



Improving the Economic Sustainability of American Indian Agriculture

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Agriculture Importance to Indian Country Economies and Traditions

- Agriculture is increasingly important to Native economies, representing the economic backbone of more than 200 tribal communities and witnessing an 88% increase in the number of American Indian farmers between 2002 and 2007. According to the Census of Agriculture, in 2007 annual Indian agriculture production exceeded \$1.4 billion in raw agriculture products – National Congress of American Indians
- It is estimated that there are over 18,000 Navajo farmers, with more than half of Arizona farms and ranches owned by members of the Navajo Nation which use dry farming techniques (Yurth, 2009). Navajos generate an estimated \$40.5 million in the informal economy and much of this undocumented income is derived from family-based agriculture and crafts enterprises (Moore, Benally and Tuttle, 2008). Of the 12,000 farms and ranches, over 11,000 are family or individually managed, and average less than 9-acres in size. Over 57% of these farms earn less than \$1,000 per year, with another 19% earning less than \$2,500 per year (US Census, 2009).
- **Need long-term sustainable agriculture options for Indian Country**

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Agricultural Risk and Climate Change

- Close cultural and economic ties to natural resources, geographic remoteness, and economic challenges have led some to characterize American Indian reservations as some of the most vulnerable populations to climate change impacts (National Climate Assessments, U.S. Global Climate Change Research Program, 2014).
- Recurring challenges facing producers across the Navajo Nation (Patrick, 2013) include...
 - Limited farming opportunities and low crop yields due to **water shortages** stemming from enduring droughts and **inadequate water storage and distribution infrastructure**
 - **Soil erosion and poor soil quality** due to open ranges, lack of fencing, overgrazing and depleted organic material
 - **Lack of knowledge** of modern crop production and risk management practices, limited access to equipment and technical assistance, and knowledge of market and sales opportunities
 - Livestock (cattle, sheep, and goat) production, and market and sales opportunities are limited by the poor quality animals

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Climate Change Impacts to Agriculture in the West

- Less overall water availability, especially late in the season
- Periods of flooding, too much water
- Warmer temperatures, increased growing degree days
- Larger variability in temperatures
- Increased pest pressure
- Reduced productive rangeland
- Increased erosion on range and fallow areas
- Etc.....

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Potential Responses to Water Availability & Timing – Ag only

- Concentrate water use on most fertile areas
 - Reduce overall irrigated acres
- Produce high-value crops (price per unit higher)
 - Fresh produce vs. grains, etc.
 - Food grade crops vs. livestock feed
- Produce low water-use crops (drought resistant)
 - Traditional crops
- Implement water saving irrigation methods
 - Drip vs. flood or sprinkler vs. flood
- Produce annual crops to reduce risk
 - Teff vs. alfalfa (perennial with 5-8 year stand life)

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Other Potential Responses to Climate Change Impacts – Ag only

- Introduce drought resistant grasses to fallow and range areas for livestock feed
 - Alleviate erosion, low to no water needed other than rainfall, provide feed for cattle
- Expand tourism activities around agriculture and food (agritourism, food or cultural tourism)
 - Food and cultural tourism very popular
- Use technology to protect against temperature change, pests, etc.
 - Use of hoop houses (with shade), row covers, netting, etc.
 - Monitor soil moisture and deliver water as needed

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Water Availability – Institutional Responses

- Tap new water sources
- Reuse/recycle water
- Desalinization
- Change water allocation (rights) to higher valued uses
- Water banking and other delivery structure systems
- Water markets and secondary sales
- Land tenure changes

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Agriculture Ability to Dampen Climate Change Impacts – “Good News”

- Reductions in GHG emissions (methane and nitrous oxide)
- Agricultural carbon sequestration
- For example:
 - Conversion to organic farming systems – sequester 32% of man-made GHG emissions
 - Feeding and grazing management, manure management, etc.
 - Improve organic content in soil for carbon sequestration
 - Change in species or variety selection
 - Forestation

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What Research Can Provide

- Projections on climate change impacts, scenarios.....
- Projections of water availability, stream flows, ground water reserves, etc.
- Weather projections
- Growth rates for pests, weeds, and other invasive species
- Recommendations for institutional changes to improve efficiency
- Recommendations on marketable high value crops or drought resistant crops
- Recommendations on water saving technologies
- Profitability and risk analysis tools for potential grower or community level changes in agriculture
- Other.....

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Producer Adoption of New Technologies, Crops, etc.

- Major indicators of change/adoption
 - Access to information****
 - Farm characteristics such as location, ownership/tenure, size, crops, and income
 - Farmer characteristics such as age, education level, experience level, risk tolerance
 - Environmental priorities and lifestyle
 - Overall attitudes
 - Water availability (short-term and long-term)
 - Costs and length of time to transition
 - Policy and financial assistance
 - Opinions and actions of neighbors

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What types of information or tools, formats, timing, etc. will improve your ability to adapt agriculture to climate change?

