QUAPAW NATION

HARVARD CLIMATE SOLUTIONS LIVING LAB

MICROGRID SOLAR & AGRIVOLTAIC OPPORTUNITIES

TEAM #4

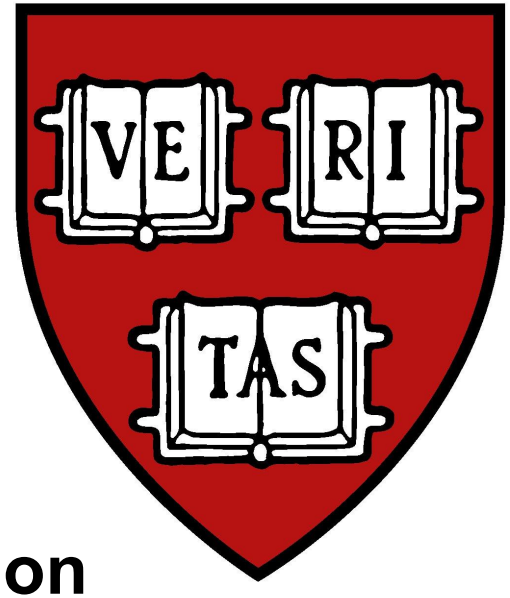
ANDREW WEI | AOIFE BLANCHARD | CHARLOTTE ROSS | ETHICA BURT | ERIN O'DWYER | MAURO MORABITO | NOBUHIRO MITSUOKA

Presentation

April 20, 2022

The Quapaw Nation

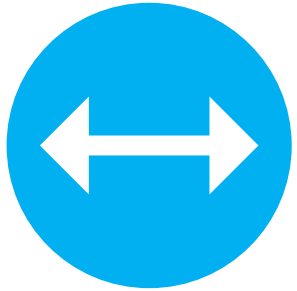
A Partnership for Climate Action



Goals Alignment
Continued Collaboration

Addressing Land Use Tensions

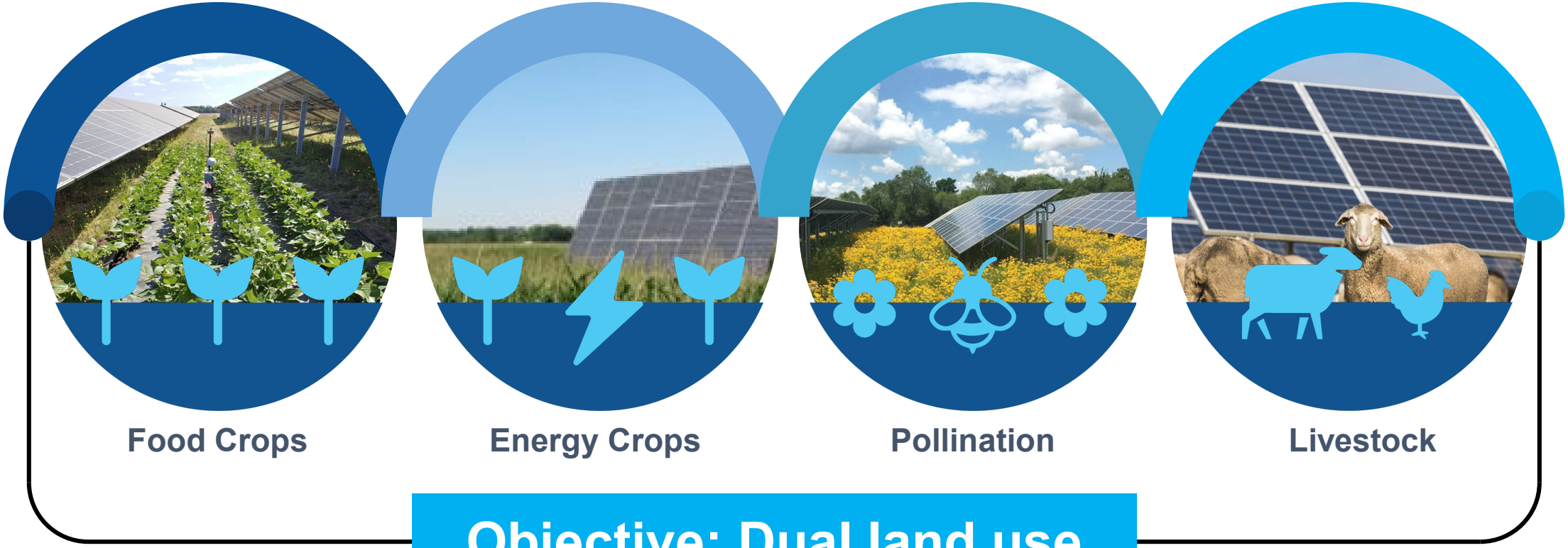
Demand for **renewable energy** (e.g., solar)



