Alaskan Farms on the Table

Alaska FFA Association and the USDA Northwest Climate Hub

Sun Circle Farm, Palmer Alaska—NRCS

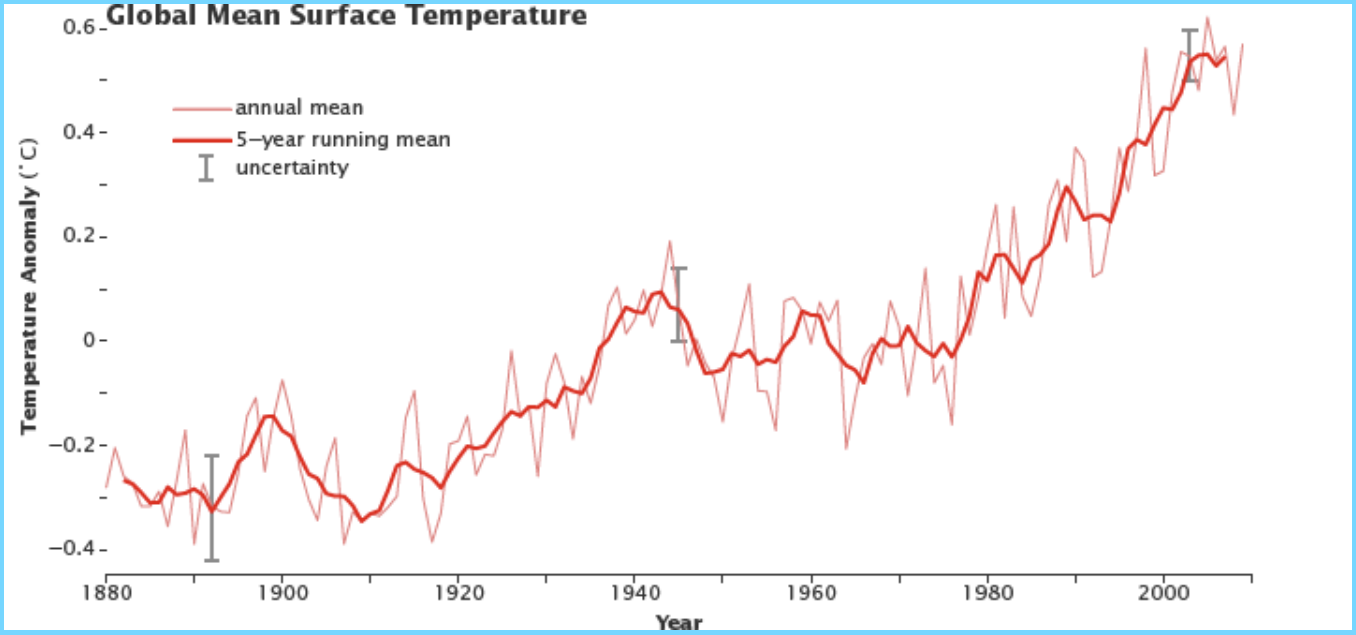
USDA Northwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

Alaska FFA Association

Adapted from USDA Southwest Climate Hub's "Farm on the Table" Lesson Plan created by the Asombro Institute for Science Education.

Global Warming vs Climate Change

Global Warming: increase in Earth's average temperature.

