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This transcript was generated from the Closed Captions of the program.

Open

[00:00:15] male narrator: THE OVER 37 MILLION PEOPLE
[00:00:17] IN CALIFORNIA ARE RUNNING OUT OF WATER,
[00:00:22] WATER THAT IS NEEDED FOR CITY SERVICES,
[00:00:28] WATER FOR DRINKING,
[00:00:31] WATER NEEDED FOR AGRICULTURE,
[00:00:35] NEEDED FOR GROWING ALL THOSE FRUITS AND VEGETABLES,
[00:00:41] NEEDED FOR THE VINEYARDS
[00:00:43] THAT PRODUCE CALIFORNIA'S WORLD-CLASS WINES.
[00:00:49] WHERE DOES THIS CRITICAL WATER COME FROM?
[00:00:54] SOME COMES FROM CALIFORNIA'S OWN SIERRA NEVADA MOUNTAINS
[00:01:00] AND SOME FROM THE ROCKY MOUNTAINS
[00:01:03] 1,000 MILES AWAY IN COLORADO.
[00:01:07] AND THE REASON CALIFORNIA IS RUNNING OUT OF WATER?
[00:01:12] CLIMATE CHANGE,
[00:01:14] OR AS IT IS SOMETIMES CALLED, GLOBAL WARMING.
[00:01:20] IN THE NEW WARMER CLIMATE,
[00:01:22] EACH YEAR, THERE IS LESS WATER STORED
[00:01:24] IN MOUNTAIN RESERVOIRS FOR USE BY CALIFORNIANS.
[00:01:29] >> THE CLIMATE CHANGE ISSUE HAS BEEN GETTING
[00:01:31] A LOT OF ATTENTION IN CALIFORNIA, AND, YOU KNOW,
[00:01:35] NOT TO SOUND SMUG, BUT I REALLY DO THINK
[00:01:36] CALIFORNIA IS LEADING THE WAY FOR THE REST OF THE COUNTRY
[00:01:39] TO REALLY ADDRESS THESE PROBLEMS.
[00:01:41] PART OF THE REASON FOR THAT IS NOT BECAUSE
[00:01:43] WE'RE NECESSARILY MORE PROGRESSIVE
[00:01:45] OR MORE ADVANCED OR SOMETHING.
[00:01:46] WE ARE AT THE FRONT OF THE LINE FOR THESE PROBLEMS.
[00:01:49] OUR SNOWPACKS ARE MORE VULNERABLE
[00:01:52] THAN MOST IN THE COUNTRY TO THESE KIND OF PROBLEMS.
[00:01:55] WE HAVE, YOU KNOW, ESTUARIES.
[00:01:56] WE HAVE A LOT OF COASTLINE,
[00:01:57] AND WE HAVE ESTUARIES THAT FACE SEA LEVEL RISE.
[00:01:59] SO IT'S NOT NECESSARILY THAT WE'RE, YOU KNOW,
[00:02:03] AHEAD OF EVERYONE ELSE IN ANY WAY
[00:02:04] EXCEPT THAT WE'RE EXPERIENCING THESE PROBLEMS FIRST.
[00:02:07] SO THIS IS A GOOD PLACE.
[00:02:09] THERE IS A LOT OF ATTENTION BEING PAID
[00:02:11] TO CLIMATE CHANGE AND CLIMATE SCIENCE
[00:02:12] HERE IN CALIFORNIA.
[00:02:14] narrator: IN THIS PROGRAM,
[00:02:17] WE WILL LOOK AT THE DIRECT IMPACT
[00:02:19] CLIMATE CHANGE IS HAVING ON CALIFORNIA'S WATER SUPPLY,
[00:02:24] THE IMPACT ON CALIFORNIA'S UNIQUE ECOSYSTEMS,
[00:02:27] SUCH AS THE REDWOOD FORESTS,
[00:02:31] AND THE IMPACT THAT RISING SEA LEVELS
[00:02:33] WILL HAVE ON ITS PORTS
[00:02:36] AND THE URBAN CENTERS OF SAN DIEGO,
[00:02:40] LOS ANGELES,
[00:02:43] AND SAN FRANCISCO.

This transcript was generated from the Closed Captions of the program.

