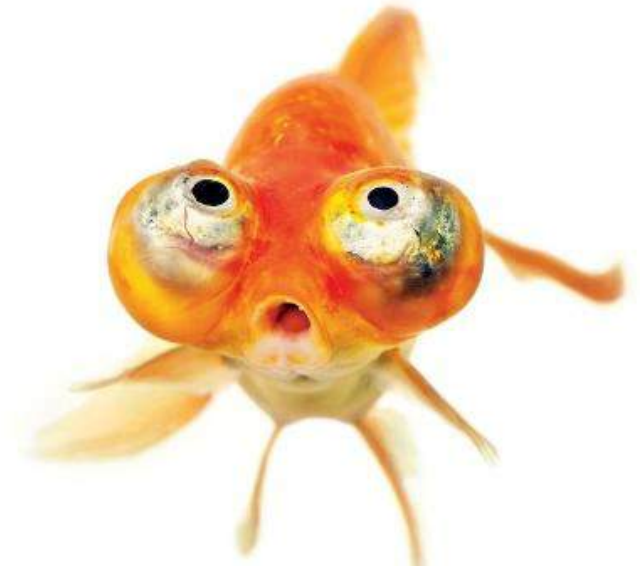


Today's class schedule

- **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

So can satellites!

Deforestation

Brazil
2000-2019



NASA



Photo by Jazlynn Hall



Photo by Omar Gutierrez

NASA

Hurricane Maria

Puerto Rico 2017

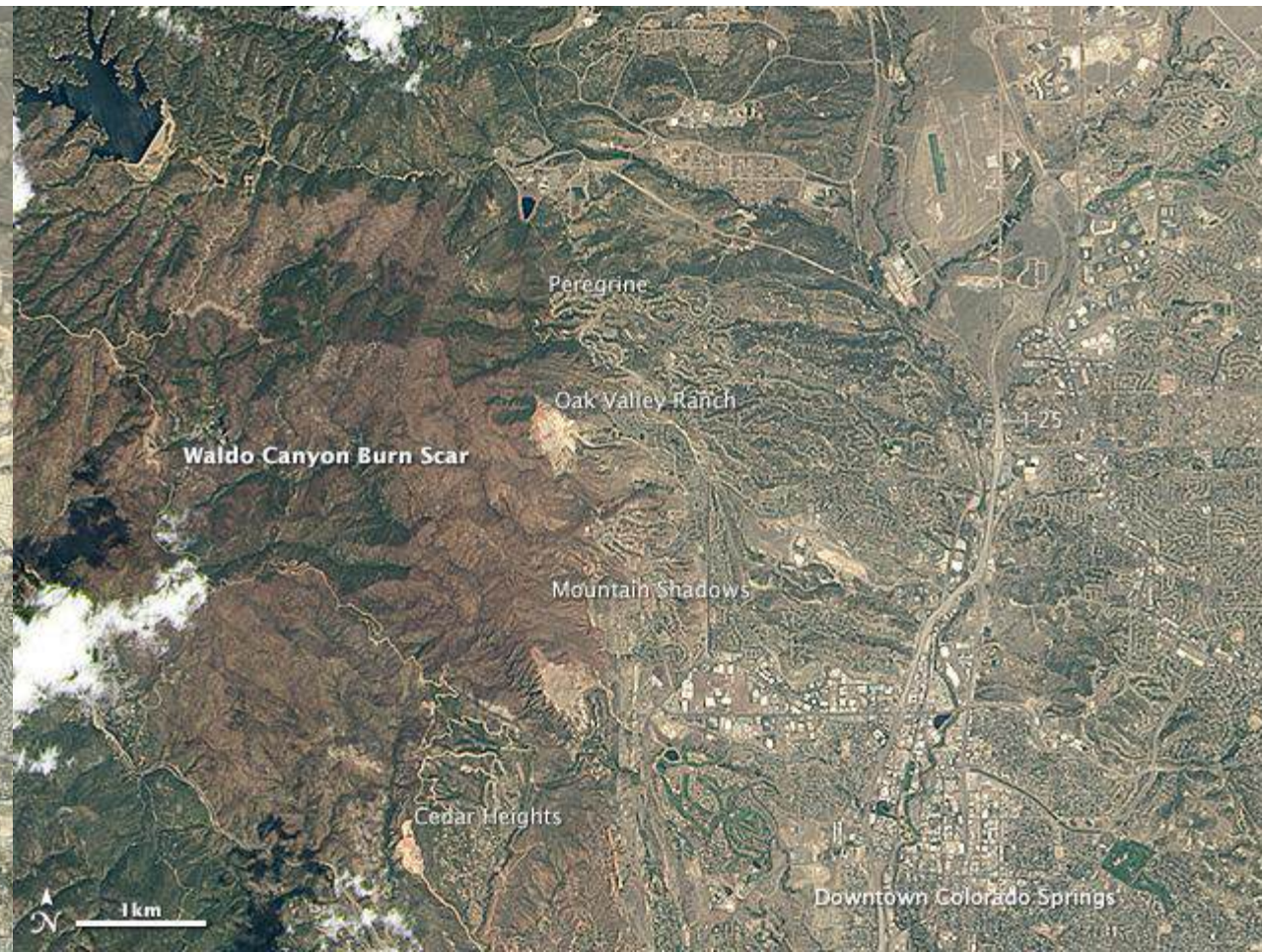


1985



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

Low



Moderate



High



Types of wildfire



We can measure burn severity across
landscapes using remote sensing

Remote sensing:

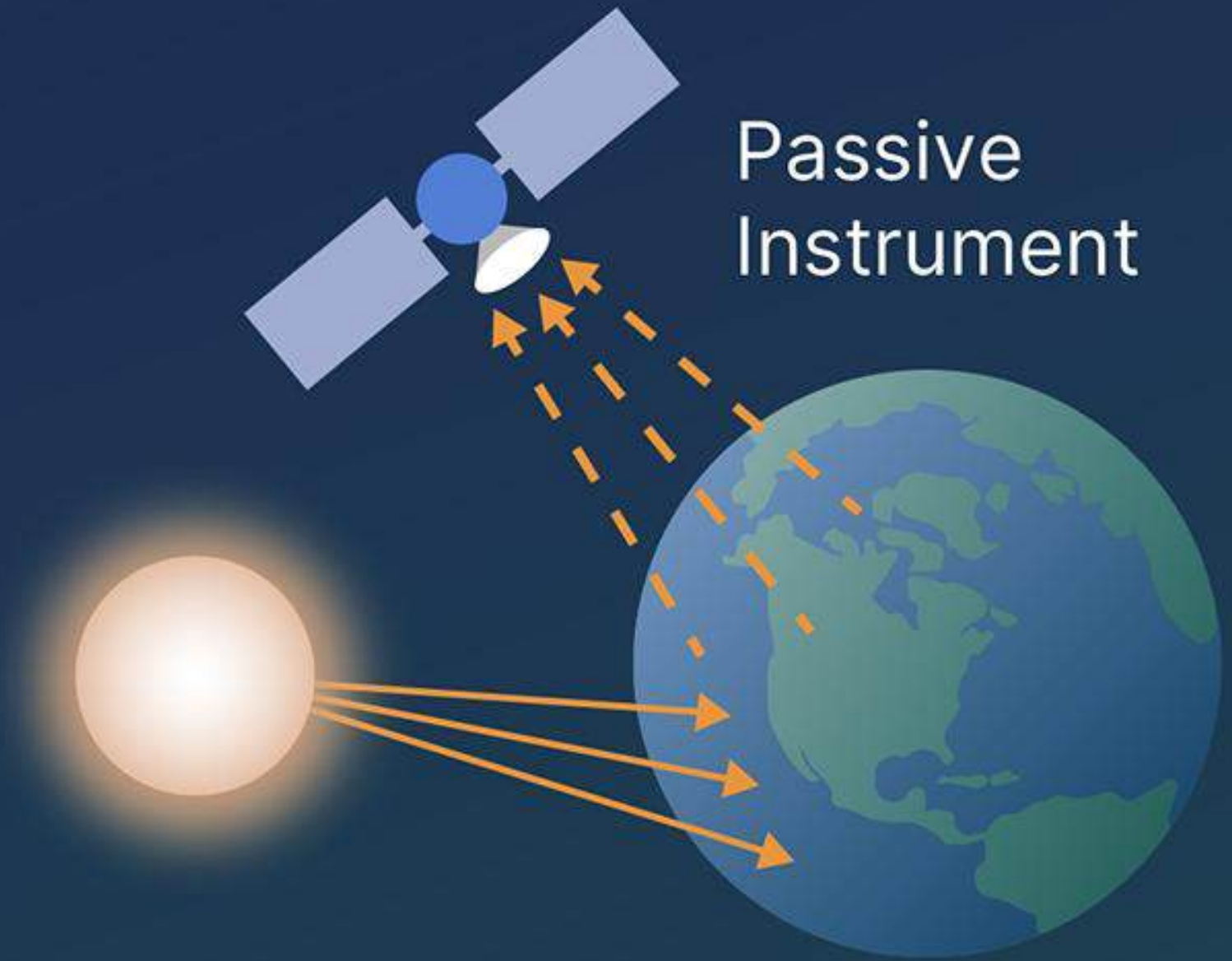
the acquiring of information from a distance
(NASA)

We use remote sensing every day

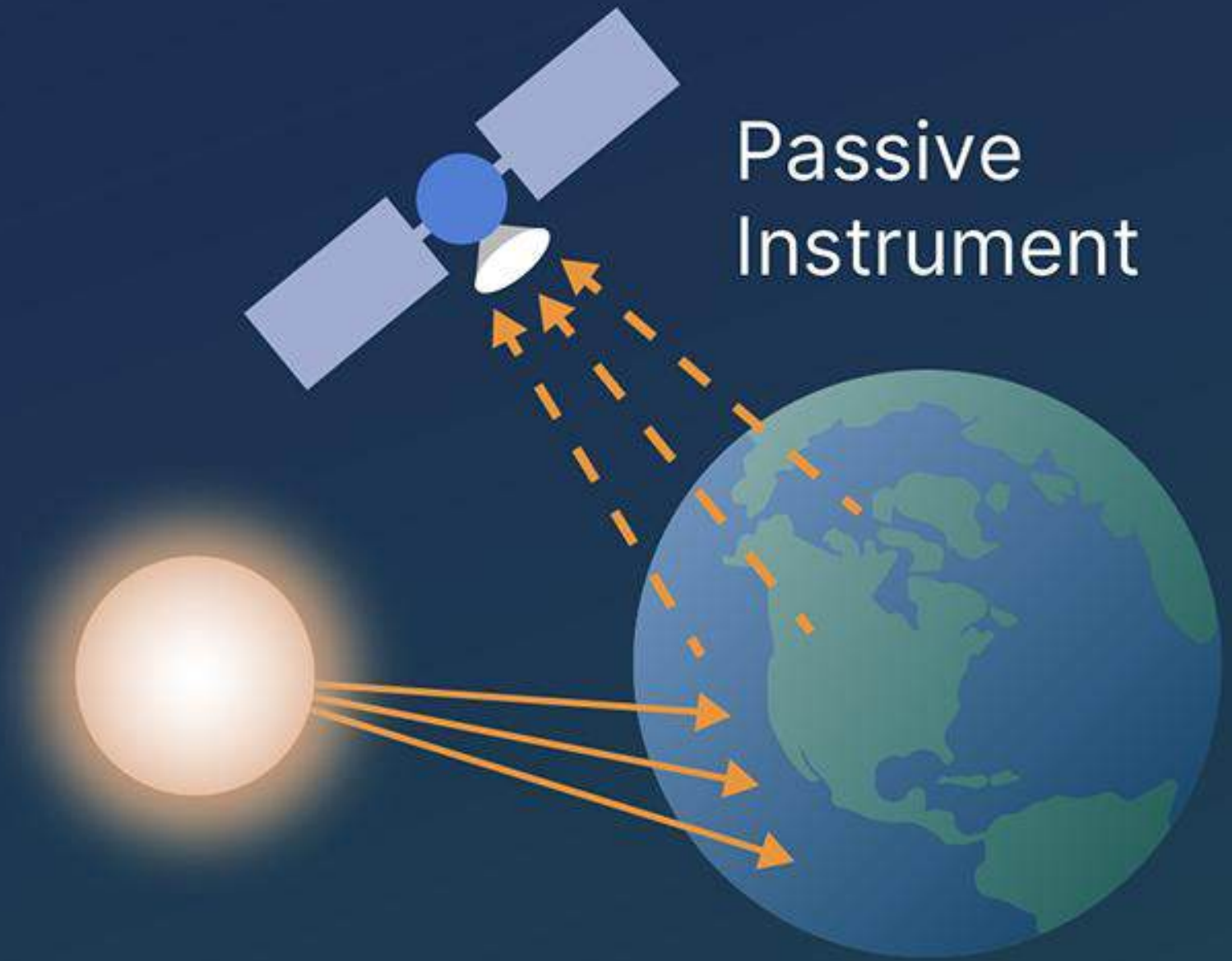
Our eyes!



