Dr. Jeffrey Brawn Podcast Transcript The Anthropositive Outlook©

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Krti Tallam: Jeff, thank you so much for being with me today, I am really glad to have you on and get connected with you. So, I'm going to start off by briefly asking you to introduce your research so that the listeners can kind of get a sense of what you've done from your own perspective, and then kind of share how it's led you to the work you're currently doing today.

Jeffrey Brawn: Uh, so the Panama work sort of set the trajectory for the rest of my research career, I've been working in Panama for over 30 years… and I continue to work there, I'm headed down there in about a month and a lot of the work that we're doing there is continuing a long-term project there that I sort of took up the baton and ran with for a while, and I'm in the process of, kind of, deemphasizing that personally, and handing that project off to one of my former graduate students who's a assistant professor at the University of Wyoming, Corey

Tarwater.
So that's kind of my background, but what I'm working on is these days almost entirely on the latest chips of climate change and the viability and sort of the prospects for tropical bird communities, tropical bird populations. I'm becoming very concerned about land-use and climate change in terms of how it's going to affect constituent animal populations and communities, so most of the writing I'm doing, and most of the analysis that I'm doing is taking advantage of the long-term dataset that was accumulated in Panama, which is now, if you include everyone that's been working here, it's close to 40 years of almost continuous modeling, so - monitoring, excuse me - so, it's one of the longest term studies of its kind in the neotropics, so, so we're trying to take advantage of that now and politically, do, see if we can detect trends or relate changes in populations, you know, in the local abundances and what not, to changes in environmental conditions, so I'm doing a lot of that.

Krti Tallam: That's incredible. Is, are there any of those findings that you currently have an idea about that you can share with listeners, or is it kind of all still in the works?
Jeffrey Brawn: Well the most recent thing we've done is, where I work in Panama it's, seasonal tropics, so it's tropics that have a distinct dry season and a distinct wet season… And we looked at the effects of how long the dry season is, on the population biology of some of the species that we've been sampling for years… As it turns out, a longer dry-season has a negative effect on about a third of the species we looked at… So, where you get more sort of xeric or dryer conditions, more intense seasonal drought, you tend to, uh, the populations tend not to do as well, they either don't produce any young that year, or, we're not quite sure of the mechanisms, all we know is that what's called population growth rates are much lower, then you have a much longer dry season, and the reason this is a concern is because most of the projections for the region project longer dry seasons, either in connection with El Nino events, and in Panama where we were, it's an El Nino at least where we were, it tends to be a much longer dry season, it tends to be more intense seasonal drought. So the ENSO events, you know the El Nino oscillation, is expected to be more frequent in the tropics, and just for a number of reasons, things are expected to get dryer in a lot of areas - some areas will get wetter, some areas will get dryer. But the study I referred to, that we did in Panama, and some other studies, are all sort of starting to point too changes in precipitation are going to be really important, and probably more important than changes in temperature at tropical latitudes. In the temperate zone we tend to worry about temperature, but at the tropical latitudes, even in the old-world tropics or the paleo tropics, it looks like changes in rainfall regimes, how much rain falls and when it falls, kind of the pattern of rain fall, um, looks like it's going to be pretty darn important.

Krti Tallam: Wow, that's amazing. Is that in anyway, you talked earlier about land-use and climate change being interconnected. Is the precipitation factor,

um, a direct result of the way land is being used there, or land is being used somewhere else, or is that an indirect effect in some way, and how's climate change playing into that?

