
Google+
Doug Morton
NASA's Goddard Space Flight Center
Elizabeth Reinhardt
Doug Morton
Bill Patzert

1
00:00:04,070 --> 00:00:02,310
at nasa goddard's space flight center in

2
00:00:06,230 --> 00:00:04,080
greenbelt maryland we're going to be

3
00:00:08,710 --> 00:00:06,240
discussing the wildfires for about the

4
00:00:11,749 --> 00:00:08,720
next hour we're taking your questions at

5
00:00:14,629 --> 00:00:11,759
the hashtag nasafire or also using the

6
00:00:16,390 --> 00:00:14,639
hashtag ask nasa you can also type your

7
00:00:18,790 --> 00:00:16,400
questions into the youtube comments box

8
00:00:21,830 --> 00:00:18,800
or here on the google plus page um

9
00:00:24,630 --> 00:00:21,840
joining us for this wildfire hangout are

10
00:00:26,310 --> 00:00:24,640
a number of experts here at nasa goddard

11
00:00:28,470 --> 00:00:26,320
in a different building than where i am

12
00:00:30,390 --> 00:00:28,480
is doug morton he is a research

13
00:00:33,030 --> 00:00:30,400

scientist here at nasa goddard and a

14
00:00:34,389 --> 00:00:33,040
fire specialist joining us from nasa's

15
00:00:36,630 --> 00:00:34,399
jet propulsion laboratory out in

16
00:00:38,950 --> 00:00:36,640
california is bill patzert he's a

17
00:00:41,270 --> 00:00:38,960
climatologist and then also joining us

18
00:00:43,110 --> 00:00:41,280
from the u.s forest service is elizabeth

19
00:00:45,430 --> 00:00:43,120
reinhardt she's the assistant director

20
00:00:47,590 --> 00:00:45,440
for fire and aviation management there

21
00:00:49,670 --> 00:00:47,600
at the forest service um we know we have

22
00:00:52,150 --> 00:00:49,680
a number of viewers today this is also

23
00:00:53,990 --> 00:00:52,160
going to be archived on youtube but as

24
00:00:55,510 --> 00:00:54,000
we're doing it right now please submit

25
00:00:56,950 --> 00:00:55,520
your questions send them in we have a

26
00:00:58,310 --> 00:00:56,960
body of people here getting them and

27
00:00:59,510 --> 00:00:58,320
pulling them in and i'll be reading them

28
00:01:01,510 --> 00:00:59,520
on the air

29
00:01:03,110 --> 00:01:01,520
just to kick things off right away i

30
00:01:06,149 --> 00:01:03,120
want to go right to bill patzert out

31
00:01:08,310 --> 00:01:06,159
there at nasa's jpl lab to talk about

32
00:01:11,750 --> 00:01:08,320
what essentially it takes to start a

33
00:01:14,550 --> 00:01:11,760
wire wildfire take it away bill

34
00:01:17,030 --> 00:01:14,560
well good morning everybody uh

35
00:01:20,469 --> 00:01:17,040
first thing to understand is that fire

36
00:01:23,190 --> 00:01:20,479
is a very natural part of our ecosystems

37
00:01:26,310 --> 00:01:23,200
and uh here in the american west our

38
00:01:28,469 --> 00:01:26,320

history has been written in great fires

39
00:01:31,270 --> 00:01:28,479
but the nature of fires and their

40
00:01:32,710 --> 00:01:31,280
behavior has changed over the past few

41
00:01:34,870 --> 00:01:32,720
decades

42
00:01:38,789 --> 00:01:34,880
fire seasons are longer

43
00:01:40,870 --> 00:01:38,799
the number of acres of fire of

44
00:01:44,630 --> 00:01:40,880
wildland that has burned has increased

45
00:01:47,990 --> 00:01:44,640
dramatically costs are up fatalities are

46
00:01:51,030 --> 00:01:48,000
up and there's more and more costs for

47
00:01:53,910 --> 00:01:51,040
things like aviation now now just to

48
00:01:55,350 --> 00:01:53,920
start at the 101 level at the simplest

49
00:01:57,510 --> 00:01:55,360
level

50
00:01:58,870 --> 00:01:57,520
fire equals

51
00:02:00,950 --> 00:01:58,880
fuel

52
00:02:03,190 --> 00:02:00,960
plus ignition

53
00:02:03,990 --> 00:02:03,200
it's a pretty simple formula

54
00:02:06,389 --> 00:02:04,000
but

55
00:02:09,029 --> 00:02:06,399
that formula can be changed by lots of

56
00:02:12,070 --> 00:02:09,039
things for instance fires create their

57
00:02:13,750 --> 00:02:12,080
own meteorology their own winds

58
00:02:15,030 --> 00:02:13,760
and accompanied by

59
00:02:16,949 --> 00:02:15,040
driving

60
00:02:18,470 --> 00:02:16,959
forceful winds like here in southern

61
00:02:20,550 --> 00:02:18,480
california

62
00:02:22,070 --> 00:02:20,560
fires really become

63
00:02:24,070 --> 00:02:22,080

unmanageable

64
00:02:25,110 --> 00:02:24,080
and you really can't fight them all

65
00:02:26,390 --> 00:02:25,120
right

66
00:02:29,510 --> 00:02:26,400
and uh

67
00:02:32,229 --> 00:02:29,520
the other issue is is that uh we fight a

68
00:02:33,350 --> 00:02:32,239
lot of fires in the united states

69
00:02:35,030 --> 00:02:33,360
and uh

70
00:02:37,030 --> 00:02:35,040
some people think

71
00:02:39,910 --> 00:02:37,040
we fight too many fires

72
00:02:42,710 --> 00:02:39,920
and so what happens it becomes uh

73
00:02:46,070 --> 00:02:42,720
these great national uh forests

74
00:02:49,030 --> 00:02:46,080
naturally burn every 20 to 30 years

75
00:02:51,750 --> 00:02:49,040
but when you fight too many fires you

76
00:02:54,710 --> 00:02:51,760
get too much old-growth forest

77
00:02:57,670 --> 00:02:54,720
and it becomes a problem in itself so

78
00:03:00,790 --> 00:02:57,680
you set yourself up for super fires

79
00:03:04,070 --> 00:03:00,800
and then another factor is is that

80
00:03:06,710 --> 00:03:04,080
people have moved into the wildlands in

81
00:03:09,750 --> 00:03:06,720
the united states and so there are more

82
00:03:12,790 --> 00:03:09,760
people living in harm's way

83
00:03:15,270 --> 00:03:12,800
and you know my simple formula is is if

84
00:03:16,710 --> 00:03:15,280
you put people in a wild land or

85
00:03:19,110 --> 00:03:16,720
grasslands

86
00:03:20,470 --> 00:03:19,120
that guarantees fire

87
00:03:22,790 --> 00:03:20,480
and of course the thing we'd like to

88
00:03:25,589 --> 00:03:22,800

talk about here is

89
00:03:27,670 --> 00:03:25,599
what's the impact of climate change

90
00:03:30,869 --> 00:03:27,680
we're living in a warmer world

91
00:03:33,030 --> 00:03:30,879
in the west it's a drier world

92
00:03:35,030 --> 00:03:33,040
the population center of the country has

93
00:03:37,430 --> 00:03:35,040
switched from the midwest and the

94
00:03:40,550 --> 00:03:37,440
northeast into the west

95
00:03:41,910 --> 00:03:40,560
and so we've seen more fires larger

96
00:03:46,949 --> 00:03:41,920
fires

97
00:03:49,589 --> 00:03:46,959
of sets the background and of course

98
00:03:50,710 --> 00:03:49,599
nasa is trying to study all these

99
00:03:53,350 --> 00:03:50,720
factors

100
00:03:55,350 --> 00:03:53,360
the things that set you up for a fire

101
00:03:57,990 --> 00:03:55,360
how fires behave

102
00:03:59,190 --> 00:03:58,000
and what the future of fires are for the

103
00:04:00,630 --> 00:03:59,200
west

104
00:04:02,149 --> 00:04:00,640
um elizabeth i'd love to see if you

105
00:04:04,470 --> 00:04:02,159
could chime in here you're at the u.s

106
00:04:05,429 --> 00:04:04,480
forest service and that seems to be part

107
00:04:08,070 --> 00:04:05,439
of the

108
00:04:10,309 --> 00:04:08,080
story we're telling about wildfires now

109
00:04:13,190 --> 00:04:10,319
is the idea that there's been so much

110
00:04:15,350 --> 00:04:13,200
fire suppression for so many years

111
00:04:17,509 --> 00:04:15,360
i wonder if you could bring up my um

112
00:04:19,749 --> 00:04:17,519
slide that shows the trend of acres

113
00:04:21,909 --> 00:04:19,759

burned over time

114
00:04:22,950 --> 00:04:21,919
uh so that i could talk to that a little

115
00:04:24,469 --> 00:04:22,960
bit

116
00:04:26,870 --> 00:04:24,479
you know um

117
00:04:29,110 --> 00:04:26,880
bill's formula that he showed i

118
00:04:31,110 --> 00:04:29,120
i certainly agree with it and we have

119
00:04:33,350 --> 00:04:31,120
another simple formula we talk about a

120
00:04:35,510 --> 00:04:33,360
lot in the forest service

121
00:04:37,510 --> 00:04:35,520
not that visual but it was a bar chart

122
00:04:38,790 --> 00:04:37,520
showing acres burned if you can find

123
00:04:40,070 --> 00:04:38,800
that

124
00:04:42,230 --> 00:04:40,080
um

125
00:04:43,749 --> 00:04:42,240
we have another uh simple formula we

126
00:04:45,990 --> 00:04:43,759
talk about in the forest service a lot

127
00:04:48,230 --> 00:04:46,000
and that's the fire behavior triangle

128
00:04:50,070 --> 00:04:48,240
and the three factors that really can

129
00:04:51,590 --> 00:04:50,080
troll fire behavior

130
00:04:55,830 --> 00:04:51,600
are topography

131
00:04:58,230 --> 00:04:55,840
weather and fuels so

132
00:05:00,870 --> 00:04:58,240
uh in a given landscape topography is a

133
00:05:03,749 --> 00:05:00,880
constant and whether we have strong

134
00:05:06,710 --> 00:05:03,759
indications is currently very conducive

135
00:05:09,110 --> 00:05:06,720
to active fire behavior so that leaves

136
00:05:11,909 --> 00:05:09,120
the one angle of the fire behavior

137
00:05:14,790 --> 00:05:11,919
triangle that we can possibly impact

138
00:05:16,950 --> 00:05:14,800

which is fuels and vegetation

139
00:05:20,790 --> 00:05:16,960
it's certainly true that fuels

140
00:05:22,310 --> 00:05:20,800
accumulate in the absence of disturbance

141
00:05:25,029 --> 00:05:22,320
most of our

142
00:05:27,830 --> 00:05:25,039
wild lands in the united states 94 of

143
00:05:30,230 --> 00:05:27,840
them fire plays a fundamental ecological

144
00:05:33,590 --> 00:05:30,240
role and when that role is interrupted

145
00:05:34,550 --> 00:05:33,600
or removed it has consequences

146
00:05:37,189 --> 00:05:34,560
um

147
00:05:38,950 --> 00:05:37,199
it's difficult to know

148
00:05:41,350 --> 00:05:38,960
to what extent

149
00:05:44,150 --> 00:05:41,360
the current increases in fire we're

150
00:05:46,950 --> 00:05:44,160
seeing are climate driven or fuel driven

151
00:05:49,110 --> 00:05:46,960
certainly we know that post-world war ii

152
00:05:51,430 --> 00:05:49,120
there was a dramatic reduction

153
00:05:52,870 --> 00:05:51,440
in acres burned around the west that

154
00:05:55,110 --> 00:05:52,880
reduction

155
00:05:57,590 --> 00:05:55,120
was partially due to our increased

156
00:05:59,189 --> 00:05:57,600
capability to suppress fires it was

157
00:06:01,110 --> 00:05:59,199
partially due also to the fact that

158
00:06:02,310 --> 00:06:01,120
those happen to be relatively cool wet

159
00:06:04,230 --> 00:06:02,320
decades

160
00:06:07,189 --> 00:06:04,240
so um

161
00:06:09,270 --> 00:06:07,199
since uh actually 25 years ago i think

162
00:06:12,150 --> 00:06:09,280
of as sort of the the point of

163
00:06:14,550 --> 00:06:12,160

inflection in our fire occurrence curve

164
00:06:17,590 --> 00:06:14,560
when we started uh seeing much more

165
00:06:20,309 --> 00:06:17,600
acreage burned and that increase has

166
00:06:22,469 --> 00:06:20,319
increased over time

167
00:06:24,950 --> 00:06:22,479
some of that may be due to the fact that

168
00:06:27,270 --> 00:06:24,960
we entered that period in a fire deficit

169
00:06:30,150 --> 00:06:27,280
so to speak some of the areas hadn't

170
00:06:32,230 --> 00:06:30,160
been visited by fire as often as maybe

171
00:06:34,950 --> 00:06:32,240
they were historically adapted to so

172
00:06:37,029 --> 00:06:34,960
fuels had accumulated whether that's

173
00:06:38,950 --> 00:06:37,039
because we were so successful at

174
00:06:40,950 --> 00:06:38,960
suppressing them or because those happen

175
00:06:43,430 --> 00:06:40,960
to be cool wet decades it's a little bit

176
00:06:44,390 --> 00:06:43,440
hard to say and in retrospect

177
00:06:46,309 --> 00:06:44,400
um

178
00:06:48,230 --> 00:06:46,319
well we can only go forward from here

179
00:06:50,150 --> 00:06:48,240
and our tools for going forward are to

180
00:06:51,510 --> 00:06:50,160
manage that vegetation

181
00:06:57,350 --> 00:06:51,520
in

182
00:06:59,029 --> 00:06:57,360
fire to play its natural ecological role

183
00:07:01,029 --> 00:06:59,039
um i want to bring doug morton into the

184
00:07:03,510 --> 00:07:01,039
conversation and also describe where i

185
00:07:05,749 --> 00:07:03,520
am right now um doug let me throw it

186
00:07:07,749 --> 00:07:05,759
right to you this over doug's shoulder

187
00:07:09,990 --> 00:07:07,759
you can see almost a visualization of

188
00:07:12,230 --> 00:07:10,000

fires doug can you sort of explain

189
00:07:13,830 --> 00:07:12,240
what these visualizations show when it

190
00:07:16,309 --> 00:07:13,840
comes to fires

191
00:07:18,150 --> 00:07:16,319
sure at nasa we have about 14 different

192
00:07:19,990 --> 00:07:18,160
satellites that are observing the earth

193
00:07:22,469 --> 00:07:20,000
and many of those fires are very useful

194
00:07:23,990 --> 00:07:22,479
for identifying actively burning fires

195
00:07:25,670 --> 00:07:24,000
mapping out the burns cars that come

196
00:07:27,510 --> 00:07:25,680
from those fires and of course studying

197
00:07:29,270 --> 00:07:27,520
how the smoke and the greenhouse gases

198
00:07:31,029 --> 00:07:29,280
they get released from fires contribute

199
00:07:32,870 --> 00:07:31,039
to global warming and also altering

200
00:07:34,550 --> 00:07:32,880
other components of the earth's system

201
00:07:36,710 --> 00:07:34,560
behind me you can see an animation

202
00:07:38,309 --> 00:07:36,720
showing some of the active fires

203
00:07:39,670 --> 00:07:38,319
this is one of the hallmarks of the way

204
00:07:41,350 --> 00:07:39,680
in which nasa satellites provide

