Smithsonian Folklife Festival Interview

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DG: And, okay, the first thing I'm going to ask you: Can you give me your name, address, email, zip code and everything else?

JF: Sure. My name is Jeremy Fried. J-E-R-E-M-Y F-R-I-E-D. I'm with the US Forest Service Pacific Northwest Research Station in the Forest Inventory Analysis Program.

DG: Job position?

JF: I'm team leader for the Environmental Analysis and Research Team. Like a lot of foresters I thought I'd have a career in the woods because I liked being in the outdoors, particularly in the wilderness. So when it came time to figure out what I was going to do for college I veered away from the path of going into physics as I'd planned to and shifted over into forestry, and never looked back. I went ahead and got ultimately three degrees in forestry: Bachelor's at Berkeley in Forest Management, a Master's in Forest Ecology at Oregon State, and a PhD in Forest Economics and Management again at Berkeley, studying pretty much every facet of forestry. I think one of the things that most attracted me to it was that you didn't really have to settle down into anything very narrow because forestry is broad enough that there's a lot of interesting questions to address – you can bring a lot of different skills to bear and learn a lot in the process.

So my first job out of my PhD was working as a professor at Michigan State University. I taught forest management and geographic information science there for about seven years. In my last year there I was on sabbatical leave at the University of Helsinki in Finland, where I designed a curriculum in geographic information science, and designed and taught five graduate courses in that field. It was a terrific experience; I enjoyed it very much.

It was about that time that the opportunity came to join the Forest Service, which was something I'd always wanted to do, even back in my undergraduate days. This really seemed like the right opportunity for me because I could bring in all my background in ecology and economics and management and systems science and systems analysis and modeling, into the job here at the

Forest Inventory and Analysis Program in Portland. So I applied for the job, and I was very fortunate and lucky to be offered the position. So shortly after moving back to the United States from Finland I came out here in 1999.

The Forest Inventory Analysis Program is dedicated to collecting and analyzing information about our forests for the entire country. That's all forest lands: all national forests, private lands, every kind of forest land that's out there. Most people agree that it's difficult to make good decisions unless you have the information about the resource that you're managing, and FIA fills a very important role there. Because while you might put plots in on a given national forest or an ownership to decide about whether you ought to harvest the timber or do some kind of silvicultural treatment on a very stand specific sort of basis, or you might have remote sensing information like from satellite imagery or air photos that tell you something about the forest cover of the whole area – if you want to have details on just what species are down there? What's the stand structure? Is it conducive to fires perhaps coming in burning up the stand, or insect and disease invasion, or exotic invasives? You can't tell any of those things from aerial photos or from remote sensing. You have to get down there on the ground. And so the beauty of FIA is that it's a statistically representative systematic sample of the entire landscape with incredible detail in terms of the attributes that are collected on the forests right down there on the ground. We have a grid – well, that's getting into the "how we do it".

It's a program that's not a "Johnny come lately". We've been collecting this kind of information about the forest now since around the 1930s when we were mandated to do so on an every-ten-year basis. Not just here in Oregon, but for the entire country. So the history of FIA is very interesting to look at. At the beginning the interest was primarily in maps, knowing where the forests were and what forest types they were, and the inventories were done as basically sketch maps - people being out there in the field and sketching the boundaries between different forest types, and putting in some plots – samples of the vegetation in those forests to be able to say something about each forest type. And it's evolved over the ensuing seventy years to become ever more scientific and ever more statistically rigorous. It allows us to draw even stronger and more concrete inferences, the way it's done now, which is as a grid inventory. What that means is that we have a representative set of plots that's at a regular interval across the landscape on about a 3.1 mile grid. On those plots we send people out, essentially every ten years to measure what's there: measure the trees, measure the understory vegetation, what species are there, how big are they? How much of the land do they cover? As well as downed wood, which turns out to be very important for ecological questions like wildlife habitat quality as well as issues like wildfire and how fast the fires are going to spread or how intense they'll burn.

There's been tremendous changes in the forestlands of this country since its inception two hundred years ago, but even in the last seventy years the types of forest management have changed. Things have swung between uneven age management and even age management, for example. There have been periods of accelerated harvest and cutting where a lot of the older trees have been cut and replaced with young, densely packed forests of saplings. And knowing

something about the rate at which this is happening and some of the effects this has on the ecosystem is what the FIA data helps us get at.