Introduction to Climate Change

[00:03:04] IN THE 1980s, CLIMATE SCIENTISTS BEGAN NOTICING
[00:03:08] THAT THE WORLD WAS WARMING UP.
[00:03:12] WHAT WAS CAUSING THIS UNEXPECTED WARMING
[00:03:15] OF THE LOWER ATMOSPHERE WHERE WE LIVE?
[00:03:20] IT WAS US.
[00:03:23] IN THE 19TH CENTURY, PEOPLE IN EUROPE
[00:03:26] AND NORTH AMERICA FOUND NEW CHEAP SOURCES OF ENERGY:
[00:03:30] FIRST COAL
[00:03:33] AND THEN OIL.
[00:03:38] THESE CHEAP SOURCES OF ENERGY UNLEASHED THE INDUSTRIAL AGE,
[00:03:45] AND BY THE 21ST CENTURY, IT HAD CREATED A GLOBAL ECONOMY
[00:03:49] WITH 6.7 BILLION PEOPLE DEPENDENT ON CHEAP FOSSIL FUELS.
[00:03:56] COAL IS BURNED IN POWER PLANTS TO GENERATE ELECTRICITY,
[00:04:01] ELECTRICITY THAT LIGHTS UP THE WORLD,
[00:04:05] RUNS OUR FACTORIES,
[00:04:09] RUNS EVERYTHING IN OUR HOMES, FROM TVs
[00:04:14] TO OVENS
[00:04:17] TO COMPUTERS.
[00:04:21] OIL PUMPED FROM THE GROUND
[00:04:23] IS CONVERTED BY GIANT PROCESSING PLANTS
[00:04:26] TO MANY LIQUID FUELS THAT POWER OUR CARS,
[00:04:30] POWER OUR TRAINS AND PLANES,
[00:04:34] AND HEAT OUR HOMES.
[00:04:38] HOWEVER, SCIENTISTS RECENTLY DISCOVERED
[00:04:41] AN UNINTENDED CONSEQUENCE
[00:04:43] OF BURNING ALL THESE FOSSIL FUELS
[00:04:45] DURING THE 150 YEARS OF INDUSTRIALIZATION.
[00:04:50] WHEN WE BURN THOSE FOSSIL FUELS, ENERGY IS PRODUCED.
[00:04:56] BUT SO IS A GAS KNOWN AS CARBON DIOXIDE.
[00:05:02] CARBON DIOXIDE, ALSO CALLED CO2,
[00:05:05] IS A GREENHOUSE GAS,
[00:05:08] THE MOST ABUNDANT GREENHOUSE GAS IN THE TROPOSPHERE,
[00:05:12] THE LOWER LAYER OF OUR ATMOSPHERE.
[00:05:16] HERE, THE GREENHOUSE GASES PRODUCE
[00:05:19] WHAT IS CALLED THE GREENHOUSE EFFECT.
[00:05:24] IN GENERAL, THE MORE CO2 IN THE ATMOSPHERE,
[00:05:29] THE WARMER THE PLANET BECOMES.
[00:05:32] TODAY THAT ADDED CO2
[00:05:35] FROM BURNING ALL THOSE FOSSIL FUELS
[00:05:37] IS WARMING THE PLANET NEAR THE SURFACE
[00:05:40] AND WILL CONTINUE TO DO SO FOR MANY CENTURIES.
[00:05:45] WE KNOW NOW THAT THIS WARMING IS NOT THE SAME
[00:05:48] EVERYWHERE ON EARTH.
[00:05:51] SOME PLACES, LIKE CALIFORNIA,
[00:05:54] ARE HAVING LONGER AND MORE FREQUENT HEAT WAVES.
[00:05:59] ISOLATED GEOGRAPHICALLY
[00:06:01] AND POSSESSING A RARE MEDITERRANEAN CLIMATE,
[00:06:05] CALIFORNIA'S CLIMATE-CHANGE IMPACTS
[00:06:08] AND ADAPTATION STRATEGIES ARE UNIQUE AS WELL.
[00:06:12] >> THE INFORMATION FROM THIS TOWER
[00:06:14] WILL BE USED TO MONITOR FOR CHANGES
[00:06:16] DUE TO CLIMATE CHANGE.

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California's Terrestrial Ecosystems and Climate Change

[00:06:29] narrator: OF ALL THE CLIMATE TYPES
[00:06:30] IN THE WORLD, THE RAREST IS THE MEDITERRANEAN CLIMATE.
[00:06:35] THERE ARE ONLY FIVE REGIONS OF THE PLANET
[00:06:37] WHERE THE MEDITERRANEAN CLIMATE OCCURS.
[00:06:42] ONE OF THESE REGIONS COVERS MUCH OF CALIFORNIA.
[00:06:48] A "CLIMATE" IS DEFINED AS "LONG-TERM PATTERNS
[00:06:51] OF TEMPERATURE AND PRECIPITATION OVER THE FOUR SEASONS."
[00:06:57] ECOSYSTEMS, INTERCONNECTED WEBS OF PLANTS AND ANIMALS,
[00:07:02] ARE ADAPTED TO CLIMATES.
[00:07:05] FOR EXAMPLE,
[00:07:07] CALIFORNIA'S REDWOOD FORESTS ARE UNIQUELY ADAPTED
[00:07:10] TO ITS COASTAL MEDITERRANEAN CLIMATE,
[00:07:14] A CLIMATE THAT CAN BE DESCRIBED AS HOT AND DRY IN THE SUMMER,
[00:07:18] WITH VERY LITTLE RAINFALL, AND COOL AND WET IN THE WINTER.
[00:07:24] HOW HAS THIS CLIMATE CHANGED AS A RESULT OF GLOBAL WARMING?
[00:07:31] INTERESTINGLY, WEATHER RECORDS AND CLIMATE CHANGE MODELS
[00:07:35] SHOW A GRADUAL RISE IN TEMPERATURE
[00:07:37] WITH SMALL CHANGES IN OVERALL PRECIPITATION,
[00:07:40] BUT WITH WILD PRECIPITATION CHANGES
[00:07:43] FROM YEAR TO YEAR.
[00:07:45] >> THE TEMPERATURES HAVE GONE UP PERHAPS TWO DEGREES FAHRENHEIT
[00:07:49] OVER THE LAST 50 YEARS IN MOST PLACES IN THE WEST,
[00:07:51] NOT JUST CALIFORNIA, BUT MOST PLACES IN THE WEST.
[00:07:55] AND AS A RESULT OF THE EARLIER SNOWMELT,
[00:07:57] THE MAXIMUM SPRING FLOOD IN THE STREAMS
[00:07:59] COMES A LITTLE BIT EARLIER NOW,
[00:08:01] MAYBE A WEEK OR TWO WEEKS EARLIER THAN IT USED TO.
[00:08:04] >> YOU KNOW, CALIFORNIA IS SORT OF AT A BORDER
[00:08:08] BETWEEN THOSE NORTHERN AREAS
[00:08:10] THAT GET THE PACIFIC NORTHWEST STORMS ALL THE TIME
[00:08:13] AND MEXICO, WHICH GETS, YOU KNOW,
[00:08:15] KIND OF TROPICAL STORMS ALL THE TIME.
[00:08:17] WE'RE IN THAT BORDER AREA, AND SO WHAT YOU'LL SEE
[00:08:20] IS THAT AS THINGS CHANGE,
[00:08:22] THE BORDER AREA CHANGES NORTH AND SOUTH.
[00:08:24] SO CALIFORNIA IS PROBABLY GOING TO SEE MORE VARIETY
[00:08:28] IN ITS WEATHER THAN UP NORTH, WHERE WE CAN EXPECT
[00:08:32] THESE PACIFIC NORTHWEST STORMS TO CONTINUE TO COME,
[00:08:34] AND DOWN SOUTH, WHERE WE EXPECT, YOU KNOW,
[00:08:36] TROPICAL SITUATIONS TO COME.
[00:08:38] BUT WE'RE GOING TO SEE MORE VARIATION.
[00:08:39] SOME YEARS, WE'RE GONNA GET THE NORTHERN STORMS,
[00:08:41] WHERE WE'LL GET INTENSE COLD, LOTS OF RAIN.
[00:08:44] OTHER YEARS, WE'LL GET, YOU KNOW, WARMER STORMS.
[00:08:46] SO THE BIGGEST PREDICTION IS THAT WE WILL SEE WARMER CLIMATE,
[00:08:50] BUT WE WILL SEE MORE VARIATION.
[00:08:53] narrator: HOWEVER, EVEN IF CHANGES
[00:08:55] IN CALIFORNIA'S MEDITERRANEAN CLIMATE ARE SLIGHT,
[00:08:58] THESE SMALL CHANGES ARE PREDICTED
[00:09:01] TO HAVE DRAMATIC IMPACTS ON THE STATE'S UNIQUE,
[00:09:03] GEOGRAPHICALLY ISOLATED ECOSYSTEMS.
[00:09:08] THESE ARE CALLED POCKET ECOSYSTEMS,
[00:09:11] AND THEY ARE FOUND THROUGHOUT THE STATE.
[00:09:15] >> ONE OF THE BIG CONCERNS
[00:09:16] IS CHANGES IN RANGES AND DISTRIBUTIONS.
[00:09:19] WHEN YOU HAVE SUCH A SMALL AREA,
[00:09:21] LIKE A LOT OF THE MEDITERRANEAN CLIMATE TYPES ARE,
[00:09:23] THERE'S NOT A LOT OF DISTANCES THAT THOSE ANIMALS CAN MOVE TO

