REGENERATIVE AG 101

PART 1 | THE INS, THE OUTS, AND THE ENVIRONMENTAL IMPACT

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DEFINING REGENERATIVE AGRICULTURE

> To increase **soil quality and biodiversity in farmland while producing nourishing** farm products profitably. Unifying principles consistent across regenerative farming systems include:
>
> — LaCanne & Lundgren (2018)

Abandoning tillage
(or actively rebuilding soil communities following a tillage event)

Eliminating spatiotemporal events of bare soil

Fostering plant diversity on the farm

Integrating livestock & cropping operations on the land

BAYER'S DEFINITION

BAYER VALUE PROPOSITION

Adapt & regenerate while maintaining our farms

NATURE POSITIVE OUTCOMES

- Conserve water resources
- Strive to maintain, preserve, or restore biodiversity
- Mitigate climate change
- Improve soil health

- Each farm is a unique ecosystem
- Win by being the most grower centric
- Customized to the farmer's operations
- Provide a plethora of tools to help growers farm regeneratively

REGENERATIVE AGRICULTURE PRACTICES

MOST COMMONLY MENTIONED PRACTICES

Among academia/ researchers

26% No or low external inputs

19% Integrate livestock

12% No synthetic pesticide or fertilizer

12% Reduced tillage

10% Crop rotation

MOST COMMONLY MENTIONED PRACTICES

Among growers/ field professionals

40% Integrate livestock

40% Reduced tillage

36% Use cover crops

32% Use crop rotations

32% Use no or low external inputs

Source:
'What is regenerative agriculture? A review of scholar and practitioner definitions based on processes and outcomes. Frontiers in Sustainable Food Systems.' Newton, P., Civita, N., Frankel-Goldwater, L., Bartel, K., & Johns, C. (2020)

REGENERATIVE AGRICULTURE OUTCOMES

MOST COMMONLY MENTIONED OUTCOMES

Among academia/researchers

41% Improve soil health

22% Increase biodiversity

17% Improve ecosystem health

17% Increase carbon sequestration

17% Improve social & economic well-being

MOST COMMONLY MENTIONED OUTCOMES

Among growers/ field professionals

86% Improve soil health

64% Increase soil carbon sequestration

46% Increase biodiversity

46% Improve water health

41% Improve social & economic well-being

Source:
'What is regenerative agriculture? A review of scholar and practitioner definitions based on processes and outcomes. Frontiers in Sustainable Food Systems.' Newton, P., Civita, N., Frankel-Goldwater, L., Bartel, K., & Johns, C. (2020)

