Washington State 2025
SOLAR SUMMIT

Advancing Solar in a Time of Uncertainty

October 24, 2025 | South Seattle Community College

Session 4

Dual-Use Solar in Washington: How Do You Like Them Apples?

Moderator: Justin Allegro, The Nature Conservancy

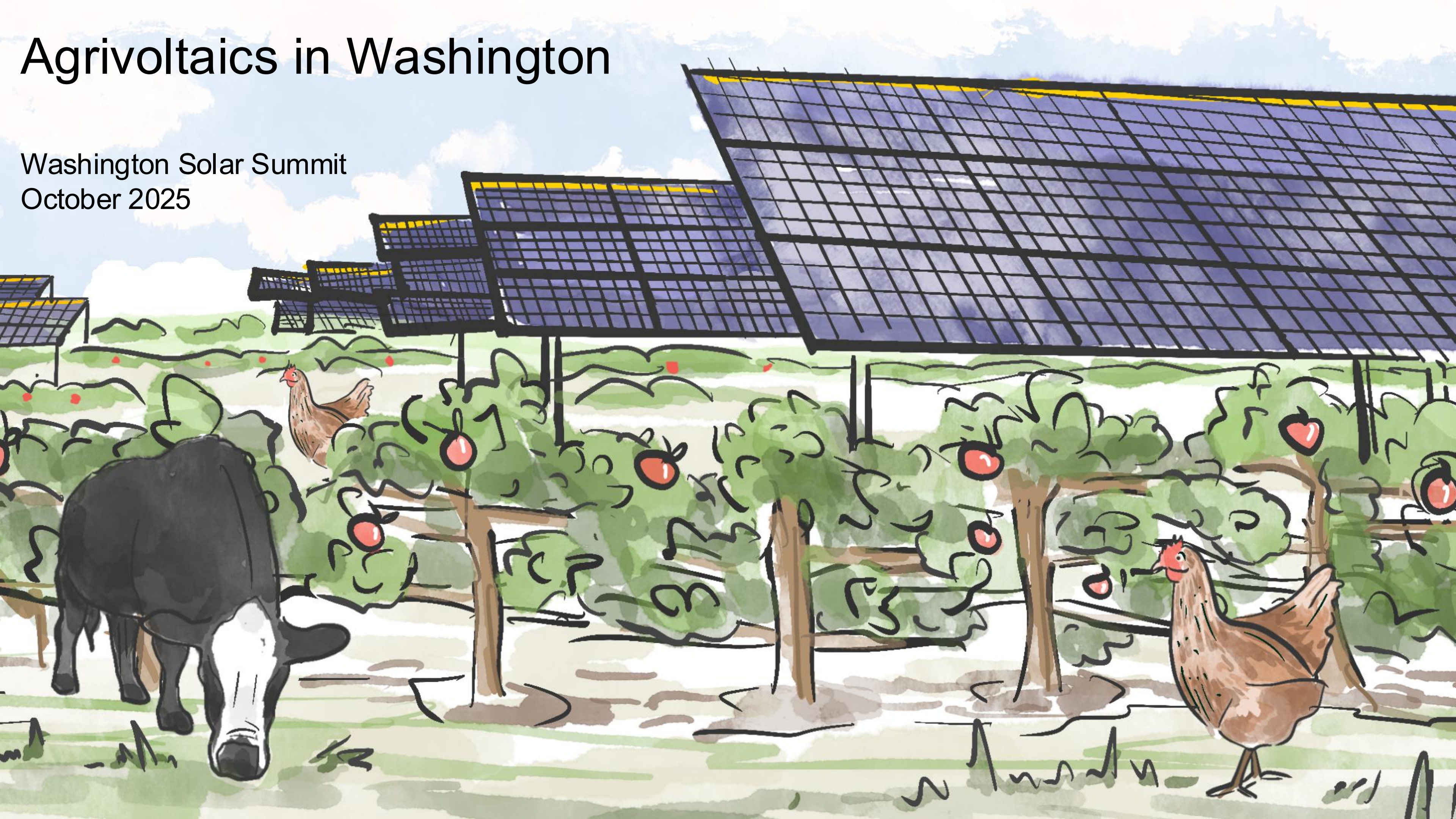
Featuring: Addie Candib, American Farmland Trust;

Max Lambert, The Nature Conservancy;