**Satellites “see”
ecosystems using
light**



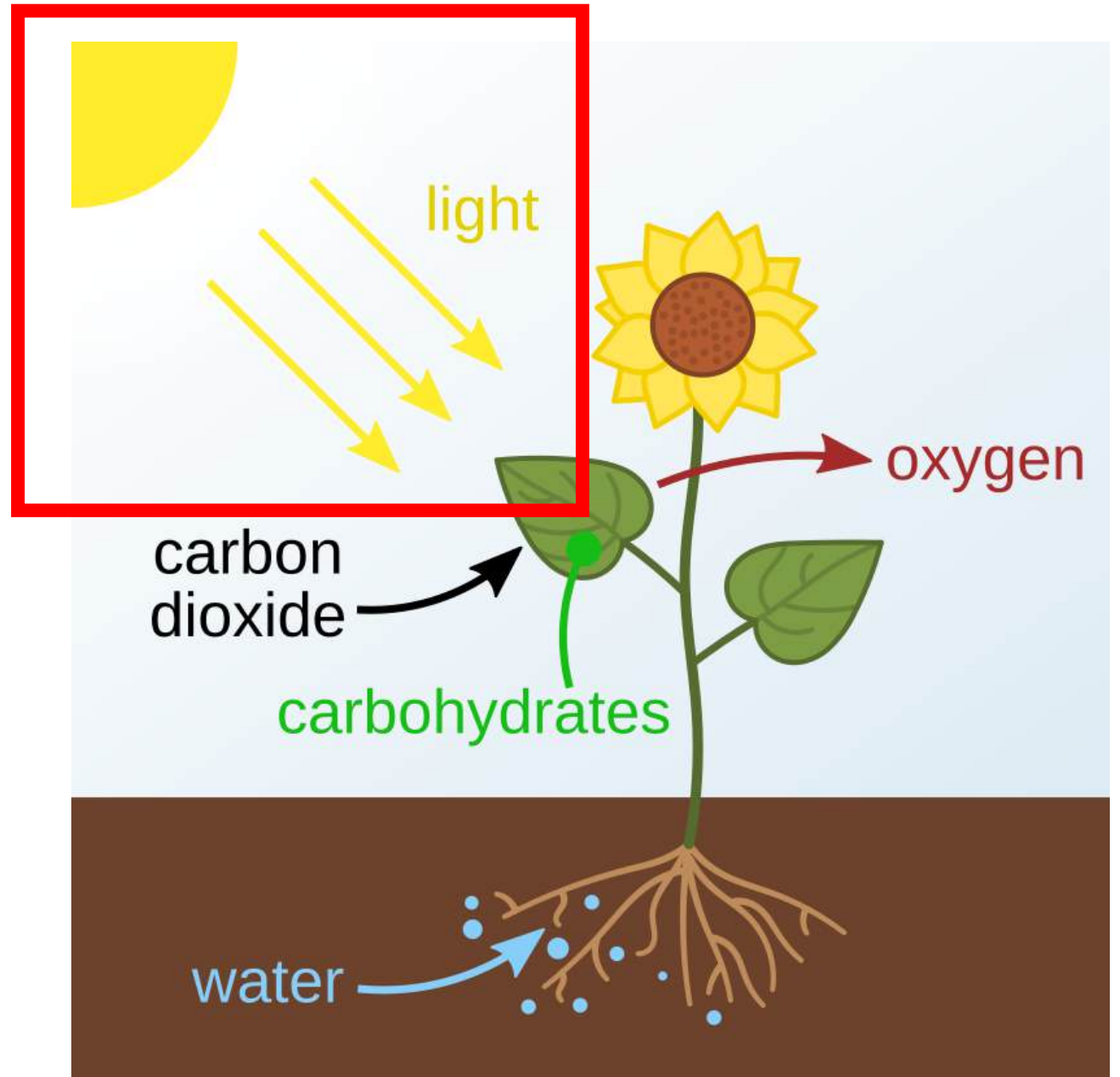
Satellites “see”
ecosystems using
reflections of light
from the earth’s
surface



How (on earth) does this relate to plants?

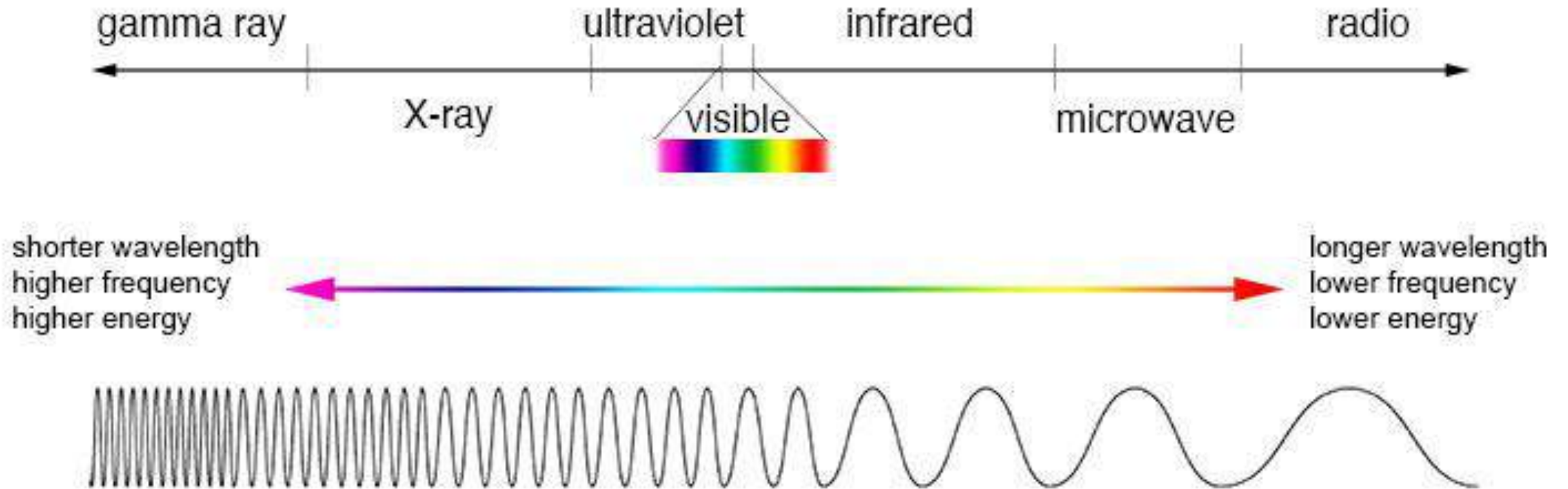
Photosynthesis

What is light?



