NASA SILICON VALLEY

PODCAST

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00:00:00,429 --> 00:00:04,750
Host (Matthew Buffington): You’re listening to the NASA in Silicon Valley podcast, Episode

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00:00:04,750 --> 00:00:05,750
64.

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00:00:05,750 --> 00:00:08,520
Today for the intro I have Frank joining me again.

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00:00:08,520 --> 00:00:10,620
Frank, tell us a little bit about our guest today.

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00:00:10,620 --> 00:00:11,660
Frank Tavares: Hey, Matt.

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00:00:11,660 --> 00:00:12,660
Sure!

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00:00:12,660 --> 00:00:14,010
Today our guest is Adam Moreno.

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00:00:14,010 --> 00:00:17,350
He was actually a fan of the podcast before coming to NASA.

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00:00:17,350 --> 00:00:22,191
So that’s kinda a cool thing to see that cycle of the podcast bringing people in, and

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00:00:22,191 --> 00:00:24,400
now putting that all back out there.

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00:00:24,400 --> 00:00:28,100
Host: It was interesting after we recorded the session that he was like, "Oh yeah, I’ve

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00:00:28,100 --> 00:00:30,789
listened to all the episodes before, so this
is kinda surreal."

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00:00:30,789 --> 00:00:32,810
So it’s nice coming full circle.

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00:00:32,810 --> 00:00:33,980
Frank Tavares: Totally, totally.

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00:00:33,980 --> 00:00:39,790
So yeah, Adam is a computer scientist by trade
who sits at the crux between supercomputing

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00:00:39,790 --> 00:00:41,590
and Earth Sciences.

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00:00:41,590 --> 00:00:47,760
Which is I think a really cool combination
of skillsets because NASA does so much research

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00:00:47,760 --> 00:00:52,260
on Earth sciences and gathers a huge amount
of global data.

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00:00:52,260 --> 00:00:57,010
So what Adam does is he works with a program
called NEX, the NASA Earth Exchange, that

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00:00:57,010 --> 00:01:01,790
works to bring those datasets and make them
public, so any researcher anywhere in the

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00:01:01,790 --> 00:01:05,640
world can make use of all that data that NASA
collects.

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00:01:05,640 --> 00:01:10,890
So especially in this day and age, having

access to all of that information about the

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00:01:10,890 --> 00:01:14,630
Earth’s climate systems and weather and
all this different stuff can be really, really

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00:01:14,630 --> 00:01:15,630
important.

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00:01:15,630 --> 00:01:16,630
Host: Excellent!

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00:01:16,630 --> 00:01:19,560
So we don’t want to spoil it too much, but
a little bit of housekeeping before we jump

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00:01:19,560 --> 00:01:20,560
on in.

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00:01:20,560 --> 00:01:25,420
Folks who are listening, who want to participate,
we’re using the hashtag #NASASiliconValley

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00:01:25,420 --> 00:01:27,810
on any social media platform you can think
of.

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00:01:27,810 --> 00:01:33,409
Also, we have a phone number, that’s (650)
604-1400.

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00:01:33,409 --> 00:01:37,619
Give us a call, leave us a message, we’ll
see how we can integrate that into the episodes.

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00:01:37,619 --> 00:01:44,060
Also, obviously if you’ve already found
us, we would love reviews, comments, thoughts,

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00:01:44,060 --> 00:01:45,780
suggestions, all that stuff.

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00:01:45,780 --> 00:01:48,660
You can find us on all of the major podcast platforms.

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00:01:48,660 --> 00:01:53,640
Or you can grab our RSS feed and plug into your favorite podcasting app.

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00:01:53,640 --> 00:01:55,010
But for today's episode…

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00:01:55,010 --> 00:01:57,840
Frank Tavares: Let's hear from Adam Moreno.

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00:01:57,840 --> 00:02:09,900
[Music]

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00:02:09,900 --> 00:02:11,400
Host: Tell us a little bit about yourself.

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00:02:11,409 --> 00:02:15,569
You haven't been here that long, but what brought you to NASA?

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00:02:15,569 --> 00:02:17,299
How did you end up in Silicon Valley?

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00:02:17,299 --> 00:02:24,799
Adam Moreno: Yeah, so I'm from a small, rural town in northeastern Oregon.

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00:02:24,799 --> 00:02:29,760
Then I went and got my bachelor's in computer engineering from Oregon State.

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00:02:29,760 --> 00:02:36,590

I went into the Peace Corps for a couple years,
then went to graduate school for my master's

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00:02:36,590 --> 00:02:39,290
at University of Montana.

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00:02:39,290 --> 00:02:46,091
There, I was fortunate enough to have an advisor
who, super smart, super nice guy, and has

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00:02:46,091 --> 00:02:53,760
been working with NASA for years now, decades
now, on some of their Earth-observing satellite

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00:02:53,760 --> 00:02:55,409
missions.

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00:02:55,409 --> 00:03:01,889
While I was there, he, I guess, got an invitation
from NASA Ames to send some of his students

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00:03:01,889 --> 00:03:10,309
to come here and learn how to use the supercomputer
that we have here to be able to do cool Earth

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00:03:10,309 --> 00:03:11,309
science.