Jeffrey Brawn: It, yeah, in Panama probably it's not as much an affect of land use, but there is a lot of evidence now that land use, if you get rid of a forest in an area, that's going to dry that area out, just because of the way rainfall works and kind of evapotranspiration and the way rainfall kind of patterns… the natural history of rainfall in tropical latitudes. So if you take the forest away, you're going to lose a lot of the precipitation that's usually goes back up into the atmosphere from evapotranspiration, it's just lost to runoff. So, in places like um, oh, certain parts of Brazil, Mata Grosso, and other places in Brazil, where there's been a lot of agricultural development, and I understand why there's been agricultural development, people need to eat, and you know, there is a lot of food insecurity in the world, so I'm not knocking agriculture, but where this agriculture does occur, there may be some long-term and regional effects on rainfall patterns, and that's going to actually come back and feed back on the productivity of agriculture… they have to start irrigating, and there's less rainfall, and it starts to dry out. So a lot of tropical biologists have talked about savannah-ization of the rainforest, where the landcover type will convert from rainforest, as kind of a collective term, what - me and you went down there, and we started walking to the forest, it'd be wet, it'd be humid - so let's just say human forests are rainforests. If you get rid of those, or even not directly get rid of them but if there's a lot of drying out, then those forests are not going to persist because they are just not going to be viable without enough rainfall and precipitation. So there may be - what they do in certain areas, with a lot of row-crop development - and a lot of land use, conversion of lands pasture and what not, may actually affect the rainforests, hundreds and thousands of miles away. So that's one factor. And then also, climate forcing, as far as climate change, when we think about it - with more carbon dioxide, with more carbon in the atmosphere, carbon forcing - will also change rainfall patterns as well, so it's a combination of land use and more large-scale, global effects from climate change and carbon in the atmosphere, will both have affects to change rainfall patterns, and so far it does't look too good…it looks like it's pretty concerning for the viability and integrity of a lot of tropical ecosystems.

Krti Tallam: Wow. Two questions, one for the listeners, can you define what you said - carbon forcing or climate forcing?

Jeffrey Brawn: Same thing, you know I'm not a climate modeler and I'm not an atmospheric scientist, so I'll be sloppy with that.

Krti Tallam: Yeah.

Jeffrey Brawn: Because the concentration of carbon in the atmosphere does change a lot of things, and because of warming of the oceans and changes in the frequency of ENSO events, that's going to change rainfall patterns across the latitudes quite a bit. And if you add in the land use factor, then there are two

things that are potentially going to operate in concert to really change rainfall patterns, and we'll have longer dry seasons and more intense seasonal drought and other factors like that, it's tough to predict, in some areas, if you look at sort of the projection map, some areas may actually get wetter, just because of how these things work. But it looks like a lot of these areas are going to get dryer, and that's not good for agriculture and that's not good for tropical biodiversity.

Krti Tallam: Yeah... wow. To go back a little bit, how did you get this position with STRI, because for students who are interested, like for me, I don't know how I'd even apply for that.
Jeffrey Brawn: Yeah, we call it STRI.
Krti Tallam: Oh, okay.
Jeffrey Brawn: STRI has, it's a research bureau of the Smithsonian Institution, in Panama, it's been there for decades, and they have a large number of research scientists there, and I was just fortunate enough to get a postdoc position with one of the scientists who worked down there, a guy named James Carr, who sent someone up from the University of Washington, he's retired now, he's emeritus at the University of Washington, but he started this study. And so, I just got a postdoc there and it worked out really well. And, you know, the way to get that kind of position, if you want a postdoc position, you have to get a doctorate. So, you have to be productive with that, and the way I got hired was that I picked up a lot of analytic / statistical skills when I was in graduate school, and they were looking for kind of an analyst, kind of a person who knows their way around a compute rand can do statistical analysis on some of the data that had been accumulated to that point, and for whatever reason I fit the bill and so I got the job, and went on from there.

Krti Tallam: That's fantastic. The interesting thing about that is I wanted to talk to you, you said it was roughly 1989-1992 that you were a statistical consultant and analyst, right, for the Panama Oil Spill project.
Jeffrey Brawn: Yeah, what happened was - and I forgot the oil company, so I'm not going to speculate that - the oil company, I think it where they were storing oil, they weren't producing oil, but a lot of oil would get stored, a lot of refineries and what not would store oil there, because of the commerce with the Panama Canal, it's a good place to store and load it onto oil barges, I forgot what they call them, but move them around from place to place, this is in the Panama Canal, and I forgot the details but there was just this humungous spill. And it got into the mangroves, and it got into wetlands, and it got into a lot of areas that people had been doing research, from the Smithsonian, had been doing research, before. So it was an ideal opportunity to study the impact of the oil spill, because it kind of had before and after data, and just a lot of biologists down there that, you know, knew enough about those systems in order to be able to do analysis on them. So it was mostly wetland-type systems and mangrove forests, if memory serves, and they just needed someone. I was kind of between contracts

as it were, and I was looking for some work, and I wanted to keep down in Panama, so they just needed an analyst, and I wasn't the only one, there were a couple people living in the States that were hired as statistical consultants who were there to help out the biologists, so it worked out really well.