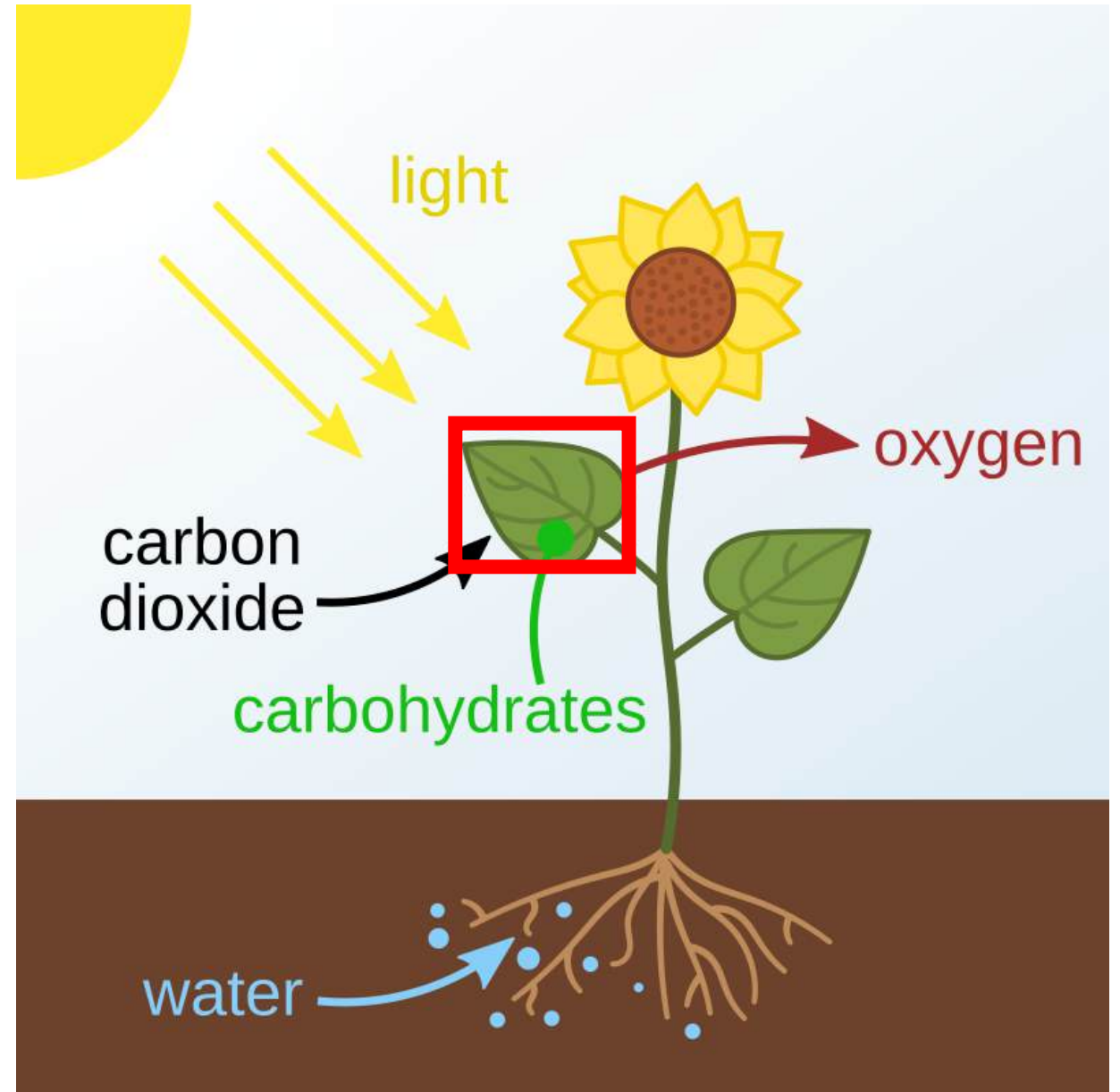
LIGHT = ELECTROMAGNETIC RADIATION

Electromagnetic spectrum



Photosynthesis

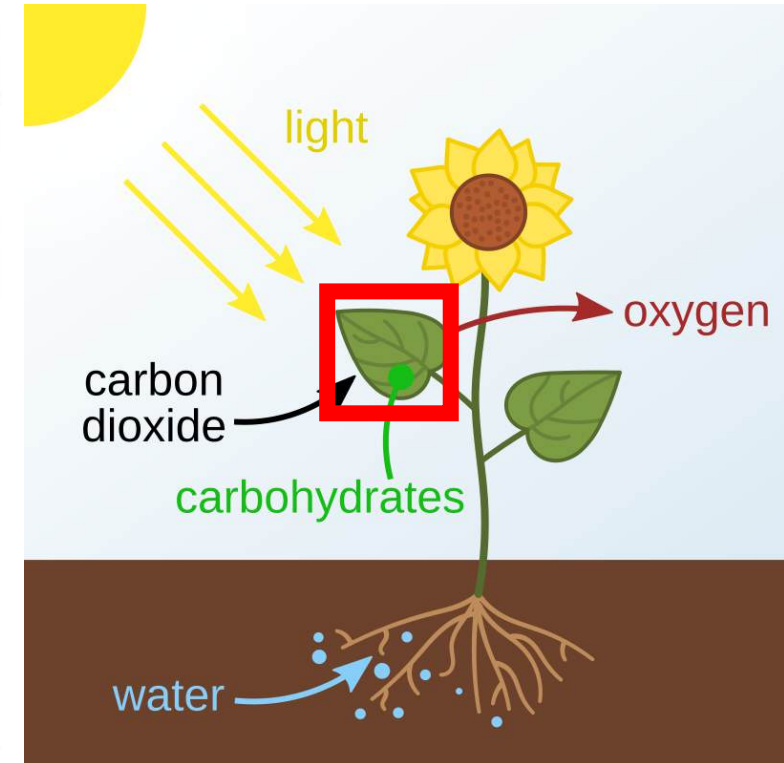
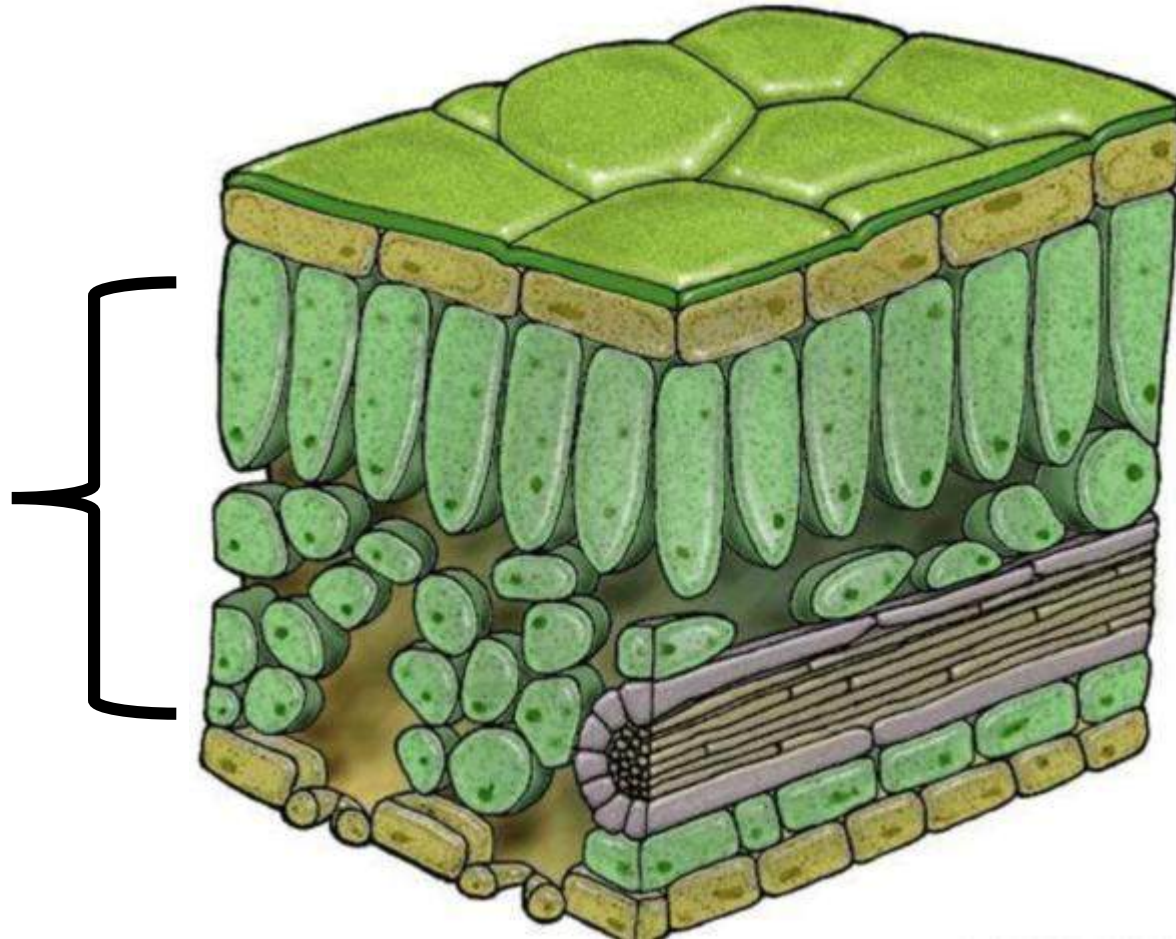
Chloroplast: specialized organelle, the site of photosynthesis



Photosynthesis

Leaf cross section:

Chloroplasts
found here

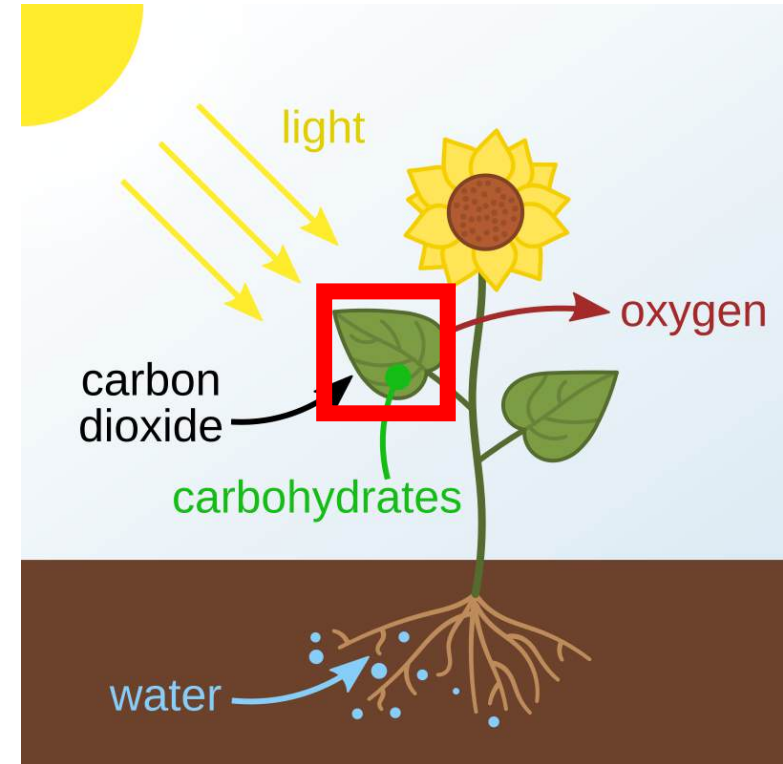
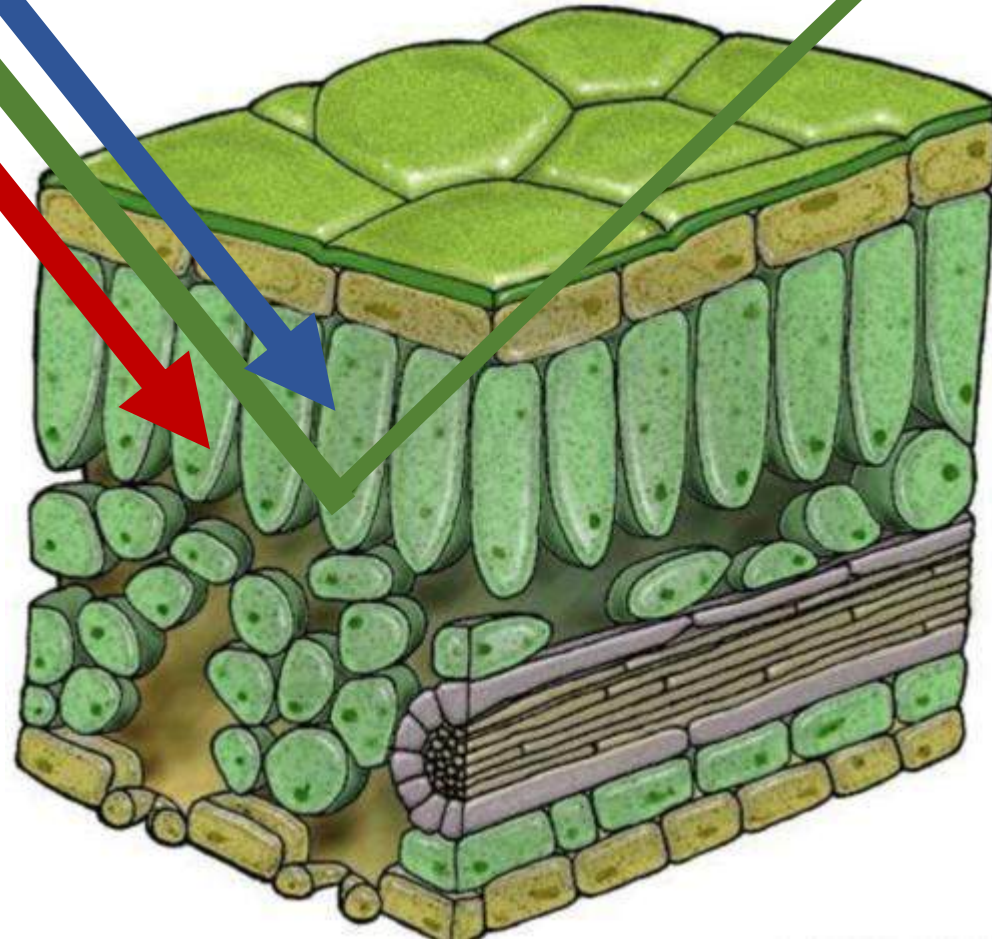