205
00:07:42,710 --> 00:07:41,360
information obviously to resource

206
00:07:44,870 --> 00:07:42,720
management groups including the forest

207
00:07:47,029 --> 00:07:44,880
service but also to other protected area

208
00:07:48,390 --> 00:07:47,039
and park managers around the world these

209
00:07:50,309 --> 00:07:48,400
actively burning fires can be

210
00:07:52,790 --> 00:07:50,319
transmitted within 30 minutes of a

211
00:07:53,909 --> 00:07:52,800
satellite overpass by text message or on

212
00:07:55,430 --> 00:07:53,919
a smartphone

213
00:07:58,309 --> 00:07:55,440

to park managers around the world

214
00:08:00,230 --> 00:07:58,319
including in australia or south africa

215
00:08:02,869 --> 00:08:00,240
it's one of the vital roles that nasa

216
00:08:04,070 --> 00:08:02,879
data play for looking at fire and fire

217
00:08:05,589 --> 00:08:04,080
management

218
00:08:07,670 --> 00:08:05,599
certainly as a scientist i'm interested

219
00:08:09,670 --> 00:08:07,680
in using more than just the today's

220
00:08:11,350 --> 00:08:09,680
actively burning fires but also looking

221
00:08:13,110 --> 00:08:11,360
at how those fires have changed those

222
00:08:14,629 --> 00:08:13,120
trends have changed over time to

223
00:08:16,629 --> 00:08:14,639
understand how the combination of

224
00:08:18,150 --> 00:08:16,639
factors that bill and

225
00:08:20,869 --> 00:08:18,160
elizabeth pointed out before the

226
00:08:23,670 --> 00:08:20,879
combined influence of human activity and

227
00:08:27,029 --> 00:08:23,680
climate change as way as the way that

228
00:08:28,390 --> 00:08:27,039
fires are playing out in the landscape

229
00:08:29,749 --> 00:08:28,400
thanks doug i want to remind everybody

230
00:08:31,029 --> 00:08:29,759
and we're getting some great questions

231
00:08:32,870 --> 00:08:31,039
and now i'll be reading them in just a

232
00:08:35,269 --> 00:08:32,880
second you can ask questions either in

233
00:08:36,469 --> 00:08:35,279
the youtube comments box or by using the

234
00:08:40,310 --> 00:08:36,479
hashtag

235
00:08:42,469 --> 00:08:40,320
nasafires or nasafire or also ask nasa

236
00:08:43,589 --> 00:08:42,479
we're keeping an eye on all of them um i

237
00:08:45,829 --> 00:08:43,599
also want to point out where i'm

238
00:08:47,350 --> 00:08:45,839

situated here at nasa goddard is one of

239
00:08:49,350 --> 00:08:47,360
the places where the satellite data

240
00:08:51,269 --> 00:08:49,360
comes in that doug was talking about i'm

241
00:08:53,269 --> 00:08:51,279
going to angle my screen back here you

242
00:08:54,790 --> 00:08:53,279
can see a satellite pass

243
00:08:56,790 --> 00:08:54,800
going over essentially greenland and

244
00:08:59,190 --> 00:08:56,800
there's what the satellite passes look

245
00:09:01,509 --> 00:08:59,200
like this is where the data comes in

246
00:09:03,670 --> 00:09:01,519
from many of all of the many of the

247
00:09:07,590 --> 00:09:03,680
earth science satellites that nasa has

248
00:09:09,269 --> 00:09:07,600
terra aqua landsat and that information

249
00:09:11,350 --> 00:09:09,279
comes in here and then it's turned into

250
00:09:13,750 --> 00:09:11,360
what essentially are called level one

251
00:09:15,269 --> 00:09:13,760
products that scientists like doug

252
00:09:17,269 --> 00:09:15,279
morton and i believe bill patzert used

253
00:09:19,350 --> 00:09:17,279
in their computer models um bill i

254
00:09:21,670 --> 00:09:19,360
wanted to ask you when it comes to

255
00:09:24,630 --> 00:09:21,680
forecasting fires in the future

256
00:09:27,829 --> 00:09:24,640
how reliable are the models and how

257
00:09:29,829 --> 00:09:27,839
confident can the people who get ideas

258
00:09:31,590 --> 00:09:29,839
of what wildfires may or may not be in

259
00:09:33,269 --> 00:09:31,600
individual states or counties how

260
00:09:35,750 --> 00:09:33,279
confident can they be about different

261
00:09:38,389 --> 00:09:35,760
fire forecasts

262
00:09:41,750 --> 00:09:38,399
well uh you know remember we have great

263
00:09:44,070 --> 00:09:41,760

natural cycles in the climate system and

264
00:09:46,949 --> 00:09:44,080
for instance for the last dozen years

265
00:09:49,350 --> 00:09:46,959
the west has been extremely dry

266
00:09:51,269 --> 00:09:49,360
here in southern california

267
00:09:53,750 --> 00:09:51,279
since january

268
00:09:56,710 --> 00:09:53,760
essentially the rain's just turned off

269
00:10:00,070 --> 00:09:56,720
so we've had a very busy active fire

270
00:10:01,509 --> 00:10:00,080
season and so a good forecast of fires

271
00:10:03,990 --> 00:10:01,519
is drought

272
00:10:05,670 --> 00:10:04,000
and as we look into the future of the

273
00:10:09,269 --> 00:10:05,680
west

274
00:10:12,870 --> 00:10:09,279
is one of the climate forecasts is for

275
00:10:16,230 --> 00:10:12,880
not only a warmer west but a drier west

276
00:10:21,030 --> 00:10:16,240
and so that definitely translates into a

277
00:10:22,710 --> 00:10:21,040
more fiery west and uh as population

278
00:10:25,990 --> 00:10:22,720
shifts and more and more people are

279
00:10:32,630 --> 00:10:26,000
moving into harm's way of these fires

280
00:10:35,509 --> 00:10:33,910
and doug you said you had some you may

281
00:10:37,829 --> 00:10:35,519
have something to add when it comes also

282
00:10:40,069 --> 00:10:37,839
about developing these projections

283
00:10:41,350 --> 00:10:40,079
i think at nasa we're looking

284
00:10:43,350 --> 00:10:41,360
excuse me bill i'm just going to chime

285
00:10:44,470 --> 00:10:43,360
in with a a follow-on to the points you

286
00:10:46,389 --> 00:10:44,480
were making which is that we're

287
00:10:48,550 --> 00:10:46,399
certainly interested in looking out over

288
00:10:50,310 --> 00:10:48,560

the next century in particular using the

289
00:10:52,230 --> 00:10:50,320
latest generation of climate models to

290
00:10:53,750 --> 00:10:52,240
understand how conditions that do favor

291
00:10:55,509 --> 00:10:53,760
fire activity those hot and dry

292
00:10:57,269 --> 00:10:55,519
conditions bill was mentioning are

293
00:10:59,430 --> 00:10:57,279
likely to play out and certainly as we

294
00:11:01,590 --> 00:10:59,440
look out towards the end of this century

295
00:11:03,430 --> 00:11:01,600
we're seeing years for example like 2012

296
00:11:05,190 --> 00:11:03,440
which was very dry across the front

297
00:11:07,269 --> 00:11:05,200
range of the rockies and the midwest of

298
00:11:09,190 --> 00:11:07,279
the country that kind of a fire season

299
00:11:11,030 --> 00:11:09,200
being the new normal by the end of the

300
00:11:12,470 --> 00:11:11,040
century so certainly a trend towards

301
00:11:14,630 --> 00:11:12,480
hotter and drier conditions in regions

302
00:11:16,710 --> 00:11:14,640
that are already experiencing fires and

303
00:11:17,829 --> 00:11:16,720
even an increase in those fires in

304
00:11:19,350 --> 00:11:17,839
places where

305
00:11:21,350 --> 00:11:19,360
fires haven't historically been all that

306
00:11:23,590 --> 00:11:21,360
important places like the upper midwest

307
00:11:25,190 --> 00:11:23,600
of the u.s or other northern great

308
00:11:26,949 --> 00:11:25,200
plains regions

309
00:11:28,389 --> 00:11:26,959
nasa scientists are also using satellite

310
00:11:31,269 --> 00:11:28,399
data to understand how we can project

311
00:11:32,710 --> 00:11:31,279
fire on a much shorter time scale

312
00:11:35,110 --> 00:11:32,720
many of the viewers may be familiar with

313
00:11:36,870 --> 00:11:35,120

the influence of cycles like el nino

314
00:11:38,470 --> 00:11:36,880
and how that can contribute to

315
00:11:40,389 --> 00:11:38,480
rainier or drier conditions in different

316
00:11:41,990 --> 00:11:40,399
parts of the world we're certainly using

317
00:11:43,509 --> 00:11:42,000
information like that information that

318
00:11:45,430 --> 00:11:43,519
comes from sea surface temperatures like

319
00:11:47,030 --> 00:11:45,440
the el nino phenomenon as well as

320
00:11:48,790 --> 00:11:47,040
variability in the atlantic sea surface

321
00:11:51,350 --> 00:11:48,800
temperatures to try to make projections

322
00:11:52,870 --> 00:11:51,360
of fire activity out just a few months

323
00:11:54,470 --> 00:11:52,880
so for example i'm a part of a research

324
00:11:56,230 --> 00:11:54,480
group that's made a projection of fire

325
00:11:58,069 --> 00:11:56,240
activity in the amazon we made that

326
00:11:59,829 --> 00:11:58,079
projection in may and the peak of the

327
00:12:01,269 --> 00:11:59,839
fire season's yet to come

328
00:12:03,590 --> 00:12:01,279
so those are the ways in which these

329
00:12:05,509 --> 00:12:03,600
tools are providing a lens on future

330
00:12:07,750 --> 00:12:05,519
fire activity over the scale of months

331
00:12:09,110 --> 00:12:07,760
to decades

332
00:12:10,629 --> 00:12:09,120
and elizabeth there at the forest

333
00:12:12,069 --> 00:12:10,639
service how do you take these

334
00:12:13,750 --> 00:12:12,079
projections that come from the research

335
00:12:15,350 --> 00:12:13,760
scientists and apply them into

336
00:12:18,629 --> 00:12:15,360
essentially the real world when it comes

337
00:12:21,350 --> 00:12:18,639
to managing our nation's forests

338
00:12:24,389 --> 00:12:21,360

you know our um preparedness

339
00:12:27,190 --> 00:12:24,399
is um

340
00:12:29,110 --> 00:12:27,200
the the pre-positioning of fire crews

341
00:12:31,910 --> 00:12:29,120
and resources takes these predictions

342
00:12:35,030 --> 00:12:31,920
into account we have our own predictive

343
00:12:37,590 --> 00:12:35,040
services groups that looks at um

344
00:12:39,030 --> 00:12:37,600
weather projections seasonally

345
00:12:41,670 --> 00:12:39,040
in addition to

346
00:12:43,590 --> 00:12:41,680
weather and drought

347
00:12:46,230 --> 00:12:43,600
prevalence of fine fuels is an important

348
00:12:48,470 --> 00:12:46,240
predictor of fire behavior so in some

349
00:12:50,389 --> 00:12:48,480
places where fine fuels are limiting

350
00:12:53,269 --> 00:12:50,399
a wet spring

351
00:12:54,949 --> 00:12:53,279
actually is conducive to fire activity

352
00:12:58,550 --> 00:12:54,959
later in the season when those fine

353
00:13:00,150 --> 00:12:58,560
fields the grasses um begin to dry out

354
00:13:02,949 --> 00:13:00,160
so um

355
00:13:04,949 --> 00:13:02,959
we definitely um take that information

356
00:13:06,629 --> 00:13:04,959
into account in placement and

357
00:13:09,030 --> 00:13:06,639
preparedness of our

358
00:13:10,310 --> 00:13:09,040
firefighting resources

359
00:13:11,670 --> 00:13:10,320
that actually leads us to the first

360
00:13:14,069 --> 00:13:11,680
question we're going to take from the

361
00:13:16,550 --> 00:13:14,079
internet just to remind anybody watching

362
00:13:18,870 --> 00:13:16,560
just write questions in the

363
00:13:21,350 --> 00:13:18,880

youtube comments page in the google plus

364
00:13:23,750 --> 00:13:21,360
page here and also we're monitoring uh

365
00:13:26,310 --> 00:13:23,760
twitter and facebook um she's a hashtag

366
00:13:28,389 --> 00:13:26,320
uh nasafire on twitter and we'll find it

367
00:13:30,150 --> 00:13:28,399
quickly um but

368
00:13:33,030 --> 00:13:30,160
what elizabeth just said about a cooler

369
00:13:36,230 --> 00:13:33,040
spring we got a question in google plus

370
00:13:37,750 --> 00:13:36,240
by nicolo lipuri he uh

371
00:13:40,230 --> 00:13:37,760
had the question

372
00:13:42,790 --> 00:13:40,240
essentially a summer that starts barely

373
00:13:44,790 --> 00:13:42,800
at the end of july seems not so global

374
00:13:47,509 --> 00:13:44,800
warming explain to me why if i have to

375
00:13:49,269 --> 00:13:47,519
wear a sweater in july that actually

376
00:13:51,269 --> 00:13:49,279
global warming's happening and that it's

377
00:13:52,790 --> 00:13:51,279
actually increasing fires i'm going to

378
00:13:54,629 --> 00:13:52,800
throw that uh not to put you on the spot

379
00:13:56,949 --> 00:13:54,639
but we've got a climatologist right here

380
00:13:59,509 --> 00:13:56,959
so bill can you sort of draw on that

381
00:14:01,269 --> 00:13:59,519
idea of that if it's first that cold and

382
00:14:03,350 --> 00:14:01,279
rainy all the way into july how can it

383
00:14:05,990 --> 00:14:03,360
possibly lead to or show that climate

384
00:14:08,150 --> 00:14:06,000
change and global warming is happening

385
00:14:10,069 --> 00:14:08,160
okay that's a that's a great question

386
00:14:13,509 --> 00:14:10,079
because it's actually pretty been pretty

387
00:14:17,750 --> 00:14:13,519
cool here in la too which we appreciate

388
00:14:20,310 --> 00:14:17,760

but don't confuse weather with climate

389
00:14:23,350 --> 00:14:20,320
climate are long-term trends

390
00:14:26,389 --> 00:14:23,360
and for instance 2012

391
00:14:28,829 --> 00:14:26,399
was the warmest year in the contiguous

392
00:14:31,509 --> 00:14:28,839
united states since modern

393
00:14:34,629 --> 00:14:31,519
record-breaking record

394
00:14:37,189 --> 00:14:34,639
keeping has begun all right so you're

395
00:14:40,230 --> 00:14:37,199
definitely living in a warmer world even

396
00:14:42,870 --> 00:14:40,240
though you might be having a cooler july

397
00:14:44,870 --> 00:14:42,880
and the other factors like rising sea

398
00:14:48,069 --> 00:14:44,880