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[00:09:28] OR THAT PLANT SEEDS CAN BE DISTRIBUTED TO.
[00:09:29] THERE'S JUST NOT A LOT OF PLACES TO MOVE TO.
[00:09:32] YOU'RE NOT GOING TO BE ABLE TO MOVE 100 MILES NORTH.
[00:09:35] SO WE HAVE SOME BIG QUESTIONS
[00:09:36] ABOUT HOW CLIMATE CHANGE IS ULTIMATELY GONNA AFFECT
[00:09:40] MEDITERRANEAN CLIMATES.
[00:09:42] >> CLIMATE CHANGE IS STARTING TO AFFECT THOSE PLACES
[00:09:46] THAT ARE MORE SENSITIVE.
[00:09:47] WE ALSO HAVE A FEW SPECIES THAT YOU WOULD EXPECT TO FIND
[00:09:50] IN MORE MONTANE ENVIRONMENTS.
[00:09:53] WE HAVE PIKA AND MARMOTS,
[00:09:55] WHERE THEY CAN FIND SHADE AND SHELTER
[00:09:58] IN SOME OF THE HOLES IN THE ROCKS.
[00:10:01] SO AS THINGS HEAT UP,
[00:10:02] THEY ARE STARTING TO BE AFFECTED TOO,
[00:10:04] SO WE MAY SEE THOSE POPULATIONS NOT ABLE TO BE HERE ANYMORE,
[00:10:07] BECAUSE THERE IS NOWHERE ELSE TO GO.
[00:10:09] narrator: ONE OF THE MORE INTERESTING RESULTS
[00:10:11] OF GLOBAL WARMING
[00:10:12] IN CALIFORNIA'S MEDITERRANEAN CLIMATE
[00:10:14] IS TAKING PLACE IN THE REDWOOD FORESTS.
[00:10:18] >> YOU KNOW, THE REDWOOD TREES
[00:10:19] HAVE BEEN GROWING FASTER IN THE LAST COUPLE DECADES
[00:10:23] THAN THEY HAVE IN THEIR HISTORY.
[00:10:25] SOME PEOPLE THINK THAT IT'S BECAUSE
[00:10:26] THERE'S MORE CARBON DIOXIDE AVAILABLE
[00:10:28] AND PLANTS LIKE CARBON DIOXIDE.
[00:10:30] SOME PEOPLE THINK IT'S BECAUSE THE WARMER WEATHER
[00:10:33] HAS CAUSED US TO HAVE A LONGER GROWING SEASON AS WELL.
[00:10:36] IT HAS DEFINITELY GOTTEN WARMER.
[00:10:38] SO REDWOOD TREES, THE BIGGEST TREES IN THE WORLD,
[00:10:40] ARE GROWING FASTER THAN THEY EVER HAVE BEFORE.
[00:10:44] narrator: HOWEVER, IN THE KLAMATH
[00:10:46] AND SIERRA NEVADA MOUNTAINS,
[00:10:48] SOME OF THE SPECTACULAR
[00:10:49] AND UNIQUE POCKET FOREST ECOSYSTEMS,
[00:10:52] SUCH AS THIS COMBINATION OF CEDAR AND PINE,
[00:10:55] WILL PROBABLY DISAPPEAR
[00:10:57] AS THE CLIMATE CONTINUES TO WARM.
[00:11:01] THIS CONTINUAL WARMING IS NOT ONLY BEING FELT ON LAND,

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California's Oceanic Ecosystems and Climate Change

