WEBVTT

1 00:00:00.310 --> 00:00:01.163 <v ->Okay.</v>

2 00:00:02.630 --> 00:00:05.480 It's time to get started. I'm Robert Dubrow.

3 00:00:05.480 --> 00:00:07.440 I'm the faculty director of the

4 00:00:07.440 --> 00:00:08.970 Yale Center on Climate Change and Health.

5 00:00:08.970 --> 00:00:11.120 I know most of you, but maybe not everyone.

6 00:00:12.140 --> 00:00:17.140 And it's a great pleasure today to introduce Jose Siri,

7 00:00:18.040 --> 00:00:20.563 who is speaking to us from London.

8 00:00:21.700 --> 00:00:24.010 And since 2019,

9 00:00:24.010 --> 00:00:26.510 he's been the senior science lead for

10 00:00:26.510 --> 00:00:29.890 Cities, Urbanization and Health for the Wellcome Trust's

11 00:00:29.890 --> 00:00:32.053 Our planet, Our Health Programme.

12 00:00:32.930 --> 00:00:36.330 Some of his previous positions have included

13 00:00:36.330 --> 00:00:39.270 being a research fellow in Urban Health for the

14 00:00:39.270 --> 00:00:43.160 UN University International Institute for Global Health.

15 00:00:43.160 --> 00:00:45.320 He's been a research scholar for the

16 00:00:45.320 --> 00:00:48.990 International Institute for Applied Systems Analysis,

17 00:00:48.990 --> 00:00:53.990 and he got his PhD in Epidemiology with a concentration

18 00:00:54.160 --> 00:00:56.600 in infectious disease epidemiology

19 00:00:56.600 --> 00:00:59.100 from the University of Michigan.

20 00:00:59.100 --> 00:01:04.100 So without further ado, I'll let Jose start his talk.

21 00:01:05.900 --> 00:01:06.733 <v ->Great!</v>

22 00:01:06.733 --> 00:01:09.763 Many thanks, Robert. Can you hear me? Thumbs up?

23 00:01:10.650 --> 00:01:11.583 Great, great.

24 00:01:12.500 --> 00:01:14.010 So it's great to be with you today.

25 00:01:14.010 --> 00:01:15.410 Thanks again to Robert.

26 00:01:15.410 --> 00:01:18.670 Thanks to the Yale Center on Climate Change and Health,

27 00:01:18.670 --> 00:01:20.853 and thank you to you all for joining.

28 00:01:21.930 --> 00:01:23.010 Today, I'm gonna talk about

29 00:01:23.010 --> 00:01:24.460 the central role that cities play

30 00:01:24.460 --> 00:01:27.660 in climate change and health and how systems-based research

31 00:01:27.660 --> 00:01:29.420 can contribute to the solutions.

32 00:01:29.420 --> 00:01:31.660 And I hope that you'll see or you'll agree with me

33 00:01:31.660 --> 00:01:33.560 why we need this type of approach to compliment

34 00:01:33.560 --> 00:01:36.050 traditional public health research.

35 00:01:36.050 --> 00:01:39.013 So I want to start with a few concrete examples.

36 00:01:41.320 --> 00:01:43.210 Just this past month,

37 00:01:43.210 --> 00:01:46.200 we saw one of the most intense heat events in history

38 00:01:46.200 --> 00:01:48.650 in the Western North American heat wave.

39 00:01:48.650 --> 00:01:49.930 So starting in late June,

40 00:01:49.930 --> 00:01:51.890 the Pacific Northwest and Western Canada

41 00:01:51.890 --> 00:01:55.360 saw maximum temperatures up to 19 degrees Celsius

42 00:01:55.360 --> 00:01:57.963 above normal, lasting through early July.

43 00:01:59.100 --> 00:02:02.710 This is a map showing temperature anomalies on June 27th,

44 00:02:02.710 --> 00:02:04.730 compared to the typical average for the same day

45 00:02:04.730 --> 00:02:05.680 in different years.

46 00:02:06.770 --> 00:02:08.780 The heat caused power outages,

47 00:02:08.780 --> 00:02:10.630 it destroyed infrastructure,

48 00:02:10.630 --> 00:02:12.830 it buckled roads across the region,

49 00:02:12.830 --> 00:02:15.640 it spoiled crops, and damaged trees,

50 00:02:15.640 --> 00:02:18.470 some places saw major water quality declines

51 00:02:18.470 --> 00:02:20.464 because of fish kills,

52 00:02:20.464 --> 00:02:22.550 and of course, it sparked wildfires,

53 00:02:22.550 --> 00:02:25.660 which continue to be a major concern in the region.

54 00:02:25.660 --> 00:02:29.270 Some places even saw serious flooding from snow melt.

55 00:02:29.270 --> 00:02:32.380 So the drought, excuse me, the fire had a whole range,

56 00:02:32.380 --> 00:02:34.320 excuse me, the heatwave,

57 00:02:34.320 --> 00:02:36.890 had a whole range of complex consequences.

58 00:02:36.890 --> 00:02:39.640 And we still don't know the full health impacts,

59 00:02:39.640 --> 00:02:43.683 but there've been estimated 700 plus excess deaths so far.

60 00:02:44.790 --> 00:02:47.960 There was a significant rise in hospitalizations,

61 00:02:47.960 --> 00:02:49.960 and there was morbidity, not just from the heat,

62 00:02:49.960 --> 00:02:51.910 but also from cascading events

63 00:02:51.910 --> 00:02:54.550 like smoke inhalation from wildfires,

64 00:02:54.550 --> 00:02:57.483 major mental health impacts, of course, for those effects.

65 00:02:58.950 --> 00:03:01.700 In this context, impacts were much worse because this region

66 00:03:01.700 --> 00:03:03.680 has a low uptake of air conditioning,

67 00:03:03.680 --> 00:03:06.740 and it hadn't prepared in other ways for this level of heat.

68 00:03:06.740 --> 00:03:08.690 So in other words, they're not adapted.

69 00:03:09.590 --> 00:03:12.010 A preliminary attribution study has estimated

70 00:03:12.010 --> 00:03:14.820 that this is about a one in 1,000 year event

71 00:03:14.820 --> 00:03:15.940 in today's climate,

72 00:03:15.940 --> 00:03:18.550 but that it would have been 150 times rarer

73 00:03:18.550 --> 00:03:21.050 without human-induced climate change.

74 00:03:21.050 --> 00:03:22.980 Under two degrees Celsius warming,

75 00:03:22.980 --> 00:03:26.000 which is the minimum goal for the Paris Climate Agreement,

76 00:03:26.000 --> 00:03:27.590 an event of this magnitude might happen

77 00:03:27.590 --> 00:03:28.740 every five to 10 years.

78 00:03:30.310 --> 00:03:32.470 Of course, we know that cities amplify heat waves

79 00:03:32.470 --> 00:03:34.840 because of urban heat island effects.

80 00:03:34.840 --> 00:03:37.320 Cities can be significantly hotter than surrounding areas,

81 00:03:37.320 --> 00:03:38.343 especially at night.

82 00:03:39.690 --> 00:03:41.660 In the left figure below,

83 00:03:41.660 --> 00:03:43.680 you see how climate change might shift

84 00:03:43.680 --> 00:03:45.380 the distribution of hot days.

85 00:03:45.380 --> 00:03:46.680 Now, to the right.

86 00:03:46.680 --> 00:03:48.590 In the right, you see the additional shifts

87 00:03:48.590 --> 00:03:50.300 from urban heat islands.

88 00:03:50.300 --> 00:03:52.440 And the message from from this figure is that

89 00:03:52.440 --> 00:03:54.800 even small rises in average heat

90 00:03:54.800 --> 00:03:57.250 can lead to large increases in extreme heat

91 00:03:57.250 --> 00:03:59.280 at the leading edge of the distribution,

92 00:03:59.280 --> 00:04:00.790 especially in cities where you have

93 00:04:00.790 --> 00:04:02.490 the additional amplifying effects.

94 00:04:03.810 --> 00:04:07.070 So let's cross the world to South Africa,

95 00:04:07.070 --> 00:04:09.300 and three years earlier.

96 00:04:09.300 --> 00:04:13.100 In 2018, after three consecutive years of low rainfall,

97 00:04:13.100 --> 00:04:15.210 Cape Town had one of the worst water crises

98 00:04:15.210 --> 00:04:16.810 ever recorded in the major city.

99 00:04:17.750 --> 00:04:20.720 Early that year, officials estimated that the water system

100 00:04:20.720 --> 00:04:24.560 would actually fail on a so-called ”day zero” in April.

101 00:04:24.560 --> 00:04:26.170 In other words, they projected that water levels

102 00:04:26.170 --> 00:04:28.290 would be too low for any withdrawals

103 00:04:28.290 --> 00:04:31.273 and the city would essentially have to shut the system down.

104 00:04:32.120 --> 00:04:34.920 The chart you see here is a measure of water storage

105 00:04:34.920 --> 00:04:37.360 for the city over the five proceeding years.

106 00:04:37.360 --> 00:04:38.520 The black lines at the bottom

107 00:04:38.520 --> 00:04:41.880 show have the minimum levels needed to allow withdrawals.

108 00:04:41.880 --> 00:04:43.260 Now,

109 00:04:43.260 --> 00:04:45.660 in this case, the city averted the crisis,

110 00:04:45.660 --> 00:04:47.640 but not before it drew up security plans

111 00:04:47.640 --> 00:04:50.400 to protect emergency water supplies.

112 00:04:50.400 --> 00:04:52.470 Water was severely rationed.

113 00:04:52.470 --> 00:04:55.570 Citizens were challenged and in some cases, even shamed,

114 00:04:55.570 --> 00:04:58.020 into conserving and consumption was reduced

115 00:04:58.020 --> 00:05:00.410 by more than half, which allowed the city to survive

116 00:05:00.410 --> 00:05:01.460 until the rains came.

117 00:05:02.980 --> 00:05:05.360 But even though the crisis was averted,

118 00:05:05.360 --> 00:05:08.200 it sort of highlighted some of the severe inequities

119 00:05:08.200 --> 00:05:10.630 and conflicts related to water in the city.

120 00:05:10.630 --> 00:05:11.463 Now for example,

121 00:05:11.463 --> 00:05:13.270 informal settlements in Cape Town

122 00:05:13.270 --> 00:05:16.410 received less than 4% of the water supply,

123 00:05:16.410 --> 00:05:19.490 even though they represent 20% of the population.

124 00:05:19.490 --> 00:05:22.670 There were conflicts over the use of water for public health

125 00:05:22.670 --> 00:05:24.743 versus for agricultural priorities.

126 00:05:25.960 --> 00:05:26.793 And again,

127 00:05:26.793 --> 00:05:28.970 this is a situation where the systems

128 00:05:28.970 --> 00:05:31.670 that the city of Cape Town had put into place

129 00:05:31.670 --> 00:05:34.250 just weren't designed for the conditions they encountered.

130 00:05:34.250 --> 00:05:35.550 They weren't well adapted.

131 00:05:37.310 --> 00:05:39.910 As for the Western American heat wave,

132 00:05:39.910 --> 00:05:41.960 this was a quite rare event,

133 00:05:41.960 --> 00:05:45.990 perhaps 0.7% per year in today's climate,

134 00:05:45.990 --> 00:05:47.960 but made five and a half times more likely

135 00:05:47.960 --> 00:05:49.960 because of human-induced climate change.

136 00:05:50.840 --> 00:05:52.860 In an intermediate warming scenario,

137 00:05:52.860 --> 00:05:56.280 the probability of a drought as bad as this or worse

138 00:05:56.280 --> 00:06:00.430 could rise to 25% per year by the end of the century.

139 00:06:00.430 --> 00:06:03.020 In a high warming scenario, it could rise to 80%.

140 00:06:03.020 --> 00:06:05.410 So you would see this kind of drought most years,

141 00:06:05.410 --> 00:06:06.243 essentially.

142 00:06:08.200 --> 00:06:10.490 Again, cities amplified drought risks

143 00:06:10.490 --> 00:06:12.660 because they concentrate massive amounts of people

144 00:06:12.660 --> 00:06:14.530 in a small area,

145 00:06:14.530 --> 00:06:16.330 they impact health directly,

146 00:06:16.330 --> 00:06:18.500 but also through loss of livelihoods,

147 00:06:18.500 --> 00:06:20.260 impacts on agriculture,

148 00:06:20.260 --> 00:06:23.810 and sometimes even increased infectious disease risks.

149 00:06:23.810 --> 00:06:24.643 So for example,

150 00:06:24.643 --> 00:06:26.850 where hygiene suffers because of lack of water.

151 00:06:27.940 --> 00:06:29.840 As with almost all climate risks,

152 00:06:29.840 --> 00:06:32.540 the greatest impacts are on the poor and marginalized.

153 00:06:34.660 --> 00:06:36.870 So coming back to the U.S. now,

154 00:06:36.870 --> 00:06:38.210 one year earlier than that.

