Today’s class schedule

- **Recap** from last class: disturbance and succession
- **Intro question** and follow up
- **Learning objectives**
- **Science application:** Tracking vegetation disturbance from wildfire
  - Lecture
  - Data exercise
- **Discussion**

Goldfish moment

celestial eye goldfish
(Carassius Auratus)

Intro Question:

Raise your hand if you
(or someone you know)
has a houseplant

Intro Question:

Raise your hand if you
(or someone you know)
has killed a houseplant

The average millennial has killed over 7 houseplants

We (or most of us) have seen healthy and disturbed vegetation

Think-pair-share

What do the leaves of a healthy, undisturbed plant look like?

What about a stressed or dying plant?

What about a dead plant?

Color

Water content (high, moderate, low)

	Healthy	Stressed	Dead
Color			
Water content			

Spend 1 minute thinking about each answer,
then 2 minutes pairing with a partner to discuss

	Healthy	Stressed	Dead
Color	Green leaves	Yellow/orange leaves	Brown leaves (or none at all)
Water content	High moisture	Moderate moisture	Low moisture

We can often visually detect disturbance

We can often visually detect disturbance

Fire

Insects

Drought

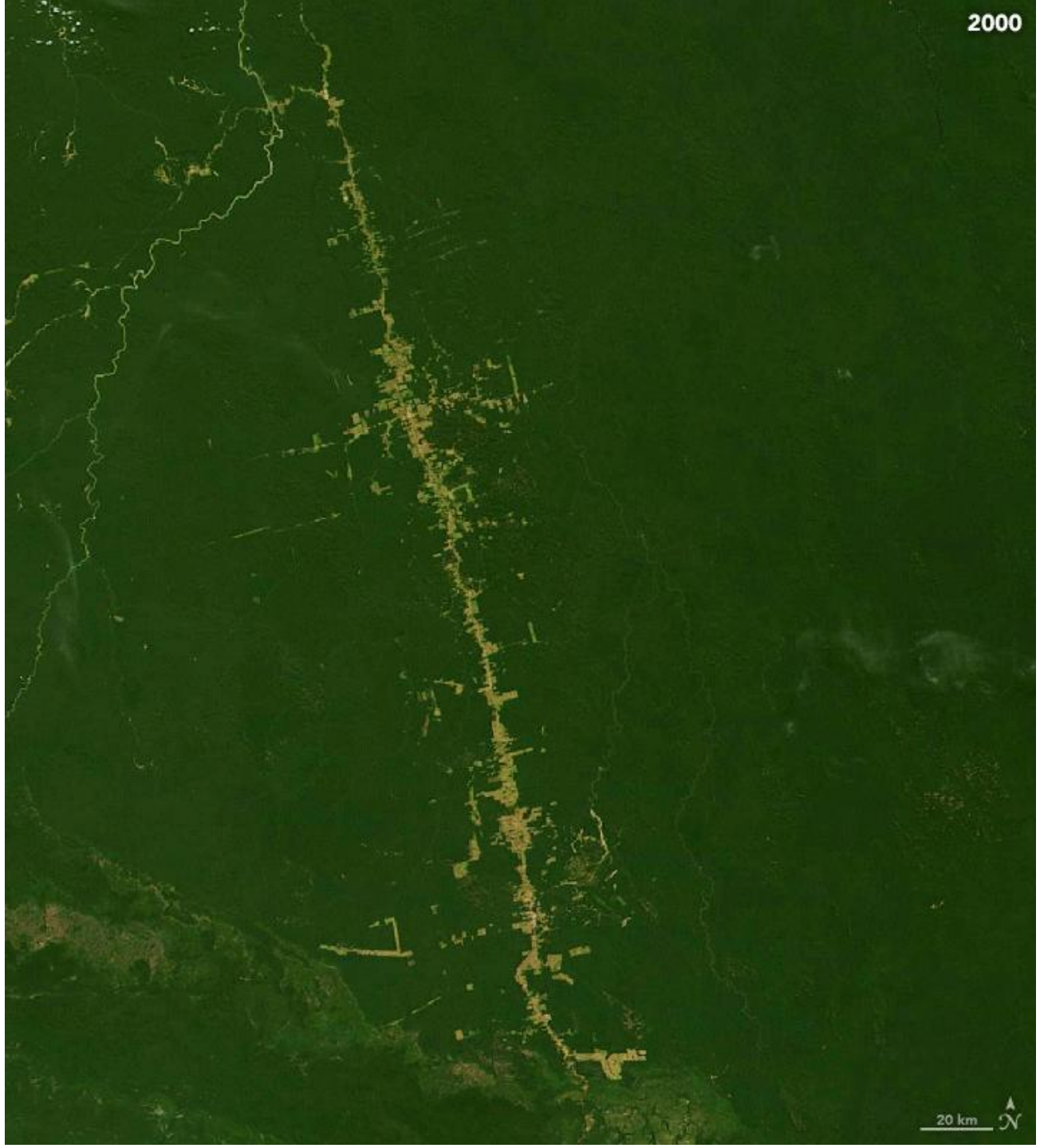
Wind

Dye et al. 2024

So can satellites!

Deforestation

Brazil
2000-2019



NASA


Photo by Jazlynn Hall

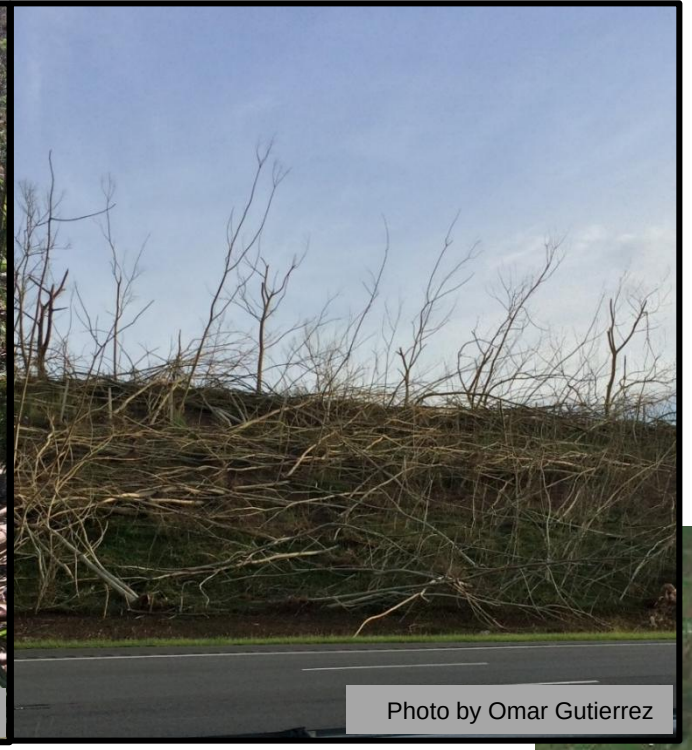


Photo by Omar Gutierrez

NASA

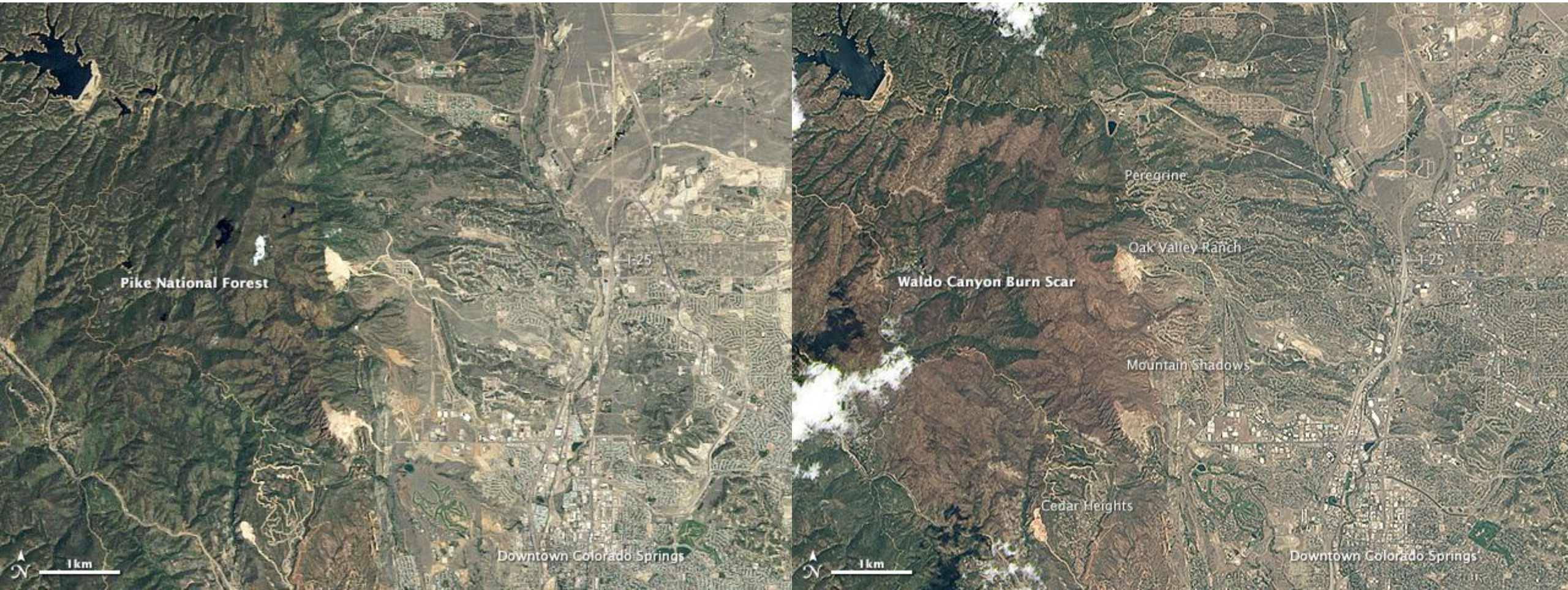
Hurricane Maria

Puerto Rico
2017

1985

2013

NASA



Wildfire

Scientific Application:

Tracking vegetation disturbance from wildfire using remote sensing

Cameron Peak Fire

Cameron Peak Fire

- **August 13 2020 - December 2 2020**
- **208,663 acres**

Learning objectives

1. Describe different types of wildfire and burn severity.

2. Explain how remote sensing can be used as a useful tool for ecology

3. Connect remote sensing and spectral indices to vegetation and burn severity

4. Interpret vegetation and disturbance from a wildfire using NBR

Types of wildfire

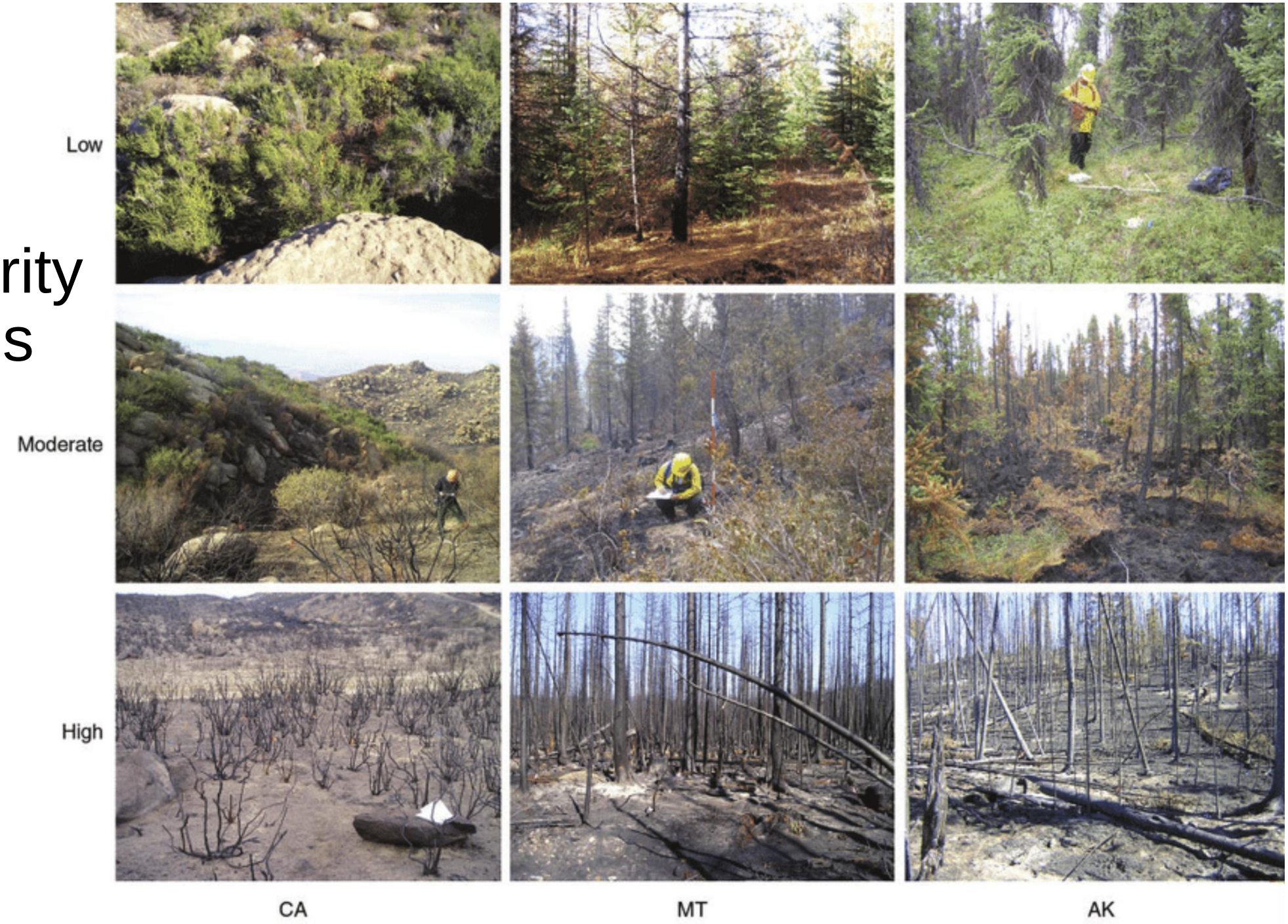
This leads to different burn severity levels

Burn severity

the degree of short-term ecological change caused by fire, typically measured by **biomass lost or vegetation killed by fire**

(Keeley 2009, Morgan et al. 2014).

