

## TRANSCRIPT

**INTERVIEWEE:** Bill Calvert

**INTERVIEWER:** David Todd

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**Google Voice** [00:00:00] This call is now being recorded.

**David Todd** [00:00:04] Morning, Bill.

**Bill Calvert** [00:00:06] Good morning, David.

**David Todd** [00:00:08] Okay.

**Bill Calvert** [00:00:10] Okay.

**David Todd** [00:00:12] Yeah. Yeah.

**Bill Calvert** [00:00:15] So what would you like to talk about?

**David Todd** [00:00:18] Well, typically we just try to go through these same questions that you saw and were kind to respond to. You don't need to recite what you wrote before. But we try to sort of stick to the cues that you've seen before, so we don't surprise or shock. And I think that's the general plan, at least on my side.

**David Todd** [00:00:47] How does that work for you?

**Bill Calvert** [00:00:49] Yeah, it's fine.

**Bill Calvert** [00:00:49] I do kind of wonder why the redundancy, though. It seems like maybe the written word would suffice. But. I don't know.

**David Todd** [00:01:01] That's a good question. You know, I think that both are useful, but in my view, at least, this, the way people speak is different from the way they write. And sometimes you get things that are, I don't know, fresher and more authentic. It's not, you know, edited and proofread. And that's a personal opinion here.

**David Todd** [00:01:34] But I think there's also you get extras with spoken word - there's inflections and even dialect and accents that you just don't pick up in written documents.

**David Todd** [00:01:53] But both are handy.

**David Todd** [00:01:55] And I really appreciate you going to the trouble of preparing those written notes, and it helps me understand a little bit more about where you're coming from, and maybe eases my side of the discussion, so I don't sound quite like a fool.

**Bill Calvert** [00:02:13] Okay, well.

**Bill Calvert** [00:02:17] Should we go on?

**David Todd** [00:02:19] Sure. Sure.

**David Todd** [00:02:20] Well, let me say a few words at the outset is to fix this in location and time, and give a little introduction to the project and maybe a short description of yourself as well.

**David Todd** [00:02:39] So, that will take a couple minutes and then I'll just start with the questions that you've seen before and just go through them in the same order that the listed in.

**Bill Calvert** [00:02:50] Okay.

**David Todd** [00:02:52] All right.

**David Todd** [00:02:53] Well, good morning. My name is David Todd, and I have the great privilege of being here with Dr. Bill Calvert. And with his permission, we plan on recording this interview for research and educational work on behalf of a non-profit group called the Conservation History Association of Texas, and for a book and a web site for Texas A&M University Press, and finally for an archive at the Briscoe Center for American History, which is at the University of Texas at Austin.

**David Todd** [00:03:24] And I want to stress that you would have all rights to use the recording as you see fit as well. It is his.

**David Todd** [00:03:30] And before going any further, I just want to make sure if this is all right with you.

**Bill Calvert** [00:03:35] Oh, yes. This is fine. I'm agreeable.

**David Todd** [00:03:40] Good. Well, thank you. Well, let's get started then.

**David Todd** [00:03:43] It is Friday, June 30th, 2023. It's about 8:10 a.m. Central Time, about 9:10 Eastern time. And my name, as I said, is David Todd. I'm representing the Conservation History Association of Texas, and I am in Austin. And we are conducting a remote audio interview with Dr. Bill Calvert, who is based near Bar Harbor, Maine.

**David Todd** [00:04:11] Dr. Calvert is an entomologist and he has spent years studying butterflies. He was one of the first to study monarch butterflies at their overwintering sites in Michoacan, Mexico, starting in the mid-seventies and in the early 1990s organized Texas Monarch Watch. And over the years, has participated in a number of field research trips, ecotourism tours and even film projects related to the monarch.

**David Todd** [00:04:40] Today, we'll talk about Dr. Calvert's life and career, so far, and especially focus on what he's learned about the study and conservation of the monarch butterfly.

**David Todd** [00:04:52] So with that little introduction, I was hoping we could start with a question about your youth, your early years, and if there might have been people or events in those years that influenced your interest in nature and insects in particular.

**Bill Calvert** [00:05:12] Yes. I mean, I'm always interested in nature. I have always been interested in nature, not in the sense of being an avid collector, though, I never seemed to have gotten into that.

**Bill Calvert** [00:05:30] I'm an Army brat, so I lived in multiple places.

**Bill Calvert** [00:05:35] I think, as far as influence goes, I was very, very closely associated with a number of Boy Scout groups. And the people who led us into nature on camping trips and so forth were extremely influential in my life.

**Bill Calvert** [00:05:58] I really didn't get into entomological research until I became a graduate student at the University of Texas in the 1960s. And in that instance, I sort of was given free rein at Brackenridge Field Laboratory in Austin. And I just started observing things and became extremely fascinated by butterfly drumming behavior.

**Bill Calvert** [00:06:29] David, how do I know when to stop?

**David Todd** [00:06:32] Well, you're doing great. And I should emphasize that I try to speak as little as possible. I'm trying to pay attention and take notes, but I try not to interrupt. So, you're doing great. And I'll pop up if you feel like you've run the course of a particular question and we'll go on.

**Bill Calvert** [00:06:52] Okay. I think I have.

**Bill Calvert** [00:06:56] With this audio, will you take out the asides and so forth?

**David Todd** [00:07:03] Yes, to some extent. You know, we try to keep true to what you've said. So it's always a judgment call. And I try to ... the default is to leave as much as possible because I'm never sure what will be valuable.

