Interview with Robert Griffiths by Max Geier, November 6, 1997, at the Corvallis Forest Sciences Lab; Transcribed by Andy Coleman and Keesja Hoechstra.

After completing a PhD at OSU in 1972, Bob Griffiths spent the next dozen years in marine microbiology research. However, research funding in oceanography became increasingly scarce, so he switched to forest soils using his skills in microbiology and biochemistry. He teamed up with Kermit Cromack and Phil Sollins on studies of fungal mats in forest and meadow soils, soil respiration, and carbon dynamics. He was also very active in through the NSF Research Experience for Undergraduates program based at Andrews Forest for many years, although he did not have a teaching position in the university.

Max Geier: This is an interview with Robert Griffiths, taking place on Thursday, the 6th of November, 1997. The place of the interview is Dr. Griffiths' office at the Forest Science Laboratory [U.S. Forest Service] in Corvallis Oregon. The interviewer is Max Geier, and the time of the interview is 1 o'clock in the afternoon.

Geier: What I've been trying to start out with each person I interview, is I ask if you could just talk a little bit about your personal background, how you came to be involved with the Andrews Forest, where you were before you were at OSU, and how you would like to define your work.

Bob Griffiths: Let's see. I came to Oregon State in '68, got a Ph.D. here in '72, and have been here ever since, working in different capacities, primarily in the Department of Microbiology, about 22 years, or something like that. About 10 or 11 years ago, Kermit Cromack, in this department, came to me, saying that he has this new system to look at these mycorrhizal mats of forest soil. My training was in microbiology, biochemistry and oceanography, and I was actually an oceanographer at the time. I spent about the first 12 years of my career as an oceanographer. He said, "Hey, this is a neat system over here." Funding was getting tough in oceanography, so I said, "What the heck, we'll take a look at forest soils!" And I guess the rest is history. I moved over here in '92, so I've been here for about five- and-a-half years, or something like that.

Geier: Up until that time, you hadn't really done much with the Andrews, before '92?

Griffiths: No, no, no. I started out, actually, about '86 or '87, doing some work at both the Andrews and Mary's Peak, working on these mats, continued on mats for a number of years, and kind of branched out into ozone. Actually, I think it was probably '87 when I first started doing work on the Andrews.

Geier: What drew you up there?

Griffiths: It was a neat place to work on these mycorrhizal mats.

Geier: Were there other people doing work in that area?

Griffiths: Well, actually there was another thing going on as well about the same time. It was the same year, '86, that Steve Carpenter, who was in this department as a mycologist, and who is now working for Hewlett Packard making a real living for himself. (Laughs)

Geier: Welcome to Oregon Higher Education!

Griffiths: Yeah, he got tired of the soft-money game like all the rest of us out here. Anyhow, he got me interested in the log decomposition project. Of course, Mark Harmon was in charge of that. It was actually Mark that got me involved. So, at the same time I first started working on mats, I was working on this log decomp project. It was within six months of when they cut the logs. We did studies on respiration and nitrogen fixation in those logs, and that work continues today. Those were my first contacts. It was maybe only a year after that, probably '88, that they had an REU program going on at the Andrews. The whole program was about 10 students each summer, and I got involved doing that as a mentor, and helped out on that. And I have repeated with that ever since.

Geier: Can you back up a little bit here? I'm interested in some of your academic roots and your mentors. I mean, what brought you towards microbiology?

Griffiths: Okay.

Geier: Are you originally from California?

Griffiths: No, I was originally from Ohio, and ended up going to Oberlin [College]. Got into biology as a pre-med student. I was in pre-med at Oberlin, and I was about ready to get drafted, and went into the Navy (laughs) after that. I was a naval officer for about three-and-a-half years.

Geier: You were doing what?

Griffiths: I was a naval officer for three-and-a-half years. Didn't do any science while I was there. (Laughs) In any event, I got out and started pushing drugs for a pharmaceutical company for a short while, and just hated that. I was also interested in biology, but I never could remember all the plant names though, so most everything in biology when I went through Oberlin, was slanted towards taxonomy and descriptives, and there was very little physiology and that sort of thing going on. When I started getting back into it, I discovered that there were lots of these neat things happening in the field of biology, things were just turning around literally, so you could make it as a biologist and not remember all the plant names.

Geier: Late '60's?

Griffiths: Mid '60's. I went to San Jose State in '66 and finished my degree there in '68. Actually, I was either going to go into entomology or microbiology, and this one new faculty member was a microbiologist. He was anxious to start with a graduate student, so he took me under his wing, and he was a marine microbiologist. His mentor actually was Dick Morita, who is on the faculty here, an emeritus professor in microbiology.

Geier: Who's the guy you were working with?

Griffiths: Working with at that point? Dr. H-A-I-G-H-T, and I did a thesis on marine organisms, factors involved in what happens to them when they get heated up. Anyhow, it was a sort of zoological type work on these marine microorganisms. I applied to Oregon State, was accepted, came up here, and worked with his mentor, Dick Morita, who was also in marine microbiology. I continued on essentially straight physiological studies, photo-effects on the shifts in catabolic pathways to glucose metabolism, showing that there was a basic shift from one pathway to another, depending upon shifts in salinity in marine organisms.

Geier: So your move up to OSU, was because of the mentor relationship, or because of OSU's reputation in oceanography?

Griffiths: Basically, just kind of came here because it seemed like a good idea and deal at the time. (Laughs) And because my mentor down there said, "Hey, you'd really like it up in Corvallis, and you shouldn't have any problem getting in." That's how I moved up here.

Geier: Had you been here before at all?

Griffiths: No, no, no. My wife and I were living in California at that point, and we moved up here in '68.

Geier: I'm kind of curious of the connections between oceanography, [fungal] mats, and log decomposition. How did that transition take place?

