
NASA
SNACK
TIME
WITH NASA
SPACE SALAD
NASA

1
00:00:00,200 --> 00:00:02,502
What do I do with my hands, OK?

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00:00:02,502 --> 00:00:04,904
[UPBEAT MUSIC]
Hey everyone, welcome to Snack Time with NASA.

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00:00:04,938 --> 00:00:06,973
I'm your host, Kathleen Gaeta.

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00:00:06,973 --> 00:00:09,542
Now, we've been exploring all the ways that NASA helps

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00:00:09,542 --> 00:00:11,544
get some of your favorite foods onto your plate.

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00:00:11,811 --> 00:00:15,148
And so far, all of those foods have been down here on Earth, obviously.

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00:00:15,348 --> 00:00:16,583
But we're NASA, right?

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00:00:16,583 --> 00:00:20,987
So while we may not be professional chefs,
we do know a thing or two about space.

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00:00:21,454 --> 00:00:24,391
That's why today we'll be learning
what it takes to grow food

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00:00:24,424 --> 00:00:28,161
two hundred miles above our heads
onboard the International Space Station.

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00:00:28,561 --> 00:00:29,529
And later, we'll hear

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00:00:29,529 --> 00:00:33,333

how the space station helps us monitor
the health of plants down here on Earth.

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00:00:33,633 --> 00:00:34,734
So let's get into it.

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00:00:34,734 --> 00:00:37,303
As you can see, I have a nice haul of greens right in front of me.

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00:00:37,470 --> 00:00:41,041
Some romaine lettuce, some bok choy, radishes, micro greens.

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00:00:41,541 --> 00:00:44,210
Now, I got all these ingredients for my local grocery store.

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00:00:44,344 --> 00:00:47,547
But actually, every single one of these plants is grown onboard the ISS.

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00:00:48,014 --> 00:00:51,785
And here to help explain how that happens is Matt Romeyn, Project Scientist

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00:00:51,785 --> 00:00:54,721
at the Kennedy Space Center. Matt, thank you so much for being here.

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00:00:54,721 --> 00:00:58,258
How's it going?
Matt: Oh it's going good, glad to be here Kathleen.

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00:00:58,391 --> 00:01:01,161
Kathleen: So you sent me a list of vegetables that you work with,

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00:01:01,161 --> 00:01:03,329
and I'm wondering how you go about choosing

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00:01:03,329 --> 00:01:06,199
which foods to grow up in space?

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00:01:06,199 --> 00:01:10,370

Matt: We have to do a lot of crop screening. We're able to screen these crops and test them at our growth char

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00:01:10,370 --> 00:01:13,039
at Kennedy Space Center that are able to replicate the environmental conditions

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00:01:13,039 --> 00:01:15,875
on the International Space Station, except for microgravity.

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00:01:18,211 --> 00:01:20,713
We're looking for how productive they grow, growth for compact

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00:01:20,713 --> 00:01:24,751
morphologies and crops that are nutritious and flavorful.

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00:01:24,751 --> 00:01:27,720
Kathleen: OK, I have to ask, have you ever grown potatoes in space?

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00:01:29,322 --> 00:01:33,493
Matt: Well, we've been growing crops recently on ISIS - last five years or so.

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00:01:33,693 --> 00:01:36,830
We haven't had potatoes recently, but in the past we've done them

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00:01:36,830 --> 00:01:37,931
on the shuttle program

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00:01:37,931 --> 00:01:40,400
and we have grown them extensively on the ground at Kennedy Space Center.

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00:01:41,201 --> 00:01:44,804
Kathleen: I will eat a space potato in my lifetime, I promise you that.

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00:01:45,105 --> 00:01:48,541
Anyways, so you suggested I pick up some bok choy and mustard

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00:01:48,541 --> 00:01:51,811
greens, and I can't say those are typical salad ingredients for myself.

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00:01:51,945 --> 00:01:54,247
Matt: The bok choy is interesting because the crew recently

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00:01:54,247 --> 00:01:57,550
grew and got to eat that on the ISS and they really enjoyed it.