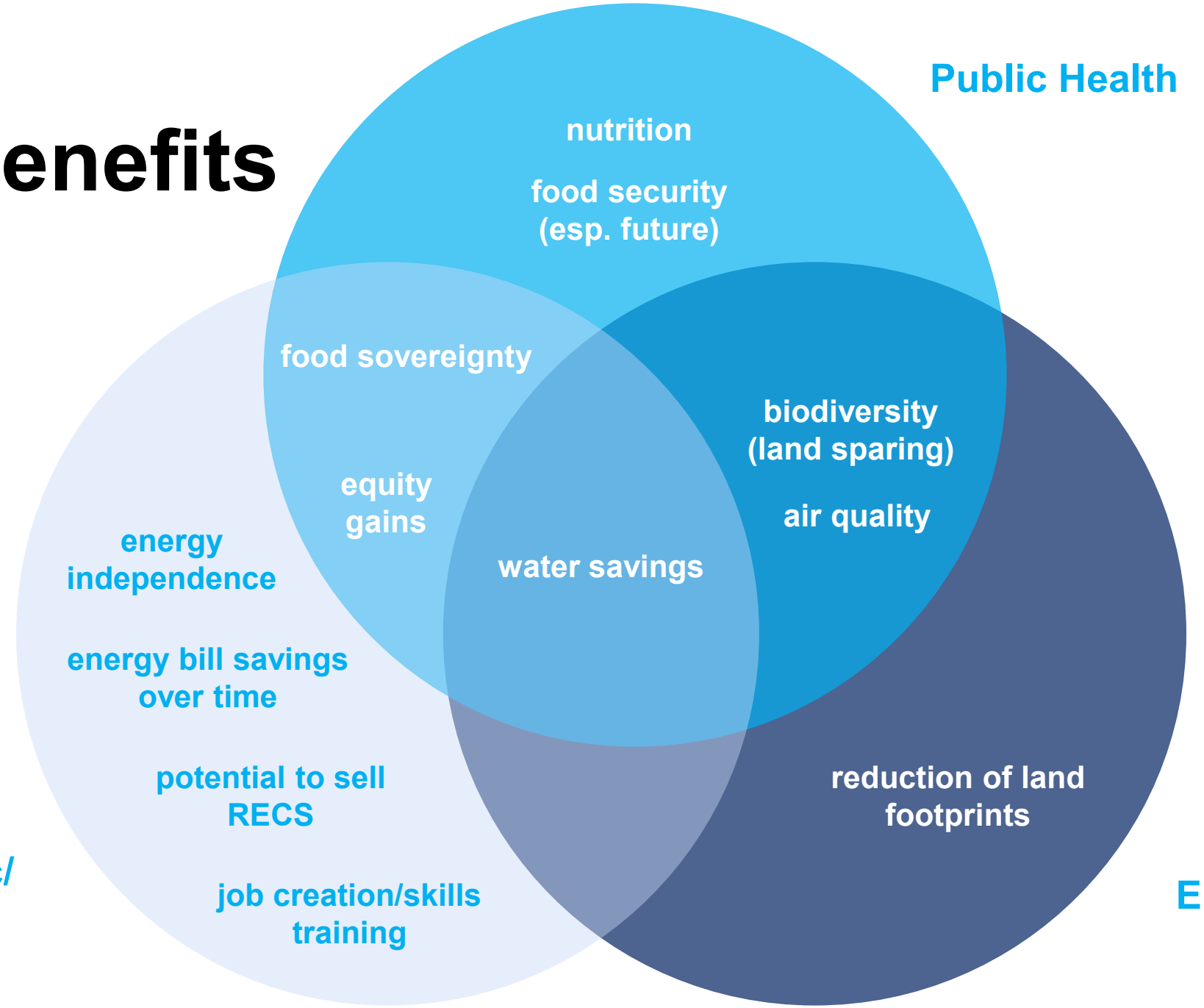
Tradeoff between **energy** vs. **food production**

Agrivoltaics

solar photovoltaic (PV) panels + agricultural operations



Co-Benefits


Public Health
nutrition
food security
(esp. future)
food sovereignty
equity
gains
biodiversity
(land sparing)
air quality
water savings
energy
independence
energy bill savings
over time
potential to sell
RECS
job creation/skills
training
reduction of land
footprints
Economic/
Tribal
Environment