Burn severity examples



Lentile et al. (2006)

Types of wildfire

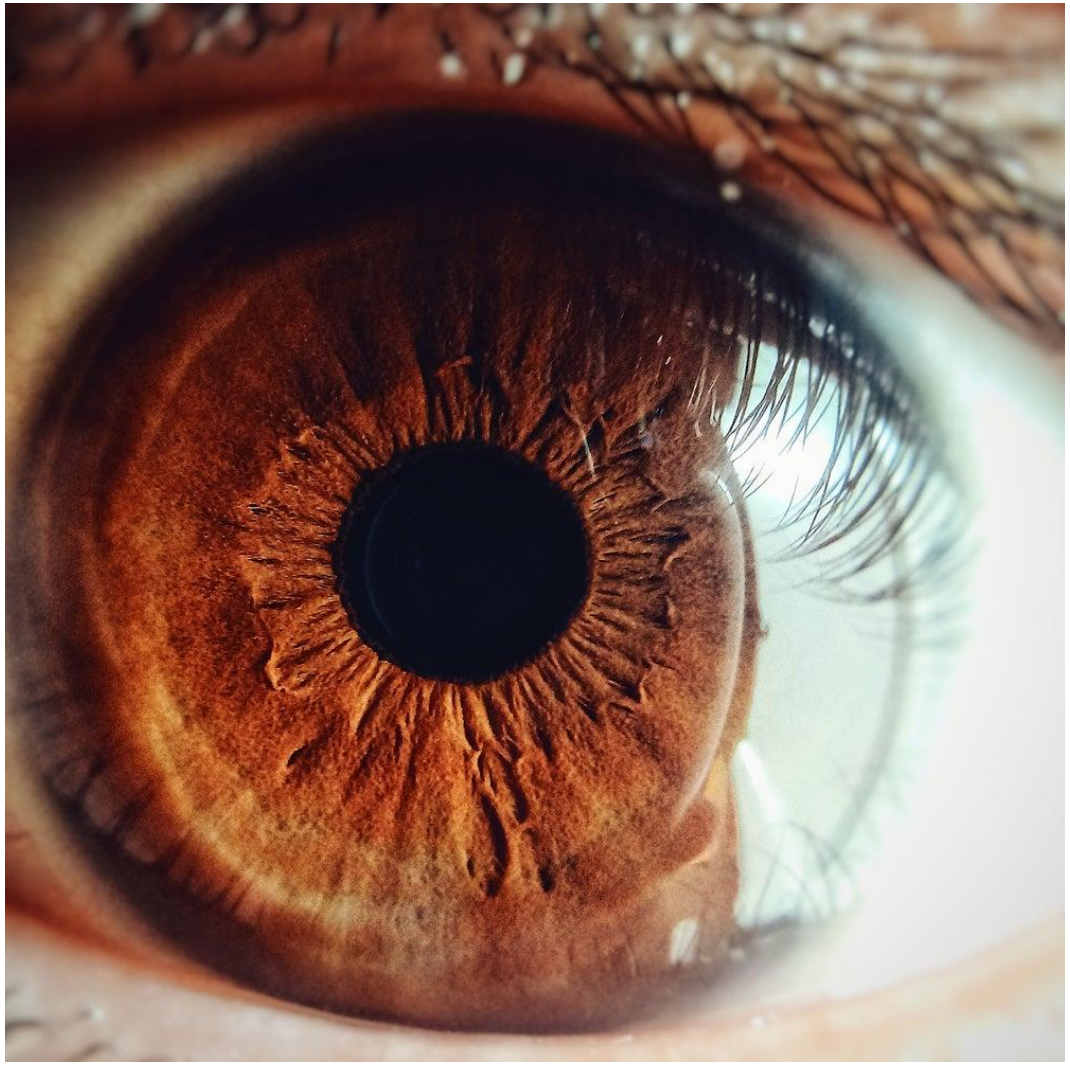
We can measure burn severity across landscapes using remote sensing

Remote sensing:

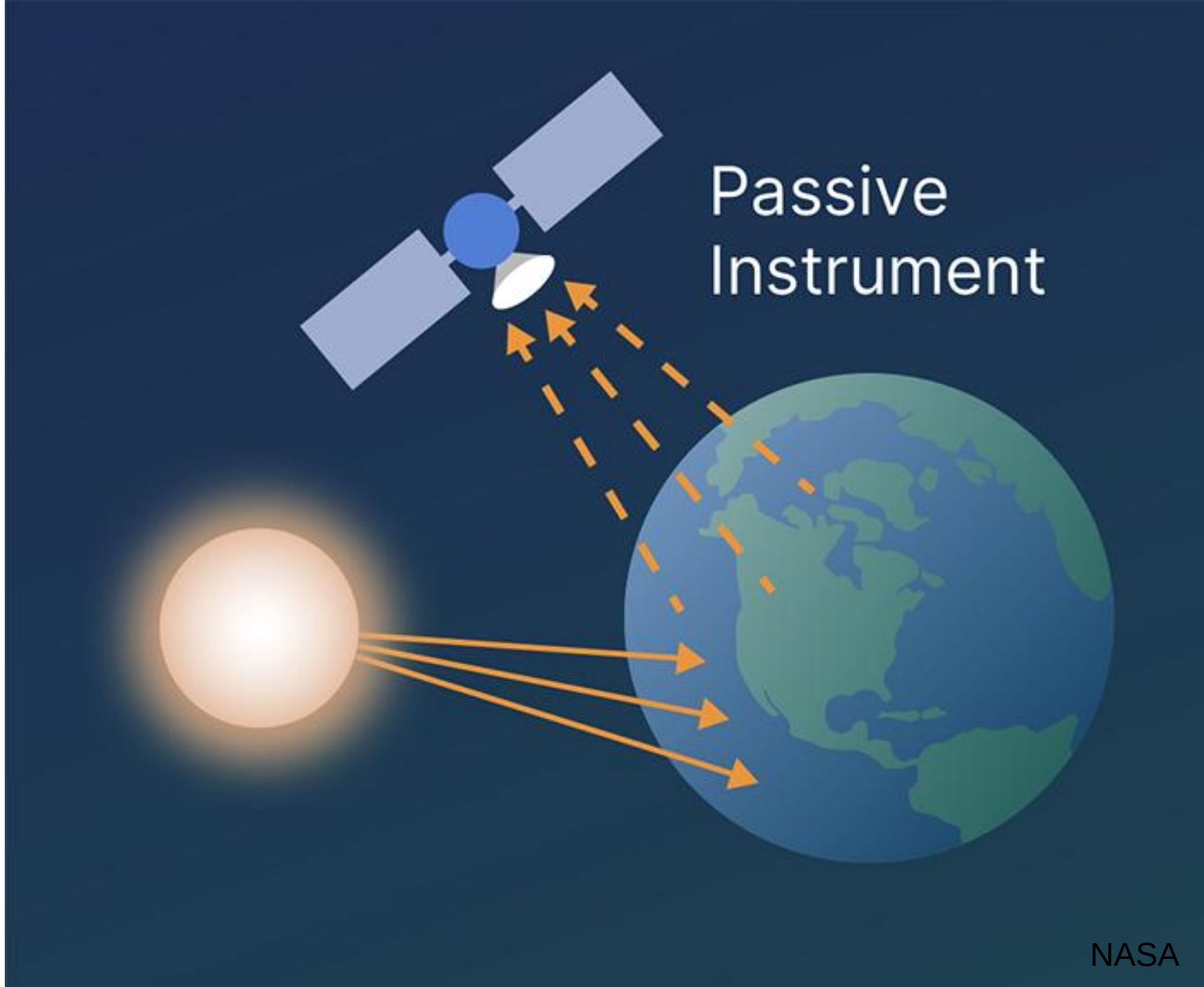
the acquiring of information from a distance (NASA)

We use remote sensing every day

Our eyes!