level which is the unequivocal proof of

399
00:14:49,110 --> 00:14:48,079
global warming continues to increase

400
00:14:51,189 --> 00:14:49,120
so

401
00:14:52,870 --> 00:14:51,199
you know weather can give you a break

402
00:14:56,150 --> 00:14:52,880
but in the long run climate's going to

403
00:14:59,990 --> 00:14:58,310
thanks so much bill um sorry to be

404
00:15:02,150 --> 00:15:00,000
laughing about it such a serious topic

405
00:15:03,910 --> 00:15:02,160
but when it comes to uh climate change

406
00:15:05,269 --> 00:15:03,920
it's so interesting to continue to come

407
00:15:06,870 --> 00:15:05,279
up with the difference between

408
00:15:09,189 --> 00:15:06,880
individual weather and climate and

409
00:15:10,870 --> 00:15:09,199
because we talk about forecasts and both

410
00:15:13,030 --> 00:15:10,880
it can be a bit confusing for a lot of

411
00:15:14,470 --> 00:15:13,040
people um i have a question probably for

412
00:15:15,910 --> 00:15:14,480
elizabeth

413
00:15:17,350 --> 00:15:15,920

and people keep these questions coming

414
00:15:19,829 --> 00:15:17,360
in we have a question from the youtube

415
00:15:21,750 --> 00:15:19,839
comment section douglas crandall asks

416
00:15:23,750 --> 00:15:21,760
what's the most common ignition of

417
00:15:25,269 --> 00:15:23,760
wildfires i know that sometimes we hear

418
00:15:26,870 --> 00:15:25,279
about arson sometimes we hear about

419
00:15:29,269 --> 00:15:26,880
lightning can you talk a little bit

420
00:15:31,189 --> 00:15:29,279
elizabeth what causes these wildfires

421
00:15:34,069 --> 00:15:31,199
and is there a way to sort of

422
00:15:36,550 --> 00:15:34,079
limit one or the other oh doug good

423
00:15:38,629 --> 00:15:36,560
question and um i think

424
00:15:41,590 --> 00:15:38,639
i don't know off the top of my head what

425
00:15:43,829 --> 00:15:41,600
percent of our fires are human-caused

426
00:15:45,910 --> 00:15:43,839
versus lightning caused but i believe

427
00:15:48,310 --> 00:15:45,920
the majority of them are human-caused

428
00:15:52,949 --> 00:15:48,320
and we always take suppression action on

429
00:15:56,790 --> 00:15:55,990
certain parts of the country are more um

430
00:15:59,269 --> 00:15:56,800
are

431
00:16:02,470 --> 00:15:59,279
impacted more by lightning-caused fires

432
00:16:05,990 --> 00:16:02,480
and um one thing we're really curious to

433
00:16:07,509 --> 00:16:06,000
observing as climate change plays out is

434
00:16:08,790 --> 00:16:07,519
what will be the impacts of climate

435
00:16:11,030 --> 00:16:08,800
change on

436
00:16:12,710 --> 00:16:11,040
uh prevalence of lightning and wear you

437
00:16:15,350 --> 00:16:12,720
know that's the type of detail that you

438
00:16:17,590 --> 00:16:15,360

think we know things are warming we know

439
00:16:20,310 --> 00:16:17,600
that in a warmer climate regardless of

440
00:16:22,949 --> 00:16:20,320
the precipitation patterns vegetation is

441
00:16:25,670 --> 00:16:22,959
under more moisture stress and so it's

442
00:16:27,430 --> 00:16:25,680
more likely to be dead and dying and

443
00:16:29,829 --> 00:16:27,440
dry and flammable

444
00:16:31,829 --> 00:16:29,839
but some details like oh where will we

445
00:16:33,590 --> 00:16:31,839
experience more lightning storms wow

446
00:16:35,189 --> 00:16:33,600
that is really

447
00:16:36,949 --> 00:16:35,199
one of those cases where the devil's in

448
00:16:39,030 --> 00:16:36,959
the details and i don't know what

449
00:16:43,430 --> 00:16:39,040
projections tell us about lightning

450
00:16:46,310 --> 00:16:43,440
caused ignitions in a in a wildland

451
00:16:48,629 --> 00:16:46,320
that's increasingly populated we can

452
00:16:52,790 --> 00:16:48,639
only expect that human-caused ignitions

453
00:16:57,749 --> 00:16:54,470
and doug

454
00:17:01,829 --> 00:16:57,759
go ahead bill in california 95 of all

455
00:17:04,630 --> 00:17:01,839
fires are human ignited all right

456
00:17:05,990 --> 00:17:04,640
and so my simple formula for fire in

457
00:17:11,909 --> 00:17:06,000
california

458
00:17:15,350 --> 00:17:13,429
sorry for the pause in me i wasn't

459
00:17:16,069 --> 00:17:15,360
expecting uh such a simple formula of

460
00:17:17,590 --> 00:17:16,079
all

461
00:17:19,669 --> 00:17:17,600
when doug can you come in a little bit

462
00:17:21,350 --> 00:17:19,679
too that's an interesting idea on a

463
00:17:22,230 --> 00:17:21,360

possible connection between climate

464
00:17:23,750 --> 00:17:22,240
change

465
00:17:25,750 --> 00:17:23,760
increasing

466
00:17:27,590 --> 00:17:25,760
intensity of storms

467
00:17:30,950 --> 00:17:27,600
possibly leading to more lightning which

468
00:17:32,950 --> 00:17:30,960
may cause actually more wildfires

469
00:17:34,390 --> 00:17:32,960
well it's fully a coupled system and i

470
00:17:35,590 --> 00:17:34,400
think both bill and elizabeth have

471
00:17:38,310 --> 00:17:35,600
pointed to the important role that

472
00:17:41,110 --> 00:17:38,320
humans play in modifying the fire regime

473
00:17:43,350 --> 00:17:41,120
of our planet um across the us it might

474
00:17:45,350 --> 00:17:43,360
even be as much as 70 of the fires from

475
00:17:47,110 --> 00:17:45,360
nasa satellites are associated with

476
00:17:49,510 --> 00:17:47,120
fires for forced management or for

477
00:17:51,350 --> 00:17:49,520
agricultural production across places

478
00:17:53,029 --> 00:17:51,360
like the brazilian amazon or maybe even

479
00:17:54,950 --> 00:17:53,039
broadly looking at california that

480
00:17:56,390 --> 00:17:54,960
number is darn close to 100

481
00:17:57,909 --> 00:17:56,400
so clearly humans are an important

482
00:18:00,070 --> 00:17:57,919
source of ignitions

483
00:18:02,070 --> 00:18:00,080
how human activities change and respond

484
00:18:04,950 --> 00:18:02,080
to a changing climate ultimately will

485
00:18:06,549 --> 00:18:04,960
influence how fires will respond as well

486
00:18:08,070 --> 00:18:06,559
those hot and dry conditions those

487
00:18:09,669 --> 00:18:08,080
extreme events that i think are so

488
00:18:11,909 --> 00:18:09,679

critical when we think specifically

489
00:18:13,830 --> 00:18:11,919
about fires certainly there's a wide

490
00:18:15,750 --> 00:18:13,840
range of science and study right now on

491
00:18:17,750 --> 00:18:15,760
the intensity of storms the prevalence

492
00:18:19,830 --> 00:18:17,760
of hurricanes etc but if we think just

493
00:18:21,909 --> 00:18:19,840
about those conditions that favor fires

494
00:18:23,909 --> 00:18:21,919
um those extreme events things we

495
00:18:25,190 --> 00:18:23,919
consider now to be a once a decade kind

496
00:18:27,029 --> 00:18:25,200
of activity

497
00:18:28,470 --> 00:18:27,039
those are certainly on the rise whether

498
00:18:30,310 --> 00:18:28,480
we look at major fire regions in the

499
00:18:32,950 --> 00:18:30,320
western u.s whether we look at places

500
00:18:34,549 --> 00:18:32,960
like australia or southern africa

501
00:18:36,870 --> 00:18:34,559
these are places that will see more

502
00:18:38,390 --> 00:18:36,880
extreme fire conditions

503
00:18:40,549 --> 00:18:38,400
again an early start to the fire year in

504
00:18:45,669 --> 00:18:40,559
california a very early start to the

505
00:18:48,310 --> 00:18:46,870
thanks so much doug martin just to

506
00:18:50,070 --> 00:18:48,320
remind everybody watching this is a

507
00:18:51,750 --> 00:18:50,080
google plus hangout hosted here at nasa

508
00:18:53,350 --> 00:18:51,760
goddard it's live on youtube now and it

509
00:18:55,110 --> 00:18:53,360
will be archived on youtube so if you're

510
00:18:57,909 --> 00:18:55,120
watching after the fact thank you so

511
00:19:00,070 --> 00:18:57,919
much we're taking questions in live now

512
00:19:04,230 --> 00:19:00,080
um through the hashtag ask nasa through

513
00:19:05,990 --> 00:19:04,240

the hashtag nasafire and also on youtube

514
00:19:07,909 --> 00:19:06,000
and here in the google plus page here's

515
00:19:09,669 --> 00:19:07,919
a question we have from the youtube

516
00:19:11,669 --> 00:19:09,679
comments page and this might put

517
00:19:14,870 --> 00:19:11,679
elizabeth a bit on the spot uh so

518
00:19:15,830 --> 00:19:14,880
apologies elizabeth but um jack ring in

519
00:19:20,710 --> 00:19:15,840
the

520
00:19:22,390 --> 00:19:20,720
about when it comes to fuel for fires is

521
00:19:25,830 --> 00:19:22,400
there a difference between acreage

522
00:19:27,830 --> 00:19:25,840
burned in u.s forest service land versus

523
00:19:30,150 --> 00:19:27,840
reservation land he says at least here

524
00:19:32,470 --> 00:19:30,160
in arizona the native american lands are

525
00:19:34,549 --> 00:19:32,480
much better cleared of underbrush than

526
00:19:35,750 --> 00:19:34,559
are the u.s forest service lands i don't

527
00:19:38,150 --> 00:19:35,760
want to put you on a spot about a

528
00:19:40,150 --> 00:19:38,160
particular tract of land out there but

529
00:19:43,430 --> 00:19:40,160
it does lead to the idea of how to

530
00:19:44,789 --> 00:19:43,440
manage forests as a way of minimizing

531
00:19:46,470 --> 00:19:44,799
wildfire

532
00:19:47,590 --> 00:19:46,480
risk

533
00:19:49,990 --> 00:19:47,600
certainly

534
00:19:52,710 --> 00:19:50,000
many tribes have a strong tradition of

535
00:19:55,270 --> 00:19:52,720
active forest management

536
00:19:56,870 --> 00:19:55,280
and certainly many of our national

537
00:19:59,029 --> 00:19:56,880
forests

538
00:20:00,390 --> 00:19:59,039

are in need of fuel management

539
00:20:01,510 --> 00:20:00,400
treatments

540
00:20:03,270 --> 00:20:01,520
however

541
00:20:06,070 --> 00:20:03,280
it's also true that many of our most

542
00:20:08,310 --> 00:20:06,080
devastating wildfires this year have

543
00:20:09,669 --> 00:20:08,320
been on private lands not federal lands

544
00:20:11,669 --> 00:20:09,679
of any kind

545
00:20:13,510 --> 00:20:11,679
so

546
00:20:17,270 --> 00:20:13,520
definitely we take seriously our

547
00:20:18,870 --> 00:20:17,280
responsibility to manage and steward the

548
00:20:22,470 --> 00:20:18,880
national forests which are a public

549
00:20:26,150 --> 00:20:22,480
resource and which we

550
00:20:27,270 --> 00:20:26,160
we value deeply ourselves

551
00:20:29,190 --> 00:20:27,280
so

552
00:20:30,789 --> 00:20:29,200
i guess i don't have any statistics for

553
00:20:34,230 --> 00:20:30,799
you about

554
00:20:35,990 --> 00:20:34,240
relative fuel conditions on tribal lands

555
00:20:37,590 --> 00:20:36,000
versus national forest lands and i would

556
00:20:39,190 --> 00:20:37,600
certainly expect it to vary

557
00:20:40,390 --> 00:20:39,200
geographically

558
00:20:41,750 --> 00:20:40,400
um

559
00:20:45,270 --> 00:20:41,760
but there's no question that there's

560
00:20:48,870 --> 00:20:47,110
thank you so much elizabeth we have a

561
00:20:51,029 --> 00:20:48,880
question um coming in through a phone

562
00:20:53,830 --> 00:20:51,039
bridge from a reporter from the futurist

563
00:20:58,149 --> 00:20:53,840

hold on one moment

564
00:21:00,470 --> 00:20:58,159
uh

565
00:21:01,590 --> 00:21:00,480
go ahead with your question

566
00:21:04,070 --> 00:21:01,600
all right

567
00:21:07,190 --> 00:21:04,080
um yeah i heard doug morton say that

568
00:21:08,950 --> 00:21:07,200
places like the upper midwest could see

569
00:21:10,710 --> 00:21:08,960
more fire activity where those are

570
00:21:11,909 --> 00:21:10,720
places that have not historically seen a

571
00:21:13,590 --> 00:21:11,919
lot of fires

572
00:21:15,669 --> 00:21:13,600
now i'm wondering

573
00:21:16,789 --> 00:21:15,679
not too far from the upper midwest is

574
00:21:19,750 --> 00:21:16,799
canada

575
00:21:22,549 --> 00:21:19,760
so could what should this fire activity

576
00:21:24,710 --> 00:21:22,559
become a uh trans national issue for

577
00:21:28,630 --> 00:21:24,720
example you could see more fires

578
00:21:30,630 --> 00:21:28,640
crossing to or from canada and or the us

579
00:21:32,470 --> 00:21:30,640
yeah since those many of those forests

580
00:21:34,870 --> 00:21:32,480
intersect and if so

581
00:21:37,029 --> 00:21:34,880
could this end up being a problem that

582
00:21:39,110 --> 00:21:37,039
canada and the united states would have

583
00:21:41,350 --> 00:21:39,120
to cooperatively work together to

584
00:21:42,310 --> 00:21:41,360
address

585
00:21:43,750 --> 00:21:42,320
i think

586
00:21:46,870 --> 00:21:43,760
that's a really good question and

587
00:21:48,549 --> 00:21:46,880
certainly we see areas like that

588
00:21:50,549 --> 00:21:48,559

northern forest boundary between the u.s

589
00:21:52,390 --> 00:21:50,559
and canada as some of those areas that

590
00:21:54,310 --> 00:21:52,400
are projected to dry the most during the

591
00:21:55,750 --> 00:21:54,320
fire season based on this latest

592
00:21:58,149 --> 00:21:55,760
generation of climate models from the

593
00:21:59,510 --> 00:21:58,159
ipcc the intergovernmental panel on

594
00:22:01,350 --> 00:21:59,520
climate change

595
00:22:03,590 --> 00:22:01,360
the trans boundary issue that you bring

596
00:22:05,510 --> 00:22:03,600
up is is pretty important certainly we

597
00:22:07,110 --> 00:22:05,520
think directly about how these fires

598
00:22:09,029 --> 00:22:07,120
forced in particular along that boundary

599
00:22:11,909 --> 00:22:09,039