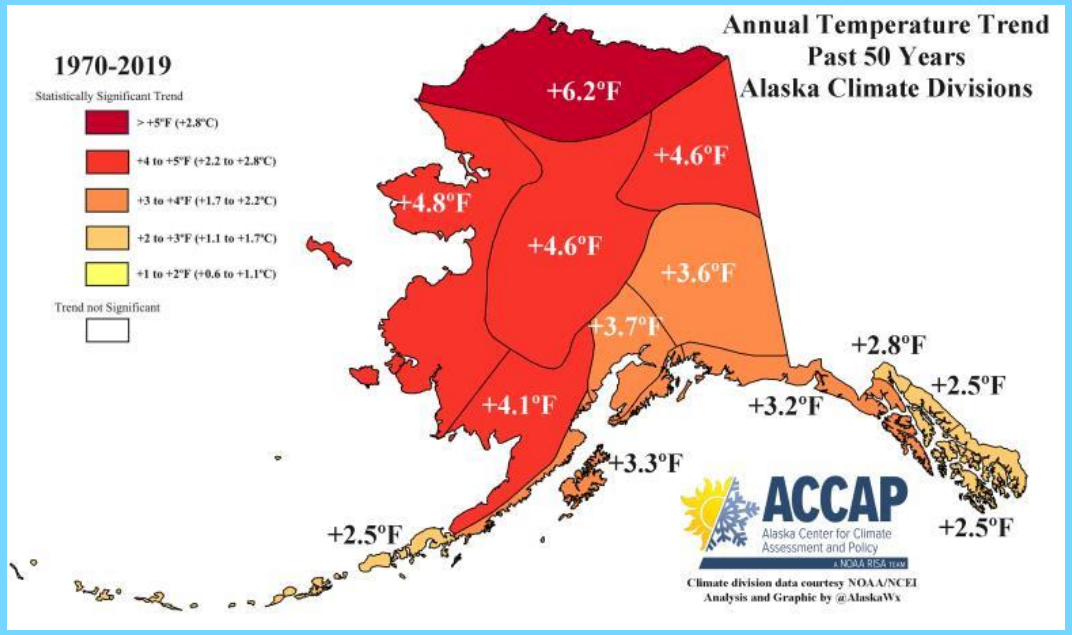


Climate Change: long term-change in Earth's climate or the climate of a region

- Warming AND changes besides temperature

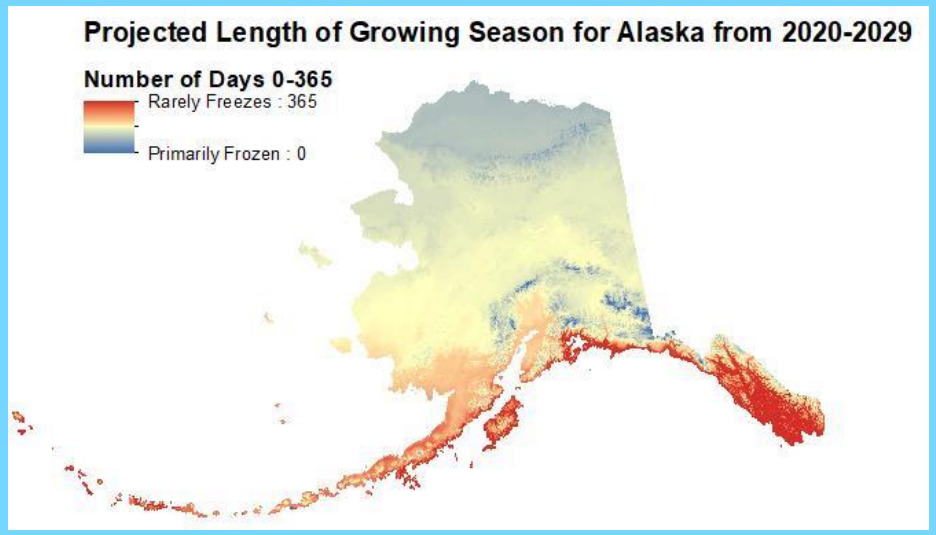
Climate Change & Alaska

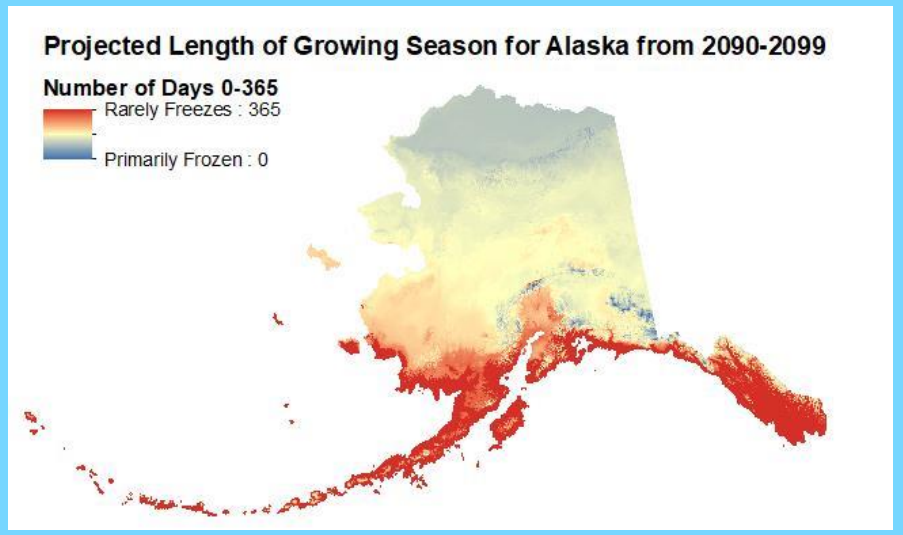
- Changing faster in Alaska than anywhere else in the United States
- Increasing temperatures will lead to
  - sea ice loss, coastal erosion, and permafrost thaw
  - increased risk of wildfire
- Extreme precipitation and drought likely to increase