[00:11:06] BUT IT IS ALSO OCCURRING IN CALIFORNIA'S COASTAL WATERS.
[00:11:12] IT IS A WARMING THAT IS AFFECTING EVERYTHING
[00:11:14] FROM THE SMALLEST SHELLFISH
[00:11:17] TO CALIFORNIA'S LARGE POPULATIONS OF SEABIRDS.
[00:11:34] CALIFORNIA'S COASTAL WATERS,
[00:11:35] WHICH ARE GENERALLY NUTRIENT-RICH,
[00:11:37] COLD OCEANIC WATERS, ARE SLOWLY WARMING.
[00:11:43] INDEED, OCEANIC WATERS EVERYWHERE ON THE PLANET
[00:11:46] ARE WARMING.
[00:11:49] BUT CALIFORNIA'S COASTAL WATERS ARE ALSO SUBJECT
[00:11:52] TO TEMPERATURE CHANGES BROUGHT ABOUT
[00:11:55] BY SUCH PERIODIC OCEANIC PHENOMENA AS EL NINO.
[00:12:00] >> THE CHANGES IN THE OCEAN
[00:12:01] ARE A LITTLE HARDER TO SEE BECAUSE THE CHANGE THERE
[00:12:06] HAS BEEN A LITTLE SMALLER THAN IT HAS BEEN OVER LAND.
[00:12:09] BUT I THINK WE TEND TO SEE MORE OF WHAT WE CALL EXOTICS
[00:12:12] OR WARM-WATER FISHES UP HERE NOW
[00:12:14] THAN WE USED TO IN OLDEN TIMES:
[00:12:16] YELLOWFIN TUNA, DORADO, AND THOSE KINDS OF THINGS.
[00:12:20] >> THE OTHER THING WE SEE IS THAT THERE IS A GRADUAL WARMING
[00:12:22] OF THE OCEAN WATER, AND THAT'S BEEN HARD TO TRACK
[00:12:26] BECAUSE WE HAVE, YOU KNOW, THINGS LIKE EL NINO,
[00:12:28] WHICH ARE CYCLES THAT GO ON FOR THREE TO SEVEN YEARS.
[00:12:31] WE HAVE WHAT WE CALL THE PACIFIC DECADAL OSCILLATION,
[00:12:34] WHICH IS, YOU KNOW, TENS OF YEARS' OSCILLATIONS,
[00:12:37] PROBABLY AROUND 30 YEARS OR SOMETHING LIKE THAT,
[00:12:39] WHERE THEY GET WARM WATER AND THEN COOLER WATERS.
[00:12:42] AND THEN WE HAVE OTHER THINGS GO ON THAT ARE RELATED
[00:12:45] TO CLIMATE CHANGE,
[00:12:47] WHERE WE GET A LONG-TERM TREND OF WATER GETTING WARMER.
[00:12:52] WHEN THAT WATER GETS WARMER,
[00:12:53] WE SEE DIFFERENT SPECIES SHOWING UP HERE.
[00:12:55] ONE OF THE SPECIES THAT WAS VERY RARE
[00:12:59] PRIOR TO JUST RECENTLY WAS THIS BIG OLD HUMBOLDT SQUID.
[00:13:02] IT'S A SQUID THAT'S THIS BIG.
[00:13:04] AND THEN THE RISSO'S DOLPHINS THAT LIKE TO FEED ON THEM,
[00:13:07] WE SEE THEM WAY MORE OFTEN NOW
[00:13:09] THAN WE EVER DID, YOU KNOW, TEN YEARS AGO.
[00:13:11] IN 2005, 1/2 MILLION CASSIN'S AUKLETS
[00:13:15] ON THE FARALLON ISLANDS OFF SAN FRANCISCO,
[00:13:17] TO OUR KNOWLEDGE, NOT ONE OF THEM RAISED A CHICK.
[00:13:20] THAT'S A DRAMATIC EFFECT.
[00:13:23] AND THAT SAME YEAR, THE COMMON MURRES,
[00:13:27] GULLS, RHINOCEROS AUKLETS, OTHER SPECIES,
[00:13:29] THEY JUST HAD ALMOST A TOTAL COLLAPSE
[00:13:31] OF BREEDING SUCCESS THOSE YEARS.
[00:13:35] narrator: SO AS THE OCEANIC WATERS
[00:13:37] CONTINUE TO WARM,
[00:13:39] CALIFORNIA'S FISHERIES MIGHT COLLAPSE,
[00:13:43] COLLAPSE AS THE OCEANIC FOOD CHAIN
[00:13:45] ALONG THE COAST CHANGES.
[00:13:49] WHAT WILL HAPPEN TO CALIFORNIA'S OCEANIC
[00:13:52] AND INTERTIDAL ECOSYSTEM IS A GREAT UNKNOWN.
[00:13:57] WHAT IS NEEDED IS MORE RESEARCH
[00:14:01] AND BETTER CLIMATE IMPACT MODELS
[00:14:02] TO HELP FISHERIES MANAGERS PREPARE FOR THE CHANGES AHEAD.