may be vulnerable to fire but the long

600
00:22:13,669 --> 00:22:11,919
distance transport of the smoke aerosols

601
00:22:15,190 --> 00:22:13,679
that come from those fires is something

602
00:22:16,950 --> 00:22:15,200
we can already point to as being a

603
00:22:19,909 --> 00:22:16,960
pretty significant impact there were

604
00:22:21,350 --> 00:22:19,919
fires in quebec in 2003 uh the smoke

605
00:22:22,549 --> 00:22:21,360
plume from those fires reached all the

606
00:22:24,470 --> 00:22:22,559
way down to where we are here in

607
00:22:26,710 --> 00:22:24,480
maryland in washington dc

608
00:22:29,430 --> 00:22:26,720
when that smoke hit the metro area of dc

609
00:22:31,190 --> 00:22:29,440
there were thousands of 911 calls within

610
00:22:32,310 --> 00:22:31,200
a half an hour because people smelled

611
00:22:34,149 --> 00:22:32,320
smoke

612
00:22:35,510 --> 00:22:34,159
that's just one example i think if you

613
00:22:38,070 --> 00:22:35,520

think also about the way that we as

614
00:22:39,669 --> 00:22:38,080
scientists connect the aerosols the

615
00:22:42,390 --> 00:22:39,679
smoke that's transported from these

616
00:22:44,390 --> 00:22:42,400
fires and its transport up from the u.s

617
00:22:46,789 --> 00:22:44,400
over canada and up into the ice sheets

618
00:22:48,789 --> 00:22:46,799
in regions like greenland those

619
00:22:50,310 --> 00:22:48,799
aerosols and the black carbon that rains

620
00:22:51,750 --> 00:22:50,320
out on the

621
00:22:53,990 --> 00:22:51,760
ice sheets

622
00:22:56,549 --> 00:22:54,000
in greenland has a significant impact on

623
00:22:59,830 --> 00:22:56,559
how quickly that ice is melting and how

624
00:23:01,190 --> 00:22:59,840
rapidly this link between fires and

625
00:23:03,750 --> 00:23:01,200
melting ice

626
00:23:06,070 --> 00:23:03,760
helps play a role in the global

627
00:23:07,510 --> 00:23:06,080
the global earth system picture

628
00:23:08,789 --> 00:23:07,520
and doug i have a question when you say

629
00:23:10,710 --> 00:23:08,799
black carbon are we actually just

630
00:23:12,470 --> 00:23:10,720
talking about like literally soot from

631
00:23:13,750 --> 00:23:12,480
these fires or is it something else more

632
00:23:16,630 --> 00:23:13,760
specific

633
00:23:18,549 --> 00:23:16,640
well fires release a range of different

634
00:23:20,230 --> 00:23:18,559
particle emissions that's essentially

635
00:23:21,110 --> 00:23:20,240
little particles of

636
00:23:22,870 --> 00:23:21,120
burned

637
00:23:25,029 --> 00:23:22,880
vegetation that's the black carbon piece

638
00:23:26,710 --> 00:23:25,039

it's essentially like very fine charcoal

639
00:23:29,669 --> 00:23:26,720
but you also see the release of carbon

640
00:23:31,750 --> 00:23:29,679
dioxide methane which are two very

641
00:23:33,110 --> 00:23:31,760
important greenhouse gases and so

642
00:23:34,870 --> 00:23:33,120
part of the research that we do is to

643
00:23:36,789 --> 00:23:34,880
take information about the amount of

644
00:23:39,909 --> 00:23:36,799
fuels that are there in a forest as it

645
00:23:41,990 --> 00:23:39,919
burns we can see some of that damage as

646
00:23:44,070 --> 00:23:42,000
we take nasa imagery of the burn scar

647
00:23:46,149 --> 00:23:44,080
after the fire passes and we can also

648
00:23:47,990 --> 00:23:46,159
take measurements of the smoke plume and

649
00:23:49,909 --> 00:23:48,000
the greenhouse gases in the atmosphere

650
00:23:51,750 --> 00:23:49,919
with other nasa satellites we can put

651
00:23:53,830 --> 00:23:51,760
those two pieces together in a model to

652
00:23:55,350 --> 00:23:53,840
understand how fires overall are

653
00:23:56,549 --> 00:23:55,360
contributing to the problem of global

654
00:23:58,390 --> 00:23:56,559
warming

655
00:24:00,070 --> 00:23:58,400
thanks for clearing it up for me um

656
00:24:01,750 --> 00:24:00,080
elizabeth reinhart with the u.s forest

657
00:24:04,070 --> 00:24:01,760
service um i was wondering if you could

658
00:24:05,830 --> 00:24:04,080
comment a little bit about the idea of

659
00:24:07,510 --> 00:24:05,840
fires crossing borders i mean of course

660
00:24:09,270 --> 00:24:07,520
fires don't actually care what side of a

661
00:24:11,350 --> 00:24:09,280
fence they're on and how does the u.s

662
00:24:13,510 --> 00:24:11,360
forest service work with canada when it

663
00:24:14,870 --> 00:24:13,520

comes to fires that might be along the

664
00:24:16,310 --> 00:24:14,880
border

665
00:24:19,350 --> 00:24:16,320
you know we work closely with our

666
00:24:21,350 --> 00:24:19,360
canadian neighbors and we also have

667
00:24:24,549 --> 00:24:21,360
agreements with other countries as well

668
00:24:27,830 --> 00:24:24,559
we work with mexico and we have sent aid

669
00:24:29,430 --> 00:24:27,840
and received aid from australia and i

670
00:24:31,350 --> 00:24:29,440
believe some countries in europe in

671
00:24:32,710 --> 00:24:31,360
times of

672
00:24:35,590 --> 00:24:32,720
um but you know what's really

673
00:24:37,430 --> 00:24:35,600
interesting i think is to address that

674
00:24:39,590 --> 00:24:37,440
at a much smaller scale and think about

675
00:24:42,630 --> 00:24:39,600
how we work across boundaries that are

676
00:24:44,870 --> 00:24:42,640
just property boundaries rather than um

677
00:24:46,710 --> 00:24:44,880
uh national boundaries so one thing

678
00:24:49,909 --> 00:24:46,720
we've been working on in the forest

679
00:24:53,269 --> 00:24:49,919
service is trying to make more of an

680
00:24:55,909 --> 00:24:53,279
effort to strategically locate our fuels

681
00:24:57,110 --> 00:24:55,919
and vegetation work in places where

682
00:24:58,870 --> 00:24:57,120
there's a

683
00:25:01,350 --> 00:24:58,880
neighboring effort right across the

684
00:25:03,669 --> 00:25:01,360
property line so to speak so that we can

685
00:25:05,990 --> 00:25:03,679
be good neighbors and so that

686
00:25:06,870 --> 00:25:06,000
that also so that the effects of our

687
00:25:08,710 --> 00:25:06,880
work

688
00:25:11,029 --> 00:25:08,720

are um

689
00:25:13,110 --> 00:25:11,039
uh i guess enhanced by the effects of

690
00:25:14,630 --> 00:25:13,120
the neighboring work so i think there's

691
00:25:17,750 --> 00:25:14,640
a real opportunity

692
00:25:22,070 --> 00:25:17,760
for us moving forward to coordinate our

693
00:25:24,310 --> 00:25:22,080
work with um neighboring landowners

694
00:25:25,750 --> 00:25:24,320
thank you so much just so anyone tuning

695
00:25:27,990 --> 00:25:25,760
in now that was elizabeth reinhart she's

696
00:25:30,310 --> 00:25:28,000
with the u.s forest service also joining

697
00:25:32,870 --> 00:25:30,320
us had something here yeah that and uh

698
00:25:34,230 --> 00:25:32,880
joining us also is bill patzert at jpl

699
00:25:36,149 --> 00:25:34,240
bill take it away

700
00:25:38,710 --> 00:25:36,159
yeah i just wanted to point out to

701
00:25:40,710 --> 00:25:38,720
everybody that fires are not only in the

702
00:25:42,870 --> 00:25:40,720
west some of the largest fires we've

703
00:25:44,549 --> 00:25:42,880
seen in the united states have actually

704
00:25:46,870 --> 00:25:44,559
occurred in the midwest and the

705
00:25:47,750 --> 00:25:46,880
northeast historically

706
00:25:50,630 --> 00:25:47,760
and

707
00:25:52,070 --> 00:25:50,640
the other point i would make is that in

708
00:25:53,669 --> 00:25:52,080
in the world where the climate is

709
00:25:55,669 --> 00:25:53,679
changing

710
00:25:56,789 --> 00:25:55,679
precipitation patterns temperature

711
00:25:58,950 --> 00:25:56,799
patterns

712
00:26:02,149 --> 00:25:58,960
ecosystems will change

713
00:26:04,070 --> 00:26:02,159

and so what a forest looks like today

714
00:26:06,789 --> 00:26:04,080
is not necessarily what it will look

715
00:26:08,710 --> 00:26:06,799
like in a half a century and we're

716
00:26:11,269 --> 00:26:08,720
already beginning to see this

717
00:26:13,190 --> 00:26:11,279
the great conifer forest in canada are

718
00:26:15,990 --> 00:26:13,200
moving farther north

719
00:26:17,909 --> 00:26:16,000
as the arctic tundra melts

720
00:26:21,669 --> 00:26:17,919
we're seeing more and more

721
00:26:24,630 --> 00:26:21,679
new species develop in the arctic tundra

722
00:26:28,310 --> 00:26:24,640
and even here in the united states

723
00:26:30,950 --> 00:26:28,320
the level the altitude at which various

724
00:26:34,149 --> 00:26:30,960
plants and trees grow

725
00:26:35,269 --> 00:26:34,159
is dramatically changing in some areas

726
00:26:37,590 --> 00:26:35,279
and so

727
00:26:39,909 --> 00:26:37,600
with changing ecosystems

728
00:26:44,230 --> 00:26:39,919
it will be an entirely new story with

729
00:26:48,950 --> 00:26:46,549
so um i think that's a really good and

730
00:26:51,269 --> 00:26:48,960
sobering point that you make bill and

731
00:26:53,029 --> 00:26:51,279
one thing that's of concern to us is

732
00:26:55,269 --> 00:26:53,039
that not only

733
00:26:57,590 --> 00:26:55,279
is fire occurrence increasing in terms

734
00:27:01,110 --> 00:26:57,600
of acreage burned but that we receive

735
00:27:02,789 --> 00:27:01,120
many anecdotal accounts of fire severity

736
00:27:05,430 --> 00:27:02,799
and intensity

737
00:27:07,909 --> 00:27:05,440
outside the range of people's experience

738
00:27:11,110 --> 00:27:07,919

which really adds to the potential risk

739
00:27:13,669 --> 00:27:11,120
to firefighters to the public and to

740
00:27:15,830 --> 00:27:13,679
ecological systems if they're being

741
00:27:18,630 --> 00:27:15,840
stressed with a a kind of disturbance

742
00:27:23,029 --> 00:27:18,640
that's outside the range of the historic

743
00:27:25,990 --> 00:27:24,390
thank you for anyone joining us i'm

744
00:27:27,590 --> 00:27:26,000
aries keck here at nasa goddard space

745
00:27:29,029 --> 00:27:27,600
flight center and as you can see behind

746
00:27:31,110 --> 00:27:29,039
me this is where some of the data comes

747
00:27:32,789 --> 00:27:31,120
in from our nasa satellites and joining

748
00:27:35,830 --> 00:27:32,799
us are a panel of experts we're also

749
00:27:39,669 --> 00:27:35,840
taking questions um on uh twitter at the

750
00:27:41,750 --> 00:27:39,679
hashtag ask nasa or the hashtag nasafire

751
00:27:43,669 --> 00:27:41,760
also in the youtube comment section and

752
00:27:45,750 --> 00:27:43,679
here on the google plus page we have a

753
00:27:47,750 --> 00:27:45,760
question here from twitter um it's from

754
00:27:50,470 --> 00:27:47,760
katie campbell she's a multimedia

755
00:27:53,590 --> 00:27:50,480
journalist at kcts9

756
00:27:56,389 --> 00:27:53,600
out in seattle and she asked uh is there

757
00:27:59,350 --> 00:27:56,399
any mapping or tracking of smoke or air

758
00:28:00,710 --> 00:27:59,360
quality decline related to wildfires i'm

759
00:28:02,149 --> 00:28:00,720
going to throw that to doug morton first

760
00:28:03,830 --> 00:28:02,159
because i know he's standing and it's

761
00:28:06,389 --> 00:28:03,840
essentially sitting in front of a wall

762
00:28:08,870 --> 00:28:06,399
of computer models but i believe kitty's

763
00:28:10,789 --> 00:28:08,880

katie campbell's question is more about

764
00:28:12,630 --> 00:28:10,799
ground level pollution and not

765
00:28:15,269 --> 00:28:12,640
necessarily the kind of pollution that

766
00:28:17,350 --> 00:28:15,279
you study doug or do you study both

767
00:28:19,909 --> 00:28:17,360
well the pollution uh that we see that

768
00:28:21,350 --> 00:28:19,919
comes from fires impacts us here and the

769
00:28:23,269 --> 00:28:21,360
the air we breathe and the lower

770
00:28:25,510 --> 00:28:23,279
boundary layer but obviously also at

771
00:28:27,590 --> 00:28:25,520
times can get transported um around the

772
00:28:29,350 --> 00:28:27,600
entire globe and so yes i'm sitting in

773
00:28:31,750 --> 00:28:29,360
front of an image showing fires from the

774
00:28:33,430 --> 00:28:31,760
last 10 days and you can see the the

775
00:28:35,830 --> 00:28:33,440
extent of fires especially in southern

776
00:28:37,590 --> 00:28:35,840
africa those are low intensity savannah

777
00:28:38,789 --> 00:28:37,600
fires these are regions that burn every

778
00:28:40,549 --> 00:28:38,799
year

779
00:28:42,470 --> 00:28:40,559
yes one of the important things that we

780
00:28:44,389 --> 00:28:42,480
do track and where nasa satellite data

781
00:28:46,470 --> 00:28:44,399
are provided not just to nasa scientists

782
00:28:49,029 --> 00:28:46,480
but also to the naval research lab it's

783
00:28:50,230 --> 00:28:49,039
looking at operational meteorology and

784
00:28:51,669 --> 00:28:50,240
navigation

785
00:28:56,789 --> 00:28:51,679
as well as the fact that we're following

786
00:29:00,710 --> 00:28:58,710
interesting and slash dangerous uh

787
00:29:02,470 --> 00:29:00,720
plumes of both dust and smoke that come

788
00:29:04,630 --> 00:29:02,480

from fires in africa and transit the

789
00:29:06,950 --> 00:29:04,640
atlantic and uh influence the amazon

790
00:29:09,029 --> 00:29:06,960
region as well as fires and industrial

791
00:29:11,350 --> 00:29:09,039
pollution that crosses the pacific ocean

792
00:29:12,789 --> 00:29:11,360
from areas of southeast asia just

793
00:29:15,190 --> 00:29:12,799
recently have been two

794
00:29:17,909 --> 00:29:15,200
important examples one with fires in

795
00:29:20,070 --> 00:29:17,919