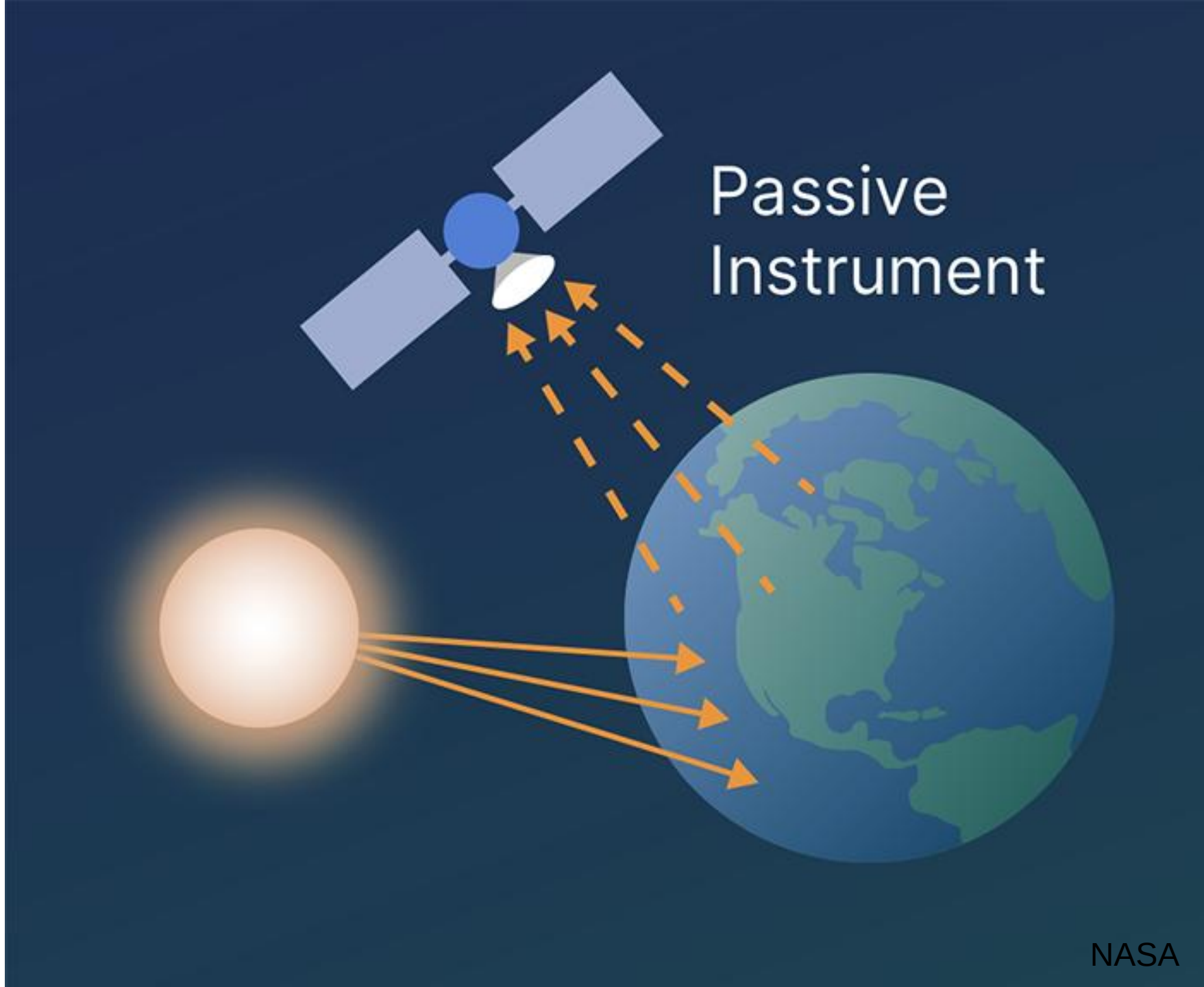


Satellites “see” ecosystems using light



NASA

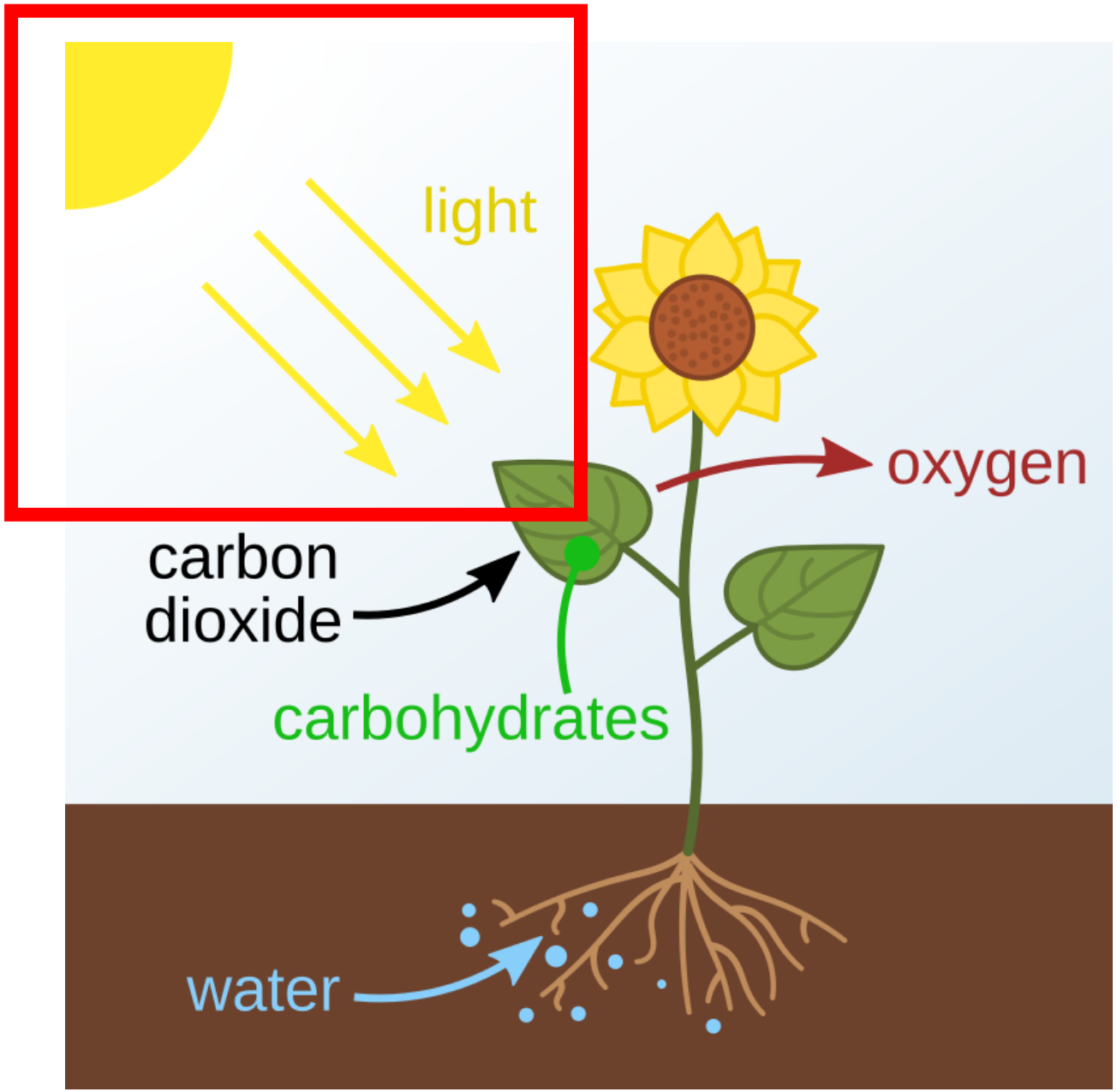
Satellites “see” ecosystems using reflections of light from the earth’s surface



How (on earth) does this relate to plants?

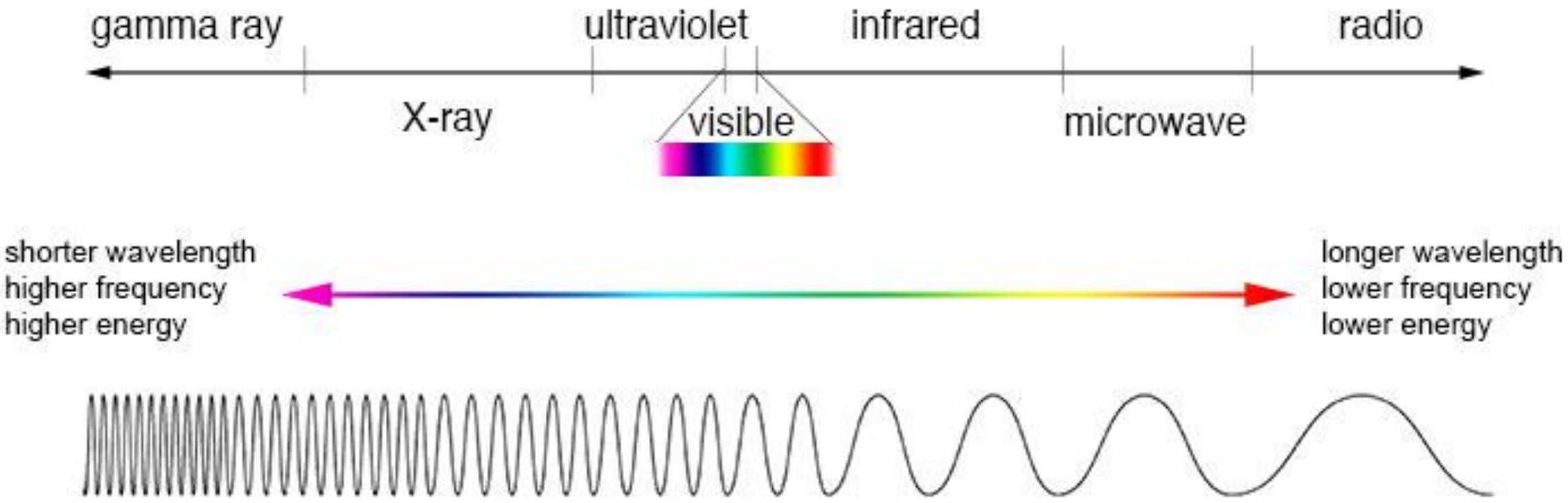
Photosynthesis

What is light?



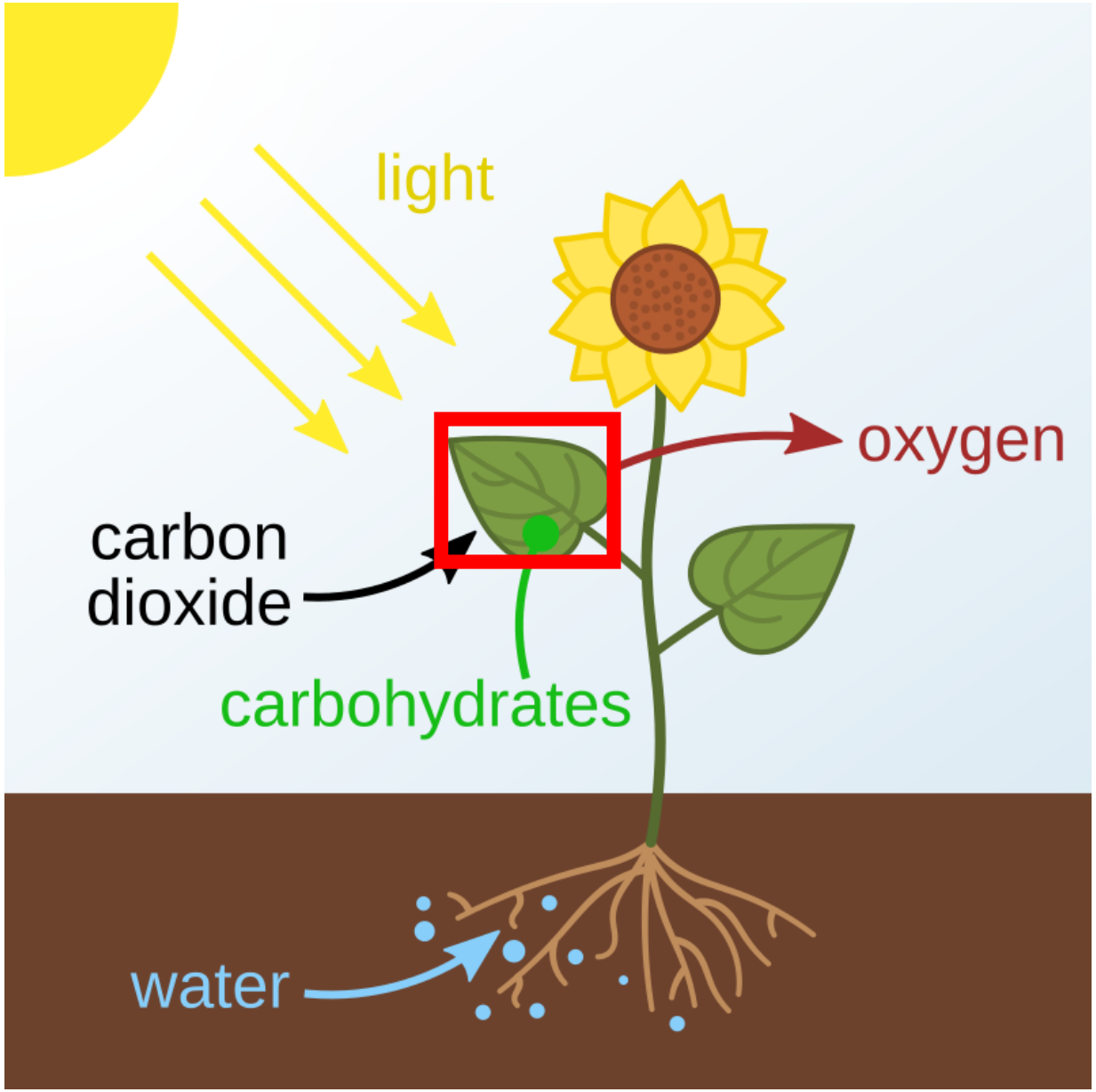
LIGHT = ELECTROMAGNETIC RADIATION

Electromagnetic spectrum



Photosynthesis

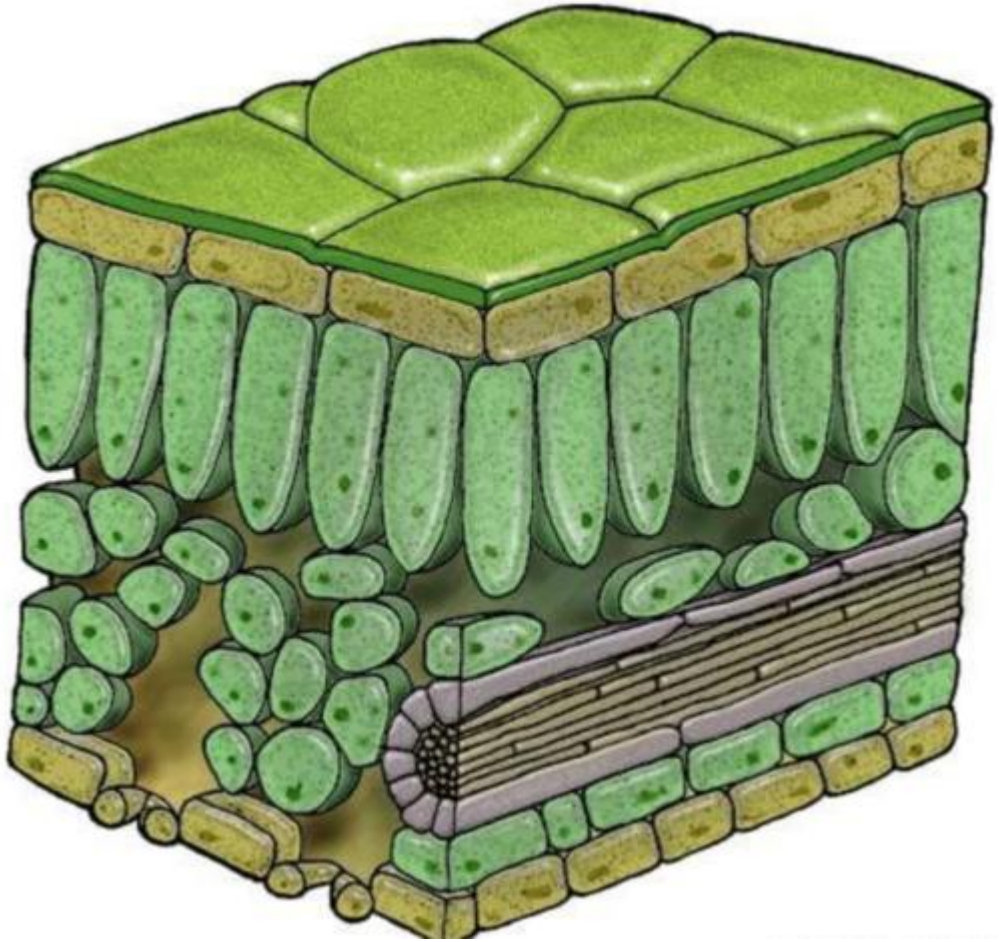
Chloroplast: specialized organelle, the site of photosynthesis