Satellites measure this

Red

Blue

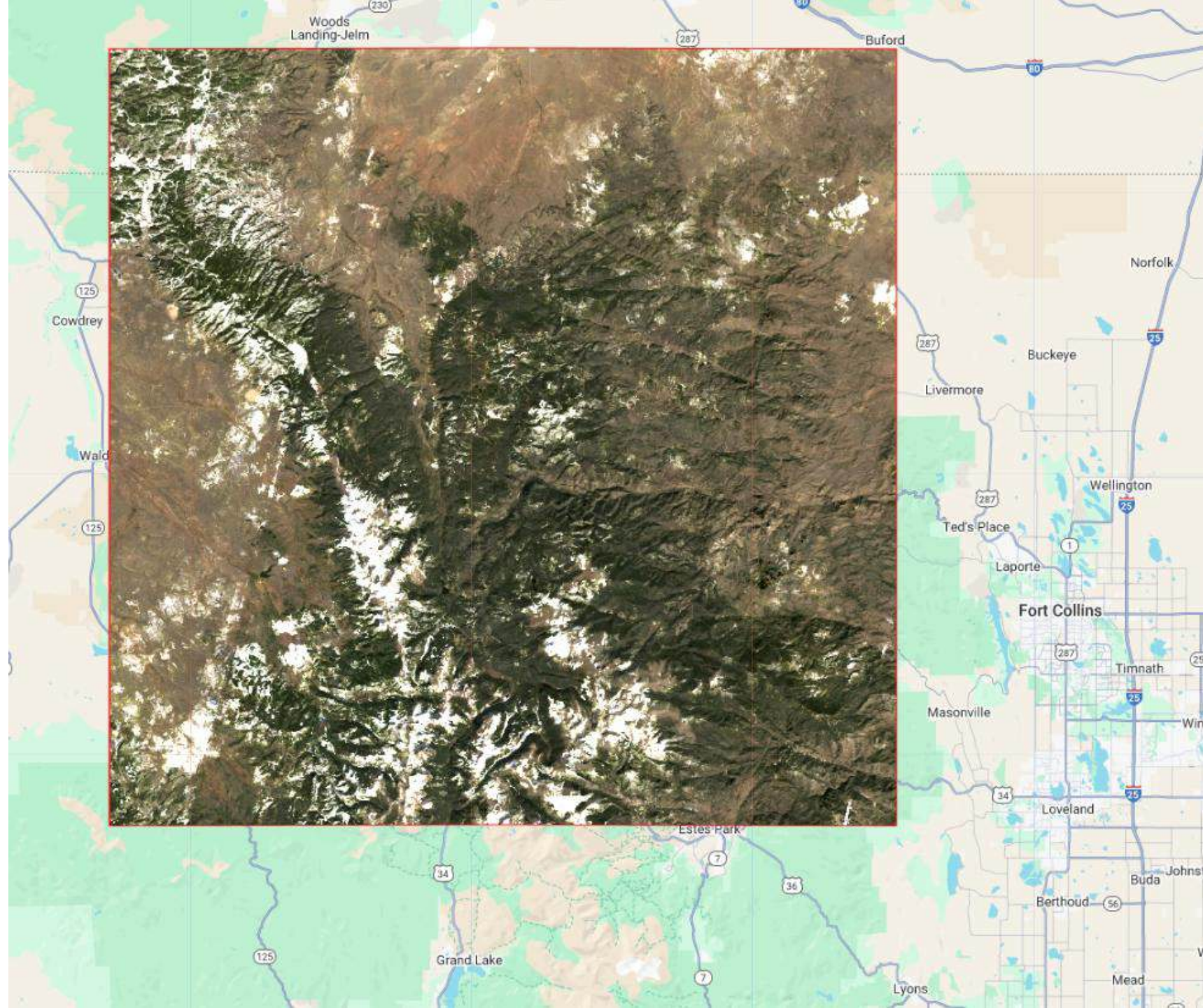
Green



Cameron Peak fire area

This is what our
eyes would see

Red = red
Green = green
Blue = blue



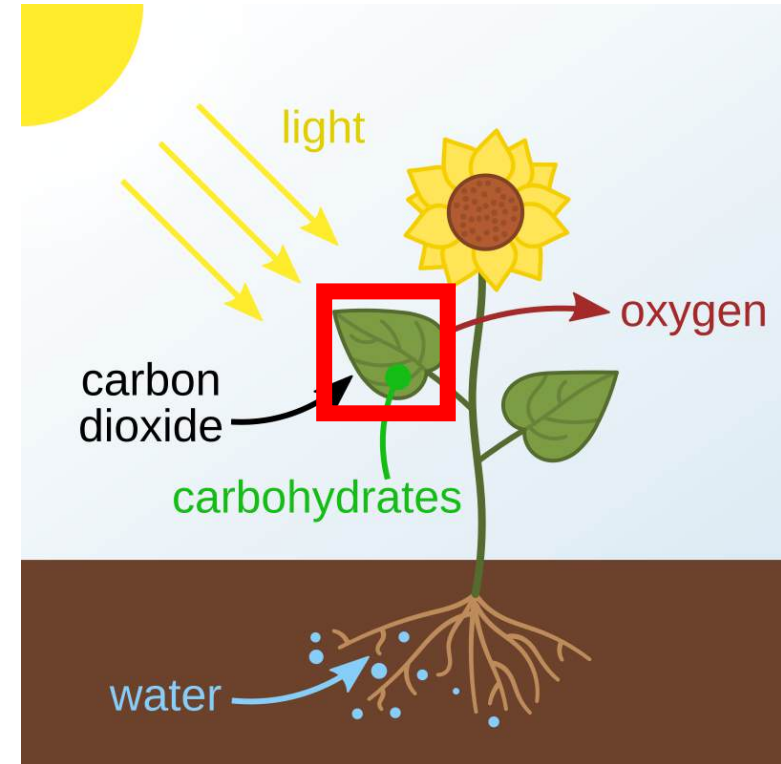
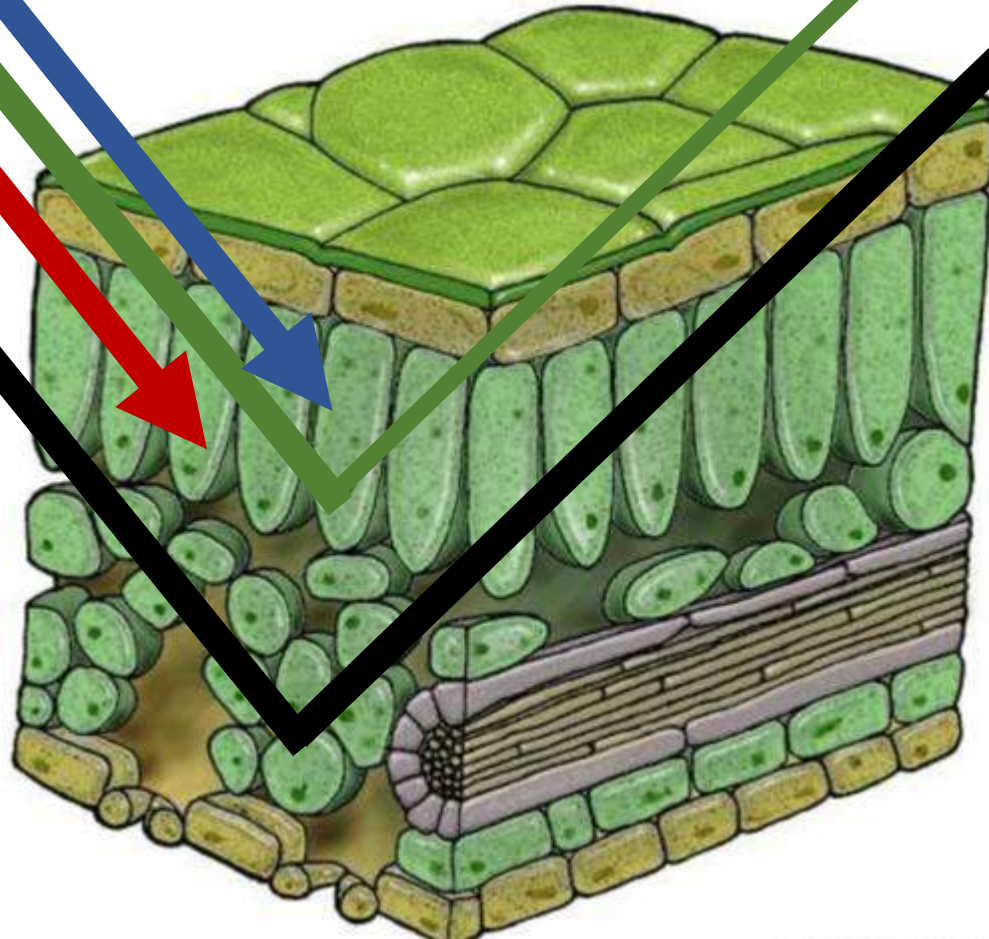
Satellites measure this