sumatra inundating areas of singapore

796
00:29:22,389 --> 00:29:20,080
with the kinds of dense

797
00:29:24,230 --> 00:29:22,399
smoke and dangerous levels of

798
00:29:26,710 --> 00:29:24,240
particulate matter and surface level

799
00:29:27,909 --> 00:29:26,720
ozone in terms of public health impacts

800
00:29:30,070 --> 00:29:27,919
the kinds of things that haven't been

801
00:29:31,750 --> 00:29:30,080
seen since the late 1990s in a very

802
00:29:35,110 --> 00:29:31,760
large el nino

803
00:29:37,350 --> 00:29:35,120
event in 1997 1998 so that juxtaposition

804
00:29:40,149 --> 00:29:37,360
of having large cities in regions where

805
00:29:42,230 --> 00:29:40,159
wildfires especially wildfires that can

806
00:29:44,549 --> 00:29:42,240
generate quite a bit of smoke

807
00:29:46,950 --> 00:29:44,559
really drives home this issue of how

808
00:29:48,870 --> 00:29:46,960
fires are impacting people in the local

809
00:29:50,789 --> 00:29:48,880
scale and that those same aerosols can

810
00:29:57,750 --> 00:29:50,799
be transported globally impacting

811
00:30:01,430 --> 00:29:59,269
excellent we have we have another

812
00:30:03,110 --> 00:30:01,440
question coming in from youtube it's

813
00:30:05,110 --> 00:30:03,120

jack ring again

814
00:30:06,870 --> 00:30:05,120
and that question is have the models

815
00:30:09,750 --> 00:30:06,880
used to project the next

816
00:30:11,909 --> 00:30:09,760
few decades of wildfires been used to

817
00:30:13,669 --> 00:30:11,919
look backwards over the last 50 years to

818
00:30:15,510 --> 00:30:13,679
actually see if they predicted the

819
00:30:17,430 --> 00:30:15,520
reality i mean after that question first

820
00:30:18,630 --> 00:30:17,440
to doug but then i imagine that uh bill

821
00:30:20,710 --> 00:30:18,640
and elizabeth may have something to say

822
00:30:22,789 --> 00:30:20,720
about that as well i think it also sums

823
00:30:24,389 --> 00:30:22,799
up on just how do you check that your

824
00:30:28,950 --> 00:30:24,399
forecast and your models are actually

825
00:30:32,630 --> 00:30:30,710
well we talked today about how fire in

826
00:30:34,630 --> 00:30:32,640
some ways is a simple equation and other

827
00:30:37,110 --> 00:30:34,640
ways fire is a complex equation i mean

828
00:30:39,029 --> 00:30:37,120
some place right now is burning

829
00:30:40,549 --> 00:30:39,039
and that's true this year like every

830
00:30:41,990 --> 00:30:40,559
other year it's one of the reasons why

831
00:30:43,510 --> 00:30:42,000
it's so valuable to have a fleet of

832
00:30:45,269 --> 00:30:43,520
satellites that are observing fires

833
00:30:46,950 --> 00:30:45,279
around the globe

834
00:30:48,710 --> 00:30:46,960
that said there are certainly conditions

835
00:30:50,789 --> 00:30:48,720
and things which we feel are much more

836
00:30:52,070 --> 00:30:50,799
predictable if you get santa ana winds

837
00:30:53,830 --> 00:30:52,080
in southern california you're very

838
00:30:55,590 --> 00:30:53,840

likely to have fires

839
00:30:57,510 --> 00:30:55,600
and again if we look at our regions and

840
00:30:59,430 --> 00:30:57,520
across the globe areas that are

841
00:31:02,149 --> 00:30:59,440
projected to get hotter and drier are

842
00:31:04,070 --> 00:31:02,159
certainly areas where the conditions are

843
00:31:05,510 --> 00:31:04,080
set the climate piece of the fire

844
00:31:06,950 --> 00:31:05,520
triangle that elizabeth talked about or

845
00:31:09,029 --> 00:31:06,960
the fire equation that the bill

846
00:31:11,029 --> 00:31:09,039
mentioned um that's almost out of the

847
00:31:12,710 --> 00:31:11,039
picture now if you imagine that humans

848
00:31:14,950 --> 00:31:12,720
and their role in

849
00:31:17,029 --> 00:31:14,960
igniting these fires are also increasing

850
00:31:18,789 --> 00:31:17,039
in some of these fire prone areas

851
00:31:20,389 --> 00:31:18,799
you certainly think that there's a

852
00:31:23,430 --> 00:31:20,399
pretty strong set of indicators that

853
00:31:25,430 --> 00:31:23,440
we're headed for a world with more fire

854
00:31:26,710 --> 00:31:25,440
how do we check that information again

855
00:31:28,549 --> 00:31:26,720
one of the unique things about having

856
00:31:29,669 --> 00:31:28,559
this long history of nasa satellite data

857
00:31:32,070 --> 00:31:29,679
is that we can actually go back and

858
00:31:33,669 --> 00:31:32,080
compare this year to previous years and

859
00:31:36,070 --> 00:31:33,679
how much fire we've seen in any one

860
00:31:37,350 --> 00:31:36,080
specific part of the globe

861
00:31:39,029 --> 00:31:37,360
i mentioned some of the work we do in

862
00:31:41,029 --> 00:31:39,039
the brazilian amazon and and that is a

863
00:31:42,870 --> 00:31:41,039

case where we make a projection of how

864
00:31:44,630 --> 00:31:42,880
much fire activity we expect to see

865
00:31:47,509 --> 00:31:44,640
based on how the climate system is set

866
00:31:49,430 --> 00:31:47,519
up which regions are drier today than

867
00:31:51,830 --> 00:31:49,440
they are normally and so those areas are

868
00:31:53,750 --> 00:31:51,840
primed for for more fire in places where

869
00:31:55,110 --> 00:31:53,760
where fuels the kinds of things that you

870
00:31:57,029 --> 00:31:55,120
know we talk a lot about in the western

871
00:31:58,630 --> 00:31:57,039
us but is important in all regions for

872
00:32:00,549 --> 00:31:58,640
fires fuels are not limiting in a

873
00:32:02,070 --> 00:32:00,559
tropical rainforest you just need

874
00:32:03,990 --> 00:32:02,080
conditions that are dry enough to let

875
00:32:05,830 --> 00:32:04,000
those fires burn so we can actually go

876
00:32:08,630 --> 00:32:05,840
back and check so our projections from

877
00:32:10,310 --> 00:32:08,640
last year for uh the previous year were

878
00:32:11,750 --> 00:32:10,320
for a below average fire year and it

879
00:32:13,509 --> 00:32:11,760
turns out that the fires we observed

880
00:32:14,549 --> 00:32:13,519
with nasa satellites told that same

881
00:32:15,990 --> 00:32:14,559
story

882
00:32:18,389 --> 00:32:16,000
this is a year where we've projected

883
00:32:20,389 --> 00:32:18,399
actually a much higher fire year for the

884
00:32:21,350 --> 00:32:20,399
brazilian amazon and parts of the living

885
00:32:23,190 --> 00:32:21,360
amazon

886
00:32:24,870 --> 00:32:23,200
and we'll wait and see certainly that's

887
00:32:26,470 --> 00:32:24,880
the kind of information we're sharing

888
00:32:29,029 --> 00:32:26,480

broadly with people as we expect this

889
00:32:30,630 --> 00:32:29,039
region to be at higher risk of fires

890
00:32:32,470 --> 00:32:30,640
and then the nasa satellite data will

891
00:32:36,870 --> 00:32:32,480
tell the story about how this year

892
00:32:40,549 --> 00:32:39,110
thanks so much doug people continue to

893
00:32:43,430 --> 00:32:40,559
bring the questions in we have quite a

894
00:32:45,830 --> 00:32:43,440
few coming in this one is from the

895
00:32:47,269 --> 00:32:45,840
comment section of youtube and i'm going

896
00:32:49,909 --> 00:32:47,279
to throw it to bill patzer our

897
00:32:51,590 --> 00:32:49,919
climatologist there at nasa's jpl lab

898
00:32:56,230 --> 00:32:51,600
out in california

899
00:32:58,149 --> 00:32:56,240
iron 69 iron 69 asks is elevated co2

900
00:33:01,029 --> 00:32:58,159
going to increase the rate of plant

901
00:33:02,630 --> 00:33:01,039
growth significantly and then i imagine

902
00:33:04,389 --> 00:33:02,640
that that could have an effect on

903
00:33:06,149 --> 00:33:04,399
wildfires bill

904
00:33:08,710 --> 00:33:06,159
is increased co2 going to actually

905
00:33:09,909 --> 00:33:08,720
change plant growth around the world

906
00:33:11,909 --> 00:33:09,919
well you know that's a that's an

907
00:33:14,710 --> 00:33:11,919
excellent question there i just read a

908
00:33:16,870 --> 00:33:14,720
really good paper about uh when you look

909
00:33:19,990 --> 00:33:16,880
at the growth of co2

910
00:33:21,909 --> 00:33:20,000
it has a very strong annual signal

911
00:33:25,669 --> 00:33:21,919
where there's uh in the northern

912
00:33:27,830 --> 00:33:25,679
hemisphere there's tremendous amount of

913
00:33:30,549 --> 00:33:27,840

uptake of co2

914
00:33:33,509 --> 00:33:30,559
and in the northern hemisphere of winter

915
00:33:35,669 --> 00:33:33,519
just the opposite there's a

916
00:33:38,070 --> 00:33:35,679
co2 that's

917
00:33:41,350 --> 00:33:38,080
gas to the atmosphere so they

918
00:33:43,830 --> 00:33:41,360
characterize it that rise and dip is

919
00:33:46,389 --> 00:33:43,840
becoming larger in other words the earth

920
00:33:47,990 --> 00:33:46,399
is taking deeper breaths

921
00:33:49,190 --> 00:33:48,000
of co2

922
00:33:50,070 --> 00:33:49,200
all right

923
00:33:53,750 --> 00:33:50,080
and

924
00:33:54,789 --> 00:33:53,760
so the nature of the cycle is changing

925
00:33:56,070 --> 00:33:54,799
all right

926
00:33:58,389 --> 00:33:56,080
but uh

927
00:34:00,149 --> 00:33:58,399
the the fact is is that it's slowly

928
00:34:03,430 --> 00:34:00,159
increasing you know

929
00:34:04,789 --> 00:34:03,440
this year co2 finally reached 400 parts

930
00:34:08,389 --> 00:34:04,799
per million

931
00:34:11,510 --> 00:34:08,399
and that's uh that's almost a 40

932
00:34:13,430 --> 00:34:11,520
increase in co2 in my lifetime

933
00:34:16,710 --> 00:34:13,440
which is because i'm the oldest person

934
00:34:17,829 --> 00:34:16,720
here i can say that right but the uh

935
00:34:19,190 --> 00:34:17,839
so

936
00:34:21,990 --> 00:34:19,200
co2

937
00:34:24,710 --> 00:34:22,000
is having a huge impact

938
00:34:25,669 --> 00:34:24,720

because of course it's making a warmer

939
00:34:27,669 --> 00:34:25,679
world

940
00:34:30,790 --> 00:34:27,679
most of that heat is being

941
00:34:33,109 --> 00:34:30,800
absorbed by the oceans and so rising sea

942
00:34:34,629 --> 00:34:33,119
level which has been eight inches in the

943
00:34:36,389 --> 00:34:34,639
past century

944
00:34:40,069 --> 00:34:36,399
and so the

945
00:34:41,430 --> 00:34:40,079
the nature of all the major cycles is

946
00:34:42,389 --> 00:34:41,440
changing now

947
00:34:45,430 --> 00:34:42,399
essen

948
00:34:47,510 --> 00:34:45,440
and ecosystem the nature of ecosystems

949
00:34:50,629 --> 00:34:47,520
are changing and so we'll have to see

950
00:34:55,829 --> 00:34:53,669
now the national cohesive wildland fire

951
00:34:57,670 --> 00:34:55,839
strategy has apparently three goals

952
00:34:59,589 --> 00:34:57,680
resilient landscapes

953
00:35:02,470 --> 00:34:59,599
fire adapted communities and an

954
00:35:04,150 --> 00:35:02,480
effective inefficient wildfire response

955
00:35:06,230 --> 00:35:04,160
elizabeth reinhardt there at the u.s

956
00:35:07,750 --> 00:35:06,240
ford's forest service can you talk a

957
00:35:10,630 --> 00:35:07,760
little bit about what it would mean to

958
00:35:12,630 --> 00:35:10,640
have a fire adapted community i imagine

959
00:35:14,150 --> 00:35:12,640
it's more than just keeping your house

960
00:35:17,109 --> 00:35:14,160
particularly wet

961
00:35:20,390 --> 00:35:17,119
right a fire adapted community like a

962
00:35:22,950 --> 00:35:20,400
fire resilient landscape is one that can

963
00:35:26,550 --> 00:35:22,960

um experience wildfire and not be

964
00:35:29,030 --> 00:35:26,560
devastated by it so um you know in the

965
00:35:31,030 --> 00:35:29,040
fire management community historically

966
00:35:34,230 --> 00:35:31,040
we're very very good at putting out

967
00:35:36,790 --> 00:35:34,240
fires and in fact our initial attack

968
00:35:39,829 --> 00:35:36,800
success rate is like 98 or something

969
00:35:41,990 --> 00:35:39,839
that means that 98 of the starts that we

970
00:35:43,750 --> 00:35:42,000
respond to we just put them right out

971
00:35:46,069 --> 00:35:43,760
but

972
00:35:48,550 --> 00:35:46,079
experience is beginning to show us that

973
00:35:51,190 --> 00:35:48,560
that long success rate

974
00:35:53,109 --> 00:35:51,200
um may not be completely sustainable

975
00:35:55,190 --> 00:35:53,119
that those few fires that escape and the

976
00:35:55,990 --> 00:35:55,200
proportion that escapes is not seeming

977
00:35:58,550 --> 00:35:56,000
to

978
00:36:01,270 --> 00:35:58,560
grow but what is happening is that the

979
00:36:03,190 --> 00:36:01,280
ones that escape are bigger than they've

980
00:36:05,430 --> 00:36:03,200
been in the past we're having more big

981
00:36:07,510 --> 00:36:05,440
fires and the big fires are getting

982
00:36:11,829 --> 00:36:07,520
bigger that's what's causing our great

983
00:36:14,230 --> 00:36:11,839
increases in acres burn so we really

984
00:36:16,550 --> 00:36:14,240
have to plan not just to respond to

985
00:36:17,510 --> 00:36:16,560
fires not just to put fires out

986
00:36:21,109 --> 00:36:17,520
but

987
00:36:22,630 --> 00:36:21,119
we need to be proactive about planning

988
00:36:27,589 --> 00:36:22,640

for

989
00:36:29,750 --> 00:36:27,599
face of fire and in

990
00:36:31,829 --> 00:36:29,760
in an ecological sense that it that

991
00:36:33,190 --> 00:36:31,839
makes total sense because we know most

992
00:36:37,270 --> 00:36:33,200
of our wild

993
00:36:38,870 --> 00:36:37,280
ecosystems evolved as fire adapted so 94

994
00:36:41,589 --> 00:36:38,880
of our wildlands

995
00:36:43,910 --> 00:36:41,599
