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Narrator: ESTIMATES ON THE TOTAL NUMBER OF DIFFERENT LIVING ORGANISMS THAT INHABIT OUR PLANET RANGE FROM 8 MILLION TO 60 MILLION OR MORE. OF THESE, ONLY ABOUT 2 MILLION HAVE BEEN DESCRIBED SCIENTIFICALLY. THERE ARE A LOT YET TO BE DISCOVERED. MANY OF THESE DISCOVERIES COULD BE MADE IN TROPICAL RAINFORESTS, WHERE IT IS THOUGHT THAT OVER HALF OF THE WORLD'S SPECIES EXIST. BUT WE ARE LOSING THESE BASTIONS OF BIODIVERSITY BEFORE WE EVEN KNOW WHAT'S IN THEM. AND TROPICAL BIOLOGIST BILL LAURANCE IS LEARNING WHAT IMPACT EVEN A SMALL ROAD CAN HAVE ON THEIR VIABILITY. A LOT OF TREE MORTALITY, A LOT OF DEATHS.

Narrator: IN THE OCEANS, TOO
SMALL CHANGES IN A FRAGILE
CORAL REEF ECOSYSTEM
CAN HAVE LASTING EFFECTS.
ECOLOGIST JEREMY JACKSON IS
FINDING
HUMAN IMPACT ON THE WORLD'S
OCEANS
COULD BE SETTING THEM ON A
PATH OF DRASTIC CHANGE
THAT HE CALLS THE RISE OF
SLIME.

Dr. Jackson: IF THE WORLD
BECOMES A WORLD OF SLIME
THEN THERE'S NOT MUCH ROOM
FOR PEOPLE.

Narrator: THESE STUDIES --
ONE ON LAND, THE OTHER IN
WATER --
ARE SHOWING JUST HOW
DELICATE ECOSYSTEMS ARE
AND WHAT AN IMPORTANT ROLE
BIODIVERSITY PLAYS
IN THEIR ABILITY TO ENDURE.

JUST OVER 15 MILES FROM THE
HEART OF PANAMA CITY
AND STEPS AWAY FROM THE
PANAMA CANAL
LIES SOBERANIA NATIONAL PARK
A 55,000-ACRE RAINFOREST

THAT IS JUST ONE OF THE MANY
RAINFORESTS AROUND THE
WORLD

BEING STUDIED BY TROPICAL
BIOLOGIST BILL LAURANCE.

Dr. Bill Laurance: THE FOCUS OF
OUR RESEARCH IS, ESSENTIALLY
HOW DO HUMANS AFFECT
TROPICAL RAINFORESTS?

ABOUT 40 MILLION ACRES OF
TROPICAL FOREST
ARE BEING DESTROYED EVERY
YEAR.

THAT'S ABOUT 80 FOOTBALL
FIELDS A MINUTE

AND AS A CONSEQUENCE, WE ARE
SEEING VAST LANDSCAPES
BEING DENUDED OF FORESTS.

WE ARE ALSO SEEING THE
ORIGINAL RAINFOREST
BEING CHOPPED UP INTO
ISOLATED ISLANDS OR PARCELS.

AND THIS MIGHT SEEM
LIKE AN IRONIC PLACE TO TALK
ABOUT IT HERE

BECAUSE IT SEEMS LIKE SUCH A
BEAUTIFUL AREA.

WE ARE IN THE HEART OF
PANAMA IN SOBERANIA NATIONAL
PARK

BUT THIS IS PROBABLY THE
FUTURE OF MUCH OF TROPICAL

BIOLOGY

BECAUSE ALTHOUGH IT SEEMS
LIKE A LARGE AREA OF
RAINFOREST

OVER HERE WE HAVE
BULLDOZERS KNOCKING DOWN
THE FOREST.

OVER IN THIS DIRECTION WE
HAVE SLASH-AND-BURN FARMING
GOING ON.

WE HAVE HUNTERS
ENCROACHING FROM ALL SIDES
OF THE FOREST
HAVING MAJOR IMPACTS ON THE
WILDLIFE COMMUNITIES.

THIS IS AN ISLAND OF FOREST,
AND IT'S SHRINKING OVER TIME.

AND SO REALLY THIS IS THE
HEART OF THE QUESTION
WE ARE TRYING TO GET OUT
HERE.

ARE THESE GOING TO BE ISLANDS
OF SURVIVAL

OR ISLANDS OF EXTINCTION?

YES, YOU'RE VERY CUTE.

Narrator: FOR LAURANCE, THE
IMPORTANCE OF THE
RAINFOREST

AROSE FROM A LIFELONG LOVE
OF ANIMALS.

VERY PRETTY LITTLE BIRD.