Green

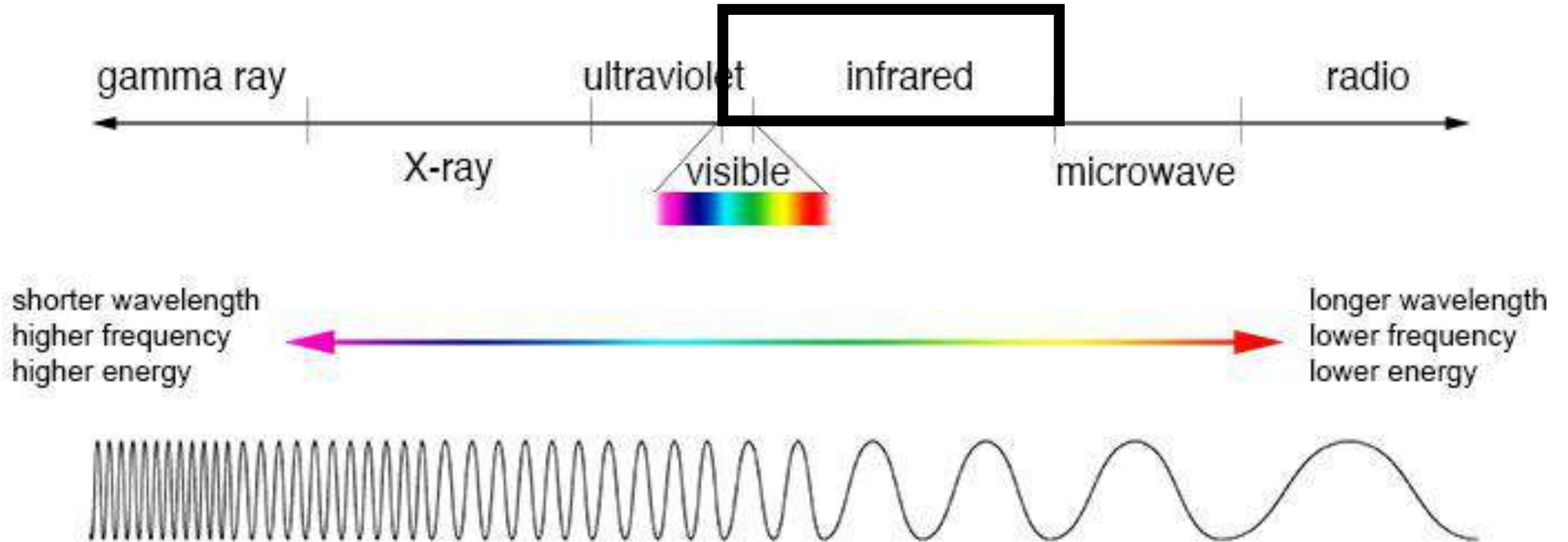
Infrared

Red

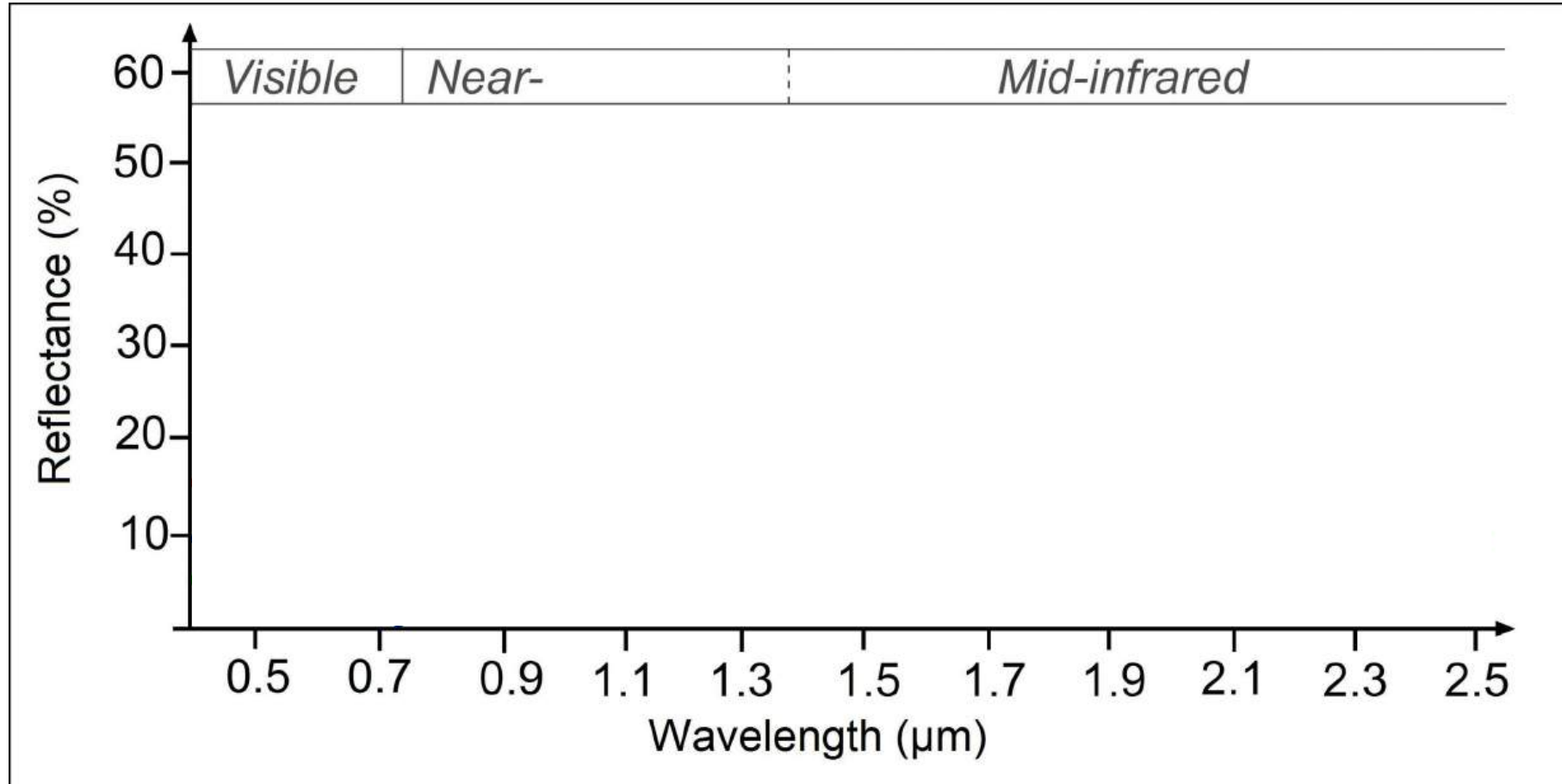
Blue



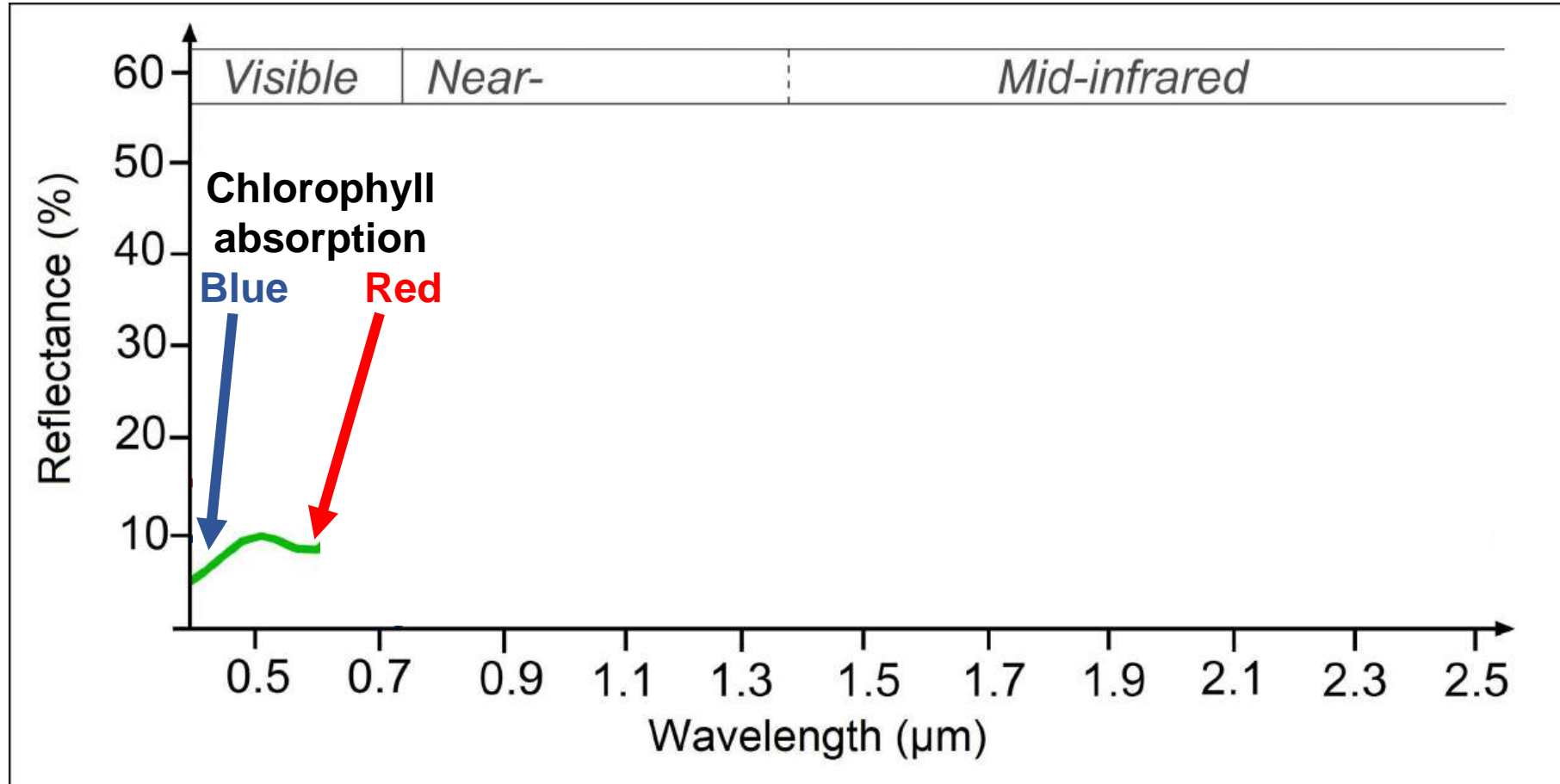
Electromagnetic spectrum



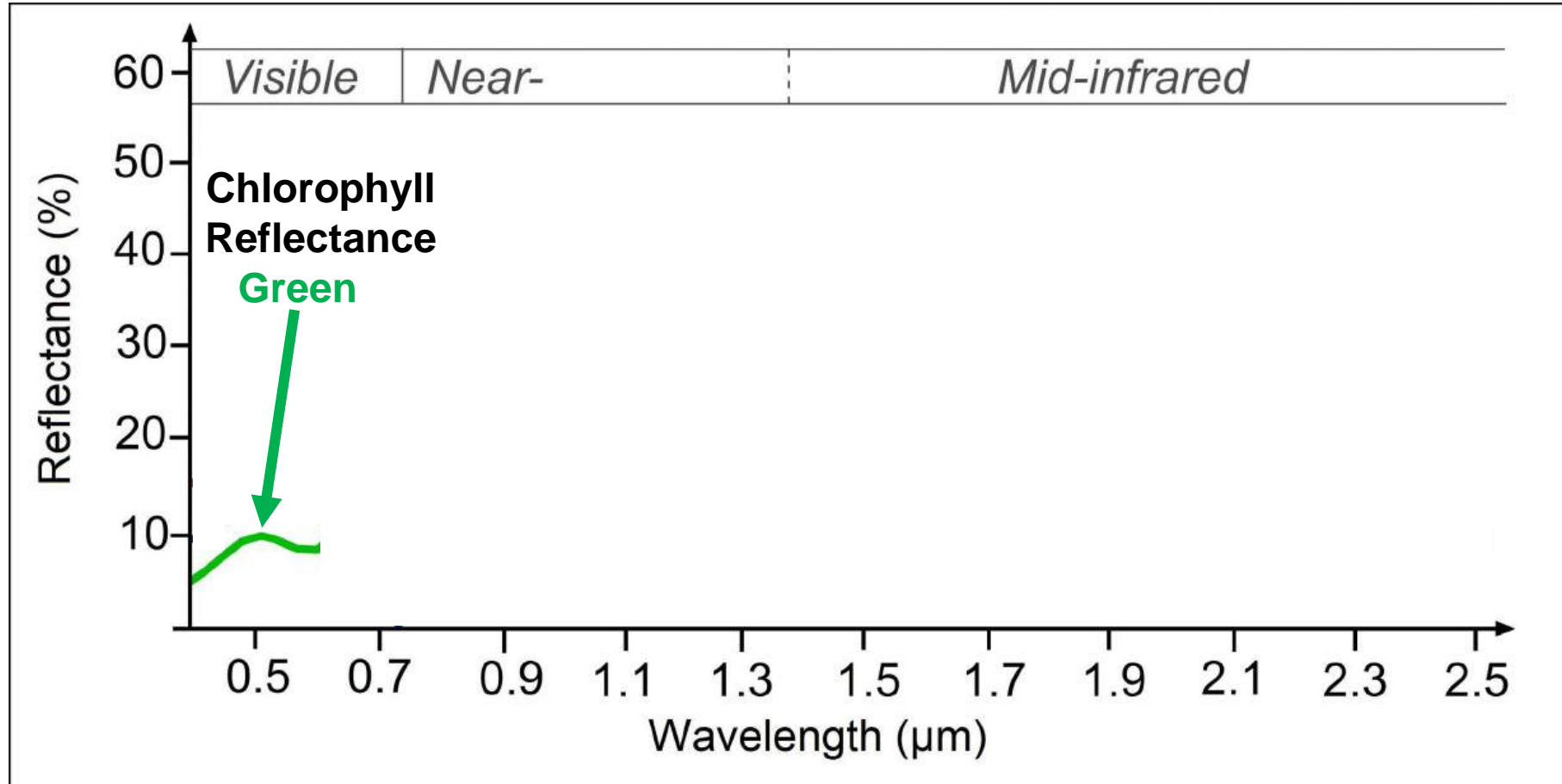
Reflectance of healthy plants



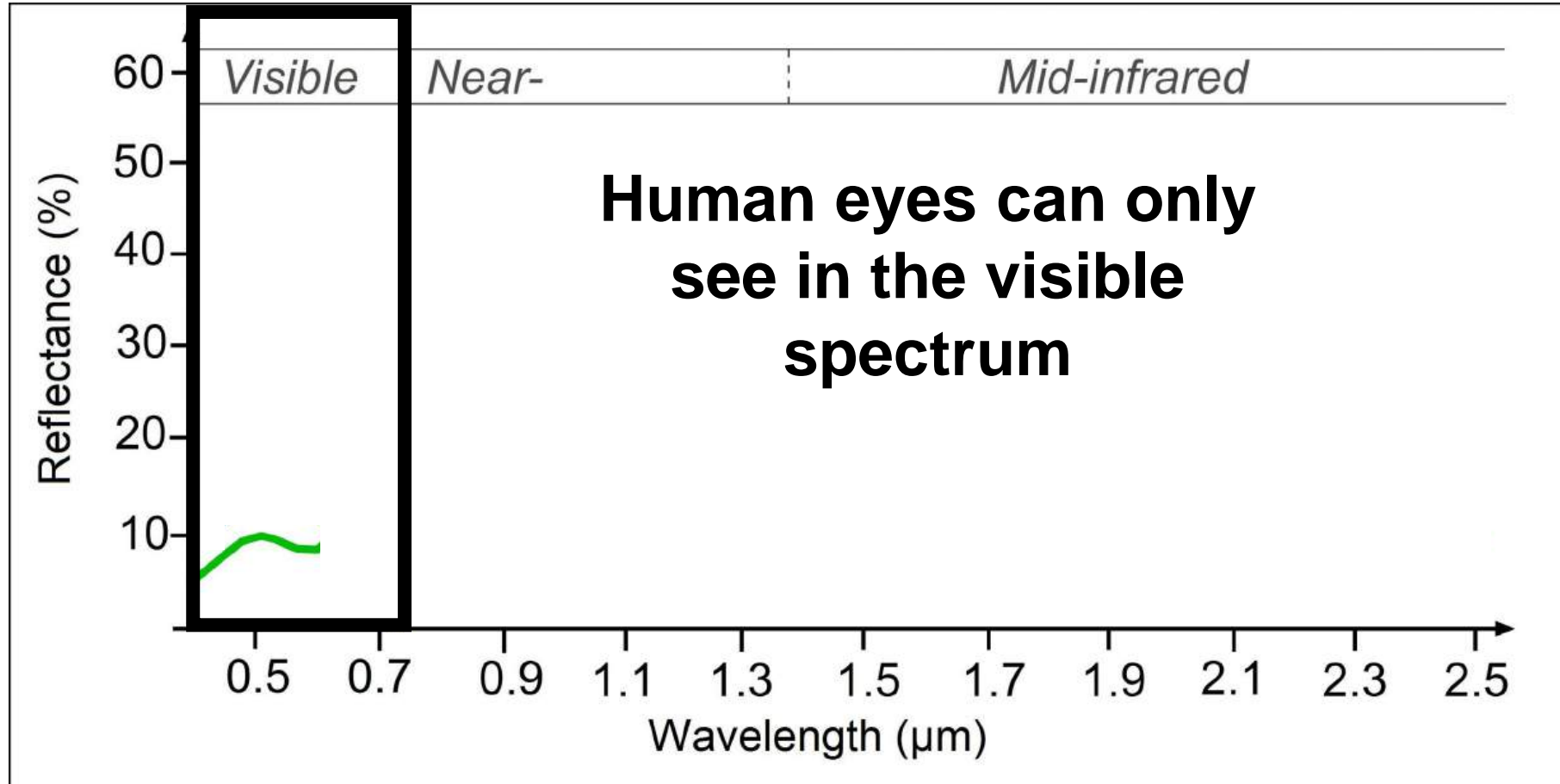