5 PRINCIPLES OF SOIL HEALTH

ARMOR THE SOIL

INTEGRATE ANIMALS

LIVING ROOTS
ALL YEAR ROUND

DIVERSITY IN THE
SOIL OF BOTH PLANT
AND ANIMAL SPECIES

LIMITED
DISTURBANCE

IN-FIELD PRACTICES: FERTILITY

PRACTICES

- Timing
- Placement
- Form
- Rate: MRTN Type Rates

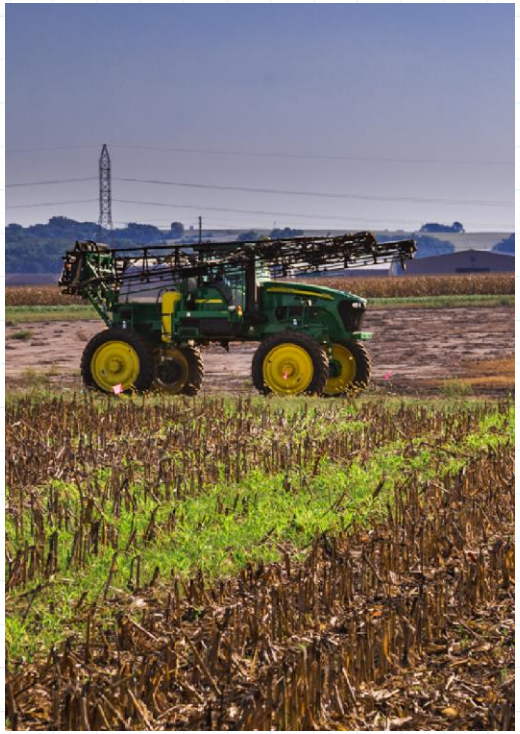
THE 4Rs

RIGHT RATE
RIGHT SOURCE
RIGHT TIME
RIGHT PLACE

OUTCOMES

- Decrease GHGs
- Reduce Nutrient Loss

IN-FIELD PRACTICES:
CULTIVATION



NO TILL

STRIP TILL

REDUCED TILLAGE

IN-FIELD PRACTICES: COVERS

LATE SUMMER /FALL

SPRING THAW
GROWTH TERMIN.

SPRING/SUMMER
CASH CROP

SOIL LEVEL

- NITROGEN
- POTASSIUM
- SULFUR
- CALCIUM
- PHOSPHORUS

COVER CROP ROOTS

EDGE OF FIELD

- WATER & SEDIMENT CONTROL BASINS
- SLOTTED BOARD RISER PIPES WITH PADS
- TAILWAY RECOVERY
- BUFFERS
- RIPARIAN AREAS
- BIOREACTORS
- CONTROLLED DRAINAGE
- GRASSED WATERWAYS
- TERRACES

OUTCOMES

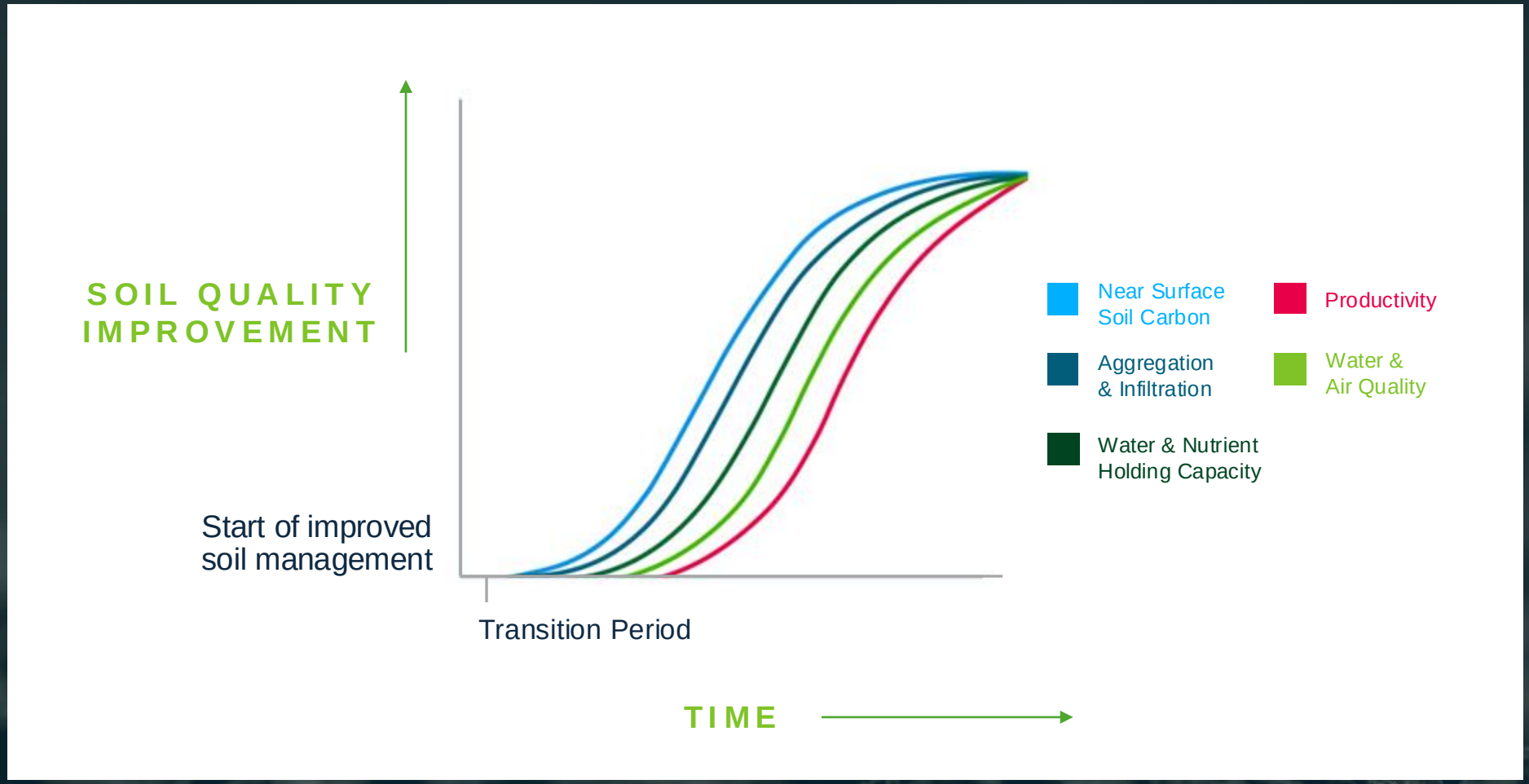
- Reduce nutrient loss
- Decrease erosion
- Increase biodiversity
- Recycle water