**Bill Calvert** [00:07:21] Uh huh.

**David Todd** [00:07:22] Anyway, so you mentioned that that you first got interested in entomology when you were at UT and that you were, I think, interested in in the operation of butterfly feet and how that was useful to the butterfly. Maybe you can talk just a little bit about what it was that you were studying.

**Bill Calvert** [00:07:41] Oh, yes. My experimental creature was a butterfly, the *Chlosyne lacinia*, the border patch butterfly. I saw it in the field, landing on potential host plants, not on flowers. Of course, they land on flowers to take nectar. But they land on the host plant and they would take their four legs and they'd sort of, well, we used the term, "drum". It is very much like drumming. It's the alternate striking of the leaf with the spines and their forelegs.

**Bill Calvert** [00:08:23] And I looked into that, used a scanning microscope and discovered that there were some sensory hairs that were positioned along those spines. And then conducted a series of experiments trying to figure out how they used the drumming behavior. Came up with a conclusion that they do use it to verify their host plants so they don't make

mistakes. And if they do make a mistake and lay on the wrong plant then they, that particular egg or group of eggs will perish.

**David Todd** [00:09:04] That's fascinating. So it's their way of sort of verifying that this is a safe and productive place to lay their eggs?

**Bill Calvert** [00:09:14] Yes, I think that's true.

**Bill Calvert** [00:09:16] There are other cues that lead them to the general site where their host plants are located. They're probably visual cues. But once they're there, they start this drumming behavior on potential candidates and eventually end up laying your eggs there.

**David Todd** [00:09:39] Huh. Well, that's fascinating. And, you had this really structured, organized, formal, experimental education. Were there any general interest books or films or TV shows that might have been important to you when you were first getting started and, you know, natural research work?

**Bill Calvert** [00:10:11] Oh, goodness. That was so long ago.

**Bill Calvert** [00:10:14] I mean, I watched nature presentations from David Attenborough, I believe, was one of the major presenters. I did those sorts of things. And just being in nature was really what, what sort of launched me.

**David Todd** [00:10:35] Yes, I think you'd mentioned this before. Maybe you could give an example of how these scout trips and maybe scout leaders and camping outings might have been important to you. Were there any that sort of rise in your memory that you could tell us about?

**Bill Calvert** [00:10:54] Oh, there were, but they didn't have much to do with research. It was just being in magnificent settings. I remember in Germany. We had some sort of ceremony involving fires on top of a mountain. And it was just quite spectacular and impressed my young mind.

**Bill Calvert** [00:11:18] It was just, again, it was just, you know, being there in nature and, you know, camping and eating and chatting around fires in support with people who had experience in that sort of thing. That was very influential.

**David Todd** [00:11:40] Okay.

**David Todd** [00:11:43] Well, so tell me about your first encounter with monarch butterflies. And how was it that you first got started learning about them?

**Bill Calvert** [00:11:59] I had a position at the University of Massachusetts at Amherst studying caterpillars, and I would occasionally go across town and attend lectures at Amherst College. And there I met Lincoln Brower. And he was studying monarchs at the time and he needed a sample taken during the migration. And I had just migrated up there from Texas, and I knew Texas pretty well. I didn't know much about monarchs at the time.

**Bill Calvert** [00:12:37] But I went down, and I learned, to my dismay, that the monarchs had already passed through Texas. But I caught up with them in Mexico, in Bustamante, Mexico,

made a collection, took them back to Lincoln and sort of got established as someone who could really help him with his research. And also, I began to study the monarch myself.

**David Todd** [00:13:09] And for those who might not be familiar with Lincoln Brower, can you tell us just a little bit about him?

**Bill Calvert** [00:13:16] Well, he had been studying monarchs for decades before I met him. He was the one who did the experiments with birds and feeding them monarch butterflies that were infused with the cardiac glycosides, and then photographing their reaction to them. And that appeared in Scientific American, I think, sometime in the 1960s, sort of establishing him as a preeminent researcher with monarchs, this notion that the monarchs were protected by the ingestion of chemicals that they obtained from their food plant.

**Bill Calvert** [00:14:11] What else?

**Bill Calvert** [00:14:11] Well, we just, he and I continued this research. He funded the trip to Mexico where we rediscovered the location of monarch sites. And then we began to begin a series of experiments over several years where essentially we were trying to figure out the major, well, we were trying to locate the colonies, which we did. We were also trying to figure out the major causes of mortality, which we did.

**David Todd** [00:14:46] Well let's talk about those. The two of those things are, of course, very important. These travels to Mexico, in particular your efforts, your successful efforts, to find the colonies where the monarchs, where they were overwintering. Could you tell us how you found them? Sounds like you had a few clues, but there was some adventure and experimenting to actually find the colonies. How did that go about?

**Bill Calvert** [00:15:22] Well, there was quite a bit of adventure - mainly driving down there. I think 900 miles, if I remember correctly, 900 miles from Austin to the overwintering colonies.

**Bill Calvert** [00:15:36] But basically, we had two important clues. The person who discovered the monarch colonies was Fred Urquhart. And his actually, the real person who discovered it was Kenneth Brugger, who worked in Mexico and who worked with Urquhart. Urquhart published in two different locations two important clues. One of them was that they, it was located in, the colonies, were located in the state of Michoacan. And the second one is that it was at 3000 meters altitude.

**Bill Calvert** [00:16:17] And we scrounged around a number of libraries in the Amherst area, found a good map of that area of Michoacan, Mexico, and were able to isolate a couple of mountaintops that fit those descriptions.

**Bill Calvert** [00:16:41] And we went there. We went to the town of Angangueo, presented a sample butterfly to the mayor. And he understood immediately what we were looking for. He was a little confused about why we were looking for it. But, anyway, he located his nephew and the nephew took us up on the mountain the next day and we searched and searched and searched. And at the end of the day, we found a colony.