Callum McSherry, Cascadia Renewables

Agrivoltaics in Washington

Washington Solar Summit
October 2025



Solar and Land Use

Lambert and Gilbert, *In Review*

Solar and Land Use

Greenfield PV

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Greenfield PV

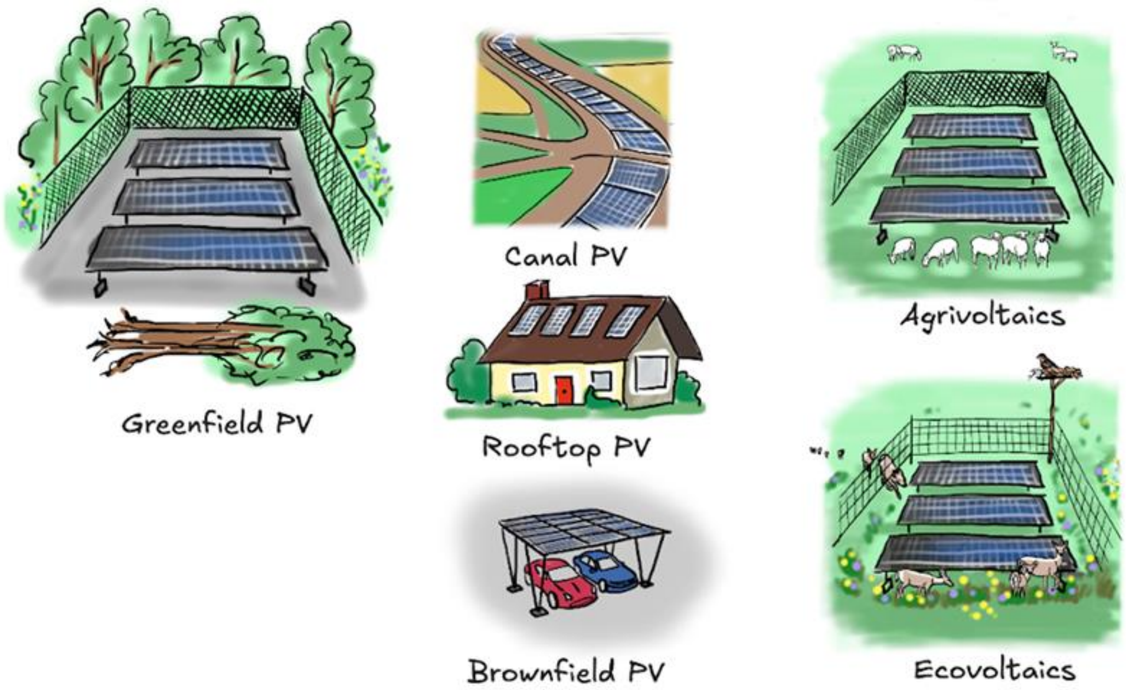
Canal PV

Rooftop PV

Brownfield PV

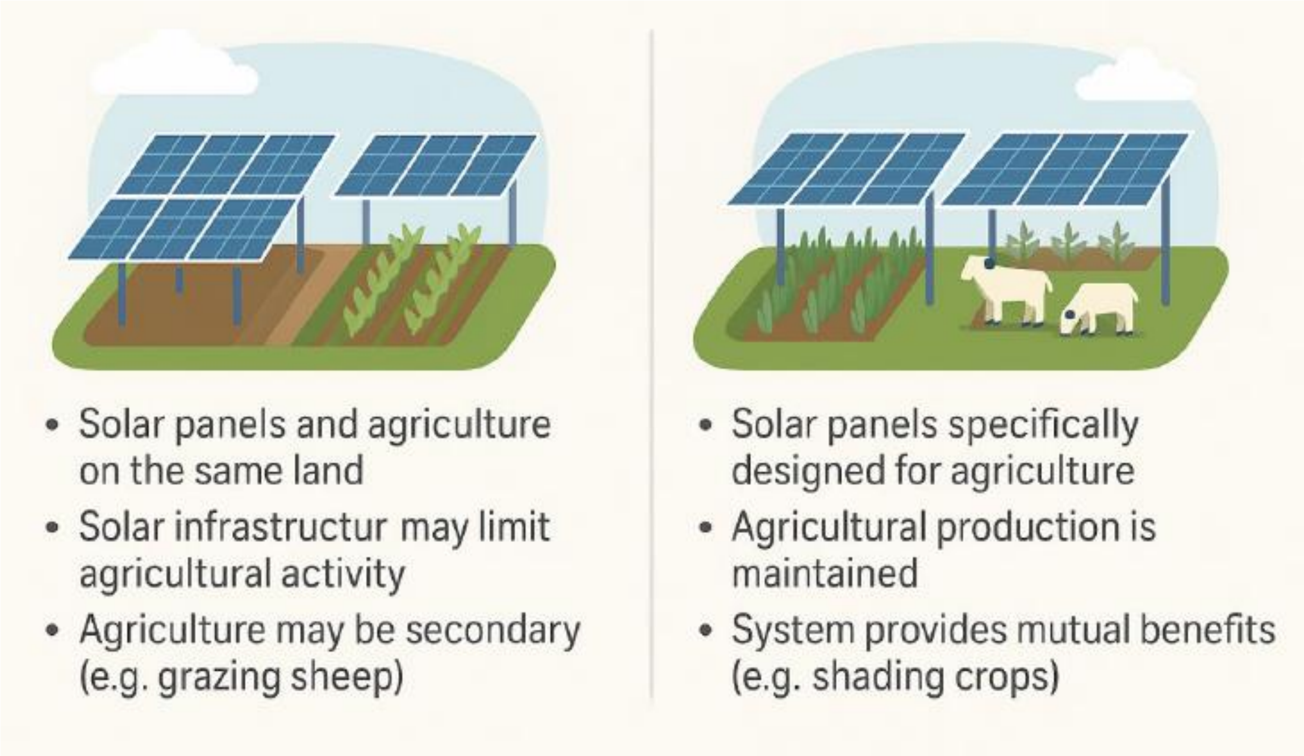
Lambert and Gilbert, *In Review*

Solar and Land Use



Lambert and Gilbert, *In Review*

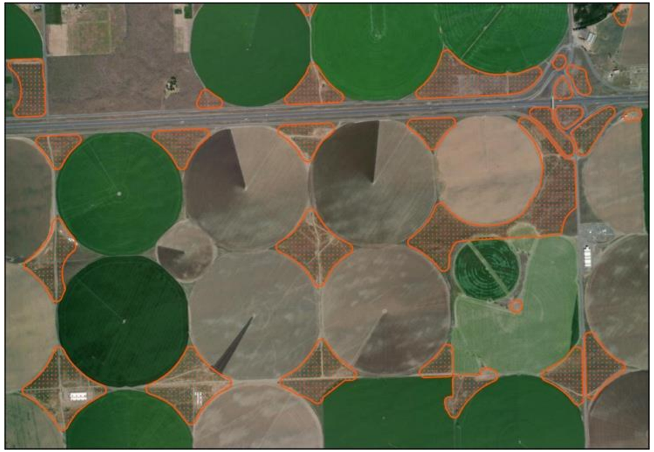
Co-Location | Dual-Use

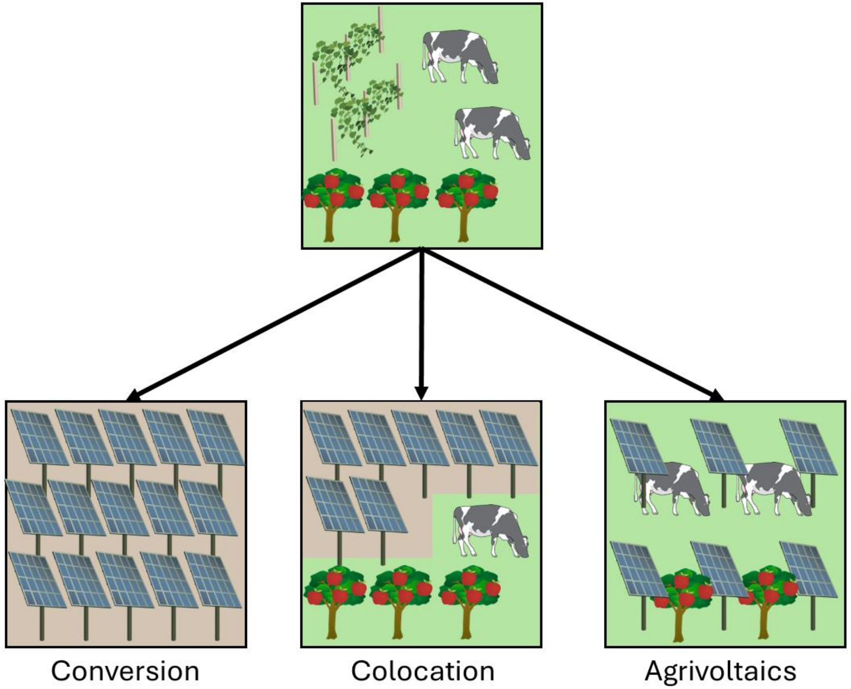


Smith 2025

Agrivoltaics

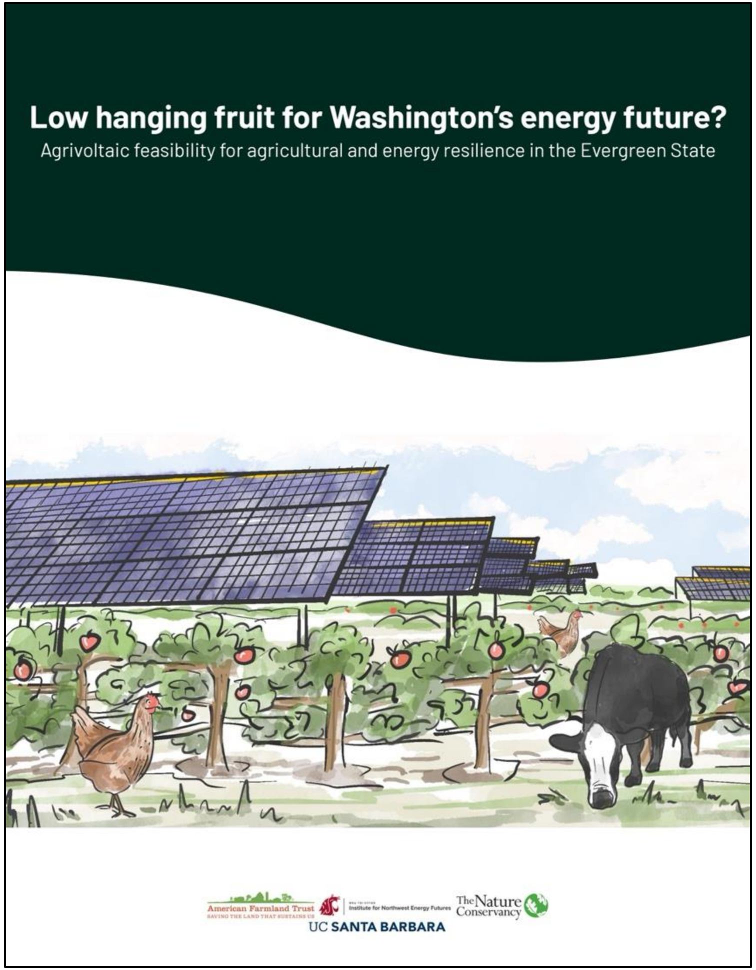
- **Agrivoltaics** = installing solar arrays on farmland in manner that allows for the continued production of crops and/or livestock <u>beneath</u> or <u>between</u> solar panels
- Not conversion or general co-location
    - Other co-location could include solar on pivot corners, dairy infrastructure, or irrigation canals





Agrivoltaics Report

1. Science synthesis
2. Mapping
3. Modeling: parcel-scale and crop impacts
4. Farmer survey



Science Synthesis

- What works?
  - Perennial fruits tend to be most successful
    - Tree fruit – and apples – are particularly good candidates
      - Similar or improved yield and quality
      - Solar arrays can replace trellising and shade cloth