IRRIGATION & WATER MANAGEMENT

PRACTICES & OUTCOMES

- Source water change
- Water scheduling equipment
- Furrow surge valves
- Furrow PIPE PLANNER
- Pivots: Nozzles, drop lines, etc.
- Water conservation
- Energy Savings

WHEN TO EXPECT OUTCOMES



https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soils/soil-health/role-of-organic-matter

COMPLEX OUTCOMES

Many practices have multiple outcomes, and some outcomes are reliant on other outcomes

Increased fertilizer use efficiency can prevent nutrient loss

CLIMATE CHANGE & OUR EFFORTS

CLIMATE CHANGE CAN

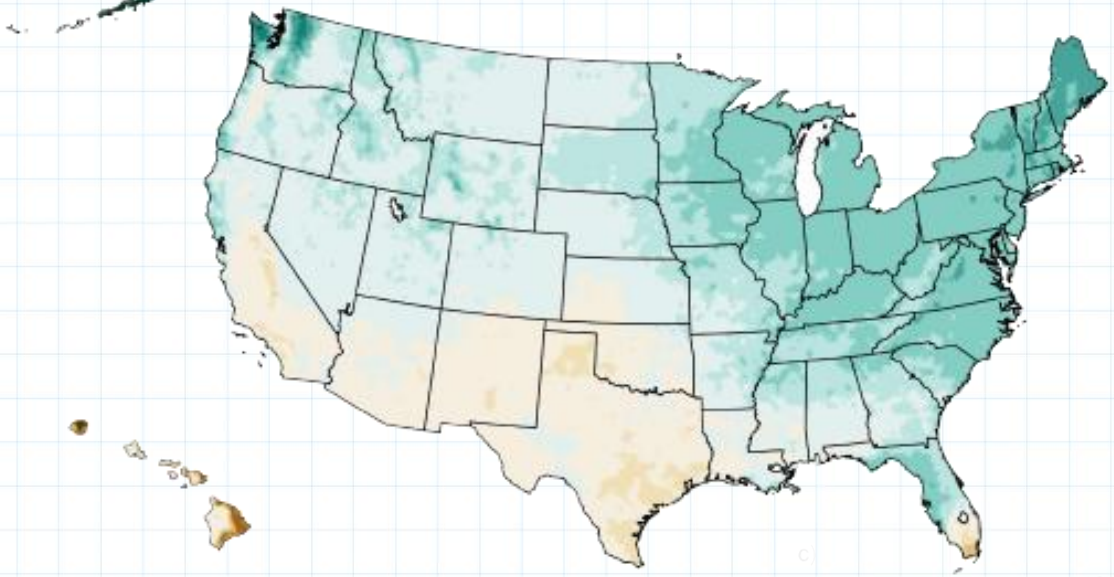
- Change precipitation pattern spatially