Some of the earliest inventory data is really critical for understanding what our forests looked like earlier in the twentieth century, particularly if we are interested in trying to restore those conditions, as a lot of folks are. The early inventories tell us something about the range of species, the variability and diversity in species that were there, something about stand structure where the old growth was. A lot of that has changed pretty dramatically over the last seventy years, and knowing something about what the natural range of the variability was back in the 1930s and '40s is really important for being able to know what endpoint you might want to manage towards. One of our projects here at FIA is trying to go back and analyze that early inventory information, a lot of which is not in digital form – a lot of which is still in map form. We have one project going on in California where a set of plots was collected between 1919 and 1930. That data is getting entered into a computer. The maps are getting digitized and we're going to be able to reconstruct a complete inventory for a considerable area in Northern California dating back to the '20s and '30s, which will provide an excellent basis for being able to look at what was the variability, what were the structures of stands then, and how does that compare to what we have now.

I think everyone agrees, no matter how they feel about forests and whether they should be used or how they should be used, that you can't really make good decisions unless you know what you have, and what you had, and what you're trying to get to. So that's really what our program's all about.

We're a national program now. How we do it now is fairly consistent across the entire United States. We have what's called "annual inventory", which means that we visit – the western United States, 10 percent of the plots – these are permanent plots that we come back and revisit every decade. We visit 10 percent of those every year with trained field crews. These are people with forestry backgrounds and botany backgrounds that are trained to measure the trees accurately and precisely, and enter that data into data recorders. They take measurements on the heights of the trees, the diameters, the height of the crown base which is an important indicator both of the vigor of the tree and of its susceptibility to fire for example, as well as information on understory vegetation species. Downed woody debris, which is basically trees that were vertical and now they're horizontal or in some other arrangement. Those get measured too so that volume can be calculated – biomass, all kinds of information that can be useful in modeling both habitat quality and carbon sequestration. Carbon dynamics, for example.

We do this on these plots, as I said, once every ten years. Over a ten-year period we ultimately measure all of the plots in each state. The number of plots depends on the size of the state, but each plot represents six thousand acres somewhere out there on the landscape. East of the Mississippi River we measure on a five-year cycle which means we get to all the plots over a five year period so we measure 20 percent of the plots each year. This incredible database is built

from field measurements that are then brought back to the office digitally in computerized form. Arranged in databases, the data is checked and cleaned – made sure that the errors are removed so we end up with a very high quality data product. Then these measurements are compiled, which means, for example, we calculate volume, or we calculate biomass, or we calculate site index, which is a measure of the quality of the site for growing trees - how fast would the trees grow there, for example. All those are estimated using equations that are in computer programs. At the end of all this you have a very rich database with something on the order of seven hundred variables or attributes associated with each plot. Those databases then are distributed to all kinds of clients – folks on the National Forest, private lands, consultants, and universities. People use this data for research. They use this data to make predictions about timber supply and they look at it for estimates in the rate of change in the forest. They even look at it in terms of what it says about development processes: how quickly is forest land getting converted to other uses, for example, or vice versa.

We use this data here at the Forest Inventory Analysis Program on our team to look at policy-relevant, issue-driven hypothesis-based research questions. For example, looking at the issue of fuel hazard: there's been a buildup of small trees due to fire suppression over the last hundred years, and we have the data to be able to look at quantitatively how much of that has occurred, and how much change has there been in the risk of fires taking out whole forests – having crown fires instead of just surface fires as believed to have happened earlier in the twentieth century.

Other issues are exotic invasives. Since we measure the understory vegetation as well as the trees on these plots we can say something about the ubiquity or abundance of exotic vegetation, whether it's blackberry or thistle or other kinds of vegetation that's come in and invaded areas that used to be all native vegetation.

Some other questions are looking at fire in terms of predicting how bad fire would be based on variables that we measure on the plots. So we've taken advantage of some recent fires that have happened in Oregon and California – to go back and remeasure plots that we measured before where we knew exactly what the conditions were on those plots in terms of the structure of the forest. We can calculate from that the probability or likelihood that fire would have destroyed that forest. Now we can go back and look at that forest and see what the fire effects were. What was the fire intensity? How much of the crown burned? What's the damage to the soil? That sort of thing.

So we have a very useful and versatile data set as a result of this program that's used both internally to address research questions – we also work with partners - cooperators and collaborators at universities and state agencies, for example, or other research agencies to address questions, and we make the data available to anyone who wants it. This is public data, paid for with your tax dollars, so it's available to everybody.