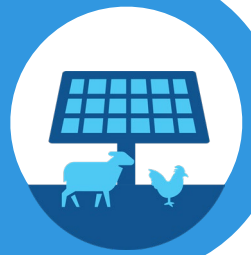
Project Criteria

Scenarios

1. Ground mount solar

2. Ground mount solar + crops

3. Ground mount solar + grazing

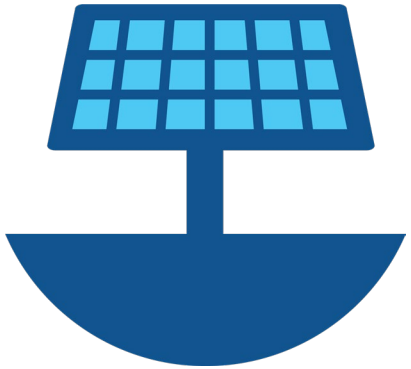


4. Microgrid [solar + storage] + agrivoltaics

Scenario 1

Attributes

- Ground mount solar
- No agrivoltaics



Good option for

- ✓ Technical feasibility
- ✓ Economic feasibility
- ✓ Environmental Sustainability

Forefront Power, Illinois

5 MW DC

Ground Mount Solar

Ute Tribe, Colorado

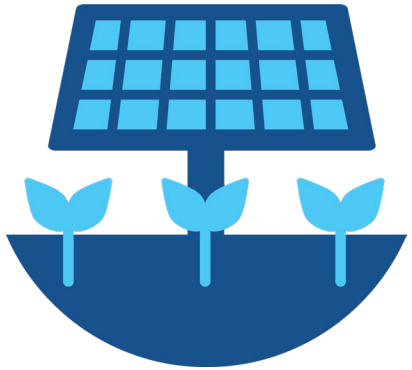
1.3 MW DC

Ground Mount Solar

Scenario 2

Attributes

- Ground mount solar
- Crop/pollinator agrivoltaics



Good option for

- ✓ Agricultural production
- ✓ Technical feasibility
- ✓ Environmental Sustainability

56 Brewing/Bare Honey, Wisconsin

Various Agrivoltaic Pollinator Projects

Jack’s Solar Garden, Colorado

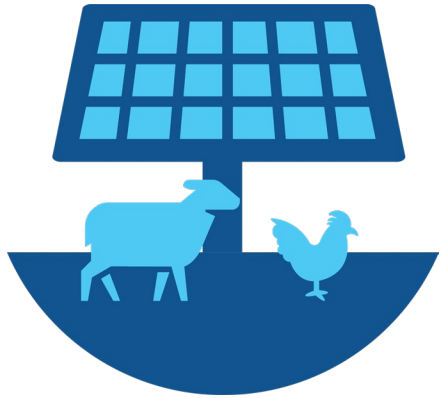
1.2 MW

Vegetable Farm and Artist Community

Scenario 3

Attributes

- Ground mount solar
- Grazing agrivoltaics



Good option for

- ✓ Agricultural production
- ✓ Environmental Sustainability

Blue Prairie Solar, Wisconsin

3.1 MW DC

Sheep Grazing

University of Minnesota

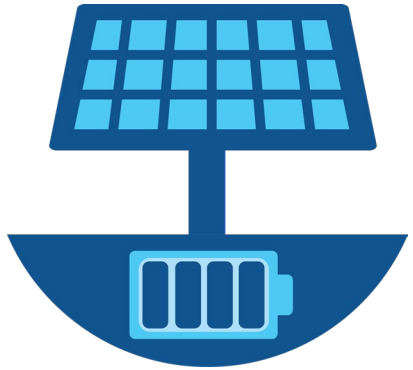
50 kW Pilot Project

Cow Grazing

Scenario 4

Attributes

- Microgrid [solar + storage]
- Agrivoltaics



Good option for

- ✓ Agricultural production
- ✓ Environmental Sustainability
- ✓ Sovereignty & Good Governance

Blue Lake Rancheria, California

420 kW DC Solar

1.2 MWh Battery Storage

Microgrid [No Agriculture]

Ishkonige Nawadide Solar, Wisconsin

500 MW DC Solar

1 MWh Battery Storage

Microgrid [Crops]

How do metrics add value?