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Sea Level Rise

[00:14:09] ANOTHER FACTOR THAT IS ALREADY HAVING AN EFFECT
[00:14:12] ON THOSE COASTAL ECOSYSTEMS IS SEA LEVEL RISE.
[00:14:18] SEA LEVEL RISE IS A DIRECT RESULT
[00:14:20] OF GLOBAL WARMING.
[00:14:34] CURRENTLY, TWO GREAT ICE SHEETS CONTAIN THE WORLD'S RESERVOIR
[00:14:38] OF FROZEN WATER.
[00:14:41] THE LARGEST COVERS THE CONTINENT OF ANTARCTICA
[00:14:45] AND IS IN THE SOUTHERN HEMISPHERE.
[00:14:49] THE OTHER RESTS ON THE ISLAND OF GREENLAND
[00:14:51] AND IS IN THE NORTHERN HEMISPHERE.
[00:14:55] RIGHT NOW, THESE GREAT ICE SHEETS
[00:14:58] ARE RAPIDLY MELTING, AND AS THEY DO,
[00:15:01] THEY DUMP FRESHWATER INTO THE OCEAN.
[00:15:06] THE RESULT IS SEA LEVEL RISES ACROSS THE PLANET.
[00:15:11] FOR A STATE LIKE CALIFORNIA, WITH 1,300 MILES OF COASTLINE,
[00:15:16] IMPACTS OF SEA LEVEL RISE WILL BE DANGEROUS,
[00:15:21] ESPECIALLY BECAUSE MOST OF ITS 37 MILLION PEOPLE
[00:15:25] LIVE ALONG ITS COASTLINE.
[00:15:29] ALREADY, THE SEA LEVEL RISE IS AFFECTING THE WETLANDS
[00:15:33] ALONG THE COAST.
[00:15:35] >> FROM HUMBOLDT BAY DOWN ALL THE WAY
[00:15:37] TO THE MEXICAN BORDER, YOU CAN DOCUMENT A GRADUAL
[00:15:40] AND SIGNIFICANT SEA LEVEL RISING.
[00:15:44] AND THAT IMPACTS A LOT OF OUR ESTUARIES AND BAYS
[00:15:47] WHERE WE'VE DEVELOPED ALL AROUND
[00:15:49] THE ESTUARIES AND BAYS.
[00:15:51] AND AS THE SEA LEVEL RISES EVEN AN INCH,
[00:15:53] IT CHANGES A LOT THE DISTRIBUTION
[00:15:56] OF THE SALT-MARSH KIND OF HABITATS.
[00:15:58] AND THE SALT MARSH HABITATS
[00:16:00] ARE CRADLES TO A LOT OF THE FOOD THAT WE EAT,
[00:16:04] A LOT OF THE SPECIES THAT WE USE COMMERCIALLY:
[00:16:07] FISH, CRUSTACEANS, YOU KNOW, LIKE CRABS,
[00:16:10] THINGS LIKE THAT.
[00:16:11] AND AS THAT AREA BETWEEN THE OCEAN
[00:16:16] AND THE EDGE OF DEVELOPMENT GETS NARROWER AND NARROWER,
[00:16:19] THERE'S LESS SPACE AVAILABLE
[00:16:21] FOR THOSE KIND OF ANIMALS TO LIVE.
[00:16:23] narrator: BUT THE GREATEST IMPACT OF SEA LEVEL RISE
[00:16:27] WILL BE ON THE COASTAL POPULATIONS
[00:16:29] AND INFRASTRUCTURES, SUCH AS SEAPORTS.
[00:16:34] IN THE SAN DIEGO AND LOS ANGELES BASIN AREAS,
[00:16:37] SEA LEVEL RISE IS PREDICTED TO HAVE DRAMATIC EFFECTS.
[00:16:42] >> BUT WE WILL SEE THE INFLUENCES
[00:16:44] ON THE OCEAN RISE, AND AS THE WATER GETS HIGHER.
[00:16:49] THERE HAVE BEEN MODELS DEVELOPED FOR THE BIG CITY AREAS
[00:16:52] ALONG THE CALIFORNIA COASTLINE, SAN DIEGO, AND LOS ANGELES,
[00:16:56] AND THEY SHOW WHAT'S GOING TO HAPPEN WHEN YOU HAVE
[00:16:58] A 3-INCH OR A 6-INCH OR A 1-FOOT RISE IN WATER.
[00:17:03] AND THE END RESULT IS THAT IT WILL INUNDATE A LOT
[00:17:06] OF PLACES WHERE PEOPLE CURRENTLY LIVE.
[00:17:09] AND SO THAT'S HOW IT'S GOING TO HAVE SUCH A DIRECT EFFECT.
[00:17:11] THERE ARE SO MANY PEOPLE
[00:17:13] THAT WANT TO LIVE RIGHT ALONG THE COAST,
[00:17:15] RIGHT ALONG THE OCEAN,
[00:17:16] BE ABLE TO WALK TO THE OCEAN AND TO SEE IT.
[00:17:19] A LOT OF THOSE HOUSES ARE GOING TO BE MORE AND MORE INFLUENCED
[00:17:22] BY THE STORMS.

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[00:17:23] YOU THINK ABOUT IF THE MODEL COMES TRUE
[00:17:25] THAT IT SHOWS THAT WE DO HAVE MORE INTENSE STORMS HAPPENING
[00:17:28] ON A MORE REGULAR BASIS,
[00:17:30] THAT'S THAT MANY MORE FREQUENTLY TIMES
[00:17:32] THAT WATER IS GOING TO GO UP OVER THE EDGES
[00:17:34] OF THE BEACHES,
[00:17:35] IS GOING TO GO FARTHER INLAND THAN IT DID BEFORE.
[00:17:38] SO I THINK WE'RE GOING TO SEE,
[00:17:39] AS THE WATER LEVELS CONTINUE TO CHANGE,
[00:17:43] AS THE OCEAN LEVELS GO UP,
[00:17:44] WE'RE GOING TO HAVE MORE AND MORE AREAS
[00:17:46] THAT ARE GOING TO BE UNINHABITABLE
[00:17:48] JUST BECAUSE THEY ARE SO INFLUENCED BY THE TIDES
[00:17:50] AND BY THE WATER.
[00:17:51] narrator: TO THE NORTH, IMPACTS WILL BE DIFFERENT.
[00:17:56] STORM SURGES IN SAN FRANCISCO BAY
[00:17:59] BROUGHT ABOUT BY PERFECT STORM FACTORS
[00:18:00] OF HIGH TIDES, POWERFUL STORMS, AND RISING SEA LEVELS
[00:18:06] PRESENT THE POSSIBILITY
[00:18:08] OF A HURRICANE KATRINA TYPE DISASTER,
[00:18:12] A DISASTER WITH MAJOR DESTRUCTION OF PROPERTY
[00:18:16] AND DANGER TO HUMAN LIFE IF THE BAY'S LEVIES FAIL.
[00:18:20] >> FOR THE FUTURE, PROJECTIONS ARE SHOWING AN ACCELERATION
[00:18:24] ON THE ORDER OF 50 TO AROUND 2 METERS PER CENTURY
[00:18:27] FROM THE LOW TO HIGH END.
[00:18:30] SO THAT CAN CAUSE A LOT OF PROBLEMS AROUND THE BAY.
[00:18:34] THERE'S A LOT OF-- AROUND SAN FRANCISCO BAY,
[00:18:36] THERE'S A LOT OF LOW-LYING AREAS,
[00:18:37] AND THOSE ARE EITHER GOING TO BE INUNDATED
[00:18:42] BY THESE HIGHER WATERS,
[00:18:43] OR THEY'RE GONNA HAVE TO BE LEVEED AND PROTECTED.
[00:18:45] SO--AND BUILDING LEVEES IS A VERY EXPENSIVE PROCESS,
[00:18:49] SO SOME DECISIONS ARE GOING TO HAVE TO BE MADE.
[00:18:52] THERE'S A LOT OF AREAS AROUND THE BAY
[00:18:54] THAT, IN THE '50s AND '60s, WERE FILLED.
[00:18:56] THE BAY WAS FILLED IN AND THEN PROTECTED BY LEVEES
[00:18:59] AND DEVELOPED.
[00:19:00] SO THERE ARE PEOPLE LIVING ON THESE AREAS,
[00:19:02] AND THOSE WOULD BE THE FIRST TO BE VULNERABLE,
[00:19:04] BECAUSE THEY ARE VERY LOW-LYING.
[00:19:06] SO, YOU KNOW, THIS IS A MULTIBILLION DOLLAR PROBLEM.
[00:19:10] narrator: BUT THE BIGGEST CHALLENGE
[00:19:12] CONFRONTING CALIFORNIANS BROUGHT ABOUT BY GLOBAL WARMING
[00:19:16] IS ITS DIMINISHING FRESHWATER SUPPLY.