fireplace a fundamental ecological role

996
00:36:47,270 --> 00:36:43,920
so if we manage those forests to be

997
00:36:49,190 --> 00:36:47,280
healthy they can withstand fire and come

998
00:36:52,150 --> 00:36:49,200
back and continue to be healthy but what

999
00:36:54,470 --> 00:36:52,160
about communities we as people also need

1000
00:36:56,870 --> 00:36:54,480
to learn to be fire adapted just as

1001
00:36:58,550 --> 00:36:56,880
ponderosa pine trees might be and what

1002
00:37:00,550 --> 00:36:58,560
does that involve it involves a number

1003
00:37:02,230 --> 00:37:00,560
of things it involves managing the

1004
00:37:03,990 --> 00:37:02,240
vegetation

1005
00:37:06,710 --> 00:37:04,000
immediately around

1006
00:37:08,950 --> 00:37:06,720
your residence and it involves

1007
00:37:11,270 --> 00:37:08,960
constructing homes out of less flammable

1008
00:37:13,109 --> 00:37:11,280
materials little things like having

1009
00:37:14,870 --> 00:37:13,119
closed gutters instead of gutters that

1010
00:37:19,430 --> 00:37:14,880
are full of pine needles can make a big

1011
00:37:23,270 --> 00:37:21,190
another aspect of fire adapted

1012
00:37:26,310 --> 00:37:23,280
communities is planning um

1013
00:37:28,870 --> 00:37:26,320

communications ahead of time and also

1014
00:37:30,630 --> 00:37:28,880
planning so that there's access in and

1015
00:37:32,870 --> 00:37:30,640
out of the community

1016
00:37:34,790 --> 00:37:32,880
a community that only has one access

1017
00:37:39,589 --> 00:37:34,800
road going into it doesn't tend to be

1018
00:37:43,270 --> 00:37:41,589
thank you so much elizabeth for anyone i

1019
00:37:44,950 --> 00:37:43,280
could add something to that please go

1020
00:37:46,790 --> 00:37:44,960
right ahead let me just remind everyone

1021
00:37:49,910 --> 00:37:46,800
please keep the questions coming in both

1022
00:37:52,069 --> 00:37:49,920
on youtube and on twitter and we'll be

1023
00:37:53,990 --> 00:37:52,079
uh just we're following along on hashtag

1024
00:37:56,150 --> 00:37:54,000
nasafire and i'm going to pass it right

1025
00:37:57,990 --> 00:37:56,160
off to bill patzer there at nasa's jpl

1026
00:38:00,230 --> 00:37:58,000
lab he's our climatologist joining us

1027
00:38:02,710 --> 00:38:00,240
today go ahead bill well there's a

1028
00:38:04,550 --> 00:38:02,720
growing tendency in the american west

1029
00:38:07,990 --> 00:38:04,560
for more and more urban and suburban

1030
00:38:09,829 --> 00:38:08,000
development not only near wildlands but

1031
00:38:12,230 --> 00:38:09,839
into wild lands

1032
00:38:14,230 --> 00:38:12,240
all right and this is what i call high

1033
00:38:16,630 --> 00:38:14,240
risk zoning

1034
00:38:19,030 --> 00:38:16,640
all right people that like to build

1035
00:38:21,109 --> 00:38:19,040
their communities in things that look

1036
00:38:22,069 --> 00:38:21,119
like national forests

1037
00:38:22,950 --> 00:38:22,079
all right

1038
00:38:25,030 --> 00:38:22,960

and

1039
00:38:26,150 --> 00:38:25,040
that's a that's a dangerous business

1040
00:38:28,630 --> 00:38:26,160
because

1041
00:38:30,630 --> 00:38:28,640
all these lands were made to burn every

1042
00:38:31,510 --> 00:38:30,640
20 to 30 years

1043
00:38:33,430 --> 00:38:31,520
now

1044
00:38:34,710 --> 00:38:33,440
you can protect yourself

1045
00:38:36,550 --> 00:38:34,720
by having

1046
00:38:38,790 --> 00:38:36,560
more stringent

1047
00:38:41,030 --> 00:38:38,800
construction standards in other words

1048
00:38:42,790 --> 00:38:41,040
you can build to protect yourself

1049
00:38:43,829 --> 00:38:42,800
against fire

1050
00:38:47,910 --> 00:38:43,839
and

1051
00:38:53,349 --> 00:38:47,920
not

1052
00:38:55,990 --> 00:38:53,359
they're at high risk the other thing is

1053
00:38:58,710 --> 00:38:56,000
in california you're required to build

1054
00:39:00,950 --> 00:38:58,720
defensible areas if you live near

1055
00:39:02,310 --> 00:39:00,960
grasslands and wildlands

1056
00:39:03,430 --> 00:39:02,320
and that's another thing that's not

1057
00:39:05,990 --> 00:39:03,440
enforced

1058
00:39:07,829 --> 00:39:06,000
and so the consequence of this is that

1059
00:39:11,109 --> 00:39:07,839
there is just too much

1060
00:39:12,790 --> 00:39:11,119
expensive firefighting going on in the

1061
00:39:16,069 --> 00:39:12,800
american west

1062
00:39:17,750 --> 00:39:16,079
defending homes that 30 years ago this

1063
00:39:19,030 --> 00:39:17,760

was wild land

1064
00:39:20,550 --> 00:39:19,040
now it's

1065
00:39:22,230 --> 00:39:20,560
it's uh

1066
00:39:24,470 --> 00:39:22,240
it's expensive

1067
00:39:26,310 --> 00:39:24,480
uh communities

1068
00:39:28,550 --> 00:39:26,320
that

1069
00:39:30,390 --> 00:39:28,560
30 years ago were not allowed to exist

1070
00:39:31,670 --> 00:39:30,400
in these wild areas

1071
00:39:33,190 --> 00:39:31,680
and so uh

1072
00:39:35,270 --> 00:39:33,200
you know this is uh

1073
00:39:38,790 --> 00:39:35,280
it's dangerous it's deadly and it's

1074
00:39:42,310 --> 00:39:40,630
thank you so much phil um just from

1075
00:39:43,829 --> 00:39:42,320
people dialing now i'm aries keck here

1076
00:39:45,430 --> 00:39:43,839
at nasa goddard space flight center and

1077
00:39:47,910 --> 00:39:45,440
we're joined by bill patzert out at

1078
00:39:50,310 --> 00:39:47,920
nasa's jpl lab he's a climatologist doug

1079
00:39:52,550 --> 00:39:50,320
morton also here at nasa goddard and

1080
00:39:54,310 --> 00:39:52,560
elizabeth reinhart who's with the u.s

1081
00:39:55,910 --> 00:39:54,320
forest service

1082
00:39:58,230 --> 00:39:55,920
we have a question coming in and i'd

1083
00:40:00,310 --> 00:39:58,240
like to sort of throw this to doug uh

1084
00:40:03,910 --> 00:40:00,320
that question is uh could you comment a

1085
00:40:05,910 --> 00:40:03,920
little bit doug on the use of nd ndvi

1086
00:40:08,829 --> 00:40:05,920
for anyone uh listening that is a

1087
00:40:11,990 --> 00:40:08,839
measure of vegetation and then also soil

1088
00:40:14,390 --> 00:40:12,000

moisture to asset to assess drought

1089
00:40:15,589 --> 00:40:14,400
impacts and pine beetle infestations i

1090
00:40:17,109 --> 00:40:15,599
thought i'm going to ask you to back out

1091
00:40:18,710 --> 00:40:17,119
a little bit from going right into those

1092
00:40:20,790 --> 00:40:18,720
two particular

1093
00:40:22,790 --> 00:40:20,800
fields of data and pine beetles and just

1094
00:40:26,069 --> 00:40:22,800
talk a little bit about how nasa has

1095
00:40:28,550 --> 00:40:26,079
been for decades has been studying fire

1096
00:40:30,870 --> 00:40:28,560
using satellites and then going more

1097
00:40:33,430 --> 00:40:30,880
specific about how possibly effects like

1098
00:40:35,030 --> 00:40:33,440
pine beetles and soil moisture can be

1099
00:40:37,589 --> 00:40:35,040
measured from space and then used in

1100
00:40:39,589 --> 00:40:37,599
these wildfires

1101
00:40:42,310 --> 00:40:39,599
take a deep breath that's a lot to think

1102
00:40:43,910 --> 00:40:42,320
about but it's true that we do use our

1103
00:40:45,829 --> 00:40:43,920
satellites to study the health and

1104
00:40:47,670 --> 00:40:45,839
productivity of vegetation that's in

1105
00:40:49,589 --> 00:40:47,680
part what you understand from the idea

1106
00:40:51,910 --> 00:40:49,599
if you can see green vegetation you can

1107
00:40:53,270 --> 00:40:51,920
see brown or dried out vegetation and

1108
00:40:55,349 --> 00:40:53,280
the way that we use our satellites from

1109
00:40:57,109 --> 00:40:55,359
space that helps us to understand quite

1110
00:40:58,790 --> 00:40:57,119
a bit about the vulnerability of some of

1111
00:41:00,309 --> 00:40:58,800
these forested landscapes in particular

1112
00:41:02,870 --> 00:41:00,319
to fire

1113
00:41:04,950 --> 00:41:02,880

ndvi is just one measure of how much

1114
00:41:06,230 --> 00:41:04,960
green vegetation we have and that's a

1115
00:41:08,710 --> 00:41:06,240
measurement we've been making for

1116
00:41:10,950 --> 00:41:08,720
decades now since the launch of the

1117
00:41:12,710 --> 00:41:10,960
earliest satellites in the early 1970s

1118
00:41:14,309 --> 00:41:12,720
so we have an idea about how our

1119
00:41:16,069 --> 00:41:14,319
planet's changing which areas are

1120
00:41:18,550 --> 00:41:16,079
responding to the variability we see in

1121
00:41:20,550 --> 00:41:18,560
climate by growing more vegetation or in

1122
00:41:23,030 --> 00:41:20,560
areas like the driest parts of the

1123
00:41:24,950 --> 00:41:23,040
mountain west areas where those same

1124
00:41:27,670 --> 00:41:24,960
beetles are killing large areas of

1125
00:41:29,829 --> 00:41:27,680
forest making that tinder dry region

1126
00:41:31,510 --> 00:41:29,839
that much more vulnerable to fires

1127
00:41:33,349 --> 00:41:31,520
we have a couple of new satellites that

1128
00:41:35,589 --> 00:41:33,359
we've been using now for only the last

1129
00:41:37,270 --> 00:41:35,599
decade to look at how water is stored in

1130
00:41:39,030 --> 00:41:37,280
the landscape

1131
00:41:41,670 --> 00:41:39,040
i will point anyone who's interested to

1132
00:41:43,589 --> 00:41:41,680
learn more from the grace satellites

1133
00:41:44,870 --> 00:41:43,599
a really amazing set of tools that allow

1134
00:41:46,710 --> 00:41:44,880
us to look at how

1135
00:41:49,510 --> 00:41:46,720
water that's stored in the ground is

1136
00:41:51,910 --> 00:41:49,520
changing season to season year to year

1137
00:41:53,829 --> 00:41:51,920
so for very large river basins like the

1138
00:41:55,510 --> 00:41:53,839

mississippi or the amazon we can

1139
00:41:57,750 --> 00:41:55,520
actually see whether this is a drought

1140
00:41:59,750 --> 00:41:57,760
year or flood year just by changes in

1141
00:42:02,069 --> 00:41:59,760
gravity since that water and the flow of

1142
00:42:03,589 --> 00:42:02,079
water in those systems is very heavy and

1143
00:42:05,349 --> 00:42:03,599
things like mountains although they

1144
00:42:06,230 --> 00:42:05,359
influence the earth's gravity are pretty

1145
00:42:07,990 --> 00:42:06,240
fixed

1146
00:42:09,910 --> 00:42:08,000
so we can put those different pieces of

1147
00:42:12,150 --> 00:42:09,920
the puzzle together again using nasa

1148
00:42:13,829 --> 00:42:12,160
satellites to study rainfall to look at

1149
00:42:15,750 --> 00:42:13,839
how that rainfall the memory of that

1150
00:42:17,750 --> 00:42:15,760
rainfall in the lands

1151
00:42:19,349 --> 00:42:17,760
through the measure of soil moisture and

1152
00:42:21,270 --> 00:42:19,359
then how the vegetation on those

1153
00:42:22,870 --> 00:42:21,280
landscapes is responding

1154
00:42:25,190 --> 00:42:22,880
each of those pieces comes together to

1155
00:42:26,710 --> 00:42:25,200
help us understand the risks of fire for

1156
00:42:28,710 --> 00:42:26,720
people living in the mountain west

1157
00:42:30,309 --> 00:42:28,720
beetles are a reality i think that comes

1158
00:42:32,390 --> 00:42:30,319
back again to a point that bill made

1159
00:42:34,470 --> 00:42:32,400
earlier thinking about how climate is

1160
00:42:37,349 --> 00:42:34,480
influen climate change on our warmer

1161
00:42:39,349 --> 00:42:37,359
world uh is altering a wide range of

1162
00:42:41,829 --> 00:42:39,359
systems um

1163
00:42:44,069 --> 00:42:41,839

warmer winters allow beetles to over wet

1164
00:42:46,150 --> 00:42:44,079
over winter and then kill more trees and

1165
00:42:50,710 --> 00:42:46,160
those dead trees are then primed for

1166
00:42:54,950 --> 00:42:52,630
now we have a question coming in from

1167
00:42:56,790 --> 00:42:54,960
twitter it is

1168
00:42:59,109 --> 00:42:56,800
wondering what is possibly the biggest

1169
00:43:00,550 --> 00:42:59,119
misconception that u.s scientists have

1170
00:43:02,710 --> 00:43:00,560
heard about the connection between

1171
00:43:04,309 --> 00:43:02,720
wildfires and climate change i'm going

1172
00:43:05,750 --> 00:43:04,319
to throw it to our climatologist either

1173
00:43:07,990 --> 00:43:05,760
bill first but i'd love to hear what

1174
00:43:09,430 --> 00:43:08,000
elizabeth has to say and doug has to say

1175
00:43:11,510 --> 00:43:09,440
about that too we're talking about

1176
00:43:13,670 --> 00:43:11,520
misconceptions here when it comes to the

1177
00:43:16,150 --> 00:43:13,680
connection between climate change and

1178
00:43:18,550 --> 00:43:16,160
wildfires bill

1179
00:43:20,309 --> 00:43:18,560
well you know climate change is uh is

1180
00:43:22,470 --> 00:43:20,319
definitely the real deal

1181
00:43:23,990 --> 00:43:22,480
we're living in a warmer world

1182
00:43:26,470 --> 00:43:24,000
and

1183
00:43:28,630 --> 00:43:26,480
climate patterns all over the planet

1184
00:43:29,910 --> 00:43:28,640
are subtly changing

1185
00:43:32,069 --> 00:43:29,920
but uh

1186
00:43:34,470 --> 00:43:32,079
every time you see a fire or you see a

1187
00:43:36,630 --> 00:43:34,480
hurricane or a tornado

1188
00:43:38,790 --> 00:43:36,640

and you turn on the evening news and

1189
00:43:41,750 --> 00:43:38,800
they tell you you're living in a wilder

1190
00:43:44,230 --> 00:43:41,760
world because of climate change

1191
00:43:46,630 --> 00:43:44,240
that's not entirely true

1192
00:43:48,870 --> 00:43:46,640
because the other thing that happens

1193
00:43:51,349 --> 00:43:48,880
is that there are more and more of us