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00:03:11,309 --> 00:03:16,730
Host: So even thinking back, I'm imagining
spending time in Montana, it's called Big

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00:03:16,730 --> 00:03:18,849
Sky for a reason.

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00:03:18,849 --> 00:03:24,120
But even imagining like Peace Corps, I mean
I know from traveling overseas, if you go

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00:03:24,120 --> 00:03:28,290
to some countries that are developing countries,
not as much light pollution.

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00:03:28,290 --> 00:03:30,819
I'm thinking Montana, not as much light pollution.

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00:03:30,819 --> 00:03:34,969
So you'd just be like sitting back and looking
at the stars, like just blow your mind.

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00:03:34,969 --> 00:03:36,430
Adam Moreno: Yeah, that's right.

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00:03:36,430 --> 00:03:40,620
But you know actually I think it's interesting
because if you ask most people what they think

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00:03:40,620 --> 00:03:45,290
about NASA, or what comes to mind when they
think about NASA, the first thing that comes

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00:03:45,290 --> 00:03:47,010
to mind, of course, is space.

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00:03:47,010 --> 00:03:51,089
You know, astronauts, space shuttles, and
of course we do all that cool stuff.

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00:03:51,089 --> 00:03:53,819
But we also do a lot of cool Earth science
as well.

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00:03:53,819 --> 00:03:54,819
Host: Absolutely.

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00:03:54,819 --> 00:04:00,290
Adam Moreno: And so actually, in the Peace
Corps, this is where I kind of changed gears.

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00:04:00,290 --> 00:04:04,979
Because I had a degree in computer engineering,
but then I went into the Peace Corp, and I

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00:04:04,979 --> 00:04:05,979
went –

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00:04:05,979 --> 00:04:09,299
Host: That seems kind of rare, going from
computer engineering to go to the Peace Corps.

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00:04:09,299 --> 00:04:10,299
Where did you go?

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00:04:10,299 --> 00:04:11,299
What did you do?

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00:04:11,299 --> 00:04:12,299
Adam Moreno: Well, so I went to Paraguay.

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00:04:12,299 --> 00:04:18,060
I was sent out into the jungle in Paraguay
to a little community of like 300 people.

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00:04:18,060 --> 00:04:20,049
I built my house there.

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00:04:20,049 --> 00:04:23,150
I worked with the schools, farmers, students,
all that sort of stuff.

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00:04:23,150 --> 00:04:27,030
But what I think actually kind of changed
my path from maybe a traditional engineering

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00:04:27,030 --> 00:04:33,490
path to doing Earth science sort of stuff
is just, you know, the majority of people

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00:04:33,490 --> 00:04:39,179
who live out in the countryside in South America
are subsistence farmers, right?

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00:04:39,179 --> 00:04:42,340
They live off of what they grow.

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00:04:42,340 --> 00:04:45,400
If they don't grow anything, their family
doesn't eat.

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00:04:45,400 --> 00:04:47,919
So things like droughts and heatwaves –

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00:04:47,919 --> 00:04:48,919
Host: High stakes.

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00:04:48,919 --> 00:04:51,419
Adam Moreno: Yeah, they're a matter of life
and death, really.

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00:04:51,419 --> 00:04:57,980
So when I came back I realized I want to work
on something that can help the majority of

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00:04:57,980 --> 00:05:02,860
the world that are so tied to the environment
that it's a matter of life and death.

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00:05:02,860 --> 00:05:10,210
So I came back and I decided that I wanted
to study climate-related issues, ecology-related

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00:05:10,210 --> 00:05:11,360
issues.

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00:05:11,360 --> 00:05:17,550
So at University of Montana I studied forest
ecology and ecological modeling.

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00:05:17,550 --> 00:05:23,120
And ecological modeling just means taking
an ecological system, like a forest, turning

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00:05:23,120 --> 00:05:28,919
it into mathematical equations, and then turning
those equations into a computer model that

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00:05:28,919 --> 00:05:29,919
you can then use to –

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00:05:29,919 --> 00:05:35,969
Host: Yeah, and this is one of the cool things
that NASA does, is the data collection, then

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00:05:35,969 --> 00:05:38,900
using the scientific community to turn data
into knowledge.

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00:05:38,900 --> 00:05:44,560
But gathering that data, it's not just from
satellite-based telescopes.

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00:05:44,560 --> 00:05:48,599
There's a lot of data collection on the ground.

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00:05:48,599 --> 00:05:54,250
People always tend to think of the larger
climate, the big picture, mother Earth perspective,

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00:05:54,250 --> 00:05:56,560
but a lot of that data is used for agriculture.

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00:05:56,560 --> 00:05:57,689
Adam Moreno: Yeah, that's right.

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00:05:57,689 --> 00:06:02,719
Host: Even here in the United States, it's

crucial information for, you know, even disaster

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00:06:02,719 --> 00:06:03,719
response.

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00:06:03,719 --> 00:06:07,810
You've got to know how the Earth is reacting.

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00:06:07,810 --> 00:06:12,040
That data that NASA collects pays dividends
for all kinds of groups down the road.

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00:06:12,040 --> 00:06:13,239
Adam Moreno: Yeah, that's right.