Some other ways that our data gets used: we produce inventory reports which tell about the state of the forest at any given time, generally every decade. How much volume is out there, how many acres of forest land, and by forest type and ownership - pretty resolved categories. You can look at the change between one inventory and the next, which is useful for a number of policy questions. Another area we look at is: using remote sensing combined with the FIA field data we can make wall-to-wall maps that predict forest attributes. Whether that's the forest type or the size or the fire hazard or the downed woody fuels - biomass – any kind of forest attribute that we can measure on the plot. With approaches like the {gradient 14:00} nearest neighbors' imputation, which we're working on with some collaborators at Oregon State and the Corvallis Lab, we're able to generate these maps for entire landscapes. And managers find these very useful for being able to identify places that might need treatment or trace places that are likely to have rare and endangered species or likely to have stand structures that they want to preserve or maintain. Developing these map products can be a very useful outgrowth of the FIA data. Another way that the FIA data is used by people that do remote sensing analysis with satellite imagery is to validate their models. They may be able to predict something about what's on the ground but our plots tell what's really there on the ground. They can compare the predictions they make for the places where our plots are with the data our plot shows there and they can validate those models to say something about how accurate they are there. Which is a very important role.

And the map as a way of presenting data is turning out to be a very effective communication tool, not just among researchers but even the general public. Being able to look at a map to see where the forests are, and forests of different types, and how they're changing over time from one inventory to the next is just a very clear way of seeing what's actually happening out there on the landscape. These developments in remote sensing and in GIS that are allowing us to do this have really taken us a long way to making people see how valuable the data is.

I'm thinking there are some pretty terrific things we could do on the Mall to show what our program does. Of course one of the things we could do is we could set up some simulated trees and have people demonstrating how measurements are taken. For example, we use lasers to measure the heights of the trees, diameter tapes to measure the diameters and such.

DG: Boring?

JF: And we have increment borers that bore the trees so we can count the rings and get the ages and get the growth on those trees, for example. We could have some of our staff there demonstrating those techniques and teaching people in the general public to use those kinds of tools and they could try their hand at it. We could even have some contests to see how accurately people could measure some of these variables that are measured in the field. We wouldn't necessarily have to limit it to trees – we could have some shrubs and forbs and downed woody debris to measure just like we have on real plots so people could get a sense of the totality of the kinds of attributes we measure out in the forest.

Another possibility would be to use the stand visualization simulator which takes the data that we collect on FIA plots and puts it into a computer-simulated image so you can take a look at what's there on the plot in a simulated way. With the SVS fire and fuels extension it's actually possible to light a surface fire and see what happens in that stand. You can look at a stand that has branches that reach down close to the ground – what we call a "low height to the crown base" – and you'd see that those stands catch fire and burn up, whereas a stand that's been treated or thinned so that the branches are higher up and the crowns are farther apart, that stand wouldn't burn. Just a surface fire would come through without burning up the crowns and causing a stand replacing fire.

And that kind of technology is available. We could show that on a big screen. People could select different stands and experiment and see what happens with different weather conditions, even. Another kind of techie computer thing we could do would be to use interactive maps to show what's on the ground somewhere. We could have a map of a state or part of a state with the plot showing on that map. The user could come up and click on the plot and either an SVS image could come up showing the trees on that plot and how they're arranged, or even photos of what's there on the plot including what's down on the ground or photos up at the canopy to look at things like canopy closure and canopy cover – anything you want to link to that site. That's one of the powers of GIS.

It would be nice to be able to present how some of our data gets used in making decisions or analyzing some the contemporary problems that resource managers face. For example, global warming is one where our data provides tremendous value in being able to look at how much biomass is out there in the forest. How much of it is dead and decaying biomass, like the downed wood, and how much of it is biomass that's accumulating and therefore accumulating carbon in the growth of new trees. Because the carbon dynamics, which can be much better understood with the kind of data that we collect, is what controls the global warming that's happening currently. If carbon can be sequestered in forests, a lot of the carbons being produced through the burning of fossil fuels can be taken out of the system, and therefore global warming might be slowed down or perhaps even stopped. Those are really pressing questions globally, not just in the United States.

Some other ways we could represent the data and what's happening out in the forest in a very dynamic way would be to have a kind of time clock – a digital clock that's a counter of what's happening in terms of growth or number of trees over time. You could do this for the entire country or for particular regions. Since we have this data going back for some time you could look at when trees are building up and we're getting more trees or tree volume is increasing and when tree volume is decreasing. Both of those kinds of patterns have happened at different points in time over the last century for the period that we have data. We could present those rates as they're happening now through digital counters that show the change in number of trees or change in volume or change in the area of forest land, or change in the area of forest land that's not fragmented, for example. That's an important ecological question.

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