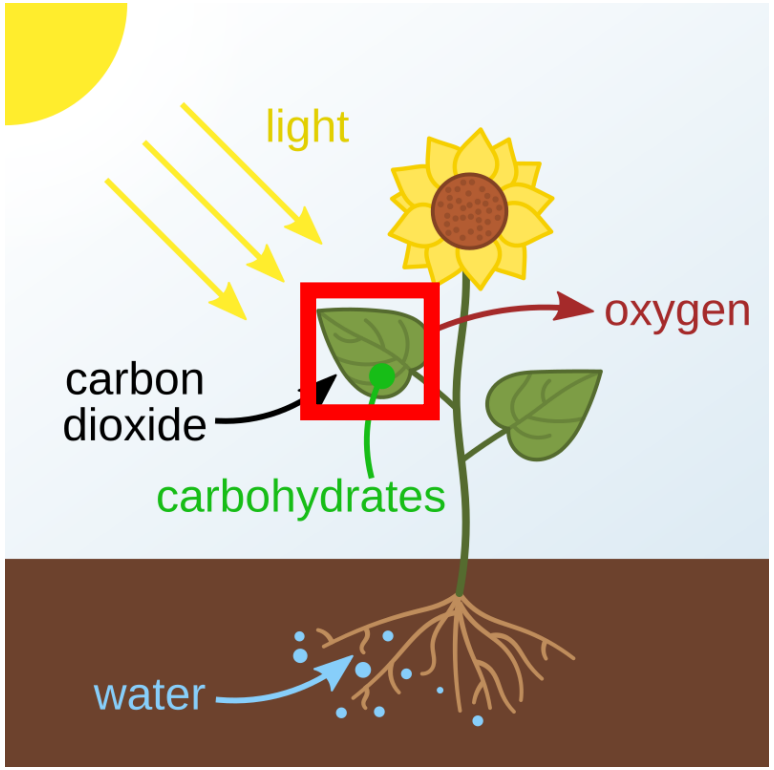


Photosynthesis

Leaf cross section:

