Moving from VULNERABILITY...

...to ADAPTATION

GOLDEN GATE BIOSPHERE CLIMATE ADAPTATION PROJECT
Defining Adaptation

**Climate change adaptation** refers to adjustments in natural or human systems in response to changing climate conditions.

**ADAPTATION STRATEGIES & ACTIONS:**

- Reduce climate impacts (*sensitivity & exposure*)
- Increase climate resilience (*adaptive capacity*)
Applying Vulnerability Results to Adaptation Planning

Sensitivity & Exposure

• Prevent the introduction and establishment of invasive species
• Actively plant drought-tolerant native species in an area projected to get drier
• Reduce stand density to increase tree vigor and structural diversity
Applying Vulnerability Results to Adaptation Planning

EXPOSURE

• Restore riparian vegetation to limit water temperature increases
• Thin to reduce the threat of sudden oak death on vulnerable sites
• Identify and protect areas of less/slower change (e.g., refugia)

Photo by USFS/Mike McMillan (Public Domain)
Applying Vulnerability Results to Adaptation Planning

ADAPTIVE CAPACITY

• Maintain/create migration corridors for native plants/wildlife
• Collect and store seed from rare plants to facilitate persistence and maintain genetic diversity
• Partner with local tribes to expand the use of cultural burning

Photo by USFWS via Flickr (Public Domain)
Case Study #1: Ojai Community Defense Zone Project

Restoring and expanding a fuelbreak system in Los Padres National Forest

- Increase defensible space within the forest and WUI to reduce the threat of wildfire
- Protect watershed habitat value and water quality
- Create safer conditions for the public/firefighters and increase efficacy/cost effectiveness of fire suppression activities
Case Study #1: Ojai Community Defense Zone Project

STEP 1: IDENTIFYING CLIMATE & NON-CLIMATE VULNERABILITIES

Altered wildfire regimes
• Increases post-fire erosion in severely burned areas, negatively impacting watersheds
• Increases damage/risk within the WUI and resources needed for fighting fires

Increased extreme precipitation events
• Increases flooding and associated erosion in burned areas
STEP 1: IDENTIFYING CLIMATE & NON-CLIMATE VULNERABILITIES

Increased temperatures, changes in precipitation, and more drought

- Dries out fuels and extends the length of the fire season
- Contributes to fast-moving, intense fires during hot/dry periods
- Reduces water availability and the increases distance to water sources used for fighting fires
Case Study #1: Ojai Community Defense Zone Project

STEP 1: IDENTIFYING CLIMATE & NON-CLIMATE VULNERABILITIES

**Increased invasive grasses**
- Alters availability and continuity of fine fuels, contributing to more severe wildfires and altered timing of fires

**Increasing human populations**
- Increases number of fire ignitions and the number of people at risk during a wildfire
STEP 2: REDUCING VULNERABILITIES THROUGH EXISTING PROJECT ACTIONS

ACTION: Managing ground cover to result in a mixture of bare ground, grasses, and forbs
✓ Removes/controls invasive grasses

ACTION: Use irregular widths, shapes, and patterns in the fuelbreak design
✓ Reduces the potential for increased erosion by minimizing the distance that soil can move
Case Study #1: Ojai Community Defense Zone Project

STEP 2: REDUCING VULNERABILITIES THROUGH EXISTING PROJECT ACTIONS

ACTION: Expanding width of the fuel break
✓ Reduces wildfire rate of spread by decreasing available fuels

ACTION: Using mechanical treatments for fuel removal around dwellings and other occupied buildings
✓ Decreases the risk of ignitions and reduces wildfire rate of spread and potential severity
**STEP 3: NEW PROJECT ACTIONS TO ADDRESS REMAINING VULNERABILITIES**

**ACTION:** Plant native perennial grasses within the fuelbreak

- Reduces invasive grass establishment by maintaining dominance of native species, helping decrease flashy fire behavior
- Increases water infiltration
- Reduces erosion potential by minimizing bare soil
STEP 3: NEW PROJECT ACTIONS TO ADDRESS REMAINING VULNERABILITIES