**David Todd** [00:17:12] Can I ask you a favor? Is there some noise in the background? I think we're picking it up on the recording.

**Bill Calvert** [00:17:25] Okay. Well, someone here is preparing their breakfast, so maybe I can get into the room here.

**David Todd** [00:17:37] Okay. That'd be great. Sure. Sorry to interrupt you.

**Bill Calvert** [00:17:45] Okay. I 'm in another room.

**David Todd** [00:17:49] Okay, well, so, let's pick up where we left off. So, this village mayor arranged for his nephew to take you up on the mountain. And this was Sierra Chica, is that right?

**Bill Calvert** [00:18:09] Yes. That was the name of the mountain where we were. And it's above the town of Anganguero, an old mining town in the extreme eastern Michoacan.

**David Todd** [00:18:26] How can you describe what this part of Mexico is like?

**Bill Calvert** [00:18:34] Well, it's extremely mountainous. The mountains in the eastern Michoacan go up to 12,000 feet. Old mining area, full of mines, old mines, mine entrances. And the mine was still active when we first arrived. Shut down for a while. I'm not sure of its status now.

**Bill Calvert** [00:19:03] The valleys are mainly cleared for planting. The mountaintops are fir forests, mainly fir forests, with some few hardwoods scattered in there. From above 12,000 feet, I'd say they end at 12,000 feet. Some of them go a little bit higher. It gives way to pine forests, which are very, very different than oyamel, I guess in quality from the fir forest. The fir forest is very dense, thick. The pine forests, not so.

**David Todd** [00:19:45] And then the people who live in this area - what can you say about them? How would you describe the local communities?

**Bill Calvert** [00:19:55] Well, many of them are ejidos, meaning, I guess the best translation would be collective farm. A group of people live together. Most of them, many of them, are related to each other. And they farm the land collectively. They are not ... it's not a very enriching enterprise. It's very small scale. It's hard for them to grow many crops because of the altitude.

**Bill Calvert** [00:20:31] It's very cold, even though it's in the middle of a, it's technically in the tropics, about 20 degrees, 19 to 20 degrees north.

**Bill Calvert** [00:20:44] I'm trying to think of some other aspects of them. They're mainly indigenous. I mean, there's some the mestizo, meaning Spanish penetration into these communities. But mainly they're just indigenous people who live in the area.

**David Todd** [00:21:07] Okay.

**David Todd** [00:21:08] And then what was your first reaction when you did find this overwintering site? Do you remember how it struck you?

**Bill Calvert** [00:21:19] Yeah, it was astonishing. I mean, we arrived in late afternoon and they were coming back into their roosts, and, you know, the entire forest was just colored golden, with these living creatures flying into the, flying back into the forest, and forming their roosts.

And of course, the majority were already there. The majority of butterflies don't leave the roost during the day. They just remain dormant. But a certain percentage go out each day and then they fly back at night. And that's what we witnessed: their flying back at night.

**Bill Calvert** [00:21:57] They, it was just, I can't think of enough superlative words. It's just astonishing.

**David Todd** [00:22:08] Wow. It sounds like just a remarkable thing - so many and so colorful and so beautiful.

**Bill Calvert** [00:22:17] Yes. Beautiful. That's another word.

**Bill Calvert** [00:22:22] But of course, just spectacular, too.

**Bill Calvert** [00:22:26] They were on the western fringe of this massif, this Sierra Chinca. And you looked out over the volcanic plains of Michoacan. It was just amazing, an amazing sight.

**David Todd** [00:22:48] You know, I'm sure it's just astonishing if you're not from there. And this is a new sight. But I'm curious what the local community thought of these butterflies, if they paid much attention to them or if they were, it was an important part of their culture and life.

**Bill Calvert** [00:23:09] That's a difficult question. I know that in the early days, the local people would come up on holidays and they'd sort of camp in the area of the monarch. So in that sense, you know, they did appreciate them. But they didn't have much of an idea of their biology. They didn't know where they were from. I mean, there were some amazing stories about they being the souls of dead children returning to where they were from.

**Bill Calvert** [00:23:56] We had to sort of sift through these stories and try to find something that was true. They, going back to how, whether or not they appreciated these butterflies, I think maybe, mainly, mostly not. They knew that they came every year. They knew that they infested their forest at the top of the mountain, but they didn't pay much attention to them.

**Bill Calvert** [00:24:31] There was no way they could, or they didn't conceive of ways to make a living or to use them or exploit them to make a living. So, they didn't pay much attention.

**David Todd** [00:24:44] I read, and of course this is all second or third hand, but that some of the indigenous folks felt like there was a tie, maybe you were touching on this talking about the souls of dead children returning to, I guess, the Dia de los Muertos because the butterflies returned around that season. Was that anything that they discussed with you?

**Bill Calvert** [00:25:20] You mean the coincidence that the butterflies were returning to Mexico around the end of October and the beginning of November?

**David Todd** [00:25:29] Yes, that's right.

**Bill Calvert** [00:25:32] No. Other than the simple fact that some of them stated that they were, that they were souls of children returning. I guess that's the only connection that I can think of.

**David Todd** [00:25:49] Okay. Well, let's shift gears just a little bit.

**David Todd** [00:25:57] I think that one of the things that you have been involved with is this group called Texas Monarch Watch, which I believe you helped create in 1993. And I was wondering if you could tell us a bit about the origins of the group and what some of its activities were over time.