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00:06:13,239 --> 00:06:14,639
And that's NASA's job, right?

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00:06:14,639 --> 00:06:20,340
To understand this huge, massive, complex
system that we're living on, and in, and that

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00:06:20,340 --> 00:06:21,340
we depend on.

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00:06:21,340 --> 00:06:25,789
I mean it hasn't been that long that humans
have been able to actually study the whole

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00:06:25,789 --> 00:06:27,699
entire globe.

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00:06:27,699 --> 00:06:34,259
It wasn't until the '70s that NASA and USGS
sent up the first satellites dedicated to

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00:06:34,259 --> 00:06:37,590
monitoring the environment, actually.

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00:06:37,590 --> 00:06:41,969
And also you need big computers to be able
to understand what's going on, and that also

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00:06:41,969 --> 00:06:43,349
hasn't been that long.

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00:06:43,349 --> 00:06:49,560
So actually this is all relatively new science,
being able to study continents, entire continents,

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00:06:49,560 --> 00:06:53,550
or the entire global system altogether.

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00:06:53,550 --> 00:06:56,930
But yeah, so that's what I do here.

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00:06:56,930 --> 00:07:00,490
But that was my master's.

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00:07:00,490 --> 00:07:06,779
I did my master's in Montana, then for my
Ph.D. I went to Vienna, Austria, and I did

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00:07:06,779 --> 00:07:09,449
my Ph.D. over there.

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00:07:09,449 --> 00:07:19,189
My last year of my Ph.D., I came to AGU, the
American Geophysical Union, here in San Francisco.

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00:07:19,189 --> 00:07:21,029
I knew I wanted to come NASA.

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00:07:21,029 --> 00:07:23,180
I'd been here before, I had some exposure.

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00:07:23,180 --> 00:07:26,400

I was like, "Okay, this is where I want to
be."

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00:07:26,400 --> 00:07:34,029
So I met with Rama Nemani, who is now my mentor
here at Ames, and I just asked him.

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00:07:34,029 --> 00:07:39,060
I was like, "I want to come be in your group,
how can I make this happen?"

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00:07:39,060 --> 00:07:45,189
He pointed me towards this fellowship opportunity
that all NASA bases have.

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00:07:45,189 --> 00:07:49,620
So I applied for it, and I got it, and now
I'm here.

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00:07:49,620 --> 00:07:53,879
Host: And you said, it hasn't even been quite
a year yet.

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00:07:53,879 --> 00:07:54,879
Adam Moreno: No, not even a year.

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00:07:54,879 --> 00:07:55,879
Host: Oh wow.

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00:07:55,879 --> 00:07:58,969
And we were talking right before we came on
doing this that you had actually listened

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00:07:58,969 --> 00:08:01,199
to the podcast before even joining up.

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00:08:01,199 --> 00:08:02,220
Adam Moreno: Yeah, that's right.

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00:08:02,220 --> 00:08:05,370
Host: "Well, I'm going to be working there,
better find out what people are doing."

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00:08:05,370 --> 00:08:06,469
Adam Moreno: Yeah, that's right.

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00:08:06,469 --> 00:08:10,309
So, my last year of my Ph.D., I knew I was
coming.

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00:08:10,309 --> 00:08:14,689
I wasn't really nervous, I was just kind of
concentrating on my dissertation and defending,

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00:08:14,689 --> 00:08:18,150
but then I stumbled across this podcast here.

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00:08:18,150 --> 00:08:21,879
That's when I got nervous, actually.

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00:08:21,879 --> 00:08:26,210
Hearing about all the cool stuff all the smart
people here are doing, and I was like, "Oh

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00:08:26,210 --> 00:08:27,710
okay, coming to the big leagues now."

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00:08:27,710 --> 00:08:29,039
Host: Oh, fun.

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00:08:29,039 --> 00:08:31,930
So you're working right now, is it called
Earth Exchange?

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00:08:31,930 --> 00:08:33,089
Am I saying that right?

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00:08:33,089 --> 00:08:35,360

Adam Moreno: The NASA Earth Exchange, yeah.

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00:08:35,360 --> 00:08:43,149
I work in a group called the NASA Earth Exchange,
or NEX, and it's made up of Earth scientists

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00:08:43,149 --> 00:08:45,230
and software engineers.

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00:08:45,230 --> 00:08:52,610
So actually it's kind of a hybrid group of
the Earth sciences division and the advanced

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00:08:52,610 --> 00:08:55,930
supercomputing division.

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00:08:55,930 --> 00:09:06,060
What's NEX's goal is, is just facilitating
Earth scientists to be able to use all of

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00:09:06,060 --> 00:09:13,250
NASA's facilities, like the supercomputer,
and getting access to all of the data that

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00:09:13,250 --> 00:09:14,630
exists in the world actually.

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00:09:14,630 --> 00:09:23,610
So we try to bring in massive datasets, bring
it in to one place, then allow the NASA scientists,

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00:09:23,610 --> 00:09:27,920
especially throughout all of the bases at
NASA to come and be able to use the facilities

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00:09:27,920 --> 00:09:28,920
here.