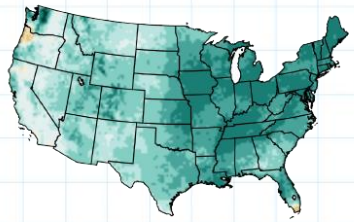
DIFFERENCE IN INCHES

-5 -3 -2 -1 -0.5 0 0.5 1 2 3 5

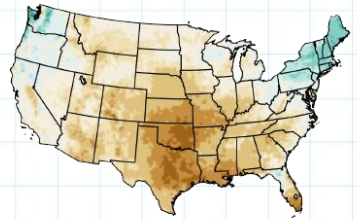
PROJECTED CHANGES IN ANNUAL PRECIPITATION BY 2036-2065

AVE. OF ALL AVAILABLE PROJECTIONS





AVE. OF WETTEST 20%



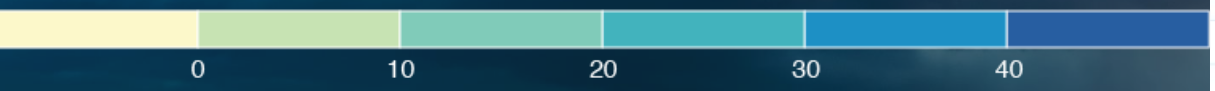
AVE. OF DRIEST 20%

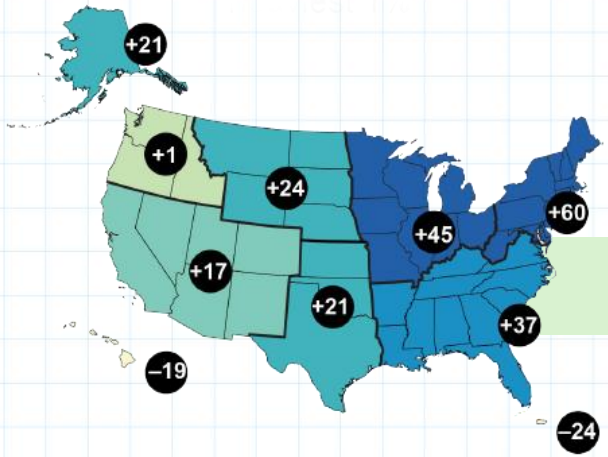
https://nca2023.globalchange.gov/

CLIMATE CHANGE & OUR EFFORTS

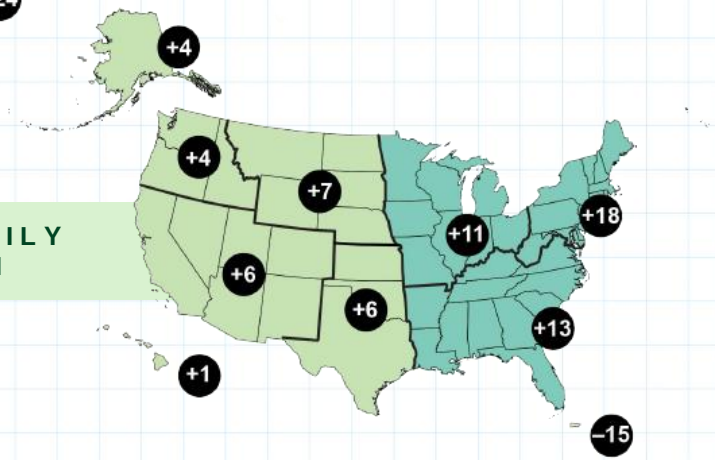
CLIMATE CHANGE CAN

- Change precipitation pattern spatially
- Increase number of heavy precipitation events, or extreme events