Dr. Bill Laurance: I WAS ONE OF

THOSE KIDSTHAT JUST LOVED
ANIMALS.
AND I RAISED MOUNTAIN LIONS
AND BEAR CUBS
AND I WAS A FALCONER.
I HAD BIRDS OF PREY AND OWLS
AND FERRETS AND FLYING
SQUIRRELS --
JUST A WHOLE MENAGERIE
THAT MY LONG-SUFFERING
PARENTS PUT UP WITH.
I STARTED WORKING IN ZOOS IN
THE UNITED STATES.
AND EVENTUALLY I JUST BECAME
CONVINCED
THAT IT'S THE PROTECTION OF
THE NATURAL HOMES
THE ECOSYSTEMS, THAT'S
REALLY CRITICAL.
SO AT THAT TIME I DECIDED THAT
I WANTED TO WORK
ON CONSERVATION OF NATURAL
ECOSYSTEMS.
[SPEAKING FOREIGN LANGUAGE]
Narrator: THAT DESIRE HAS TAKEN
LAURANCE ALL OVER THE WORLD.
FOR OVER 25 YEARS
HE HAS BEEN STUDYING
RAINFORESTS
IN AFRICA, AUSTRALIA, BRAZIL
AND AT THE SMITHSONIAN
TROPICAL RESEARCH INSTITUTE

IN PANAMA.

Dr. Bill Laurance: WE DO SOME
WORK HERE IN PANAMA
BUT THE AMAZON AND CENTRAL
AFRICA WHERE WE WORK
ARE JUST SUCH HOT SPOTS OF
FOREST DESTRUCTION.

IN THE AMAZON, THERE IS
INCREDIBLE FOREST
DESTRUCTION

FOR CATTLE RANCHING.

THERE'S A HUGE EXPLOSION IN
SOY BEAN FARMING.

THERE'S MASSIVE LOGGING
OPERATIONS.

THERE'S AN AVALANCHE OF NEW
HIGHWAYS AND ROADS

AND OTHER KINDS OF PROJECTS
WHICH ARE CREATING A LOT OF
PROBLEMS FOR THE FOREST.

WE FOCUS ON THOSE AREAS
BECAUSE THEY'RE THE MOST
IMPORTANT

FROM A CONSERVATION
PERSPECTIVE.

Narrator: OFTEN CALLED THE
LUNGS OF THE PLANET

THE WORLD'S RAINFORESTS HAVE
GONE

FROM COVERING 14% OF THE
EARTH'S LAND SURFACE

TO 6% OVER THE LAST 50 YEARS.

IN ADDITION TO PROVIDING US
WITH OVER 20% OF THE OXYGEN
WE BREATHE
THESE FORESTS ARE THE MOST
BIOLOGICALLY DIVERSE HABITATS
ON THE PLANET
HOME TO OVER HALF OF THE
WORLD'S ESTIMATED 60 MILLION
SPECIES
OF PLANTS, ANIMALS, AND
INSECTS.

Dr. Bill Laurance: ONE OF THE
REALLY EXCITING THINGS
ABOUT WORKING IN TROPICAL
RAINFORESTS
IS THEY'RE JUST SUCH A
MYSTERY
AND THERE'S JUST SO MUCH WE
DON'T KNOW ABOUT WHAT'S HERE
EVEN JUST IN TERMS OF
CATALOGING THE NUMBER OF
SPECIES HERE.
RIGHT NOW WE THINK THERE ARE
SOMEWHERE BETWEEN
MAYBE 5 MILLION AND 50 MILLION
SPECIES
LIVING IN THE TROPICAL
RAINFORESTS OF THE WORLD.
WE ARE TALKING ABOUT THAT
ROUGH OF RECKONING HERE.
AND ONE OF THE REASONS
THAT WE HAVE SUCH A VAGUE

IDEA OF WHAT'S HERE
IS THE RAINFOREST CANOPY.
STUDIES THAT HAVE BEEN DONE
IN TRAPPING INSECTS IN THE
CANOPY
HAVE FOUND IN MANY CASES
THAT 80% OR 90% OF THE
SPECIES
THAT THEY ARE FINDING UP HERE
ARE NEW TO SCIENCE
HAVE NEVER BEFORE BEEN
DOCUMENTED.
AND IF WE EXTRAPOLATE FROM
WHAT WE ARE FINDING HERE
THROUGHOUT THE TROPICAL
WORLD
WE ARE GETTING NUMBERS LIKE
50 MILLION
WHICH IS JUST AN
EXTRAORDINARY NUMBER.
SO THIS IS ONE OF THE LAST
GREAT BIOLOGICAL FRONTIERS
IS THE RAINFOREST CANOPY.
Narrator: AND THE HEART AND
SOUL OF THESE FORESTS ARE
THE TREES.
Dr. Bill Laurance: TREES ARE THE
FOUNDATION OF THE FOREST.
THEY FORM THE ARCHITECTURE
OF THE FOREST.
THEY DETERMINEITS
MICRO-CLIMATE.

THEY ARE THE FOOD SOURCES OF MOST THINGS OUT THERE. SO IF YOU CHANGE THE TREE COMMUNITIES YOU ARE REALLY CHANGING THE ECOLOGY AND THE HABITAT FOR JUST ABOUT EVERYTHING ELSE.

Narrator: ONE WAY THAT RAINFOREST TREE COMMUNITIES HAVE BEEN CHANGED IS THROUGH OUTRIGHT DESTRUCTION OR HABITAT LOSS. THIS DESTRUCTION HAS BROKEN LARGE RAINFORESTS UP INTO MANY SMALLER HABITAT FRAGMENTS.

