1
00:00:08,350 --> 00:00:04,170
[music]

2
00:00:08,370 --> 00:00:12,520
Across the Rocky Mountain West,

3
00:00:12,540 --> 00:00:16,700
red hues dot the forest.

4
00:00:16,720 --> 00:00:21,060
But these aren't the colors of autumn. These trees are dying,

5
00:00:21,080 --> 00:00:25,240
under attack by an unseen adversary - the mountain pine beetle.

6
00:00:25,260 --> 00:00:29,420
Mountain pine beetles are native to western forests,

7
00:00:29,440 --> 00:00:33,570
and they've evolved with the lodgepole pine trees they infest.

8
00:00:33,590 --> 00:00:37,690
But in the last few years, warming temperatures have caused their numbers to surge.

9
00:00:37,710 --> 00:00:41,810
They're killing an unprecedented number of trees.

10
00:00:41,830 --> 00:00:45,890
Some say the swath of dead forest left behind sets the stage

11
00:00:45,910 --> 00:00:49,950
for another Rocky Mountain native - wildfire.

12
00:00:49,970 --> 00:00:53,970
[Phil Townsend:] "For a long time we thought that beetle damaged forests were more likely to burn than green

13
00:00:53,990 --> 00:00:58,150

And that's because they look much drier and

14
00:00:58,170 --> 00:01:02,340
you have a feeling that this is just a tinderbox ready to go."

15
00:01:02,360 --> 00:01:06,520
But are these trees really more likely to burn?

16
00:01:06,540 --> 00:01:10,700
Forest ecologist Phil Townsend and his team are using NASA satellite

17
00:01:10,720 --> 00:01:14,880
imagery to find out.

18
00:01:14,900 --> 00:01:19,060
The Landsat satellites don't have high enough resolution to discern individual trees,

19
00:01:19,080 --> 00:01:23,240
but Landsat's special near-infrared sensor can

20
00:01:23,260 --> 00:01:27,420
detect areas of damaged forest. In this false color view,

21
00:01:27,440 --> 00:01:31,590
green means healthy forest. Green and red together

22
00:01:31,610 --> 00:01:35,770
means damaged trees mixed with healthy ones - possible beetle damage.

23
00:01:35,790 --> 00:01:39,960
Recently burned forest shows up as bright red.

24
00:01:39,980 --> 00:01:44,140
Landsat images let us study forest health across a large area.

25
00:01:44,160 --> 00:01:48,290
But each pixel captures almost a thousand square meters of forest -

26
00:01:48,310 --> 00:01:52,420
covering lots of trees. So how can you be sure what's really going on inside a pixel?

27
00:01:52,440 --> 00:01:56,540
You've got to hit the ground and see.

28
00:01:56,560 --> 00:02:00,640
The team lays out transect tape to measure out points

29
00:02:00,660 --> 00:02:04,710
thirty meters apart - the area within a single Landsat pixel.

30
00:02:04,730 --> 00:02:08,750
Within this pixel zone, they get a close-up look at the health of each tree.

31
00:02:08,770 --> 00:02:12,920
[Phil Townsend:] "When we're in the forest, conducting our research, we look for signs of

32
00:02:12,940 --> 00:02:17,110
beetle damage to the trees. The first and most obvious sign would be

33
00:02:17,130 --> 00:02:21,280
whether the tree has red needles or not. Well, that's a sign that the tree is

34
00:02:21,300 --> 00:02:25,460
dead, but it's not necessarily always caused by beetles. So we then

35
00:02:25,480 --> 00:02:29,650
look at the bark of the tree and if we see pitch tubes, which are where beetles

36
00:02:29,670 --> 00:02:33,820
have attacked the tree, or exit holes, which are where

37
00:02:33,840 --> 00:02:38,000
the young beetles have emerged from the tree, then we know that there has been

38
00:02:38,020 --> 00:02:42,180

beetle damage." Pitch tubes are holes bored by beetles.

39
00:02:42,200 --> 00:02:46,360
Living trees defend themselves from beetles by streaming sticky resin from the wounds.

40
00:02:46,380 --> 00:02:50,550
But if enough beetles drill enough holes, the trees die.

41
00:02:50,570 --> 00:02:54,720
The research confirms that they're reading the

42
00:02:54,740 --> 00:02:58,880
Landsat data correctly. The target zones are, for the most part, killed by beetles.

43
00:02:58,900 --> 00:03:03,030
Next, they can compare those zones

44
00:03:03,050 --> 00:03:07,160
to areas burned by fire, and what they've discovered is surprising.

45
00:03:07,180 --> 00:03:11,270
Instead of creating a tinderbox ready to burn, the beetle-killed swaths

46
00:03:11,290 --> 00:03:15,350
appear to have little effect on fire. In fact, in some instances,

47
00:03:19,550 --> 00:03:15,470
they may even reduce the risk of severe fires.

48
00:03:19,570 --> 00:03:23,600
come off the tree, that fuel source isn't so much there. So actually

49
00:03:23,620 --> 00:03:27,640
the beetle damaged forest may be less susceptible to burning

50
00:03:27,660 --> 00:03:31,820
than a green forest, where you still have material, and during a drought this material

51
00:03:31,840 --> 00:03:36,190
may be very dry and be able to carry the fire

52
00:03:36,210 --> 00:03:40,370
from the surface up to the canopy." The Landsat data, double-checked

53
00:03:40,390 --> 00:03:44,550
with on-the-ground observations, show us that things aren't always as they appear

54
00:03:44,570 --> 00:03:48,720
at first glance. [Phil Townsend:] "I think it's important for

55
00:03:48,740 --> 00:03:52,900
people not to assume that there are relationships between

56
00:03:52,920 --> 00:03:57,090
certain types of features out on the landscape. It's often much more complicated

57
00:03:57,110 --> 00:04:01,270
than we think. 'Oh, that forest has been damaged by beetles, it's more

58
00:04:01,290 --> 00:04:05,450
likely to burn,' and that's why it's important to ask questions and

59
00:04:05,470 --> 00:04:09,630
not just take everything as gospel truth and to go out and actually

60
00:04:09,650 --> 00:04:13,830
do the research and see if what we think in our mind is actually what's happening

61
00:04:13,850 --> 00:04:18,000
on the ground." While one mystery seems

62
00:04:18,020 --> 00:04:22,170
to be solved, another remains. Why are both mountain pine beetle numbers

63
00:04:22,190 --> 00:04:26,350

and fire risk on the rise? The answer

64
00:04:26,370 --> 00:04:30,470
may well be our changing climate. Cold winter nights

65
00:04:30,490 --> 00:04:34,600
kill beetle larvae. In the last decade, temperatures haven't dipped as low.

66
00:04:34,620 --> 00:04:38,700
More beetles are surviving to damage more forest.

67
00:04:38,720 --> 00:04:42,770
And fires take hold and spread faster in a warmer, drier climate.

68
00:04:42,790 --> 00:04:46,810
[Phil Townsend:] "The beetles and the fire might not directly be related to each other, but they

69
00:04:46,830 --> 00:04:50,980
might be each related to the change in the climate, and that's important to find out."