Krti Tallam: That's amazing - and since then, how have you found that statistics, just this very different field - what people would think is very different from ecology or conservation - how often have you used statistical analyses to look at large-scale models or to just look at your situation in Panama right now.
Jeffrey Brawn: Well you use it for everything. I mean, any day, any graduate student in conservation biology or ecology is going to have to pick up some analytical skill. And it's a lot easier now than it was 30 years ago; now the software's there, R is there, it's free, once you develop a little programming ability in R, and all that wonderful programming and all those routines are available to you. So if you pick up enough coursework to understand conceptually what's going on analytically, then you've just got a really good research skill. So, when I've been training students, I always tell them, 'well it's one thing to be good in the field and to be a good natural historian, I think that's really important, but also to have some sort of analytical skills, whether it's geographic information systems, or you're on a molecular lab, and you know, these days there's molecular or genomic biology, and then analysis comes in there with bioinformatics… Really, if you don't have those kind of research skills to go along with the data acquisition part of it, which is the fun part that gets you out on the field, then, you know, you're really going to be handicapped. And I would say that students these days are much more sophisticated with analytic skills than they were in my day, when I was in school. And then we all took 2-3 STATs courses, but things are just much more available now and it's easier to get at some of this stuff, through some of the software I talked about, that, it's just a lot easier. So.

Krti Tallam: Okay! On that note, so for you, you have backgrounds in applied population ecology, community and evolutionary ecology, statistical ecology, disease ecology… you've a wide range, but for me personally, as a person coming into conservation, and pretty new, I kind of notice that I've been told often to narrow down my focus, which makes sense so that you're looking at a specific area or case study or something, but I've always been told, narrow it down, narrow it down, narrow it down, and I wonder with the climate change predicament today, and with so many factors playing into that, and with people needing to not just have *teams* with different skillsets but also individually being able to understand a lot of like, whether it's statistics or policy or computer science, kind of being able to pull all of that together to make sense of ecology. How do you, how should people train themselves in some way to be good at several topics, or do you recommend be okay at several and then zoom in on one, how do you find that balance?

Jeffrey Brawn: Yeah, you have to get really good at something. Okay, so, say if you were going to do disease ecology, you'd want to learn epidemiology, you'd want to learn a little, you know, about how the pathogens work, so a little bacteriology or a little vector biology, things like that...but you want to learn ecology as well. And in that particular case, modeling skills are very useful in disease ecology and epidemiology. So, you know, these days students need to be good at a lot of things, but really, really good at a couple things that they're going to really focus on. One reason to focus a little bit, is to really learn the primary literature in your area, to know what kind of - what the important questions are - make sure that you are not proposing to do something that was done 20 years ago, which happens a lot, believe it or not, I mean I look through the journals, people are acting like this is a new question and what not, and it's like, 'I remember talking about that 30 years ago' and the techniques might be newer, and you know, so they may be applying more - genomics is a new word, I mean when I was in graduate school, nobody talked about genomics, we talked about molecular genetics - that was just starting in and making a serious impact on conservation, conservation genetics was just starting to, people were starting to think about that. So, it's, you want to bring in skills, but you also want to be able to, you know, have a good knowledge of a couple fields or one field that you're in. So, you really need to know a lot, and I think it's impossible for any one person to know a lot, so if it's a really complex question, you want to get an integrated team together; conservation has become much more collaborative. So, the department that I happen to be in, we have 4 or 5 environmental social scientists. And they're not biologists, you know, they're either policy people or sociologists or psychologists, and because people are so important in conservation biology - you can't do conservation biology without thinking about people; people that think that aren't really conservation biologists - so, things really need to be integrative, and you may need to bring in someone that has really good statistical skills, or knows how to do sampling design, experimental design, bring in somebody that knows the organisms of interests, you might even want to bring in a geographer to do the geographic information, the spatial analysis, so, really, it's hard to get all the skills that are necessary if you're really asking a complex question, so that's why you see these integrated teams of scientists on a lot of grant proposals and a lot of studies that have had high-impact because a lot of people are needed to answer the question because it's so complex.

Krti Tallam: Yeah. That kind of reminds me, so in science, it's a very, very competitive field, and there are a lot of people who are very good at what they do, and interested in making it for themselves in the field, and you know, being someone everybody comes to for a certain topic or something. How do you find generous collaborators to work with, and how do you kind of figure out that pathway. Because, for me I think I've learned the most from having some incredible mentors, and it's also taught me how to be a mentor when I'm older, for younger students. But I think that I was in a very privileged situation. So,

how does everybody kind of deal with that, and if you get a bad collaboration team, how do you kind of work through that.