Griffiths: When you're looking at carbon and nitrogen cycling, like I've done in a marine environment, most of the work I did there I did in the poles. I worked in the Antarctic and the Arctic for most of that time. Anyhow, the processes are essentially the same. It doesn't make a difference, if it is forest soils or marine sediments or logs or whatever, the same sorts of chemical cycles take place, there are just different factors involved, and slightly different actors involved (laughs) in terms of who does what, but these things happen everywhere. And they are real basic biochemical transformations, and you pretty much move from one field to another, studying the same types of things. But, just having to deal with a whole new literature, it was a pretty giant jump, going from oceanography to forest science. It's interesting though, that I am supposed to be making my living as a microbial ecologist studying in forest soils, because I never had any formal training in either forestry or soils. (Laughs)

Geier: Was there much connection between people like Dick Morita and Forest Science?

Griffiths: No.

Geier: None at all.

Griffiths: The only initial contact was, and for different reasons, was Steve Carpenter, who happened to run into a colleague of mine, they got talking, and we all got together. It seemed like a kind of neat thing to do. I got involved in a lot of projects, and then, Kermit Cromack approached us about how he knew we were working on nutrient-cycling, and that there was potential for interesting things that could be studied in the soil mats or bio maps.

Geier: Was it all in the literature?

Griffiths: No. We just knew each other and kept talking, and mutual contacts. Also, another interesting thing. Dick Waring had asked me, and I don't remember how this started, but he wanted me to evaluate a thesis a student of his had done, looking at starch buildup in fine roots, and how physiology of trees influenced that, soil-tree interactions, that sort of thing. That was another connection. All of these happened about the same time, all independent of one another.
Geier: Like it was meant to be.

Griffiths: I guess it was meant to be.

Geier: Were there any particular models that you relied on as you were developing your career, first in oceanography, and then as you moved into soil cycles? Anybody that you worked for or whose thoughts were really enlightening?

Griffiths: Well, I guess the model that I was following was that of my mentor, Dick Morita, because he was one of the very early people in marine microbiology that was looking at processes and the biochemistry of what's going on, rather than just descriptive microbiology. You know, what's there, and what we can isolate. He was one of the first ones looking at the effects of pressure on cells and enzymes, and the effects of starvation and the effect of heating; all these things on marine organisms. I was interested in how these organisms functioned. Most of the work he did was in the laboratory. He did very physiological, classic work, using marine organisms. I was a lot more interested in going out and actually doing things in the field. Initially, I got into it because there was money available to work in the Antarctic on this project. They said, "What do you think," and I said, "Sure, what the heck, I'll try it."

Geier: That was while you were up here at OSU?

Griffiths: I had virtually no training in ecology. It's all been kind of picked up, learned the hard way, along the way.

Geier: But you had a field orientation early on as a student?

Griffiths: Yeah, I worked all over Alaska, parts of Canada, all over the Chukchi Sea, Beaufort Sea, Norton Sound and the Aleutians, and all the way down to Seattle, along the coast. It's been pretty neat. Most of the funding was from NOAA, the National Oceanographic and Atmospheric Administration. They had a huge project to look at the effects of offshore drilling on marine systems. We were particularly interested in what the effects of crude oil might be on microbial processes in offshore and nearshore environments, so we spent a lot of time on ships, and a lot of time out in marine labs up there. That work continued through the early '80's, starting in '75.

Geier: When you made the transition from oceanography to forest soils, what do you recollect about your first actual involvement on the Andrews?

Griffiths: The first time actually out there, I went out to look for sites where we could try these mats we were interested in working on. I went with this silviculturist, Vince Puleo. Apparently, he's still employed with the Willamette National Forest in Eugene. I don't remember exactly what he is doing now, but he was the silviculturist for the Blue River Ranger District at the time. He took me out and showed me some spots, and after that, we collaborated on putting together a two-day workshop on soil biology for employees of the Willamette National Forest. That was one of my early involvements. Then, I was involved in the wood decomp study sites. So, we went out and did some limited fieldwork there, but mostly working on the materials they brought back to the lab. Then, I had involvement with the students working there as well. So, it wasn't until probably '88 or '89 that I really got out there working at a much more involved level. It was about that time, I was starting to get a little bit of funding, actually from the LTER group. So, what I did was set up 20 sites, permanent sites on the Andrews, kind of reference sites, for below-ground work. Nothing like that had been done before. We had reference bands that had been in place for forty or fifty years, looking at growth rates and the rest of it, vegetation, but there was nothing set up for below ground. We wanted to be able to set up places where we could go in and disturb the soils, and not disturb some other place. That's why we've been going the way of regional reference bands, and also, I wanted to put together a different kind of design which would give us a broad climatic range, so we could look at the effects of climate on soil processes on a monthly time status. We did that, and studied those sites for a number of years, and we have since expanded those sites to about 24, I think it is. Where we are in addition to looking at variability in climate, we are also looking at effects of harvesting. So, we've been comparing clear cuts, a young stand, 30-35 years old, and old growth, in the same general area, and looking at seasonal differences, comparing levels, what's going on below ground. And in each of those sites, we have ten stations or locations that we keep using in the sample.

Geier: Those are all in the Andrews?

Griffiths: They are all in the Andrews. Then, a couple years after that, '93 I guess it was, I established a set of almost 200 sites, 184 sites, at half-kilometer intervals along roads all over

the Andrews, and those have been well-documented. We use those for studies, and we will continue to use those for kind of large-scale studies on the whole-basin level/scale.

Geier: Do you have students working with you? Who's setting up these sites?

Griffiths: Mostly undergraduate students and money from REU projects, from the LTER program, volunteers, work study, whatever I can get. Typically, I'll have four students a year in the summer, working on these projects, but then, when we get REU students, we'll get everybody involved. We'll get fifteen people out there. That's kind of ongoing. I've also set up a real intensive plot where we have got GIS overlays of everything that's out there. And this is again, part of the network that I've tried to establish for ongoing below-ground work. I've had a lot of interest from people looking at insects, and fungal genetics. A bunch of other folks are wanting to use the sites. So, I've actually got sites for three different scales for different purposes. So that's kind of my ongoing legacy of work, along with posting data.