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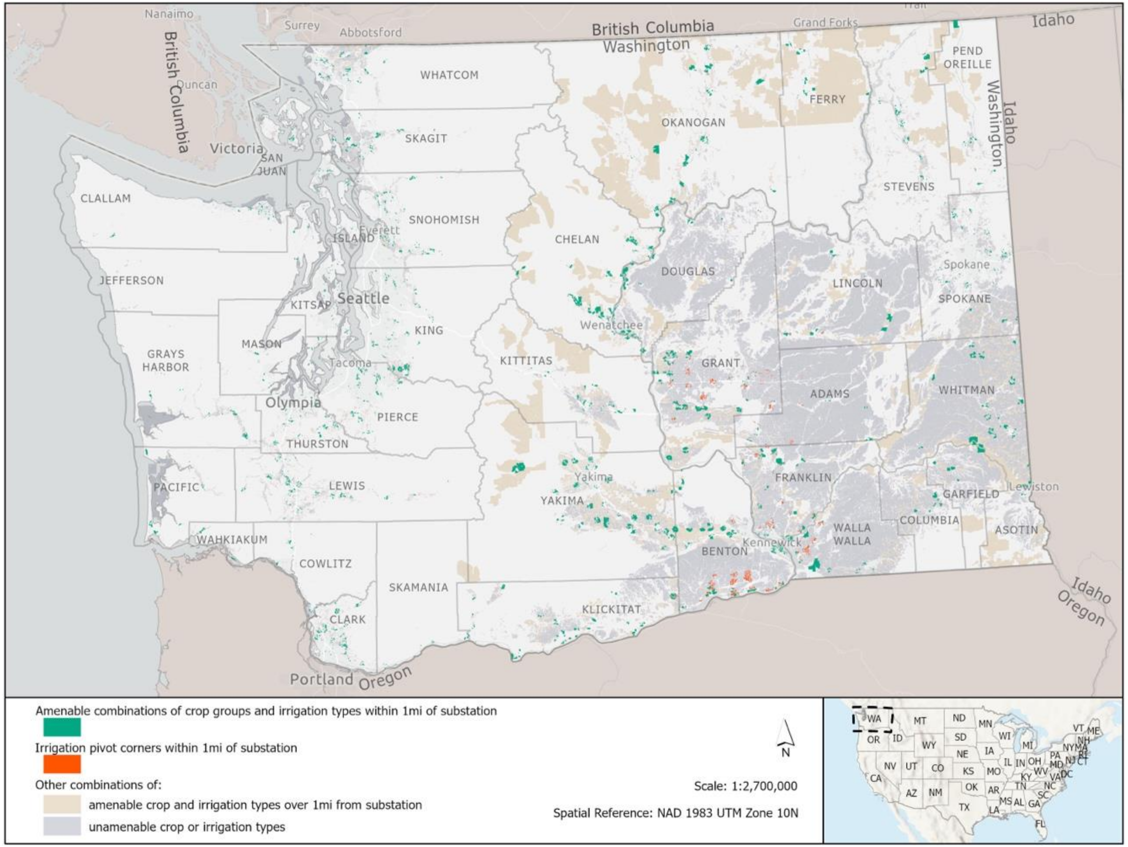
  - Vegetables have variable success
  - Grains, soy, alfalfa, potatoes, etc. are currently not feasible
    - Shade intolerance and technical limitations
    - Potential for bifacial solar panels
  - Livestock
    - Simpler integration
    - Improved welfare
    - Little research on production effects

Science Synthesis

- Economics
  - Ground-mounted solar is more profitable than agriculture or agrivoltaics
  - Agrivoltaics can be profitable, depending on the crop and setup
    - Some crops are hard to make profitable
  - Policy incentives are typically necessary
  - CAPEX is costlier than standard solar, but OPEX tends to be cheaper
  - **Still cheaper than rooftop solar**
- Social Science
  - Farming is a central component of farmers' identities
  - Multiple studies show farmers have higher support for agrivoltaics than direct conversion of farmland to solar
  - The broader public tends to prefer agrivoltaics over direct conversion of rural landscape to solar
  - Agrivoltaics might increase the "social license" to farm

Mapping

- “First Principles” approach
  - Crop type
  - Irrigation infrastructure intensity
  - Energy infrastructure proximity
  - PVout calculated for each field
- Most ag land is **not** amenable
- 87,000 – 351,707 potential acres
  - 9-70 GW



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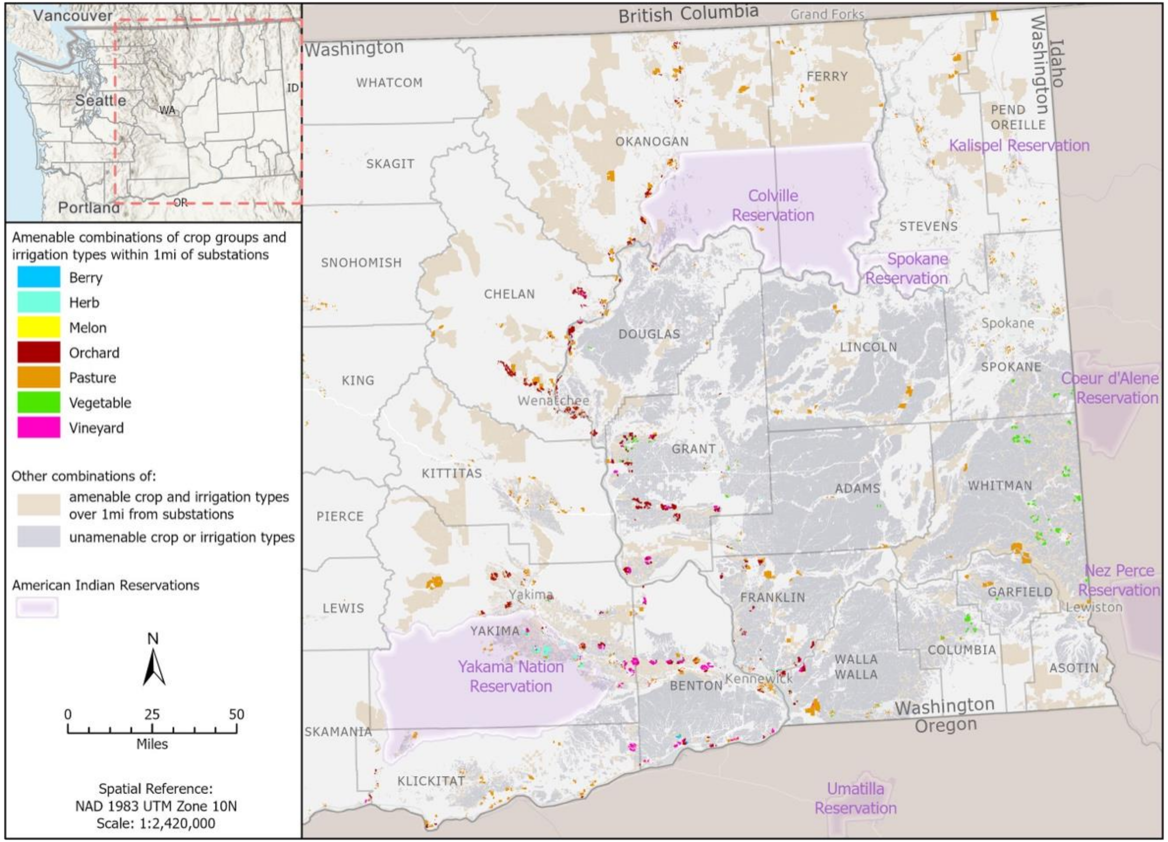
  - Orchards = 50% of agrivoltaic potential
  - Pasture < 10% of agrivoltaic potential
  - Vineyards & Veggies = ~30% of potential
- Geographic variation