Chloroplasts found here



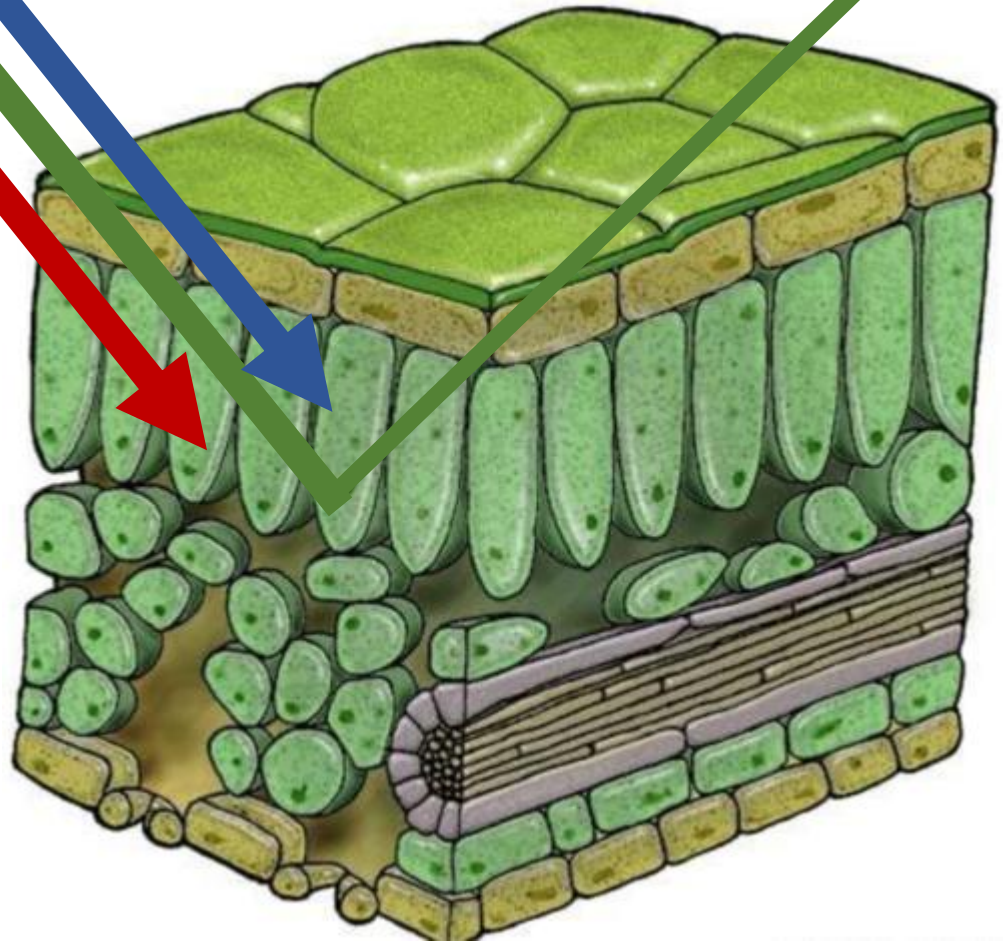


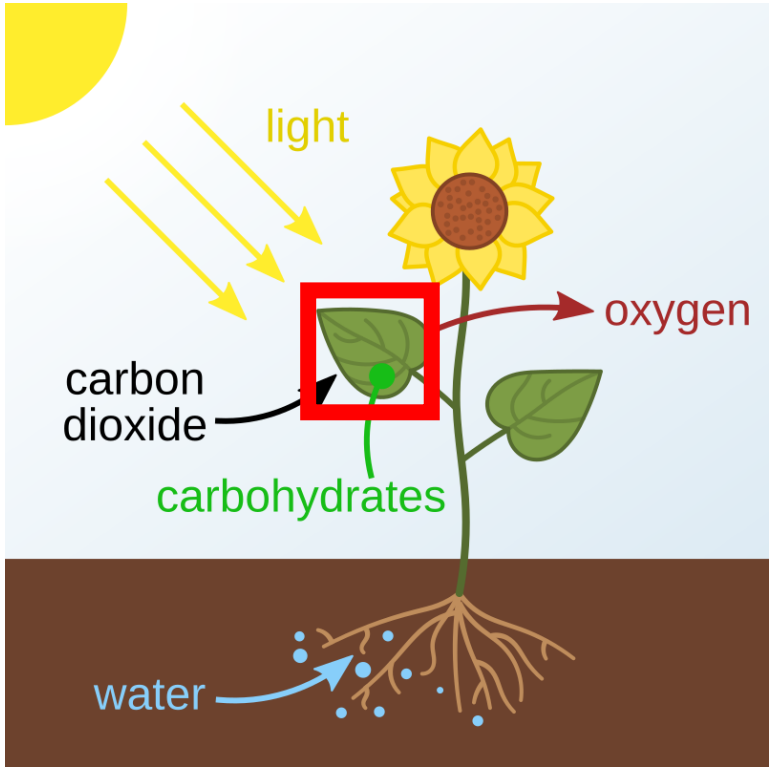
Satellites measure this

Red

Blue

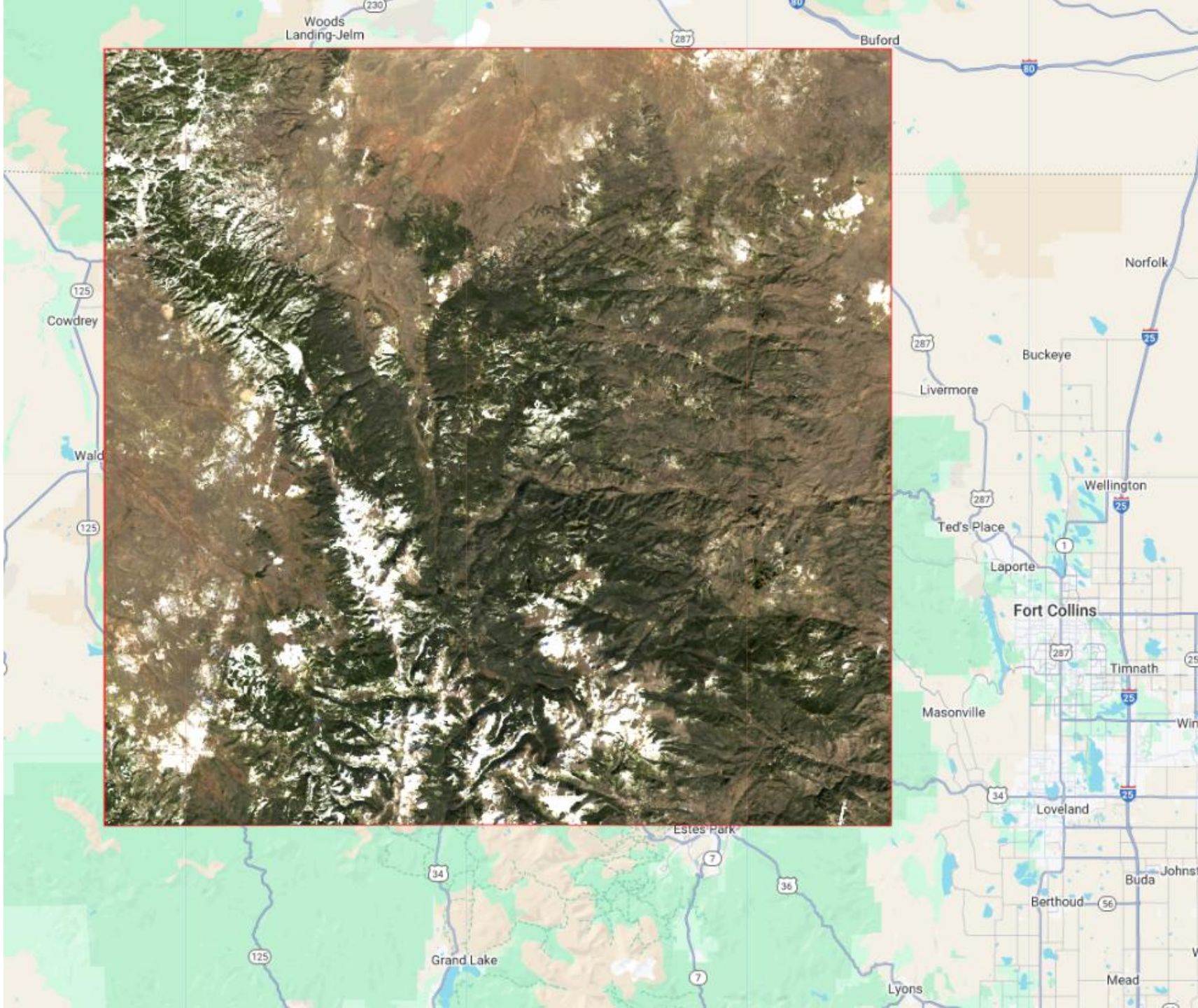
Green

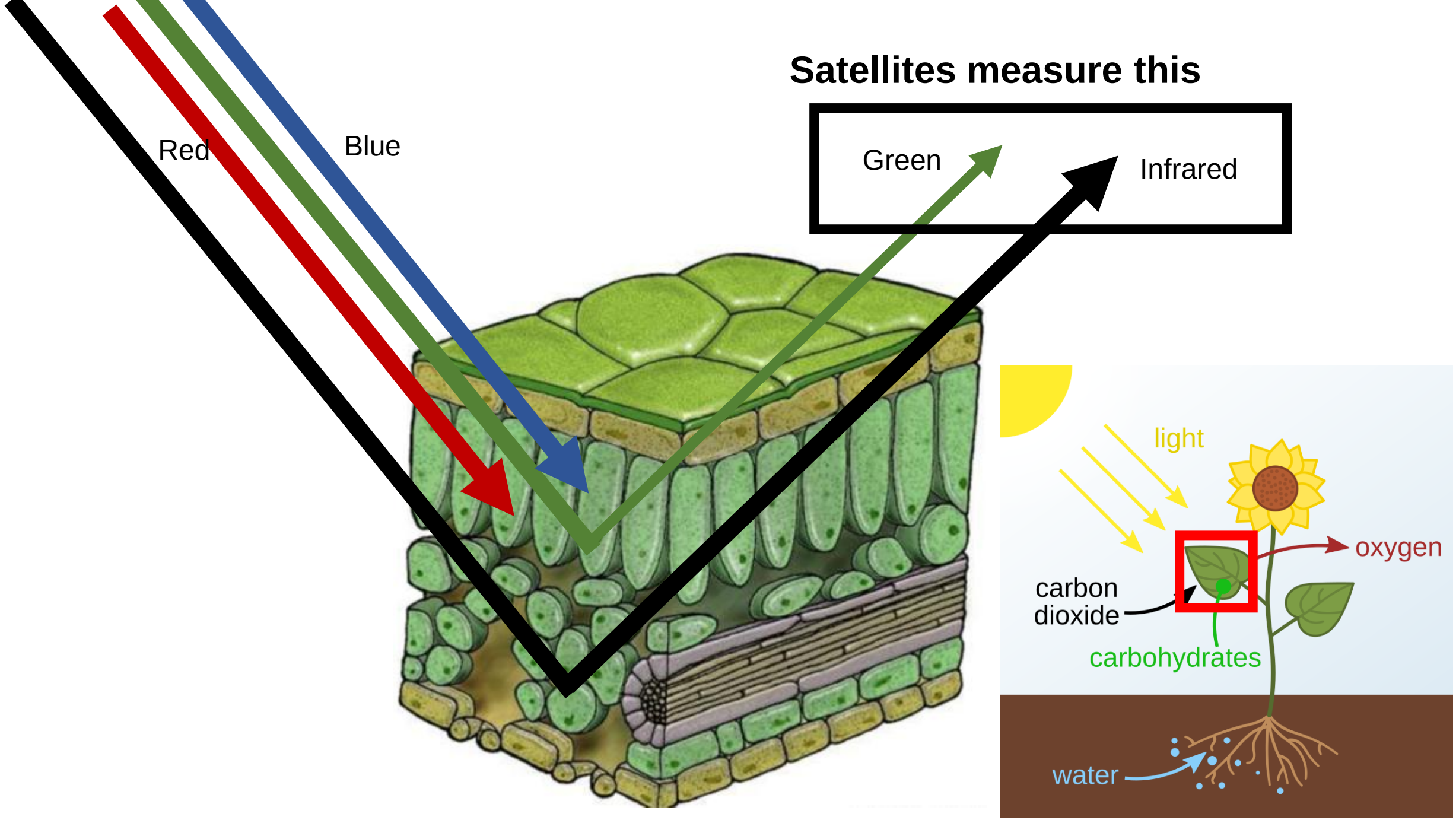




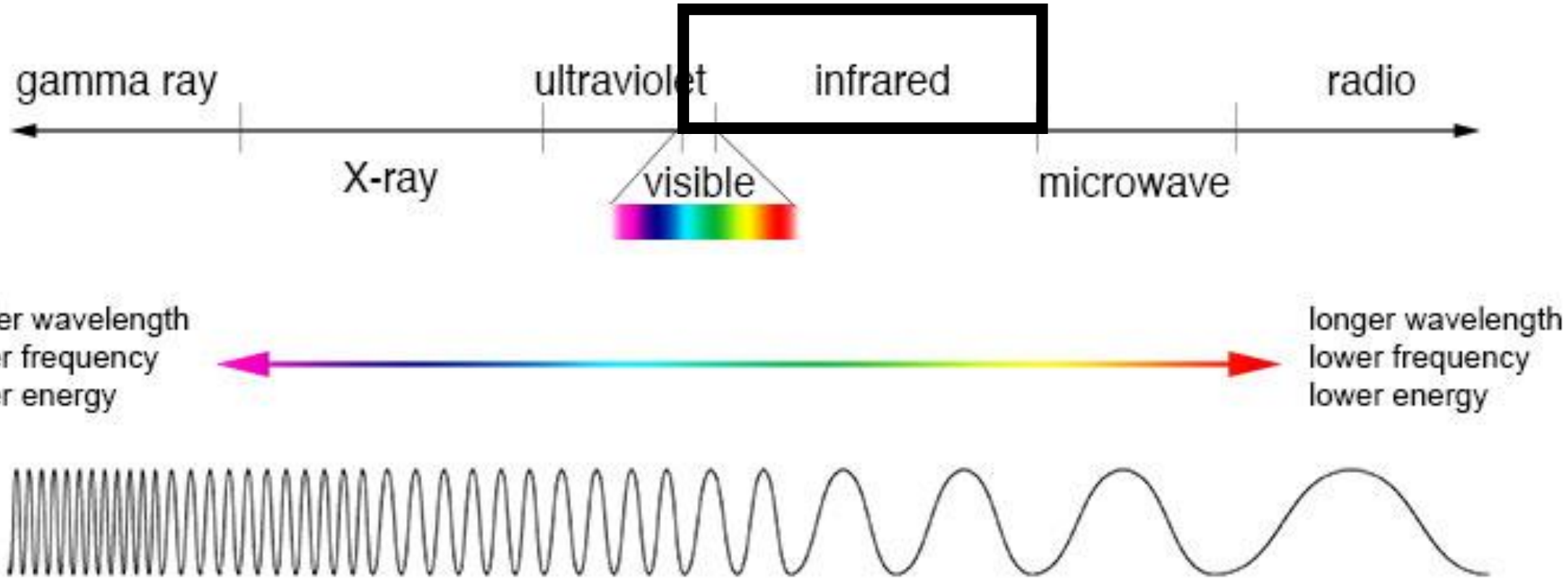
Cameron Peak fire area
This is what our eyes would see

Red = red
Green = green
Blue = blue

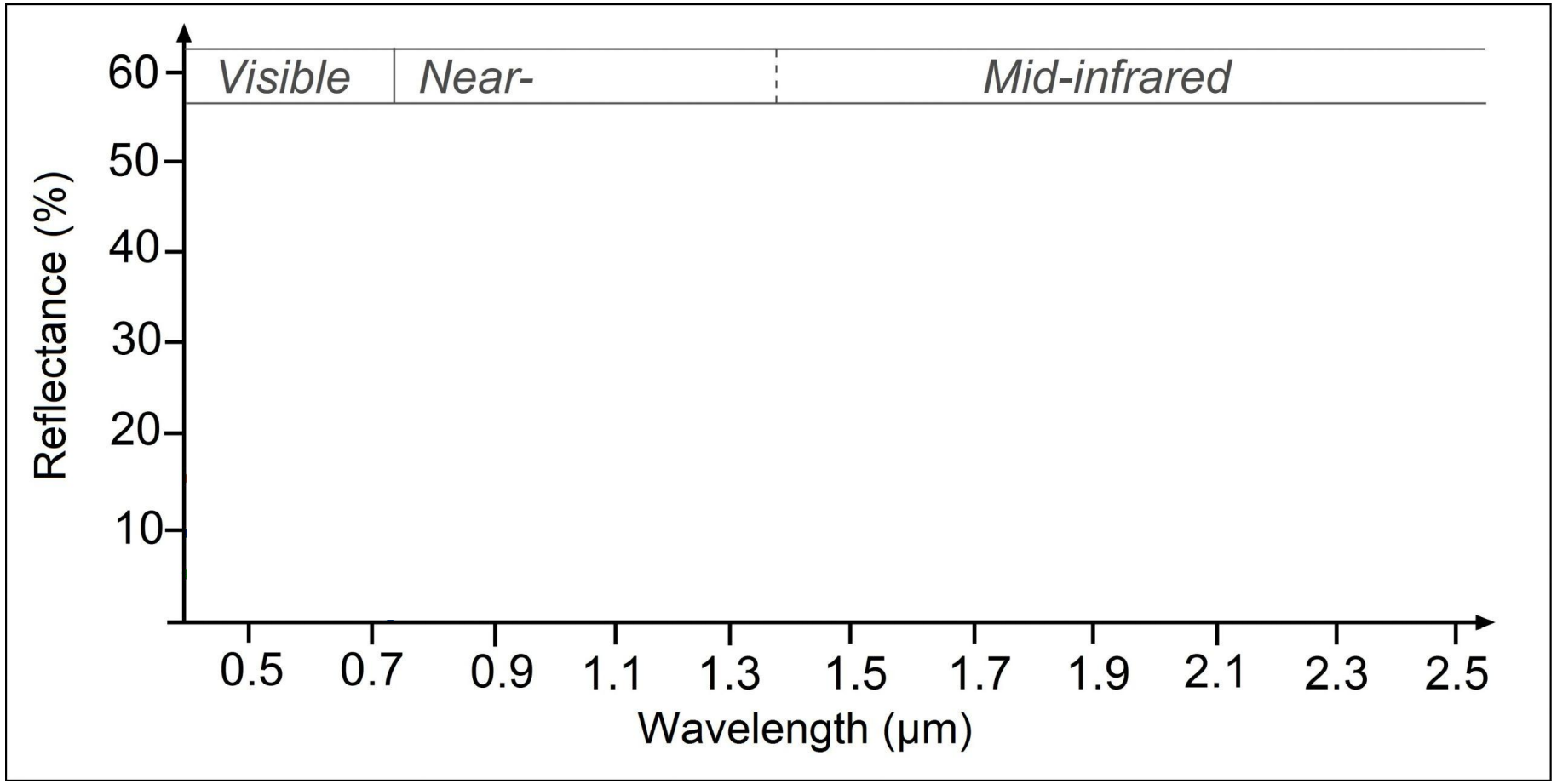



Red
Blue
Satellites measure this
Green
Infrared
light
oxygen
carbon
dioxide
carbohydrates
water