- We can use behavioral economics to improve messages and impacts

- Nudges or cues

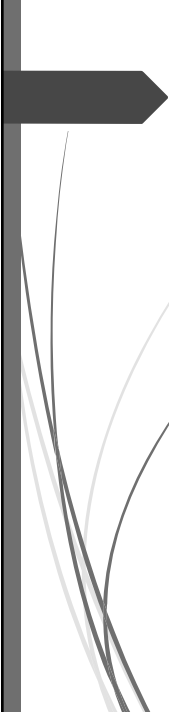
Cue	Behavioural Impact
Messenger	We are heavily influenced by the communicator/source of information (expertise, trustworthiness, personality)
Incentives	We are motivated by the timing and magnitude of incentives (gifts, coupons, completion certificates, loss of money)
Norms	We are strongly influenced by the actions of others (friends, family, those we respect)
Defaults	We commonly use pre-set options (opting in or out is less likely)
Saliency	Our attention is drawn to what is relevant (easy to understand, see, or find)
Priming	Our acts are often influenced by sub-conscious cues (words, pictures, sounds, smells)
Affect	Our emotional associations can powerfully shape our actions (words, images, events)
Commitments	We seek to be consistent with our public promises and reciprocate acts
Ego	We act in ways that create a positive self image

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Simple Game – Nudge Experiment

- Each person takes one card
- Each person takes on response sheet – Write name at top and circle the card number you have for round 1
- We do 2 rounds of three decisions each
- Evaluate how format and type of information effects behavior/choice

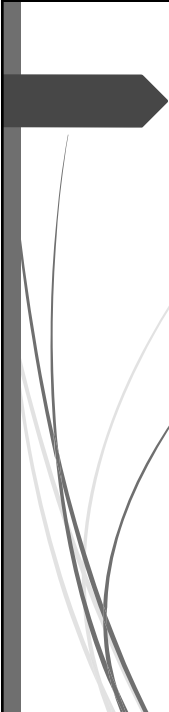
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Round 1: Option 1

- On your 100 acres you can switch from flood irrigation to sprinkler/drip irrigation
- The results of a change or no change is represented on your card
- Do not discuss anything with your neighbor

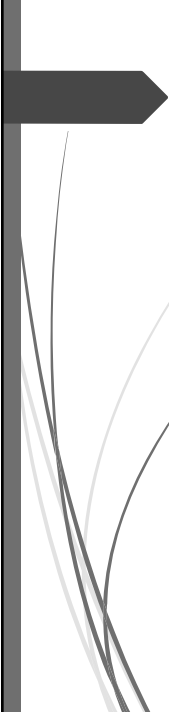
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Round 1: Option 2

- On your 100 acres you can switch from a high water use crop to a low water use crop
- The results of a change or no change is represented on your card
- Do not discuss anything with your neighbor

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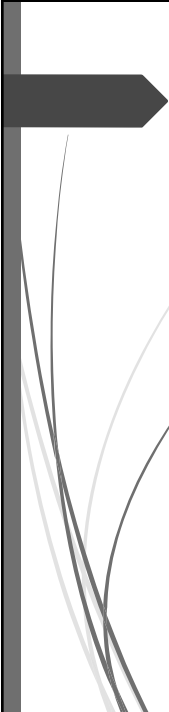


Round 1: Option 3

- On your 100 acres you can switch to a higher value crop, a higher price point per item
- The results of a change or no change is represented on your card
- Do not discuss anything with your neighbor

- For round 2 switch cards, A goes to B and vice versa, A1 goes to B1 and vice versa, A2 goes to B2 and vice versa
- Circle the card number you have for round 2

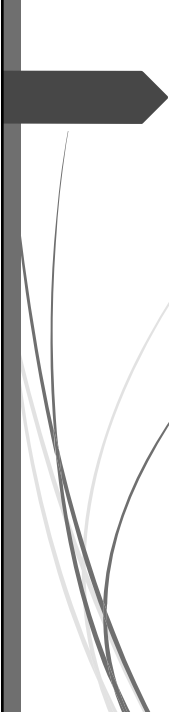
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Round 2: Option 1

- On your 100 acres you can switch from flood irrigation to sprinkler/drip irrigation
- The results of a change or no change is represented on your card – **read your new card completely**
- Do not discuss anything with your neighbor

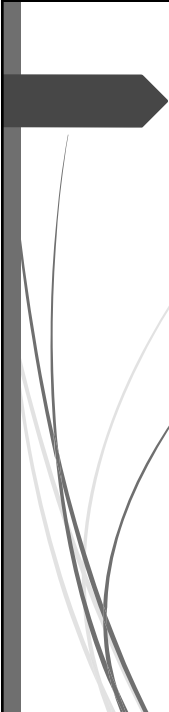
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Round 2: Option 2

- On your 100 acres you can switch from a high water use crop to a low water use crop
- The results of a change or no change is represented on your card
- Do not discuss anything with your neighbor

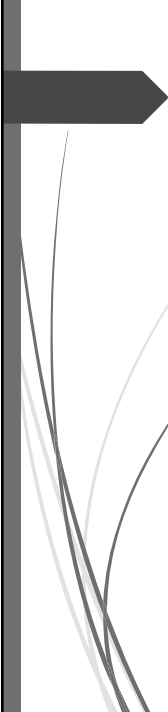
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Round 2: Option 3

- On your 100 acres you can switch to a higher value crop, a higher price point per item
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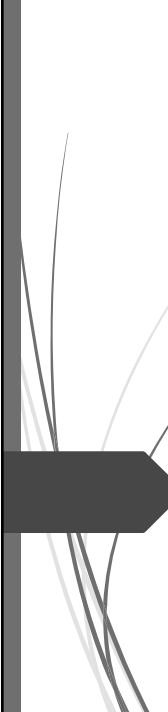
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Observations

- Effect of the percentage of gain from change?
- Effect of the positive vs. negative position – same info?
- Effect of the option type (crops, irrigation, etc.)?
- Effect of the color of the card?
- Did anything your neighbor said effect your response?

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Thank you!

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