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California's Fresh Water Problem

[00:19:31] CALIFORNIANS' NEED FOR FRESHWATER IS ENORMOUS.
[00:19:36] IN THE NORTH, INCREDIBLE AMOUNTS OF WATER ARE NEEDED
[00:19:40] TO IRRIGATE THE CROPS IN THE HUGE CENTRAL VALLEY,
[00:19:44] WHERE EVERYTHING FROM OLIVES
[00:19:47] TO FRESH FRUIT, SUCH AS STRAWBERRIES
[00:19:51] TO RICE IS GROWN.
[00:19:54] THE SALINAS VALLEY,
[00:19:56] WHERE MUCH OF THE NATION'S LETTUCE IS GROWN,
[00:19:58] DEPENDS TOTALLY ON IRRIGATION.
[00:20:03] AND THE WORLD-RENOWNED WINE-GROWING REGION
[00:20:05] NORTH OF SAN FRANCISCO ALSO DEPENDS ON IRRIGATION.
[00:20:11] IN ADDITION, ALL OF THE PEOPLE LIVING IN THE BAY AREA
[00:20:15] NEED FRESHWATER FOR DRINKING
[00:20:17] AND MUNICIPAL SERVICES FOR HOMES AND INDUSTRY.
[00:20:22] WHERE DOES ALL THIS WATER COME FROM?
[00:20:26] THE SNOWPACKS OF THE CASCADE MOUNTAINS
[00:20:30] AND, MOST IMPORTANTLY, THE SIERRA NEVADA MOUNTAINS
[00:20:33] TO THE EAST.
[00:20:36] THESE MOUNTAINS ACCUMULATE SNOW IN THE WET WINTER SEASON
[00:20:41] AND SLOWLY RELEASE WATER AS THE SNOW MELTS
[00:20:43] INTO THE SACRAMENTO AND SAN JOAQUIN RIVER SYSTEMS,
[00:20:48] TWO RIVER SYSTEMS THAT CONVERGE JUST EAST
[00:20:50] OF THE SAN FRANCISCO BAY AREA.
[00:20:55] ALONG THE COURSE OF THESE RIVERS ARE MANY RESERVOIRS
[00:20:59] WHERE WATER IS STORED TO BE RELEASED AND USED
[00:21:02] DURING CALIFORNIA'S LONG, DRY SUMMERS.
[00:21:07] AS WINTER SHRINKS AS A RESULT OF GLOBAL WARMING,
[00:21:10] SO DOES THE SNOWPACK.
[00:21:13] >> IN CALIFORNIA, OUR SNOWPACKS ARE VERY SENSITIVE
[00:21:15] TO SMALL CHANGES IN TEMPERATURE.
[00:21:17] AMONG SNOWPACKS IN THE WEST, THEY ARE SOME OF THE WARMEST.
[00:21:19] THAT IS, THEY'RE ONLY A LITTLE BELOW FREEZING ON AVERAGE.
[00:21:22] SO WHEN YOU HAVE EVEN A SMALL WARMING,
[00:21:24] IT ACTUALLY--IT RESULTS IN A LOSS OF A GOOD DEAL
[00:21:27] OF THAT SNOWPACK.
[00:21:29] FOR EXAMPLE, FOR ABOUT A 1 1/2 DEGREE CELSIUS WARMING,
[00:21:33] ON AVERAGE, OF THE AIR TEMPERATURE,
[00:21:35] YOU LOSE ABOUT 1/3
[00:21:37] OF THE TOTAL SNOWPACK IN CALIFORNIA,
[00:21:38] AND THAT'S A LOT OF WATER
[00:21:40] THAT'S INSTEAD OF RUNNING OFF LATER IN THE YEAR
[00:21:42] AS SNOWMELT RUNOFF,
[00:21:43] IT'S RUNNING OFF, YOU KNOW, PRIOR TO--
[00:21:45] DURING THE WET SEASON, DECEMBER THROUGH MARCH,
[00:21:47] AS RAINFALL RUNOFF.
[00:21:48] narrator: A PROBLEM THAT IS COMPOUNDED
[00:21:51] BY THE DRAMATIC YEAR-TO-YEAR FLUCTUATIONS
[00:21:53] OF PRECIPITATION
[00:21:54] AS THE GLOBAL CLIMATE MOVES TO A NEW BALANCE POINT.
[00:22:00] DAVE SCOTT OF THE NATIONAL PARK SERVICE
[00:22:03] HELPS RUN A SOPHISTICATED WEATHER STATION
[00:22:05] IN THE SIERRAS THAT MONITORS THE SNOWPACK.
[00:22:09] >> AND THERE IS EVIDENCE THAT THE SNOW LEVEL
[00:22:12] IS BECOMING HIGHER AND HIGHER IN ELEVATION,
[00:22:14] SO MORE OF THE PRECIPITATION IS FALLING AS RAIN,
[00:22:17] WHICH QUICKLY RUNS DOWNSLOPE INTO OUR RESERVOIRS
[00:22:20] AND TOWARDS THE OCEAN,
[00:22:21] AS OPPOSED TO WATER FALLING AS SNOW,