155 00:06:38.210 --> 00:06:40.460 In 2017,

156 00:06:40.460 --> 00:06:43.210 Hurricane Harvey dumped as much as five feet of water

157 00:06:43.210 --> 00:06:44.473 on parts of Texas.

158 00:06:45.310 --> 00:06:46.950 Over a hundred people died,

159 00:06:46.950 --> 00:06:49.300 30,000 people were displaced,

160 00:06:49.300 --> 00:06:52.633 and the storm caused $125 billion worth of damage.

161 00:06:53.690 --> 00:06:56.060 Aside again, from the direct health impacts

162 00:06:56.060 --> 00:06:57.740 and environmental exposures,

163 00:06:57.740 --> 00:07:00.660 many, many people suffered mental trauma from the disaster

164 00:07:00.660 --> 00:07:03.960 and from the losses of their homes or their livelihoods.

165 00:07:03.960 --> 00:07:06.970 Again, impacts felt disproportionately on Black

166 00:07:06.970 --> 00:07:08.163 and poor residents.

167 00:07:09.470 --> 00:07:12.650 This was another extremely rare event,

168 00:07:12.650 --> 00:07:15.430 perhaps one in 2,000 years in today's climate,

169 00:07:15.430 --> 00:07:18.210 I've seen as low as one in 9,000 years.

170 00:07:18.210 --> 00:07:20.290 But again, the rainfall totals were made more than

171 00:07:20.290 --> 00:07:23.340 three times as likely, like human-induced climate change,

172 00:07:23.340 --> 00:07:25.750 and the risk might increase to one in 100

173 00:07:25.750 --> 00:07:27.050 by the end of the century.

174 00:07:28.810 --> 00:07:31.100 In Houston itself, within the city,

175 00:07:31.100 --> 00:07:32.830 modeling suggests that the urban environment

176 00:07:32.830 --> 00:07:35.070 not only exacerbated the flooding,

177 00:07:35.070 --> 00:07:38.990 because of impervious services and channeling the water,

178 00:07:38.990 --> 00:07:42.040 but the urban environment actually increased local rainfall,

179 00:07:42.040 --> 00:07:44.220 through interactions with meteorological system,

180 00:07:44.220 --> 00:07:45.590 making the observed flooding,

181 00:07:45.590 --> 00:07:48.983 the observed water levels 21 times more likely.

182 00:07:51.400 --> 00:07:52.450 So,

183 00:07:52.450 --> 00:07:55.230 it's not hard to find material unfortunately

184 00:07:55.230 --> 00:07:57.020 for climate and health.

185 00:07:57.020 --> 00:07:58.700 There are hundreds of other examples

186 00:07:58.700 --> 00:08:00.910 that I could have used here.

187 00:08:00.910 --> 00:08:03.140 All of these have connections to adaptation

188 00:08:03.140 --> 00:08:06.500 because they speak to the need to plan for such impacts,

189 00:08:06.500 --> 00:08:09.060 but they're also intimately linked to mitigation

190 00:08:09.060 --> 00:08:11.020 because all of them were made much more likely

191 00:08:11.020 --> 00:08:13.003 by human greenhouse gas emissions.

192 00:08:14.120 --> 00:08:16.210 So these events really illustrate that climate change

193 00:08:16.210 --> 00:08:18.130 is not just the concern for the future,

194 00:08:18.130 --> 00:08:21.350 we're already seeing serious impacts today.

195 00:08:21.350 --> 00:08:23.970 They show how cities mediate and modify

196 00:08:23.970 --> 00:08:27.270 both overall climate impacts and the distribution of impacts

197 00:08:27.270 --> 00:08:28.263 across society.

198 00:08:29.300 --> 00:08:31.730 They show how much human-induced climate change

199 00:08:31.730 --> 00:08:34.570 has already increased health risks,

200 00:08:34.570 --> 00:08:37.800 and how these health risks may increase in the future.

201 00:08:37.800 --> 00:08:40.410 And they tell us or they show us really,

202 00:08:40.410 --> 00:08:42.870 the cities are critical part of solutions

203 00:08:42.870 --> 00:08:45.343 for climate mitigation, adaptation, resilience.

204 00:08:46.670 --> 00:08:48.410 So for the rest of my talk,

205 00:08:48.410 --> 00:08:51.450 I'm gonna be discussing why cities are critical

206 00:08:51.450 --> 00:08:53.910 for climate and health impacts and solutions,

207 00:08:53.910 --> 00:08:55.790 what challenges we face in implementing

208 00:08:55.790 --> 00:08:59.090 healthy climate action in cities and beyond,

209 00:08:59.090 --> 00:09:01.400 why we should see many climate and health challenges

210 00:09:01.400 --> 00:09:03.870 in cities as systems problems,

211 00:09:03.870 --> 00:09:07.530 and how a systems-based research agenda can help catalyze

212 00:09:07.530 --> 00:09:08.423 solutions.

213 00:09:09.830 --> 00:09:10.730 So, first of all,

214 00:09:10.730 --> 00:09:13.480 why are cities critical for climate and health impacts?

215 00:09:15.100 --> 00:09:18.780 First of all, cities are where we mostly live.

216 00:09:18.780 --> 00:09:21.290 And this is a fairly new situation.

217 00:09:21.290 --> 00:09:23.010 Most of us tend to think of, for example,

218 00:09:23.010 --> 00:09:24.580 the Industrial Revolution

219 00:09:24.580 --> 00:09:28.150 as the time of massive urbanization as I do.

220 00:09:28.150 --> 00:09:30.080 But the population of England in 1800

221 00:09:30.080 --> 00:09:32.143 was maybe just 10 to 20% urban.

222 00:09:33.300 --> 00:09:36.270 Urban population growth began to overtake rural

223 00:09:36.270 --> 00:09:38.050 about half a century ago.

224 00:09:38.050 --> 00:09:39.360 And according to the UN,

225 00:09:39.360 --> 00:09:42.180 we became majority urban around 2007,

226 00:09:42.180 --> 00:09:44.800 where you see these two curves cross.

227 00:09:44.800 --> 00:09:48.270 Today, the UN estimates that we're about 55%,

228 00:09:48.270 --> 00:09:50.973 and by 2050, two-thirds of us will live in cities.

229 00:09:51.850 --> 00:09:54.130 Now it's worth mentioning that these numbers are quite

230 00:09:54.130 --> 00:09:54.963 uncertain.

231 00:09:54.963 --> 00:09:58.770 We actually can't measure who lives in city

232 00:09:58.770 --> 00:10:01.090 and how many people live in city directly.

233 00:10:01.090 --> 00:10:04.380 We've tended to use national definitions for urban,

234 00:10:04.380 --> 00:10:05.580 whatever they are.

235 00:10:05.580 --> 00:10:09.140 But in Norway or Sweden, a city with 200 people

236 00:10:09.140 --> 00:10:10.320 is considered urban.

237 00:10:10.320 --> 00:10:12.440 In Japan, you have to have 50,000 people

238 00:10:12.440 --> 00:10:13.930 to be considered urban.

239 00:10:13.930 --> 00:10:17.070 So cross country comparisons are quite difficult.

240 00:10:17.070 --> 00:10:18.530 There have been a few efforts to apply

241 00:10:18.530 --> 00:10:20.560 a single standard everywhere.

242 00:10:20.560 --> 00:10:23.490 One effort using a construct called degree of urbanization,

243 00:10:23.490 --> 00:10:26.750 puts the global urban share of the population

244 00:10:26.750 --> 00:10:29.410 at about 75 to 80%.

245 00:10:29.410 --> 00:10:32.053 Most of the increase coming from Asia and Africa.

246 00:10:33.020 --> 00:10:34.800 There's some controversy over that definition.

247 00:10:34.800 --> 00:10:38.130 There's other efforts, but whatever method you use,

248 00:10:38.130 --> 00:10:40.570 the take home message is that we're mostly urban

249 00:10:40.570 --> 00:10:42.820 and we'll be adding billions of more city dwellers

250 00:10:42.820 --> 00:10:44.370 over the course of the century.

251 00:10:45.440 --> 00:10:46.410 So,

252 00:10:46.410 --> 00:10:48.900 given that we're mostly urban species today

253 00:10:49.790 --> 00:10:51.430 from the standpoint of an ecologist,

254 00:10:51.430 --> 00:10:53.430 cities are our dominant habitat

255 00:10:53.430 --> 00:10:55.810 and they've profoundly affect our health.

256 00:10:55.810 --> 00:10:58.670 And I like to think of the analogy of a fish tank.

257 00:10:58.670 --> 00:11:00.640 So if you buy a fish tank,

258 00:11:00.640 --> 00:11:02.720 you have to supply it with fresh or salt water,

259 00:11:02.720 --> 00:11:04.360 depending on the kind of fish,

260 00:11:04.360 --> 00:11:06.270 you need to add light and heat,

261 00:11:06.270 --> 00:11:08.930 gravel, hiding places for the fish,

262 00:11:08.930 --> 00:11:11.778 you have to regularly add food, you need a filter,

263 00:11:11.778 --> 00:11:13.740 and so on and so forth.

264 00:11:13.740 --> 00:11:17.700 If you imagine building an ideal habitat for a human being,

265 00:11:17.700 --> 00:11:20.590 it probably wouldn't look too much like modern cities,

266 00:11:20.590 --> 00:11:22.240 that some are better than others.

267 00:11:23.140 --> 00:11:26.390 This list here is from Stephen Boyden's seminal work

268 00:11:26.390 --> 00:11:28.330 on human ecology in Hong Kong.

269 00:11:28.330 --> 00:11:30.900 And I love that this includes not just physical,

270 00:11:30.900 --> 00:11:32.630 but psychosocial needs.

271 00:11:32.630 --> 00:11:33.820 So, of course,

272 00:11:33.820 --> 00:11:36.860 cities should supply clean air, water and food,

273 00:11:36.860 --> 00:11:38.780 but it's equally important that they supply

274 00:11:38.780 --> 00:11:42.853 emotional support, and variety, and a sense of purpose.

275 00:11:44.210 --> 00:11:46.760 But again, the key is that cities, in many ways,

276 00:11:46.760 --> 00:11:48.860 determine the health of the human species.

277 00:11:50.770 --> 00:11:52.980 Virtually, every urban system affects health

278 00:11:52.980 --> 00:11:54.063 in familiar ways,

279 00:11:55.130 --> 00:11:57.820 but also along pathways that we may not be aware of,

280 00:11:57.820 --> 00:11:59.520 or when we think about, excuse me.

281 00:12:03.020 --> 00:12:07.070 Urban transport systems affect physical activity,

282 00:12:07.070 --> 00:12:09.980 they affect the air pollution and exposure to air pollution,

283 00:12:09.980 --> 00:12:14.500 mental health and opportunities for social interaction.

284 00:12:14.500 --> 00:12:15.780 For women, in some contexts,

285 00:12:15.780 --> 00:12:17.680 they also can seriously affect safety

286 00:12:17.680 --> 00:12:18.930 or perceptions of safety.

287 00:12:19.890 --> 00:12:22.820 Housing affects exposure to extreme temperatures,

288 00:12:22.820 --> 00:12:25.940 infectious vectors, toxic pollutants,

289 00:12:25.940 --> 00:12:28.480 but it can also influence a sense of belonging

290 00:12:28.480 --> 00:12:30.423 and variety and daily experience.

291 00:12:31.430 --> 00:12:35.050 Cultural systems have impacts on creativity, of course,

292 00:12:35.050 --> 00:12:36.636 but also on loneliness,

293 00:12:36.636 --> 00:12:38.890 and even on infectious disease transmission

294 00:12:38.890 --> 00:12:42.143 as we've seen in lots of examples during COVID-19.

295 00:12:43.030 --> 00:12:46.660 And I'm sure I've left relevant systems off this list.

296 00:12:46.660 --> 00:12:47.810 I won't go through them all,

297 00:12:47.810 --> 00:12:50.830 but I just really want to emphasize the point that cities,

298 00:12:50.830 --> 00:12:53.790 through their complex integrated dynamic systems,

299 00:12:53.790 --> 00:12:56.540 are among the main drivers of our health and wellbeing.

300 00:12:57.500 --> 00:13:00.640 Now, importantly, for what we're discussing today,

301 00:13:00.640 --> 00:13:02.840 cities affect virtually all the pathways along which

302 00:13:02.840 --> 00:13:04.503 climate change affects health.

303 00:13:05.800 --> 00:13:08.690 So you have direct impacts, for example, through storms,

304 00:13:08.690 --> 00:13:10.420 drought, flooding, and heat.

305 00:13:10.420 --> 00:13:11.660 And as we've seen,

306 00:13:11.660 --> 00:13:15.040 these are all modified and sometimes amplified by cities

307 00:13:15.040 --> 00:13:16.700 in urban systems.

308 00:13:16.700 --> 00:13:18.190 You have indirect impacts,

309 00:13:18.190 --> 00:13:20.640 might mediated through ecological systems.