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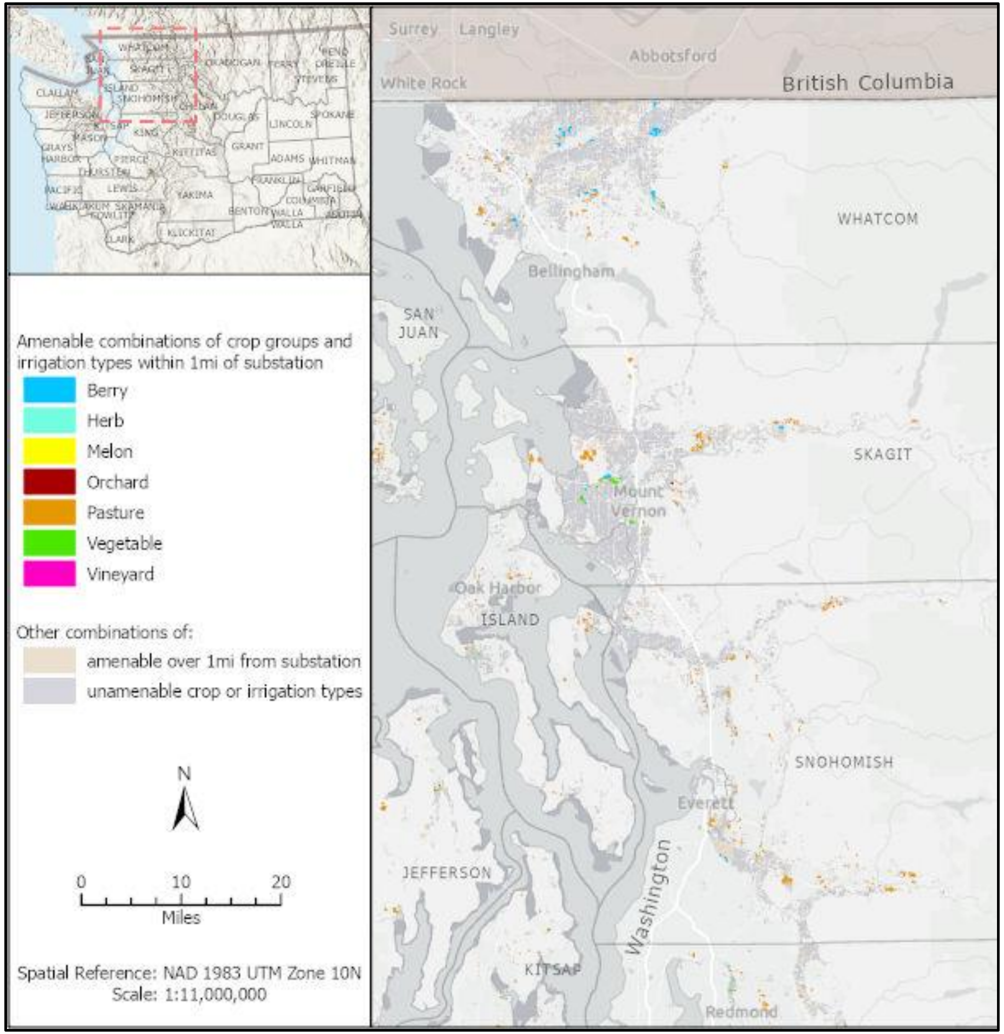
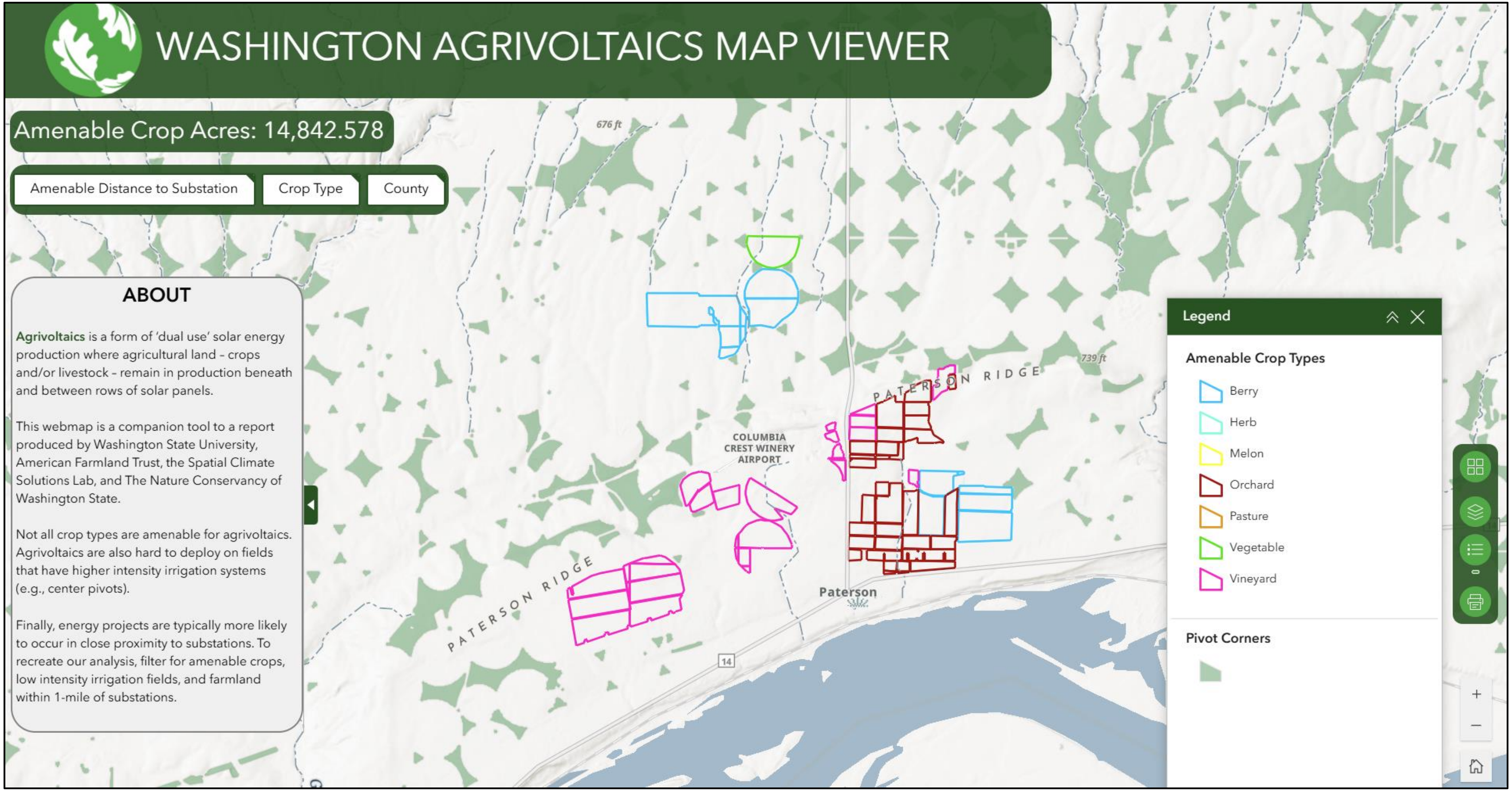
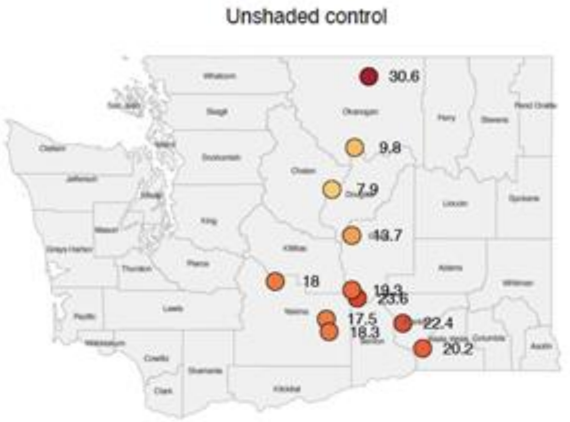