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[00:22:24] WHICH STICKS UP IN THE MOUNTAINS.
[00:22:26] THE MOUNTAINS ACT LIKE A FREEZER OR A REFRIGERATOR,
[00:22:29] STORING THAT WATER THROUGHOUT THE WINTER
[00:22:32] AND THEN MELTING IT OFF
[00:22:33] IN THE LATE SPRING, EARLY SUMMER,
[00:22:35] WHEN CALIFORNIA NEEDS THAT WATER THE MOST.
[00:22:37] narrator: THIS MEANS DEVELOPING NEW STRATEGIES
[00:22:40] FOR CONTROLLING THE WATER FLOW FROM THE MOUNTAINS
[00:22:43] TO THE CROPS AND PEOPLE DOWNSTREAM.
[00:22:46] >> APRIL 1ST IS TYPICALLY THE PEAK
[00:22:48] OF THE SNOWPACK ACCUMULATION,
[00:22:49] SO IT'S WHEN THE DEEPEST SNOWPACKS
[00:22:51] ARE UP IN THE MOUNTAIN.
[00:22:52] AND WATER IS MANAGED DIFFERENTLY DURING THOSE TWO PERIODS.
[00:22:56] PRIOR TO APRIL 1ST, THE FLOWS TEND TO BE REALLY PEAKY.
[00:22:59] THIS IS WHEN THE STORMS ARE.
[00:23:00] AND DURING THAT PERIOD, THE RESERVOIRS HAVE TO KEEP
[00:23:05] SOME FLOOD-CONTROL SPACE IN THEM.
[00:23:06] THEY HAVE TO KEEP SOME SPACE EMPTY
[00:23:08] TO CATCH THESE FLOODS AND PREVENT DOWNSTREAM FLOODING.
[00:23:11] SO THE WATER IS FLUSHED THROUGH MORE QUICKLY.
[00:23:13] IT'S NOT CAPTURED,
[00:23:14] BECAUSE THEY HAVE TO KEEP THIS SPACE IN THE RESERVOIR.
[00:23:16] AFTER APRIL 1ST, THE INFLOWS ARE MUCH SMOOTHER.
[00:23:19] IT'S SNOWMELT RUNOFF, AND THEY RELY ON THAT WATER
[00:23:21] TO RECHARGE THE RESERVOIRS AND PROVIDE THE WATER,
[00:23:25] ULTIMATELY, THAT WE USE LATER IN THE YEAR.
[00:23:27] narrator: THE OVERALL EFFECT IS LESS WATER
[00:23:30] FOR THE COMPETING NEEDS OF AGRICULTURE, PEOPLE,
[00:23:34] AND WILDLIFE.
[00:23:37] THE SAME COMPETITION IS EVEN MORE INTENSE TO THE SOUTH.
[00:23:41] HERE, THE LOS ANGELES URBAN CENTER GETS
[00:23:43] HALF OF ITS WATER FROM THE SIERRAS,
[00:23:47] TRANSPORTING IT THROUGH MAN-MADE CANALS.
[00:23:52] THE OTHER HALF OF ITS SUPPLY COMES FROM A CANAL
[00:23:55] THAT BRINGS WATER FROM THE COLORADO RIVER,
[00:23:59] A CANAL AND RIVER SYSTEM
[00:24:01] THAT ALSO SUPPLIES ALL OF SAN DIEGO WITH WATER.
[00:24:06] AT THE SAME TIME, AGRICULTURE IN THE IMPERIAL VALLEY,
[00:24:10] WHICH YIELDS TWO CROP CYCLES PER YEAR,
[00:24:13] DEPENDS EXCLUSIVELY ON OTHER CANALS
[00:24:15] THAT ALSO TAP INTO THE COLORADO RIVER.
[00:24:20] NOT ONLY IS CALIFORNIA TAKING WATER FROM THE COLORADO RIVER,
[00:24:23] BUT SO ARE THE UPSTREAM COMMUNITIES
[00:24:25] OF LAS VEGAS AND PHOENIX
[00:24:29] AND, DOWNSTREAM, THE COUNTRY OF MEXICO.
[00:24:35] THE PROBLEM HERE IS CRITICAL.
[00:24:38] THE RESERVOIRS ALONG THE COLORADO RIVER,
[00:24:40] SUCH AS THE WATER BEHIND THE GREAT HOOVER DAM,
[00:24:43] ARE RUNNING DRY.
[00:24:48] MORE WATER IS DRAWN OFF EVERY YEAR THAN IS REPLENISHED,
[00:24:54] AND THE REPLENISHMENT WILL ONLY DIMINISH
[00:24:56] AS THE SNOWPACK IN THE ROCKIES DECLINES
[00:24:59] AND THE DESERT AREAS THROUGH WHICH THE COLORADO FLOWS
[00:25:03] SHIFT TO A WARMER AND DRYER CLIMATE.
[00:25:06] >> CLIMATE HERE, IN TERMS OF DROUGHTS AND STORMS,
[00:25:10] HAS BEEN, I WOULD SAY, FAIRLY STABLE
[00:25:12] OVER THE LAST 50 YEARS,
[00:25:14] ALTHOUGH, AGAIN, THAT IS CHANGING ALSO,
[00:25:16] WITH DROUGHTS BECOMING A LITTLE MORE FREQUENT.