310 00:13:20.640 --> 00:13:22.700 These are also affected by cities.

311 00:13:22.700 --> 00:13:25.450 So for example, cities drive deforestation,

312 00:13:25.450 --> 00:13:28.140 increasing the likelihood of zoonotic disease transmission

313 00:13:28.140 --> 00:13:32.580 when previously separated species come into contact.

314 00:13:32.580 --> 00:13:35.810 They can cause food system disruptions when they grow over

315 00:13:35.810 --> 00:13:38.030 or expand over productive agricultural land,

316 00:13:38.030 --> 00:13:39.130 which is quite common.

317 00:13:40.060 --> 00:13:42.030 Indirect impacts can also be mediated

318 00:13:42.030 --> 00:13:45.530 through social processes like migration or trade.

319 00:13:45.530 --> 00:13:47.560 And of course, cities are the primary driver

320 00:13:47.560 --> 00:13:50.043 and destination of those processes as well.

321 00:13:51.570 --> 00:13:55.830 Cities are also where most mitigation and adaptation actions

322 00:13:55.830 --> 00:13:59.713 either are implemented or are the driving force behind it.

323 00:14:02.590 --> 00:14:04.740 Perhaps most importantly,

324 00:14:04.740 --> 00:14:07.980 cities emit about three-quarters of all greenhouse gases

325 00:14:07.980 --> 00:14:10.120 from final energy use.

326 00:14:10.120 --> 00:14:12.880 They use more than three quarters of all natural resources.

327 00:14:12.880 --> 00:14:15.230 They produce about half of all the waste

328 00:14:15.230 --> 00:14:17.020 that humanity produces.

329 00:14:17.020 --> 00:14:19.540 And the graph on the left shows

330 00:14:19.540 --> 00:14:22.090 global greenhouse gas emissions by economic sector.

331 00:14:23.880 --> 00:14:27.890 Electricity and heat production, transportation, buildings,

332 00:14:27.890 --> 00:14:29.300 and to some extent, industry,

333 00:14:29.300 --> 00:14:31.670 are important sources of urban emissions

334 00:14:31.670 --> 00:14:33.470 as you might imagine.

335 00:14:33.470 --> 00:14:36.090 But even emissions that happen in rural

336 00:14:36.090 --> 00:14:37.890 or undeveloped areas,

337 00:14:37.890 --> 00:14:41.100 so for example, from agriculture or forestry,

338 00:14:41.100 --> 00:14:43.330 are mostly the result of urban demand

339 00:14:43.330 --> 00:14:44.683 for goods and services.

340 00:14:46.230 --> 00:14:47.510 On the right,

341 00:14:47.510 --> 00:14:50.770 the figure shows two common ways of accounting for emissions

342 00:14:50.770 --> 00:14:53.570 and the bluer circle towards the top,

343 00:14:53.570 --> 00:14:56.640 shows all emissions arising from goods and services produced

344 00:14:56.640 --> 00:14:57.980 within the city,

345 00:14:57.980 --> 00:15:00.820 whether they're consumed there or exported somewhere else.

346 00:15:00.820 --> 00:15:03.193 That's the usual way that we measure emissions.

347 00:15:04.130 --> 00:15:05.960 The greener circle shows all emissions

348 00:15:05.960 --> 00:15:09.140 arising from goods and services consumed by the city,

349 00:15:09.140 --> 00:15:11.390 wherever they're produced.

350 00:15:11.390 --> 00:15:13.990 And in fact, especially in wealthy cities,

351 00:15:13.990 --> 00:15:16.820 a high percentage of emissions are from imported goods

352 00:15:16.820 --> 00:15:17.653 and services.

353 00:15:17.653 --> 00:15:19.290 So, you buy your iPhone,

354 00:15:19.290 --> 00:15:20.870 and you don't have any emissions from that,

355 00:15:20.870 --> 00:15:23.920 but emissions are produced in China or somewhere else

356 00:15:23.920 --> 00:15:25.943 or where that phone is produced.

357 00:15:26.800 --> 00:15:28.630 We've done a lot less well at documenting

358 00:15:28.630 --> 00:15:31.210 so-called consumption-based emissions.

359 00:15:31.210 --> 00:15:32.940 For example, they're not generally included

360 00:15:32.940 --> 00:15:34.410 in net-zero commitments,

361 00:15:34.410 --> 00:15:37.610 which are pledges to reach a state of carbon neutrality

362 00:15:37.610 --> 00:15:38.723 by a certain date.

363 00:15:39.630 --> 00:15:42.020 There are efforts underway to change that,

364 00:15:42.020 --> 00:15:44.310 led by groups like C40 Cities,

365 00:15:44.310 --> 00:15:46.510 which is a network of the world's largest

366 00:15:46.510 --> 00:15:47.910 and most influential cities.

367 00:15:49.500 --> 00:15:50.580 So,

368 00:15:50.580 --> 00:15:53.710 just as urban populations are growing,

369 00:15:53.710 --> 00:15:56.250 so too our urban extents.

370 00:15:56.250 --> 00:15:59.160 The amount of land that we devote to cities is projected

371 00:15:59.160 --> 00:16:01.573 to increase dramatically over the century.

372 00:16:02.720 --> 00:16:04.680 In fact, many analysts suggest

373 00:16:05.930 --> 00:16:10.090 that we're more than double total urban land extents.

374 00:16:10.090 --> 00:16:12.560 I believe Karen Seto, who I think is with us here,

375 00:16:12.560 --> 00:16:15.800 has estimated that 60% of all of the urban infrastructure

376 00:16:15.800 --> 00:16:18.413 that we're going to need has yet to be built.

377 00:16:22.420 --> 00:16:24.580 Under some scenarios of fossil fuel development,

378 00:16:24.580 --> 00:16:27.260 as you see on the right graph here,

379 00:16:27.260 --> 00:16:29.330 models have projected that we could have as much as

380 00:16:29.330 --> 00:16:32.340 six times as much urban land by the end of the century

381 00:16:32.340 --> 00:16:33.253 as we have now.

382 00:16:34.440 --> 00:16:37.160 More than two-thirds of the expansion in urban land

383 00:16:37.160 --> 00:16:39.570 will happen in Africa and Asia.

384 00:16:39.570 --> 00:16:40.460 And so,

385 00:16:40.460 --> 00:16:43.180 you can imagine that this is a tremendous opportunity

386 00:16:43.180 --> 00:16:45.650 to rethink how we design our fish tank,

387 00:16:45.650 --> 00:16:48.320 how we make our cities healthier places,

388 00:16:48.320 --> 00:16:50.070 both for people and for the planet.

389 00:16:52.600 --> 00:16:53.433 So,

390 00:16:54.440 --> 00:16:57.500 I've highlighted some troubling trends and statistics here,

391 00:16:57.500 --> 00:16:58.970 but I really want to emphasize that

392 00:16:58.970 --> 00:17:00.793 cities can be forces for good.

393 00:17:01.690 --> 00:17:02.910 It's really important to remember that.

394 00:17:02.910 --> 00:17:06.520 These two pictures are before and after shots of a place

395 00:17:06.520 --> 00:17:07.940 in Seoul, South Korea,

396 00:17:07.940 --> 00:17:09.093 called Chonggyecheon.

397 00:17:10.490 --> 00:17:13.633 I'm positive, I'm butchering the pronunciation, but I try.

398 00:17:15.090 --> 00:17:18.240 From the late 1950s to the mid-1970s,

399 00:17:18.240 --> 00:17:20.890 this was a site of major industrialization

400 00:17:20.890 --> 00:17:24.400 and really a perfect example of car dependency.

401 00:17:24.400 --> 00:17:26.730 You can see in the upper picture that the site included

402 00:17:26.730 --> 00:17:28.670 an elevated highway.

403 00:17:28.670 --> 00:17:31.270 This was constructed over the bed of a former river.

404 00:17:32.700 --> 00:17:36.720 In 2003, the then mayor of Seoul initiated a project

405 00:17:36.720 --> 00:17:39.450 to remove the highway and restore the river.

406 00:17:39.450 --> 00:17:41.340 It was highly controversial.

407 00:17:41.340 --> 00:17:43.420 It was expected to lead to terrible congestion

408 00:17:43.420 --> 00:17:44.970 and other consequences,

409 00:17:44.970 --> 00:17:48.370 but actually it's become a showcase for the city.

410 00:17:48.370 --> 00:17:52.080 The new watercourse, which you see in the lower picture,

411 00:17:52.080 --> 00:17:54.520 led to locally cooler temperatures,

412 00:17:54.520 --> 00:17:57.310 by some measures an increase in biodiversity,

413 00:17:57.310 --> 00:17:59.030 less traffic congestion,

414 00:17:59.030 --> 00:18:00.340 less pollution,

415 00:18:00.340 --> 00:18:01.710 more tourism,

416 00:18:01.710 --> 00:18:04.343 and cultural and economic revitalization.

417 00:18:05.380 --> 00:18:08.050 And cities everywhere are taking actions like this,

418 00:18:08.050 --> 00:18:10.240 and trying experiments like this.

419 00:18:10.240 --> 00:18:13.160 Now, we saw a host of new experiments in public space

420 00:18:13.160 --> 00:18:14.440 and infrastructure,

421 00:18:14.440 --> 00:18:17.570 and working in mobility during COVID-19

422 00:18:17.570 --> 00:18:18.920 in cities around the world.

423 00:18:20.270 --> 00:18:23.870 Cities are also taking the lead on net-zero commitments,

424 00:18:23.870 --> 00:18:25.380 and adaptation matters,

425 00:18:25.380 --> 00:18:27.350 and on integrating all these activities

426 00:18:27.350 --> 00:18:29.390 under one-governance structure.

427 00:18:29.390 --> 00:18:31.660 So the city of Amsterdam, I believe,

428 00:18:31.660 --> 00:18:34.130 is taking an explicit Doughnut Economics Approach

429 00:18:34.130 --> 00:18:37.160 to their development, where they both mitigate

430 00:18:39.170 --> 00:18:40.650 the excesses of growth,

431 00:18:40.650 --> 00:18:43.840 but also provide all the social needs for the population.

432 00:18:43.840 --> 00:18:47.810 So really important that we see cities not as problematic,

433 00:18:47.810 --> 00:18:49.453 but as a source of solutions.

434 00:18:51.080 --> 00:18:53.163 So now,

435 00:18:53.163 --> 00:18:54.990 I want to talk a little bit about some of the challenges

436 00:18:54.990 --> 00:18:58.620 to implementing healthy climate action in cities.

437 00:18:58.620 --> 00:19:01.110 Many of these things that I'll talk about, of course,

438 00:19:01.110 --> 00:19:03.160 apply to climate and health more broadly.

439 00:19:04.780 --> 00:19:07.650 One challenge is that we just don't know where we're going

440 00:19:07.650 --> 00:19:10.230 in terms of emissions pathways.

441 00:19:10.230 --> 00:19:11.700 This figure shows annual growth,

442 00:19:11.700 --> 00:19:14.960 global greenhouse gas emissions under different scenarios.

443 00:19:14.960 --> 00:19:18.080 If we do nothing, we're up in this pink gray area,

444 00:19:18.080 --> 00:19:19.340 and we're probably looking at

445 00:19:19.340 --> 00:19:21.570 more than four degrees Celsius of warming,

446 00:19:21.570 --> 00:19:23.800 which would be catastrophic.

447 00:19:23.800 --> 00:19:26.220 But fortunately, we are already doing something,

448 00:19:26.220 --> 00:19:29.920 and under current policies, we're probably in this tan space

449 00:19:29.920 --> 00:19:33.020 in the middle and looking about three degrees of warming,

450 00:19:33.020 --> 00:19:35.880 which would still be extremely serious.

451 00:19:35.880 --> 00:19:38.810 Our current pledges and targets under the Paris Agreement,

452 00:19:38.810 --> 00:19:40.060 get us down to about 2.4,

453 00:19:41.270 --> 00:19:43.910 and if we were able to take the urgent massive action

454 00:19:43.910 --> 00:19:45.120 that we need to take,

455 00:19:45.120 --> 00:19:47.620 we might still be able to hold a warming to two degrees

456 00:19:47.620 --> 00:19:48.963 or even 1.5.

457 00:19:50.890 --> 00:19:53.290 But it's important to remember that all the climate impacts

458 00:19:53.290 --> 00:19:56.464 that we're seeing today are just

459 00:19:56.464 --> 00:19:58.640 1.1 or 1.2 degrees of warming.

460 00:19:58.640 --> 00:20:00.030 So even 1.5,

461 00:20:00.030 --> 00:20:02.540 even if we meet the goals of the Paris Agreement,

462 00:20:02.540 --> 00:20:05.330 we're looking at significantly more serious health impacts

463 00:20:05.330 --> 00:20:06.393 and other impacts.

464 00:20:07.735 --> 00:20:10.800 Now, of course, not knowing what to adapt to,

465 00:20:10.800 --> 00:20:14.010 makes it quite difficult for cities to plan effectively.