Reflectance



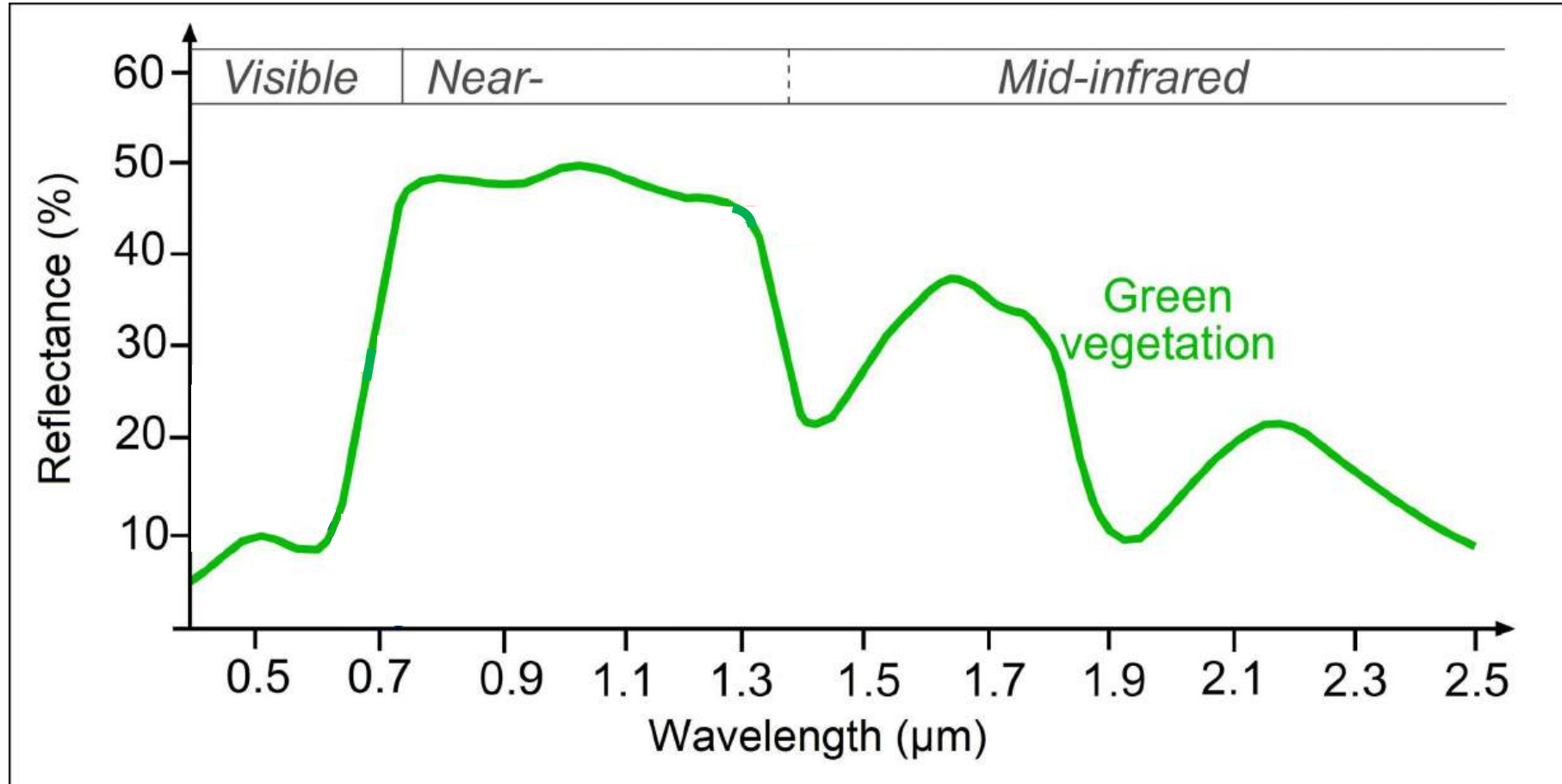
Reflectance



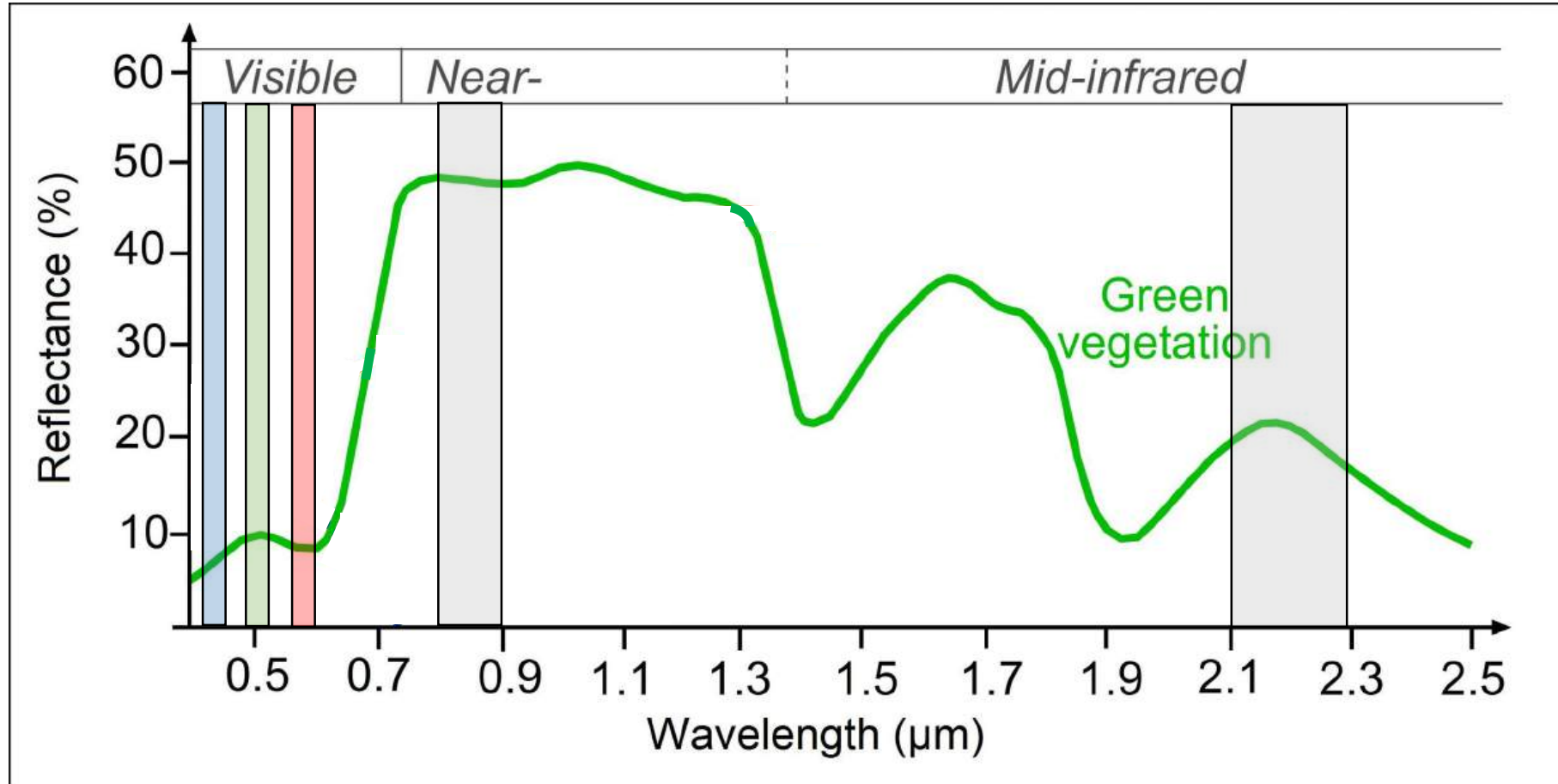
Reflectance



Reflectance

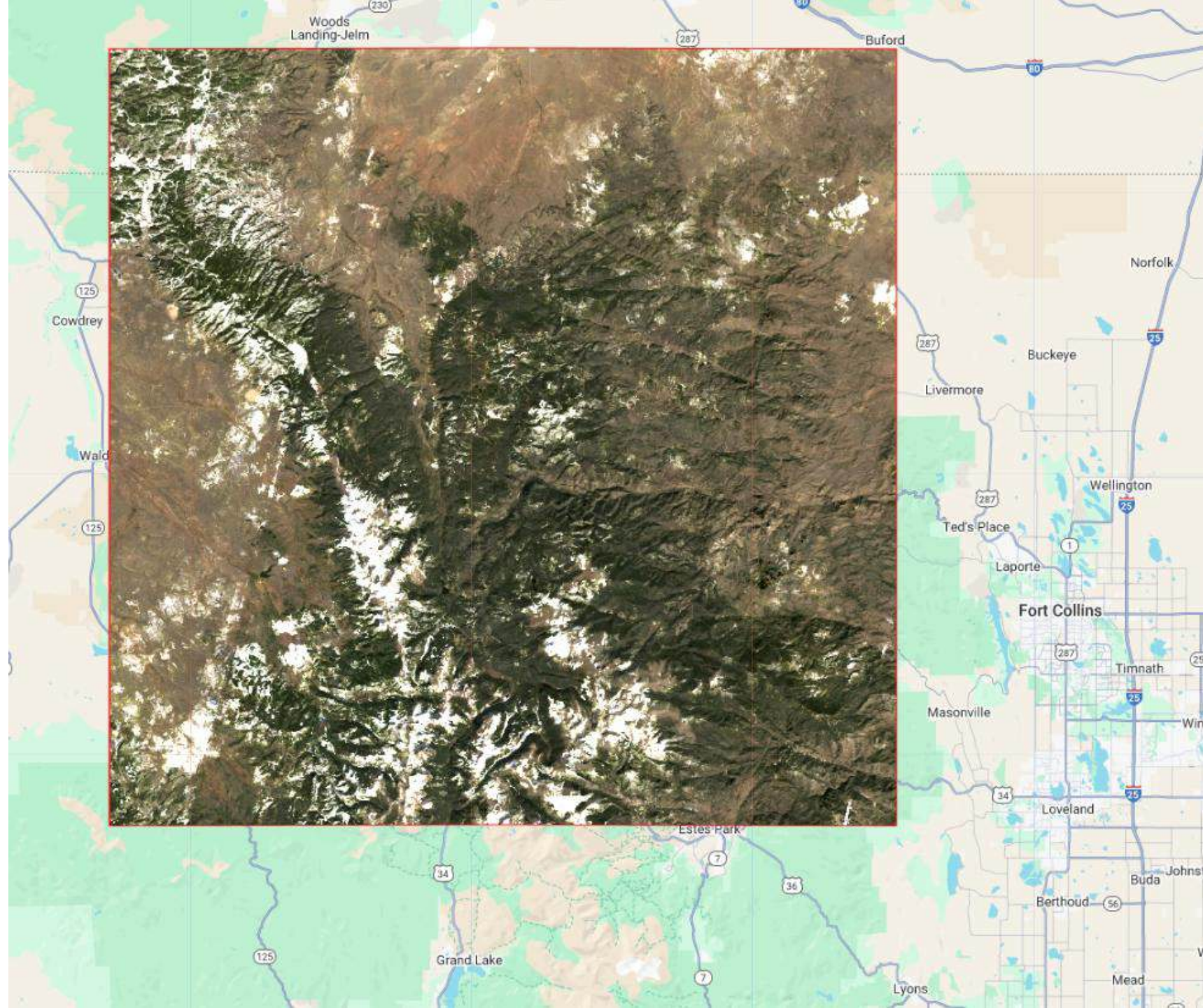


Satellites measure across this



Cameron Peak fire area **Satellites see this**

Red = red