Climate Change & Alaskan Agriculture

- Longer growing season—increase diversity of crops and meet local demand for Alaska-grown produce
- Crop yields may improve or degrade—shifting growing season could affect growth
- Increased pressure from weeds and invasive plants
- Pests and diseases may increase due to warmer conditions





Alaskan Farms on the Table Game

- You are a farmer
- Goal: stay <u>in the black</u>
- Circle <u>one</u> of the regions in Table 1

NRCS Alaska

Bushes Bunches Produce Stand

Table 1. Farm locations and data: 2021 values are averages, and 2070 values are predicted changes

Circle one region:		MAT-SU VALLEY	WESTERN KENAI	COPPER RIVER	FAIRBANKS	NENANA
TEMPERATURE	2021 (°F)	28.9	33.6	26.5	27.3	25.5
	2070 (°F)	+8	+8	+8	+10	+10
PRECIPITATION	2021(in.)	33.55	56.3	73.56	17.54	17.5
	2070 (in.)	+10%	+10%	+10%	+15%	+15%
AVERAGE FARM SIZE IN ALASKA		98 Acres	121 Acres	98 Acres	372 Acres	372 Acres
COMMON CROPS		hay, potatoes, carrots, beets, cabbage, broccoli, melons	hay, onions, carrots, potatoes	hay, potatoes, carrots, cabbage	barley, hay, potatoes, carrots	hay, potatoes, carrots

Weather data source: https://www.ncdc.noaa.gov/cag
Crop data source: https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Alaska/index.php

No-till Planting

A type of planting where the seeds are inserted directly into the soil, instead of turning the soil over before inserting the seeds

- Pros:
  - Lower labor, equipment, and fuel costs
  - Reduces water runoff from precipitation and irrigation
  - Limits wind erosion and compaction, and increases organic material
- Cons:
  - High upfront equipment costs
  - May require more herbicide and fungicide

A no-till planter in Alaska. Credit: NRCS.

Hedgerows & Windbreaks

A row of wild or planted shrubs and trees bordering a road or field

- Pros:
  - Helps prevent some wind and water erosion of the soil
  - Can help prevent the spread of insect and fungal diseases
  - Can create pollinator habitat
- Cons:
  - Fewer rows for crops
  - Needs watering and maintenance

A windbreak in North Dakota—NRCS

Water Collection and Storage Unit

Collects rainfall from roofs or runoff from fields to be used for irrigation

- Pros:
  - Water source available during droughts
- Cons:
  - Can take a few years to gather enough water to help mitigate effects
  - Requires space

Water cisterns on Sun Circle Farm, Palmer, AK—NRCS

Soil Moisture Monitoring

- Pros:
  - Helps farmers know the best time to irrigate crops, saving on water cost
  - Inexpensive equipment
- Cons:
  - Biggest expense is labor

Beehives and Flower Strips

- Pros:
  - Reliable pollination of crops
  - Can provide habitat for native pollinators other than bees

- Cons:
  - Cannot use insecticides due on harm inflicted to colonies

Wildflowers planted near crops can improve habitat for pollinators. NRCS

Customize your farm!