466 00:20:14.010 --> 00:20:16.200 It also makes it quite difficult and challenging

467 00:20:16.200 --> 00:20:17.523 to project impacts.

468 00:20:19.280 --> 00:20:20.860 So,

469 00:20:20.860 --> 00:20:23.380 a second issue is that we don't know enough

470 00:20:23.380 --> 00:20:24.430 about tipping points.

471 00:20:25.698 --> 00:20:27.670 A tipping point is a set of conditions

472 00:20:27.670 --> 00:20:30.610 where small changes can lead to abrupt shifts

473 00:20:30.610 --> 00:20:33.060 in the state of a complex system.

474 00:20:33.060 --> 00:20:36.640 Most often, we hear about climate change tipping points.

475 00:20:36.640 --> 00:20:37.830 So for example,

476 00:20:37.830 --> 00:20:40.600 there's a hypothesis that if the Greenland ice sheet melts

477 00:20:40.600 --> 00:20:41.680 too quickly,

478 00:20:41.680 --> 00:20:43.970 the influx of cold water could shut down

479 00:20:43.970 --> 00:20:46.650 the circulation of the North Atlantic Ocean currents

480 00:20:46.650 --> 00:20:49.550 and that would cause a very rapid shift in global climate.

481 00:20:50.500 --> 00:20:53.060 So that's one climate tipping point.

482 00:20:53.060 --> 00:20:55.340 There are many other potential climates tipping points,

483 00:20:55.340 --> 00:20:58.440 but tipping points aren't limited to climate systems.

484 00:20:58.440 --> 00:21:00.570 So you can have ecological tipping points,

485 00:21:00.570 --> 00:21:03.263 and socio-economic tipping points as well.

486 00:21:04.220 --> 00:21:07.090 So to give an example of an ecological tipping point,

487 00:21:07.090 --> 00:21:10.250 drier conditions can cause less vegetation growth,

488 00:21:10.250 --> 00:21:14.050 which leads to less evapotranspiration, even less rain,

489 00:21:14.050 --> 00:21:17.350 and eventually leads to rapid desertification.

490 00:21:17.350 --> 00:21:19.520 And there's evidence that that may have

491 00:21:19.520 --> 00:21:21.520 already started happening in some areas.

492 00:21:23.380 --> 00:21:25.540 In terms of socioeconomic tipping points,

493 00:21:25.540 --> 00:21:27.360 sea-level rise, or sustained drought

494 00:21:27.360 --> 00:21:29.540 can lead to sudden abandonment of settlements

495 00:21:29.540 --> 00:21:30.543 and out-migration.

496 00:21:31.380 --> 00:21:33.070 Imagine if the Cape Town drought

497 00:21:33.070 --> 00:21:34.733 had gone on a couple more years.

498 00:21:36.170 --> 00:21:39.180 Importantly, tipping points can also be positive.

499 00:21:39.180 --> 00:21:42.360 We might see a sudden transition to renewable energy

500 00:21:42.360 --> 00:21:44.420 when a critical mass and cheaper technology

501 00:21:44.420 --> 00:21:46.100 leads to universal adaption.

502 00:21:46.100 --> 00:21:49.030 We've seen that kind of rapid spread for mobile phones

503 00:21:49.030 --> 00:21:50.833 and social media, for example.

504 00:21:52.010 --> 00:21:54.880 But deep uncertainty about the likelihood, magnitude,

505 00:21:54.880 --> 00:21:57.230 and timing of tipping points is another factor that

506 00:21:57.230 --> 00:22:00.730 complicates city planning and even global climate planning

507 00:22:00.730 --> 00:22:02.093 and policy discourse.

508 00:22:05.220 --> 00:22:06.810 We don't have enough information

509 00:22:06.810 --> 00:22:10.570 about the limits of adaptation or its effectiveness.

510 00:22:10.570 --> 00:22:14.030 The figure here shows frequency of adverse impacts

511 00:22:14.030 --> 00:22:15.950 from some event on the Y-axis

512 00:22:17.040 --> 00:22:20.563 and intensity of adverse impacts on the X-axis.

513 00:22:21.880 --> 00:22:24.670 So when frequency or intensity are very low,

514 00:22:24.670 --> 00:22:26.010 when they're in the blue,

515 00:22:26.010 --> 00:22:27.010 we don't worry about them.

516 00:22:27.010 --> 00:22:28.260 They're acceptable risks.

517 00:22:29.330 --> 00:22:31.320 Beyond some limit of acceptable risk,

518 00:22:31.320 --> 00:22:34.530 which is shown here by the curve line at the lower left,

519 00:22:34.530 --> 00:22:36.120 we adapt to the risk,

520 00:22:36.120 --> 00:22:39.250 but there are limits to what's possible or feasible.

521 00:22:39.250 --> 00:22:42.480 A limit to adaptation is a point at which an actor

522 00:22:42.480 --> 00:22:45.170 can no longer secure valued objectives

523 00:22:45.170 --> 00:22:48.063 from intolerable risk through adaptive action.

524 00:22:48.950 --> 00:22:52.180 So the point at which your adaptive action can't secure

525 00:22:52.180 --> 00:22:53.740 what you need to secure.

526 00:22:53.740 --> 00:22:55.560 Above the limits of adaptation,

527 00:22:55.560 --> 00:22:57.970 which is the second curve line in this figure,

528 00:22:57.970 --> 00:23:00.250 to the upper right, risks are so severe

529 00:23:00.250 --> 00:23:03.470 that we have to try to avoid them or mitigate them.

530 00:23:03.470 --> 00:23:05.357 And you may have heard the phrase,

531 00:23:05.357 --> 00:23:08.867 "Adapt to what you can't avoid, avoid what you can't adapt."

532 00:23:10.470 --> 00:23:14.120 Barriers to adaptation can be physiological.

533 00:23:14.120 --> 00:23:16.540 So for example, where heat and humidity go beyond

534 00:23:16.540 --> 00:23:19.330 the human body's capacity to cool itself,

535 00:23:19.330 --> 00:23:21.270 they can also be ecological, social,

536 00:23:21.270 --> 00:23:24.253 cultural, physical infrastructural, or technological.

537 00:23:25.110 --> 00:23:28.130 I'm sure there are other things that they can be.

538 00:23:28.130 --> 00:23:30.780 So we need to have a much better understanding of the limits

539 00:23:30.780 --> 00:23:31.613 to adaptation.

540 00:23:33.630 --> 00:23:34.463 One second.

541 00:23:36.730 --> 00:23:39.350 In terms of effectiveness,

542 00:23:39.350 --> 00:23:42.640 we have lots of projections and sort of modeled estimates of

543 00:23:42.640 --> 00:23:44.710 the effectiveness of potential actions,

544 00:23:44.710 --> 00:23:48.750 but far fewer measurements of performance of adaptation

545 00:23:48.750 --> 00:23:52.490 in reducing health or climate impacts or risks.

546 00:23:52.490 --> 00:23:53.990 So,

547 00:23:53.990 --> 00:23:56.340 as things become more and more implemented in the world,

548 00:23:56.340 --> 00:23:58.883 we need evaluations of those projects.

549 00:23:59.900 --> 00:24:02.240 Even when we know adaptation has been effective,

550 00:24:02.240 --> 00:24:03.460 it's hard to separate out

551 00:24:03.460 --> 00:24:05.630 the effects of personal behavioral change,

552 00:24:05.630 --> 00:24:08.600 changing contextual factors, and specific interventions.

553 00:24:08.600 --> 00:24:10.510 So we need a theory that helps us

554 00:24:10.510 --> 00:24:12.443 disentangle those patterns.

555 00:24:14.470 --> 00:24:15.303 Another challenge,

556 00:24:15.303 --> 00:24:17.490 and this is a really important one,

557 00:24:17.490 --> 00:24:19.660 from my perspective, is that existing research

558 00:24:19.660 --> 00:24:21.913 doesn't reflect non-patterns of risk.

559 00:24:22.840 --> 00:24:26.320 The figure above is from a preprint of a new review.

560 00:24:26.320 --> 00:24:28.040 They used machine learning approaches

561 00:24:28.040 --> 00:24:31.690 to evaluate about 16,000 climate and health studies.

562 00:24:31.690 --> 00:24:34.180 And if you notice the scale, there is a log scale,

563 00:24:34.180 --> 00:24:36.430 so keep that in mind.

564 00:24:36.430 --> 00:24:39.030 Notice where the studies are concentrated.

565 00:24:39.030 --> 00:24:42.550 The second figure below shows the locations of heat wave

566 00:24:42.550 --> 00:24:45.500 and health research over close to half a century.

567 00:24:45.500 --> 00:24:47.130 It's even a starker pattern,

568 00:24:47.130 --> 00:24:48.690 and that's for one specific risk,

569 00:24:48.690 --> 00:24:52.590 but you can do that for any different climate analysis.

570 00:24:52.590 --> 00:24:55.120 In both cases, there's a significant lack of research

571 00:24:55.120 --> 00:24:58.130 in countries and cities that will experience

572 00:24:58.130 --> 00:25:01.000 serious climate and health impacts.

573 00:25:01.000 --> 00:25:04.000 That includes Latin America, Africa,

574 00:25:04.000 --> 00:25:07.810 the Middle East, Central Asia and Oceania.

575 00:25:07.810 --> 00:25:10.530 And lots of research in the U.S. and Europe,

576 00:25:10.530 --> 00:25:13.280 India and China, but much of the rest of the world

577 00:25:13.280 --> 00:25:14.143 needs a lot more.

578 00:25:16.020 --> 00:25:17.960 We still don't have nearly enough evidence

579 00:25:17.960 --> 00:25:20.420 on how cities interact with modify and mediate

580 00:25:20.420 --> 00:25:22.260 climate health relationships.

581 00:25:22.260 --> 00:25:23.850 And because we haven't done the research,

582 00:25:23.850 --> 00:25:26.140 we especially have limited information about

583 00:25:26.140 --> 00:25:28.770 how these interactions are already affecting residents

584 00:25:28.770 --> 00:25:31.620 of informal settlements, secondary cities,

585 00:25:31.620 --> 00:25:32.970 cities in the Global South,

586 00:25:33.990 --> 00:25:36.540 or how they'll affect in the future.

587 00:25:36.540 --> 00:25:38.400 We don't have enough evidence on impacts

588 00:25:38.400 --> 00:25:41.620 on marginalized groups or intersectional impacts,

589 00:25:41.620 --> 00:25:43.650 even in high-income countries.

590 00:25:43.650 --> 00:25:46.290 And we don't have enough evidence on impacts

591 00:25:46.290 --> 00:25:49.140 mediated via complex indirect pathways,

592 00:25:49.140 --> 00:25:51.543 which I'll talk a little bit more about later.

593 00:25:52.580 --> 00:25:55.070 And of course we've seen the climate change

594 00:25:55.070 --> 00:25:57.950 will push our infrastructure beyond the tolerances

595 00:25:57.950 --> 00:25:59.730 that it was designed for.

596 00:25:59.730 --> 00:26:02.900 That was something in several of the examples that I gave.

597 00:26:02.900 --> 00:26:05.840 We need much more information on how our infrastructure

598 00:26:05.840 --> 00:26:09.093 would respond to and what we do to fix it.

599 00:26:10.600 --> 00:26:14.790 So another issue is that we have systematically incomplete

600 00:26:14.790 --> 00:26:17.513 information on how to catalyze climate action.

601 00:26:18.430 --> 00:26:21.370 And some of you may be familiar with this picture.

602 00:26:21.370 --> 00:26:24.590 This picture represents a story from World War II.

603 00:26:24.590 --> 00:26:26.780 Bombers were being regularly shot down

604 00:26:26.780 --> 00:26:28.570 when they went out on raids,

605 00:26:28.570 --> 00:26:30.300 and the U.S. Military was trying to figure out

606 00:26:30.300 --> 00:26:31.520 what to do about it.

607 00:26:31.520 --> 00:26:34.440 So when the bombers came back, they systematically mapped

608 00:26:34.440 --> 00:26:37.360 the bullet holes in planes returning from combat,

609 00:26:37.360 --> 00:26:39.400 and they proposed to add armor to the parts

610 00:26:39.400 --> 00:26:40.600 that had the most holes.

611 00:26:41.440 --> 00:26:43.880 But a statistician named Abraham Wald,

612 00:26:43.880 --> 00:26:46.690 pointed out the solution was the exact opposite

613 00:26:46.690 --> 00:26:49.220 because these were the planes that had survived.

614 00:26:49.220 --> 00:26:52.160 So the military should armor the parts with no bullet holes,

615 00:26:52.160 --> 00:26:54.300 because any plane that got hit in those places

616 00:26:54.300 --> 00:26:55.300 didn't make it back.

617 00:26:56.370 --> 00:26:59.510 This type of effect has been called survivorship bias,

618 00:26:59.510 --> 00:27:00.733 and it's really common.