1194
00:43:53,109 --> 00:43:51,359
living in harm's way

1195
00:43:55,270 --> 00:43:53,119
anybody that lives

1196
00:43:57,910 --> 00:43:55,280
within 18 inches of sea level on the

1197
00:43:58,950 --> 00:43:57,920
american gulf coast or the east coast

1198
00:44:01,589 --> 00:43:58,960
all right

1199
00:44:03,990 --> 00:44:01,599
is definitely asking for it or if you

1200
00:44:05,829 --> 00:44:04,000
live outside oklahoma city without a

1201
00:44:09,270 --> 00:44:05,839
storm shelter

1202
00:44:11,670 --> 00:44:09,280
or in the american west if you build in

1203
00:44:13,990 --> 00:44:11,680
wild areas that historically burned

1204
00:44:16,069 --> 00:44:14,000
every 20 to 30 years

1205
00:44:17,109 --> 00:44:16,079
and so a big part of this

1206
00:44:19,190 --> 00:44:17,119
is just

1207
00:44:21,190 --> 00:44:19,200
tremendous growth in population

1208
00:44:23,270 --> 00:44:21,200
population density

1209
00:44:25,670 --> 00:44:23,280
and people moving into

1210
00:44:26,950 --> 00:44:25,680
areas that historically

1211
00:44:28,390 --> 00:44:26,960
have flooded

1212
00:44:30,710 --> 00:44:28,400
and burned

1213
00:44:33,109 --> 00:44:30,720

you know in southern california in 1950

1214
00:44:34,550 --> 00:44:33,119
there were four million people

1215
00:44:36,390 --> 00:44:34,560
now there are more than 20 million

1216
00:44:37,910 --> 00:44:36,400
people between san diego and santa

1217
00:44:39,589 --> 00:44:37,920
barbara

1218
00:44:41,109 --> 00:44:39,599
and more and more of them are living in

1219
00:44:43,829 --> 00:44:41,119
harm's way

1220
00:44:45,910 --> 00:44:43,839
and so climate change is the real deal

1221
00:44:48,550 --> 00:44:45,920
but human behavior

1222
00:44:49,829 --> 00:44:48,560
is the dominant factor

1223
00:44:50,950 --> 00:44:49,839
i'm going to jump in there for a second

1224
00:44:52,790 --> 00:44:50,960
i know i was going to throw it to both

1225
00:44:54,710 --> 00:44:52,800
elizabeth and doug but we have a comment

1226
00:44:58,390 --> 00:44:54,720
question in from youtube that leads to

1227
00:45:00,069 --> 00:44:58,400
this topic um while matt haldane asked

1228
00:45:02,069 --> 00:45:00,079
that uh wildfires have traditionally

1229
00:45:03,990 --> 00:45:02,079
contributed a small amount of damage

1230
00:45:06,069 --> 00:45:04,000
compared to other natural disasters like

1231
00:45:07,510 --> 00:45:06,079
hurricanes and flooding and so we've

1232
00:45:09,270 --> 00:45:07,520
answered this a little bit but i'd like

1233
00:45:11,270 --> 00:45:09,280
to elizabeth address a little more are

1234
00:45:14,069 --> 00:45:11,280
we going to see wildfires becoming sort

1235
00:45:15,829 --> 00:45:14,079
of a greater piece of our overall damage

1236
00:45:17,589 --> 00:45:15,839
pie happening here in the u.s in the

1237
00:45:22,069 --> 00:45:17,599
coming years

1238
00:45:23,910 --> 00:45:22,079

some people certainly think so um and uh

1239
00:45:27,109 --> 00:45:23,920
and to be clear that

1240
00:45:29,109 --> 00:45:27,119
the direct costs of wildfire in terms of

1241
00:45:31,990 --> 00:45:29,119
putting out the fire are only a small

1242
00:45:33,030 --> 00:45:32,000
piece of what wildfire costs society in

1243
00:45:35,030 --> 00:45:33,040
terms of

1244
00:45:36,950 --> 00:45:35,040
damaged watersheds

1245
00:45:39,109 --> 00:45:36,960
subsequent flooding

1246
00:45:42,550 --> 00:45:39,119
and you know damaged utilities things

1247
00:45:43,430 --> 00:45:42,560
like that but um but it's also likely

1248
00:45:45,829 --> 00:45:43,440
that

1249
00:45:47,910 --> 00:45:45,839
other natural hazards may respond to

1250
00:45:49,349 --> 00:45:47,920
climate change with an increased

1251
00:45:51,190 --> 00:45:49,359
signal so

1252
00:45:52,630 --> 00:45:51,200
so i don't really like to speculate but

1253
00:45:54,790 --> 00:45:52,640
i would like to add something to what

1254
00:45:57,510 --> 00:45:54,800
bill said which is that um

1255
00:46:00,069 --> 00:45:57,520
you know any given fire just like any

1256
00:46:02,309 --> 00:46:00,079
storm we can't really say oh this is a

1257
00:46:03,829 --> 00:46:02,319
climate change cause

1258
00:46:05,829 --> 00:46:03,839
it might have you know

1259
00:46:08,710 --> 00:46:05,839
we know that um

1260
00:46:11,750 --> 00:46:08,720
fire in general is episodic and highly

1261
00:46:13,349 --> 00:46:11,760
variable so it's the fires we see

1262
00:46:15,270 --> 00:46:13,359
might have been seen 100 years ago or

1263
00:46:17,670 --> 00:46:15,280

200 years ago

1264
00:46:20,790 --> 00:46:17,680
any individual fire but what i think we

1265
00:46:23,109 --> 00:46:20,800
need to keep our eye on is trends and um

1266
00:46:26,550 --> 00:46:23,119
and when we look at fire occurrence in

1267
00:46:28,870 --> 00:46:26,560
in the west we do see a very very strong

1268
00:46:31,910 --> 00:46:28,880
trend in the last 25 years that i think

1269
00:46:35,109 --> 00:46:33,430
doug i'd like to throw a question to you

1270
00:46:36,470 --> 00:46:35,119
especially when it comes to we've been

1271
00:46:37,910 --> 00:46:36,480
talking a lot about climate change in

1272
00:46:43,109 --> 00:46:37,920
the next few

1273
00:46:45,030 --> 00:46:43,119
about the ipcc report that's going to be

1274
00:46:46,870 --> 00:46:45,040
coming out i'd love doug if you could

1275
00:46:48,470 --> 00:46:46,880
talk a little about what is the ipcc

1276
00:46:50,630 --> 00:46:48,480
report for people who haven't heard of

1277
00:46:52,309 --> 00:46:50,640
it and then do you know what it says

1278
00:46:55,270 --> 00:46:52,319
particularly about climate change can

1279
00:46:57,430 --> 00:46:55,280
you give us a bit of a preview about it

1280
00:46:59,990 --> 00:46:57,440
well i first off i'll say that i'm not

1281
00:47:01,510 --> 00:47:00,000
an author of this version of the ipcc

1282
00:47:03,750 --> 00:47:01,520
report the intergovernmental panel on

1283
00:47:06,630 --> 00:47:03,760
climate change is an intergovernmental

1284
00:47:08,550 --> 00:47:06,640
uh a global effort of the nation's uh

1285
00:47:10,790 --> 00:47:08,560
top scientists from around the world

1286
00:47:13,510 --> 00:47:10,800
that gathers together to understand and

1287
00:47:15,109 --> 00:47:13,520
synthesize climate research there's also

1288
00:47:17,510 --> 00:47:15,119

a component of that work which is not

1289
00:47:19,270 --> 00:47:17,520
just synthesis but is the fact that we

1290
00:47:20,950 --> 00:47:19,280
as scientists are trying to generate new

1291
00:47:23,349 --> 00:47:20,960
understanding of our climate and how the

1292
00:47:25,510 --> 00:47:23,359
earth is functioning as a system that

1293
00:47:27,109 --> 00:47:25,520
newest latest research is is also one of

1294
00:47:29,349 --> 00:47:27,119
the things that people will look for

1295
00:47:31,670 --> 00:47:29,359
when the ipcc release their fifth

1296
00:47:33,510 --> 00:47:31,680
assessment report uh in the first part

1297
00:47:35,750 --> 00:47:33,520
of it in september

1298
00:47:37,430 --> 00:47:35,760
no i don't have any of the uh the major

1299
00:47:39,589 --> 00:47:37,440
highlights to share with everybody a

1300
00:47:42,550 --> 00:47:39,599
month in advance but one thing i can say

1301
00:47:45,190 --> 00:47:42,560
is that the climate models that were run

1302
00:47:46,870 --> 00:47:45,200
to help inform that assessment report

1303
00:47:48,870 --> 00:47:46,880
those data are available and so when we

1304
00:47:51,190 --> 00:47:48,880
look at those data we've been seeing a

1305
00:47:53,190 --> 00:47:51,200
visualization of of the dryness of the

1306
00:47:55,109 --> 00:47:53,200
atmosphere over north america that's

1307
00:47:57,030 --> 00:47:55,119
actually derived from those latest

1308
00:47:59,750 --> 00:47:57,040
generation of climate models those

1309
00:48:01,750 --> 00:47:59,760
climate models in aggregate have a very

1310
00:48:03,829 --> 00:48:01,760
similar story that they tell about a

1311
00:48:05,750 --> 00:48:03,839
warming and drying set of conditions

1312
00:48:07,910 --> 00:48:05,760
across the central and northeastern

1313
00:48:09,510 --> 00:48:07,920

portions of north america that area of

1314
00:48:10,870 --> 00:48:09,520
the mountain west all the way out into

1315
00:48:12,150 --> 00:48:10,880
quebec

1316
00:48:13,750 --> 00:48:12,160
one of the things i would come back to

1317
00:48:15,190 --> 00:48:13,760
though that i think is really important

1318
00:48:18,069 --> 00:48:15,200
as we think about fire and climate

1319
00:48:19,750 --> 00:48:18,079
change is the idea that climate

1320
00:48:23,030 --> 00:48:19,760
influences fire in ways that we don't

1321
00:48:24,870 --> 00:48:23,040
always anticipate so a warmer night uh

1322
00:48:26,390 --> 00:48:24,880
may not trigger the public's attention

1323
00:48:28,790 --> 00:48:26,400
but it certainly makes a difference for

1324
00:48:30,549 --> 00:48:28,800
fire fighting a wildfire the same is

1325
00:48:32,069 --> 00:48:30,559
true for a warmer winter

1326
00:48:34,150 --> 00:48:32,079
much of the warming we've seen across

1327
00:48:36,150 --> 00:48:34,160
north america in the last 30 or 40 years

1328
00:48:37,750 --> 00:48:36,160
has actually been in the winter time but

1329
00:48:39,510 --> 00:48:37,760
i don't need to tell your you know the

1330
00:48:41,190 --> 00:48:39,520
viewers in the mountain west either the

1331
00:48:42,710 --> 00:48:41,200
ones who like to ski in the winter or

1332
00:48:45,190 --> 00:48:42,720
the ones worried about wildfire in the

1333
00:48:47,589 --> 00:48:45,200
summer that less snowpack from warmer

1334
00:48:49,109 --> 00:48:47,599
winters means important things like more

1335
00:48:51,430 --> 00:48:49,119
beetles coming through the winter as

1336
00:48:53,510 --> 00:48:51,440
well as bigger and more dangerous

1337
00:48:55,750 --> 00:48:53,520
wildfires in the summertime so i think

1338
00:48:57,430 --> 00:48:55,760

that idea that the climate and the

1339
00:48:59,589 --> 00:48:57,440
changes in climate we see in a warmer

1340
00:49:01,349 --> 00:48:59,599
world impacts fires in ways we don't

1341
00:49:03,829 --> 00:49:01,359
always think about it's certainly an

1342
00:49:05,510 --> 00:49:03,839
important message to convey

1343
00:49:06,870 --> 00:49:05,520
thank you so much doug for anyone tuning

1344
00:49:08,230 --> 00:49:06,880
in i'm aries keck i'm here at nasa

1345
00:49:10,390 --> 00:49:08,240
goddard space flight center and we're

1346
00:49:12,069 --> 00:49:10,400
talking about wildfires and the

1347
00:49:13,990 --> 00:49:12,079
increased amount of them this year and

1348
00:49:15,750 --> 00:49:14,000
also their connections to climate change

1349
00:49:17,910 --> 00:49:15,760
i have a question i'm going to give to

1350
00:49:19,430 --> 00:49:17,920
uh bill patzert there at nasa's jpl

1351
00:49:21,190 --> 00:49:19,440
center because i think it leads to some

1352
00:49:24,069 --> 00:49:21,200
of the misconceptions people have about

1353
00:49:26,710 --> 00:49:24,079
things on uh in youtube comments uh mark

1354
00:49:28,790 --> 00:49:26,720
madrid asked is the sun's magnetic

1355
00:49:30,630 --> 00:49:28,800
change going to affect our weather in

1356
00:49:32,470 --> 00:49:30,640
coming months so bill i'd love to hear

1357
00:49:34,630 --> 00:49:32,480
what you have to say as a climatologist

1358
00:49:36,870 --> 00:49:34,640
about the effects of the sun

1359
00:49:38,069 --> 00:49:36,880
on wildfires here on earth i know

1360
00:49:39,750 --> 00:49:38,079
there's probably some people who think

1361
00:49:40,710 --> 00:49:39,760
it could have a lot to do nothing to do

1362
00:49:42,950 --> 00:49:40,720
can you sort of clear up some

1363
00:49:44,549 --> 00:49:42,960

misconceptions there

1364
00:49:46,470 --> 00:49:44,559
well the the

1365
00:49:49,349 --> 00:49:46,480
sun's magnetic field

1366
00:49:52,470 --> 00:49:49,359
switches approximately every 11 years

1367
00:49:55,349 --> 00:49:52,480
it's the great 11 year solar cycle

1368
00:49:58,309 --> 00:49:55,359
and it probably has subtle impacts on

1369
00:50:00,630 --> 00:49:58,319
our climate and our weather but it

1370
00:50:04,230 --> 00:50:00,640
doesn't have major impacts

1371
00:50:08,390 --> 00:50:04,240
and so when we look at the great cycles

1372
00:50:10,470 --> 00:50:08,400
el nino la nina or even decadal scale 10

1373
00:50:12,470 --> 00:50:10,480
to 20-year droughts

1374
00:50:13,750 --> 00:50:12,480
or a long-term trends like global

1375
00:50:15,990 --> 00:50:13,760
warming

1376
00:50:18,710 --> 00:50:16,000
the solar cycle the switch in the

1377
00:50:22,549 --> 00:50:18,720
magnetic field every 11 years is not a

1378
00:50:26,630 --> 00:50:24,390
okay we have then we have a question

1379
00:50:28,950 --> 00:50:26,640
from a reporter from climate wire

1380
00:50:30,870 --> 00:50:28,960
nathaniel massey he would like to know

1381
00:50:32,549 --> 00:50:30,880
um i know doug just mentioned snow a

1382
00:50:34,069 --> 00:50:32,559
minute ago he would like to know if we

1383
00:50:36,390 --> 00:50:34,079
could comment a little about a little

1384
00:50:38,710 --> 00:50:36,400
bit about the heat wave and wildfires

1385
00:50:40,230 --> 00:50:38,720
that are being seen in siberia right now

1386
00:50:42,309 --> 00:50:40,240
not a place you would think of having a

1387
00:50:44,950 --> 00:50:42,319