Geier: People working with entomologists and fungal groups are working on it?

Griffiths: At this point, the people that have only shown an interest, haven't done anything, but are very much interested in pursuing it. One is Joey Spatafora in the Botany Department here [OSU]. We plan on doing a collaborative project starting next year. There is also a scientist with the National Biological Service in Seattle, who has expressed interest in doing genetic work there as well. There have been a number of entomologists, Andy Moldenke being one. There have been some entomologists from U of O that have approached me about using those sites for their entomological studies. I guess the next thing we are putting together, is sites that we will be using for LTER 4 to study stands that have different successional trajectories. They have been cut and they are either coming [tree establishment] along really slow or really fast. We are going to try and determine, what is cause and what is effect. In other words, are there things in the soil that would cause the site to have a predisposition to be a fast site or a slow site? Once we do have a number of sites on the Andrews, particularly in high, south-facing slopes where very little [tree] regeneration is taking place, and very, very slowly. And we would like to determine what that translates into in terms of effects on biology and chemistry, nutrient-cycling, rates of carbon and nitrogen-cycling, and such.

Geier: Like the one you were talking about at the Andrews days ["HJA Daze" – annual public event to show work and programs] up there?

Griffiths: Yeah.

Geier: How would you characterize your understanding of the purpose of an experimental forest since you started working out there, and how much exposure had you had to that as a concept?

Griffiths: I can't say that it was much different than what has turned out to be the reality of it. It was obvious it was a place where there was a lot of multi-disciplinary research going on. I

might preface this to say that I was actually going to meetings for LTER, before I had done much work out there. So, very early on, I had a pretty good sense of what was going on in terms of who the players were and how people interacted and worked in kind of a multi-disciplinary way. I think fairly early on, it was obvious that one of the main advantages was that you had, was long-term records of management and a bunch of other records; climate data and data on other subjects.

Geier: This was before Steve Carpenter [contacted you]?

Griffiths: Well, I never heard of it before him! Experimental forest, what was that? (Laughs) They cut trees, I guess. I didn't have a clue!

Geier: Actually, those were my same feelings before I started working in this department. So, you started going to the LTER meetings after the Andrews folks contacted you to find out more about your work before you got into the actual work?

Griffiths: No, it was clear that this was going to potentially be an interesting way to go early on. We got very neat results really fast, it was obvious, and we got funding right away. The first proposal we put into the USDA Competitive Grants, got funded. It was unbelievable. So, we had the money to get started, and that was the thing that really made us go in that direction. If there was no money, we wouldn't have begun. So, it was obvious this was where all the action was, where all the movers and shakers were, and I wanted to be in the middle of it, so I started going to the meetings and participating the best I could.

Geier: From what you said, it sounds like you were attracted, at least in part, by the promise of multi-disciplinary potential?

Griffiths: Yeah, and the working relationships. It was obvious that the rapport people had with one another, even outside the college and the university, was great. They had people here from the Forest Service, and there was no distinction about organizations, but it was, what you can do, a "we will work together" type of approach, which was unusual at the time, unfortunately.

Geier: I wanted to ask you about, actually, the kind of inter-disciplinary potential at OSU. Do you find that characteristic of the university in general, or primarily with this group?

Griffiths: I think it's pretty unusual overall in science. In oceanography, there was a different kind of rapport. It was an "old boys club," pretty much. You either went to Scripps or you went to Woods Hole, and if you didn't go to either one, you were pretty much out of it. You go on a cruise, it would be intense interdisciplinary activity because that is the only way you could function, really. But speaking as a biologist, it wasn't like it was all one campus, or there was a center, or a place. It was folks from all over the United States that flew in, maybe from all over the world, to some port, you got on a ship and went out and did your science, came back, and all went your different ways. You got together for a meeting once a year and called it good.

That is the way things typically happened in that field. That's the only thing that I can really speak to. I think in a lot of other fields that I have been associated with, people are so concerned with covering their backsides, they are not very forthcoming about what they are doing, and are not terribly cooperative, overall. But the attitude is totally different here. It's not universal in this field, believe me. All you have to do is look at UW and other places. This is very, very unusual.

Geier: You're talking about the university now?

Griffiths: I'm talking about the LTER group specifically, and in a lot of ways, the Department of Forest Science [OSU], because that is pretty much the way people operate around here. But in the Cascade Center [for Ecosystem Management], or the LTER, however you want to define it, it's unique that not only are scientists talking with each other, but people are actively managing the forest, from the Blue River District. They're constantly working with these folks and sharing information, and that is really unique as well. So, it's not only unique in terms of size, it is also unique in terms of the interaction between the people that are practicing forest science.

Geier: Who at the district have you worked most closely, that you have been involved with?

Griffiths: John Cissel, Lynn Burditt, and a number of other people I've had interactions with over the years. But typically, it's just that I have a certain thing that I need to find out, or I know this person will do it, and that's it. So, there hasn't been much in terms of one-on-one, long-term kind of concerted effort in any given area, from myself, personally. I was just contacted by their soil scientist, who is new out there, at the Blue River Ranger District. It looks like he is interested in cooperating, and so we are beginning to go, but, I guess that would be it. Mostly with John [Cissel]; he's kind of been the liaison. I haven't been very much involved in things that are directly related to some of the management things they have been doing, or some of the tests that they have specifically laid out. So, I haven't had really a need to do that.

Geier: When you work down there, do you typically go down there and stay for a period, or do you go down there and come back in the same day?

Griffiths: I usually go down and spend a night, at least. Rarely will I be there more than 2 or 3 days, although if this LTER program or the REU program gets funded, I am supposed to be running that show, so I will be spending more time down there. Quite a bit more time. I have always had a lot of folks working down there full-time. I have had students there, and had one student that was there for a full year, but typically, I only go in for a couple of days at the most.