Green = green
Blue = blue

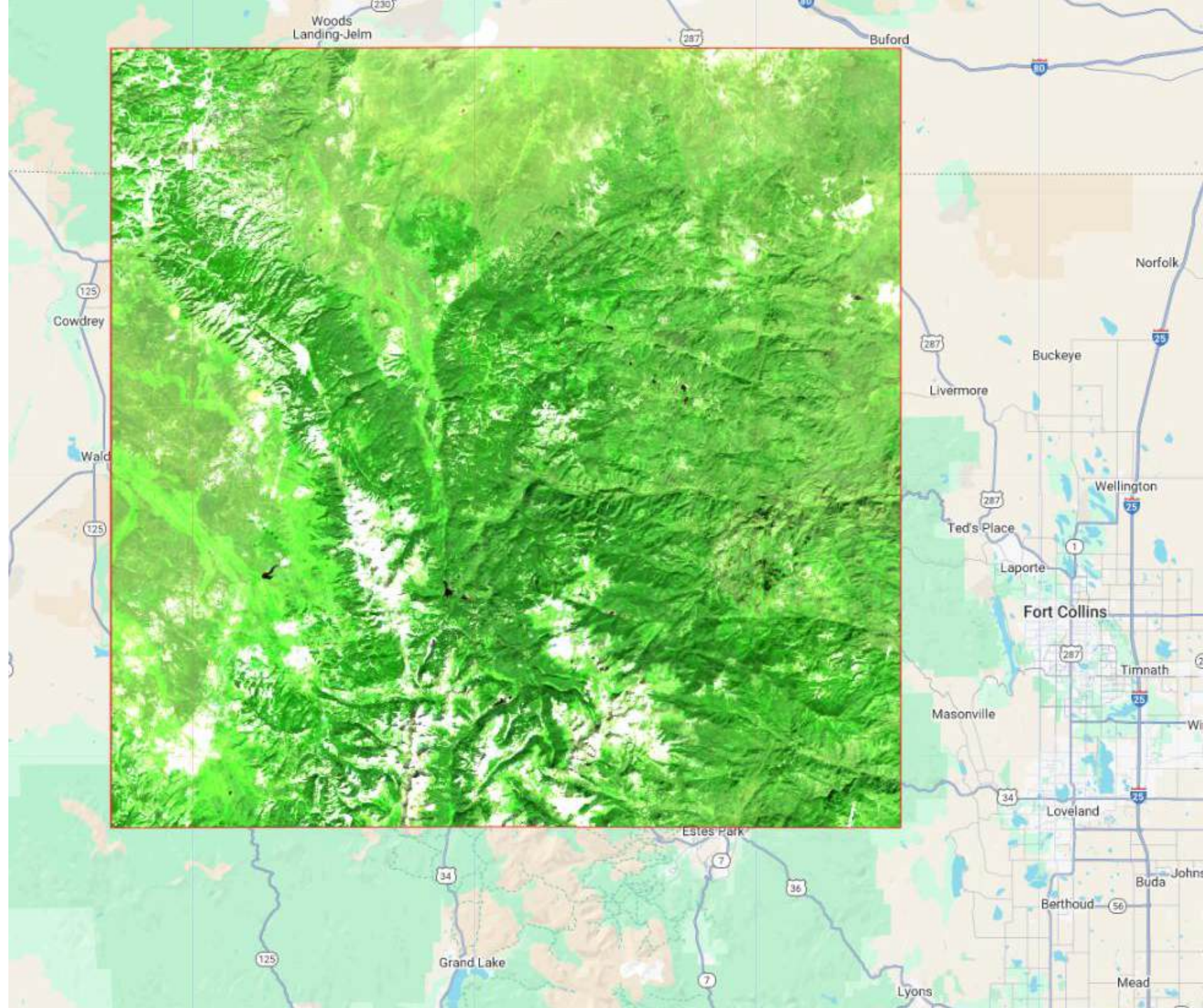


Cameron Peak fire area **Satellite ALSO** **see this**

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

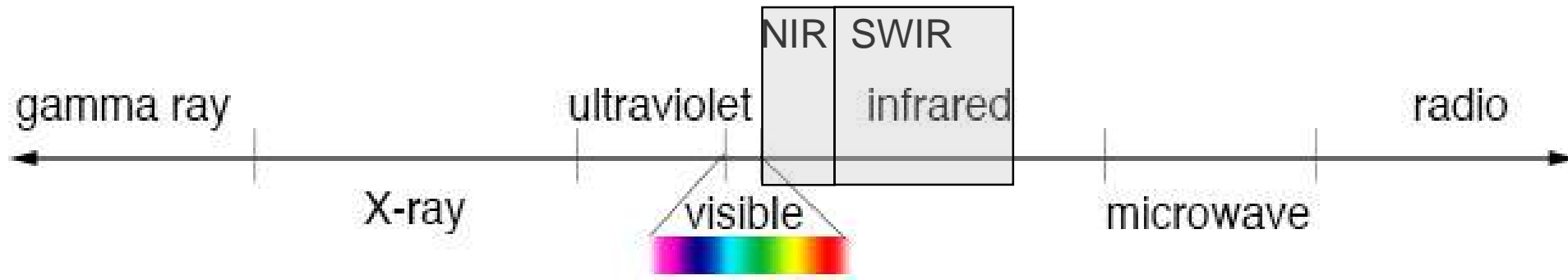
Example of a vegetation index: Normalized Burn Ratio (NBR)