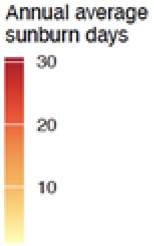


WASHINGTON AGRIVOLTAICS MAP VIEWER
Amenable Crop Acres: 14,842.578
Amenable Distance to Substation
Crop Type
County
ABOUT
Agrivoltaics is a form of 'dual use' solar energy production where agricultural land - crops and/or livestock - remain in production beneath and between rows of solar panels.
This webmap is a companion tool to a report produced by Washington State University, American Farmland Trust, the Spatial Climate Solutions Lab, and The Nature Conservancy of Washington State.
Not all crop types are amenable for agrivoltaics. Agrivoltaics are also hard to deploy on fields that have higher intensity irrigation systems (e.g., center pivots).
Finally, energy projects are typically more likely to occur in close proximity to substations. To recreate our analysis, filter for amenable crops, low intensity irrigation fields, and farmland within 1-mile of substations.
676 ft
739 ft
PATERSON RIDGE
PATERSON RIDGE
COLUMBIA CREST WINERY AIRPORT
Paterson
14
Legend
Amenable Crop Types
Berry
Herb
Melon
Orchard
Pasture
Vegetable
Vineyard
Pivot Corners

Crop Agrivoltaic Modeling

Agrivoltaics reduce apple sunburn





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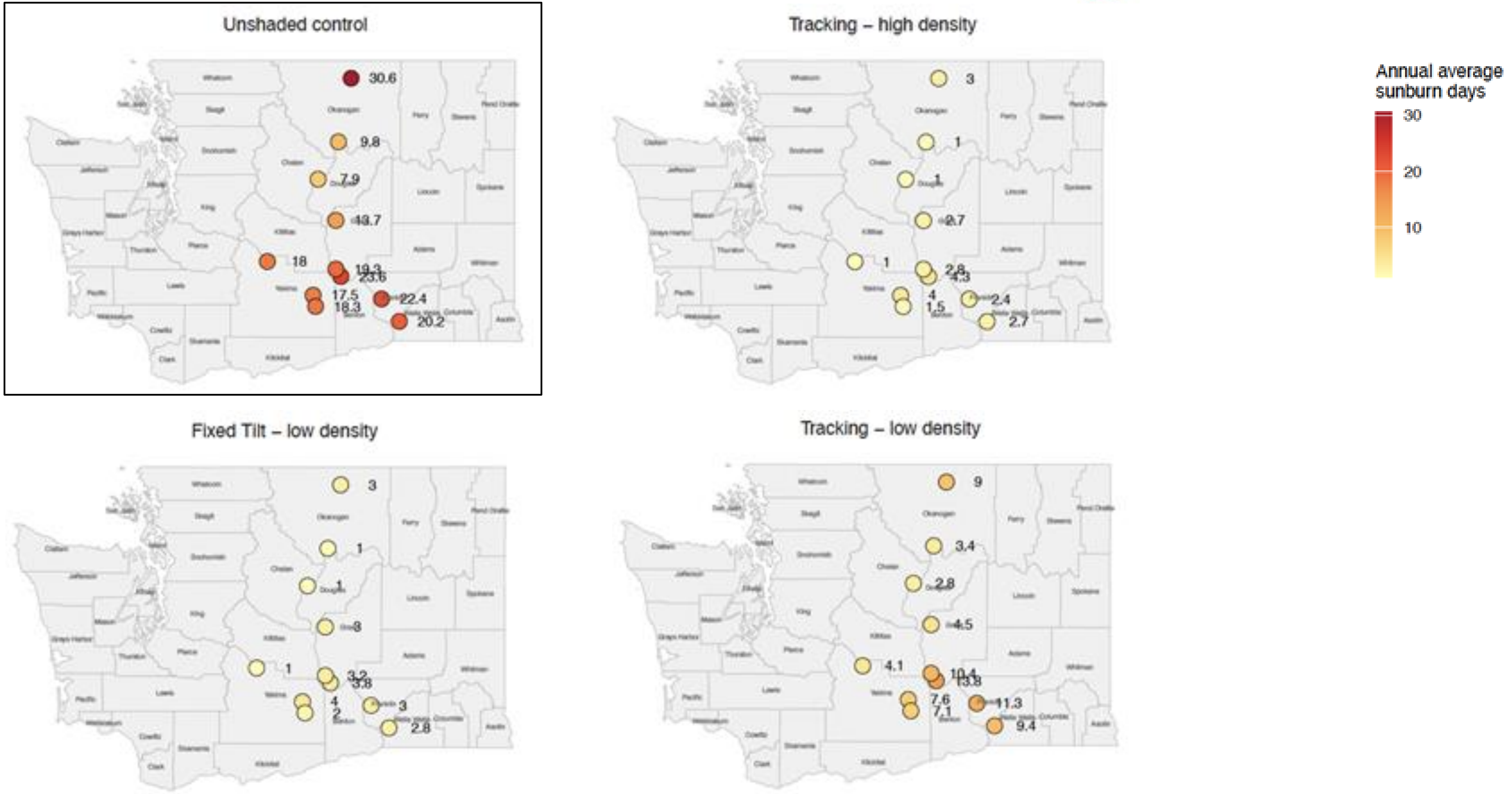
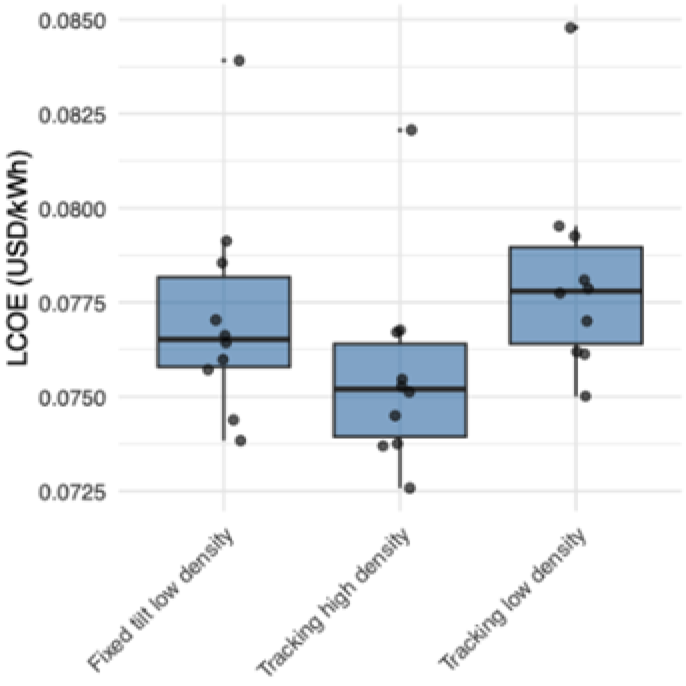
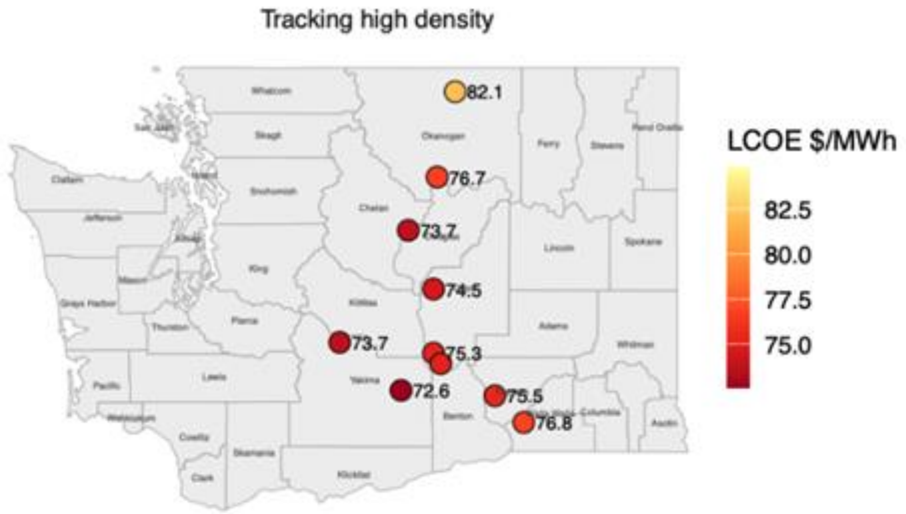
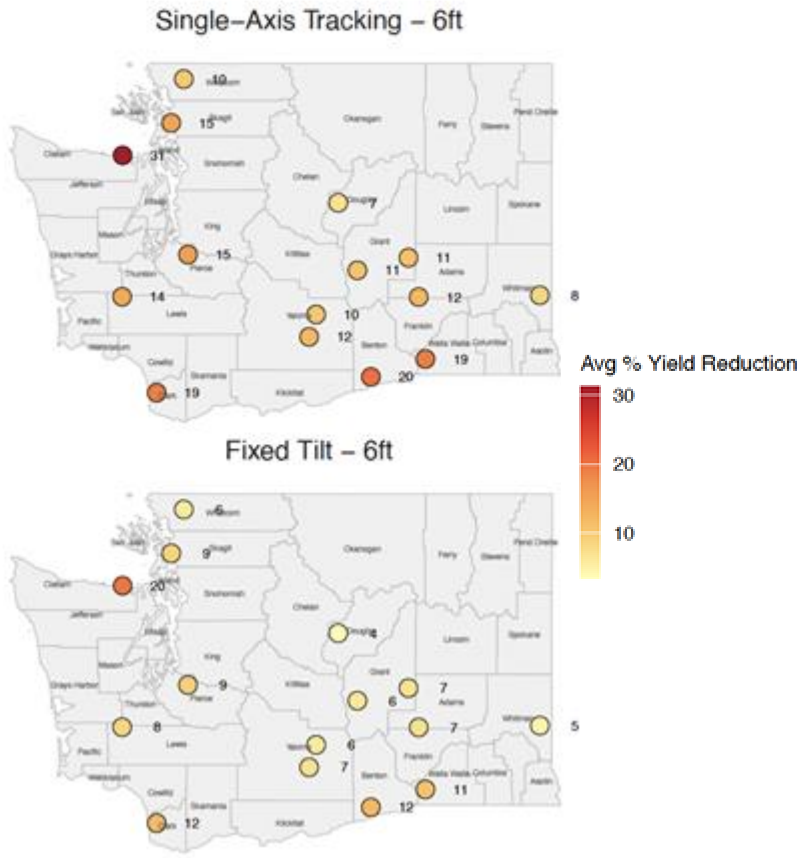


