GRACE BRUSH

July 6, 1999

Mame Warren,
interviewer

Warren: This is Mame Warren. Today is July 6, 1999. I’m in Baltimore, Maryland, with Dr. Grace Brush. I want to know all about what brought you here. Let’s start with why Johns Hopkins. Why are you here?

Brush: You want to know the whole story? [Laughter]

Warren: Sure, I want to know the whole story.

Brush: Well, I’m here because people of my generation pretty much followed their husbands caree-wise, so that is why I’m here, but it’s not the reason that I’m doing what I’m doing here exactly. But I came here from Princeton, where I worked as a research scientist in the Department of Geology. My husband was on the faculty there. Prior to that, we were at the University of Iowa, where I was on the faculty of the Department of Botany there on a part-time basis, and my husband was on the faculty at the engineering school. Prior to that, we were with the U.S. Geological Survey for just a couple of years. And before that, we were in graduate school. So we got our degrees, mine in biology and Lucien’s in geology from Harvard in 1956. So that’s sort of a backwards route to where I am today.

We came to Baltimore in 1969, and I worked initially as a part-time research person for a couple of years, and then I became a full-fledged research—I forget exactly what the title was, but it was research scientist. And then in 1990, got tenure, a full professorship here.
Warren: So, just to clarify, you were doing research for quite a while before?

Brush: Oh, yes, a long time.

Warren: Were you teaching?

Brush: I was also teaching. Then I did want to get—I least wanted to be considered for the faculty, and that sort of thing didn’t happen until about 1988, when a position became available that I could compete for, and which I did, and in 1990 was appointed full professor. I’m not doing anything differently than I did as a research person, but it made a difference in terms of some—I didn’t have to work so hard to get all—I wasn’t on soft money any longer, which made a difference. So more research dollars could go for students. It’s just much easier to be part of the institution.

Warren: Explain what you’re saying there. Explain that a little more.

Brush: Well, if you’re a research person, there are a lot of advantages. Well, if I did not have the appointment, I couldn’t do any research. But the situation is that you have to bring in all of the money, including salary, everything that supports the work you want to do. The university provides the facility, the room, the lab space, but they get overhead from the grants you get, so you’re very much tied to being able to get this research money. So I did that for a number of years, from 1972 until 19–and I’m still getting research money and so on, but at least I had a—I can’t quite describe exactly. There’s a very big difference. But you’re doing the same sort of thing.

There’s a certain recognition, I think, on being on the faculty. Probably that is very important. And having some say in the programs that go on, the students that come in, that kind of thing. But from a very practical point of view, in terms of what I’m doing, it’s essentially very
similar to what I was doing then. I’m teaching an extra course since I became a tenured person. I teach the course on ecology now for the school. Before, there was no requirement for teaching before, but I did give a course on plant geography and ecology, and I advised graduate students through that time. I had some of the best graduate students during that time, too.

Warren: Tell me about that.

Brush: All right. I don’t like to name names, but I will—

Warren: Please do.

Brush: –because you omit people sometimes.

Warren: Please do.

Brush: But I’ll tell you a story about one thing that happened. There have been two really major types of research I’ve been involved with, and one was describing the vegetation and understanding why it occurs as it does throughout the state of Maryland. I’ll get to that later. And the other aspect of the research that I’m doing has to do with trying to know the history of what’s been going on. I mean, why is the landscape the way it is today? What has been the impact of humans on this landscape? How did it change before humans were here, just related to climate?

And I was beginning to think about these—well, I’m trained, first of all, I’m trained as a paleobotanist, so this has always been in the back of my mind. But I was thinking about this pretty much after we did the vegetation work in Maryland, and seeing how very closely the forest associations were related to the soil types, the water-holding availability, and beginning to wonder how would that be different when you had a different climate regime, if you had really dry conditions, cold conditions.

So I was thinking about the historical aspect of this when the Chesapeake Bay program
began in the late 1970s, when the Environmental Protection Agency had some millions of dollars to spend through Senator [Charles Mac] Mathias' efforts for the preservation of the Bay, or at least the recovery of it, or to address the problems of sedimentation, pollution, and the submerged grasses, what was really going on.

I began to go to some of these meetings that were related to what kinds of research were needed, and I was interested that with respect to the submerged grasses, many people were saying, "Well, we don't know what is happening to them. It may just be sort of a cyclical population boom-and-bust event, and they will come back eventually." I can remember saying, "Oh, but we can test that, because we can look at the sediment cores and look at the seeds, and we can tell you whether or not this was a one-time event or whether it had occurred many times in the past."

So there were people on these committees, including Dave Flemer, who was at the Environmental Protection Agency. You may know him, because he worked at Solomons. You came from there?

Warren: No, I didn't.

Brush: But anyway, he had come from the Midwest, initially where a lot of this work had been done in the Great Lakes, and he was very enthusiastic, so we got some money to start doing—taking these sediment cores in three areas of the Bay, one in the upper [unclear] Bay area. The second place was in the Patuxent River, which has always been a good area to study ecologically. And then down in the Ware River in Virginia.