**Bill Calvert** [00:26:22] Well, the whole idea seemed to start with a field trip that I took with Chip Taylor at the University of Kansas, deep into Mexico. He was studying bees, at the time - Africanized bees. And I went down with him just to see what was going on.

**Bill Calvert** [00:26:47] And we had talked about monarch butterflies and monarch butterfly migration.

**Bill Calvert** [00:26:54] And right after that, he established the Monarch Watch through the University of Kansas, and I set up the Texas Monarch Watch. We collaborated with each other. He sent me the tags that I distributed among Texans. And that went on for a couple of years. And then finally he took over the distribution of tags, which was fine with me because it was a bother.

**Bill Calvert** [00:27:21] But basically, what we both did was just gather information about the migration to our respective, well, in his case through the entire eastern part of the United States, in my case, Texas.

**Bill Calvert** [00:27:37] And I had a telephone line that people could call and report the presence of monarchs. So, I would dutifully note down the locations that they reported. And he was doing pretty much the same thing.

**Bill Calvert** [00:27:54] And then he would go to Mexico and collect the tags that the campesino guards had collected during the course of the wintering season and come back and compile that data as to where they came from and how long it took them, and so on and so forth.

**Bill Calvert** [00:28:17] And that has continued. He has continued that into the present. I'm not sure exactly how active it is anymore, but they've gathered an enormous amount of data from that study.

**David Todd** [00:28:32] Well, it is striking to me that this is research that used a lot of volunteer citizen partners, that this is sort of a sample of citizen science. Is that a fair way to describe it?

**Bill Calvert** [00:28:48] Yes, I think so. It really got people involved. It stimulated interest. And the Monarch Watch website is still active, and people are still reporting the presence of monarchs - their position, their abundance, and so forth.

**Bill Calvert** [00:29:15] It seems like, in addition to that, they've become activists in trying to get people to conserve nature, to promote the flourishing of the monarch butterfly. One thing in particular that they're doing is they seem to be lobbying state transportation agencies. Sorry, can't remember what that's called anymore. But anyway, they're lobbying each state to modify their mowing programs, so allow the monarch butterfly larvae to finish their lifecycle, become adults and fly off because they mow.



**David Todd** [00:30:01] That's interesting.

**David Todd** [00:30:03] And I gather that some of this data is that of your citizen scientist partners for collecting and y'all were compiling was passed on to a group called Journey North. Is that right?

**Bill Calvert** [00:30:20] Oh, yeah. Journey North was certainly involved. And, I'm not sure that, I mean, they had their own network of people reporting to them. They were mainly, they mainly dealt with schoolteachers, which was, of course, an enormous number of people. And then, in addition to that, there was an enormous number of children who got interested in monarchs through these school monitoring programs.

**Bill Calvert** [00:30:49] And that was just amazingly successful. And I understand that it's still going on.

**David Todd** [00:30:59] I think that I saw a video once that had you reporting from Mexico by telephone to Journey North. Is that right?

**Bill Calvert** [00:31:12] Yes, I'm sure that happened on many occasions.

**David Todd** [00:31:18] So, you were, in a sense, their roving reporter on Monarch Watch or rather Texas Monarch Watch down there.

**Bill Calvert** [00:31:29] Yes.

**David Todd** [00:31:30] Okay.

**David Todd** [00:31:32] So I think one thing that has been of interest and concerning, of course, is the trends in monarch populations. And I guess there's good sign that they're declining.

**David Todd** [00:31:51] Can you describe, you know, what's going on and what do you think is responsible for these declines?

**Bill Calvert** [00:32:01] Well, there are two factors that seem to be preeminent.

**Bill Calvert** [00:32:09] The main one, I think, is loss of habitat. And loss of habitat includes, of course, the reduction in the population of milkweeds through the use of chemicals, through the use of corn and soy seeds which will withstand these herbicides. This is thought to have been a major, major factor in the late nineties and early 2000s in reducing the population.

**Bill Calvert** [00:32:45] But then the population has seemed to have, to some degree, stabilized at that lower level.

**Bill Calvert** [00:32:52] And now it's just a combination of factors. You know, people using so many pesticides to kill insects, which include monarchs, of course.

**Bill Calvert** [00:33:05] And, but it's also curious that there's one sort of renegade scientist. His name is Andy Davis at the University of Georgia, who uses a different method to measure monarch population, and has concluded that there's no real serious change in summer populations.

**Bill Calvert** [00:33:30] Somehow, the monarchs, in spite of low wintering populations, seem to, in many instances, make it up on their journey north. And Texas is thought to be extremely important in this phenomenon, in that if there's a really good milkweed crop in Texas, the monarchs will flourish. That is, that first generation will grow to an enormous extent and make up for losses.

**David Todd** [00:34:06] That's interesting. So, I guess a lot of the annual seasonal counts have been based on the number of hectares in the overwintering sites.

**Bill Calvert** [00:34:20] Yes.

**David Todd** [00:34:20] So what happens between those winter counts might be a whole other story. Is that what you're saying?

**Bill Calvert** [00:34:26] Yes, I think so. There have been various methods tried to, I'm tempted to use the word "guess" the population size in Mexico, but it seems like the best method that has evolved through all of those is one that's indirect, and that is you measure the size of all the colonies each year and then you add it all up and you compare that from year to year.

**Bill Calvert** [00:35:03] There have been other studies. And the result seems to be somewhere around 20 million butterflies per hectare.

**David Todd** [00:35:18] So how are they counted in these wintering sites?

**Bill Calvert** [00:35:25] How are they counted? Well, they're not. That's the problem. I mean, you use mark-recapture studies and that seems to have yielded somewhere around 15 million per hectare.