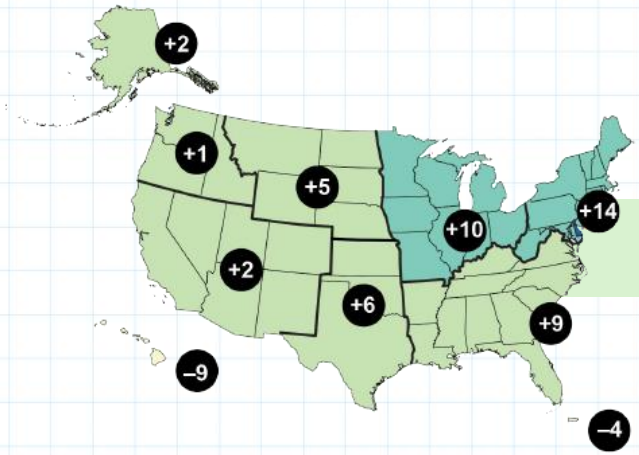




TOTAL PRECIPITATION ON HEAVIEST 1% OF DAYS



5 YR MAXIMUM DAILY PRECIPITATION



ANNUAL MAXIMUM DAILY PRECIPITATION

https://nca2023.globalchange.gov/

CLIMATE CHANGE & OUR EFFORTS

CLIMATE CHANGE CAN

- Change precipitation pattern spatially
- Increase number of heavy precipitation events, or extreme events
- Increase flood magnitudes