Table 2. Climate-mitigating adaptations

ADAPTATION	PROS	CONS	COST (POINTS)	CHOSEN COSTS
NO-TILL PLANTING ☐	-Reduces costs of labor, equipment, fuel -Reduces soil erosion from water and wind -Retains soil moisture -Increases soil organic matter -Limits soil compaction	-May require more herbicide and fungicide due to higher soil moisture -High upfront cost	15	
HEDGEROWS ☐	-Reduce soil erosion from water and wind -Create pollinator habitat -Prevent spread of some insects and fungal diseases	-Require some watering and maintenance -Possibly reduce number of crop rows	5	
WATER CISTERN COLLECTION & STORAGE UNIT ☐	-Collects rainfall and/or other water runoff for use when water is scarce	-Requires space -Can take a few years to collect enough water	10	
SOIL MOISTURE MONITORING ☐	-Decreases irrigation expenses by eliminating unnecessary watering of crops	-Requires labor to operate equipment	3	
BEEHIVES & FLOWER STRIPS ☐	-Reliable pollination of crops -Provide habitat for variety of pollinators	-Requires some maintenance -Unable to use insecticides	5	
			TOTAL COST (POINTS)	

STARTING OUTPUT FACTOR = 100 – _____ = _____
TOTAL COST

1. Add up all chosen adaptations and record in the "Total Cost" blank.

2. Then calculate the "Starting Output Factor"

Practices and Treatments – Year 1

- Choose at least two of the nine options
- Success will be dependent on weather
- Will play for 6 years (rounds)

Crop Seed Varieties

- Drought resistant variety pros:
  - Can produce a more reliable yield/acre during periods of prolonged drought
- Flood resistant variety pros:
  - Can tolerate being submerged for longer periods of time or multiple times/year
- Cons:
  - Seeds need to be repurchased every year

Credit: NRCS

Interplanting

Planting a crop together with another in alternating rows

- Pros:
  - Decreased need for crop treatments
  - Less economic risk in case of a crop fail year
- Cons:
  - Requires more planning

Interplanting on Sun Circle Farm in Palmer, AK—NRCS

Crop Rotation

A system of varying crops in the same field year after year

- Pros:
  - Avoid depleting the soil of nutrients
  - Helps control weeds, disease, and other pests
- Cons:
  - Requires more planning

Credit: NRCS

Spread Spacing

Increasing the amount of space between planted rows of crops

- Pros:
  - Can reduce the need for crop treatments
  - Less competition for resources by plants
- Cons:
  - Lower crop yield per acre

Photo by Chris Bennett

Fertilizing

The process of making the soil more fertile or productive by adding nutrients or organic matter to the soil

- Pros:
  - Can make crops grow larger, faster
- Cons:
  - Depletes natural soil fertility causing an annual reliance

Credit: Bureau of Labor Statistics

Herbicide

Spraying a substance that targets unwanted vegetation

- Pros:
  - Can greatly reduce loss from plant pests
- Cons:
  - Becomes less effective with continual use

Pigweed
Amaranthus spp.

Credit: University of Delaware

Insecticide

Spraying a substance that targets insect pests

- Pros:
  - Can greatly reduce loss from insect pests
- Cons:
  - Will harm natural pollinators
    - Should not choose if you have beehives and flower strips
  - Becomes less effective with continual use

Credit: USDA

Fungicide

Spraying a substance that targets unwanted fungal pathogens

- Pros:
  - Can greatly reduces loss from fungal pathogens
- Cons:
  - Needs to be applied before infection to be effective

Credit: USDA

YEAR 1 PRACTICES AND TREATMENTS

YEAR 1

Starting Output Factor (from Page 2): _____

Choose **at least two** practices and/or treatments.

PLANTING PRACTICES	DESCRIPTION	COST (POINTS)	CHOSEN COSTS	+/-	DIE ROLL
DROUGHT RESISTANT CROP VARIETY ☐	Can produce a more reliable yield per acre during periods of prolonged drought, but seeds need to be purchased every year	2			
FLOOD RESISTANT CROP VARIETY ☐	Can tolerate being submerged for longer periods of time or multiple times per year, but seeds need to be purchased every year	2			
INTERPLANTING ☐	Can reduce erosion, spread of pathogens, and need for crop treatments; there is less economic risk in case of a crop fail year	2			
CROP ROTATION ☐	Can improve soil health and reduce loss from pathogens due to host plants changing locations from year to year	2			
SPREAD SPACING OF ROWS ☐	Lower crop yield/acre, but can reduce the need for crop treatments	2			
CROP TREATMENTS	**DESCRIPTION**	**COST (POINTS)**	**CHOSEN COSTS**	**+/-**	**DIE ROLL**
FERTILIZING ☐	Can increase rate of growth but depletes soil fertility causing an annual reliance	2			
HERBICIDE ☐	Can reduce loss from plant pests but becomes less effective with continual use	2			
INSECTICIDE ☐	Can reduce loss from insect pests but will harm natural pollinators; should **NOT** choose if have beehives & flower strips	2			
FUNGICIDE ☐	Can reduce loss from fungal pathogens but needs to be applied before infection to be effective	2			
		TOTAL COST (POINTS)		OUTPUT CHANGE TOTAL	