**Bill Calvert** [00:35:41] And then we did a more direct method where we would, that resulted from a lot of estimations, meaning we would put squares on trunks of trees and count butterflies within a square of a known area. We'd estimate the heights of the column of these trunk clusters. We'd figure out the number of butterflies in trunk clusters.

**Bill Calvert** [00:36:08] And then we would take down boughs from these trees of different sizes. And we'd take samples of butterflies, butterfly weight. And then we'd weigh the branches and figure out how many butterflies are on the branches. And then we'd figure out how many branches of that size.

**Bill Calvert** [00:36:28] There was just so much estimation involved.

**Bill Calvert** [00:36:31] And it came up with something around 15 million per hectare.

**Bill Calvert** [00:36:36] And then other people, Brower in particular, used dead butterflies on the ground during the winter, during January, and some sort of estimate of the percentage of butterflies that had fallen to the ground to obtain an estimate of the population size, which turned out to be considerably higher than the mark-recapture and the direct methods that we used.

**Bill Calvert** [00:37:04] So, somebody else in 2014 came up with some sort of composite figure of about 20,000 per hectare.

**David Todd** [00:37:17] This is really interesting. I guess it is sort of triangulating on getting a accurate number using different methods.

**David Todd** [00:37:23] There was one method I didn't quite understand and maybe you can elaborate a little bit more with mark-recapture. How would that work as a count?

**Bill Calvert** [00:37:39] Well, you go into the forest and you try to get as many people as you can because you need to mark a considerable number in order to get an accurate estimate. You go into the forest and on a color-coded basis, you mark butterflies and release them.

**Bill Calvert** [00:38:05] And then you come back after a certain period of time and you recapture and you count how many of the marked butterflies that you recapture and then use the formula to calculate the population number.

**Bill Calvert** [00:38:22] And you'd keep repeating this through the season to try to get a more accurate figure.

**David Todd** [00:38:31] So, this would be a release and recapture just within days or months or a full year?

**Bill Calvert** [00:38:40] I think it would extend over about a month period. That's what we did anyway. It was about a month long, yes, that we measured. We'd go in about once a week, and we'd mark-recapture, and then we'd, at the same time, we were marking with a different color and we'd go back and recapture those and then repeat it, I think we repeated that three times, three different colors.

**David Todd** [00:39:09] And I'm slow here. But how would you, I guess, you'd understand the percentage that you're able to recapture. And that would be a way to kind of leverage out, back out the number of butterflies in the whole colony? Is that what you're saying?

**Bill Calvert** [00:39:28] That's essentially correct, yes. And there's a formula that's used, and I'm a little rusty on that.

**David Todd** [00:39:41] Okay, well, maybe we can shift to what folks have been trying to do to answer this decline in butterflies that seems to have been observed. I think you mentioned that some of the public got involved in trying to get highway agencies to change their mowing schedules. Were there other efforts that might have been taken up to try to help the monarchs?

**Bill Calvert** [00:40:15] Well, yes, golly, there's an enormous push to plant milkweeds and plant milkweeds in gardens, mainly in gardens. I would say that's the major thrust right now.

**Bill Calvert** [00:40:35] I mean, there are people involved in writing Departments of Transportation to get them to mow on a better schedule.

**Bill Calvert** [00:40:42] But, I think that's the major thrust of the conservation effort, is to get people to plant milkweeds.

**Bill Calvert** [00:40:56] It's interesting how the, you know, the cutting of the eastern forest, which I think reached a climax in about 1840. We cut most of these forests down by then,

resulted in the extension of milkweed into areas that were once forested. And that must have been a wonderful impetus or caused the increase in monarch population size.

**Bill Calvert** [00:41:32] Of course, nobody was around to document that at the time, so it's all highly speculative, but it would be nice to get back those densities.

**David Todd** [00:41:46] That's interesting. So there really isn't a clear baseline after this big intervention in the eastern forests of the U.S. that may have caused the populations of both milkweed and butterflies to have boomed.

**Bill Calvert** [00:42:03] Yes, I think that's true. I mean, again, it's speculation, but it's very logical.

**David Todd** [00:42:14] Okay. So, one of the things I thought was really interesting about your work with monarchs is that it took you on many trips to the Mexican highlands, these areas in Michoacan where these monarchs overwintered. And I was hoping that you could talk a little bit about some of these travels down there, and some of the partners that would go with you and that might have helped spread the word about the situation for the monarchs and what might be done about it.

**Bill Calvert** [00:42:54] I'm sorry, I missed a key word. You used something to describe who went with us or who went with me.

**David Todd** [00:43:01] Yeah, it seemed like these field trips and eco-cultural tours that you took to the overwintering sites were also a way of spreading the word and maybe getting more attention and awareness to what was going on with the monarchs.

**Bill Calvert** [00:43:18] Well yeah.

**David Todd** [00:43:19] Is that accurate?

**Bill Calvert** [00:43:21] There was a group of people in Mexico City who, kind of, well, one in particular saw the hat of the person who was featured in the National Geographic article, and concluded that this person was from Michoacan.

**Bill Calvert** [00:43:44] So, this group from Mexico City, it was sort of a camping group, you know, some friends who would go out into nature together, started exploring the area around Eastern Michoacan, and discovered the butterfly colonies. And then they formed the conservation effort that was centered in Mexico - "ProMonarca", I think, was the name of it. And they've done quite a bit to advance the cause of monarchs in Mexico.

**David Todd** [00:44:24] That is interesting. This creature seems to have stood up an international effort to help these butterflies.