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00:01:58,051 --> 00:02:00,420
They actually found a way to cook it, using their food warmer

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00:02:00,887 --> 00:02:04,557
and combining some garlic paste, soy sauce, and bit of olive oil.

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00:02:05,492 --> 00:02:08,995
The mustard greens are great because they have a lot of strong flavors.

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00:02:09,295 --> 00:02:12,332
And when you're an astronaut on the ISS, with the microgravity,

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00:02:12,332 --> 00:02:14,234
you have a diminished sense of taste and smell.

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00:02:14,234 --> 00:02:16,970
So they like those bolder flavors that kind of punch through there.

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00:02:18,004 --> 00:02:19,672
Kathleen: Wow. I did not know that.

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00:02:19,672 --> 00:02:24,410
And now, do you also grow the same plants
that you're growing in space down at KSC?

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00:02:24,577 --> 00:02:28,081
Matt: Yeah, well, we're growing plants in space on ISS, we also have ground controls

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00:02:28,081 --> 00:02:29,215
at KSC that

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00:02:29,215 --> 00:02:32,852
replicate the exact conditions on the ISS - the temperature, humidity, the CO2

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00:02:32,852 --> 00:02:37,824
levels, we can control for everything but the microgravity element.

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00:02:37,857 --> 00:02:40,527
Kathleen: Ok, and I assume that so that you can more closely monitor

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00:02:40,527 --> 00:02:43,396
the difference of plants growing in space versus on Earth.

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00:02:43,696 --> 00:02:46,933
What have you discovered in that process?

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00:02:46,933 --> 00:02:49,702
Matt: Well, we find that plants, for the most part,
grow similar in space as on Earth.

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00:02:50,103 --> 00:02:52,272
A big variable is the water.

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00:02:52,272 --> 00:02:56,309
There's a lack of convective
flow in space, and that makes water very

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00:02:56,309 --> 00:02:59,913
sticky. Plants like a good mix of water
and oxygen in their root zone.

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00:02:59,913 --> 00:03:03,149
And when we have water that doesn't mix well with

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00:03:03,149 --> 00:03:06,653
oxygen, we get a lot of swinging back and forth between

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00:03:06,653 --> 00:03:09,422
the roots being flooded and being in a state of drought.

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00:03:10,256 --> 00:03:12,258
We have technologies that are working on that.

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00:03:12,258 --> 00:03:14,294
To solve that problem of microgravity.

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00:03:14,294 --> 00:03:17,730
Luckily, when we get to Mars and the moon,
those problems mostly go away.

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00:03:18,831 --> 00:03:22,402
Kathleen: Got it. And so talk to me about this little space garden

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00:03:22,435 --> 00:03:24,971
I keep hearing of - the VEGGIE Growth System. What is that?

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00:03:25,104 --> 00:03:27,607
Yeah, the VEGGIE. We've got two of those on ISS,

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00:03:27,607 --> 00:03:29,175
And it's a real simple system.

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00:03:29,175 --> 00:03:32,111
It's about the size of a piece of carry-on luggage.

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00:03:32,645 --> 00:03:36,149
It uses LED lighting and has six little plant pillows in there

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00:03:36,149 --> 00:03:40,420
that are filled with growth medium, which is basically a soil substitute.

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00:03:40,620 --> 00:03:43,323
And that's how we're able to grow and propagate the plants on the ISS.

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00:03:45,525 --> 00:03:46,859
Kathleen: That's so interesting.

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00:03:46,859 --> 00:03:49,762
The vision of a space garden just brings a lot of joy to me

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00:03:49,762 --> 00:03:51,164
and I'm sure a lot of people.

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00:03:51,164 --> 00:03:53,866
Anyway, so is there a plant that you're kind of the most excited

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00:03:53,866 --> 00:03:55,702
about trying to grow in space?

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00:03:55,702 --> 00:03:56,903
Matt: Definitely peppers.