1. Insert "Starting Output Factor" from page 2.

2. Add up the cost of the practices and treatments and insert the total into the appropriate blank.

_____ - _____ + _____ + _____ = _____

Starting Output Factor | Total Cost | Output Change Total | Farm Adaptation Bonus | New Starting Output Factor

YEAR 1: Roll the Die

YEAR 1

Starting Output Factor (from Page 2): _____

Choose **at least two** practices and/or treatments.

PLANTING PRACTICES	DESCRIPTION	COST (POINTS)	CHOSEN COSTS	+/-	DIE ROLL
DROUGHT RESISTANT CROP VARIETY ☐	Can produce a more reliable yield per acre during periods of prolonged drought, but seeds need to be purchased every year	2			
FLOOD RESISTANT CROP VARIETY ☐	Can tolerate being submerged for longer periods of time or multiple times per year, but seeds need to be purchased every year	2			
INTERPLANTING ☐	Can reduce erosion, spread of pathogens, and need for crop treatments; there is less economic risk in case of a crop fail year	2			
CROP ROTATION ☐	Can improve soil health and reduce loss from pathogens due to host plants changing locations from year to year	2			
SPREAD SPACING OF ROWS ☐	Lower crop yield/acre, but can reduce the need for crop treatments	2			
CROP TREATMENTS	**DESCRIPTION**	**COST (POINTS)**	**CHOSEN COSTS**	**+/-**	**DIE ROLL**
FERTILIZING ☐	Can increase rate of growth but depletes soil fertility causing an annual reliance	2			
HERBICIDE ☐	Can reduce loss from plant pests but becomes less effective with continual use	2			
INSECTICIDE ☐	Can reduce loss from insect pests but will harm natural pollinators; should **NOT** choose if have beehives & flower strips	2			
FUNGICIDE ☐	Can reduce loss from fungal pathogens but needs to be applied before infection to be effective	2			
		TOTAL COST (POINTS)		OUTPUT CHANGE TOTAL	

Year 1 Weather – Historically Normal

- Positive investments (“+”)
  - Interplanting
  - Crop rotation
  - Spread spacing of rows
  - Fertilizing
  - Herbicide
  - Insecticide
  - Fungicide
- Negative investments (“-”)
  - Drought resistant crop varieties
  - Flood resistant crop varieties

Add 3 points for each of the following farm adaptations implemented:

- No-till planting
- Hedgerows
- Water collection and storage
- Soil moisture monitoring
- Beehives and flower strips

Year 1 Handout

YEAR 1

Starting Output Factor (from Page 2): _____

Choose **at least two** practices and/or treatments.

PLANTING PRACTICES	DESCRIPTION	COST (POINTS)	CHOSEN COSTS	+/-	DIE ROLL
DROUGHT RESISTANT CROP VARIETY ☐	Can produce a more reliable yield per acre during periods of prolonged drought, but seeds need to be purchased every year	2			
FLOOD RESISTANT CROP VARIETY ☐	Can tolerate being submerged for longer periods of time or multiple times per year, but seeds need to be purchased every year	2			
INTERPLANTING ☐	Can reduce erosion, spread of pathogens, and need for crop treatments; there is less economic risk in case of a crop fail year	2			
CROP ROTATION ☐	Can improve soil health and reduce loss from pathogens due to host plants changing locations from year to year	2			
SPREAD SPACING OF ROWS ☐	Lower crop yield/acre, but can reduce the need for crop treatments	2			
CROP TREATMENTS	**DESCRIPTION**	**COST (POINTS)**	**CHOSEN COSTS**	**+/-**	**DIE ROLL**
FERTILIZING ☐	Can increase rate of growth but depletes soil fertility causing an annual reliance	2			
HERBICIDE ☐	Can reduce loss from plant pests but becomes less effective with continual use	2			
INSECTICIDE ☐	Can reduce loss from insect pests but will harm natural pollinators; should **NOT** choose if have beehives & flower strips	2			
FUNGICIDE ☐	Can reduce loss from fungal pathogens but needs to be applied before infection to be effective	2			
		TOTAL COST (POINTS)		OUTPUT CHANGE TOTAL	