Setting requirements

- Enables a more specific Request for Proposal (RFP), improving the quality of project proposals submitted by contractors

Visualizing tradeoffs

- Enables efficient comparison of projects with different benefits and limitations
- Enables comparison of quantitative and qualitative impacts
- Allows project proposals to be compared against benchmarks and case studies

Evaluation tools

	Category	Description	Weighting
GOALS	Electricity production	*Does the project generate sufficient electricity, and do so reliably?*	12
GOALS	Agricultural production	*Does the project create sufficient dual-use land for agricultural uses?*	12
GOALS	Environmental sustainability	*Will the project reduce GHG emissions and align with the tribe's ecological values?*	12
GOALS	Economic feasibility	*Is the project cost-effective, and are the financial and legal risks bearable?*	10
GOALS	Technical feasibility	*Is the project technically sound, with limited anticipable risks?*	10
GOALS	Sovereignty and good governance	*Does the project create tribal ownership and community engagement?*	8
CO-BENEFITS	Energy independence	*Does the project reduce the tribe's reliance on imported electricity?*	7
CO-BENEFITS	Food sovereignty	*Does the project reduce the tribe's reliance on food imports?*	8
CO-BENEFITS	Public health improvement	*Does the project improve the tribe's air, water, nutrition, and general well-being?*	5
CO-BENEFITS	Economic opportunity	*Does the project generate revenue and jobs for the tribe?*	8
CO-BENEFITS	Tribal leadership	*Does the project create opportunities for knowledge sharing with other tribes?*	8
	TOTAL *(must add up to 100)*		100

Step 1

Decide on relative weights of the possible goals and co-benefits *(illustrative)*

Evaluation tools

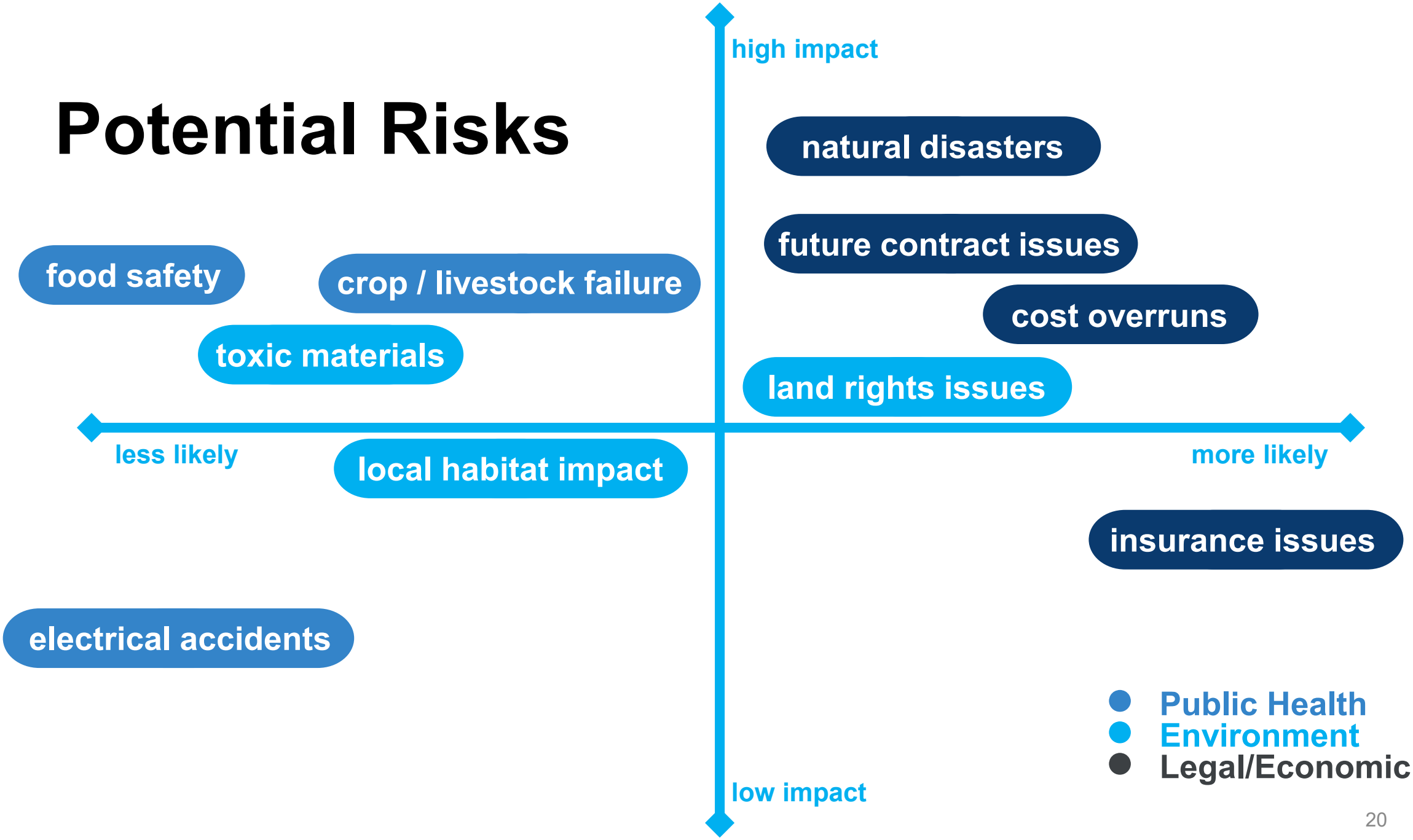
	Category	Description	Weighting
GOALS	Electricity production	*Does the project generate sufficient electricity, and do so reliably?*	12
	Agricultural production	*Does the project create sufficient dual-use land for agricultural uses?*	12
	Environmental sustainability	*Will the project reduce GHG emissions and align with the tribe's ecological values?*	12
	Economic feasibility	*Is the project cost-effective, and are the financial and legal risks bearable?*	10
	echnical feasibility	*Is the project technically sound, with limited anticipable risks?*	10
	overeignty and good governance	*Does the project create tribal ownership and community engagement?*	8
CO-BENEFITS	ergy indepe		
	Food sovereig		
	Public health		
	Economic opp		
	Tribal leaders		