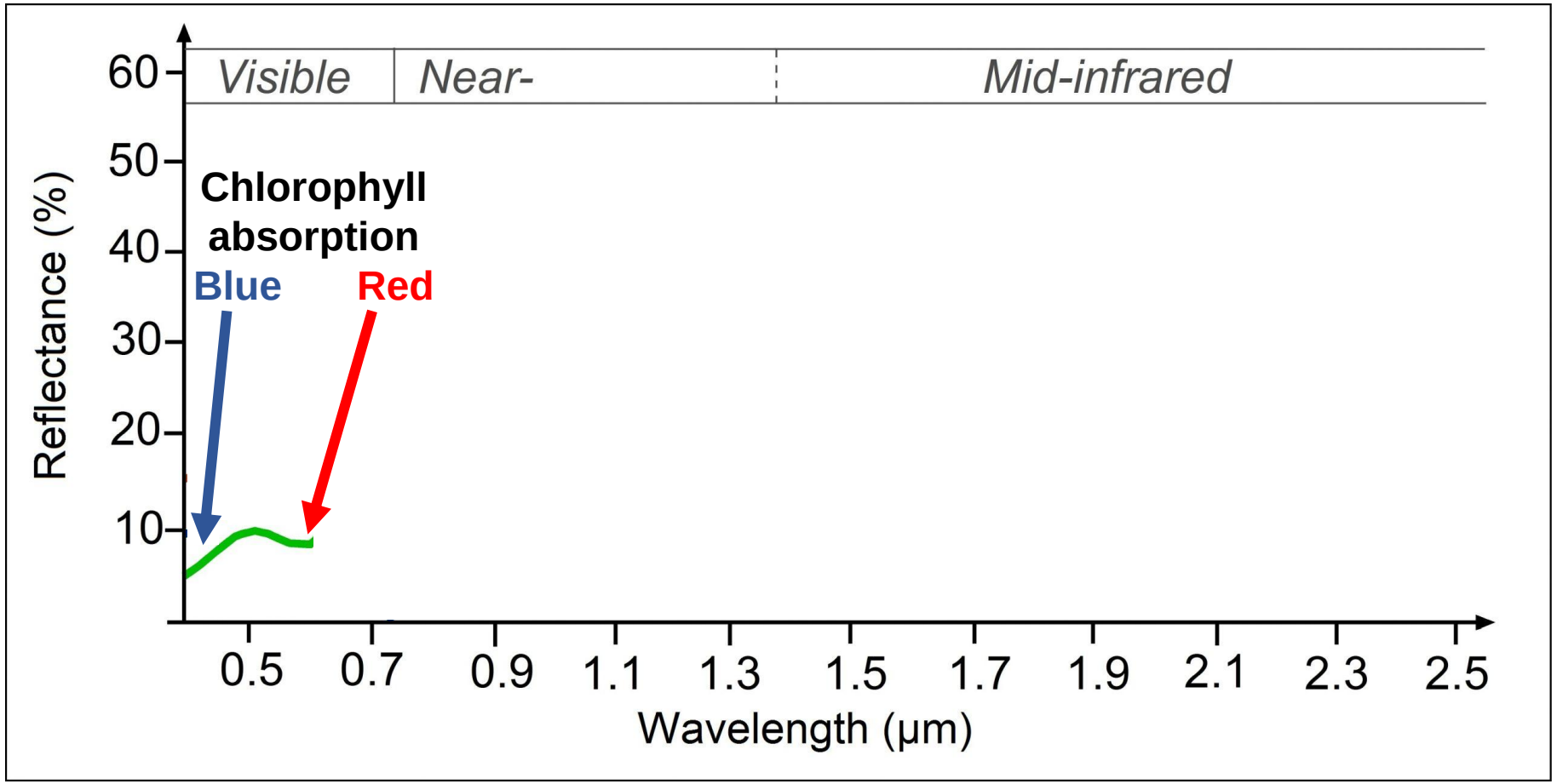
Electromagnetic spectrum



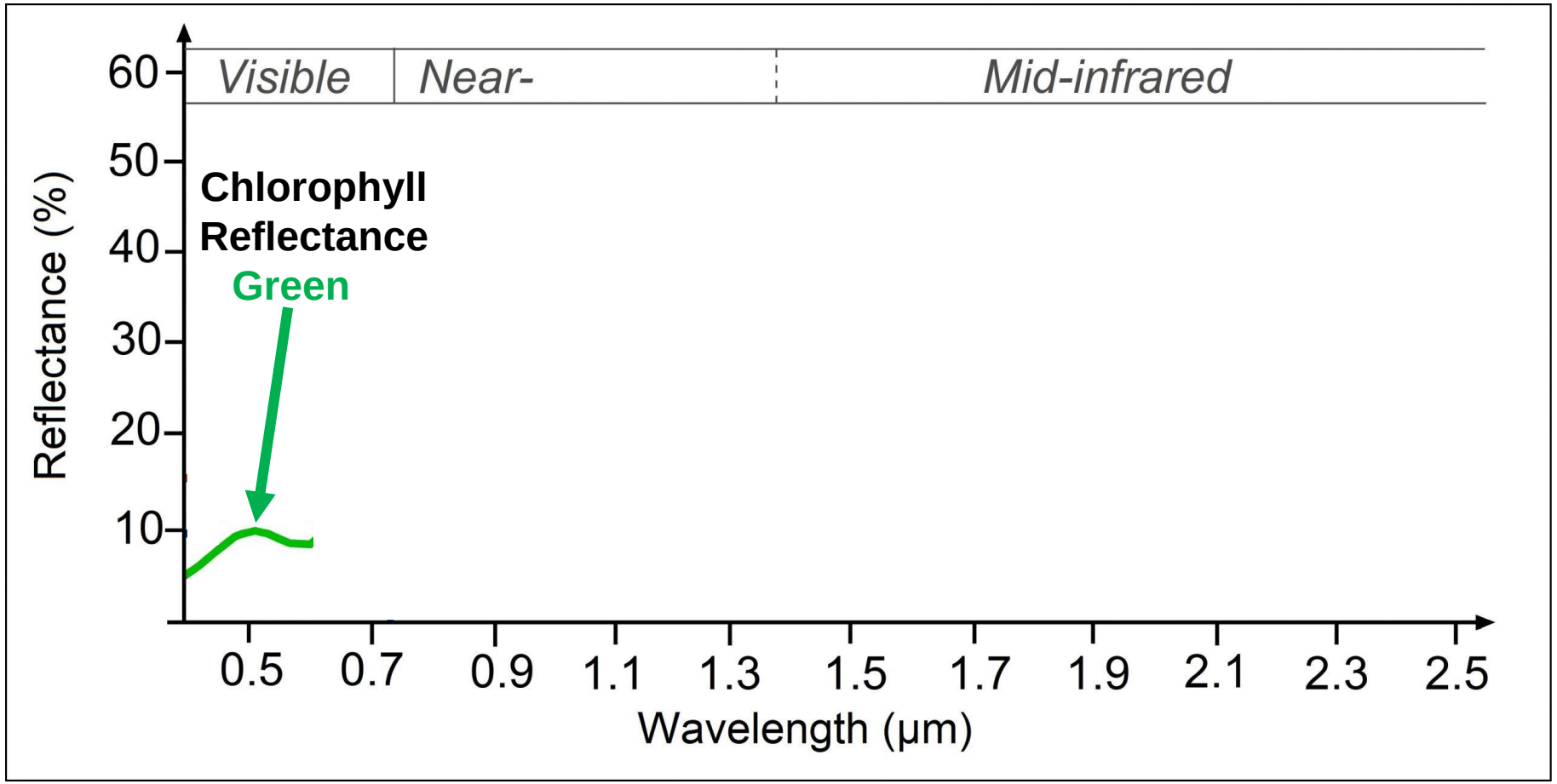
Reflectance of healthy plants



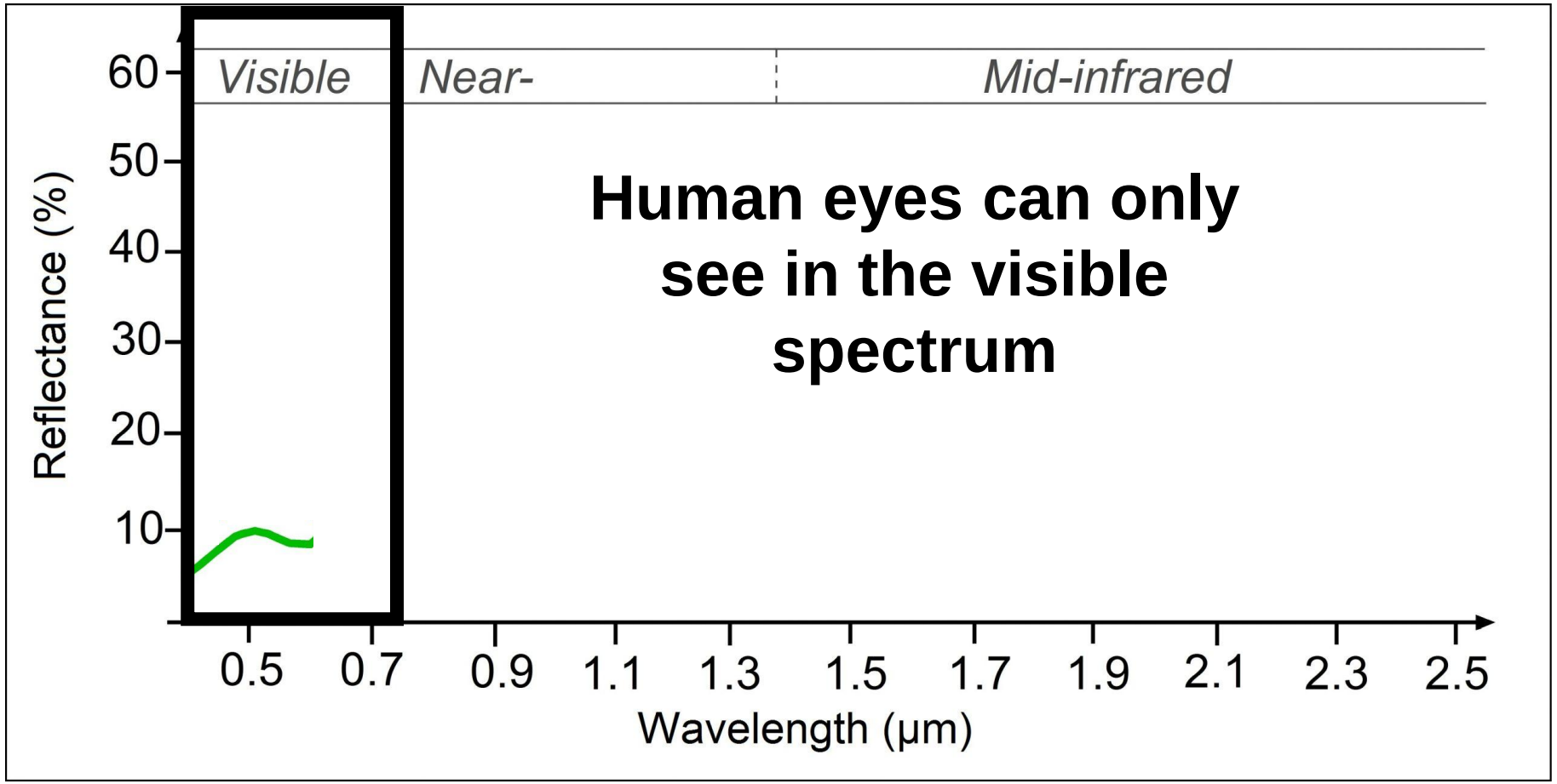
Reflectance



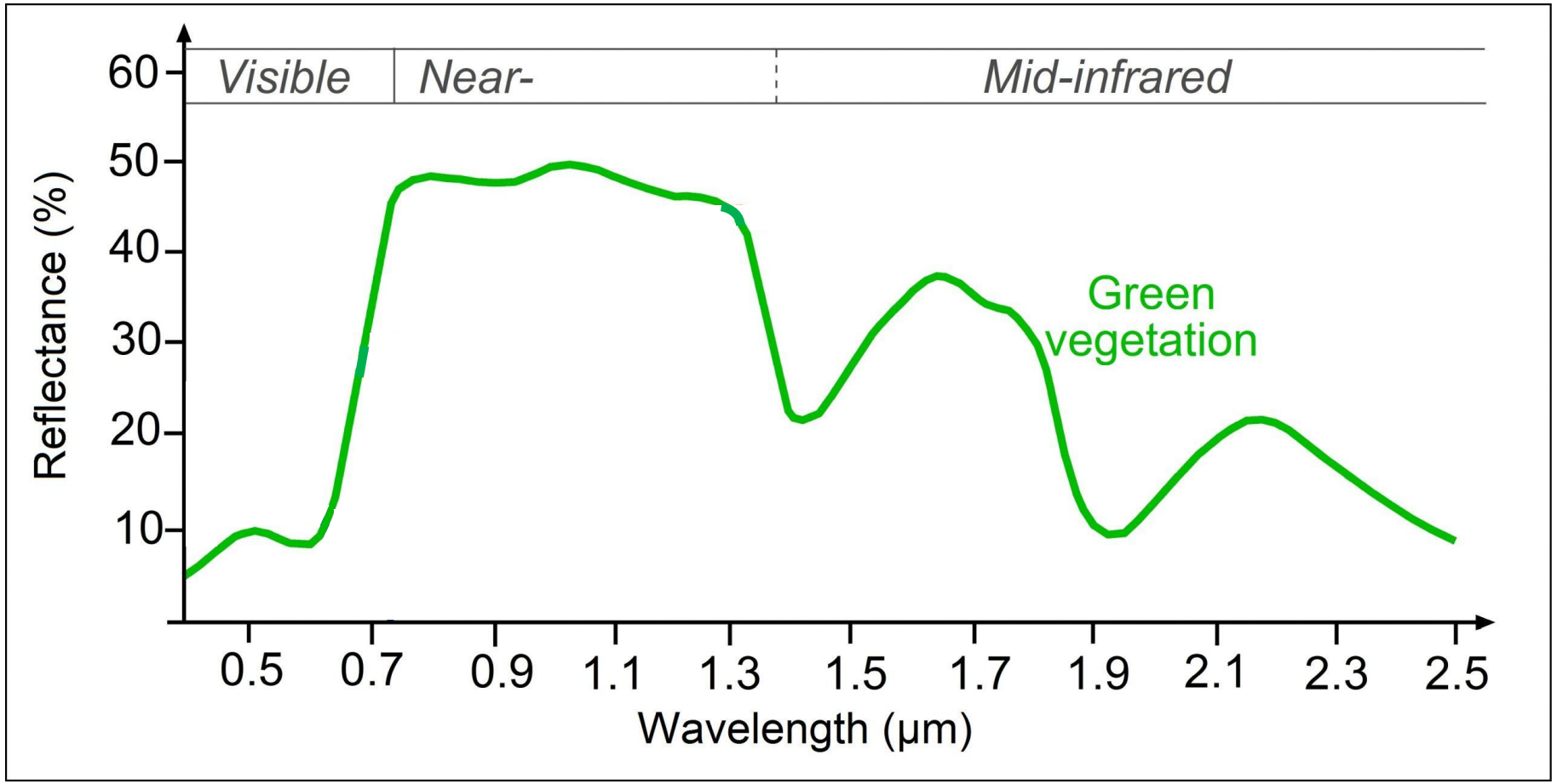
Reflectance



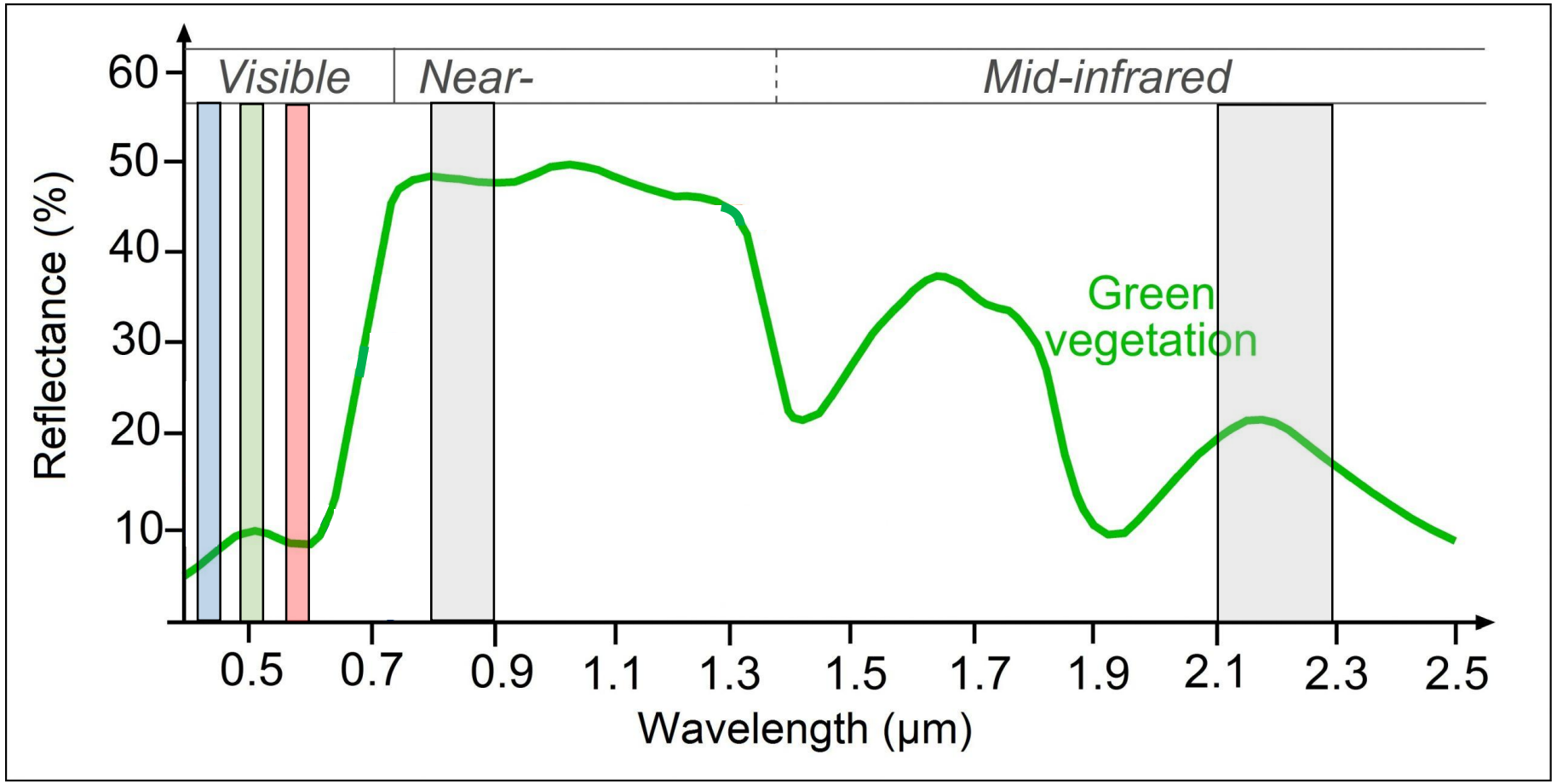
Reflectance



Reflectance

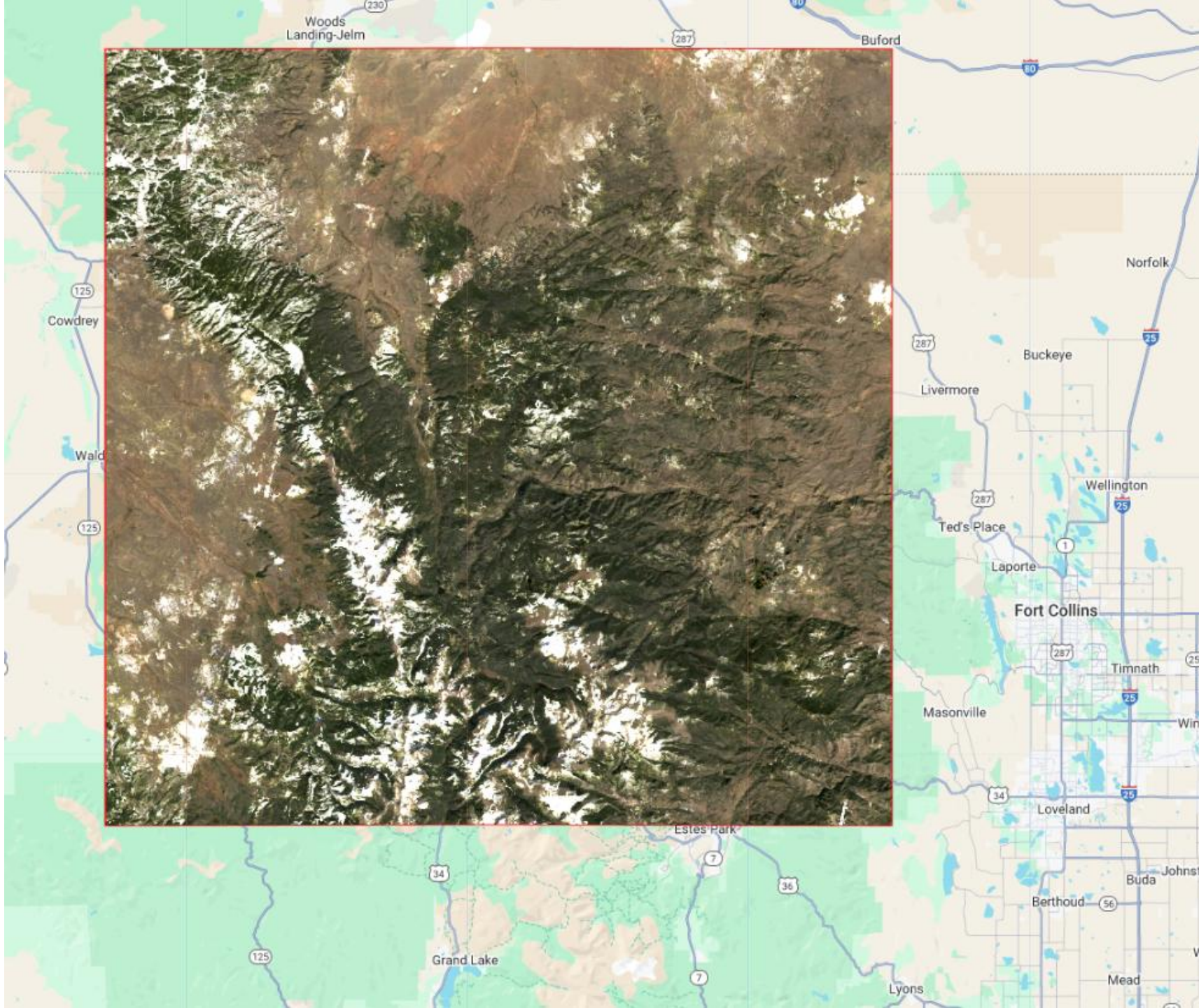


Satellites measure across this



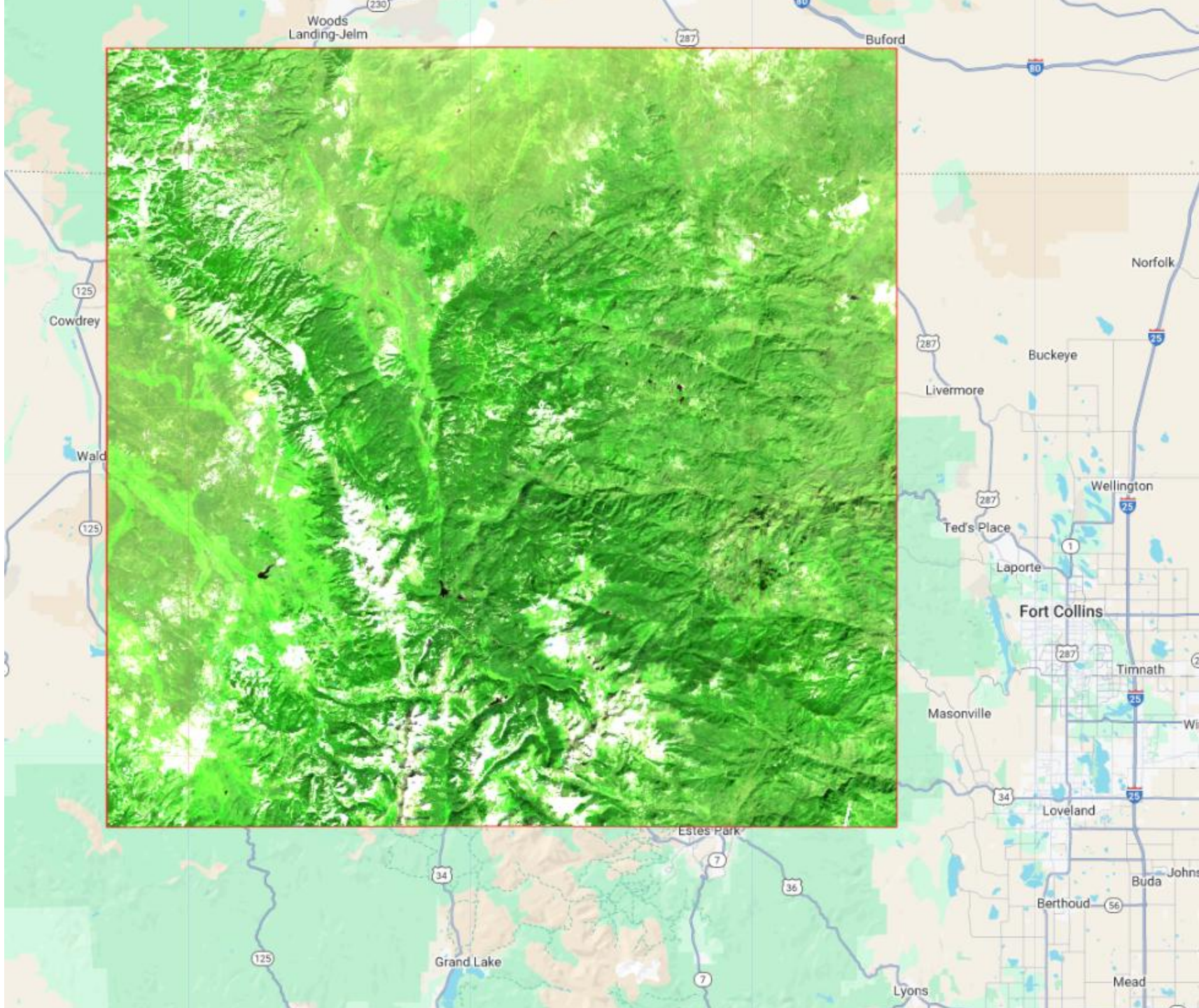