So I had to get students now for this, and generally what happens in a school is that students apply and they're accepted, depending on whether their interests are the same as the
faculty interests and so on. So you have these students working for you. Well, I didn’t have—my students have always been, when I got research support, then I had to go and find some students who could get in here, too.

So I knew of a young man named Frank Davis, who is from Baltimore, had graduated from Williams College and was working for the Chesapeake Bay Foundation for a while, and then had enrolled at the School of Public Health, and was a very bright and enthusiastic person. I knew him personally, his family, and was at a wedding. We always laugh about this, my method of recruiting a student, because I was at his brother’s wedding and I saw Frank and said hello. I said, “Do you want to do graduate work in paleoecology?” And he said, “Yes, it sounds interesting.”

So I gave him my number, and Monday he called and he started. He is probably one of the most recognized ecologists in the country now, at the University of California at Santa Barbara. You know, you take great pride in these people who have been so extraordinarily successful, well known all over. So he was one of a number who have been just absolutely extraordinary.

Warren: Let me ask you. He was at the School of Public Health?

Brush: Right. But he was working with Southwick [phonetic], who was there at the time, and I’m not sure whether Southwick was planning to leave, and I’m not sure just why, but he was very excited about working on this particular project because it had to do with the Bay, which he was very involved with as a kid.

So he did a very interesting study which was on the submerged macrophytes, and showed the history of these and how they were affected very much by sedimentation in the Bay. That was published in Ecology in 1985. So that work was based on one course from one locality, which were extremely good and very important for us at the time, because it showed so clearly at that
locality what the effect of land clearance was. We could show precisely that the submerged macrophytes were beginning to go out as the waters became more eutrophic and so on.

Well, since that time—well, then Frank went on to Santa Barbara and he’s doing entirely different things, mainly having to do with remote sensing of [unclear]. But then after that, and much later, we began to look at the whole upper Bay, the submerged macrophytes in the whole upper Bay, and began to realize we never should have done that. [Laughter] It was much more complex. That one core was fine. But actually, I’m joking about that.

The paper’s just gone in, hopefully will be published before too long, but it shows the kinds of changes that occurred in all the different tributaries, and they weren’t the same. I mean, some tributaries were affected much more dramatically by land clearance than others, and it has to do very much with the local history. So, for example, in the Elk River, where there was a long deterioration of the submerged macrophytes, there was just a history of mining, of canneries, all kinds of activities that were influencing the Elk River more so than, for example, the Chester River. So we started looking at the local history of these tributaries and relating that to the health of the submerged macrophytes.

Really, the upshot of that, I think, is that for restoration purposes, you just have to begin to look at each of those tributaries individually. They’re all different hydrodynamically. They’ve had different kinds of land use. I think from that point of view, that is important. You just can’t go in with one solution for this restoration or whatever we’re going to try to do with it.

Warren: It’s certainly one thing we’ve learned in trying to understand what’s going on with the Bay, isn’t it?

Brush: Yes, but it’s very complicated.
Warren: A simple question for the sake of my transcriber. How do you spell macrophytes?

Brush: M-A-C-R-O-P-H-Y-T-E-S. They’re underwater plants that grow totally under water. They’re not grasses. They look like grasses. They’re called submerged aquatic vegetation, or SAV, often, but they’re also called submerged macrophytes, which means submerged large plants, rather than algae, which are the small plants.

Warren: So it seems like a natural that Johns Hopkins would be involved in studying the Bay. I know that they were involved in doing that kind of research long before you got involved.

Brush: Oh, yes, they were.

Warren: Can you talk some about the Chesapeake Bay Institute and other things that Hopkins has been involved in through the years?

Brush: Well, I would say probably one of the most--the things that have been a very wrong decision that was made, however made by Hopkins, was whatever decisions went into losing the Chesapeake Bay Institute, because it was an enormous resource. The best of the research was done at that institute. The University of Maryland has taken over, in a very, very good way, all of that research. They have excellent scientists. They have wonderful research and laboratories. We don’t have that anymore. And students--because I teach the ecology course and get students who are very interested in environmental things, over and over say, “Why do we not have an institute like that here?”

I don’t know all of the reasons, and it probably doesn’t matter why the institute was no longer--I don’t know whether it was affordable or what. I have no idea. But it eventually went down the drain, essentially. It was moved from the campus to Shady Side, and so it lost the student connections then. And the loss is very real, because there were, on that faculty of the
Chesapeake Bay Institute, Jodi Deming, who’s now a very, very well-known biological oceanographer out at the University of Washington, Jim McCarthy, who is world-known, now at Harvard, and a lot of other people who went on to become very famous in their fields and had started here.

Don Pritchard was one of the most remarkable people, and I think had an enormous influence. He certainly had a large influence on me, because I came from a very biological background, not so quantitative, and it was the questions that he would pose, as well as the questions of Lucien, my husband, who was also a quantitative engineering type.

I think I would have to say the biggest compliment I ever got in my life was at the Chesapeake Bay Chestertown meeting. I don’t know if you knew about that. It was what they called a “dialogue across the generations,” which was organized by the Chesapeake Bay Consortium. grant, I believe, I think the Chesapeake Bay program office. At that meeting there were six of us who were panelists. It was “Reds” [Gordon Wolman], Gene Cronin, Don Pritchard, myself, Hargiss, who’s at VIMS, and also the person who’s at Duke University, whose name I can’t remember right now, but these were people who had worked on the Bay issues for a long period of time.