3. Add up the positive and negative investments and insert the total into the appropriate blank.

4. Insert total adaptation bonus (bottom of previous slide).

5. Add up all of the blanks to calculate the "Starting Output Factor" for the next year (be sure to pay attention to the sign).

$$\underline{\text{Starting Output Factor}} - \underline{\text{Total Cost}} + \underline{\text{Output Change Total}} + \underline{\text{Farm Adaptation Bonus}} = \underline{\text{New Starting Output Factor}}$$

6. Repeat for each year.

Practices and Treatments – YR 2

- Choose at least two of the nine options
- Success will be dependent on weather

Year 2 Weather - Drought

- Positive investments (“+”)
  - Drought resistant crop varieties
  - Interplanting
  - Crop rotation
  - Fertilizer
  - Insecticide
- Negative investments (“-”)
  - Flood resistant crop varieties
  - Spread spacing
  - Herbicide
  - Fungicide

Add 3 points for each of the following farm adaptations implemented:

- No-till planting
- Water collection and storage
- Soil moisture monitoring
- Beehives and flower strips

Practices and Treatments – YR 3

- Choose at least two of the nine options
- Success will be dependent on weather

Credit: NRCS & BLS

Year 3 Weather – Heat Wave

- Positive investments (“+”)
  - Interplanting
  - Crop rotation
  - Spread spacing of rows
  - Insecticide
- Negative investments (“-”)
  - Drought resistant crop varieties
  - Flood resistant crop varieties
  - Fertilizer
  - Herbicide
  - Fungicide

Add 3 points for each of the following farm adaptations implemented:

- No-till planting
- Water collection and storage
- Soil moisture monitoring

Year 3 – Subsidy Announcement

Beehives

- Pollination from bees in the US is worth over $14 billion
- Many crops would not exist, or be less productive without bees

*Add *10 points* in the Subsidy Bonus blank if you have invested in beehives*

Important crops pollinated by bees

- Peppers – red, green, bell, chili
- Watermelon
- Cucumber
- Pumpkin
- Strawberry
- Cotton
- Apple
- Alfalfa
- Cherry
- Peach
- Pear
- Raspberry/Blackberry
- Blueberry
- And many, many more

Practices and Treatments – YR 4

- Choose at least two of the nine options
- Success will be dependent on weather

Credit: NRCS & BLS

Year 4 Weather - Wind

- Positive investments (“+”)
  - Interplanting
  - Crop rotation
  - Spread spacing of rows
- Negative investments (“-”)
  - Drought resistant crop varieties
  - Flood resistant crop varieties
  - Fertilizer
  - Herbicide
  - Insecticide
  - Fungicide

Add 3 points for each of the following farm adaptations implemented:

- No-till planting
- Hedgerows

Practices and Treatments – YR 5

- Choose at least two of the nine options
- Success will be dependent on weather

Credit: NRCS & BLS

Year 5 Weather – Increased Precipitation

- Positive investments (“+”)
  - Flood resistant crop varieties
  - Interplanting
  - Crop rotation
  - Spread spacing of rows
  - Fungicide
- Negative investments (“-”)
  - Drought resistant crop varieties
  - Fertilizer
  - Herbicide
  - Insecticide

Add 3 points for each of the following farm adaptations implemented:

- No-till planting
- Hedgerows

Practices and Treatments – YR 6

- Choose at least two of the nine options
- Success will be dependent on weather

Credit: NRCS & BLS

Year 6 Weather – Heat Wave

- Positive investments (“+”)
  - Interplanting
  - Crop rotation
  - Spread spacing of rows
  - Insecticide
- Negative investments (“-”)
  - Drought resistant crop varieties
  - Flood resistant crop varieties
  - Fertilizer
  - Herbicide
  - Fungicide

Add 3 points for each of the following farm adaptations implemented:

- No-till planting
- Water collection and storage
- Soil moisture monitoring

Year 6 – Subsidy Announcement

Water conservation includes using water resources responsibly (not overwatering) and only watering when necessary.

Extreme droughts are predicted to happen more often as a result of global climate change.

*Add *5 points* in the subsidy bonus blank if you invested in soil moisture monitoring*

*Add *10 points* in the subsidy bonus blank if you invested in water collection and storage*

*If you invested in both, add *15 points* total*