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00:09:28,920 --> 00:09:34,910

And I think the longer-term goal is to make
it even more accessible to the general public

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00:09:34,910 --> 00:09:36,300
at large.

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00:09:36,300 --> 00:09:41,390
You know, NASA has 10 to 12 bases, however
you want to count it.

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00:09:41,390 --> 00:09:43,500
Host: Different centers and locations.

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00:09:43,500 --> 00:09:45,709
Adam Moreno: Right, different centers.

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00:09:45,709 --> 00:09:51,400
You know, there's a lot of people doing all
kinds of science there, but maybe they don't

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00:09:51,400 --> 00:09:55,160
all have direct access to the supercomputer
like we do here at Ames.

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00:09:55,160 --> 00:09:59,980
So NEX's idea was just to help facilitate
that.

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00:09:59,980 --> 00:10:03,490
Host: Help facilitate that because it's not
only the researchers here, it's also NASA,

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00:10:03,490 --> 00:10:09,199
as funded by the taxpayers, goes through great
effort to get that information also available

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00:10:09,199 --> 00:10:11,449
to the scientific community.

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00:10:11,449 --> 00:10:16,020
Because we don't have to do it on our own,
we can reach out to the larger group.

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00:10:16,020 --> 00:10:20,310
You almost kind of crowdfund, or you know,
crowdsource, I guess.

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00:10:20,310 --> 00:10:25,130
Have everybody working and looking at these
datasets and you just see things as they pop

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00:10:25,130 --> 00:10:26,130
up.

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00:10:26,130 --> 00:10:27,130
Adam Moreno: That's right.

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00:10:27,130 --> 00:10:33,180
One of the great things that NASA Earth science
does is they give out their data to the entire

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00:10:33,180 --> 00:10:36,800
world for free, actually.

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00:10:36,800 --> 00:10:41,250
This actually spurs science and innovation
all over the world.

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00:10:41,250 --> 00:10:47,370
Because as scientists here in the United States,
maybe we don't focus on small countries like

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00:10:47,370 --> 00:10:52,779
Paraguay or something, but if I'm an ecologist
in Paraguay, you know, Paraguay can't afford

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00:10:52,779 --> 00:10:58,959
to have a space program, but they can get
access to NASA's data to help them understand

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00:10:58,959 --> 00:11:03,190
their ecosystem over there.

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00:11:03,190 --> 00:11:07,360
That's one of the great things NASA does,
is give away all of the data that we have

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00:11:07,360 --> 00:11:10,450
processed, ready to use, for free to the entire
world.

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00:11:10,450 --> 00:11:15,801
Host: Yeah, not too long ago, we had one of
the exoplanet specialists in here, and they

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00:11:15,801 --> 00:11:19,800
were talking about – of course, traditionally
when you think of NASA, you think of rocket

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00:11:19,800 --> 00:11:23,660
launches, but you also think of looking out
into the universe, the solar system and beyond

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00:11:23,660 --> 00:11:30,019
– but they were telling this story of how
looking at a faraway star and how a planet

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00:11:30,019 --> 00:11:34,500
will transit in front of it, and then you
can confirm, "Yes, okay.

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00:11:34,500 --> 00:11:37,080
There is an exoplanet around that star."

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00:11:37,080 --> 00:11:41,639
You can see how that planet pulls on the gravity
to get another idea of like, you can start

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00:11:41,639 --> 00:11:45,630
deducing the density of that planet.

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00:11:45,630 --> 00:11:51,540
But then she was also saying how if you capture
that light right as it gets through the ring

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00:11:51,540 --> 00:11:58,920
around that star, you have light that passes
through that planet's atmosphere, we can look

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00:11:58,920 --> 00:12:04,630
at that atmosphere, you put it out on the
spectrum and you can start figuring out, "Oh,

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00:12:04,630 --> 00:12:06,550
this is mainly made of oxygen, nitrogen.

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00:12:06,550 --> 00:12:10,920
This is more carbon," or whatever the molecules
or the properties.

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00:12:10,920 --> 00:12:15,339
So you can really start to understand exoplanets
and understand what they're making up.

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00:12:15,339 --> 00:12:22,529
And I immediately think of an analog of a
planet to compare it to, is the one we're

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00:12:22,529 --> 00:12:23,970
sitting on.

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00:12:23,970 --> 00:12:29,660
So as much as we can understand what this
Earth is doing, and what it's made of, then

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00:12:29,660 --> 00:12:33,190
that helps us be able to compare it to those
exoplanets so we can confirm, are they really

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00:12:33,190 --> 00:12:35,660
Earth-like planets out there?

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00:12:35,660 --> 00:12:37,259
And we know that because of what we know about Earth.

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00:12:37,259 --> 00:12:39,500
Adam Moreno: Yeah, no, that's right.

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00:12:39,500 --> 00:12:41,930
That's another reason why NASA does Earth science.

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00:12:41,930 --> 00:12:46,110
Because we need to understand what's happening on Earth to be able to understand the other

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00:12:46,110 --> 00:12:47,110
planets.

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00:12:47,110 --> 00:12:51,580
And actually one of the great things about being an early-career scientist here at NASA,

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00:12:51,580 --> 00:12:55,230
is we have this early-career network here.