Then the question was asked of Don Pritchard, what was the most significant research on the Bay, that he would consider. Prior to that question, other people were asked the same question, of course, that Don Pritchard, physical description of what an estuary is, and Don said the most important work was the work I had done on the sedimentation. I was just absolutely thrilled, because he would not have said that unless he meant it, and it meant so much to me, to feel that this work was really very important in terms of understanding the deterioration of the
Bay.

So we lost an awful lot with the demise of the Chesapeake Bay Institute.

Warren: Tell me about their work. Tell me what they did.

Brush: The major work that was done there was measuring the salinity distributions, the oxygen distributions in the water column, and, from that, figuring out just exactly what the circulation of the Bay was, how the tides influenced, how the fresh water and salt water mixed, the whole mixing and characteristics of the Bay, which controlled the biology of it. I think that was the major sort of thing, was the physical oceanography which they were doing.

Then there was a lot of work done on the influence of wind on the mixing of the waters, and then later there was work on the oxygen, the anoxia in the Bay, the amount of nutrients that were in the Bay, the influence of the sediment and what was going on in bacterial action in the sediment itself, and also some biological work later with Jodi Deming’s work on microorganisms.

Most of the biological work was done at the University of Maryland, because Gene Cronin was the biological person, whereas Don Pritchard was a physical oceanographer. I can’t think exactly how much—there was a lot of work being done on algal dynamics by people whose names I don’t quite remember, but as a teaching tool and a place to take students, to have students really go out on boats and make measurements and so on. It’s not there anymore.

Warren: They had the Warfield?

Brush: The Warfield.

Warren: And what did they do on the Warfield?

Brush: They would go out and take sediment cores or make measurements of salinity or oxygen in the water column. You know, all kinds of experimental things. They would look at the amount
of carbon production in the water and so on, just whatever oceanographers do. And that boat was
an NSF [National Science Foundation]-funded research vessel.

But anyway, if you were going to do any research on the Bay, you generally have to get
ship time, and so you could get ship time with the Warfield. Now you have to go to the
University of Maryland vessel. I don’t think the Warfield is even in operation anymore. I’m not
sure.

Warren: That was my next question. What happened to it? I don’t know.

Brush: I think somebody down in Florida bought it. I asked recently about it. And bought it as
sort of a tourist kind of boat, but it’s not a research vessel anymore.

Warren: That is a loss to the Bay.

Brush: It is a loss. Of course, it’s been replaced by work that has been done by the University of
Maryland from the Horn Point Laboratories and the laboratories at Solomons, so there’s a lot of
very good work, excellent work going on, and all of us are colleagues of these people, but we
don’t have it here. It’s not our institution.

For example, I gave a course on the Chesapeake Bay last fall, and we had a field trip on a
boat, but we went on the University of Maryland boat, which was fine, too, but it would have
been nice to have the facilities of a laboratory on the Bay that we could just use for our own
students. So that’s not here.

Warren: Thank you. That’s just wonderful material. That’s exactly what I’m looking for. Tell
me about being at Johns Hopkins. What makes Johns Hopkins different? You’ve been at a
number of different institutions, which is great, because some of the people I’m talking to have
been here their own lives.
Brush: That’s true.

Warren: So what makes Johns Hopkins different?

Brush: I’ve been at a number of places, and I would say the best comparison would be the University of Iowa, which was a very large state university. I was in the botany department there and here. Now, at the University of Iowa, it was very good. I didn’t get a lot of research done there for a number of reasons, but you never really were outside of your own department. You were always talking to botanists, maybe a few geologists, but never to anyone who was an environmental engineer or something like that. So what was very nice about here, and different, is that the questions that are asked about your research are quite different from what you would get from your own people in precisely your own field.

I have Alan Stone, who is next door to me here as an environmental chemist, so when we’re looking at these sediment cores or thinking about why the vegetation is where it is, a question comes up from Alan, like, “Do you know anything about the transfer of chromium,” say, from someplace to light, from a chromium mining, through the landscape, you know, how does this affect vegetation. So questions like that have come up, and that kind of thing I would never probably have even thought about in the traditional kind of biology department that I normally would be in, because I would never be in this department had I not followed someone here. It would never have occurred to me to apply to someplace like this, nor would they hire somebody like me, probably.

Warren: That interests me that you’re in the School of Engineering.

Brush: It’s been a big—I would say that being in the School of Engineering has really developed my work. I mean, I would have never done the work on measuring, actually trying to measure
sedimentation rates, or trying to figure out a way to do that, unless I were in this kind of school where someone would say, "Look. We really need to know what the sedimentation rate is. We can't just say, 'Oh, there's been a lot of sediment there,' and so on, because if you're going to try to figure out the fluxes of things, the actual quantities and so on, you have to have numbers.

