INTRO:

There are more than 300 former gold mining sites in Nova Scotia.
And at many of these sites, traces of toxic metals can still be found in the soil and water.
Research out of Saint Mary's University is looking at whether they can be found in other areas as well.
Lichens - which are not plants, but are made up of a fungus and a cyanobacteria that work together - are highly sensitive to their environments.
The CBC's Moira Donovan went out with researchers to hear why they're looking at lichens found at former gold mines as a means of tracking contamination.

STORY:

Michael:

My name is Michael Smith, and I am a master's of science student at St. Mary's University.
So we're at the Montague Gold Mines, right near Dartmouth, Nova Scotia. There was historical gold mining that took place here, and from the 1860s, to about the 1940s. So it's a really big site, and it's quite contaminated with mercury and arsenic.

What have you been doing here?

So I've been looking kind of at dust and air quality. So we use lichens to look at the air quality and lichens, they accumulate elements from the atmosphere rather than from roots, because they don't have roots like normal plants do. So they accumulate the elements from the air, and that's why they're good to look at the air quality.

Linda:

I am Linda Campbell. I'm a professor at St. Mary's University. I've worked with Michael Smith on his master's project, which was looking at lichen as a biomonitor of mercury and arsenic accumulation from legacy goldmine tailing sites. Using lichen is just fascinating. It's such a fascinating organism; very resilient, and it can live for such a long time as well, but very sensitive to the environment. So it is a very good monitoring tool to understand the environmental changes.

Sound effects: There’s a lot of lichen in the woods, but of course, as soon as we start looking for it and try to find it then we can’t find it.

Michael:

I found some beard lichen but I couldn't find the other one. But yeah, so this is the usnea. It's called a fruticose growth form. So it's shrubby, it's more three dimensional than the other type. So these ones are thought to intercept more gases or collect more gases, because they have a

wider surface area to volume ratio. So lichens, they can accumulate particles on the surface. And then those can also be absorbed into the actual lichen body. So what we actually did was we, when we collected our lichen samples we separated them, we had one for that was washed with water and then one that was unwashed. So the one that was unwashed was to take into account dust particles on the surface, plus what was absorbed. And then the reason we washed them was to remove the dust to kind of see how much dust was on them by comparing the washed and unwashed. So for mercury, we actually just found that there wasn't a lot of mercury being washed off the surface. So mercury is probably not associated with dust particles. So most is probably being absorbed. So we thought the mercury is likely depositing as a gas and then being absorbed right into it.

So there are tailings, this is a whole bunch of waste rock here, and then there are tailings underneath. So we thought they would be elevated here because tailings can get picked up by wind, and also mercury could be released as a gas from the soil surface or the water surface, and then deposit to the nearby lichens that are growing on the trees.

Linda:

And if I can just add to that as well, some of the highest mercury that we have found has been in the lichen. There are some historical documents that have showed stamp mills and mercury amalgamations sites, and they were located right here where we are. And so it does match well what we're seeing, from Michael's results to those historical documents of where we know where past practices took place, in those stamp mills and amalgamation, what took place 100 years ago is still being reflected in the lichen. Unfortunately, though, the tailings, they don't stay where they were deposited, as Michael was demonstrating in his work. The material is very mobile through air, water. And so we are seeing a lot of tailing materials that are going downwind. And for example, Michael found that the forest edge is an important approach in terms of management for the distribution of dust with those contaminated materials. And that emphasizes that we need the forests here. And part of the management strategy should include that.

Michael:

So this is the other one, plasmodial and it's, I guess, if you just compare the two, it's more two dimensional. So it just has like, an upper and a lower surface. And then it doesn't have as much surface area in comparison to the volume. And yeah, so this one, it kind of grows around the trunk or the branches, so it's like hugging the tree, where this one just has attached by this one part and then it hangs off. And, yeah, so this one's thought to collect more particles that are just settling from the air. So like dust. And then this one is more impacted by rainfall. They're both good options, because they did both show similar patterns across the area, but they just showed different levels.

Linda:

But you can see the lichen and it's growing, and it's because it's everywhere in the woods that it’s a good tool to use. And we've made a very nice map out of the analysis that Michael used. And it's not the same species that are going to be found across Canada, but the same genus will be found across Canada. And so then it makes it easier for comparison to different sites nationally. Working with Michael and other members of our research team, we're building many lines of evidence for the research and the potential risks of the tailings and how to manage those risks. And other approaches that we have done as well trying to better understand, yes, of course, there is a risk. And yes, there are potential issues. But where can we find the success stories in it, and that's also important, and we've done some really exciting work and successful work and more coming down the road as well.

Michael:
Lichens could even offer a good option for the modern gold mining industry, like active mines, so they could set up monitoring programs, either collecting what we did and measuring the metals in them or looking at the different species that are growing and seeing if they change over time during their operation.

Linda:

And lichens are very interesting.

EXTRO:

The CBC's Moira Donovan speaking with Saint Mary's University professor Linda Campbell, via an interpreter...
And her master's student, Michael Smith.