LAURANCE IS STUDYING THE EFFECTS OF THIS FOREST FRAGMENTATION.

Dr. Bill Laurance: FRAGMENTATION IN FOREST EDGES AFFECT THE RAINFOREST IN ALL KINDS OF WAYS.

THE RAINFOREST, UNDER ITS NORMAL CONDITIONS IS A HUMID AND DARK AND WINDLESS KIND OF ENVIRONMENT.

IT'S BEEN SURVIVING, EXISTING FOR MILLIONS OF YEARS. AND SO MANY, MANY SPECIES

HAVE BECOME SPECIALIZED
FOR THESE VERY UNIQUE
MICRO-CLIMATIC CONDITIONS.
AND THEN YOU JUXTAPOSE THAT
WITH A HARSH, DRY, WINDY
CATTLE PASTURE
AND SO THE CONDITIONS ARE
JUST COMPLETELY DIFFERENT.
Narrator: AT THE FOREST EDGE
WHERE THESE TWO DIFFERENT
ENVIRONMENTS MEET
COMMON PLANT SPECIES THAT
ARE WELL ADAPTED
TO THE SUNNY AND DRY
CONDITIONS
START TO TAKE OVER
AFFECTING THE OVERALL
DIVERSITY AND STRUCTURE OF
THE FOREST.

Dr. Sue Laurance: ONE OF THE
IMPORTANT MECHANISMS
THAT'S PUSHING THE CHANGE IN
STRUCTURE ARE THESE VINES.
WHAT THE VINES DO --
THEY START TO SMOTHER TREES
UP NEAR THE EDGE
AND ACTUALLY THEY CAN KILL
THESE TREES.
AND THE THING THAT WE ARE
MOST CONCERNED ABOUT
WITH FRAGMENTATION
AND THESE SORTS OF

STRUCTURAL CHANGES IN THE
EDGES

IS THAT THE EDGES START TO
ENCROACH
INTO THE FRAGMENT ITSELF
AND THE FRAGMENT STARTS TO
SHRINK IN AREA.

Dr. Bill Laurance: WHENEVER YOU
HAVE AN ENVIRONMENTAL
CHANGE

THERE'S WINNERS AND LOSERS.
SO THE VINES AND OTHER THINGS
THAT LIKE DISTURBANCE
ARE DOING GREAT.

WHAT WE ARE SEEING REALLY
DECLINING DRAMATICALLY
ARE THE OLD-GROWTH
RAINFOREST-INTERIOR
SPECIALISTS.

THEIR GEOGRAPHIC RANGES ARE
COLLAPSING

THEY ARE BECOMING MUCH LESS
ABUNDANT

AND THEY ARE BECOMING MUCH
MORE VULNERABLE TO
EXTINCTION.

THESE ARE THE THINGS THAT WE
ARE REALLY WORRIED ABOUT.

Narrator: AS YOU WALK IN FROM
THE EDGE OF THE FOREST
THE DIFFERENCE IN THE
ENVIRONMENT BECOMES

OBVIOUS.

Dr. Sue Laurance: IT'S A LOT DARKER IN HERE.

WE ARE A COUPLE HUNDRED YARDS FROM THE FOREST EDGE NOW

AND YOU CAN SEE JUST WHAT A DRAMATIC CHANGE IT'S BEEN -- A LOT COOLER, A LOT DARKER.

YOU GOT THESE BIG FOREST PALM TREES

AND THE FOREST UNDERSTORY IS JUST GENERALLY A LOT SPARSER NOW.

WE DON'T HAVE THAT PROFUSION OF VINES

AND WE HAVE GOT A LOT OF THESE SHADE-LOVING PLANTS WHICH CAN'T SURVIVE ON THE HARSH FOREST EDGE.

WE CALL THIS ENVIRONMENT IN HERE

THE CORE OF THE HABITAT FRAGMENT.

AND WE ARE VERY CONCERNED ABOUT HOW MUCH AREA OF CORE HABITAT DO WE HAVE?

AND WHAT WE ARE REALLY SAYING

IS HOW MUCH AREA OF PRISTINE RAINFOREST

IS LEFT WITHIN A FOREST

FRAGMENT?

AND THIS IS VERY IMPORTANT
TO TELL WHAT SPECIES ARE
GOING TO SURVIVE IN FOREST
FRAGMENTS.

IS THE CORE HABITAT BIG
ENOUGH

TO HAVE MORE THAN ONE
INDIVIDUAL OF THIS PALM
SPECIES?

BECAUSE SOME OF THESE
SPECIES CAN BE VERY RARE --
THERE COULD ONLY BE ONE PER
ACRE.

SO DO YOU NEED TO HAVE 50
ACRES TO HAVE 50 INDIVIDUALS?
AND WILL THAT BE ENOUGH FOR
THAT POPULATION TO SURVIVE
FOR A COUPLE HUNDRED YEARS?