619 00:27:01.570 --> 00:27:03.540 In the context of climate change,

620 00:27:03.540 --> 00:27:06.360 we're beginning to have many collections of implemented

621 00:27:06.360 --> 00:27:09.110 mitigation adaptation and co-benefits actions.

622 00:27:09.110 --> 00:27:11.860 And often these collections try to pull out and identify

623 00:27:11.860 --> 00:27:14.830 the salient shared features of success.

624 00:27:14.830 --> 00:27:17.150 But we have far less information on interventions

625 00:27:17.150 --> 00:27:19.810 that failed during implementation.

626 00:27:19.810 --> 00:27:22.980 Almost no information at all on actions that were rejected

627 00:27:22.980 --> 00:27:24.563 during ideation or planning.

628 00:27:26.110 --> 00:27:28.840 Actions that were proved and never implemented.

629 00:27:28.840 --> 00:27:31.590 In this context, survivorship bias can arise

630 00:27:31.590 --> 00:27:35.850 to drawing conclusions only from successful climate action.

631 00:27:35.850 --> 00:27:37.600 So we need to look at the failures.

632 00:27:39.660 --> 00:27:42.360 Another challenge is that research policy and practice

633 00:27:42.360 --> 00:27:43.943 tend to operate in silos.

634 00:27:44.990 --> 00:27:47.360 In other words, people tend to engage, primarily,

635 00:27:47.360 --> 00:27:50.650 with the concepts, people, problems and actions

636 00:27:50.650 --> 00:27:54.510 that relate to their own specific area of work or interest.

637 00:27:54.510 --> 00:27:57.340 Obviously, this challenges effective communication,

638 00:27:57.340 --> 00:27:59.100 the challenges are believed to integrate

639 00:27:59.100 --> 00:28:01.090 research policy and practice,

640 00:28:01.090 --> 00:28:03.750 and it challenges the coherence of the actions

641 00:28:03.750 --> 00:28:05.017 that we implement.

642 00:28:06.450 --> 00:28:09.350 One thing that I and many others have observed is that

643 00:28:09.350 --> 00:28:11.530 health has actually, often particularly,

644 00:28:11.530 --> 00:28:13.580 separated from other sectors.

645 00:28:13.580 --> 00:28:16.880 And maybe this is because of deference to the health sector,

646 00:28:16.880 --> 00:28:19.350 maybe it has something to do with specialization,

647 00:28:19.350 --> 00:28:21.290 maybe it's because health is life and death,

648 00:28:21.290 --> 00:28:24.260 and so occupies a sort of a different place.

649 00:28:24.260 --> 00:28:26.530 But the result is that in many cities,

650 00:28:26.530 --> 00:28:27.700 just to give one example,

651 00:28:27.700 --> 00:28:30.590 urban and transport planners have little or no contact

652 00:28:30.590 --> 00:28:31.700 with the health department,

653 00:28:31.700 --> 00:28:34.100 even though their actions have huge implications

654 00:28:34.970 --> 00:28:37.423 for health and wellbeing, and obviously for climate.

655 00:28:39.680 --> 00:28:43.150 Another challenge is that the pace of the required change

656 00:28:43.150 --> 00:28:46.213 of what we have to do is getting faster and faster.

657 00:28:47.070 --> 00:28:48.910 Every year that we delay action,

658 00:28:48.910 --> 00:28:51.420 the climate challenge becomes greater.

659 00:28:51.420 --> 00:28:52.730 As of 2019,

660 00:28:52.730 --> 00:28:56.360 we would have had to cut emissions by 7.6% each year,

661 00:28:56.360 --> 00:28:57.220 globally,

662 00:28:57.220 --> 00:28:59.290 to meet the goals of the Paris Agreement.

663 00:28:59.290 --> 00:29:03.380 And just for perspective, in 2020 with COVID-19,

664 00:29:03.380 --> 00:29:06.530 we had just a 6.4% drop in emissions.

665 00:29:06.530 --> 00:29:08.700 So that starts to give you a sense of the scale

666 00:29:08.700 --> 00:29:10.363 of what we need to do every year.

667 00:29:11.660 --> 00:29:14.600 The figure here shows how the pace and trajectory

668 00:29:14.600 --> 00:29:16.490 of the needed emissions reductions changes

669 00:29:16.490 --> 00:29:18.320 with the year when they begin.

670 00:29:18.320 --> 00:29:20.530 So if they had started in 2000,

671 00:29:20.530 --> 00:29:22.110 it would have been a much shallower

672 00:29:22.110 --> 00:29:23.520 reduction that we would have had to have.

673 00:29:23.520 --> 00:29:24.570 Now it's much deeper.

674 00:29:26.280 --> 00:29:28.017 Not only do we have to move faster than ever,

675 00:29:28.017 --> 00:29:30.970 but we have to do more than ever before.

676 00:29:30.970 --> 00:29:33.780 So our goal can't be just to reduce emissions,

677 00:29:33.780 --> 00:29:36.080 but we also have to meet all the other goals

678 00:29:36.080 --> 00:29:37.210 to sustainable development.

679 00:29:37.210 --> 00:29:39.480 We have to the end poverty and hunger,

680 00:29:39.480 --> 00:29:42.050 provide education and equality,

681 00:29:42.050 --> 00:29:43.593 and all of the other SDGs.

682 00:29:47.930 --> 00:29:49.140 The figure on the left

683 00:29:51.100 --> 00:29:53.120 just shows how health is intimately linked

684 00:29:53.120 --> 00:29:54.580 with all of those goals.

685 00:29:54.580 --> 00:29:55.413 And on the right,

686 00:29:55.413 --> 00:29:57.410 we have countries plotted, excuse me,

687 00:29:57.410 --> 00:29:59.440 on the right we have countries plotted with respect to their

688 00:29:59.440 --> 00:30:02.580 ecological footprint per capita on the Y-axis,

689 00:30:02.580 --> 00:30:05.410 and their human development index on the X-axis.

690 00:30:05.410 --> 00:30:08.070 So the further to the right on this chart,

691 00:30:08.070 --> 00:30:09.960 the better your standards of living.

692 00:30:09.960 --> 00:30:12.403 The lower down, the more sustainable you are.

693 00:30:13.610 --> 00:30:15.450 The shaded square at the bottom right

694 00:30:15.450 --> 00:30:17.420 defines the space within which countries

695 00:30:17.420 --> 00:30:19.160 have high human development

696 00:30:19.160 --> 00:30:21.860 and live within the world's limits.

697 00:30:21.860 --> 00:30:23.640 And you can see that there are very few countries

698 00:30:23.640 --> 00:30:25.950 in that space, and we need to get everyone there

699 00:30:25.950 --> 00:30:26.783 quite quickly.

700 00:30:28.000 --> 00:30:31.500 So one last challenge is that we have lots of commitments,

701 00:30:31.500 --> 00:30:33.693 but actual implementation lags far behind.

702 00:30:34.680 --> 00:30:36.970 Here, we see cities and regions that have pledged

703 00:30:36.970 --> 00:30:38.710 a net-zero emissions target,

704 00:30:38.710 --> 00:30:41.220 and we also have the percentage of national populations

705 00:30:41.220 --> 00:30:43.260 that are covered by these targets.

706 00:30:43.260 --> 00:30:46.564 As of 2020, 126 countries and 51% of global emissions,

707 00:30:46.564 --> 00:30:49.264 As of 2020, 126 countries and 51% of global emissions,

708 00:30:50.180 --> 00:30:53.210 excuse me, of the global population had net-zero goals,

709 00:30:53.210 --> 00:30:57.230 either formerly adopted, announced, or under consideration.

710 00:30:57.230 --> 00:30:59.640 But pledging and implementing are far different things,

711 00:30:59.640 --> 00:31:01.672 politically and practically.

712 00:31:01.672 --> 00:31:03.000 So we need to keep an eye on this

713 00:31:03.000 --> 00:31:06.343 and we need mechanisms for accountability.

714 00:31:07.680 --> 00:31:10.540 So I want to shift gears here and talk about

715 00:31:10.540 --> 00:31:12.710 the systemic nature of many urban challenges,

716 00:31:12.710 --> 00:31:15.220 including those related to climate and health,

717 00:31:15.220 --> 00:31:18.650 and why we should think of them as systems problems.

718 00:31:18.650 --> 00:31:22.810 So, first of all, what do I mean by systems problems?

719 00:31:22.810 --> 00:31:26.220 Systems problems arise from the interactions of networks

720 00:31:26.220 --> 00:31:29.080 of interconnected elements or systems.

721 00:31:29.080 --> 00:31:31.440 They tend to have various features,

722 00:31:31.440 --> 00:31:33.960 detailed complexity, so they have lots of variables,

723 00:31:33.960 --> 00:31:36.340 there's lots of things going on.

724 00:31:36.340 --> 00:31:38.120 Dynamic complexity.

725 00:31:38.120 --> 00:31:41.100 Cause and effect can be hard to define in these systems.

726 00:31:41.100 --> 00:31:44.550 The outcomes of interventions aren't obvious.

727 00:31:44.550 --> 00:31:46.840 They usually have multiple stakeholders acting on

728 00:31:46.840 --> 00:31:50.780 incomplete information, often with conflicting motives.

729 00:31:50.780 --> 00:31:54.010 They operate across multiple scales and sectors.

730 00:31:54.010 --> 00:31:56.130 They're often resistant to change or sometimes

731 00:31:56.130 --> 00:31:59.320 they'll change very suddenly and unexpectedly.

732 00:31:59.320 --> 00:32:01.973 And they're usually related to other problems.

733 00:32:03.750 --> 00:32:07.180 So the defining feature of systems problems is feedback,

734 00:32:07.180 --> 00:32:10.300 which can be reinforcing or balancing.

735 00:32:10.300 --> 00:32:13.760 Reinforcing feedbacks lead to exponential growth decline,

736 00:32:13.760 --> 00:32:16.590 balancing feedbacks lead to stable values.

737 00:32:16.590 --> 00:32:20.300 So remember the example of desertification before,

738 00:32:20.300 --> 00:32:22.830 where less rain went to less vegetation,

739 00:32:22.830 --> 00:32:24.140 went the less rain and so on,

740 00:32:24.140 --> 00:32:26.073 that's a reinforcing feedback loop.

741 00:32:27.190 --> 00:32:29.290 Your thermostat in your house operates

742 00:32:29.290 --> 00:32:31.480 on the principle of balancing feedback.

743 00:32:31.480 --> 00:32:33.770 When the gap between the room temperature

744 00:32:33.770 --> 00:32:35.840 and your thermostat setting gets large,

745 00:32:35.840 --> 00:32:38.460 it turns on the furnace and the room heats up.

746 00:32:38.460 --> 00:32:40.600 When the gap becomes smaller,

747 00:32:40.600 --> 00:32:43.350 it turns off the furnace so the temperature stays close

748 00:32:43.350 --> 00:32:44.700 to the desired temperature.

749 00:32:46.340 --> 00:32:48.800 So an important observation here is that you can have

750 00:32:48.800 --> 00:32:52.120 a valid causal relationship between A and B,

751 00:32:52.120 --> 00:32:54.380 perfectly valid, but still see all sorts of different

752 00:32:54.380 --> 00:32:55.850 behavior in the real world,

753 00:32:55.850 --> 00:32:58.790 depending on other connections in the system.

754 00:32:58.790 --> 00:33:01.360 System behavior can be explained endogenously

755 00:33:01.360 --> 00:33:04.450 in terms of feedbacks, delays, stocks, flows,

756 00:33:04.450 --> 00:33:06.610 and parameters within the system.

757 00:33:06.610 --> 00:33:08.630 That means that the way the system behaves

758 00:33:08.630 --> 00:33:11.630 depends on the way the elements of the system are connected.

759 00:33:13.340 --> 00:33:14.880 Simple system structures,

760 00:33:14.880 --> 00:33:17.370 or combinations of feedback loops and delays,

761 00:33:17.370 --> 00:33:21.193 give rise to characteristic patterns of behavior.

762 00:33:22.260 --> 00:33:26.010 Sometimes, we see these called systems archetypes.

763 00:33:26.010 --> 00:33:28.690 So seeing a certain pattern suggests a certain relationship

764 00:33:28.690 --> 00:33:30.340 between the elements in a system.

765 00:33:31.370 --> 00:33:33.540 So just to give a couple of examples,

766 00:33:33.540 --> 00:33:35.450 the top example here,

767 00:33:35.450 --> 00:33:38.414 you have a balancing feedback loop with a delay

768 00:33:38.414 --> 00:33:40.250 and that gives dampening oscillations.

769 00:33:40.250 --> 00:33:42.720 So if your thermostat is slow to react,

770 00:33:42.720 --> 00:33:45.070 you'd see this kind of pattern.

771 00:33:45.070 --> 00:33:46.180 The second example,

772 00:33:46.180 --> 00:33:49.500 a reinforcing loop tied to a balancing loop

773 00:33:49.500 --> 00:33:52.060 can give you a typical logistic growth curve.