So I spent a long time trying to figure out how to measure sedimentation rates at every level of a core, and we were very successful with it. But those are the kinds of questions that are being asked, and I think that that's been very--I've enjoyed it, because it's sort of like a puzzle. It's not just describing this vegetation or these trees, "We had spruce here when it was really cold, and then it became warmer and we got oaks," and so on, but the questions become, "What is there about the cold? How cold was it? How much sediment was being eroded during cold periods versus warm periods?" Things like that, that were very quantitative.

But I was exposed to that also through my husband, who is very quantitative and was very interested in what I was doing, and we did some work together, not much, but was always asking the questions about, "Well, can you put some numbers in this? What does this mean?" And, of course, then he came to this department for his own reasons, but it was very useful. It has been very helpful for me.

I would urge students to do this. In fact, none of the students who work with me, who have worked with me, very few of them have remained paleo-type people, have gone into other areas of ecology, but they've learned to think about questions that, in a way, I think were different, and I'm different, because I'm here, than a lot of my colleagues. I'm not saying I'm any better. It's just that we have a different approach, and I think that's made--for me it's been personally a very satisfying place to be intellectually.
Warren: Tell me more about the Whiting School and its work.

Brush: I don’t know a lot about the Whiting School. Other people know much more about it than I do, because I’m [unclear].

Warren: You’re part of the Whiting School?

Brush: I am part of the Whiting School, and I guess the other thing I would have to say is, the Whiting School embraces people like me, too. I think it’s a very nice place to be, because—and it’s hard to put your finger on it exactly, but it, I guess, maybe reflects the fact that the people in the Whiting School are very curious, they’re very intellectual, and they want to know what you’re doing, not just what you’re doing, but they’re excited and interested in what you’re doing. So I find it a very nice experience.

I don’t know what it would be like to be in the School of Arts and Sciences, which would be the normal place where I would be, except here in the biology departments it’s completely molecular. But, you know, I’ve had a lot of nice interaction with some of those people, too, who are very interested in having me give seminars there of my work, and have been truly interested in what we do, but that’s not what they do. I mean, they specialize in molecular biology.

Warren: How does a student find you? How does a student know what you’re doing?

Brush: That’s a good question, because last year I was really quite upset about this. We had, last year, a young student, a brilliant student named Llyd Wells, was here at the university. He had an advisor, who should have known about us. He was interested in environmental ecological questions, and he was never directed to this department. He was in Arts and Sciences. I don’t know why. It was probably just oversight.

Lynn Roberts, who is in this department, is a chemist, started to teach a course on—it was
on environmental chemistry, but related to problems, modern problems like the ozone hole and things like that. It was, of course, designed for undergraduates. She put out a poster all over the campus, and so Llyd saw this and he enrolled for the course, and he found us by his senior year.

So he took a course from me last spring and has been moaning about the fact how did he not know about us. Well, I suppose it’s a student’s responsibility, too, to see what’s going on in the school, but it’s so-so now what I do is, when I have a course, I also put up these posters. I think the web is a very important thing, because I have my ecology course on the web, and we’re doing a lot of work now to try to make it very interactive with the students. So I think, you know, that’s how they find out, probably, now, but we have to advertise ourselves a little bit, too.

Warren: I would think so, because it wouldn’t be the normal thing to go looking in the engineering school for this.

Brush: No, it really wouldn’t.

Warren: I find this department fascinating, that it embraces what it does and that it’s within the School of Engineering.

Brush: And I think it’s very good for it to be within the School of Engineering, because I think what it does is, it takes areas that are important to engineering and sort of quantifies it and puts it within the context of engineering, because a lot of the things that I would do in terms of looking at the—well, for example, a lot of the work that we’re doing now is related to restoration. How are the findings that we come up with going to help in terms of restoration of ecosystems? And so that really becomes an engineering problem in many respects, but gives it a sort of not just a technological, strictly technological solution, but let’s look at some other solutions, kind of thing.

Warren: It makes perfect sense. Do other schools do this, or is this fairly unique?
Brush: Other schools have environmental engineering programs, but they would not include what I do or, for example, what David Harvey and Erica Schoenberger, who are the human geographers, looking at the effects of what people do on demography, on social, on culture, politics of societies. That would not be included. Things would be included that would be more economically related, maybe, but not really looking at the effects of certain activities on how people live, on societal divisions and rifts and things like this. And Erica’s work, which is involved with looking at the effect of multinationals on society. So that, I don’t think—I could be wrong. I don’t know much about what environmental engineering schools do, but they do not embrace as much as this one does. Like Reds’ work. Mark Parlange, who’s in our department, he is really an engineer, I believe.

Warren: Tell me about what Reds does. Tell me about Reds as a colleague.

Brush: Reds is so enthusiastic and so knowledgeable about so many things. He really is looking at the landscape, at the characteristics of rivers and the misuse of them and how they’ve been used, how they affect the landscape under different climate regimes and so on. But he’s involved in so many other things and has such a wide perspective, that he’s just an incredible colleague, and I was very fortunate to be next door to his father also for a while. [Laughter]

Warren: I hoped you would talk about Abel Wolman. Please tell me about him.