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00:12:55,230 --> 00:13:01,639
Part of that is we take tours of different places around Silicon Valley, we also have

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00:13:01,639 --> 00:13:04,400
these happy hours and stuff.

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00:13:04,400 --> 00:13:09,269
So during the happy hours I've been able to talk with other scientists who are not Earth

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00:13:09,269 --> 00:13:11,330
scientists, you know, they're studying planets
or whatever.

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00:13:11,330 --> 00:13:13,310
Host: This is the newcomers to NASA.

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00:13:13,310 --> 00:13:16,000
Adam Moreno: Yeah, and they're doing the cutting-edge
stuff.

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00:13:16,000 --> 00:13:18,820
There is a lot of overlap.

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00:13:18,820 --> 00:13:24,850
There are a lot of people who are doing spectroscopy
on other planets, and the same methods that

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00:13:24,850 --> 00:13:31,100
they use are derived maybe from the methods
that were developed first to study the Earth,

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00:13:31,100 --> 00:13:32,100
actually.

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00:13:32,100 --> 00:13:35,400
Host: And I think some of your work, talking
about the supercomputers and software, it's

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00:13:35,400 --> 00:13:39,709
also one of those natural ways to kind of
pull things together.

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00:13:39,709 --> 00:13:42,459
It seems like, whereas stuff may have been
silo-ed.

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00:13:42,459 --> 00:13:48,380

Like okay, you have Earth science over here,
you have biosciences in one area, astrophysicists,

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00:13:48,380 --> 00:13:54,389
or even aeronautics, but it seems like a commonality
between a lot of these is becoming computing.

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00:13:54,389 --> 00:13:59,740
Because everybody who is doing research, the
supercomputer can help make better sense of

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00:13:59,740 --> 00:14:00,740
the data.

222
00:14:00,740 --> 00:14:02,850
Adam Moreno: Yeah, that's right.

223
00:14:02,850 --> 00:14:09,350
Getting data from one of the satellites about
Earth, that's super cool, and you can learn

224
00:14:09,350 --> 00:14:11,879
a lot just by looking at that data.

225
00:14:11,879 --> 00:14:17,449
But in Earth science, often what we do is
we take data from all sorts of different sources.

226
00:14:17,449 --> 00:14:19,140
Maybe several different satellites.

227
00:14:19,140 --> 00:14:20,140
Host: Okay.

228
00:14:20,140 --> 00:14:21,140
They have different instruments on them.

229
00:14:21,140 --> 00:14:22,140
They're looking at different things.

230
00:14:22,140 --> 00:14:23,600
Adam Moreno: Right, they're looking at different
things.

231
00:14:23,600 --> 00:14:27,940
Maybe one is looking at the oceans, one is
looking at the forests, atmospheres, cryosphere,

232
00:14:27,940 --> 00:14:29,529
so on and so forth.

233
00:14:29,529 --> 00:14:33,220
But then we also couple that with data on
the ground.

234
00:14:33,220 --> 00:14:39,019
So in my case, I study forests, so I'll take
forest inventory data where people are on

235
00:14:39,019 --> 00:14:46,279
the ground measuring forests, along with weather
station data, and soil data, and then we try

236
00:14:46,279 --> 00:14:50,920
to put that all together to make something
even greater than the sum of its parts.

237
00:14:50,920 --> 00:14:55,959
Through maybe a big computer model that we
need to supercomputer to be able to crunch

238
00:14:55,959 --> 00:15:00,569
all of those numbers to get a good picture
of what's happening on a continent, or on

239
00:15:00,569 --> 00:15:02,149
a global scale, things like that.

240

00:15:02,149 --> 00:15:04,370
Host: So talk a little bit about the forests.

241
00:15:04,370 --> 00:15:09,060
Especially having lived in Paraguay for a
while, in a heavily forested area.

242
00:15:09,060 --> 00:15:15,970
What happens there can affect the entire planet
in a lot of times, or the areas around it.

243
00:15:15,970 --> 00:15:21,560
So talk a little bit about how the forest
in general play into the global –

244
00:15:21,560 --> 00:15:22,660
Adam Moreno: Right, yeah.

245
00:15:22,660 --> 00:15:24,850
Why is a forest ecologist at NASA?

246
00:15:24,850 --> 00:15:27,899
Host: That's a good question.

247
00:15:27,899 --> 00:15:29,740
Adam Moreno: Yeah.

248
00:15:29,740 --> 00:15:34,620
There are several cycles that make up the
global system.

249
00:15:34,620 --> 00:15:40,949
There's the water cycle, the carbon cycle,
energy cycle, nitrogen cycle, all these different

250
00:15:40,949 --> 00:15:42,110
cycles.

251
00:15:42,110 --> 00:15:45,779

Things that are moving around the Earth and make up really the system that we call the

252
00:15:45,779 --> 00:15:48,560
Earth.

253
00:15:48,560 --> 00:15:54,860
So if we're talking about something like the carbon cycle, global forests make up the largest

254
00:15:54,860 --> 00:15:59,620
terrestrial component of the carbon cycle.