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00:03:56,903 --> 00:04:00,807
We actually just sent chili peppers to ISIS,
that will be grown in the summer,

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00:04:00,807 --> 00:04:04,310
and we're excited about peppers
because they are very challenging.

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00:04:04,410 --> 00:04:06,479
They take a long time to germinate.

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00:04:06,512 --> 00:04:09,082
They take a long time to grow, about 120 days.

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00:04:09,983 --> 00:04:11,985
And there's a real challenge with the flavor.

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00:04:12,018 --> 00:04:15,021
If we were to overwater them, they taste

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00:04:15,421 --> 00:04:18,524
like grass clippings. If we under water,

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00:04:18,524 --> 00:04:20,660
and we stress out a lot, they're really spicy.

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00:04:21,027 --> 00:04:24,130
So we're trying to really control to grow healthy plants

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00:04:24,130 --> 00:04:27,533
and flavorful plants that the crew wants to eat and enjoy.

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00:04:27,800 --> 00:04:30,036
Kathleen: Right. And you know what they say,
if you can't take the heat,

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00:04:30,036 --> 00:04:32,272
get off the space station, right?

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00:04:32,272 --> 00:04:34,974
Just kidding, that's my dad joke of the day!

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00:04:35,008 --> 00:04:36,843
Well anyways, Matt I can't thank you enough for being here.

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00:04:36,843 --> 00:04:38,678
[Bark] I learned a lot, and I hope you all did as well.

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00:04:38,678 --> 00:04:42,348
And I can't wait to hear what you grow in space next!
Matt: Thank you.

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00:04:42,348 --> 00:04:46,819
[Bark] Kathleen: Shut your little door, Buoy

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00:04:48,354 --> 00:04:50,156
So now that we know more about crops

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00:04:50,156 --> 00:04:52,292
aboard the space station, what about the crops

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00:04:52,292 --> 00:04:55,061
we study from the space station that live down here on Earth?

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00:04:55,361 --> 00:04:58,665
And for that, Christine Lee, Applications Lead for the ECOSTRESS

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00:04:58,665 --> 00:05:00,166
mission is here to talk to us.

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00:05:00,166 --> 00:05:02,435
Hey, Christine, thank you for being here.

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00:05:02,435 --> 00:05:04,337
Christine: Hi. Thank you. Glad to be here.

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00:05:04,337 --> 00:05:07,173
I was just talking with Matt about how the VEGGIE Lab on

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00:05:07,173 --> 00:05:10,943
the ISS helps us better understand how plants grow in microgravity.

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00:05:11,110 --> 00:05:14,180
And that's inspired all of the ingredients here for the salad.

105
00:05:14,781 --> 00:05:16,182
But I also know that instruments

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00:05:16,182 --> 00:05:19,852
on the ISS help us better understand how plants grow down on Earth.

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00:05:20,119 --> 00:05:21,654
I'm wondering how that is?

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00:05:21,654 --> 00:05:26,926
Christine: Well, the instrument and projects that I work on, the Ecosystem Spaceborne

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00:05:26,926 --> 00:05:31,097
Thermal Radiometer Experiment on Space Station, also known as ECOSTRESS,

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00:05:31,698 --> 00:05:35,535
collects thermal data from on board the International Space Station.

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00:05:35,702 --> 00:05:37,970
And we use this thermal data

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00:05:37,970 --> 00:05:41,074
to better understand vegetation water stress here on Earth.

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00:05:41,674 --> 00:05:45,745
And so we can apply this data in understanding crop water stress,

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00:05:45,745 --> 00:05:49,148
looking at drought across forests

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00:05:49,148 --> 00:05:51,718
in climate-vulnerable areas all around the world.

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00:05:52,318 --> 00:05:55,121
Kathleen: And so I know that we also look at the temperature of plants.

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00:05:55,121 --> 00:05:57,156
And I can't say I know why we do that?

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00:05:57,924 --> 00:06:00,193
Christine: We look at the temperature of plants because

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00:06:00,193 --> 00:06:01,861
plants contain a lot of water.

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00:06:01,861 --> 00:06:05,098
It's part of their process for photosynthesizing.