Geier: Do you stay at the headquarters site then?

Griffiths: Yes.

Geier: If you could, talk a little about what your resource or facility needs are on-site there for the kind of research you do, and how the availability of those resources is changing over time.

Griffiths: They are just like night and day. (Laughs) I had nothing to begin with. We have had a couple of old broken-down trailers, and I had what they were calling labs. It was beat up old trailers, these two benches and almost no equipment. I had a muffle furnace and a top-loading scale, which is about all I remember being there. And I never used any of that stuff. We brought everything back to Corvallis to work on.

Geier: Packed up sample bags?

Griffiths: Yes, everything was brought back. We didn't do anything out there except maybe measuring temperature. That was it. When the lab was built, I started really hustling and getting a lot of equipment for the two labs, and I ended up occupying those first two labs. But, also, I found somebody that was surplusing a still, and I got that installed, and somebody else surplused a real nice, almost brand new autoclave. Got that installed. There was another big, huge drying oven, the size of a small room. We surplused that and got it shipped out there. EPA was going to throw out some incredibly expensive ion-exchange units for purifying water. Got that shipped out there. One scientist here was retiring and he wanted to know if I wanted his refrigerated centrifuge, a $16,000 centrifuge. I said, "I'll take it." It's out there. We scrounged up enough, and then got funds to buy a chromatograph, which is out there. I am almost as well-equipped out there as I am here. We do a lot of stuff out there; enzyme assays, gas exchange work, nitrogen fixation, respiration, all those things. We got a couple of incubators there, a spectrometer, and pH meters. All kinds of good equipment. Almost all of it, I've scrounged from some place.

Geier: That takes up a lot of space. Is there any kind of administrative structure to decide how space is allocated out there? I mean, are you involved in that decision-making process?

Griffiths: If there's a void, we fill it. Except for the communal stuff, which is useful for everybody, like the autoclave and the rest of it. With those exceptions, everything else that I have hauled up there is in those two labs. I have primarily taken those.

Geier: If other people that need to use those labs, is there a system for that? Or is that pretty much set aside for you work?

Griffiths: No, but the equipment is expensive enough and finicky enough that I like to have them contact me and find out who is going to use it. I try to make the equipment as available as I can, but of course, there is stuff that could get damaged. If someone doesn't use the centrifuge right, you could tear up that whole lab, kill people, big-time. So, we do have to restrict it, and there are balances that are very expensive, and you could just walk out the door with them.

Geier: I assume that falls under administrative responsibility. Do you maintain control over that?

Griffiths: Well, that's an area that we haven't really sorted that out as neatly as I'd liked to, at this point. And that is something we have got to put together, some more specific policies in my view. And we will, it will just have to happen. There are certain things that are very high maintenance things, as well. So, we will have to get someone, either to pay for supplies or pay for maintenance. But generally, I try to make things as available as I can to students. I mean that's what it's out there for. But of course, I don't want to go out there and have a piece of equipment all "boogered up," then and have to pay, and not be able to use it.

Geier: I'm trying to get a little sense of the concepts of use of the facilities. Do you agree on some of these things out there?

Griffiths: Actually, I just sent them a memo on lab safety which we wanted to have people sign. Before, there was hardly any lab work going on, so it was not an issue, but it is becoming more and more an issue. I put together a whole series of safety guidelines, and also recommendations of how to deal with equipment issues and so forth. It is going to be more of a problem now that we have teaching labs out there. That's going to be incredible. You talk about future potential of that new facility, with a teaching lab. That is going to be just dynamite. Because right now, about 80% of the research that goes on out there, takes place three months of the summer. The rest of the time it is pretty seriously underutilized. That is my impression, anyways. That is the time when classes from OSU and other colleges and universities in the Willamette Valley could be using that as a teaching facility, and I would like to be using it for workshops and so forth. Right now, we have no money for equipment. Once we do get equipment, we'll have to be over there, and manage that as well. We'll have microscopes and sound systems that are available.

Geier: There will be a more formalized policy on the management of those things?

Griffiths: Of how to deal with the equipment and so on.

Geier: Do you think that you all could work that out?

Griffiths: Well, that is something that I would work out with Art, and with the manager that I'd be hiring. Also, Al [Levno], of course, is involved in the use of the equipment. Generally, just four or five of us will get around a table and try to hash something out. It usually works.

Geier: And if there are any problems that any people have, they just bring it to whoever?

Griffiths: Yeah.

Geier: I wanted to ask you what parts of the Andrews you might identify as your most important worksites. Also, who apart from the Andrews group, you would consider at this point to be your closest colleagues?

Griffiths: Outside of the Andrews. Almost all of them are associated with the Andrews in one way or another. Actually, I retired a year ago, but you wouldn't know it.

Geier: I had no idea!

Griffiths: I wouldn't know it either! But what that has meant is that I've purposely kind of disassociated myself from a lot of my peripheral contacts. My main interests at this point, are for the foreseeable future, to continue work at the Andrews, and for that reason, most of my current and future contacts are going to be people working out there, although I have certainly worked with many other people on different projects and have had students working different places.

Geier: What is it at this point about the Andrews that kind of keeps you involved, even though you are officially retired?