Brush: Abel Wolman was also just an incredible person to know and to talk to. It was very interesting, because I think I recall this correctly, but I would talk to him about what I was doing with these sediment cores, and, of course, he was an engineer through and through, but he had, of course, many—he was really an engineer. He was looking, in many cases, technological solutions to human problems and that sort of thing. But one day he said—Frank Davis and I were sitting
there, and he said, “I don’t know how anyone could spend time looking at the past like this.” And I remember blurting out, “I don’t know how anyone could not do this.”

And we had many conversations over the years, and later he became very—I guess more interested in, yes, the past does tell us something. History is important. Most engineers don’t. Most people often don’t think that history is very important. I think we’re beginning to see that more and more now.

In fact, one of the projects we have with the Forest Service at present, which is a pretty major sort of thing, we are looking at the history of land use on the nitrogen cycling, but looking at the nitrogen in these sediment cores that represent areas of different land use. This has stemmed from work that John Aber, a chemist, I believe, a modeler at the University of New Hampshire began to—he was working up at the Harvard Forest doing some experiments on the rate at which different types of trees were absorbing nutrients—well, nitrogen particularly. He had his experiment where he was just applying huge amounts of nitrogen fertilizer to different core stands.

The results were such that he began to think that the history of land use had a lot to do with the ability of these forests to absorb or to take up these nutrients or to lose it, and no one really knew at all, had any idea about what the history of land use, how it would affect this, because it has been different if you mine an area or if you farm it or if you use fertilizers or whatever.

So the history is beginning to be recognized as probably an important facet in what we have on the landscape today and how we will go about restoring what we think we would like to have. So whereas maybe twenty-five years ago people trying to solve problems on the landscape
would not consider history important, I think it is becoming more and more recognized now as more and more important.

One other result from the work I'm doing, and others, too, is when you look at the history, you begin to realize that things are very different from one place to another, historically, too. I often think that in the case of the Chesapeake Bay, we talk about restoring it, but I think what we’re going to restore it to is important. And I think it’s important to realize that what the healthy bay is, is something is always eating something else, so you have something eating the algae, something eating invertebrates, and so on. It turned out the oyster was very important in the past for doing this, and the crabs were important.

It seems to me that it’s not possible, from what we’ve learned, to restore it to a particular species or set of species, but we have to think about restoring the structure of it so that we get back to where something is eating something all the time. It might not be the same organisms that were there before. It might.

But until we can do that, we will not have a healthy system, and I think that’s beginning to be recognized as an important aspect. And trying to have people think in those terms, too, okay, we had the oysters for a while, but if you look back maybe 5,000 years, you probably didn’t have oysters. Maybe you had something else. Because we certainly didn’t have the same kind of trees here at that time. We haven’t looked in the sediments for what was occurring 5,000, 10,000 years ago in the Bay itself.

Warren: You’re a wonderful interview.

Brush: I’m starting to ramble. [Laughter]

Warren: No, you’re not. You’re answering my questions before I ask them. It’s wonderful. Is
there something you’ve learned here at Johns Hopkins that you don’t think you would have learned somewhere else?

**Brush:** Well, one thing for sure, I think, is I’ve learned to appreciate other people’s opinions, because I get exposed to a lot of different opinions that I would not have been exposed to in a traditional botany department, which I probably would be in, except for the course that my life has taken. So I can’t think of a specific thing, except to keep an open mind. It maybe not has to do with Johns Hopkins particularly, as with the department and set of circumstances I’m in.

**Warren:** But I wonder if that’s not true in every department. I think there’s so many interesting things going on here.

**Brush:** Oh, yes, that’s true. At Hopkins I’m sure that’s true.

**Warren:** I need to turn the tape over.

**Brush:** Okay.

[Begin Tape 1, Side 2]

**Warren:** What’s the one thing you want your students to come away with?

**Brush:** I’d like my students to come away with just learning to think clearly, independently, to be able to collect a set of data objectively, to analyze it, to come to some conclusions, realizing that this is just a technique, so that they’re not just learning—I mean, you have to learn specific things to get a thesis done or to do something, so your thesis might be, in the case of Frank Davis, it was really looking at a sediment core in detail and learning a scientific method, I guess. When he left here, he never did that at all, when he went on to actually use computer programs or computer techniques and remote sensing techniques to map vegetation in California, and he did a remarkable job of it. But what I would hope is that he had learned how to do research from a
particular problem he did here. Granted, you go into another—well, his area wasn’t that different. He was still dealing with forest trees, that sort of thing.

But if you were going to go into something—someone, for example, could become very interested in microorganisms from some work they did here, particularly on the nutrient cycling, and they would be able to go and do research in that. Granted that they would have to learn some more things, but they would have the tools for scientific analysis here. And I think that they learn that, and they learn it not just through what I do, but they are required to take a lot of quantitative courses, a lot of courses that they wouldn’t take if they were, say, just microbiologists or something like this. And I think that’s through the department. The students are learning how to think clearly and scientifically and objectively, and where to find the tools to get the data that they need to answer specific questions.