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00:06:05,198 --> 00:06:07,633
And the temperature is directly

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00:06:07,633 --> 00:06:10,737
related to the water content within those plants.

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00:06:10,737 --> 00:06:14,807
And so the hotter a plant gets, we can use that as an indicator of how

124
00:06:14,807 --> 00:06:18,711
how healthy that particular plant is.

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00:06:18,711 --> 00:06:21,781
Kathleen: Got it. OK, so all this data is captured and collected.

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00:06:21,781 --> 00:06:23,182
Who then uses it?

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00:06:23,182 --> 00:06:26,252
Christine: Well, we have a wide variety of partners.

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00:06:26,252 --> 00:06:30,323
One of our key partners is the U.S. Department of Agriculture.

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00:06:30,356 --> 00:06:34,293
They utilize the data to better understand crop water stress across

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00:06:34,293 --> 00:06:37,864
different areas, primarily in the continental United States.

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00:06:37,864 --> 00:06:41,868
And they use this to understand and inform decisions

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00:06:41,868 --> 00:06:45,638
like irrigation and water management, as well as the onset of drought.

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00:06:45,638 --> 00:06:50,343
Kathleen: And so what advantages does ECOSTRESS get being on the ISS?

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00:06:50,710 --> 00:06:53,379
Christine: We love being on the International Space Station.

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00:06:53,379 --> 00:06:58,084
One of the really unique aspects of being on the ISIS

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00:06:58,084 --> 00:07:00,887
is that there's a variable overpass time.

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00:07:00,887 --> 00:07:05,391
And what that means is that instead of taking measurements at the same time,

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00:07:05,391 --> 00:07:09,362
during each overpass, the way we might with other polar

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00:07:09,362 --> 00:07:13,366
orbiting satellite missions, is that we actually get to take a snapshot

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00:07:13,366 --> 00:07:17,637
of temperatures and water stress at different times of day.

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00:07:17,637 --> 00:07:20,573
And what this then translates to

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00:07:20,573 --> 00:07:24,110
is being able to look at the peak of vegetation water stress,

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00:07:24,110 --> 00:07:27,246
which typically occurs in the mid to late afternoon.

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00:07:27,246 --> 00:07:29,415
This is something that has not been done before.

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00:07:29,415 --> 00:07:35,488
And being able to create this daily cycle of water stress

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00:07:35,488 --> 00:07:38,958
for vegetation at these spatial and temporal scales.

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00:07:38,958 --> 00:07:42,528
Kathleen: Well, it seems to me that instruments onboard the ISS are pretty crucial

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00:07:42,528 --> 00:07:45,364
when it comes to monitoring our human caused climate change.
[DOG BARK]

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00:07:45,364 --> 00:07:47,133
Climate change is bad.

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00:07:47,166 --> 00:07:49,969
Christine: Yes, so the really great thing about ECOSTRESS is that it

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00:07:49,969 --> 00:07:54,941
complements these other instruments and other satellites like Landsat,

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00:07:54,941 --> 00:07:58,778
to create a continuous long-term record of the Earth system.

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00:07:59,378 --> 00:08:03,716
And right now, NASA is working on future missions that will build on these records

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00:08:03,716 --> 00:08:06,819
to provide climate scientists a holistic view of the Earth.

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00:08:06,819 --> 00:08:11,190
This provides us really unique insights to how vegetation

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00:08:11,190 --> 00:08:15,228
and forests around the world are reacting to environmental and climate stressors.

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00:08:15,228 --> 00:08:18,464
Kathleen: Well, you know, it's amazing to hear about all the science

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00:08:18,464 --> 00:08:21,634
that goes into growing plants both in space and on Earth.

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00:08:21,634 --> 00:08:24,470

And on that note, I'm ready to appreciate some of that science

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00:08:24,470 --> 00:08:28,040
by digging into this salad. Christine, thank you so much for being here.

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00:08:28,040 --> 00:08:31,277
I really appreciate it!
And thank you all for watching. Cheers!