774 00:33:52.060 --> 00:33:52.893 So,

775 00:33:54.043 --> 00:33:55.640 in the second diagram, we have population growth

776 00:33:55.640 --> 00:33:57.780 with an ecological carrying capacity.

777 00:33:57.780 --> 00:34:00.740 At low populations, the reinforcing loop dominates

778 00:34:00.740 --> 00:34:02.370 and growth is exponential,

779 00:34:02.370 --> 00:34:05.420 and at high populations, the balancing loop dominates,

780 00:34:05.420 --> 00:34:07.630 so growth slows until the population equals

781 00:34:07.630 --> 00:34:08.730 the carrying capacity.

782 00:34:09.780 --> 00:34:12.600 There are many other well-established systems archetypes,

783 00:34:12.600 --> 00:34:15.040 and of course, these relationships can be expressed

784 00:34:15.040 --> 00:34:16.713 mathematically and modeled.

785 00:34:18.770 --> 00:34:22.250 Simple systems structures combined into broader systems

786 00:34:22.250 --> 00:34:23.873 in constant dynamic flux.

787 00:34:25.230 --> 00:34:28.190 And this is where conventional approaches really struggle.

788 00:34:28.190 --> 00:34:30.820 So when you have health needs and risk factors

789 00:34:30.820 --> 00:34:33.730 and diseases and health resources that are all fluctuating

790 00:34:33.730 --> 00:34:35.083 constantly over time,

791 00:34:36.070 --> 00:34:39.483 it's hard to develop valid conclusions.

792 00:34:40.530 --> 00:34:42.100 Earlier, I mentioned silos,

793 00:34:42.100 --> 00:34:44.660 here's where they really become relevant.

794 00:34:44.660 --> 00:34:47.350 So when dealing with a system virtually, everyone sees,

795 00:34:47.350 --> 00:34:49.390 tends to see their own part,

796 00:34:49.390 --> 00:34:52.420 the part most related to their own work, or their own ideas,

797 00:34:52.420 --> 00:34:53.570 or their own community.

798 00:34:54.460 --> 00:34:57.680 So climate scientists tend to look at climate variables,

799 00:34:57.680 --> 00:34:59.960 city planners look at urban variables,

800 00:34:59.960 --> 00:35:01.490 health professionals tend to look at

801 00:35:01.490 --> 00:35:03.380 direct health relationships.

802 00:35:03.380 --> 00:35:05.120 Now, of course,

803 00:35:05.120 --> 00:35:07.750 there's intentional reaching across the boundaries.

804 00:35:07.750 --> 00:35:11.040 Health scientists certainly look at the impacts of variables

805 00:35:11.040 --> 00:35:13.140 in other parts of the system,

806 00:35:13.140 --> 00:35:15.340 but it's rare that anyone is able to perceive

807 00:35:15.340 --> 00:35:17.410 the whole system and the way things co-vary

808 00:35:17.410 --> 00:35:19.053 and interact at the same time.

809 00:35:20.240 --> 00:35:22.680 So an important guideline and systems thinking

810 00:35:22.680 --> 00:35:23.750 is that you can't understand

811 00:35:23.750 --> 00:35:25.200 the behavior of that whole system

812 00:35:25.200 --> 00:35:27.713 by understanding the behavior of individual parts.

813 00:35:28.760 --> 00:35:32.070 This is especially true in critical feedback loops,

814 00:35:32.070 --> 00:35:35.880 especially if feedback loops that have delayed action

815 00:35:35.880 --> 00:35:38.030 when they cross silo boundaries.

816 00:35:38.030 --> 00:35:39.330 And under those circumstances,

817 00:35:39.330 --> 00:35:42.240 it's very common for decision-makers to be surprised

818 00:35:42.240 --> 00:35:43.970 by the counter-intuitive outcomes

819 00:35:43.970 --> 00:35:47.003 or the failure of policies or interventions.

820 00:35:48.550 --> 00:35:49.560 Now,

821 00:35:49.560 --> 00:35:52.430 practitioners of systems analysis and systems thinking

822 00:35:52.430 --> 00:35:55.820 have developed heuristics about when and how to intervene

823 00:35:55.820 --> 00:35:58.510 in a system to have greatest impact.

824 00:35:58.510 --> 00:36:00.750 These are so-called leverage points,

825 00:36:00.750 --> 00:36:02.880 and some of them are more effective than others.

826 00:36:02.880 --> 00:36:06.200 So the lowest value leverage points are parameters.

827 00:36:06.200 --> 00:36:09.963 So for example, the rates of flow into or out of stocks.

828 00:36:10.970 --> 00:36:14.630 Higher up on leverage scale are physical system structures

829 00:36:14.630 --> 00:36:17.850 like buffers and material stocks and flows.

830 00:36:17.850 --> 00:36:20.700 Even higher are control structures.

831 00:36:20.700 --> 00:36:22.220 The structures that control of the working

832 00:36:22.220 --> 00:36:24.110 in the system, feedback loops,

833 00:36:24.110 --> 00:36:26.023 information flows and rules.

834 00:36:27.070 --> 00:36:29.160 The highest leverage points are those that allow

835 00:36:29.160 --> 00:36:32.400 the system structure or the goals to change,

836 00:36:32.400 --> 00:36:34.843 so if you can add feedback loops or remove them.

837 00:36:35.690 --> 00:36:38.440 And if you look at the very peak are interventions to change

838 00:36:38.440 --> 00:36:41.370 the paradigm out of which systems arise.

839 00:36:41.370 --> 00:36:43.180 In a real sense, that's what we're trying to do

840 00:36:43.180 --> 00:36:44.767 in the context of climate change

841 00:36:44.767 --> 00:36:46.520 and sustainable development.

842 00:36:46.520 --> 00:36:50.070 We want to shift our shared understanding of the goal

843 00:36:50.070 --> 00:36:53.307 of the human system, of humanity's place in the world.

844 00:36:56.210 --> 00:36:57.283 In the meantime,

845 00:36:58.120 --> 00:37:00.350 systems thinkers tell us

846 00:37:00.350 --> 00:37:03.020 that most of what we do to solve problems

847 00:37:03.020 --> 00:37:05.620 of the options that we look at,

848 00:37:05.620 --> 00:37:08.580 tend to rely on low value leverage points,

849 00:37:08.580 --> 00:37:10.980 and that we often, after we've identified them,

850 00:37:10.980 --> 00:37:13.040 push them in the wrong direction.

851 00:37:13.040 --> 00:37:15.320 So the systems approaches offer an opportunity

852 00:37:15.320 --> 00:37:17.593 to identify higher quality actions.

853 00:37:19.820 --> 00:37:22.930 Many urban climate and health challenges have features

854 00:37:22.930 --> 00:37:26.340 or show behaviors that we associate with systems problems.

855 00:37:26.340 --> 00:37:30.070 There are processes that we see replicated again and again

856 00:37:30.070 --> 00:37:32.090 in cities around the world.

857 00:37:32.090 --> 00:37:35.120 Urban sprawl, traffic congestion, gentrification,

858 00:37:35.120 --> 00:37:37.360 slum formation, air pollution,

859 00:37:37.360 --> 00:37:39.380 patterns of consumption growth.

860 00:37:39.380 --> 00:37:42.520 All of these are processes that resist change,

861 00:37:42.520 --> 00:37:46.410 that involve multiple stakeholders, and so on.

862 00:37:46.410 --> 00:37:49.840 We also see persistent why they replicated social patterns

863 00:37:49.840 --> 00:37:52.606 like prejudice and denialism.

864 00:37:52.606 --> 00:37:54.710 And this should be no surprise.

865 00:37:54.710 --> 00:37:56.610 Cities are the most complex systems

866 00:37:56.610 --> 00:37:58.410 that human beings have ever created.

867 00:37:59.290 --> 00:38:00.640 And all of this suggests that we need

868 00:38:00.640 --> 00:38:03.560 a systems-based research agenda to address

869 00:38:03.560 --> 00:38:06.583 these and other climate and health issues.

870 00:38:07.830 --> 00:38:09.940 Now, what I mean by a systems-based research agenda

871 00:38:09.940 --> 00:38:12.330 is not a replacement of traditional epidemiological

872 00:38:12.330 --> 00:38:13.790 or public health approaches.

873 00:38:13.790 --> 00:38:16.283 I think those are absolutely critical.

874 00:38:17.200 --> 00:38:19.570 And we have to make sure that we don't disrupt

875 00:38:19.570 --> 00:38:21.120 traditional science.

876 00:38:21.120 --> 00:38:23.350 What I rather mean is a program of work

877 00:38:23.350 --> 00:38:25.670 that complements traditional methods,

878 00:38:25.670 --> 00:38:28.120 that frames them within a systems context,

879 00:38:28.120 --> 00:38:31.820 and that draws on them to map complex problems,

880 00:38:31.820 --> 00:38:33.950 and identify solutions.

881 00:38:33.950 --> 00:38:35.840 A systems agenda would include components

882 00:38:35.840 --> 00:38:38.400 that apply methods to understand complexity

883 00:38:38.400 --> 00:38:41.080 and that engage broadly across disciplines,

884 00:38:41.080 --> 00:38:42.633 and especially beyond science.

885 00:38:43.970 --> 00:38:46.420 Now, this could be more or less expensive,

886 00:38:46.420 --> 00:38:47.890 but I've mapped out some of the components

887 00:38:47.890 --> 00:38:50.180 that I think are necessary.

888 00:38:50.180 --> 00:38:52.630 And these include conceptual mapping,

889 00:38:52.630 --> 00:38:54.610 systems-based case studies,

890 00:38:54.610 --> 00:38:56.190 simulation modeling,

891 00:38:56.190 --> 00:38:59.240 systemic analysis of governance planning and policy,

892 00:38:59.240 --> 00:39:00.890 and transdisciplinary research.

893 00:39:00.890 --> 00:39:03.240 And I'll talk about each of these just briefly.

894 00:39:05.580 --> 00:39:07.230 At the most basic level,

895 00:39:07.230 --> 00:39:10.030 concepts mapping can help organize information.

896 00:39:10.030 --> 00:39:12.130 I know this doesn't look very organized to you,

897 00:39:12.130 --> 00:39:14.900 but it actually helps a lot.

898 00:39:14.900 --> 00:39:17.663 It allows for exploration and hypothesis generation.

899 00:39:18.580 --> 00:39:21.500 This particular diagram is a causal process diagram

900 00:39:21.500 --> 00:39:24.870 for droughts and mental health from a systematic review.

901 00:39:24.870 --> 00:39:26.910 Now, the numbers that you see in brackets

902 00:39:26.910 --> 00:39:30.360 are the number of papers meeting the search criteria.

903 00:39:30.360 --> 00:39:32.080 So, you can see that this gives a sense of the state

904 00:39:32.080 --> 00:39:33.750 of knowledge across the system,

905 00:39:33.750 --> 00:39:36.830 and suggests where more research may be needed.

906 00:39:36.830 --> 00:39:40.600 And then there's the area of the shaded in green here,

907 00:39:40.600 --> 00:39:43.320 gives a sense of how this whole system diagram can be used

908 00:39:43.320 --> 00:39:46.010 to identify subsystems of interest.

909 00:39:46.010 --> 00:39:48.810 In this case, between drought, agricultural productivity,

910 00:39:48.810 --> 00:39:51.720 workloads and the health of the economy.

911 00:39:51.720 --> 00:39:54.920 Conceptual diagramming of this sort can also help identify

912 00:39:54.920 --> 00:39:58.513 potential co-benefits or co-risks between climate actions.

913 00:40:00.730 --> 00:40:02.720 On a more applied level,

914 00:40:02.720 --> 00:40:05.610 place-based, systems-based case studies can help,

915 00:40:05.610 --> 00:40:07.650 can also help with hypothesis generation

916 00:40:07.650 --> 00:40:09.600 and problem diagnosis.

917 00:40:09.600 --> 00:40:11.930 They can also play an important role in communication

918 00:40:11.930 --> 00:40:15.630 and advocacy because they provide a common language

919 00:40:15.630 --> 00:40:17.260 that cuts across silos,

920 00:40:17.260 --> 00:40:20.083 the language of feedback and stocks and flows.

921 00:40:21.240 --> 00:40:23.960 This is a case study series from a research project

922 00:40:23.960 --> 00:40:27.220 that I led a few years ago at UNU, it was called,

923 00:40:27.220 --> 00:40:29.600 Systems Thinking in Place-Based Methods for Healthier

924 00:40:29.600 --> 00:40:32.340 Malaysian Cities, SCHEMA for short.

925 00:40:32.340 --> 00:40:33.890 Don't ask me about the acronym.

926 00:40:37.267 --> 00:40:38.250 The case studies were produced in

927 00:40:38.250 --> 00:40:42.080 iterative cycles of engagement between a systems thinker,

928 00:40:42.080 --> 00:40:44.010 who provided technical knowledge and encourage

929 00:40:44.010 --> 00:40:46.110 thinking about dynamic processes,

930 00:40:46.110 --> 00:40:48.090 and a set of urban stakeholders who supplied

931 00:40:48.090 --> 00:40:50.430 local relevant knowledge,

932 00:40:50.430 --> 00:40:52.790 and evaluated the options, the structural options

933 00:40:52.790 --> 00:40:55.040 that were given to them by the system figure.