Narrator: TO DISCOVER EXACTLY
WHAT THE EFFECTS OF
FRAGMENTATION ARE
ON THE RARE OLD-GROWTH TREE
SPECIES IN THE AMAZON FOREST
THE RESEARCH TEAM COMPARES
PLOTS ALONG FOREST FRAGMENT
EDGES

TO PLOTS WITHIN PRISTINE
FOREST AREAS.

Dr. Bill Laurance: WE HAVE BEEN
STUDYING ABOUT 65,000 TREES
FOR THE LAST 27 YEARS.

AND OVERALL THAT'S ABOUT 1,300
DIFFERENT SPECIES OF TREES.
THAT, JUST TO PUT IT INTO
PERSPECTIVE
IS ABOUT TWICE AS MANY
SPECIES
AS OCCUR IN ALL OF NORTH
AMERICA.

Narrator: BY IDENTIFYING THE
SPECIES
AND MEASURING THE DIAMETER
OF THE TREE
THE TEAM CAN CALCULATE ITS
BIOMASS.

ONCE THIS IS DONE TO ALL THE
TREES
THEN THE TOTAL BIOMASS OF THE
PLOT CAN BE DETERMINED.

Dr. Bill Laurance: IT'S AN
ENORMOUS CHALLENGE.
IT REALLY IS ONE OF THE GREAT
CHALLENGES
IS TRYING TO DOCUMENT WHAT IS
SIMPLY OUT THERE.

AND IT'S TOUGH.
I MEAN, THERE'S NO SIMPLE,
MAGICAL ANSWER FOR THAT.
IT TAKES MUDDY-KNEED FOREST
BIOLOGISTS
TO GO OUT THERE WITH THEIR
VARIOUS TECHNIQUES
AND TRY TO COUNT AND

CAPTURE THINGS.
AND IT'S A VERY SLOW,
PAINSTAKING PROCESS.
WE HAVE TEAMS OF FIELD
TECHNICIANS
THAT GO OUT AND ACTUALLY
CLIMB THE TREES.
AND THEY COLLECT FLOWERS
AND LEAVES
THAT USE TO HELP IDENTIFY THE
SPECIES.
WE MEASURE THE TREES.
WE STUDY HOW FAST THEY ARE
DYING
WHICH NEW SPECIES OF TREES
ARE COMING INTO OUR PLOTS.

Narrator: THE RESEARCHERS
FOUND
THAT PLOTS WITHIN 100 METERS
OF THE FOREST'S EDGE
LOST UP TO 36% OF THEIR
BIOMASS OF OLD-GROWTH TREE
SPECIES
WITHIN THE FIRST 10 TO 17 YEARS
OF FRAGMENTATION.
PLOTS PAST 100 METERS
EXHIBITED NO SIGNIFICANT
CHANGES IN BIOMASS
OVER THAT SAME TIME PERIOD.
Dr. Bill Laurance: OUR
FRAGMENTATION STUDY OF THE

AMAZON IS A LONG-TERM STUDY
BECAUSE THINGS TAKE TIME TO
CHANGE.
THEY DON'T INSTANTLY
DISAPPEAR.
MANY OF THE TREES WOULD
NORMALLY LIVE
BETWEEN 400 YEARS AND MAYBE
1,500 YEARS.
AND WHAT PERHAPS IS MOST
STUNNING
IS THAT WE ARE SEEING THE
MORTALITY RATES
ARE JUST GOING THROUGH THE
CEILING
AS A CONSEQUENCE OF THESE
EDGE EFFECTS
AND THESE ENVIRONMENTAL
CHANGES THAT WE ARE SEEING
ASSOCIATED
WITH FOREST FRAGMENTATION.
SO IT'S OBVIOUS THAT THE
ECOLOGY OF THE RAINFOREST
IS JUST BEING ALTERED IN SUCH
A PROFOUND WAY
BY FOREST FRAGMENTATION.
Narrator: AND IT'S NOT JUST THE
TREES THAT ARE AFFECTED
BUT ALSO THE WILDLIFE.
SUE LAURANCE STUDIES THE
IMPACT OF FRAGMENTATION
ON BIRD SPECIES.

Dr. Sue Laurance: BIRDS ARE VERY INTERESTING TO STUDY THE EFFECTS OF FRAGMENTATION -- PARTICULARLY JUST THE EFFECTS OF ROADS BECAUSE THEY ARE HIGHLY MOBILE. THEY CAN FLY. SO A SMALL ROAD OF 50 YARDS OR A SMALL CLEARING REALLY SHOULDN'T INHIBIT AN ANIMAL THAT CAN FLY MUCH GREATER DISTANCES INSIDE THE FOREST. SO I CAUGHT BIRDS AND PUT LITTLE RADIO RECEIVERS ON THEM AND MOVED THEM ACROSS THESE GAPS TO SEE IF THEY CAN RETURN TO WHAT WAS THEIR HOME RANGE OF THEIR TERRITORY. AND THEY KNOW WHERE THEIR HOME RANGE IS BECAUSE I GENERALLY MOVE THE MALE. AND THE FEMALE WILL BE THERE CALLING AND THE MALE'S RETURNING THE CALL. SO THEY KNOW WHERE HOME IS.