Jeffrey Brawn: Eh, well a lot of it has to do with just the personality mix and how compatible people are. So, excuse me - you can cut that part out —
Krti Tallam: *Laughter.*
Jeffrey Brawn: You know, but I've been lucky with my collaborations, I've been lucky with great collaborators, I've learned a lot from them, I like to collaborate with people that know a lot more than I do.
Krti Tallam: Mmm, okay.
Jeffrey Brawn: So, you know, sometimes you just want to bring together the necessary skills, and sometimes you want to bring together people you're going to learn a lot from, really depends on the situation. You know, scientific collaboration sometimes it works and sometimes it doesn't. We're all people, and we have types of people that we get along with and types of people that, you know, there's friction with, and you just got to hope that the personality mix is compatible with getting the job done. So, there's no magic formula there, I mean if you're a good person that personally, if you're on a collaborative team, the most important thing is do what you're expected to do, don't rely on other people to do your work. You become known as the person who gets it done, that does what you're supposed to do, that doesn't waste other people's time. As you get on in your career time becomes - well, time is always your most important resource - you don't want waste other peoples' time, and you don't want other people wasting your time. Then that collaboration does not work.

Krti Tallam: That's very interesting. How early on do you suggest a student starts to obtain those experiences - do you think in high school, you know, you should start volunteering in labs, or you think kind of wait till you're a little bit more mature, figure out who you are, a little bit about your interests and then do it in college?

Jeffrey Brawn: You know, there's no one answer to that, it depends on what you're doing, I mean, I'm an avian ecologist so I study birds, so when I recruit students into my lab or into a project, if they've been bird-nerds since they were in grade-school, that's usually a pretty good sign.
Krti Tallam: Yeah.
Jeffrey Brawn: They're outside a lot, they know how to get around on field. To me, the ability to be observant in the field, and what not, is really valuable and so I look for that in students and what not. So, those students, if they start early that's a good thing. They don't have to have done that, but that's usually a good sign. The more field experience you get, the more research experience you get, that's good, but if you're starting late, if your circumstances have made it so you were't able to do that stuff, and you had to, you know, you were financially-pressed to get through college, and you just had to work on something where you were making enough money to pay tuition the next

year, you could still make it. You know. A lot of times, these internships, and these positions in a lab, or doing field work, don't pay that much, and there's a lot of opportunity cost. So there's no magic answer - you should try and get as much experience as you can, but if you're doing really well in class and things have been restricted to that, you might need to do a little catching up, but you can still get it done. So never give up, never give up.

Krti Tallam: That's awesome. That's awesome, because yeah, a lot of people are under the impression that you know, start really early, and that's specifically why I asked that question, because I was also told 'start when you're like 2 years old,' and there's no gap to even figure out where you're going, and for folks who are older, it seems like we're saying, 'oh it's too late,' and I'm not a fan of that, so that's great to hear you say.

Jeffrey Brawn: <*Inaudible*> in a little bit, but you never know. I would say it really depends on what needs to be done and what you're doing, so the more you get done, you've accumulated a reputation fo being reliable and trustworthy and you do good work, then that's all to the good, and the sooner you start to develop that portfolio, that's all to the good, and you know, when we're looking at graduate students, if they published as undergraduates, or been on a project that published as undergraduates, that's pretty good evidence that something went well, and that he or she knows what they are doing. So, if it's a complete blank slate and you have no idea what this person might be like as a researcher or as a, helping in a research project, then you have to have some other things that draw attention to you that would convince someone that you're a good risk for graduate school or for a research project.

Krti Tallam: Okay. Interesting. That's really great, thank you Jeff. So, I had a couple of questions kind of moving now to your current research on ecological disturbance and conservation of avian populations and communities. I was reading your paper, 'Agricultural development for tropical biodiversity,' which is a fantastic piece of work on biodiversity at tropical latitudes and how habitat loss and fragmentation is owing to agricultural drives to a lot of this trend. I'm kind of wondering, and you talked about this a lot earlier when we first started the conversation, I'm kind of curious how - you said people have to eat, and agriculture's system, across the globe, is a really, really big issue right now, because it is, it takes a lot of land and it kind of fragments habitats and it cuts out entire species. So, one, I'm wondering what kingdoms are affected the most, does it tend to be birds, does it tend to be other animals that you've studied, and two, what are some potential theoretical solutions to agriculture and the conflict of having to feed people and saving biodiversity.