Cameron Peak fire area **Satellites see this**

Red = red
Green = green
Blue = blue



Cameron Peak fire area **Satellite ALSO see this**

Red = red
Green = **near infrared**
Blue = blue



Vegetation index:

a formula using remote sensing measurements to estimate the amount of green vegetation over a given area

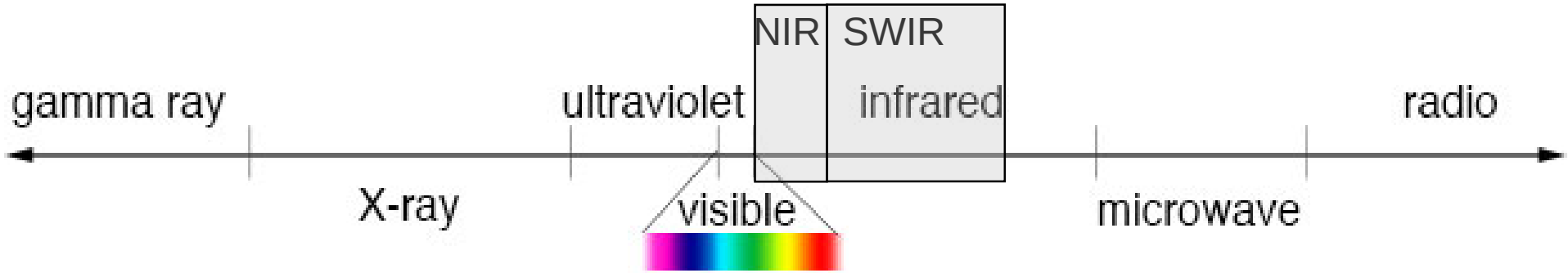
Example of a vegetation index:
Normalized Burn Ratio (NBR)