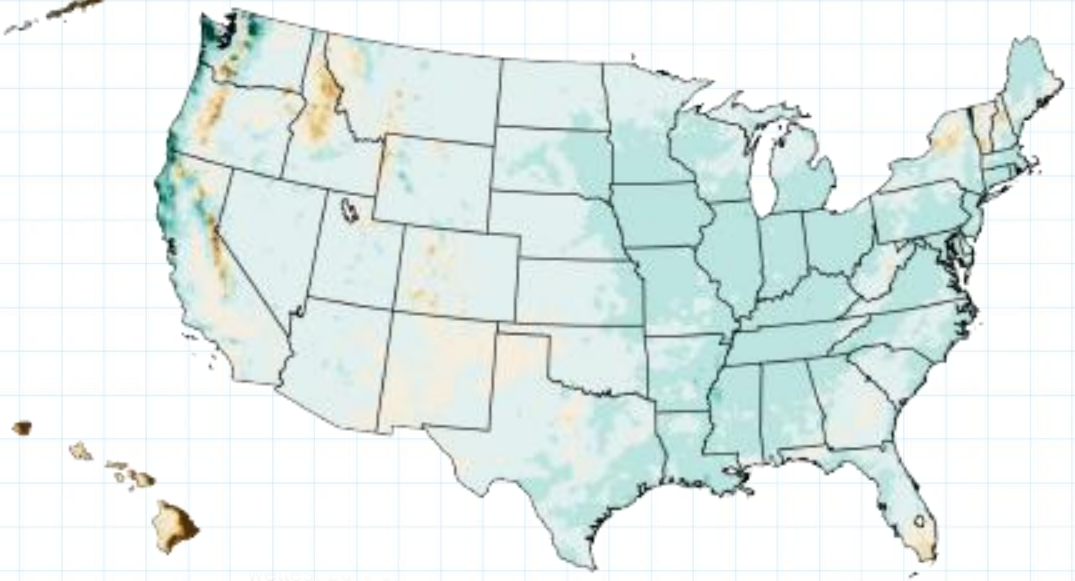
DIFFERENCE IN INCHES

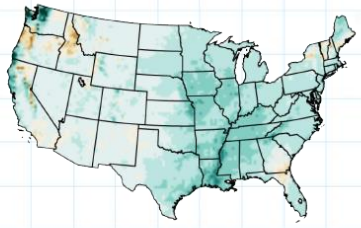
-2 -1.5 -1 -.5 -.1 0 .1 .5 1 1.5 2

PROJECTED CHANGES IN ANNUAL RUNOFF BY 2036-2065

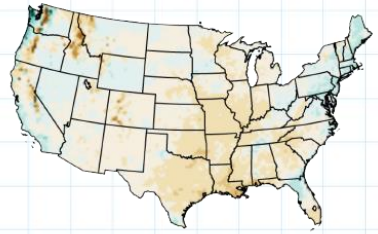
BAYER

AVE. OF ALL AVAILABLE PROJECTIONS





AVE. OF WETTEST 20%



AVE. OF DRIEST 20%

https://nca2023.globalchange.gov/

CLIMATE CHANGE & OUR EFFORTS

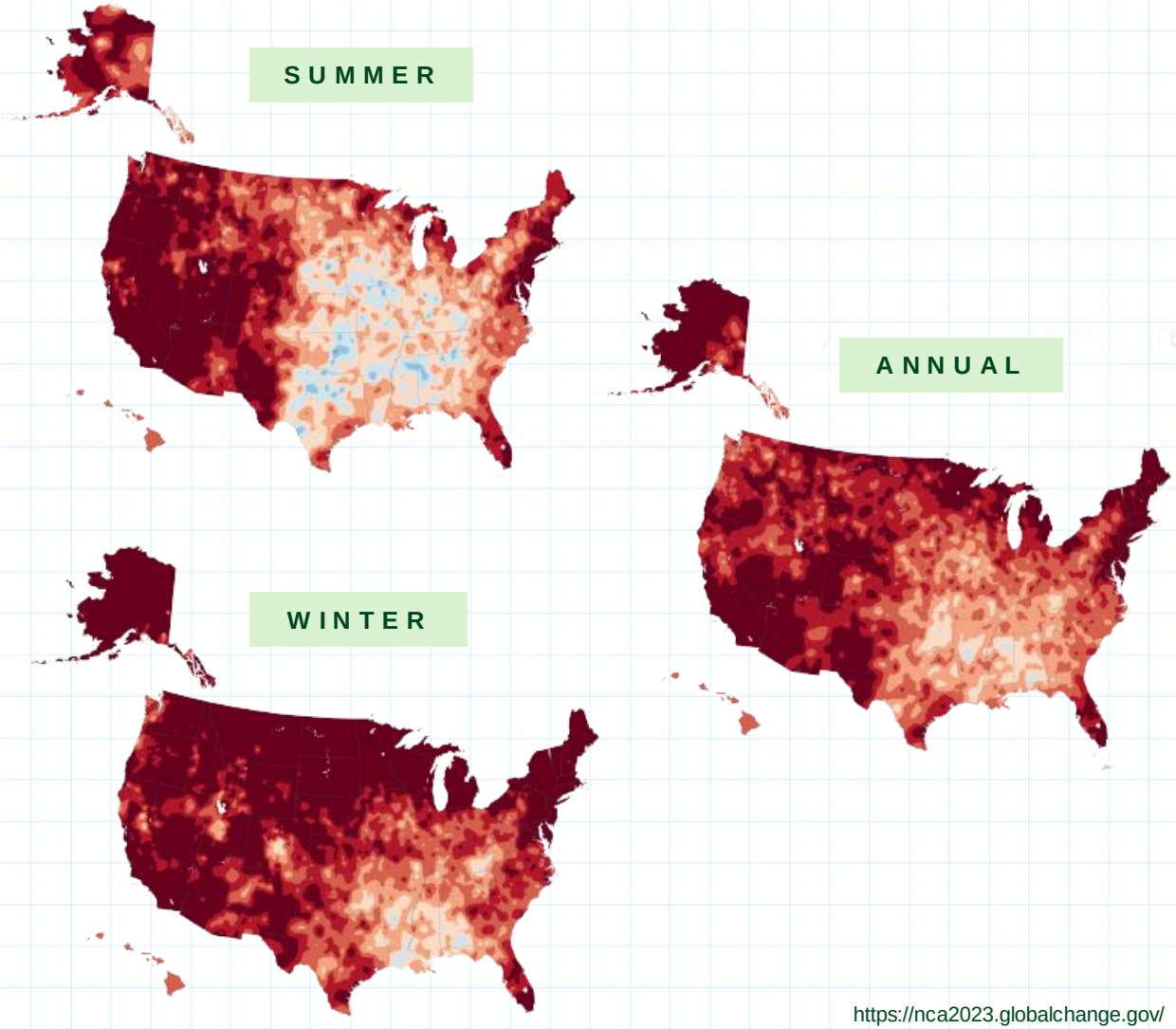
CLIMATE CHANGE CAN

- Change precipitation pattern spatially
- Increase number of heavy precipitation events, or extreme events