Jeffrey Brawn: Well, you know, you're asking really difficult questions. As far as what groups are the most vulnerable, I can't speak to knowledge from that, I mean I study birds, so I know where the birds do well. I do want to make one clarification - you know, the work I've done on ecological disturbance, that's a different kettle of fish than habitat loss due to agriculture.

Krti Tallam: Okay.

Jeffrey Brawn: So in the temperate zone, when you see that there's been a forest fire - and I'm not talking about the kind of fires they just had recently in California, those were tragic and destructive - but fire, flooding, wind, things like that, that disturb habitat periodically in a natural sense, that could be a real creative force in terms of biodiversity. So, ecological disturbance is actually a normal process that enhances biodiversity. When you get to a situation where it's thousands of acres have been clear-cut and converted into pasture, that's not ecological disturbance, that's wholesale loss of an ecosystem - yeah, we'll say an ecosystem - depending on the spatial scale. So those are kind of different, you know, a lot of people kind of mix those up a bit. But, you know, as far as a magic bullet for feeding the world, I happen to be - and some of my biologist friends and I disagree on this - but I happen to be really in favor of where land has been converted to agriculture, i think the more productive the better. I'm a fan of GMOs, because they tend to enhance productivity. There are potentially some downsides to that, for biodiversity and GMOs, but - and - I haven't seen a lot of convincing stuff, but it's not my literature on GMO food and does that have health consequences, I'm not convinced it does, but it's not my area so I really can't speak authoritatively on that. But, you know, my thinking is, if you've converted land to agriculture - and I live in Illinois and it's very, very productive - the more productive, the better, because that may put less demands on other land, and take away the need to develop other land. Now that's in the short-term; in the long-term, if we're just going to keep adding more people, and more people, and more people, and… it's really sad to think about how many people go to bed hungry. I mean, hundreds of millions of people every night on the planet go to bed hungry every night. They're food-insecure - and water insecurity is going to become a problem. Water insecurity and food insecurity are not independent, but those are going to be more and more as we go on. At some point, we need to think about per capita consumption of resources and how many people we have. And it's interesting, you know, I never heard a lot of people talking lately about the population issues at the worldwide level, but at some point, we keep adding a billion people that, you know, the agricultural companies keep saying, 'well we'll have 9 billion people by 2030 and we need to produce so much more food to feed them' - you know, in a way that's right, and in a way that's incomplete, because the incomplete part is, you know, we produce a lot of food now that doesn't get to people that need it; we waste a lot of food, I'm not a food chain analyst, but I am aware that a lot of food that's produced in the United States doesn't end up being - or a lot of agricultural products that are grown don't end up being food - and a lot of food is wasted. So, if we could take care of that, be more efficient, that's going to help. But even if we could wave a wand and not waste any food, and get the food and politically make it so that food can get to the people that need it the most, you know, and there's a lot of it - there's probably enough food that we produce now. People don't go to sleep food insecure simply because there is not enough food on the planet - it's because of poverty and other reasons. So take all that

away, just get all the food to all the people, and eventually, if we get 10 billion, 12 billion - there are going to be limits to growth, and you hear that term a lot, I've heard that term my whole life, because there should be limits to growth - and certainly me being a bird-nerd that studies birds in the tropics, I can't presume to put my views on other cultures and other societies, you know, I don't want to be proscriptive, but eventually, too many people, we're going to have to co-op so much of the planet for food production and human needs, that, in my view, it won't be a very pleasant place or a very inviting place to live. I won't live to see that and probably you won't either. But, I always tell this story that - I've read science fiction my whole life. I always wanted, and I was always just fascinated by time travel, "Oh, I want to go to see what the future's like; oh, now I wanna go back."