BUT THEY ARE JUST NOT
CHOOSING TO CROSS THE ROAD
AT ALL.

AND THAT'S A REAL CONCERN
WHEN YOU CAN SEE
THAT SOME OF THE CLEARING
PATTERNS

THAT WE HAVE SEEN IN THE
AMAZON

WHERE THEY HAVE JUST GOT
LONG ROADS

COULD STILL LEAVE 70% OF THE
FOREST INTACT

BUT POPULATIONS COULD STILL
BE DIVIDED

BY A VERY SMALL CLEARING.

Dr. Bill Laurance: THE ROADS ARE
IN SOME SENSE

ACTING AS A SORT OF A
PANDORA'S BOX.

IT'S OFTENTIMES THE FIRST STEP
IN THIS CASCADE OF
UNCONTROLLED ACTIVITIES.

IN THE AMAZON, FOR EXAMPLE
WE SEE ROADS PENETRATING
INTO THE RAINFOREST.

THE GOVERNMENT IS PUTTING IN
MANY NEW ROADS.

AND THEN OFTENTIMES YOU GET
SLASH-AND-BURN FARMERS
AND CATTLE RANCHERS AND
LOGGERS COMING IN

WHEN THE ROADS ARE THERE.
YOU GET LAND SPECULATION.
YOU GET A VERY DESTRUCTIVE
PROCESS

WHICH OFTEN TIMES LEADS
TO JUST LARGE-SCALE,
WHOLESALE FOREST
DESTRUCTION.

Narrator: BY PROVIDING
CONCRETE EXAMPLES
LIKE HOW A SMALL ROAD CAN
DISRUPT

THE STABILITY OF THE
RAINFOREST

LAURANCE'S RESEARCH IS
SHOWING JUST HOW VULNERABLE
THIS VERY FRAGILE, DIVERSE,
AND UTTERLY UNIQUE
ENVIRONMENT

REALLY IS TO CHANGE.

Dr. Bill Laurance: BUT I THINK WE
HAVE TO BE VERY VIGILANT.
IT'S ABSOLUTELY ESSENTIAL TO
UNDERSTAND

FOR THE FATE OF TROPICAL
BIODIVERSITY

WHAT SPECIES ARE GONNA BE
ABLE TO PERSIST

AND WHICH ONES ARE NOT GOING
TO BE ABLE TO SURVIVE
IN THESE FRAGMENTS OF
FOREST.

Narrator: CORAL REEFS HAVE BEEN CALLED THE RAINFORESTS OF THE SEA. AND LIKE THE RAINFORESTS THEY ARE A RICH AND PRECIOUS NATURAL RESOURCE. BUT THEY, TOO, ARE BEING IMPACTED BY HUMAN ACTION. ONE SMALL EXAMPLE OF THIS IMPACT TOOK PLACE IN APRIL 1986 WHEN A MAJOR OIL SPILL ON THE COAST OF PANAMA POLLUTED AN AREA OF CORAL REEFS, MANGROVE FORESTS, AND GRASS BEDS INCLUDING A BIOLOGICAL RESERVE BEING STUDIED BY THE SMITHSONIAN TROPICAL RESEARCH INSTITUTE. ECOLOGIST JEREMY JACKSON IS ONE OF A GROUP OF SCIENTISTS WORKING THERE HIRED TO STUDY THE ECOLOGICAL EFFECTS OF THE SPILL.

Dr. Jackson: WE WORKED ALL THE WAY DOWN THE COAST FOR SOMETHING LIKE 50, 60 MILES TO GET TO PLACES

THAT WERE LESS AND LESS
AFFECTED BY THE SPILL.
AND SO WE HAD WHAT WERE IN
EFFECT
CONTROL REEFS THAT WERE
ALONG THE COAST
AND WE WERE MONITORING THE
CONDITION ON THE CORAL REEFS
AND THE MANGROVES AND
EVERYTHING HERE
AND THEN FURTHER AND
FURTHER AND FURTHER AWAY
FROM WHERE THE SPILL WAS.

Narrator: THE RESULTS OF THE
STUDY WERE NOT SURPRISING.
THE AREA AFFECTED BY THE
SPILL WAS SEVERELY DAMAGED
COMPARED TO THE UNAFFECTED,
OR CONTROL, AREAS.

BUT FOR JACKSON, IT WAS THE
FINDINGS
MADE IN THE CONTROL AREAS
AFTER THE INITIAL STUDY
THAT WOULD BE MUCH MORE
ALARMING.

Dr. Jackson: TWO YEARS LATER
ALMOST ALL THE CORALS DIED IN
THE CONTROL AREAS
AND THEY DIED FOR REASONS
THAT HAD NOTHING TO DO WITH
THE OIL SPILL.
THEY DIED BECAUSE OF DISEASE

BECAUSE OF OVERGROWTH BY
SEAWEEDS.
THEY DIED BECAUSE OF
BLEACHING.
AND SO THAT WAS
I SUPPOSE FOR ME, THE REAL
WAKE-UP CALL
THAT THERE'S NOTHING CLOSE
TO NATURAL OUT THERE
ANYMORE
AND THAT IT WAS
JUST FUNDAMENTALLY
IMPORTANT AND INTERESTING
TO TRY AND UNDERSTAND
ALL THESE DIFFERENT
DIMENSIONS OF DEGRADATION.
SO WHAT I'M REALLY INTERESTED
IN
IS HOW HAVE PEOPLE CHANGED
THE OCEAN?
WHAT DOES IT MEAN NOT JUST
FOR THE NATURAL WORLD BUT
FOR US?
AND WHAT WILL IT PROVIDE FOR
US IN THE FUTURE?