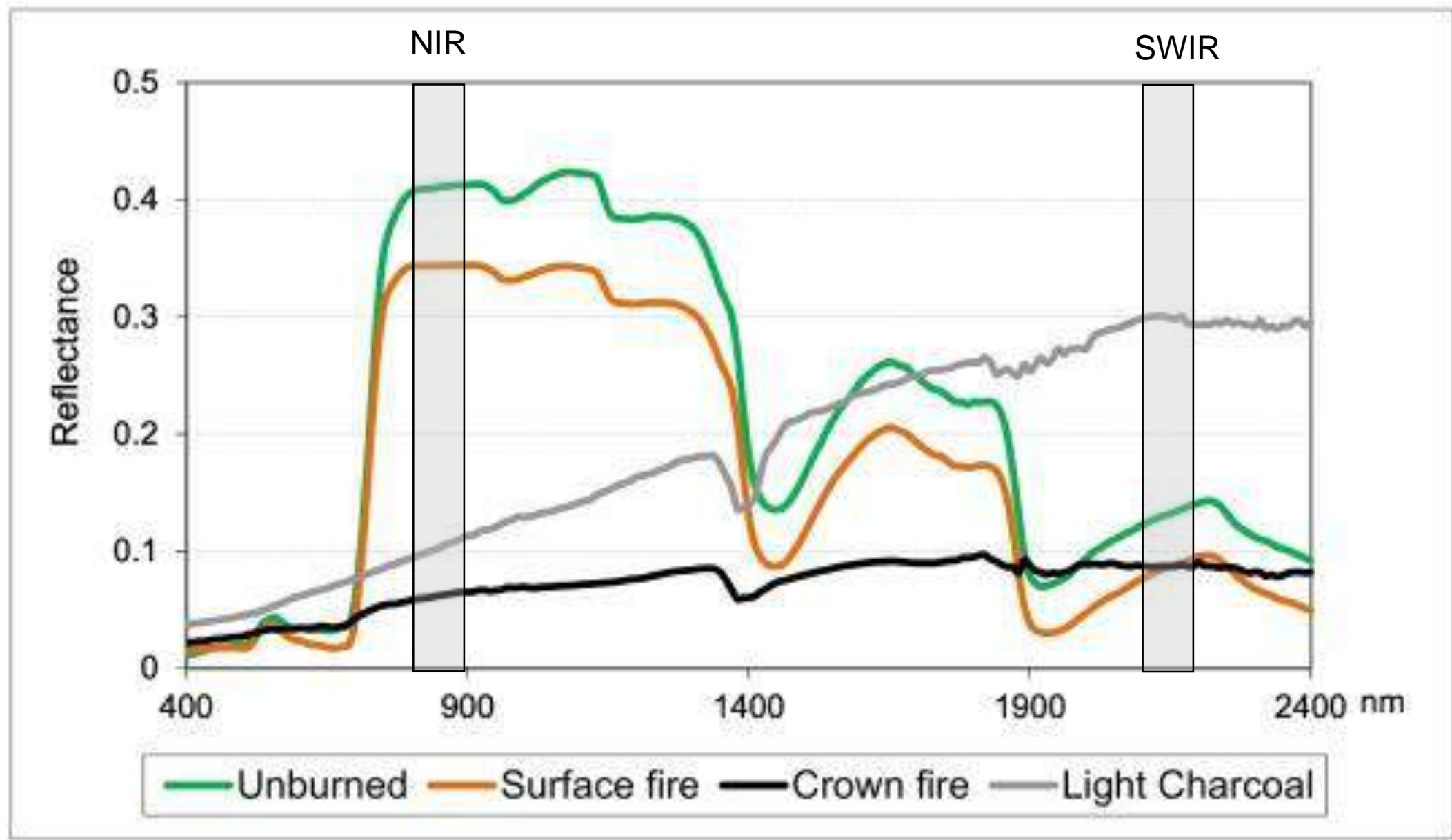
used to identify burned areas and provide a measure of
burn severity

$$\text{NBR} = (\text{NIR} - \text{SWIR}) / (\text{NIR} + \text{SWIR})$$

NIR = Near Infrared

SWIR = Shortwave Infrared





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

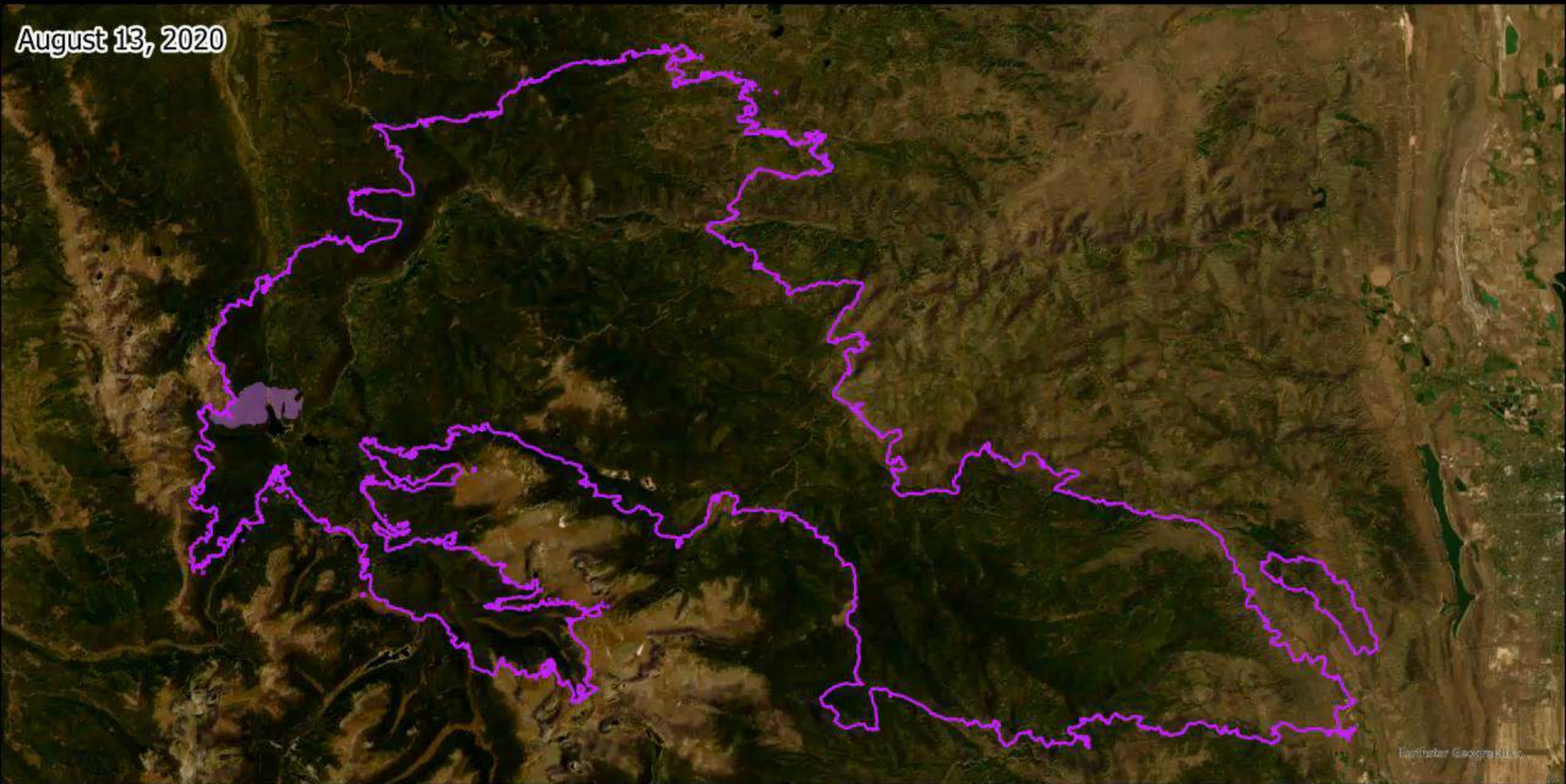
Activity

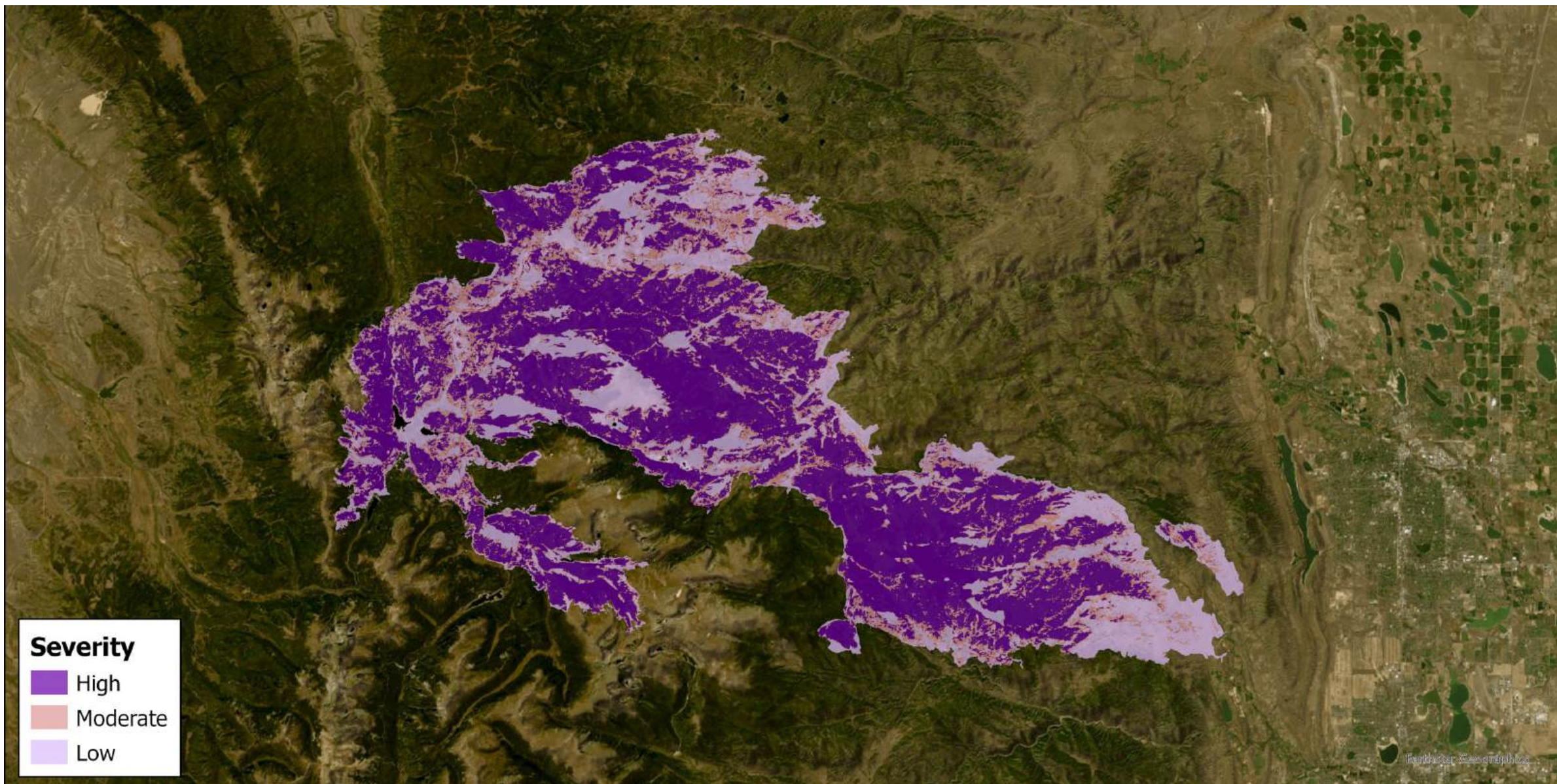
jazlynnhall.com/teachingdemo

- 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





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