Krti Tallam: *Laughter.*

Jeffrey Brawn: Back to like 2,000 years ago because it would have been pretty cool to look at - it would have been really interesting. I mean, I live in Illinois, and Illinois is this *amazingly* productive region because of all the soil and all the water that we have - I would have liked to see what it looked like then, before European settlement. Not that European settlement is all bad or anything like that, but it's really different now because we've co-opted a lot of the land for agricultural production, because it's so good to do it here - it's a great place to grow things. So, I'm not - I hate to say it - but I'm not as optimistic as I used to be. I'm not seeing a lot of political will to grapple with the real difficult problems; I mean, in the States now, we can't even get societal agreement on the importance of climate change and certainly politically. And, we all know that there's some forces at play there that, you know, read into that. I wish I was more optimistic, and maybe there'll be a change, you know, there's been tough times in the past and things that turned out well. And you know, a danger with conservation biology is it's all doom and gloom, it's all loss, it's depressing. I remember when I taught some of the courses at U of I [*the University of Illinois at Urbana-Champaign*] that I taught, it was the most depressing lectures, it was, 'this is bad,' and all that kind of thing, and you know there is still a lot left to retain and people realize this, and there's scenarios where we're going to save half the world's biodiversity, let's save half and that'll be better than nothing, and so we need to be pragmatic but, you know, it shouldn't always have a gloom and doom scenario.

Krti Tallam: Mhm. Well, that's really nice to know, and it's really nice to hear your short-term answer, long-term answer, kind of see how it's all playing together.

Jeffrey Brawn: Well, I don't pretend to have all the answers, I can only give my two cents for it.

Krti Tallam: *Laughter* Well, I appreciate it.

Jeffrey Brawn: It's really complex and again that goes back to people. I mean, the biologists have solutions for a lot of the environmental problems. If there's political will and societal will and people making decisions that are going to enable these biological solutions, that's the hard part, that's the hard

part. So.

Krti Tallam: Have you seen, over the course of working in Panama for 30+ years, have you seen a difference in the amount of technological software or materials being used, and have team dynamics changed in terms of bringing on more interdisciplinary fields, and then how have - you talked about, it was really interesting… you were saying that a lot of these issues motivate the need for close-communication and joint research agendas among conservationists, climate modelers, the agribusiness - so how do all these collaborators pool together in your particular work right now.

Jeffrey Brawn: Well, depending on what you're doing, radio telemetry was around when I was a graduate student, but you know, we're using a lot more radio telemetry, if you're looking at organisms that are large enough, you're putting on radios on the organisms that can actually be picked up by satellite, satellite telemetry, GIS… remote sensing is starting to play a huge role with conservation, especially in the tropics where a LIDAR, even more advanced-types of remote sensing, are allowing us to look at the health of forest ecosystems in places that are really hard to get to, so there's just all sorts of stuff that's being brought into play. And now when, you know, what I do, a lot of what we do is capture birds in mist-nets and put a numbered-leg band on him, and let him go, but now when we capture that bird, we often sample things, like we pull a little bit of blood - not enough to hurt them but we pull a little bit of blood - and we can get what diseases they have through molecular techniques, we can get what kind of, where it came from, we can look up what it's eating through stable isotope analysis, there's all sorts of things that have come in, that have been generated by more, you know, bench science, more lab-oriented science, that really serves the questions that a field biologist or an organismal biologist is going to ask. So there's all sorts of stuff. I mean, I still go out with binoculars and you know, look at stuff. And when you get to be my age, one technology you might want to add are hearing aids, because you start to lose your hearing a little bit, can't hear all the frequencies of the birds you want to hear. So, a lot of biologists my age, as we go on, we start to say, 'oh, you got hearing aids, oh yeah I'm going to try that!' It just sort of happens. But I would say that the way that, say, an avian ecologist - someone that studies birds - does it now verses 50 years ago, is really, really different. And 100 years ago, most avian, most work on birds was done at the end of a shot gun. It was mostly just collecting birds for museum collections - and thank goodness they did it because those museum collections are exceptionally valuable for research - that's very, very different than what we do now.

Krti Tallam: How has the literature, that kind of reminds me, how has the literature changed? Because when I was working on a parasitology project, I also noticed that the early literature was mostly about birds that had been shot, and they had actually opened the guts and looked at - counted - the number of parasites or something.