Narrator: TO UNDERSTAND THE
STATE OF THE OCEANS TODAY
JACKSON USES DATA FROM FISH
SURVEYS CONDUCTED
WORLDWIDE
ALONG WITH CATCH RECORDS

FROM THE FISHING INDUSTRY.
BUT THIS DATA DOES NOT
PROVIDE HIM
WITH ALL THE ANSWERS HE'S
LOOKING FOR.

Dr. Jackson: IF YOU WANTED TO
KNOW

WHAT MANHATTAN ISLAND WAS
LIKE AS A NATURAL ECOSYSTEM
YOU WOULDN'T GO TO WALL
STREET AND SURVEY THE BIRDS.
WALL STREET HAS CHANGED IN
THE LAST 500 YEARS.

AND IN THE SAME KIND OF WAY
IF YOU WANT TO KNOW WHAT
KIND OF FISH THERE WERE IN THE
OCEAN

YOU CAN DO A SCIENTIFIC
SURVEY OF FISH TODAY
BUT IT WOULDN'T TELL YOU
ANYTHING.

SOME SPECIES OF FISH ARE
EXTINCT

SO IT WOULD PROBABLY BE
DIFFICULT TO SURVEY THEM.

Narrator: SO TO PUT CURRENT
RESEARCH IN THE RIGHT
CONTEXT

JACKSON COMPARES IT WITH
HISTORICAL RECORDS
AND ARCHEOLOGICAL EVIDENCE
PAINTING AS ACCURATE A

PICTURE AS POSSIBLE
OF THE OCEANS BEFORE HUMAN
DISTURBANCE.

THIS PICTURE IS CALLED A
BASELINE.

Dr. Jackson: THE BASELINE IS THE
WAY IT USED TO BE.

BUT EVERY GENERATION OF
FISHERIES' BIOLOGISTS

MAKES A NEW BASELINE WHEN
THEY START THEIR CAREER.

AND SO THE FISHERIES'

BIOLOGISTS FROM 30 YEARS AGO

--

THEIR BASELINE WAS MAYBE 10%
OF THE FISHERIES' BIOLOGISTS'
BASELINE

FROM THE GENERATION BEFORE.

THIS IS AN EXAMPLE OF THE
SHIFTING-BASELINE SYNDROME.

IT'S AN INCREDIBLY IMPORTANT
IDEA.

IT'S THE MOST IMPORTANT IDEA
ABOUT UNDERSTANDING THE
ENVIRONMENT

AND HUMAN IMPACT ON THE
ENVIRONMENT.

YOU CANNOT UNDERSTAND THE
PROBLEM

JUST BY LOOKING AT THE WAY
THE WORLD IS NOW.

Narrator: SO JACKSON LOOKS TO

THE PAST.
AND WHILE HE RESEARCHES ALL
OF THE HUMAN IMPACTS ON THE
OCEAN
LIKE POLLUTION AND GLOBAL
WARMING
HIS FOCUS HAS BEEN ON THE
EFFECTS OF OVERFISHING.
HE HAS CONCLUDED FROM
VARIOUS SOURCES
THAT THE GLOBAL POPULATION
OF LARGE FISH
HAS DECLINED BY 90% SINCE
1950.
Dr. Jackson: WE KNOW THINGS
LIKE THAT
FROM DATA FROM THE JAPANESE
FISHING INDUSTRY.
THEY HAVE A MASSIVE FISHING
FLEET
AND THEY KEPT VERY GOOD
RECORDS.
AND IN THE BEGINNING OF THE
JAPANESE FISHERY
THEY FISHED MOSTLY CLOSE TO
HOME.
AND THEN THEY DEPLETED THE
FISHERIES
IN THE WESTERN PACIFIC.
SO THEY MOVED INTO THE NORTH
ATLANTIC
AND THE SOUTH ATLANTIC

AND THE CENTRAL PACIFIC AND
THE INDIAN OCEAN
AND ALL OF THE DIFFERENT
FISHERIES GROUNDS
AROUND THE WORLD.
AND IN A PERIOD OF 25 TO 30
YEARS
IN THE ENTIRE GLOBAL OCEAN
THE CATCH WAS DEPLETED FROM
10 FISH PER 100 HOOKS
TO ONE FISH PER 100 HOOKS.
THAT'S 90% OF ALL THE BIG FISH
ARE GONE.

Narrator: BUT TO JACKSON
THIS STUDY ALSO FALLS VICTIM
TO THE SHIFTING-BASELINE
SYNDROME.

Dr. Jackson: THEIR BASELINE WAS
1950.