**ACTION:** Establish trigger points for recreation closures and restrictions

- Reduces the number of ignitions by minimizing the number of humans in the area during high-risk times

**ACTION:** Install emergency grey water systems in ‘safety zones’

- Provides nearby water for fighting fires
Case Study #2: Midpeninsula Regional Open Space District

Used vulnerability information and maps produced as part of the Santa Cruz Mountains Climate Adaptation Project

- Inform land management on Midpen preserves
- Support collaborative, regional management efforts by the greater Santa Cruz Mountains Stewardship Network
Case Study #2: Midpeninsula Regional Open Space District

Highest projected increases in climatic water deficit (CWD) and Areas where vegetation approaching or already past the 95th percentile of the CWD range it can tolerate.
Case Study #2: Midpeninsula Regional Open Space District

Highest projected increases in fire risk
and
Areas where current fire risk is already very high or extreme
Case Study #2: Midpeninsula Regional Open Space District

**Management Goals:**

**Stevens Creek Red-Bellied Newt Population**
- Mitigates impacts of altered stream channel
- Provides habitat in both stream and upland areas
- Supports connective habitat
- Supports a healthy newt population
- Natural stream edge and wetland buffer

**BRC Tree Farm Restoration Site**
- Mitigates impacts of altered stream channel
- Provides habitat in both stream and upland areas
- Supports connective habitat
- Supports a healthy newt population
- Natural stream edge and wetland buffer

**Scenario planning to identify actions that would help reach restoration goals under future climate conditions:**

- **Stevens Creek Red-Bellied Newt Population**
  - Increase effective size of stream habitat
  - Increase water temperature
  - Increase stream flow
  - Increase stream connectivity
  - Reduce sedimentation

- **BRC Tree Farm Restoration Site**
  - Increase effective size of stream habitat
  - Increase water temperature
  - Increase stream flow
  - Increase stream connectivity
  - Reduce sedimentation

**Assumptions:**

- Heavy winter rains, especially in summer
- LESS WET IN SUMMER
- Populations in winter are higher than summer
- More frequent and severe wildfires
- Increased stream flow
- Increased water temperature

**Monitoring:**

- Monitoring, monitoring, monitoring...
Case Study #2: Midpeninsula Regional Open Space District

Management Goals: Stevens Creek Red-Bellied Newt Population

- Red bellied newt population size is stable or increasing, shows healthy genetic structure
- Habitat remains suitable for both aquatic and terrestrial life stages: consistent and moderate flow, accessible forest floor, structure to burrow under for moist soil during dry conditions
- Refuge or adjacent habitat remains suitable and accessible (Twitty Creek) - supports expanding population or dispersal after extreme/stochastic events, no barriers
- Habitat supports a growing newt population

Assumptions:
- Flashy flows in winter
- Warmer water temps, especially in summer
- Less water in summer

- Measure a baseline for vegetation communities and water use, soil moisture
- Manage vegetation to ensure water continues to reach the creek through August. Possibly introduce more organic to soil to increase water retention
- Characterize hydrology of the stream and tributaries to understand resilience to flashy flows/extreme precipitation events
- Construct "staging areas" for newts to find mates
- Active relocation as a last resort: move animals before big storms

Climate Future (by 2069)
- Annual Temp Avg: +1.9°C
- Winter Min Temp: +1.7°C
- Summer Max Temp: +0.8°C
- CWD Increase: 35.8mm (4.7%)
- 20-yr Fire Risk: 29% (+2.3%)
- Annual Precip: -153mm CH Annual Precip: -26 to -278mm

After flashy winter flows subside, males migrate to the streams to meet the females and breed. Very site-faithful, so may limit adaptability. Egg masses are laid in-stream.

Typically February-March, need some (moving) water through August for larvae to reach sub-adult phase.

Need more study of water temperature effects.

Which pathway makes sense based on the goals: Resist, Accept, or Direct? Maybe a combination?

Monitoring, monitoring, monitoring... Indicators and metrics!
What if it's a big hoax and we create a better world for nothing?

- Energy independence
- Preserve rainforests
- Sustainability
- Green jobs
- Livable cities
- Renewables
- Clean water, air
- Healthy children
- Etc., etc.