**Bill Calvert** [00:44:42] Yes. And in the case of, you know, people sort of going down, going on these expeditions into Mexico, there was such a great variety of people.

**Bill Calvert** [00:44:56] I mean, we had a Japanese film crew with us one year and they publicized the monarch, and the monarch sort of took off, as, you know, as a creature of international interest. Remains so today, I think.

**David Todd** [00:45:23] Yeah, it seems like it's sort of iconic and charismatic in ways and really draws a lot of attention to it.

**David Todd** [00:45:33] So, it seems like one of the really intriguing things for a lot of people is its migration. And I was wondering if you might be able to help us understand how it makes this 2000-mile multi-generation trip - you know, I guess so many generations that it can't be doing it from memory but must have other cues to guide it.

**Bill Calvert** [00:46:05] No, the ones that travel south have never been there before.

**Bill Calvert** [00:46:10] Basically, they seem to have some mechanism. It's thought to be a sun compass, meaning they can somehow compensate for the position of the sun in the sky and fly in a constant direction to the southwest, somewhere around 210 degrees.

**Bill Calvert** [00:46:40] It's also thought that they have a magnetic compass that can kind of take over when the sun compass doesn't work, that is, when the sun is completely occluded by clouds.

**Bill Calvert** [00:46:54] But what none of these theories take into account is the fact that they change their course when they reach the mountains in Mexico. They change about somewhere around 80 degrees and they start flying to the South-Southeast instead of the Southwest.

**Bill Calvert** [00:47:19] And that focuses them. It's amazing how it focuses them. I mean, butterflies that have been born a thousand miles apart in the United States, in the upper United States or Canada, can be flying alongside each other in the mountains of Mexico.

**Bill Calvert** [00:47:39] And the focusing mechanism sort of directs some right into a trans-volcanic belt where the overwintering colonies are located.

**David Todd** [00:47:50] I see. So, it helps these migrants group together, even though they might have been born a thousand miles apart, as you said, somewhere up in the Northern or Midwestern U.S.

**Bill Calvert** [00:48:04] Well, not so much Western - east of the Rocky Mountains.

**David Todd** [00:48:10] Sure. Okay. Right.

**Bill Calvert** [00:48:12] The Western group migrates to the California coast where they form numerous colonies, all the way from north of San Francisco down into Mexico. Most of them are quite small. Some of them are sizable though.

**David Todd** [00:48:30] I see. Okay.

**David Todd** [00:48:33] You know, one of the things that strikes me about the monarchs is that they weigh, what, less than an ounce, but they make this amazingly long trip and also deal with extremes of weather, from freezes and snow storms in Mexico, to hurricanes maybe, you know, on the Eastern seaboard. How do you think these butterflies protect themselves and manage to survive?

**Bill Calvert** [00:49:09] Well, many of them don't survive. I don't think there's a good estimate of what percentage of them perish on the way down.

**Bill Calvert** [00:49:22] But, some of the mechanisms they do use is when the winds are opposed to them, they'll fly extremely low. Right, almost at ground level. And unfortunately, this is when they get creamed by automobiles when they cross over highways.

**Bill Calvert** [00:49:48] If the winds are too strong and they're opposed to them, they won't fly. They just get into low areas and they hang out until the weather improves.

**Bill Calvert** [00:50:00] When the winds are correct, they catch thermals in the morning. Well, they usually begin their day by nectaring and they usually end the day by nectaring when nectar is available. But when the winds are correct, and after they've finished their morning ritual of nectaring and so forth, they'll catch thermals and they'll just ascend out of sight. And they can fly, or be transported by these winds, three to maybe 500 miles a day, if the conditions are exactly right. It's just phenomenal how far they can fly on a good day.

**Bill Calvert** [00:50:44] And how few miles they can fly in a bad day.

**David Todd** [00:50:52] I see. Okay. And it sounds like their migration typically takes them through Texas. And I was curious if you could talk a little bit about this sort of constriction that they go through this funnel that takes them south and then again north during their migrations. And maybe it's a key stage for their life history as well.

**Bill Calvert** [00:51:25] Yes, well, Texas, because of the Gulf of Mexico, they are funneled. And they seem to really concentrate in the South Texas area and then into Mexico between, say something like, say, Ciudad Victoria and Monterrey. Most of them pass through that zone and into the mountains before they make their turn.

**Bill Calvert** [00:51:57] So, yes, Texas is a good place to study the migration.

**Bill Calvert** [00:52:04] And I guess it's not just that they are passing through Texas, but I think you said earlier that the overall size of the population may hinge on how successful a milkweed crop there might be in Texas. Is that right?

**Bill Calvert** [00:52:24] Well, again, when they migrate north, we're talking, I think we're talking different migrations here. They don't, well, I keep thinking there are exceptions, but the rule is they don't reproduce on the way down, on the way to Mexico.

**Bill Calvert** [00:52:45] But in the spring, when they return, they fly from the overwintering sites into Texas, where there's, in a good year, an abundance of milkweed, lay their eggs and then that first generation flourishes if the conditions are good.

**Bill Calvert** [00:53:07] And then that generation will fly further north, eventually ending in an area about the latitude of the Great Lakes, extending all the way over to the East Coast. And then that's where they spend a couple of generations and really increase their population size.

**Bill Calvert** [00:53:26] And then it's fall again, and the milkweeds senesce, and the nectar plants disappear. It gets cooler and it gets darker and they become non-reproductive and they start their migration to the southwest.

**David Todd** [00:53:55] Okay.

**David Todd** [00:53:57] So, I guess this migration, this journey, has been, I think, a global fascination for public and for film crews. I think you mentioned the Japanese crew that was intrigued by this, and I think there was a PBS NOVA film, The Incredible Journey of the Butterflies, that you had some role in. Can you tell us a little about that?