255
00:15:59,620 --> 00:16:07,579
Half of the carbon that goes into the atmosphere gets sucked down by forests, so large-scale

256
00:16:07,579 --> 00:16:12,620
changes to the forests can change the carbon cycle, that could then change the climate

257
00:16:12,620 --> 00:16:17,130
cycle and have repercussions all over the world.

258
00:16:17,130 --> 00:16:19,760
Same with the water cycle and all of that sort of stuff.

259
00:16:19,760 --> 00:16:23,220
Host: Everything kind of interacts, and ebbs and flows.

260
00:16:23,220 --> 00:16:24,829
Adam Moreno: Everything interacts, yeah.

261
00:16:24,829 --> 00:16:27,519
Host: Like the food chain, to a certain extent.

262

00:16:27,519 --> 00:16:31,190
You tweak one thing and then other stuff happens,
even if you don't understand it right away.

263
00:16:31,190 --> 00:16:32,190
Adam Moreno: That right.

264
00:16:32,190 --> 00:16:34,420
Host: Things are all interconnected and interwoven,
very complex.

265
00:16:34,420 --> 00:16:35,860
Adam Moreno: Yep.

266
00:16:35,860 --> 00:16:42,360
Right, so I kind of say, well, a computer
is a very complex system.

267
00:16:42,360 --> 00:16:47,339
It takes a lot of engineering and science
and math to understand or build this sort

268
00:16:47,339 --> 00:16:49,120
of system.

269
00:16:49,120 --> 00:16:56,500
But the actual biggest and most complex system
on Earth, is the Earth itself.

270
00:16:56,500 --> 00:16:59,490
And we didn't engineer it, so that makes it
even harder.

271
00:16:59,490 --> 00:17:03,740
So actually, we're just trying to figure out
how this system works.

272
00:17:03,740 --> 00:17:06,010
There's still a lot of work to be done.

273
00:17:06,010 --> 00:17:12,250
My little component of figuring out this system
is figuring out how atmospheres and forests

274
00:17:12,250 --> 00:17:13,810
interact with one another.

275
00:17:13,810 --> 00:17:14,810
Host: Okay.

276
00:17:14,810 --> 00:17:18,800
So you talk about studying forests, doing
that research, and then playing that into

277
00:17:18,800 --> 00:17:22,000
being a computer scientist.

278
00:17:22,000 --> 00:17:26,560
This is an option for all computer scientists,
"Oh, you could also go study forests."

279
00:17:26,560 --> 00:17:28,600
Adam Moreno: That's absolutely true.

280
00:17:28,600 --> 00:17:35,100
And we need more people with technical abilities
to come and be able to make sense of this

281
00:17:35,100 --> 00:17:37,980
huge amount of complex data that we have.

282
00:17:37,980 --> 00:17:40,120
Host: How do you do that?

283
00:17:40,120 --> 00:17:41,120
What do you?

284
00:17:41,120 --> 00:17:42,120

What is your day-to-day?

285
00:17:42,120 --> 00:17:48,780
Are you running this data through new software,
through databases, putting it, visualizing

286
00:17:48,780 --> 00:17:53,270
it in different ways where you come up with
newer ideas instead of it just being numbers

287
00:17:53,270 --> 00:17:54,270
on a spreadsheet?

288
00:17:54,270 --> 00:17:55,270
Talk about that.

289
00:17:55,270 --> 00:18:01,600
Adam Moreno: Yeah, so my day-to-day is getting
data from all different sources, satellites

290
00:18:01,600 --> 00:18:06,780
or the ground, and then transforming that
data into something I can use.

291
00:18:06,780 --> 00:18:12,630
Maybe it's a map of a particular area, like
the United States that I want to study.

292
00:18:12,630 --> 00:18:17,070
And getting all of those datasets to match
up, right?

293
00:18:17,070 --> 00:18:21,890
They need to be able to be comparable and
usable no matter if they came from satellites

294
00:18:21,890 --> 00:18:24,390
of from the ground, or what have you.

295

00:18:24,390 --> 00:18:31,360
Then I write a lot of code that crunches those
numbers in the supercomputer.

296
00:18:31,360 --> 00:18:40,220
Maybe I'll have a forest model that will get
productivity estimates of the forest, given

297
00:18:40,220 --> 00:18:45,840
its reflectance from the satellite, given
its climate, given the type of forest there

298
00:18:45,840 --> 00:18:50,440
is on the ground, and we want to know, "Well,
how productive is vegetation all over the

299
00:18:50,440 --> 00:18:52,830
globe?" for example.

300
00:18:52,830 --> 00:18:58,470
That sort of stuff goes through the computer.

301
00:18:58,470 --> 00:19:03,340
My ultimate goal right now, while I'm here
at NASA, that kind of got me here, is I'm

302
00:19:03,340 --> 00:19:13,650
hoping to develop an early warning system
where we can monitor all of the forests throughout

303
00:19:13,650 --> 00:19:19,410
the United States, and pinpoint forests that
are extremely vulnerable to a large-scale

304
00:19:19,410 --> 00:19:24,830
mortality event, whether it's from fire, or
beetles, or even just mortality without any

305
00:19:24,830 --> 00:19:29,340
sort of agent of death like fire or beetles.