Step 2

For each project, quantify performance along the different criteria

	Scoring guidelines			
Criteria	**1**	**2**	**3**	**4**
One-time capital expenditures (CAPEX)	>$6 million	$5-6 million	$4-5 million	<$4 million
Annual operating expenditures (OPEX)	>$18,000	$9,000-18,000	$2,000-9,000	<$2,000
Financial and contracting risk	High risk	Moderate risk	Low risk	Minimal or no risk
Eligibility for grant funding	No			Yes
Insurability	High risk	Moderate risk	Low risk	Minimal or no risk
Additional grid connection costs	No			Yes

Potential Risks



Key Takeaways

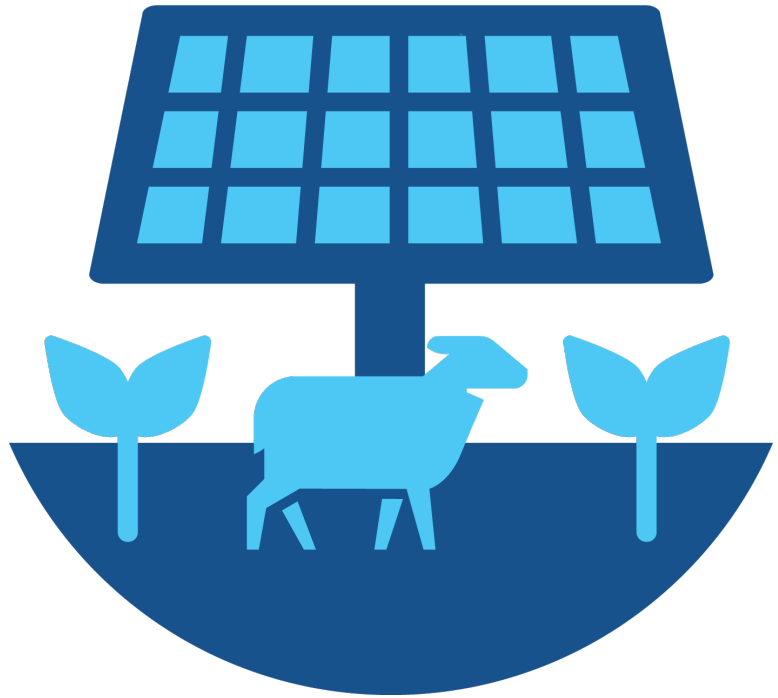
Multiple priorities

- Climate mitigation
- Agricultural production

Agrivoltaics

Potential solution enabling renewable energy and dual land use

- Co-benefits
- Scalability



THANK YOU!

Erin O'Dwyer
HSPH

Andrew Wei
HKS

Charlotte Ross
HKS

Aoife Blanchard
GSAS

Mauro Morabito
HKS

Ethica Burt
GSD

Nobuhiro Mitsuoka
Subject Matter Expert

Special thanks to the Teaching Team and our partners at the Quapaw Nation!