Jeffrey Brawn: Yeah, they still need to do that actually, that would be a good thing for people to do - it's kind of going out of style.
Krti Tallam: Okay.
Jeffrey Brawn: There's parasitologists that'll tell you that, you know, just the training in order to be able to identify those parasites, and if you did a necropsy of a bird that you sacrificed for study, if you did a necropsy, the skills in order to be able to identify all the parasites, that's getting to be a rare skill, I mean starting, go down to where the systemic <*inaudible*> in museums. So, I'm going to make a plug for people that are trained in systematics - we really need them. We can't identify it, and if we can't innumerate it, it's going to be difficult to tell what's going on, so that's one thing. But, I'll add - I'm not sure I'm answering your question but - well, two things on the literature. One is there is way, way, way more literature than there used to be. When I was a graduate student, there was about 10 journals and now it's in the mid-90s, so it's about 10 journals that you really needed to pay attention to, and now there's hundreds. Just the diversity of journals is, you know, I get papers to review and I've never heard of the journal. You know, so, if I've never done a review form, I'll always say yes so I can add it to my life-list of journals. And plus, it's way more accessible, everything is online. So the amount of information has just gone up by leaps and *bounds* compared to when I was a graduate student. When I was a graduate student, you went to the library. I haven't simply gone to the library to find things out in ... *years*.
Krti Tallam: Even though you're right by the ACES library.
Jeffrey Brawn: I'm at a university that has one of the best libraries in the country, all of it's online. And I can get books online, for books the library will just buy the Kindle version of it and you can get the book online, you don't have to physical have the book in your hand, you can use get rights to that book for an electronic version so it's really nice. So the literature has exploded, and the access of literature has increased, you know, just quantum leaps as far as access goes. So, it's impossible to keep up with all the literature now. That was not the case 50 years ago in ecology. You could pretty much have an idea of what was going on if you kept on what was going on and you just rationally tracked a number of journals.
Krti Tallam: Okay; I'm actually glad you said that because I wanted to know what you thought about the vast number of journals these days, because for me, I have a hard, hard time really getting the whole scope of things. So I kind of stick to *Nature*, or a few that I know, but do you recommend people just kind of find their journals and stick to like 5, 6, or 10, or just read - because there's also the quality of publications that matters for students coming into this.

Jeffrey Brawn: It depends on what you're going. You know, if you had to pick and choose, then the ones that have the highest impact, like *Science* and *Nature* and the journals that are associated with them, they tend to have really, really good papers, and then papers that they cite, you know if you look now, you can go to Web of Science or Google Science or something like that, and you can look at

which journals have the most impact, which have the most buzz. Doesn't always mean the best articles are in there, although usually if a paper is in *Nature* or *Science*, it's darn good. Doesn't always mean the best, and it is not necessarily the most informative depending on what you're looking at. But with things like Google [Scholar] and Web of Science, you can get a bibliography on even a restricted subject very, very quickly, so really it's how much time you have to read it all, should get at really quickly, if you have bibliographic software, you can just have that directly impact into your bibliographic software, and in 20 minutes have 500 references that are relevant to the key terms the you put in there —
Krti Tallam: Like Mendeley.
Jeffrey Brawn: Yeah, right. 50 years ago that would have taken hour after hour after hour to get that done and now you can put in 10 or 15 minutes. So I don't want graduate students complaining.
Krti Tallam: *Laughter* That's a good one - that is a good - that's a good one.
Jeffrey Brawn: Have them complain about… <*fades away*>

Krti Tallam: I want to actually ask if you could share some of those resources so I could put a list for listeners, at the end, to kind of refer to either Google Scholar, Mendeley, or some of these references that you mentioned.
Jeffrey Brawn: Well I used EndNote. And that's related to the people that use Web of Science. So EndNote's really good, Mendeley's good, RefWorks, but you can get free bibliographic software off the web as well, and Google Scholar is free, so that's really, really good. I think *Science* has a subscription fee associated with it, those few sources are very, very good.

Krti Tallam: Okay. Okay, cool. Well, I had just a couple more questions that I think might be helpful for listeners to hear you talk about. And one was, what are some of the current fields of science that you think people or conservationists should probably start training themselves in - you mentioned systematics but in terms of like fields [is] there anything that's lacking right now that we could train ourselves better in?
Jeffrey Brawn: You know, I would say people that still do organismal biology, you know, there's so much good work being done in cell biology and structural biology and genomics and transcriptomics and what not, and a lot of that has implications for medical science that takes up a lot of the, you know, the oxygen in the room, and I don't say that negatively, I think it's really really good science, but interest in organismal biology and studying, you know, being able to - from organisms up, so you know, populations, communities, ecosystems, biomes - I just hope that there's always healthy recognition that that's really important to find out how those biological systems at those levels of organization tick. That's not the only thing that's going to help conserve biodiversity, again you need the environmental policy people, you need the psychologist, you need the sociologists, those are going to be really important. So I would just say that we need a balance, if things really go, so it's just molecular and cell biology,

that’s good, but I think if we get on balance, so I would like to just see a balance in terms of the kinds of biologists that we are producing.

