

3 Before you watch

- 1 (0:20)** In the summer of 2011, as a tourist, I visited the rainforests of Borneo for the very first time, and as you might imagine, it was the overwhelming sounds of the forest that struck me the most. There's this constant cacophony of noise. Some things actually do stick out. For example, this here is a big bird, a rhinoceros hornbill. This buzzing is a cicada. This is a family of gibbons. It's actually singing to each other over a great distance.
- 2 (0:58)** The place where this was recorded was in fact a gibbon reserve, which is why you can hear so many of them, but in fact the most important noise that was coming out of the forest that time was one that I didn't notice, and in fact nobody there had actually noticed it.
- 3 (1:13)** So, as I said, this was a gibbon reserve. They spend most of their time rehabilitating gibbons, but they also have to spend a lot of their time protecting their area from illegal logging that takes place on the side. And so if we take the sound of the forest and we actually turn down the gibbons, the insects, and the rest, in the background, the entire time, in recordings you heard, was the sound of a chainsaw at great distance. They had three full-time guards who were posted around this sanctuary whose job was in fact to guard against illegal logging, and one day, we went walking, again as tourists, out into the forest, and within five minutes' walk, we stumbled upon somebody who was just sawing a tree down, five minutes' walk, a few hundred meters from the ranger station. They hadn't been able to hear the chainsaws, because as you heard, the forest is very, very loud.
- 4 (2:03)** It struck me as quite unacceptable that in this modern time, just a few hundred meters away from a ranger station in a sanctuary, that in fact nobody could hear it when someone who has a chainsaw gets fired up. It sounds impossible, but in fact, it was quite true.
- 5 (2:20)** So how do we stop illegal logging? It's really tempting, as an engineer, always to come up with a high-tech, super-crazy high-tech solution, but in fact, you're in the rainforest. It has to be simple, it has to be scalable, and so what we also noticed while we were there was that everything we needed was already there. We could build a system that would allow us to stop this using what's already there.
- 6 (2:42)** Who was there? What was already in the forest? Well, we had people. We had this group there that was dedicated, three full-time guards, that was dedicated to go and stop it, but they just needed to know what was happening out in the forest. The real surprise, this is the big one, was that there was connectivity out in the forest. There was cell phone service way out in the middle of nowhere. We're talking hundreds of kilometers from the nearest road, there's certainly no electricity, but they had very good cell phone service, these people in the towns were on Facebook all the time, they're surfing the web on their phones, and this sort of got me thinking that in fact it would be possible to use the sounds of the forest, pick up the sounds of chainsaws programmatically, because people can't hear them, and send an alert. But you have to have a device to go up in the trees. So if we can use some device to listen to the sounds of the forest, connect to the cell phone network that's there, and send an alert to people on the ground, perhaps we could have a solution to this issue for them.
- 7 (3:37)** But let's take a moment to talk about saving the rainforest, because it's something that we've definitely all heard about forever. People in my generation have heard about saving the rainforest since we were kids, and it seems that the message has never changed: We've got to save the rainforest, it's super urgent, this many football fields have been destroyed yesterday, and yet here we are today, about half of the rainforest remains, and we have potentially more urgent problems like climate change.
- 8 (4:04)** But in fact, this is the little-known fact that I didn't realize at the time: Deforestation accounts for more greenhouse gas than all of the world's planes, trains, cars, trucks and ships combined. It's the second highest contributor to climate change. Also, according to Interpol, as much as 90 percent of the logging that takes place in the rainforest is illegal logging, like the illegal logging that we saw. So if we can help people in the forest enforce the rules that are there, then in fact we could eat heavily into this 17 percent and potentially have a major impact in the short term. It might just be the cheapest, fastest way to fight climate change.



- 9 (4:43)** And so here's the system that we imagine. It looks super high tech. The moment a sound of a chainsaw is heard in the forest, the device picks up the sound of the chainsaw, it sends an alert through the standard GSM network that's already there to a ranger in the field who can in fact show up in real time and stop the logging. It's no more about going out and finding a tree that's been cut. It's not about seeing a tree from a satellite in an area that's been clear cut, it's about real-time intervention.
- 10 (5:10)** So I said it was the cheapest and fastest way to do it, but in fact, actually, as you saw, they weren't able to do it, so it may not be so cheap and fast. But if the devices in the trees were actually cell phones, it could be pretty cheap. Cell phones are thrown away by the hundreds of millions every year, hundreds of millions in the U.S. alone, not counting the rest of the world, which of course we should do, but in fact, cell phones are great. They're full of sensors. They can listen to the sounds of the forest. We do have to protect them. We have to put them in this box that you see here, and we do have to power them. Powering them is one of the greater engineering challenges that we had to deal with, because powering a cell phone under a tree canopy, any sort of solar power under a tree canopy, was an as-yet-unsolved problem, and that's this unique solar panel design that you see here, which in fact is built also from recycled byproducts of an industrial process. These are strips that are cut down.
- 11 (6:04)** So this is me putting it all together in my parents' garage, actually. Thanks very much to them for allowing me to do that. As you can see, this is a device up in a tree. What you can see from here, perhaps, is that they are pretty well obscured up in the tree canopy at a distance. That's important, because although they are able to hear chainsaw noises up to a kilometer in the distance, allowing them to cover about three square kilometers, if someone were to take them, it would make the area unprotected.
- 12 (4:34)** So does it actually work? Well, to test it, we took it back to Indonesia, not the same place, but another place, to another gibbon reserve that was threatened daily by illegal logging. On the very second day, it picked up illegal chainsaw noises. We were able to get a real-time alert. I got an email on my phone. Actually, we had just climbed the tree. Everyone had just gotten back down. All these guys are smoking cigarettes, and then I get an email, and they all quiet down, and in fact you can hear the chainsaw really, really faint in the background, but no one had noticed it until that moment. And so then we took off to actually stop these loggers. I was pretty nervous. This is the moment where we've actually arrived close to where the loggers are. This is the moment where you can see where I'm actually regretting perhaps the entire endeavor. I'm not really sure what's on the other side of this hill. That guy's much braver than I am. But he went, so I had to go, walking up, and in fact, he made it over the hill, and interrupted the loggers in the act. For them, it was such a surprise -- they had never, ever been interrupted before -- that it was such an impressive event for them, that we've heard from our partners they have not been back since. They were, in fact, great guys. They showed us how the entire operation works, and what they really convinced us on the spot was that if you can show up in real time and stop people, it's enough of a deterrent they won't come back.
- 13 (8:00)** So -- Thank you. (Applause)
- 14 (8:08)** Word of this spread, possibly because we told a lot of people, and in fact, then some really amazing stuff started to happen. People from around the world started to send us emails, phone calls. What we saw was that people throughout Asia, people throughout Africa, people throughout South America, they told us that they could use it too, and what's most important, what we'd found that we thought might be exceptional, in the forest there was pretty good cell phone service. That was not exceptional, we were told, and that particularly is on the periphery of the forests that are most under threat. And then something really amazing happened, which was that people started sending us their own old cell phones. So in fact what we have now is a system where we can use people on the ground, people who are already there, who can both improve and use the existing connectivity, and we're using old cell phones that are being sent to us by people from around the world that want their phones to be doing something else in their afterlife, so to speak. And if the rest of the device can be completely recycled, then we believe it's an entirely upcycled device.



- 15 (9:06)** So again, this didn't come because of any sort of high-tech solution. It just came from using what's already there, and I'm thoroughly convinced that if it's not phones, that there's always going to be enough there that you can build similar solutions that can be very effective in new contexts.
- 16 (9:32)** Thank you very much.