Griffiths: Well, I think it is a great tool for education. I really enjoy working with undergrads. I just think that it is an incredible teaching tool. Also, I enjoy working with practicing foresters, so when we have extension stuff or workshop things, I think that's incredibly important as well, and it's just a different kind of educational role. And when we get that teaching lab up, that's going to be outstanding. I think it is important because of the integrated research going on out there. I think that there are a lot of interesting people, a lot of dynamics involved. Where I would like to go professionally, would best be pursued through the Andrews because of the people involved, primarily, and because it is a great resource. It is an area I know very well now, and we have a very strong data base that we are building on, and it's the fact that we are building on a database that will be available a decade, fifty, or maybe one hundred years from now. People will go back to these spots and they will be able to make measurements after the climate has warmed up (much laughter), and the trees have been replaced by palm trees out here in the quad, and then grow up and study the soils out there and see what it was like 100 years ago. And go to the exact spot where we have very accurate sightings in terms of where we are using satellites and such. So anyhow, it's building a scientific legacy. I think it is very important. I think another issue that certainly keeps me involved, and I have been in it long enough that I can make a difference. I know how it works. I know the people. It's a mix in which I know the territory and I know the people, and so, a lot of time that you spend spinning your wheels, generally, trying to get new places to study and good people to collaborate with, is already taken care of, its already there in place. It's just a matter of maintaining that. So, it is very, very attractive from that aspect.

What I would like to do, is continue to develop the database that will be used to produce models, predictive models of climate change and disturbance, and be able to scale these things out, eventually up to a regional level, but certainly over a large watershed level, to make predictions as to what will happen with soil processes, what is going on below ground; how below ground functions, how the soils in the below-ground processes are going to be altered if you warm up the temperature, you cool it down, or have a fire, or do whatever we do, have large patches or small patches. I'm interested in edge effects. We have studies on edge effects,

so the scale of things becomes very important. These are all things that can be very nicely done on the Andrews, most of them. Things like fire might go off-hand. But still, you are working with the same cast of characters, you're still pretty much in the same ranger district, you know how to interact with these folks, and if you need something, you know where to get the information and how to get help. That is going to keep my plate full as long as I want to work.

Geier: Where you're sitting at the top scale, you're not tied to the Andrews?

Griffiths: It is a large enough chunk of land of wide enough climatic gradient, that it is really nicely representative, certainly of the Central Cascades. So, it is a nice representation of a fairly important block of forest, certainly across Oregon, and probably in what is going on up into Washington as well. Perhaps up into B.C. That is representative of a big chunk of real estate. If you look at a continuum in terms of the drainage, we've got the headwaters of a chunk of the McKenzie drainage, and one of the things I am interested in is fine organic material in stream sediments. That is another area that I want to become involved in. We can do that nicely on the Andrews because we have a large enough spot that we've got first- to fifth-order streams there to study, and it is part of a much larger watershed that a fair amount of information is known about. So, it is useful from that aspect. It is also useful in another way. I have used regional studies where I'll have sites on the Andrews, and know the history of those sites, and we can compare what is going on there, using exactly the same approach in other areas with the same kind of measurements, same everything else. We can go look and compare what is going on elsewhere in the study with a known quantity. So, it can act like a reference site for larger studies.

Geier: Sounds like the work that you are doing, the way it seems to be proceeding is, there can be people coming in from elsewhere, but because of what's happening on the Andrews, they can apply it, perhaps, more broadly in British Columbia or Washington?

Griffiths: I think that is where we are heading in the future. There is some of that going on. There are people from all over the United States that work at the Andrews, and there are actually a few studies, like the LIDET studies [Long-term Inter-site Litter Decomposition Experiment Team study] that Mark Harmon does. I don't know if you've talked with Mark? But that is a good example, as he looked at decomposition rates all over the United States. In that case, the Andrews is an important part of that. There is another study that is starting up now that is actually being conducted by folks here at OSU, that is designed after a similar study that we have done on hardwood forests from other places. Similarly, Stan Gregory has got things going on that are playing off of and coordinating with people from Coweeta and other LTER sites. So, there is definitely interest, a push on doing inter-site work within the LTER network. There is also some interest internationally with the Chinese, the Russians, and some others. But I have not been directly involved with any of those projects. I have done some work here in Alaska and in Georgia, looking at mycorrhizal mats, comparing those. But, that is the only kind of comparative work other than my own work, with this regional study stuff, that I have done.

But, that is clearly where the Andrews is headed, where the LTER group is headed. And if Congress does come in with some more funding, they did come in with a request, almost doubling the funding to some of the sites, and we weren't chosen, unfortunately, but that was where the thrust of that money was to go. If, in the future, we get additional funding, that is where it is going to go, to more regionalize what we are doing on the Andrews. That was the whole purpose of that [new proposal], I forgot what they called it. It was an amendment. Anyhow, it was essentially to use these funds to broaden the spatial scope of what is going on at the Andrews. Now, at the current funding level, I don't see a lot of that happening, because we are pretty much in a maintenance mode right now. That half-a-million [dollars] a year sounds like a lot of money, but it certainly doesn't go very far. So, we have pretty much had to hunker down and maintain what we have got going on that scale. Does that answer your question?

Geier: That was pretty good. I was talking to other people. Many of them come to the Andrews from various backgrounds. Your background is pretty much focused in your past professional career. I mean, you got your Ph.D., and did your research in the Arctic and Antarctic.

Griffiths: Well, virtually all my work in oceanography was polar work. I didn't work here at all. I did some work in the estuary.

Geier: Then, in terms of your forest work, it's all based here.

Griffiths: Yeah, well, with the exception of the work we did in Alaska, and then Coweeta, and Northern California and Mexico. Other than that it has all been here. Mexico was the work with Mark Harmon; termite farts, methane from termites.

Geier: What is the impact of methane from termites?

Griffiths: A lot. They produce a lot of methane. Actually, on a global basis, it definitely is a significant portion of methane, which is a very important greenhouse gas. What we discovered was, even though these things produced a lot of methane, none of it gets out of the logs. It gets oxidized before it gets out of the logs. A lot of assumptions about, we've got these termites, they're in logs, they're producing a lot of methane, therefore, you've got so much methane being produced, you got so many logs, you got so many termites per log, and you multiply all that and you get some kind of gas factory for methane. Well, it may not work that way (laughs), they may be producing some methane, but it may not ever get out in the air, and that's one of the things that we were checking. We checked at the Andrews, and we checked in the tropics in Mexico, and it gave us the same answer. Which is nothing is coming out of the log. These termites are farting their brains out, but nothing is coming out of the log! (Laughs)

Geier: So, you're concerned about global warming, obviously. It's one thing that has been driving some of your research?