Krti Tallam: That’s really nice, that’s a really good way to kind of phrase that, because I always wondered that with, especially with advancements in technology, what are we forgetting about. One of my mentors once told me that students these days don’t have strong natural history backgrounds and so that was interesting to me too, that you know, I kind of neglected that field altogether, so cool!
Jeffrey Brawn: Yeah. There’s no substitute to getting a pair of binoculars and going out there and looking at stuff that’s flying around and flipping rocks and seeing what’s under it. That stuff, I hope there’s always a place for that because you can learn a lot.

Krti Tallam: Yeah. If you, I wanted to ask if you had thoughts or advice for budding conservationists, so if you wanted to talk more about birding, please do because I love it.

Jeffrey Brawn: Well, you know, I’m not the best birder in the world… know that. But, you know, birds aren’t the only things to look at, there’s people that just go out and learn how to identify plants, you know, and they just become sort of amateur botanists, butterflies —
Krti Tallam: Snakes.
Jeffrey Brawn: All sorts of stuff, fish, you know, people that like to go in the coral reefs to identify al the fish there and what not, so it just depends on what particular area you’re in, I mean birding is really popular because most of the birds you can see during the day, they’re large enough so that you don’t have to, you know, you can see them with the naked eye or with a reasonably good set of binoculars, and there’s plenty of field guides that, you know, can help you do that. Now there’s, there’s services and software out there if you take a picture of a bird and you submit it to, you know, a recognition software, it’ll tell you what it is.

Krti Tallam: Yeah. Can you name any of those right now?
Jeffrey Brawn: Pardon?
Krti Tallam: Do any of those names come to you right now of those softwares?
Jeffrey Brawn: Yeah — there’s — I think it’s already there, usually the Cornell Lab of Ornithology is the most innovating grow pot the thing, so they’d be a place to start. I’m not quite sure it’s there yet, but it’s getting there. You know, there may be some commercial outlets that do that as well, or a birder just takes a picture of a bird and submits it, and there it is, you know, expert software.
Krti Tallam: Right. Okay.
Jeffrey Brawn: Cornell Lab of Ornithology, they’ve been innovating a lot, so usually if something is being innovated, they’re a good place to start to find out what’s going on.

Krti Tallam: Nice. Yeah, I've heard they have a phenomenal collection too of birds.
Jeffrey Brawn: They have an infamous collection, they have, I think one of the largest sound collections in the world.
Krti Tallam: I believe so, yeah.
Jeffrey Brawn: Not a collection with skins and what not, that's not what they, not as much as the Field Museum in Chicago would have, you know, or the Smithsonian would have huge physical specimens, but Cornell Lab has a huge sound collection, they're the ones that started Project FeederWatch, they also started eBird where birders go out and everything they see during that day, they can submit, and all that stuff gets integrated, so you get just an amazing amount of information that just birders and citizen scientists can contribute.
Krti Tallam: Ah, yes. Yeah. Well, I want to ask you so many more questions but I don't want to take up all your time, so I'll ask you one more which is - *laughter* - I'm sorry! *Laughter* Which is, can you share - *laughter* - can you share with listeners, any of your favorite authors.
Jeffrey Brawn: Scientific literature?
Krti Tallam: No, like even, no anything - because you love science fiction, so even authors from conservation, fiction, or anything related to that.
Jeffrey Brawn: I don't know, I have people that I read a lot, I mean in science fiction my favorite author is a person that passed away a few years ago named Jack Vance, v-a-n-c-e. So I was fascinated by him, you know, Isaac Asimov, Ursula LeGuin who just passed away.
Krti Tallam: Yes.
Jeffrey Brawn: She passed away recently, so I'm a little limited that way since I just read so much sci-fi and fantastic and all that stuff. But, you know, the pioneer people that got me interested in this kind of work would be, you know, early conservation people, you know, Charles Elton, he's from England, was from England, Paul Ehrlich, who's still with us, he's at Stanford, EO Wilson you know, these are sort of iconic people. But they're, you know, reading some of their stuff - you know, Robert MacArthur - <*inaudible*> me into ecology, they just stimulated my interest enough that I wanted to learn more, so, but.

Krti Tallam: That's awesome - that's fantastic. Well, Jeff, thank you so much. It's been a pleasure to talk to you and to learn more about your work.
Jeffrey Brawn: Okay. Well, you're welcome!

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