934 00:40:56.360 --> 00:40:57.193 In the end,

935 00:40:57.193 --> 00:40:59.350 the local stakeholders made all the decisions

936 00:40:59.350 --> 00:41:00.623 about the final model.

937 00:41:01.510 --> 00:41:03.870 This particular model explores how to assure safe food

938 00:41:03.870 --> 00:41:07.270 in school cafeterias, but the series covered a wide range

939 00:41:07.270 --> 00:41:09.530 of sustainability and health issues.

940 00:41:09.530 --> 00:41:11.250 There's lots of different methodologies

941 00:41:11.250 --> 00:41:12.460 for producing this kind of study

942 00:41:12.460 --> 00:41:14.010 and it could be done quite easily,

943 00:41:14.010 --> 00:41:16.080 so I think it's actually also a really useful tool

944 00:41:16.080 --> 00:41:19.490 for education and systems they need.

945 00:41:19.490 --> 00:41:21.450 On an even more applied level, of course,

946 00:41:21.450 --> 00:41:24.080 you have simulation models.

947 00:41:24.080 --> 00:41:25.270 Treat these with caution,

948 00:41:25.270 --> 00:41:27.420 absolute prediction is difficult,

949 00:41:27.420 --> 00:41:30.600 but they can provide useful insights to the system behavior,

950 00:41:30.600 --> 00:41:33.230 the probable outcomes of different scenarios,

951 00:41:33.230 --> 00:41:36.030 and potential unintended consequences.

952 00:41:36.030 --> 00:41:38.130 Simulation models can also be used to design

953 00:41:38.130 --> 00:41:39.670 and assess interventions,

954 00:41:39.670 --> 00:41:41.610 which is especially important for interventions

955 00:41:41.610 --> 00:41:44.050 with long time horizons.

956 00:41:44.050 --> 00:41:47.030 This particular model is of climate population

957 00:41:47.030 --> 00:41:48.550 and water supply.

958 00:41:48.550 --> 00:41:49.383 The agents here,

959 00:41:49.383 --> 00:41:50.730 which include households,

960 00:41:50.730 --> 00:41:52.760 and the water utility manager,

961 00:41:52.760 --> 00:41:54.720 make decisions based on their own attributes

962 00:41:54.720 --> 00:41:56.320 and rules for behavior,

963 00:41:56.320 --> 00:41:58.920 but also based on the current state of water system.

964 00:41:59.990 --> 00:42:01.730 Agent-based models are especially useful

965 00:42:01.730 --> 00:42:05.070 for looking at issues with distributional impacts,

966 00:42:05.070 --> 00:42:08.043 but there are many other classes of simulation model.

967 00:42:10.720 --> 00:42:13.670 Analysis of urban governance policy and planning

968 00:42:13.670 --> 00:42:15.120 is another really crucial element

969 00:42:15.120 --> 00:42:17.570 of the system-based agenda,

970 00:42:17.570 --> 00:42:19.310 just because these are the information

971 00:42:19.310 --> 00:42:21.620 and control structures for urban systems.

972 00:42:21.620 --> 00:42:24.393 So these are potentially high leverage points.

973 00:42:25.440 --> 00:42:27.620 This particular chart,

974 00:42:27.620 --> 00:42:30.010 maps different modes of urban climate governance

975 00:42:30.010 --> 00:42:31.653 against mitigation sectors.

976 00:42:32.673 --> 00:42:34.680 So for example, for transport,

977 00:42:34.680 --> 00:42:38.300 it distinguishes self-governing like procuring

978 00:42:38.300 --> 00:42:41.630 energy-efficient vehicles for the government fleet,

979 00:42:41.630 --> 00:42:46.040 governing through enabling like educational campaigns,

980 00:42:46.040 --> 00:42:47.770 governing by provisions, such as

981 00:42:47.770 --> 00:42:49.720 the provision of public transport,

982 00:42:49.720 --> 00:42:54.003 and governing by regulation such as road user charges.

983 00:42:55.520 --> 00:42:57.510 I don't want to go through this in detail,

984 00:42:57.510 --> 00:42:59.340 but just to make the point that understanding

985 00:42:59.340 --> 00:43:02.270 how each of these modes functions and practice,

986 00:43:02.270 --> 00:43:05.570 and how they themselves are connected in feedback systems

987 00:43:06.430 --> 00:43:07.980 and hierarchies.

988 00:43:07.980 --> 00:43:11.160 It again offers opportunities for problem diagnosis,

989 00:43:11.160 --> 00:43:13.690 hypothesis generation, and advocacy.

990 00:43:13.690 --> 00:43:15.780 One of the things that this kind of mapping does

991 00:43:15.780 --> 00:43:18.840 is it allows for documentation of the early stages

992 00:43:18.840 --> 00:43:22.110 of policy and planning to reduce the survivorship bias

993 00:43:22.110 --> 00:43:23.510 that I talked about earlier.

994 00:43:25.070 --> 00:43:26.093 And finally,

995 00:43:29.239 --> 00:43:32.010 transdisciplinary research is increasingly recognized

996 00:43:32.010 --> 00:43:35.060 as an important modality for resolving complex

997 00:43:35.060 --> 00:43:36.730 societal challenges.

998 00:43:36.730 --> 00:43:40.600 This is an OECD report that I helped coordinate in 2020,

999 00:43:40.600 --> 00:43:42.980 because recommendations for universities,

1000 00:43:42.980 --> 00:43:44.550 research funders, researchers,

1001 00:43:44.550 --> 00:43:46.530 and international organizations,

1002 00:43:46.530 --> 00:43:49.170 are looking to foster this kind of work.

1003 00:43:49.170 --> 00:43:50.410 Transdisciplinary research,

1004 00:43:50.410 --> 00:43:53.640 which is across the boundary between science and society.

1005 00:43:53.640 --> 00:43:55.870 That's the defining characteristic.

1006 00:43:55.870 --> 00:43:58.860 It involves non-stained stakeholders and co-design,

1007 00:43:58.860 --> 00:44:00.900 blending knowledge and creating new theory

1008 00:44:00.900 --> 00:44:02.313 in search of common goals.

1009 00:44:03.250 --> 00:44:06.060 It generally involves cycles of conceptualization,

1010 00:44:06.060 --> 00:44:08.250 implementation and evaluation.

1011 00:44:08.250 --> 00:44:09.700 It takes longer.

1012 00:44:09.700 --> 00:44:11.010 It's usually more difficult.

1013 00:44:11.010 --> 00:44:14.020 It's almost always more messy than traditional research,

1014 00:44:14.020 --> 00:44:17.900 but well-designed and this is where research can generate

1015 00:44:17.900 --> 00:44:20.240 scientific breakthroughs and local solutions

1016 00:44:20.240 --> 00:44:21.610 at the same time.

1017 00:44:21.610 --> 00:44:23.820 And that's something that's really important at this moment

1018 00:44:23.820 --> 00:44:26.403 when we have to act at the same time as we learn.

1019 00:44:27.500 --> 00:44:30.853 And just to give an example of transdisciplinary research,

1020 00:44:31.890 --> 00:44:33.050 through my program at Wellcome,

1021 00:44:33.050 --> 00:44:35.800 we fund a research partnership called RISE,

1022 00:44:35.800 --> 00:44:38.500 Revitalizing Informal Settlements and their Environments.

1023 00:44:38.500 --> 00:44:41.060 And this is a randomized control trial,

1024 00:44:41.060 --> 00:44:43.670 The complex, nature-based water and sanitation

1025 00:44:43.670 --> 00:44:46.415 and intervention in informal settlements

1026 00:44:46.415 --> 00:44:48.520 in Indonesia and Fiji.

1027 00:44:48.520 --> 00:44:50.770 The intervention itself has core features.

1028 00:44:50.770 --> 00:44:53.730 It's based on a nature-based approach to sanitation,

1029 00:44:53.730 --> 00:44:55.720 but ultimately an intervention is tailored

1030 00:44:55.720 --> 00:44:57.190 to each community.

1031 00:44:57.190 --> 00:44:59.940 Community stakeholders make the final design decisions.

1032 00:45:00.870 --> 00:45:02.597 RISE measures a wide range of health

1033 00:45:02.597 --> 00:45:04.223 and environmental outcomes,

1034 00:45:05.280 --> 00:45:07.570 and scientifically, its generated knowledge,

1035 00:45:07.570 --> 00:45:09.210 not only about the intervention,

1036 00:45:09.210 --> 00:45:10.500 but about community engagement,

1037 00:45:10.500 --> 00:45:13.100 and the capacity involving the informal settlements.

1038 00:45:14.810 --> 00:45:16.260 So for the study communities,

1039 00:45:16.260 --> 00:45:19.090 it's generated livelihoods, ownership and agency

1040 00:45:19.090 --> 00:45:21.780 beyond the benefits of the intervention.

1041 00:45:21.780 --> 00:45:24.490 And I think that we need much more of this type of research

1042 00:45:24.490 --> 00:45:26.650 to tackle the challenges of climate and health

1043 00:45:26.650 --> 00:45:27.763 in cities and beyond.

1044 00:45:28.870 --> 00:45:33.400 So that brings me to the end of my presentation.

1045 00:45:33.400 --> 00:45:35.500 I think that we're at a time when we need to harness

1046 00:45:35.500 --> 00:45:37.580 the brilliance and the exuberance of cities

1047 00:45:37.580 --> 00:45:40.130 to meet the needs of people in the planet.

1048 00:45:40.130 --> 00:45:42.170 And I think that systems thinking is critical

1049 00:45:42.170 --> 00:45:43.430 to that effort.

1050 00:45:43.430 --> 00:45:44.973 So thank you for listening.

1051 00:45:46.050 --> 00:45:47.623 I'm glad to take any questions.

1052 00:45:51.800 --> 00:45:52.980 <v ->Well, thank you, Jose.</v>

1053 00:45:52.980 --> 00:45:56.023 I could start with a question to get things started.

1054 00:45:58.100 --> 00:46:03.100 So you gave a number of examples of conceptual diagrams

1055 00:46:03.340 --> 00:46:08.000 of systems models that, you know, were hard,

1056 00:46:08.000 --> 00:46:12.280 obviously hard to digest deeply, you know,

1057 00:46:12.280 --> 00:46:15.763 given the timeframe, which, but my question is,

1058 00:46:16.660 --> 00:46:21.380 do you see a role for more quantitative systems models

1059 00:46:21.380 --> 00:46:22.803 in doing this kind of work?

1060 00:46:24.300 --> 00:46:26.240 <v ->Yeah, I absolutely do.</v>

1061 00:46:26.240 --> 00:46:28.990 And I, when I was talking about simulation modeling,

1062 00:46:28.990 --> 00:46:31.940 I was more talking about quantitative models.

1063 00:46:31.940 --> 00:46:34.680 I think that you do get into difficulties

1064 00:46:34.680 --> 00:46:37.620 when you try and get into that exact prediction.

1065 00:46:37.620 --> 00:46:40.130 We've seen, for example, with COVID-19,

1066 00:46:40.130 --> 00:46:42.560 how difficult it is to predict the exact behavior

1067 00:46:42.560 --> 00:46:43.520 of a system,

1068 00:46:43.520 --> 00:46:46.020 but we are actually quite good at predicting

1069 00:46:46.020 --> 00:46:47.540 the general shape.

1070 00:46:47.540 --> 00:46:50.450 So we may not be able to say that the people come now,

1071 00:46:50.450 --> 00:46:53.000 but we can say that there will be a peak.

1072 00:46:53.000 --> 00:46:57.500 So certainly, all sorts of climate and health questions

1073 00:46:57.500 --> 00:47:00.180 in cities and beyond are amenable

1074 00:47:00.180 --> 00:47:02.230 to that kind of quantitative model, yeah.

1075 00:47:04.410 --> 00:47:05.570 Rafael?

1076 00:47:05.570 --> 00:47:06.403 <v ->Yes.</v>

1077 00:47:06.403 --> 00:47:10.270 Thank you for a very insightful presentation, Jose.

1078 00:47:10.270 --> 00:47:13.376 And my question is about, first of all,

1079 00:47:13.376 --> 00:47:17.090 And my question is about, first of all,

1080 00:47:17.090 --> 00:47:19.750 realizing through your presentation

1081 00:47:19.750 --> 00:47:23.280 and the work that some of us are doing with food systems,

1082 00:47:23.280 --> 00:47:27.910 how it is important to not fear complexity,

1083 00:47:27.910 --> 00:47:29.840 that at the end of the day,

1084 00:47:29.840 --> 00:47:32.970 we have to deal with it

1085 00:47:32.970 --> 00:47:35.750 the way it is in reality on the one hand,

1086 00:47:35.750 --> 00:47:38.980 and we can come up with very wonderful

1087 00:47:38.980 --> 00:47:40.540 spaghetti-like diagrams,

1088 00:47:40.540 --> 00:47:43.060 like some of the ones you showed us to

1089 00:47:43.060 --> 00:47:47.330 all the innumerable factors and subsystems

1090 00:47:47.330 --> 00:47:48.763 that are interconnected,

1091 00:47:49.800 --> 00:47:52.240 explaining the problem that we have.