AND YOU CAN IMAGINE HOW
MANY BIG FISH DISAPPEARED
BEFORE 1950.

SO, ANOTHER WAY WE KNOW
ABOUT THE MAGNITUDE
OF THE FISH WE'VE LOST --
THERE'S THIS GLOBAL FISHERIES
DATA
THAT WERE ESSENTIAL
COMMERCIAL FISHERIES' DATA
AND THEY MADE MAPS OF HOW
MUCH FISH WAS TAKEN

OUT OF THE NORTHERN ATLANTIC
IN 1900 AND TODAY.
AND THE RED COLOR MEANT THAT
THERE WAS LOTS OF FISH
AND WHITE COLOR MEANT THERE
WERE NO FISH.
AND IN 1900, ALL ALONG
THE EAST COAST OF THE UNITED
STATES AND WESTERN EUROPE
IS RED.
AND IN 2000, IT'S WHITE.
IT'S JUST VIRTUALLY
THE RICHEST FISHING GROUNDS
IN THE WORLD ARE GONE.

Narrator: BESIDES THE OBVIOUS
CONCERN
OF EXTINCTION TO MANY OF
THESE LARGE FISH SPECIES
JACKSON ASKS WHAT EFFECT
THEIR ABSENCE HAS
ON THE HEALTH OF THE OCEAN
AS AN ECOSYSTEM.
OF CHIEF CONCERN ARE CORAL
REEFS.

Dr. Jackson: THE IMPORTANT
QUESTION IS
HOW IS THE FUNCTIONAL
DIVERSITY OF REEFS CHANGED
WHETHER THE SPECIES HAVE
GONE EXTINCT OR NOT?
IS IT A COMPLEX SYSTEM THAT

WORKS
IN THE KIND OF WAY THAT
SUPPORTS THE HEALTHY
POPULATIONS OF FISH?
IS IT A HEALTHY SYSTEM THAT
PROTECTS THE COASTLINE
FROM HURRICANES AND OTHER
SEVERE STORMS?
DOES IT PERFORM ALL THOSE
KINDS OF THINGS?
THERE'S NO DOUBT
THAT IN THAT KIND OF
FUNCTIONAL-DIVERSITY SENSE
CORAL REEFS HAVE BEEN VERY,
VERY BADLY IMPACTED.

Narrator: LIKE THE TREES OF THE
FOREST

CORAL REEFS ARE THE
FOUNDATION
FOR MUCH OF THE LIFE IN THE
OCEAN.
THEY PROVIDE FOOD AND
SHELTER
FOR MANY PLANTS AND SMALLER
ORGANISMS
WHICH ARE THE BOTTOM LINK OF
THE FOOD CHAIN.
THESE SMALLER ORGANISMS
ARE THE FOOD SOURCE FOR
SMALL FISH
WHICH IN TURN ARE THE FOOD
SOURCE

FOR THE LARGER FISH THAT EAT THEM.

THE SIMPLE WAY TO UNDERSTAND IT IS BIG FISH EAT LITTLE FISH.

AND THE BIG QUESTION IS WHEN YOU REMOVE THE THINGS AT THE TOP

DO THE NEXT LEVEL DOWN JUST TAKE OVER?

OR IS THE BALANCE DISTURBED IN SOME KIND OF WAY

THAT IT'S NOT THAT SIMPLE?

IT'S PRETTY CLEAR THAT IT'S NOT THAT SIMPLE.

OVERFISHING REMOVES THE MOST IMPORTANT AND ABUNDANT CONSUMERS IN A NATURAL ECOSYSTEM.

AND SO FISH, OF COURSE, EAT FISH

BUT FISH ALSO EAT SEAWEED.

IF THEY ARE NOT THERE

THE SEAWEED GROWS 10 TIMES FASTER

100 TIMES FASTER IN THE CORALS.

IT GROWS OVER THE CORALS, SMOTHERS THEM, AND KILLS THEM.

Narrator: THE ABSENCE OF FISH THAT ALLOWS FOR THIS

OVERGROWTH OF SEAWEED
AND THE DESTRUCTION OF THE
CORAL

IS AN EXAMPLE OF HOW
REMOVING ONE PART OF THE
FOOD WEB

COMPLETELY CHANGES AN
ECOSYSTEM

FROM ONE THAT IS HEALTHY AND
DIVERSE

TO ONE THAT IS ONLY
ATTRACTIVE

TO A LIMITED NUMBER OF
ORGANISMS.

IT'S WHAT JACKSON CALLS THE
RISE OF SLIME.

Dr. Jackson: WHAT I CALL THE RISE
OF SLIME

IS THE INTRODUCTION OF
EXCESSIVE AMOUNTS OF
NUTRIENTS

THAT ALLOWS THE MICROSCOPIC
PLANTS IN THE WATER

AND ALSO THE SEAWEEDS ON
THE BOTTOM

TO GROW AT EXTRAORDINARILY
RAPID RATES.

IF IT GETS OUT OF CONTROL

THERE'S FAR MORE MICROSCOPIC
PLANTS AND SEAWEEDS

THAN THE GRAZERS CAN
POSSIBLY EAT.

