was actually a few hundred feet lower than it is today. A river drained to base level and base level would be an ocean or a lake and so as base level falls, the river's have to downcut further and further and so the rivers for the most part are still in sizing but on top of that we have another big impact, and that is the rebound of the land surface. Ice is really heavy, it presses down on the land surface and as the ice retreats, the land rebounds. The ice is thicker in the North thinner in the south so the rates of rebound are actually higher at the Northeast end of the lake compared to the south west end of the lake. The end result is that the lake is actually tipping the water is sort of spilling down towards the southwest end. In the duluth area for the last few thousand years at least the Lake levels have been coming up. At the mouths of the rivers, they are experiencing lake level rise but actually most of the rivers are still in sizing and so we have an interesting set of process that are affecting the rivers right now.

JESSE: I suppose one of the signs of that sizing is the number of waterfalls we have up and down the north shore.

KAREN: Exactly. We have a fancy term for water falls, we call them niche points. Niche points are places where incision is sort of where it's held up that's how its propagating upstream.

JESSE: Thinking about a little bit more recently though, so the past 200 years since modern civilization has kind of arrived in this area. Has there been other things that have affected these streams?

Karen: In the last two hundred years probably the two biggest impacts have been land clearing and urbanization. And even on the North Shore even though we don't have too many cities and towns urbanization is a smaller impact if you look at the shore overall but it's a pretty big impact here in Duluth. And on top of that we have urbanization here in Duluth and that is particularly important to places like Duluth. So if you take a landscape that was under forest cover and you put in a city, you end up with alot of area which are called impervious surfaces. Places where water can no longer infiltrate into the ground surface and instead that water runs off into streams and what you end up with is flashier streams. The water gets to the rivers faster, the flood peaks tend to be higher, and the flood peaks actually happen earlier after a rainfall event.

JESSE: You've been looking into this stream flashiness. We tend to see flashiness here after rainfall events, during snowmelt, those periods of time in particular. Its an important component of a stream's hydrology can you comment on this flashiness factor and how it really does affect the stream.

KAREN: Well let's think about what flashiness really is. The speed at which the rainwater collects and flows into a river is what affects its flashiness and so there are two elements to that, one is how much water is being delivered and the other is how quickly it's getting into the channel. So if you have a basin that's covered with a forest cover for instance, versus an urban basin you're going to get a lot more infiltration of water into the ground more interception by vegetation and the end result is that you will have a much lower run-off into the streams. The North Shore rivers are actually pretty flashy to start with, particularly near the lake and there are several reasons for this, we have a lot of exposed bedrock and many of our soils are clay rich glacial sediments. They just have really low infiltration rate to start with so not much water can infiltrate in them, much more runs off. So we have water that's running off very quickly getting into the rivers quickly and then the rivers continue to get steeper and steeper and steeper as they move closer to the lake. So the speed and the velocity of the water increases. The end result is that if we have heavy rainfall events they rapidly turn into large flash floods. One of our students here at UMD Tiffany Sprig is actually looking into the effects of changing land use on the flashiness of streams in the duluth area. here in the Duluth area most of the hillside has already been urbanized but up over the hill it

hasn't. So Tiffany has been monitoring a number of small upland streams with different degrees of urbanization to look at their behavior in storm events.

JESSE: Kind of changing topics a little bit, given what you know about the reasons changing climate. We've seen warmer winter temperatures, we've seen more frequent heavy rainfall events, longer periods between rains, longer periods of drought potentially. What do you suspect is in store for the future of river's like the Lester and others up the shore?

KAREN: Yea well there's two different aspects of climate to think about here and the first is temperature, and then the second involves changes in precipitation and that involves both the amount of precipitation and the timing of when it's delivered. The temperature increases is particularly problematic in the North Shore streams particularly for cold water fisheries. Many places like southeast Minnesota or the driftless area in Wisconsin have great cold water fisheries because they have alot of cold spring fed rivers, on the North Shore, we have very little groundwater feeding our streams so we have cold water fisheries only because we are so far north. So temperature changes are a really big concern and there are particularly big concern for the ecosystems that have evolved in the streams on the North Shore. The delivery of rainfall is the other concern. If the same amount of rainfall comes but arrives in fewer larger events we are going to end up with less water infiltrating the groundwater and we may have to deal with more big events.

JESSE: You mentioned resiliency in your words what does resiliency mean for the streams in our area.

KAREN: Well I think from a perspective of a geomorphic perspective, stream resiliency is essentially the ability of a stream to adapt to the changing conditions while still retaining the same functionality

JESSE: So you're going to be speaking at the Minnesota Lake Superior Watershed Stream Science Symposium, tomorrow about stream resilience in a changing environment. What's your take home message going to be?

KAREN: Stream resiliency from a geomorphic standpoint is often confused with stream stability. The most resilient streams are the ones that can adapt. A river that can adapt to changing conditions needs the ability to move and so we have a tendency in our society to think of stream mobility is bad and so what I would hate to see is people aiming for stream stability when what they really want is stream resiliency. We want our streams to be able to adapt from an ecosystem perspective, I think that the biggest challenge streams are going to have is the predicted increase in temperature and so in that case the streams with the highest groundwater inputs may prove to be the most resilient.

JESSE: Dr. Karen Gran associate professor of earth and environmental sciences at the university of Minnesota Duluth, is one of over twenty presenters at the Minnesota Lake Superior Watershed Stream Science Symposium. Happening

this week in Duluth, This symposium is funded in part by the Great Lake Restoration initiative and Minnesota's Lake Superior Coastal Program. Minnesota Sea Grant helped plan the Symposium and I for one as well as Karen as I hear are looking forward to the exchange of information leading towards better management of Lake Superior tributaries. Thanks for joining us on the Sea Grant Files Karen, I'll see you tomorrow.

KAREN: Thanks very much for having me.

JESSE: This episode of the Sea Grant Files was produced by Jennifer Gasperini, Sharon Moen, Mariah Schumacher, and me Jesse Schomberg for more information or to listen to other episodes of the Sea Grant Files visit Minnesota Sea Grant at www.seagrant.umn.eud you can also follow Minnesota Sea Grant on Facebook or Twitter. Thanks for listening.