Griffiths: Oh, yeah, yeah, yeah. A lot of the work I've been doing was initially respiration, forest floor respiration, CO_2 coming out of the forest floor. But in order to really understand what is going on there, you can't just look at that. You have to look at everything else that is going on. So, we started looking at dissolved organic carbons in soils, which not many people do. Because that is the primary currency through which the carbon has to flow to get to the microorganisms to be blown off in the first place. It has to be in a liquid state. So, we looked at that. And we've looked at interactions between soil and moisture and temperature, obviously. But then, you need to start looking at other carbon pools, so we have looked at photo-carbons and labile carbon, and you can't look at this just for carbon-cycling, because nitrogen is involved in this and is necessary, for full decomposition. So, we looked at de-nitrification and nitrogen [fixation], and a bunch of other factors. What started out as a project primarily looking at respiration, kind of snowballed into all these kinds of things as well. That's kind of how we started from this little thing and that it kind of grew up.

Geier: You talked about your interest in involving undergraduates and your teaching role, and the workshops you put on. Are there some particular people you worked with closely in kind of a mentor relationship where you brought them along, and they became involved in the Andrews, or even people who've gone on elsewhere?

Griffiths: Well, I think so. Most of the undergrads I have had mentored have done great. In fact, I have had three of them as my own graduate students, and they have had varying degrees of success. I can't quite point to any one person, but I think what I've been able to do is really give students a pretty realistic taste of what doing science is about. Actually, going out and making measurements and all the things that are involved, and I've had a number of just crackerjack students I felt had real potential as scientists that discovered early on they don't like the science.

Geier: That part of it wasn't appealing to them?

Griffiths: Well, it's just the reality. It's so much different than most of their concepts of what being a scientist is coming in out of high school, mostly the public, they just don't have a clue. They just don't have a clue! And it sounds like a neat thing and they are interested in a science-type of deal, but to actually do it is much different than most people realize. And I count amongst my successes, if you can believe this or not, incredibly bright students that have learned that this is not what they want to do, and they have gone on to do other things. It's saving them, I hope, from a lot of dead ends and heartache along the way. (Laughs) And there are those that are good, really flourish, they love it, and they really dig it and go for it.

Geier: That's an interesting angle. How would you characterize the public view of what scientists do?

Griffiths: I think they figure that it is all pretty cut-and-dried. That the problems are fairly simple and easily defined, that you are able to control all of these things, do some measurements and come up with some very nice, unequivocal findings.

End of Side A, Tape 1 (of 1)

Start of Side B, Tape 1 (of 1)

Griffiths: And that is not the way it works. It's an art form, and there are lots of really squishy things involved, and there is a lot of flying by the seat of your pants, and there is a lot of just real grunt work, a lot of real repetitive, dull, dumb stuff to do, the same stuff over and over again. You make mistakes and other people make mistakes that cost you more and more time. It's a real difficult, hard, frustrating process. There are no two ways about it. It's a lot of hard work, and it's not cut and dried. It's experience, learning from your mistakes, and looking at maybe ten different ways you could go, and picking out the best way to go. If you are an inexperienced person, you will go anyone of those ten ways, and only one or two of them is going to get you where you want to be. So, it's a lot of stress, an incredible amount of stress, the logistics and getting money and the politicking. All of the stuff that is involved, there is just no way that you get any of that any other way than just doing it. It is not something you read about in novels, it's not something you see in movies or miniseries, or anything else, there is no way!

Geier: Have you had experience with certain identifying people's personality qualities, or what your ideal student might be?

Griffiths: I think I've got a pretty good idea. Maybe I'm over-reaching myself a little bit here. Number one: real bright, the brightest students I can find. If I am going to take on a student, I want a student that will challenge me as much as I can challenge them. I want someone with a real high, native level of inquisitiveness, of wanting to know, of searching, wanting to learn, who is motivated, focused. But yet, able to get along with people, at least in this field. Probably not quite as important as other fields where you can go off in your own lab, and kind of work by yourself. But in this field, you've got to work with people. You have to be very effective at working with people, and interacting in a positive way, give-and-take.

Geier: What field are you talking about here? Microbiology?

Griffiths: I'm talking about ecology in general. So, you can't have someone that is a total brain, and cannot function, cannot work with other people, get other people to help you, or help other people as well. I've had a lot of brainy kids that just don't have that drive, they don't have the intellectual drive, wanting to know, or wondering why things are this way or that. I look for, quite frankly, the best scientists in my view, have an artistic bent. They are musicians. A lot of scientists are musicians, people that are poets and painters and such. Because there is a lot of right and left lobe involvement. It's not likely characterized by more an engineering bent where you've got very much a lineal thinker, you've got so many steps, and you are going to get there. Particularly in ecology, it's parallel processing. You've got a lot of stuff going on, you've got to be able to integrate across a whole range of disciplines that are going on. You

can't go from x to y, you have to go on a lot of different parallel tracks and pull a bunch of stuff together to get there. You can't get there in one straight line. Does that make any sense?

Geier: So, when you're picking those one or two possible ways of going that are actually going to work, it takes some artistic imagination, is what you're saying, to figure out where that leads?

Griffiths: To figure out where that is, and then once you've started, then to be able to pull in other stuff from different disciplines, to make that make sense. So, it's getting the right path to begin with, but once you start down that path, you can't just go down that path with blinders. You have to go down that path by the seat-of-your-pants and pull in all the information you can that seems to apply, to make any sense out of it.