THE STUFF JUST BUILDS UP AND
BUILDS UP.

IT DIES BEFORE ANYTHING EATS
IT.

IT FALLS TO THE BOTTOM. IT
ROTS.

THE PROCESS OF ROTTING
CONSUMES ALL THE OXYGEN.

SO ALL THE ANIMALS THAT
NORMALLY WOULD BE USING
THAT OXYGEN

THEY DIE BECAUSE OF THIS
ROTTING

OF ALL THIS EXCESS
VEGETATION.

AND ALL YOU'VE GOT IS

JELLYFISH AT THE SURFACE

AND ALL THESE MICROBES.

AND SO IT'S AN ECOSYSTEM

WHICH LACKS

ALL THE KINDS OF ANIMALS WE
WANT

AND HAS ALL THE KINDS OF

ANIMALS WE DON'T WANT.

AND SO, OF COURSE, THE BIG
QUESTION IS

WILL THAT HAPPEN

EVERYWHERE?

OR WILL IT ONLY HAPPEN IN A
FEW PLACES?

OR WILL WE GET SMART AND

FIGURE OUT HOW TO STOP DOING

THAT
AND FIX IT SOMEHOW?

Narrator: SOME OF JACKSON'S
RESEARCH IS SHOWING
THAT AVOIDING THE RISE OF
SLIME IS NOT SO COMPLICATED.
IN THE SUMMER OF 2006
JACKSON AND RESEARCHERS
FROM THE SCRIPPS INSTITUTE OF
OCEANOGRAPHY
RELEASED RESULTS OF A STUDY
THAT EVALUATED THE
EFFECTIVENESS
OF RECOVERY EFFORTS ON REEF
SYSTEMS.
THE RESEARCH TEAM SAMPLED
LEVELS OF BIOMASS
FOR FISH, CORALS, AND ALGAE
AT 34 CORAL REEF SITES
IN THE NORTHWESTERN
CARIBBEAN AND OFF THE
FLORIDA KEYS.
THE SITES RANGED
FROM FULLY PROTECTED,
NO-TAKE MARINE RESERVES
TO REEFS THAT HAD BEEN
HISTORICALLY OVERFISHED.
SITES DESIGNATED AS MARINE
RESERVES
LARGER THAN 100 SQUARE
KILOMETERS

WITH NO FISHING ALLOWED FOR
MORE THAN 10 YEARS
HAVE THE GREATEST LEVELS IN
TOTAL FISH BIOMASS
INCLUDING NOT JUST TOP
PREDATORS
BUT ALSO HERBIVOROUS FISH
WHO ARE IMPORTANT IN THE
FOOD WEB
FOR REDUCING ALGAE
ABUNDANCE.

Dr. Jackson: IN THOSE PLACES --
SURPRISE, SURPRISE --
YOU DON'T KILL THE FISH, THE
FISH COME BACK.

AND THERE'S LOTS OF FISH AND
LOTS OF BIG FISH.

AND WHAT'S REALLY IMPORTANT
IS EVEN THOUGH IT'S VERY
COMPLICATED

AND WE DON'T UNDERSTAND ALL
THE DETAILS

IN THOSE PLACES WHERE
THERE'S LOTS OF FISH

THERE'S BEEN A HUGE
REDUCTION IN THE SEAWEED.

NOW, THE CORALS HAVEN'T COME
BACK YET

BECAUSE THE CORALS GROW
SLOWER.

SO IT'S GONNA TAKE A LONG TIME
FOR CORALS TO COME BACK.

AND, OF COURSE, THERE ARE
OTHER PROBLEMS THAT CORALS
HAVE.

BUT AT LEAST HALF OF THAT
STORY --

THE ELIMINATION OF THE LARGE
AMOUNTS OF SEAWEED --
HAS NOW BEEN SHOWN
EFFECTIVELY, EXPERIMENTALLY
THROUGH THE MECHANISM OF
THESE PROTECTED AREAS
IN SEEING THE REDUCTION IN THE
SEAWEED.

SO, IS IT TOO LATE?

I DON'T THINK IT'S TOO LATE.

BUT WILL WE BE ABLE TO GO TO
THE BEACH?

WILL WE BE ABLE TO EAT FISH?

WHAT WILL IT BE LIKE?

THAT'S REALLY HARD.

AND THERE'S A LOT OF SCIENCE
THERE.

WE KNOW IT WILL BE BETTER --
YOU KNOW, IF WE STOP KILLING
FISH

THERE WILL BE MORE FISH.

IF WE STOP DUMPING TOO MUCH
GARBAGE IN THE OCEAN

THE OCEAN WILL BE CLEANER.

AND IT WILL BE BETTER.

BUT WHAT EXACTLY IT WILL BE
LIKE

AND HOW WELL WE CAN MANAGE
IT --

TO PROTECT THE NATURAL
BIODIVERSITY

AND TO STILL HAVE FISH TO EAT
AND STILL HAVE CLEAN BEACHES
TO GO --

THAT'S A LOT HARDER, YOU KNOW
AND THAT'S WHAT A LOT OF US
ARE TRYING TO UNDERSTAND.

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