**Bill Calvert** [00:54:26] Well, that was filmed by a Canadian film group and they produced a film version. And then, I guess, it was taken over by public TV and made a ... Sorry. I'm trying to think of the group that produced it. Help me.

**David Todd** [00:54:57] PBS, maybe? Public Broadcasting System?

**Bill Calvert** [00:55:04] Yes. Anyway. They did a ...

**Bill Calvert** [00:55:08] I'm sorry, it was NOVA that we're trying to think of. That's what I'm trying to think of.

**David Todd** [00:55:12] Yes. Okay. Right.

**Bill Calvert** [00:55:14] And they edited it pretty well and put out that NOVA production. And yes, I had a little part in that.

**David Todd** [00:55:28] Well tell us a little bit about the role that you played for them.

**Bill Calvert** [00:55:34] I was the guide. I told them where to go.

**David Todd** [00:55:42] Yeah. And so, this was mostly focused on the overwintering site, or was this along the entire route?

**Bill Calvert** [00:55:51] Oh no. This was along the migration route. Yeah, this was the migration route. Yes. And we went into the Cumbres de Monterrey, the mountains above the town of Monterrey, Mexico.

**Bill Calvert** [00:56:03] And there we found them and it was just astonishing, the number of them. They were spiraling in the morning, you know, trying to find the thermal, and flying up above those mountains and then drifting south.

**Bill Calvert** [00:56:20] And then, of course, you know, we encountered them again in the overwintering colonies.

**David Todd** [00:56:37] And then also, did you did you track him through Texas and into the Midwest and maybe as far as Canada or...?

**Bill Calvert** [00:56:47] Oh, no, no, no. We didn't do that. That would have been a spring phenomenon. This is just filmed in the fall.

**David Todd** [00:56:54] I see. Okay.

**David Todd** [00:56:57] Well, speaking of ...

**Bill Calvert** [00:56:58] Or at least that was...

**Bill Calvert** [00:56:58] I'm sorry. Go ahead.

**David Todd** [00:57:02] No, go ahead. Finish your thought.

**Bill Calvert** [00:57:04] Well, I would just say I'm not exactly sure what happened after I left them. They might have done something in the spring. I just don't remember.

**David Todd** [00:57:18] Okay.

**David Todd** [00:57:19] Well, while we're talking about the migration, I guess part of the kind of feature of their overwintering is being in these oyamel firs. And I gather that they help keep the monarchs just somewhat warmer because that area is so high that it can freeze during the winter. Is that correct?

**Bill Calvert** [00:57:48] Oh, yeah. If you do temperature profiles, that is, if you take temperatures at maybe five different elevations up to, oh, I think we went as high as 25 feet, something like that. And you compare that inside the forest and outside the forest, you get dramatic differences. Outside the forest in high altitude tropics, it freezes every night, virtually every night.

**Bill Calvert** [00:58:23] And inside the forest, it seldom freezes. So, it really does provide a sort of warm blanket for the forest, provides a warm blanket for the butterflies to form their roosts in them.

**David Todd** [00:58:36] And so, there's sort of a microclimate there, within the forest.

**Bill Calvert** [00:58:46] Yes. Indeed.

**David Todd** [00:58:47] Okay. And, my understanding is that, through the work of Pro Monarca and other groups, there is now a monarch butterfly biosphere reserve. And I was curious if you can tell us anything about the design of this reserve and maybe how it was created.

**Bill Calvert** [00:59:13] Well, it sort of grew over the years. One of the major players was the governor of Michoacan, Cuauhtémoc Cardenas, who initialed the first decree. And I believe it was his administration that bought out the private landowners that were using those forests for lumbering purposes and established the reserve.

**Bill Calvert** [00:59:43] But through the years it was realized that the initial areas that were preserved were not big enough, so they expanded them. And also, concurrently, it seems like the local population, who was really initially worried that they would not be able to use the forest for, you know, to sell wood and to gain enough money to buy seeds and to promote their agriculture. Those same communities learned how to exploit the tourists.

**Bill Calvert** [01:00:24] And again, there were winners and losers, but mainly winners in the case. They, those communities near the butterfly sites, seem to be flourishing now.

**David Todd** [01:00:47] I think that's something that I'd really like to hear more about. It seems that there's this tension of a kind between the global community that feels like they have a stake in seeing this monarch as a world treasure. And then you've got the local



campesinos in the ejidos there, who, you know, might see these overwintering sites as their source of income and really critical to maintaining their livelihoods.

**Bill Calvert** [01:01:26] Can you tell us anything about, you know, what you might think about that, that kind of dilemma of trying to save the butterfly and its migration, but also trying to recognize that there are local folks there, often many very poor, who rely on that area?

**Bill Calvert** [01:01:46] Well, again, there seems to have been at least a partial accommodation of the needs of the locals. I mean, the lifestyles were somewhat changed. Maybe you could even say radically changed. They no longer relied on their forests for income, and they switched to tourism.

**Bill Calvert** [01:02:13] And again, you know, there are many, many people who flourished and some that didn't. I'm not sure I can elaborate too much more on that.

**David Todd** [01:02:28] Has there been much of a problem, at least in your experience, with you know, poaching or smuggling of timber from that area?

**Bill Calvert** [01:02:42] I hear reports. You know, when we first went down, the forests were not protected. They were cutting them. In one instance, they were cutting forests that had butterfly clusters formed on the boughs. So, it was really pretty, pretty pathetic.