Geier: From what you are saying, it sounds like your perception is this is something that maybe, people have to bring to the discipline, it's not something that necessarily can be taught, but someone has that artistic bent before you get started?
Griffiths: Right, you learn, but if you are a straight, linear thinker, you are not going to do very well. (Laughs)

Geier: Something else here for a second that came up while you were talking, especially when you were talking about things that kind of attract you to working with the Andrews. A lot of what you mentioned has to do with applying the ideas in some kind of pragmatic form, a management program. I was wondering if you could talk a little about how you would characterize the distinction between basic and applied research.

Griffiths: (Laughs)

Geier: I'm mostly interested in how you respond to that.

Griffiths: Well, it's all congenial, and wherever you can put your finger at some point on that continuum, and your guess is as good as anyone else's guess, in my view. And you know what the continuum is. I don't see much of a distinction. On the extreme, obviously, is that the strictly-applied research, you already know where you want to go, in my view, as you are looking for a practical answer to a problem. There is a management problem, or engineering problem, or something. In basic research, you are also trying to solve a problem, but it may not be related to any application. You may just want to know why bees are attracted to a certain flower. It could be applied, because you could use that in some way to maybe increase honey production or something like that. (Laughs)

Geier: That is a good response. I've had a lot of different responses to that question. Some of the people can make a distinction, the importance of applied-versus-basic research, and how that applies at the Andrews. In your perception, what is going on at the Andrews, would you say is applied research or basic?

Griffiths: It could be the same research problem, but it could have basic components. That is, no real applicability in terms of anything that we know of at the present time, or it could be very practical from a management point-of-view. Same activity, same set of questions. I don't know the breadth of everything going on in the Andrews. I think there is certainly a lot of this applied research by design. This is the whole idea we began with. But there is a lot of your basic stuff going on as well.

Geier: Do you have any examples?

Griffiths: Well, for example, the work we are doing with stream sediments. We are interested in making a link between management practices and stream productivity. That is a very applied type of thing, and applied type of question. And often, quite frankly, we have to couch things in those terms in order to get the funding, pure and simple. But having said that, then, the bottom line is, we found some differences, but we also found some very interesting relationships that were totally unexpected and that are going to be directives for future research. One of those that we found, is that there is increased, very much higher nitrogen fixation in the sediments in old-growth stretches than in non-old-growth stretches. This could have implications, but it goes back to more basic questions about what is really going on in those streams, and how they function in a very basic way. Another example we have found in that study, that evidently, there are shifts in the sources of carbon coming into that stream. Not too surprisingly. But there have been other studies, and they had not seen this kind of thing. We were able to document flushes of, and shifts in the characteristics of the chemical, microbiological characteristics of these sediments, the organic fraction of these sediments, which was only kind of inferred before, and we actually showed it. We showed that these pulses were very, very short lived, maybe within a matter of days. These had some very important implications into how, basically, streams work in terms of sources of carbon and their resins in the streams. Likewise, we saw a pulse of increased activity in the spring, as the algae in the stream started cranking up, and this was not epizootic fungi, but was a longer-term import. So, these things had been kind of suspected, but she showed this very, very nicely in her study. And we also saw that there were long-term differences in what was going on in these various trees, and we found elevational differences, which were also very interesting because this suggests that climate-driven mechanisms that were affecting the quality of carbon in the stream. These were all very much basic questions that were either addressed, or things that were questions of a very basic nature that were generated.

We started out trying to answer practical questions, primarily because that is how we get funding from the Forest Service. They were only interested because we were talking about very applied things. But, what all of these have when you generate some relation, when you are just out there measuring something to answer one specific question, and then you go and look at something else. But, if you try to generalize it enough so that there are enough cases to generalize, you always pick up very important basic information. At least, that's been my experience.

Here is another example, a study that we did. Just a regional study. The basic question from the BLM was this: If we thin full-stands, are the soil processes going to be more like old growth or more like fire stands? Very much another management question. What we found was, that a lot of the variables we looked at did in fact move towards old growth that we were able to measure. There was a range, there was a difference. When you thinned them, and they were allowed to regenerate for enough time, you could get more vegetation coming in. More variables similar to the structure you get with old growth is the whole idea, that these variables start moving towards old-growth characteristics. So, on that level, you have answered a question. On a much more basic level, we ask another question, that is, "Do these behave differently, biogeochemically? Are the mechanisms driving the biogeochemistry the same in old-growth stands as they are in full stands, and how does the thin, full-stand look in that?" So, we did a principle components analysis of this grove, and we found that the full stand and the thinned full stand behaved exactly the way we thought it would. In other words, the variables that we clustered out together, did cluster out together. Old growth was behaving much more different, much different. This wasn't just a few cases. These were sites from southern Oregon to the Cascades to the Coast Range. You lumped all of those numbers in there, you come up with the same answer now about what the hell's going on. That is very interesting on a very basic level. Again, we were able to answer the practical question, "No, they are not the same! They are not functioning the same." So, we also found out some very interesting basic things and answered some very basic questions in terms of how do the geochemical processes work. What is influencing what under there? And there are a different set of rules driving the old-growth forest!

Geier: So, you really raised some new questions?
Griffiths: Oh yes, absolutely. But you also come up with very interesting, basic information about forests that we didn't know before. And that is really not of much interest in application to the forest manager, other than, well you didn't quite get it that way you think here. So, we have to ask some very important questions in terms of how old-growth forests do function. Why are they functioning? Apparently, they function differently than these managed stands.

Geier: So, you design studies that are answering applied questions partly to secure funding, but you design your studies in ways that allow you to pursue basic science while you are answering their questions?

Griffiths: Yeah, and it works the other way around as well. Well, let's see, what would be a good example? There have been a number of studies that I have conducted that are strictly just to find out what influences soil respiration at different scales, with no real bent on management, *per se*. Just to understand that. We have come up with things that are potentially important from those studies for management. So, we can go either way. I guess it just depends on what kind of question you start out with. (Laughs)

Geier: Now this is a question that I've been trying to get people to address in some way. That is, as a scientist, you know how the system works pretty well and you can formulate these questions in a way that someone without your experience couldn't do. Who do you consider

your most important audience or audiences, and who are you working for? What group of people are you trying to inform of the values of science?