306
00:19:29,340 --> 00:19:36,360
And also understanding why those forests are
vulnerable, and then giving some recommendation

307
00:19:36,360 --> 00:19:42,020
of what can be done to maybe prevent this
large-scale mortality event.

308
00:19:42,020 --> 00:19:48,460
So, to do that, what I'm doing is, I'm taking
all of this data that I'm getting from the

309
00:19:48,460 --> 00:19:56,070
satellite, from the ground, and I'm writing
code that will hopefully pull out equations,

310
00:19:56,070 --> 00:20:01,580
essentially, of the physics on how climate
limits forests.

311
00:20:01,580 --> 00:20:04,020
Host: Oh, interesting, okay.

312
00:20:04,020 --> 00:20:05,540
What are the rules?

313
00:20:05,540 --> 00:20:07,650
Adam Moreno: Yeah, what are the rules, exactly.

314
00:20:07,650 --> 00:20:08,650
What are the rules?

315
00:20:08,650 --> 00:20:13,840
Because it's obvious, climate dictates what
sort of forest can be where, right?

316
00:20:13,840 --> 00:20:20,420
So, we have a different sort of forest here

in California, in Silicon Valley, than we

317
00:20:20,420 --> 00:20:25,570
have up in the Pacific Northwest, in Washington
or Oregon, and that's because the climate

318
00:20:25,570 --> 00:20:27,120
is different.

319
00:20:27,120 --> 00:20:30,070
The climate dictates all sorts of things within
the forest.

320
00:20:30,070 --> 00:20:35,330
It dictates how tall the forest can get, how
big the trees can get, how many trees can

321
00:20:35,330 --> 00:20:37,850
be in a forest, and things like that.

322
00:20:37,850 --> 00:20:44,150
But, as of yet, we don't really understand
how it limits all of those, or what this curve

323
00:20:44,150 --> 00:20:48,920
looks like, depending on your temperature
and precipitation, what sort of trees could

324
00:20:48,920 --> 00:20:50,010
exist in an area.

325
00:20:50,010 --> 00:20:56,540
So I'm trying pull out these biophysical limitations
that climate places on forests that I can

326
00:20:56,540 --> 00:21:02,500
then use to develop some sort of system that
can recognize when a forest is out of balance

327

00:21:02,500 --> 00:21:04,100
with its climate system.

328
00:21:04,100 --> 00:21:08,010
Host: You said it a handful of times, but
talk a little bit about writing the code.

329
00:21:08,010 --> 00:21:11,490
Because it's not like – I'll probably date
myself – it's not like you're opening up

330
00:21:11,490 --> 00:21:12,490
Delphi.

331
00:21:12,490 --> 00:21:20,290
It's not like you're just powering up your
PC and just writing this stuff, because a

332
00:21:20,290 --> 00:21:25,600
supercomputer, I'm imagining it does not run
on a Microsoft or an iOS system.

333
00:21:25,600 --> 00:21:27,470
Adam Moreno: No, that's right.

334
00:21:27,470 --> 00:21:30,530
Host: What all goes into that?

335
00:21:30,530 --> 00:21:36,280
Adam Moreno: Yeah, so the supercomputer we
have here at Ames is called Pleiades, and

336
00:21:36,280 --> 00:21:40,710
it has its own building that takes up this
whole entire – it's like a city block essentially.

337
00:21:40,710 --> 00:21:44,200
It even has its own cooling tower, it's so
big.

338
00:21:44,200 --> 00:21:46,200
Why do we have supercomputers?

339
00:21:46,200 --> 00:21:50,810
Well, number one, all of the data that we
need to understand the global system could

340
00:21:50,810 --> 00:21:54,890
not fit on a smaller computer, on a desktop
computer.

341
00:21:54,890 --> 00:22:01,240
But then also the computations that it takes,
if we were to try to do it on a desktop computer,

342
00:22:01,240 --> 00:22:03,080
it would take three years or something like
that.

343
00:22:03,080 --> 00:22:04,080
Host: For it to render –

344
00:22:04,080 --> 00:22:08,910
Adam Moreno: Yeah, or just to run all of the
calculations on all of the data.

345
00:22:08,910 --> 00:22:12,450
So essentially it's impossible on a normal
computer.

346
00:22:12,450 --> 00:22:17,110
But then if you write it correctly and you
utilize the architecture of the supercomputer,

347
00:22:17,110 --> 00:22:20,840
then maybe it will take a day, or something
like that.

348
00:22:20,840 --> 00:22:25,510

So, essentially a supercomputer makes impossible
calculations possible.

349
00:22:25,510 --> 00:22:26,720
Host: Oh wow.

350
00:22:26,720 --> 00:22:32,250
Adam Moreno: Yeah, so it's not just normal
programming when you're programming on a supercomputer.

351
00:22:32,250 --> 00:22:34,310
Host: Yeah, HTML, you're screwing around.

352
00:22:34,310 --> 00:22:35,680
Adam Moreno: Yeah, right.