Ruth Defries was another student of mine, and she did a beautiful study on sedimentation in the Potomac River. She now is at the University of Maryland working on a large project having to do with mapping vegetation from LANSAT data. So it meant really learning a lot of different tools to handle that, but that’s what she’s doing, and is certainly not counting pollen and sediment cores anymore. So I think that’s all right.

Generally with students, I let them go on their own pretty much, but then if things—if they’re hitting a blank wall, we try to figure out what went wrong. I don’t like to have students who just want me to tell them what to do, because that gets kind of boring. But I like students who are willing to think about things and suggest, “Let’s try this,” and often we do that, because they are very bright. I mean, I learn as much from the students as they learn from me, and we have a lot of discussions one on one about these things.
Warren: How much do you work with undergrads versus graduate students?

Brush: I don’t work with undergraduates that much. I’ve given a course in ecology. I have some undergraduates in the plant geography ecology course in the spring, and they are terrific. They’re generally juniors, seniors. Then for the research projects, this summer we had a number of people in the field, so in one particular project there’s a graduate student in charge and there are three undergraduates working with her. In trials, we do encourage them to think about questions that may come up in the field. They’re great with this. They will ask questions about, “Why is this the way it is?” and things like that.

And I always need people, undergraduates, to do—there’s always a lot of just busy work that has to be done with this kind of research, so we have undergraduates working in the laboratory or in the field. But we don’t have them just doing work; we try to talk to them and to get them interested in what’s going on. So they’re very good.

We have now this Long-term Ecological Research Center. I don’t know if you know anything about that. Well, the National Science Foundation has over the last twenty years funded areas for research which they call Long-term Ecological Research Centers, and they’re designed to conduct long-term monitoring of more or less pristine ecosystems, to see what the changes through time are, the effects of large storms, things like that.

So they’ve had, for example, the Laquillo Forest in Puerto Rico, there’s a Long-Term Ecological Research site. It’s a tropical forest. There’s a lake in Wisconsin. Places that are pretty much pristine. A few years ago, it was decided that the humans are over most of the globe and there’s really no ecosystem that is not a human ecosystem or human-dominated. So they decided to fund a human-dominated ecosystem. So this would be an urban ecosystem.
So, two years ago, Baltimore and Phoenix were chosen as the two cities to begin these studies, so we’re very involved in the Baltimore one, both doing vegetation studies and also taking sediment cores to see what the history was. The Baltimore ecosystem study is restricted to the Gwynns Falls watershed, so it’s an interesting thing, because we go from Glynden, up in Baltimore County, to Hanlon Park, which is western Baltimore City, I guess at its grimiest or whatever. But it’s very interesting, and we’re learning a lot of field techniques, because we’re looking at suburbia in a big way, and the sprawl, which is just absolutely unreal, what’s going on, trying to measure ecosystem processes and those kinds of environments, down to the harbor, or Middle Branch, which is where the Gwynns Falls comes out into the Patuxent.

So this summer, my group of people are doing the riparian vegetation, so we have this all designed. But we get out in the field and you find out that how are you going to sample this flood plain. It goes over there and there’s somebody’s house and back yard, you know. So we have to address all these questions. What do we do about somebody’s back yard? Well, somebody’s back yard is part of the landscape today. Whether you like it or not, that’s what it is. So we pretty much had the techniques worked out where we are able to sample all these different kinds of landscapes, whether it’s a trash-filled whatever, dump, or it’s somebody’s back yard or it’s a parking lot or whatever. But it’s going to be quite interesting to see what comes of this. There are also long-term measurements being made of gases that are under the soil, coming out of the soil. There are gadgets for measuring that, gadgets for measuring the amount of water in the soil.

And it’s interesting because the Gwynns Falls is really divided into two major types of geologies, too, and so we’re sort of looking at the effect of humans within the context of these geologic vegetation associations. Do humans supersede everything or is the response different of
human activities, depending on what particular soil type you’re in, vegetation type, and so on? So I think that my feeling, just looking at some very minor or some vague results is that the geology and the soils type and so on are going to be very important in the response of these systems to whatever is happening to them, whether it’s putting streams, these gabons that they put in the city streams to protect the banks, and the–

Warren: I don’t know that word.

Brush: They line the banks with rocks so that the streams.

Warren: What’s the word you’re using?


Warren: I always thought that was riprap.

Brush: Well, they call it riprap, too. That’s the same thing.

For example, one place we looked at, I forget whether it’s the Gwynns Falls stream, but if you’re around Lincoln Park and you’re down by the stream, what’s very interesting is that you don’t have any flood plain vegetation by the stream anymore. There’s stuff coming up like aspen or things that are not flood plain species. The streams cut down, it probably doesn’t flood very often anymore. But if you go up to the upper areas, up on what we call the upland, it’s all big, big flood plain species, like big sycamores, big green ashes and so on.

So what has happened there is these streams, as they’ve been controlled and so on, have cut down deeper and deeper. They were up higher and they were flooding these areas initially, which were flood plains, but the flood plains have sort of become uplands in a sense, and what’s down below, what is adjacent to the stream, is not flood plain in terms of vegetation anymore. So those are really major changes in the functions that are going on in a riparian area. So how is the
riparian area functioning with respect to its relationship to the stream? So those are questions that haven’t been asked, really, before, and that are very intriguing. What we’ll find out, we don’t know at the present time.