Griffiths: Value of the science?

Geier: Who should you be writing for?

Griffiths: You need to be writing to different audiences. If you are just pitching it to one audience, you are probably missing the boat. I think it is important to pitch it to students so they can use it as a learning tool. You need to pitch it towards managers and people that are actually doing work out there. Pitch it in a way that they can understand the implications of your work. And you need to pitch it to your colleagues on a level that multi-disciplinary folks can understand it. I haven't published on that scale, but I think that it is important to do so. That would be *BioScience*, that would be some of the more general, *Scientific American*, that kind of thing, where you are putting out concepts to a larger, professionally-informed audience and to the specialist, because they're very much interested in, specifically, the type of work you are doing. I must say that, professionally, I run a much wider gamut than most people even dream of. I've published in microbiology, working with plasmas, an incredible range of things. To me, that's good, because I have been able to reach lots of different audiences. But, I think that it is a mistake in general for science to only target, their peers. A few hundred people in the universe that give a shit what they are doing. (Laughs) Don't need to quote me on that.

Geier: Well, you'd be surprised how many people say that. As you pointed out, you have unique experiences in various areas and also demonstrated willingness to jump disciplinary boundaries, though you don't have any formal training in writing to publish in those areas. Have you ever had any problem with that in terms of other professionals, or have you found people being pretty congenial in receiving your interests?

Griffiths: Oh yeah, no problem. As a matter-of-fact, this is kind of just a fluke of this context. Within about two or three years of first getting into studying mycorrhizal mats, I knew nothing about fungi at all, but within about three or four years, I was giving a keynote address to an international conference on mycorrhizal fungi in England.

Geier: That must of been kind of intimidating!

Griffiths: It was, absolutely. (Laughs) It just so happened that I met one of the top people in the field here, we hit it off great, and I learned a lot from him. He was interested in what I was doing, and he had so much interest in what I was doing that he put me at the top of the bill of this symposium he was leading!

Geier: How did it come off?

Griffiths: Fine! I was scared shitless, but it was fine! (Laughs)

Geier: I am curious, though, your perceptions of why more people don't do that, cross disciplinary boundaries like that, form more roots like that.

Griffiths: Oh, it's scary. (Laughs) And, I don't know.

Geier: People are not hostile or anything?

Griffiths: Oh no!

Geier: My perception is that usually people are happy to have some interdisciplinary work, but nobody wants to do it. It's kind of an interesting paradox.

Griffiths: Well, very frankly, it's curricular. And quite frankly, part of it is because of economic necessity. I've been on soft funds for 24 years. That's scary, so you have to be very flexible. A lot of that was driven in that way. But, the system is not set up to promote you, if you do it. Typically, as you get up into the professorial ranks, they are looking for international leaders in the field. But if you jump around from field-to-field, you will never quite get there. That's not so true starting out, but you've got a combination of where you've got to put your energies, if you've got funding from different sources. At one point, I had funding looking at organisms from the deep sub-surface, and a project with DOE where we were looking at microorganisms in groundwater in basalts 2000 feet below the surface, looking at how they were functioning, real basic, physiological studies. And there were even studies of the Andrews setting up streams.

Geier: Did you keep working on soft money all that time because it gives you more freedom to do your work, or just difficulty in the marketplace?

Griffiths: Well, I just wanted to stay here.
Geier: Just locally?

Griffiths: Oh yeah. Ever since we got here. It was a matter of personal choice. It's been great, because you are kind of like a mercenary scientist. As long as they give you a place to work, and what not. Logan [Norris] has been fantastic, he is a great department head [Forest Science, OSU College of Forestry], and he has given me a home and we've got cash flow, we've got students coming and going, we got all these labs set up, and lots of things happening.

Geier: So, it worked out alright without too much anxiety for you?

Griffiths: It takes a lot of hustle to bring in the kind of bucks to keep the lab going, about a quarter million a year.

Geier: So, you spend a lot of time just funding everything?

Griffiths: Oh yeah. 70 percent of my time, easy.

Geier: 70 percent?

Griffiths: 70, seven-zero. That is one of the reasons I got the hell out, retired. Now I, you know, piece of cake! (Laughter)

Geier: One last question. I was wondering if you could thumb through your assessment of how you might characterize the efforts of the Andrews group, as a group, to convey information. What are the various, more successful ways they try to accomplish that, and how would you gauge their success?

Griffiths: I don't think that I want to answer this one. Well, I think, overall, the group does very well. If you look at all the workshops and all the things that we do at the Andrews, the group has done an excellent job in terms of conveying to a whole broad spectrum of people what is going on, what they are doing, what the implications are. And that is, again, tours, workshops, symposiums, you name it. I think that, and most people who have been active have been very, very good about publishing in the professional literature. In terms of synthesis, that is where you always have problems. You've heard before about the famous book [the never completed Andrews synthesis volume] that been worked on for 20 years? It's just so hard to pull that off, because everyone has got so much on their plate, and these things are just so time-consuming. So, I guess, but that's nothing new. I mean, it has been documented in almost every review we have had, and it's not unique here, and it would be nice to do more of a formal synthesis.

Geier: Who would a formal paper be targeted at as opposed to special publications and journals and such?

Griffiths: Well, it would be a more general audience, it would be in the form of a book. And what we talked about most recently, is to use the main theme of the LTER for or as kind of the nucleus for this book, a series of chapters or whatever. But it would be fairly-targeted, mostly targeted to forestry professionals, I would think, so the forest sciences [audience]. In terms of kind of a general ecology type of thing or in terms of kind of a general science, general interest type of thing. No, it would be more specific than that.

Geier: Okay, I should let you get back to work.

End of Interview