**Bill Calvert** [01:03:07] But that didn't last long. There was such an outcry that they quit that. And then they got it all protected.

**Bill Calvert** [01:03:14] And you hear these stories about illegal forestry. And apparently the cartels are involved now.

**Bill Calvert** [01:03:26] But I don't I don't have any personal experience with that.

**David Todd** [01:03:31] So one of the things I thought was interesting, and you mentioned in passing, that you were always struck by the monarch's beauty, I mean, when you first saw them in the mountains there. And I think it's always intriguing when a person who's trained as a scientist and has those aptitudes and skills also sees something in nature as just simply beautiful. And I was hoping you could talk a little bit about that.

**Bill Calvert** [01:04:04] I think even, I mean, the overwintering sites are just absolutely spectacular and it's magical to see that many creatures just sort of flying about coloring the forest golden.

**Bill Calvert** [01:04:22] But, summer monarchs are just as beautiful. I mean, they fly around with a kind of insouciance, a kind of carefreeness that is just enviable. They go from flower to flower, and they're just not in any hurry. And they're just, they're just gorgeous.

**Bill Calvert** [01:04:48] I'm looking forward to their return to New England, which is expected sometime soon. Milkweeds are ready for them.

**David Todd** [01:04:59] Well, so here's a follow-up question. It seems that the monarchs have been kind of a clock in their migration for tracking this shifting of the seasons. But with climate change, I gather that that may be shifting. And I'm wondering what sort of impact you see from climate change on the monarchs and their migrations, if you expect them?

**Bill Calvert** [01:05:37] Well, I haven't really experienced anything directly, but it seems that climate change would have two important effects on them. One, it's going to increase bad weather. And some of that bad weather is going to occur during the critical time when they arrive in Texas in the spring. And if they encounter a severe drought where there's no milkweed, the population will suffer, will suffer greatly.

**Bill Calvert** [01:06:14] Another, and this is again speculative: we're not exactly certain how flexible monarchs are with respect to warming, but it seems like the colonies are going to have to move up the mountains to get into cooler temperatures. And we don't know if they can do that.

**Bill Calvert** [01:06:40] Also, there's a limit to how they can go. Again, above about 12,000 feet, you run out of this oyamel fir forest, and you get into pines. So, and the pines don't offer the same kind of protection that the dense oyamel forest does.

**Bill Calvert** [01:06:57] So, those are two possible effects of climate change, of warming, global warming, let's call it global warming, will have on the monarchs.

**David Todd** [01:07:12] I see.

**David Todd** [01:07:16] Well, just two more questions, if you could.

**David Todd** [01:07:19] One is that it seems like the monarch is an insect that a lot of people are familiar with, they see it, they recognize it. But, it's just one of many insects, of course, in the world. And, I understand that there's concern about an overall decline in insects that may not be as apparent to people. And I was wondering if you have any thoughts about what you've noticed or thought about there.

**Bill Calvert** [01:07:52] Well, yes. I mean, monarchs are a very, very attractive creature, mainly because I think its beauty and it's, you know, easily studied in classrooms. It's sort of the teddy bear of the insect world.

**Bill Calvert** [01:08:12] But, it doesn't really contribute much to human well-being other than its aesthetic appeal. It's famous for not pollinating much, except flowers. So, I'm not sure. I'm not sure. I'm deviating from the original question, I think, which you'll put me back on track, right?

**David Todd** [01:08:39] Well, I just have read some stuff in the general literature about an overall decline in insects, apart and beyond the monarch's trends. And I'm curious if that's something that you've been tracking and thinking about.

**Bill Calvert** [01:08:59] Well, I do think about it. I have not studied it, no. I mean, I hear the same reports that you do, and it's worrisome. I understand that fireflies have pretty much disappeared from any place where they were once dazzling children in the summer. That's supposed to have to do not so much with climate change as with pollution, which is increasing rapidly each year. So, that's certainly a negative effect.

**David Todd** [01:09:38] Okay. Well, let's just try one last question and then I'll leave you be. I know you've got other obligations this morning. So, you've been kind to answer lots of questions, and I appreciate that.

**David Todd** [01:09:55] But I was wondering if there's anything that I might have missed or ignored or neglected that you might like to add about monarch butterflies or just in general about conservation?

**Bill Calvert** [01:10:11] Woo! Well, I'm rather discouraged about these matters. I mean, I think we're just poisoning the earth in the name of more efficient agriculture. I think that's the main motivator and we're going to have to deal with it. We're going to have to contend with that. We're to have to pay for our indiscretions and our stupidity.

**Bill Calvert** [01:10:55] I'm sorry to be so discouraging, but that's the way I've been, that's the way I've been feeling about it.

**Bill Calvert** [01:11:06] We're sort of lucky up here in New England, or in this part of New England, anyway. We still have fireflies, lots of them. And it seems like pollution is at a minimum up here.

**David Todd** [01:11:25] Well, you're fortunate. And you live in a very nice area, it sounds like. I hope you see plenty of fireflies tonight. And that as the summer wears on, that the monarchs return and you enjoy those too.

**Bill Calvert** [01:11:43] Well, thank you, David. I appreciate that.

**Bill Calvert** [01:11:45] And I hope that heat dome leaves you soon.

**David Todd** [01:11:52] Me too. Me, too.

**David Todd** [01:11:54] You're really kind to spend time with us today, and I greatly appreciate it and wish you all well.

**Bill Calvert** [01:12:02] Thank you, David. I enjoyed it very much.

**David Todd** [01:12:05] Good. Thank you. Me, too. Take care.

**Bill Calvert** [01:12:08] Bye.

**David Todd** [01:12:08] Bye now.