353
00:22:35,680 --> 00:22:41,340
So often, I think, scientists who have not
worked with supercomputers, they will think,

354
00:22:41,340 --> 00:22:47,670
"Oh, okay, I have this little model, and it
works well on studying, let's say, forests,

355
00:22:47,670 --> 00:22:51,210
and it works well on like a watershed, or
just one particular forest.

356
00:22:51,210 --> 00:22:56,550
Well, shoot, if I just have access to the
supercomputer, I'll just run it on the supercomputer

357
00:22:56,550 --> 00:22:57,550
and boom."

358
00:22:57,550 --> 00:22:58,550
Host: Do your supercomputing magic.

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00:22:58,550 --> 00:23:01,920

Adam Moreno: Yeah, and then boom, I have a whole global simulation.

360
00:23:01,920 --> 00:23:04,510
But that is not how it works.

361
00:23:04,510 --> 00:23:11,120
I guess I kind of liken it to if you're chopping wood and you're stacking wood, okay?

362
00:23:11,120 --> 00:23:12,120
Host: Okay.

363
00:23:12,120 --> 00:23:15,260
Adam Moreno: If you have a little bit of wood you can do it yourself and it's fine.

364
00:23:15,260 --> 00:23:16,640
You chop wood, you stack wood.

365
00:23:16,640 --> 00:23:23,020
But now let's say I give you a huge, huge warehouse full of wood and I tell you I want

366
00:23:23,020 --> 00:23:25,600
one big stack of wood.

367
00:23:25,600 --> 00:23:29,280
And I say, but I'll also give you as many people as you want.

368
00:23:29,280 --> 00:23:33,070
I'll give you a million people if you want a million people.

369
00:23:33,070 --> 00:23:37,380
Well, okay, if you just say, everyone cut and stack wood –

370

00:23:37,380 --> 00:23:39,070
Host: Everyone start, like brute force.

371
00:23:39,070 --> 00:23:40,070
Let's start chopping wood.

372
00:23:40,070 --> 00:23:41,110
Adam Moreno: Right, you don't know where the wood's going.

373
00:23:41,110 --> 00:23:42,400
Everyone cuts wood in different ways, whatever.

374
00:23:42,400 --> 00:23:43,400
It doesn't work.

375
00:23:43,400 --> 00:23:47,160
Now all of a sudden you need to organize the workers.

376
00:23:47,160 --> 00:23:51,581
You need to put some of the workers chopping wood, some of the workers moving wood, some

377
00:23:51,581 --> 00:23:55,940
of the workers stacking wood, and you need somebody organizing the stack of wood.

378
00:23:55,940 --> 00:23:56,940
Things like that.

379
00:23:56,940 --> 00:23:57,940
Host: Let alone lunch breaks and payroll.

380
00:23:57,940 --> 00:24:00,610
Adam Moreno: Yeah, those sorts of things.

381
00:24:00,610 --> 00:24:05,670
Anyways, the point is that the end goal is

the same, cut wood, stack wood.

382
00:24:05,670 --> 00:24:12,290
But since the scale is so different, and you
have so many workers, the whole process chain

383
00:24:12,290 --> 00:24:13,460
is completely different.

384
00:24:13,460 --> 00:24:15,670
And it's the same with supercomputing.

385
00:24:15,670 --> 00:24:21,341
You have a small process and the end result
is the same but just on a bigger scale, but

386
00:24:21,341 --> 00:24:25,460
getting from A to B is a completely different
story.

387
00:24:25,460 --> 00:24:26,940
Host: Excellent.

388
00:24:26,940 --> 00:24:30,610
So you're working as the fellow.

389
00:24:30,610 --> 00:24:31,610
You finished your Ph.D., right?

390
00:24:31,610 --> 00:24:33,170
Adam Moreno: Yeah, I finished my Ph.D.

391
00:24:33,170 --> 00:24:34,190
Host: So now this is the postdoc.

392
00:24:34,190 --> 00:24:36,790
Adam Moreno: This is the postdoc, right.

393

00:24:36,790 --> 00:24:38,820
Host: What do you see in the future?

394
00:24:38,820 --> 00:24:41,160
What are you hoping to work on down the road?

395
00:24:41,160 --> 00:24:43,134
Adam Moreno: Well, this early warning system
is a big dream that I have that will take

396
00:24:43,134 --> 00:24:44,134
many years to complete.

397
00:24:44,134 --> 00:24:48,960
I hope to either stay on here at NASA, or
go on and become a professor or something.

398
00:24:48,960 --> 00:24:53,270
I like teaching as well, I like mentoring,
so I don't know, we'll see.

399
00:24:53,270 --> 00:24:58,910
I think that's part of the postdoc experience,
is really understanding where you want to

400
00:24:58,910 --> 00:25:01,130
go with your next steps of your career.

401
00:25:01,130 --> 00:25:06,360
Host: So, for folks who are listening who
have questions for Adam, we are on Twitter

402
00:25:06,360 --> 00:25:09,460
@NASAAmes, and we're using the hashtag #NASASiliconValley.

403
00:25:09,460 --> 00:25:13,920
So, questions come in, we'll loop them on
over to you and see if you can get some answers

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00:25:13,920 --> 00:25:14,920
back and forth.

405
00:25:14,920 --> 00:25:15,920
Adam Moreno: Yeah, that would be great.