- Increase flood magnitudes
- Increase ambient temperature, increasing water withdrawls

TEMPERATURE CHANGE (°F)

-1 -.5 0 .5 1 1.5 2

OBSERVED CHANGES IN ANNUAL, WINTER & SUMMER TEMPERATURES & PRECIPITATION

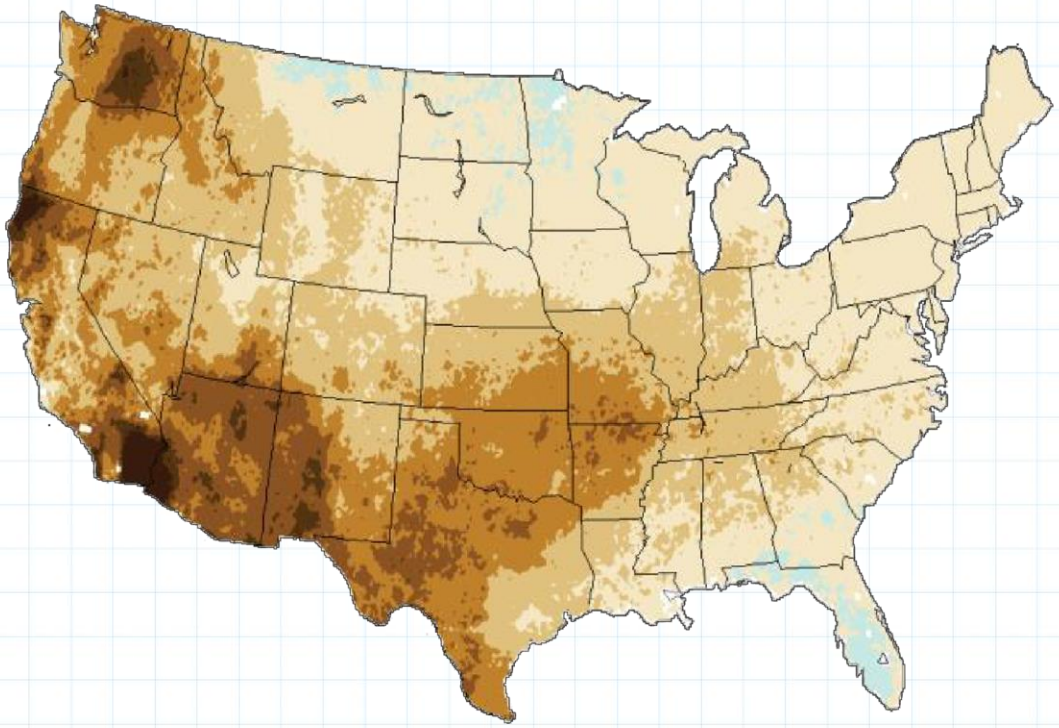


https://nca2023.globalchange.gov/

CLIMATE CHANGE & OUR EFFORTS

CLIMATE CHANGE CAN

- Change precipitation pattern spatially
- Increase number of heavy precipitation events, or extreme events
- Increase flood magnitudes
- Increase ambient temperature, increasing water withdrawls
- Increase number of consecutive dry days