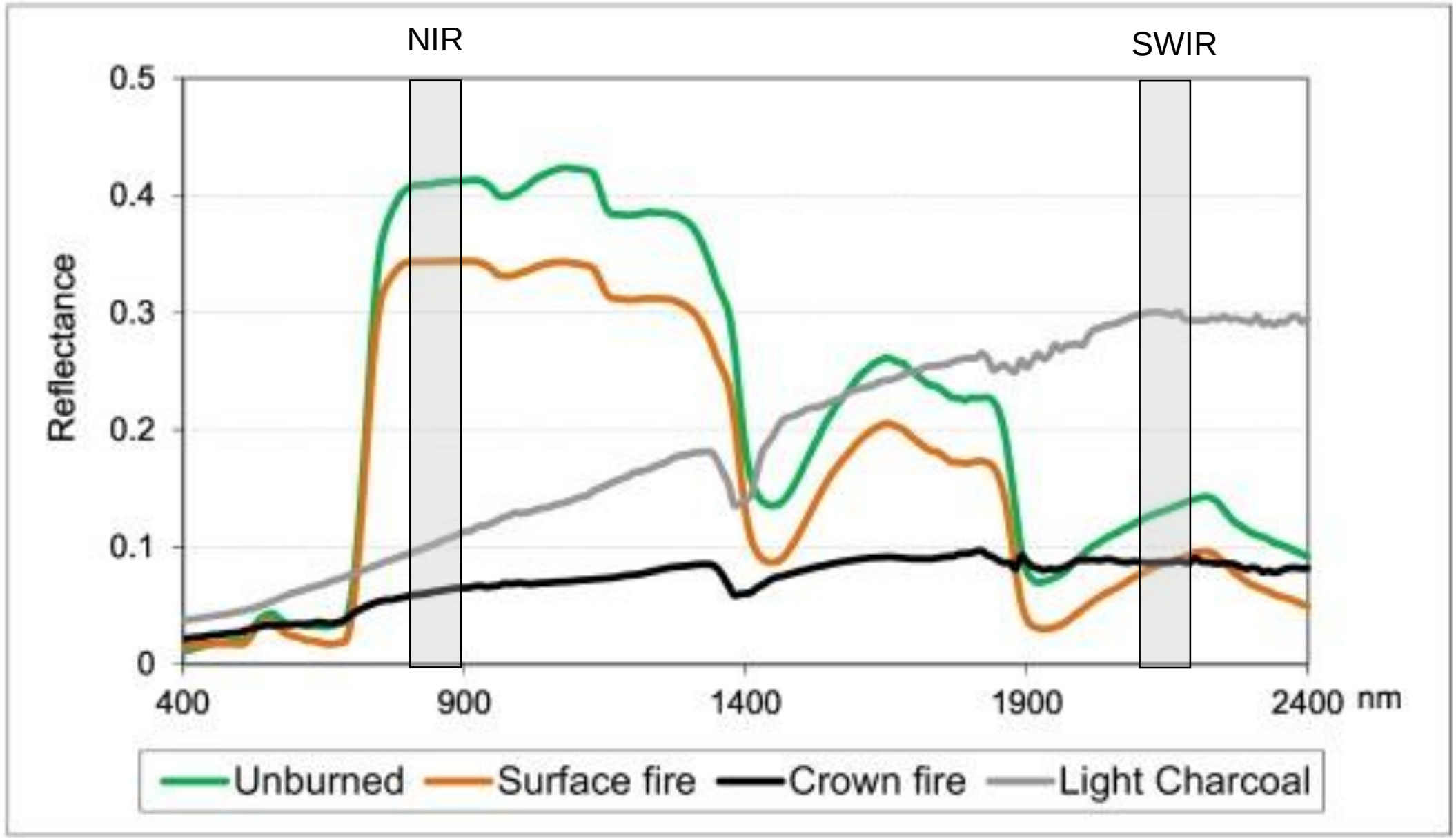
used to identify burned areas and provide a measure of burn severity

NBR = (NIR – SWIR) / (NIR + SWIR)

NIR = Near Infrared

SWIR = Shortwave Infrared





Chuvieco et al. (2019)

Normalized Burn Ratio (NBR)

Range from -1 to 1

High NBR → Healthy vegetation 🌱 (closer to 1)

Low NBR → Burned or disturbed areas 🔥 (closer to 0 or slightly below)

Disturbance changed NBR

We can quantify disturbance by measuring the change in NBR values

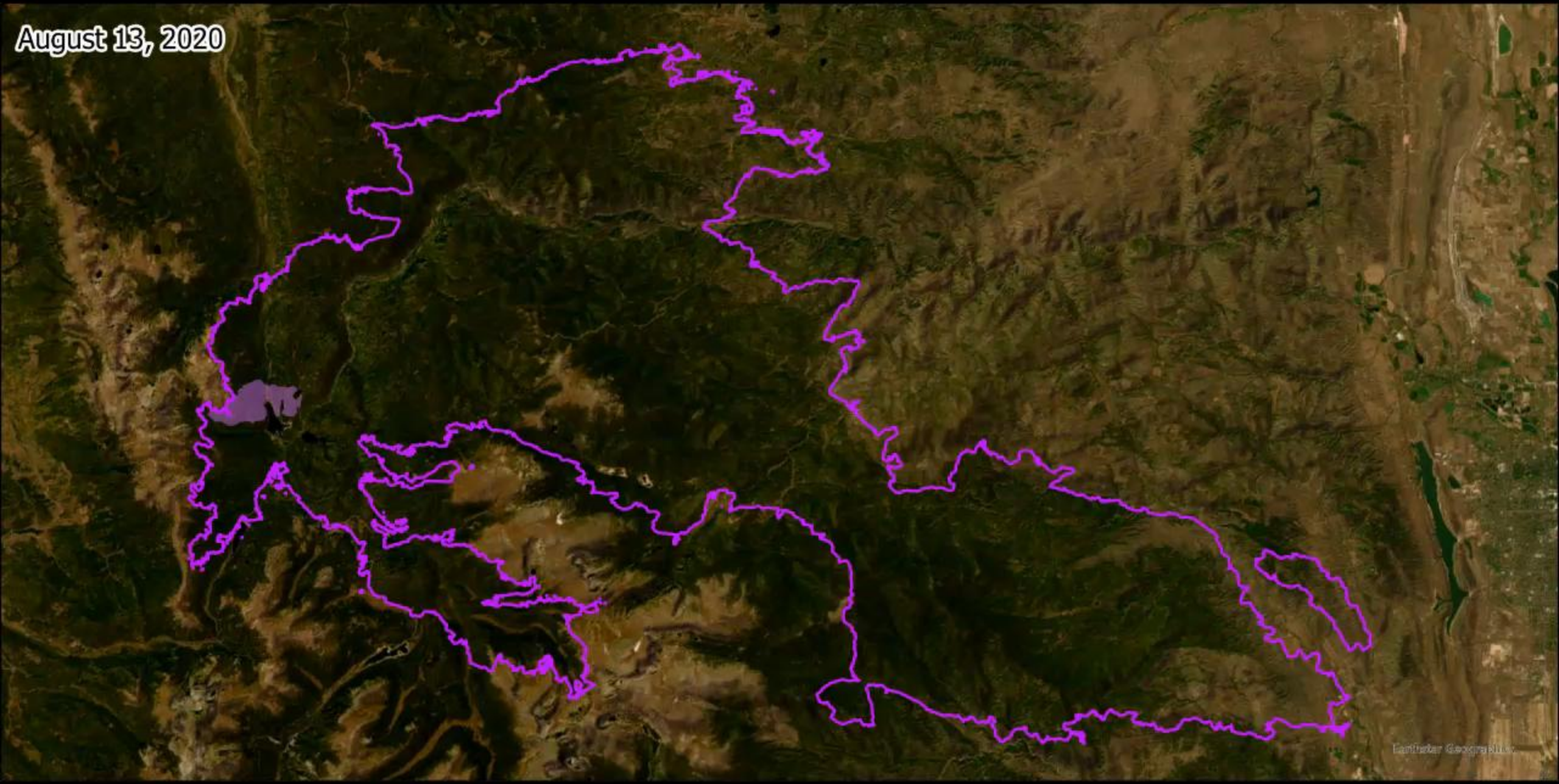
Change in NBR (dNBR)

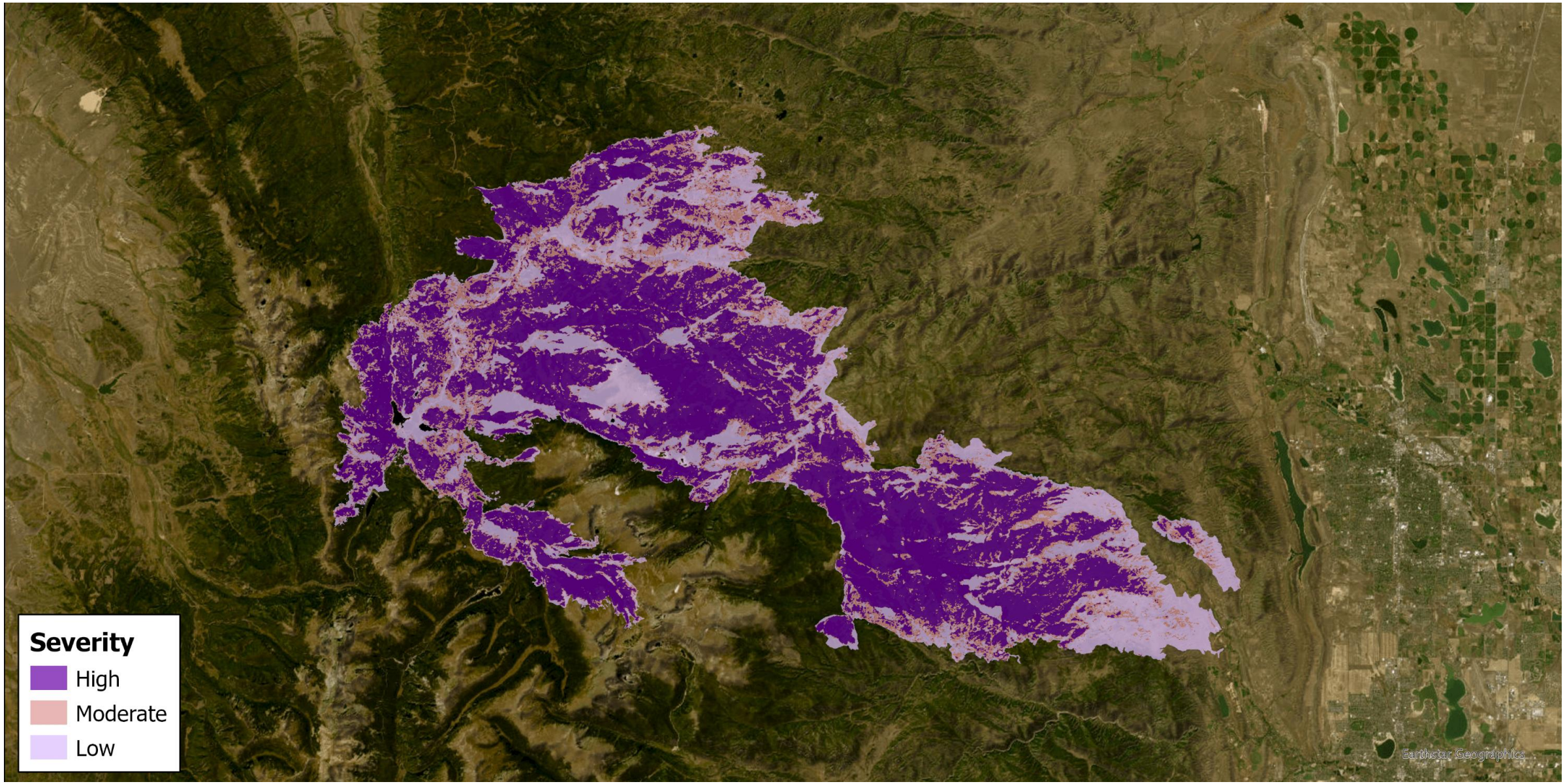
NBR pre	–	NBR post	=	dNBR
0.7 	-	-0.1 	=	0.8
0.7 	-	0.3 	=	0.4
0.7 	-	0.7 	=	0

Activity

jazlynnhall.com/teachingdemo

- Where do you think the fire was?
- Can you identify areas with high, moderate, and low burn severity?
- What type of fire may have occurred in each area?
- Did you notice anything else on the landscape?


August 13, 2020


Severity
High
Moderate
Low
Earthstar Geographics

https://storymaps.arcgis.com/stories/9c5cb69ee85e47b9a4368259e4b60ea0