lot of fire nathaniel would like to know

1388
00:50:47,030 --> 00:50:44,960

how far out of the norm are these fires

1389
00:50:49,589 --> 00:50:47,040
what weather systems possibly the jet

1390
00:50:52,309 --> 00:50:49,599
stream might be contributing to them and

1391
00:50:54,710 --> 00:50:52,319
then white the what might these effects

1392
00:50:56,150 --> 00:50:54,720
and impacts due to the albedo in the

1393
00:50:57,589 --> 00:50:56,160
region i'm going to throw that question

1394
00:50:58,790 --> 00:50:57,599
to doug and also i'd love to you could

1395
00:51:01,030 --> 00:50:58,800
back up a little bit doug can you

1396
00:51:03,750 --> 00:51:01,040
explain first for people what is albedo

1397
00:51:05,670 --> 00:51:03,760
and i could repeat the question

1398
00:51:08,150 --> 00:51:05,680
it's a really good set of questions

1399
00:51:10,390 --> 00:51:08,160
around a current event

1400
00:51:11,990 --> 00:51:10,400
there is a heat wave right now over the

1401
00:51:13,670 --> 00:51:12,000
northern portions of russia and the

1402
00:51:15,750 --> 00:51:13,680
siberian region

1403
00:51:18,150 --> 00:51:15,760
that reflects what's called an

1404
00:51:19,990 --> 00:51:18,160
atmospheric blocking event i'll take two

1405
00:51:22,870 --> 00:51:20,000
steps back from that if i can to suggest

1406
00:51:24,390 --> 00:51:22,880
that the the flow of air patterns across

1407
00:51:26,470 --> 00:51:24,400
the northern hemisphere and their

1408
00:51:29,349 --> 00:51:26,480
dominant patterns of that jet stream and

1409
00:51:31,349 --> 00:51:29,359
the flow of the atmosphere is what does

1410
00:51:33,030 --> 00:51:31,359
bring us our typical weather and what we

1411
00:51:34,870 --> 00:51:33,040
think about is changing over time if

1412
00:51:36,950 --> 00:51:34,880
we're looking at changes in climate

1413
00:51:39,030 --> 00:51:36,960

change one of the things that's sort of

1414
00:51:40,710 --> 00:51:39,040
most striking about how

1415
00:51:43,109 --> 00:51:40,720
changes in the arctic now i'm thinking

1416
00:51:45,190 --> 00:51:43,119
about things like the melting of sea ice

1417
00:51:46,790 --> 00:51:45,200
uh influences the circulation of our

1418
00:51:48,950 --> 00:51:46,800
atmosphere is that we have seen in

1419
00:51:51,910 --> 00:51:48,960
recent years several episodes where a

1420
00:51:53,430 --> 00:51:51,920
high pressure system over the um the

1421
00:51:56,150 --> 00:51:53,440
arctic and the the northern high

1422
00:51:58,390 --> 00:51:56,160
latitudes can lead to this sort of

1423
00:52:00,230 --> 00:51:58,400
block of hot air that sits over one

1424
00:52:02,230 --> 00:52:00,240
region and allows these fires to burn

1425
00:52:03,910 --> 00:52:02,240
for days and days those kinds of

1426
00:52:05,510 --> 00:52:03,920
conditions those kinds of connections

1427
00:52:07,109 --> 00:52:05,520
are one of the reasons why we here at

1428
00:52:08,390 --> 00:52:07,119
nasa are trying to understand the earth

1429
00:52:10,309 --> 00:52:08,400
as a system

1430
00:52:12,470 --> 00:52:10,319
it's not enough just to look at fire and

1431
00:52:13,829 --> 00:52:12,480
not think about how the adjacent changes

1432
00:52:15,910 --> 00:52:13,839
in the sea surface temperatures that

1433
00:52:17,270 --> 00:52:15,920
bill mentioned or this

1434
00:52:19,349 --> 00:52:17,280
melting of

1435
00:52:20,790 --> 00:52:19,359
arctic sea ice which you know we know

1436
00:52:22,549 --> 00:52:20,800
during the northern hemisphere summer is

1437
00:52:23,750 --> 00:52:22,559
is reaching now close to its minimum

1438
00:52:25,589 --> 00:52:23,760

this year

1439
00:52:27,910 --> 00:52:25,599
all of those patterns

1440
00:52:29,829 --> 00:52:27,920
influence how our atmosphere circulates

1441
00:52:32,630 --> 00:52:29,839
over the earth the question came back to

1442
00:52:34,150 --> 00:52:32,640
albedo one that for scientists is a

1443
00:52:36,710 --> 00:52:34,160
familiar phenomenon but just really

1444
00:52:38,710 --> 00:52:36,720
reflects pardon the pun how much of the

1445
00:52:41,510 --> 00:52:38,720
sun's incoming radiation gets sent back

1446
00:52:44,069 --> 00:52:41,520
into space so very dark things like the

1447
00:52:45,829 --> 00:52:44,079
open ocean or dark forests

1448
00:52:47,990 --> 00:52:45,839
absorb more of the sun's incoming

1449
00:52:51,030 --> 00:52:48,000
radiation than very bright surfaces

1450
00:52:52,790 --> 00:52:51,040
think about fresh snow or ice and so one

1451
00:52:54,710 --> 00:52:52,800
of the things that both fires and

1452
00:52:56,870 --> 00:52:54,720
changes in sea ice do is they change the

1453
00:52:58,549 --> 00:52:56,880
albedo they change how much energy gets

1454
00:53:00,230 --> 00:52:58,559
absorbed in any one of these locations

1455
00:53:01,349 --> 00:53:00,240
and then how that propagates through the

1456
00:53:05,829 --> 00:53:01,359
earth system

1457
00:53:07,910 --> 00:53:05,839
is such a complex puzzle

1458
00:53:09,750 --> 00:53:07,920
and one that we are using again most of

1459
00:53:11,589 --> 00:53:09,760
the satellite data we have available to

1460
00:53:14,470 --> 00:53:11,599
us along with these complex computer

1461
00:53:16,309 --> 00:53:14,480
models to try to disentangle

1462
00:53:18,309 --> 00:53:16,319
thank you so much doug i'm also going to

1463
00:53:20,150 --> 00:53:18,319

the next question is for uh

1464
00:53:22,150 --> 00:53:20,160
for elizabeth reinhard at the u.s forest

1465
00:53:24,150 --> 00:53:22,160
service and it's an interesting question

1466
00:53:26,390 --> 00:53:24,160
it came in through youtube raven

1467
00:53:28,150 --> 00:53:26,400
blackheart probably not a real name

1468
00:53:30,630 --> 00:53:28,160
asks does anyone know if there's any

1469
00:53:33,030 --> 00:53:30,640
work being done on genetically modified

1470
00:53:35,349 --> 00:53:33,040
trees so they might be able to consume

1471
00:53:37,109 --> 00:53:35,359
more co2 and elizabeth i'd like to

1472
00:53:39,030 --> 00:53:37,119
broaden that out a little bit

1473
00:53:40,470 --> 00:53:39,040
what about also genetically modifying

1474
00:53:42,870 --> 00:53:40,480
trees so they don't catch fire as

1475
00:53:45,109 --> 00:53:42,880
quickly

1476
00:53:47,829 --> 00:53:45,119
uh

1477
00:53:49,829 --> 00:53:47,839
you know i don't know of any work to

1478
00:53:52,309 --> 00:53:49,839
modify trees so that they don't catch

1479
00:53:54,470 --> 00:53:52,319
fires quickly you know there's a great

1480
00:53:55,270 --> 00:53:54,480
deal of genetic variability in nature

1481
00:53:57,349 --> 00:53:55,280
and

1482
00:53:59,910 --> 00:53:57,359
differences between species in fire

1483
00:54:02,390 --> 00:53:59,920
resistant or resistance are really the

1484
00:54:04,470 --> 00:54:02,400
management key here and one of the

1485
00:54:06,950 --> 00:54:04,480
reasons we have a fire problem is

1486
00:54:09,589 --> 00:54:06,960
because stands that were formerly very

1487
00:54:11,589 --> 00:54:09,599
fire resistant ponderosa pine have been

1488
00:54:13,589 --> 00:54:11,599

invaded by encroaching douglas fir

1489
00:54:16,710 --> 00:54:13,599
that's much more fire susceptible and so

1490
00:54:18,950 --> 00:54:16,720
on so i think that um

1491
00:54:21,670 --> 00:54:18,960
i don't know if we need to go so far as

1492
00:54:23,190 --> 00:54:21,680
to look for genetic genetically modified

1493
00:54:26,230 --> 00:54:23,200
trees to

1494
00:54:28,950 --> 00:54:26,240
look at genetic variability as part of

1495
00:54:29,990 --> 00:54:28,960
an answer to our fire problem

1496
00:54:33,990 --> 00:54:30,000
um

1497
00:54:35,430 --> 00:54:34,000
now in terms of capturing more co2

1498
00:54:36,790 --> 00:54:35,440
um

1499
00:54:40,309 --> 00:54:36,800
that's another really interesting

1500
00:54:43,589 --> 00:54:41,109
uh

1501
00:54:47,190 --> 00:54:43,599
i don't know the answer force certainly

1502
00:54:48,950 --> 00:54:47,200
play a key role in mitigating co2

1503
00:54:50,470 --> 00:54:48,960
emissions um

1504
00:54:52,950 --> 00:54:50,480
and

1505
00:54:56,069 --> 00:54:52,960
but again rather than looking to a

1506
00:54:59,030 --> 00:54:56,079
genetically modified organism i think

1507
00:55:01,430 --> 00:54:59,040
what we really need is uh reforestation

1508
00:55:03,910 --> 00:55:01,440
of currently unforeseen areas it has a

1509
00:55:08,390 --> 00:55:03,920
lot of potential to increase our carbon

1510
00:55:10,069 --> 00:55:08,400
sequestration capacity of forests

1511
00:55:11,670 --> 00:55:10,079
thank you bill i'd love to know as a

1512
00:55:13,109 --> 00:55:11,680
climatologist when it comes to these

1513
00:55:15,349 --> 00:55:13,119

kind of questions we heard doug talk

1514
00:55:16,790 --> 00:55:15,359
about the earth as an entire system is

1515
00:55:18,710 --> 00:55:16,800
there a way of sort of gaming that

1516
00:55:21,109 --> 00:55:18,720
system that you and other climatologists

1517
00:55:22,790 --> 00:55:21,119
could could look forward to to keeping

1518
00:55:24,230 --> 00:55:22,800
us and keeping us possibly more

1519
00:55:25,430 --> 00:55:24,240
resilient to climate change in the

1520
00:55:27,430 --> 00:55:25,440
future

1521
00:55:28,870 --> 00:55:27,440
well you know that is that was really an

1522
00:55:30,309 --> 00:55:28,880
excellent question

1523
00:55:32,309 --> 00:55:30,319
and uh

1524
00:55:33,589 --> 00:55:32,319
my simple answer is that you can't gain

1525
00:55:35,990 --> 00:55:33,599
mother nature

1526
00:55:37,030 --> 00:55:36,000
but as climate has changed throughout

1527
00:55:39,990 --> 00:55:37,040
history

1528
00:55:41,870 --> 00:55:40,000
when we look back over the last oh let's

1529
00:55:45,109 --> 00:55:41,880
say 100 million years

1530
00:55:46,549 --> 00:55:45,119
ecosystems have genetically modified

1531
00:55:50,069 --> 00:55:46,559
themselves

1532
00:55:52,549 --> 00:55:50,079
the composition of his uh ecosystems

1533
00:55:56,069 --> 00:55:52,559
change as climate changes

1534
00:55:58,069 --> 00:55:56,079
and so it's subtle but as we're talking

1535
00:56:00,789 --> 00:55:58,079
here this morning

1536
00:56:04,150 --> 00:56:00,799
is is that ecosystems throughout the

1537
00:56:06,309 --> 00:56:04,160
planet are actually in subtle ways

1538
00:56:08,950 --> 00:56:06,319

modifying themselves

1539
00:56:10,150 --> 00:56:08,960
it's called evolution all right

1540
00:56:13,349 --> 00:56:10,160
and

1541
00:56:17,670 --> 00:56:13,359
so as we look into the future

1542
00:56:21,430 --> 00:56:17,680
we see the distribution of plants trees

1543
00:56:23,910 --> 00:56:21,440
and animals animal species as well

1544
00:56:25,829 --> 00:56:23,920
they're changing in subtle ways

1545
00:56:26,950 --> 00:56:25,839
and they will respond to the changing

1546
00:56:28,470 --> 00:56:26,960
climate

1547
00:56:30,470 --> 00:56:28,480
and so

1548
00:56:32,950 --> 00:56:30,480
you know the good old days whatever it

1549
00:56:35,109 --> 00:56:32,960
used to be are gone forever

1550
00:56:36,069 --> 00:56:35,119
and so it'll be interesting to see

1551
00:56:37,510 --> 00:56:36,079
because

1552
00:56:39,510 --> 00:56:37,520
climate change is not going to be

1553
00:56:42,870 --> 00:56:39,520
stopping anytime soon

1554
00:56:46,390 --> 00:56:42,880
it's the real deal it's in our future

1555
00:56:48,390 --> 00:56:46,400
and uh the

1556
00:56:51,430 --> 00:56:48,400
we don't know exactly where it's going

1557
00:56:53,829 --> 00:56:51,440
but uh i predict that in two to three

1558
00:56:55,270 --> 00:56:53,839
hundred years the great forests as we

1559
00:56:59,030 --> 00:56:55,280
see them today

1560
00:57:03,349 --> 00:57:00,789
well thank you all so much for joining

1561
00:57:06,069 --> 00:57:03,359
us today um that was bill patzert he's

1562
00:57:08,150 --> 00:57:06,079
at nasa's jpl uh jet propulsion lab out

1563
00:57:10,549 --> 00:57:08,160

in pasadena california which actually

1564
00:57:13,430 --> 00:57:10,559
saw its own fire right on its doorstep i

1565
00:57:15,349 --> 00:57:13,440
believe last year also joining us today

1566
00:57:17,430 --> 00:57:15,359
has been doug morton he's a research

1567
00:57:19,589 --> 00:57:17,440
scientist here at nasa's goddard space

1568
00:57:21,589 --> 00:57:19,599
flight center in greenbelt maryland and

1569
00:57:23,829 --> 00:57:21,599
then also elizabeth reinhart who is the

1570
00:57:25,990 --> 00:57:23,839
assistant director of fire and aviation

1571
00:57:28,309 --> 00:57:26,000
management at the u.s forest service

1572
00:57:29,829 --> 00:57:28,319
she's joined us from washington d.c

1573
00:57:31,349 --> 00:57:29,839
thank you all so much for watching we

1574
00:57:33,430 --> 00:57:31,359
really appreciate all your questions and

1575
00:57:34,950 --> 00:57:33,440
calls this is going to remain on youtube

1576
00:57:36,630 --> 00:57:34,960
as archived versions so if you're

1577
00:57:38,309 --> 00:57:36,640
watching through the archive version and

1578
00:57:39,990 --> 00:57:38,319
you have additional questions please

1579
00:57:42,950 --> 00:57:40,000
just continue to use the hashtag

1580
00:57:44,710 --> 00:57:42,960
nasafire or send a question right to the

1581
00:57:47,030 --> 00:57:44,720
at nasa goddard twitter account or put

1582
00:57:49,030 --> 00:57:47,040
it on our facebook page i'm aries keck

1583
00:57:50,309 --> 00:57:49,040
here at nasa goddard thank you so much