1092 00:47:52.240 --> 00:47:56.940 But then, I think for decision making, for policy making,

1093 00:47:56.940 --> 00:47:58.393 at the end of the day,

1094 00:47:59.564 --> 00:48:03.370 the secret sauce is in actually breaking down

1095 00:48:03.370 --> 00:48:06.100 those systems into subsystems,

1096 00:48:06.100 --> 00:48:09.070 that we can really understand in a reasonable way,

1097 00:48:09.070 --> 00:48:12.380 that we can really understand in a reasonable way,

1098 00:48:12.380 --> 00:48:16.810 and that we can actually come up with very specific policies

1099 00:48:16.810 --> 00:48:19.170 or interventions to address them

1100 00:48:19.170 --> 00:48:21.850 versus trying to do everything at the same time.

1101 00:48:21.850 --> 00:48:22.683 So,

1102 00:48:23.560 --> 00:48:24.592 what is your take with regards to not fearing complexity,

1103 00:48:24.592 --> 00:48:28.960 what is your take with regards to not fearing complexity,

1104 00:48:28.960 --> 00:48:33.960 but at the same time embracing simplicity to try to address

1105 00:48:34.280 --> 00:48:36.403 the humongous problems that we face?

1106 00:48:37.820 --> 00:48:38.840 <v ->Yeah.</v>

1107 00:48:38.840 --> 00:48:40.160 So first of all,

1108 00:48:40.160 --> 00:48:43.250 I think that you're right about spaghetti diagrams.

1109 00:48:43.250 --> 00:48:44.220 There's a diagram,

1110 00:48:44.220 --> 00:48:46.717 a famous diagram on obesity

1111 00:48:46.717 --> 00:48:48.460 and the factors that lead to obesity,

1112 00:48:48.460 --> 00:48:51.330 and called, I think the framework shift model,

1113 00:48:51.330 --> 00:48:55.180 which is so crazy that I decided I didn't want to show it.

1114 00:48:55.180 --> 00:48:59.140 And those sorts of diagrams actually,

1115 00:48:59.140 --> 00:49:01.040 I think can lead to paralysis.

1116 00:49:01.040 --> 00:49:03.020 So they're not useful in that sense,

1117 00:49:03.020 --> 00:49:05.960 but they are useful in constructing them

1118 00:49:05.960 --> 00:49:08.490 to think about the subsystems and to learn about the things

1119 00:49:08.490 --> 00:49:09.940 that were not, you know,

1120 00:49:09.940 --> 00:49:12.180 you didn't consider it to be related and actually are.

1121 00:49:12.180 --> 00:49:13.270 But I agree with you,

1122 00:49:13.270 --> 00:49:16.170 that pulling out the subsystems is really where you get more

1123 00:49:16.170 --> 00:49:18.850 interesting and applicable results.

1124 00:49:18.850 --> 00:49:20.710 I did some work with a colleague at ANU

1125 00:49:20.710 --> 00:49:24.040 that made the argument that low order systems models.

1126 00:49:24.040 --> 00:49:27.350 So five variables or less are really useful

1127 00:49:27.350 --> 00:49:29.580 for influencing policy makers if you can get them

1128 00:49:29.580 --> 00:49:30.930 to engage with the process.

1129 00:49:32.050 --> 00:49:34.920 I have another talk.

1130 00:49:34.920 --> 00:49:38.530 I remember where actually, I was at a meeting

1131 00:49:38.530 --> 00:49:40.150 and there was a policy maker speaking.

1132 00:49:40.150 --> 00:49:41.860 She had been, I think deputy director

1133 00:49:41.860 --> 00:49:44.420 of the city of Lens in France,

1134 00:49:44.420 --> 00:49:46.170 and someone asked her, you know,

1135 00:49:46.170 --> 00:49:47.970 how do you get policy makers to engage with

1136 00:49:47.970 --> 00:49:49.170 systems thinking?

1137 00:49:49.170 --> 00:49:51.430 And she said, don't ever use the word system.

1138 00:49:51.430 --> 00:49:54.970 Once you've used the word system, they've checked out.

1139 00:49:54.970 --> 00:49:58.900 So you do have to find ways to express these things in ways

1140 00:49:58.900 --> 00:50:00.850 that are more palatable and more understandable

1141 00:50:00.850 --> 00:50:02.870 for the audience.

1142 00:50:02.870 --> 00:50:04.190 But I think that that's part of the challenge.

1143 00:50:04.190 --> 00:50:06.410 And I don't think it's, I don't think,

1144 00:50:06.410 --> 00:50:07.890 I mean, I don't think it's daunting.

1145 00:50:07.890 --> 00:50:10.950 I think it's actually really exciting that there's this

1146 00:50:10.950 --> 00:50:14.140 whole area of space that maybe we haven't spent enough time

1147 00:50:14.140 --> 00:50:16.560 thinking about, but that we can,

1148 00:50:16.560 --> 00:50:18.970 especially sort of in mapping the government structures

1149 00:50:18.970 --> 00:50:20.280 and the barriers that come about

1150 00:50:20.280 --> 00:50:22.130 through the structure of governments.

1151 00:50:23.970 --> 00:50:24.803 <v ->Thank you.</v>

1152 00:50:36.465 --> 00:50:37.850 <v ->Are there any other questions?</v>

1153 00:50:37.850 --> 00:50:39.293 Feel free to speak up.

1154 00:50:40.210 --> 00:50:42.413 While you're thinking, I'll ask another question.

1155 00:50:44.060 --> 00:50:44.893 So,

1156 00:50:45.950 --> 00:50:47.810 I guess the question is,

1157 00:50:47.810 --> 00:50:52.570 what are the limitations of cities'

1158 00:50:52.570 --> 00:50:57.460 city-level policy in a context where you don't have a

1159 00:50:57.460 --> 00:51:01.520 coherent, you know, good national policy around

1160 00:51:01.520 --> 00:51:03.720 climate change or climate change and health?

1161 00:51:06.600 --> 00:51:07.540 <v ->That's a good question.</v>

1162 00:51:07.540 --> 00:51:09.560 I think that, well, for one thing,

1163 00:51:09.560 --> 00:51:11.143 it depends on the context.

1164 00:51:12.160 --> 00:51:14.620 There's some places where there will be more importance

1165 00:51:14.620 --> 00:51:18.210 to have coherence or not depending on the climatic factors,

1166 00:51:18.210 --> 00:51:19.610 depending on social factors.

1167 00:51:20.660 --> 00:51:24.430 I think that in general, cities are a good unit to use

1168 00:51:24.430 --> 00:51:27.890 because they can, you know,

1169 00:51:27.890 --> 00:51:30.080 they can take action at a large enough scale

1170 00:51:30.080 --> 00:51:33.210 to affect people, and they're close to people.

1171 00:51:33.210 --> 00:51:35.530 National policy makers often have less understanding

1172 00:51:35.530 --> 00:51:37.700 of the issues than city policy makers.

1173 00:51:37.700 --> 00:51:40.110 I think where you really do have to have coherence between

1174 00:51:40.110 --> 00:51:44.150 cities and countries is in finance,

1175 00:51:44.150 --> 00:51:46.600 because cities don't have the finance to be able to take

1176 00:51:46.600 --> 00:51:49.008 the kinds of actions that they need to take.

1177 00:51:49.008 --> 00:51:49.841 So for example,

1178 00:51:49.841 --> 00:51:52.500 there's a group called the Coalition for Urban Transitions,

1179 00:51:53.980 --> 00:51:56.490 which I believe is funded by Bloomberg.

1180 00:51:56.490 --> 00:51:59.540 It's sort of a partner to the C40 Cities program,

1181 00:51:59.540 --> 00:52:02.580 which advocates and provides evidence for governments

1182 00:52:02.580 --> 00:52:05.083 to fund climate action through cities.

1183 00:52:06.410 --> 00:52:07.460 But,

1184 00:52:07.460 --> 00:52:11.090 yeah, so in general, I think the cities are a good unit.

1185 00:52:11.090 --> 00:52:12.940 Obviously, it's much better if you can coordinate

1186 00:52:12.940 --> 00:52:15.030 city action with national action.

1187 00:52:15.030 --> 00:52:17.410 And that's something that we don't see enough of.

1188 00:52:17.410 --> 00:52:19.410 In the United States, you have huge disparities

1189 00:52:19.410 --> 00:52:22.300 between city climate action and national climate action,

1190 00:52:22.300 --> 00:52:24.523 but hopefully that's changing for the better.

1191 00:52:30.790 --> 00:52:34.890 So I see a question here. Why don't I read it out?

1192 00:52:34.890 --> 00:52:35.723 Based on your research,

1193 00:52:35.723 --> 00:52:38.870 do you see a potential role for environmental lawyers

1194 00:52:38.870 --> 00:52:41.150 in overcoming the silos you mentioned

1195 00:52:41.150 --> 00:52:43.420 and perhaps addressing the need for accountability

1196 00:52:43.420 --> 00:52:47.000 and meeting commitments pledged by national governments?

1197 00:52:47.000 --> 00:52:49.970 So, first of all, I see a role for everybody.

1198 00:52:49.970 --> 00:52:51.960 You know, we're having the silos that I mentioned,

1199 00:52:51.960 --> 00:52:55.903 so lawyers, architects, urban planners, engineers,

1200 00:52:57.600 --> 00:53:01.390 public policy makers, civil society, everybody has a role.

1201 00:53:01.390 --> 00:53:04.220 But specific to the role of law, that's actually,

1202 00:53:04.220 --> 00:53:05.710 that's something that we're thinking about

1203 00:53:05.710 --> 00:53:07.570 at Wellcome, right now,

1204 00:53:07.570 --> 00:53:10.220 because we're designing a whole new strategy

1205 00:53:10.220 --> 00:53:11.690 that includes climate and health

1206 00:53:11.690 --> 00:53:14.387 as one of the three fundamental areas that we'll fund

1207 00:53:14.387 --> 00:53:17.160 for the next several decades.

1208 00:53:17.160 --> 00:53:18.980 And one of the elements in there,

1209 00:53:18.980 --> 00:53:21.540 is how do we design funding for,

1210 00:53:21.540 --> 00:53:23.900 to produce the kind of research that lawyers

1211 00:53:23.900 --> 00:53:27.130 will be able to use in holding governments

1212 00:53:27.130 --> 00:53:28.630 and other players accountable.

1213 00:53:29.490 --> 00:53:32.290 So you'll have seen, or you may have seen that recently

1214 00:53:32.290 --> 00:53:35.210 there was a judgment in Holland against

1215 00:53:35.210 --> 00:53:38.050 the Shell oil company that said,

1216 00:53:38.050 --> 00:53:41.315 that basically, it was liable for not having a policy

1217 00:53:41.315 --> 00:53:43.530 that basically, it was liable for not having a policy

1218 00:53:43.530 --> 00:53:46.650 that did enough to curb emissions.

1219 00:53:46.650 --> 00:53:49.530 And we hope that we're gonna see many, many more judgments

1220 00:53:49.530 --> 00:53:50.363 like that.

1221 00:53:50.363 --> 00:53:52.120 Not just against the oil companies,

1222 00:53:52.120 --> 00:53:54.900 but really against all sorts of players

1223 00:53:54.900 --> 00:53:57.050 that are not taking appropriate climate action.

1224 00:53:57.050 --> 00:54:00.450 So I think the role of lawyers is actually quite critical

1225 00:54:00.450 --> 00:54:01.283 in all of this.

1226 00:54:12.720 --> 00:54:14.580 <v ->Okay. One last chance.</v>

1227 00:54:14.580 --> 00:54:15.673 Any other comments?

1228 00:54:16.800 --> 00:54:18.530 Feel free to either put it in the chat

1229 00:54:18.530 --> 00:54:19.883 or just speak right up.

1230 00:54:23.690 --> 00:54:25.320 Okay, well,

1231 00:54:25.320 --> 00:54:30.120 thank you very much, Jose, for a wonderful seminar,

1232 00:54:30.120 --> 00:54:32.100 it was very comprehensive and...

1233 00:54:35.070 --> 00:54:36.500 <v ->Thanks, Robert. It's great to be here.</v>

1234 00:54:36.500 --> 00:54:38.050 And if anyone has any questions,

1235 00:54:38.050 --> 00:54:40.483 I'm very glad to answer it so,

1236 00:54:42.271 --> 00:54:44.210 you know, just write me.

1237 00:54:44.210 --> 00:54:45.043 <v ->Okay.</v>

1238 00:54:45.043 --> 00:54:46.153 So, bye everyone.