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[00:25:18] AND THE MODELS PREDICT THAT IN THE VERY NEAR TERM,
[00:25:22] THERE WILL BE LESS PRECIPITATION
[00:25:23] AND LESS RUNOFF,
[00:25:25] PARTICULARLY INTO THE COLORADO SYSTEM.
[00:25:26] SO THAT SYSTEM IS ALREADY OVERDRAFTED,
[00:25:30] AND IT DOESN'T LOOK GOOD FOR THE FUTURE THERE.
[00:25:32] narrator: THE PEOPLE OF CALIFORNIA
[00:25:34] WILL HAVE TO FIGURE OUT HOW TO DIVIDE UP LESS WATER
[00:25:37] AMONG ALL THESE COMPETING NEEDS
[00:25:40] OR TAKE DRASTIC MEASURES AFFECTING AGRICULTURE
[00:25:43] AND POPULATIONS,
[00:25:46] POPULATIONS THAT ARE ALSO THREATENED
[00:25:49] BY INCREASED FIRE HAZARDS.

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Fire

[00:26:03] FIRE FREQUENCY AND SIZE OF FIRES
[00:26:06] ARE EXPECTED TO INCREASE IN CALIFORNIA
[00:26:08] AS ITS CLIMATE WARMS.
[00:26:12] THERE ARE TWO REASONS FOR THESE INCREASES
[00:26:14] IN FIRE ACTIVITY.
[00:26:18] FIRST, ACROSS THE STATE, THE FIRE SEASON IS LENGTHENING
[00:26:22] AS WHAT HAD ONCE BEEN A WETTER WINTER SEASON
[00:26:25] GROWS SHORTER.
[00:26:28] THIS IS HAVING A TERRIBLE CONSEQUENCE
[00:26:30] FOR CALIFORNIA'S MANY MOUNTAIN ECOSYSTEMS,
[00:26:35] PRODUCING MORE INTENSE AND FASTER CROWN FIRES
[00:26:38] THAT ARE HARDER TO CONTAIN.
[00:26:42] THE SECOND CHANGE IN FIRE EVENTS IS OCCURRING
[00:26:44] IN CALIFORNIA'S SCRUB/CHAPARRAL ECOSYSTEMS,
[00:26:47] PARTICULARLY IN THE LOS ANGELES AND SAN DIEGO AREAS.
[00:26:54] THE PATTERN OF WET YEARS FOLLOWED BY DROUGHT YEARS
[00:26:57] PRODUCES TINDERBOX CONDITIONS DURING THE DRY YEARS.
[00:27:03] SMALL FIRES DRIVEN BY THE POWERFUL SANTA ANA WINDS
[00:27:08] LEAD TO EXPLOSIVE FIRE EVENTS.
[00:27:12] THANKFULLY, CALIFORNIA IS LEADING THE WAY

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The Future

[00:27:15] IN PLANNING FOR CLIMATE CHANGE,
[00:27:19] LOOKING FOR WAYS TO ADAPT TO THE NEW WORLD
[00:27:21] OF REDUCED FRESHWATER SUPPLIES,
[00:27:25] RISING SEA LEVELS,
[00:27:30] INCREASED FIRE EVENTS,
[00:27:34] AND CHANGING ECOSYSTEMS.
[00:27:51] CALIFORNIA IS SETTING THE STANDARD FOR DEALING
[00:27:54] WITH CLIMATE CHANGE IN THE NATION IN ANOTHER WAY.
[00:27:59] IT IS SETTING THE STANDARD
[00:28:01] FOR HOW TO REDUCE A STATE'S CARBON FOOTPRINT.
[00:28:05] IT'S PROMOTING THE IDEA OF CAP AND TRADE
[00:28:08] FOR CO2 EMISSIONS AND REDUCTIONS.
[00:28:12] IT HAS ENACTED LAWS FORCING CARMAKERS
[00:28:15] TO MAKE MORE FUEL-EFFICIENT CARS,
[00:28:21] AND IT IS QUICKLY BUILDING WIND FARMS
[00:28:26] AS WELL AS SOLAR FARMS
[00:28:28] IN ORDER TO REDUCE ITS DEPENDENCE
[00:28:30] ON COAL-FIRED POWER PLANTS TO GENERATE ELECTRICITY.
[00:28:35] MOST EXPERTS ARE OPTIMISTIC.
[00:28:39] >> THE FUTURE OF THE UNITED STATES
[00:28:40] IS REALLY GOING TO DEPEND A LOT ON HOW WELL--
[00:28:44] YOU KNOW, WHAT ROLE WE PLAY IN THE DEVELOPMENT
[00:28:47] OF THIS NEW TECHNOLOGY AND THE IMPLEMENTATION OF IT.
[00:28:50] WELL, I'M ALWAYS OPTIMISTIC.
[00:28:52] I THINK THAT HUMANS CAN ADAPT.
[00:28:53] WE'RE ADAPTABLE.
[00:28:55] WE'VE DONE A PRETTY GOOD JOB OF IT.
[00:28:56] AND I'VE GOT KIDS, AND THOSE KIDS ARE SMART,
[00:28:58] AND THEY'RE DOING NEAT THINGS, YOU KNOW.
[00:28:59] AS LONG AS WE HAVE KIDS THAT ARE SMART
[00:29:01] AND ARE DOING NEAT THINGS, YOU KNOW, WE'VE GOT A FUTURE.

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