NUMBER OF DAYS

https://nca2023.globalchange.gov/

GROWER PERSPECTIVES

2023 FARMER'S VOICE SURVEY

84%

of farmers are working to reduce GHG emissions

90%

say the weather has changed

88%

say they are critical to ensuring food security but don't get the credit they deserve

WE SURVEYED

800 GROWERS

to get their perspectives on:

- CLIMATE CHANGE
- BIODIVERSITY
- REGENERATIVE PRACTICES

ALSO

4 in 10

Farmers say measures to protect & increase soil health on their farm are among the most important ways to tackle the risks of extreme weather

GROWER CHALLENGES

LESS TIME TO HANDLE THREATS

FARMS ARE BECOMING LARGER

LESS AVAILABLE HELP ON HAND

PRESSURE TO CHANGE SYSTEMS FOR PROGRAMS

SLOW IMPLEMENTATION OF TECHNOLOGY

GROWER MOTIVATION

MOTIVATION

- Consumer perceptions
- Future of what they have built
- Future of their children
- Soil health benefits & resilience
- Financial resources
- Looming regulations

FUTURE FARM PLANS

90%

PLAN TO PASS ON THE FARM

FARMERS ARE CURIOUS ABOUT

- Soil health
- Economic benefits
- Time savings

OUR PROGRAMS

OUR PILLARS

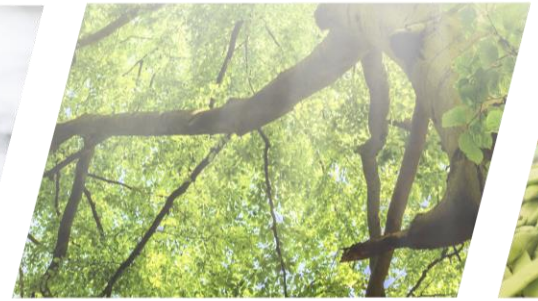
CLIMATE

SOIL HEALTH

WATER

BIODIVERSITY

SOCIAL & ECONOMIC WELLBEING



INDICATORS

OUTCOMES

PRACTICES

SCIENCE: THE FOUNDATION OF OUR PROGRAM

OUR DATA-DRIVEN RESOURCES
& IN-FIELD EXPERTISE

PROGRAM DESIGN

Pioneers in sustainable systems research who work directly with growers to shape the future of farming.

DELIVERING NEW SOLUTIONS IN
PRECISION & REGENERATIVE AGRICULTURE

ForGround
by Bayer

DIGITAL PLATFORM

That helps growers transition to regenerative practices and connects growers, acres, and buyers to more meaningful opportunities.

CLIMATE FIELD VIEW™

BAYER ECOSYSTEM SERVICES

DATA-DRIVEN
RECOMMENDATIONS

SCOPE 3 REDUCTIONS
& PRODUCT CARBON FOOTPRINTS

GROWER — **SHARED BENEFITS** — **COMPANY**

DIRECT CONNECTION
TO THE FARM & GROWER SUPPORT

VERIFICATION & NAVIGATION OF COMPLEX CERTIFICATION

ForGround
by Bayer

COLLABORATING TO DECARBONIZE
ACROSS THE VALUE CHAIN

SUPPORT FARMERS ON THEIR REGENERATIVE JOURNEY

MEASURE THE CARBON FOOTPRINT OF THE ENTIRE PRODUCTION CYCLE

JOIN US NEXT MONTH FOR PART 2

A deep dive on how Perdue successfully lowered carbon emissions in its supply chain by supporting regenerative agriculture.