**Warren:** It seems that this is a place that encourages you to investigate things that haven’t been thought about before.

**Brush:** Well, one of the things that was very interesting when we started this work was, again, getting back to the history. We’ve had beaver populations here, before they were exterminated, essentially. Certainly when the Europeans came over, there were lots of beavers on the landscape. I had looked at some pollen in streambanks a long time ago around here, and there’s a black layer often down in a stream bank, and it’s full of water lily pollen. So I began to think the landscape may well have been a very wetland, marshy-type place, manipulated or controlled by the beaver activity, and it would be interesting to compare the nutrient processes and so on at that time in the soil with what we have now with no beavers, but a human-manipulated system.

So we’re sort of taking that attack. And it was interesting, because we were out at Glynden with one of the researchers who’s a hydrologist, and another one who’s a geochemist who looks at nutrient cycling and so on, a couple of weeks ago. I had talked about this beaver-dominated thing, and other people have been talking about it. Larry Band, who was with us, who was the hydrologist, said, “You know, this looks like it would be analogous to the beaver-dominated landscape.” It was at the headwaters of Glynden, at the headwaters of the Gwynns Falls at Glynden, which was where the Sacred Heart Church is right out, and there’s a lot of parking area and so on.

But the whole landscape in that lower area is all very wet. There are like two channels
going up. Beautiful trees, wetland trees and so on. And then right in the middle of that there’s a rise, and it’s a sewer line. So what happened, we think, is the sewer line, they couldn’t dig too deep for the pipes because it was wet, and then they just brought dirt over and filled it in. So if you remove that visually, you had a swampy, wet area all through there, just exactly what you’d expect if you had a lot of beaver dams around and things like that. We don’t have anything, of course, very close to that now. Well, I mean, the stream, the Jones Falls, for example, is all underground after Penn Station, so we changed that whole landscape.

One of the questions that’s being asked is how has the groundwater been changed by this, because initially the groundwater was fed by infiltration into the soil of rain from the upper area. So much of that is paved now that it’s just flushing down. Is the groundwater getting deeper? I mean, questions like this which are very important in terms of what’s going on in the landscape in terms of people’s water supply, too, often.

Warren: I’ll bet your students like to just rub up against you and get some of your sense of inquiry.

Brush: One of the interesting things is, I have a student this year, she’s a junior, a philosophy major and natural sciences major, who’s really interested in the way science works, so she’s taking notes. We encourage her to take notes through all of this, because this is how science works. You have a beautifully designed thing, you go out in the field, you know. This is what the whole situation looks like. And how do you make decisions in the field then? On what basis are they made to keep the scientific inquiry objective? So it’ll be interesting to see what she comes up with. Maybe total disgust. [Laughter]

Warren: From her philosopher’s point of view.
Let's switch gears a little bit. I have a couple more questions. Have you run into any gender issues here? Were you among the first women in the department?

**Brush:** I think I was the first tenured professor in this school. I'm not really sure about that. I can't say I ran into gender. I'm probably not a good person to ask, because I tend to shut my eyes and try to ignore those problems. I guess the thing that I found difficult for a long time was I felt that the work I was doing was equivalent to what other people were doing, and I wanted a faculty position. The response, whenever I asked, pretty much was, "But there is no opening." So that becomes an institutional sort of thing.

Then eventually when there was an opening, it was very difficult—there was an opening, but it wasn’t in my area. It was in the human geography area. So it meant that the department had to decide to switch that to my area, which they did. Then I competed for it and got it.

So the gender thing, in most cases, is a very subtle kind of thing, and I think the thing that happens is, "Oh, you're here. We're so glad to have you here." and it’s very nice, but there is not the reciprocal thing, "What could we do for you?" And yet on the other hand, facilities were made available, so all of that was made available, but there was never the sort of reciprocal thing I might think of today as—nobody, for example, would ever ask, "Is there anything we could do?" I mean, I had to bring the—I would never have gotten the tenured position if I didn’t work for it or ask for it and so on. Maybe that’s a natural sort of thing. Maybe you’ve got to be aggressive about getting something like that, that nobody’s going to give you something unless you ask for it.

**Warren:** Did you have a sense that that was the case because you’re a woman or is that the way things are here?
Brush: Well, the problem is that most, at that time and still, most people who are in my position and are women. Rarely do you get—I mean, I think it may be changing some now, but rarely do you get the position where a woman is hired in just the reverse situation and the husband is going to be a research—you know, is in that position. It does happen, but most of the time it’s the opposite way. It’s the woman who comes along with the man. I’m not sure—I’m thinking of the recent people who have been hired here as—well, Lynn Roberts was hired. Her husband works with a computer company, so he didn’t have a problem. Sherri Cooper, who was a very good student of mine, went down to Duke, but then she’s moving out to a small school in Pennsylvania. But her husband also is in the computer industry, and these people can move very easily.

I think schools are confronted with the problem today of finding something for spouses, and things come up that are—and I think this is everywhere—I think people don’t realize these gender issues are very so much a part, part and parcel, of the way we think about things, the way men think about things, the way women think about things often, too.

I was reminded of this very much by my daughter-in-law, who works at McDonogh School as public relations person there, but they’re moving. But anyway, she was telling about the fact that I think at McDonogh they had an awareness—they called it an awareness program for teachers, because they are coeducational there. So the teachers call on girls in the class. These are things that Mary Anne told me, no one would even—you really have to be made aware of it, because you do things that you just have no idea that—I can’t quite explain it. I think that the gender issues is there very strong, but it’s very subtle and it’s very hard to identify exactly. I can’t say that I’ve really felt it at all since I got promoted, but I also haven’t looked to see in what ways I may not be getting what everybody else is getting and so on.
And then the other thing that did happen, and it was a good and a bad thing, maybe, I’m not sure, but I used to complain to my husband a lot about this, and his response, because he was, of course, at that age, too, was the most important thing is to be doing what you like to do, and don’t worry about whether you have the title or that or whatever. There’s more to it than that. But at least what that did was, I did what I really like to do, and therefore when the time came when I could compete, I was very competitive. I mean, there was no question if I would be considered for an appointment, I would get it. And I think what happens to a lot of women as they don’t get that encouragement and they don’t concentrate on what they really like to do research-wise, and time goes by and they don’t get things accomplished, and it’s very difficult. It’s extraordinarily difficult, and it’s a very complicated situation. I can’t say much more about it than that.

**Warren:** Do you think there’s a personality to this place? Does Johns Hopkins have a personality?

**Brush:** Well, I think this department definitely has a personality, and I say that when I compare it with Princeton, where we were previously, where I was a research scientist there, but I was in the geology department, and it may just have been the mix of people, I liked what I was doing there. I wasn’t getting much done, and I’m not sure why I wasn’t getting much done. I had young children at the time. That may have had something to do with it. But I certainly wasn’t intellectually excited like here. So that’s not to say that Princeton doesn’t have departments that are terribly exciting. Certainly their biology department was then. I had some contact with them. And their geology department, probably, too.

But there’s a lot of excitement here, a lot of questions being asked, ideas being floated
around, and I think it may have to do with the mix of people. There's such a variety of different kinds of people in this department. I don't know if the engineering school as a whole has a particular personality.

The other thing that is true for the school as a whole is that it's small, and therefore you can communicate with anyone you want to. There are no barriers to communication, even for the students. For example, a student of mine who might be interested, say, in nutrient cycling, his or her whole curriculum will be designed for that particular thing. So the person will take courses in chemistry or math or what are needed to accomplish the thesis or the research project that they're planning to do. So in that respect it's pretty flexible, and that may be part of the personality, I think, is flexibility.

**Warren:** You've mentioned a sense of excitement several times. Can you give me an example of that?

**Brush:** Just the excitement of when you find something out research-wise. I'm trying to think of something specific. Oh, yes. We had, a few years ago, discovered some climatic changes in our cores. It was really very exciting. When you find something like that and you tell people about it, they're very excited about it, too. So you're never put down with respect to that. I've never had this experience here that I can remember, where someone would say, "Oh, that doesn't mean anything," or, "Prove it to me," or something. It's, "Oh, that sounds great. That's fun. That's exciting." And I think students get that kind of response.

It may be that it may be nothing exciting at all eventually. It may turn out not to be that, what you thought it was. But the fact is that it sort of gives you a feeling of, "Well, this is fun. This is really interesting." I think that's important to keep people going, because a lot of the work
is very, very routine in any kind of science, so I think that exists here.

A lot of it, too, has to do—I mean, Reds is a very exciting person, and he’ll talk to all the students or anyone and so on, and he’s always available. So is Mark Parlange, a new guy here who’s great. We just have these great conversations, I think. And only a few people never have time to talk to you. Most of them do. So that is very good.

**Warren:** Is there anything we haven’t talked about that you think we should?

**Brush:** I don’t know. I can’t think offhand.

**Warren:** What do you think about the future? What direction do you think Johns Hopkins will be going in the next 125 years?

**Brush:** It’s hard to tell, because we have new deans and we’ve been very fortunate in the past of having deans and heads of departments and so on who have been terribly good, and you just never know how that’s going to change. A lot of these changes are very recent, so they just don’t know just exactly how that’s going to—and that is an important thing. The people who run these places have a large influence on it. So it hopefully won’t change, but you just never know. I mean, the Chesapeake Bay Institute went down the drain and we don’t know why. So, no, not everything is great that happens here. It’s a unique and wonderful place, but there have been changes that have not been good, and there have been changes that have been very good. So it’s hard to predict these things. Maybe they’re often unpredictable and often just happen chaotically. [Laughter]

**Warren:** Then you look at the sediment and figure out what it was. [Laughter] That’s right.

**Brush:** It was chaotic or it wasn’t predictable. [Laughter]

**Warren:** I want to thank you. This has been a marvelous, very efficient interview.

**Brush:** I hope that you edit carefully, because I rambled on a lot. I don’t think I said anything
that I would not have--

Warren: I promise you, you gave me exactly what I came here for. So I thank you.

[End of interview]