Apple agrivoltaics can be economically viable

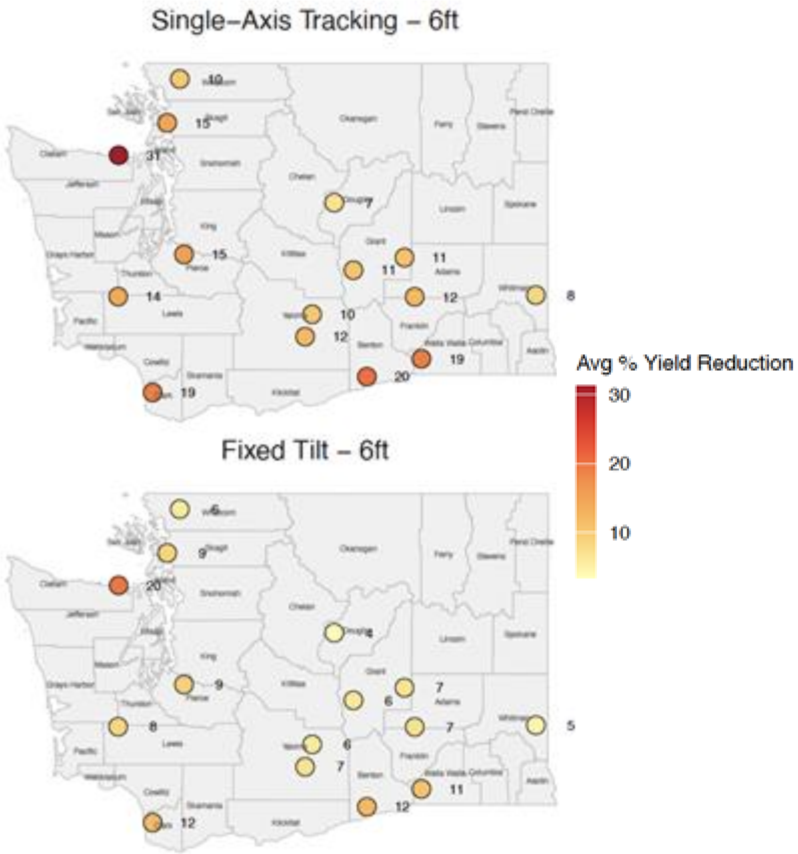




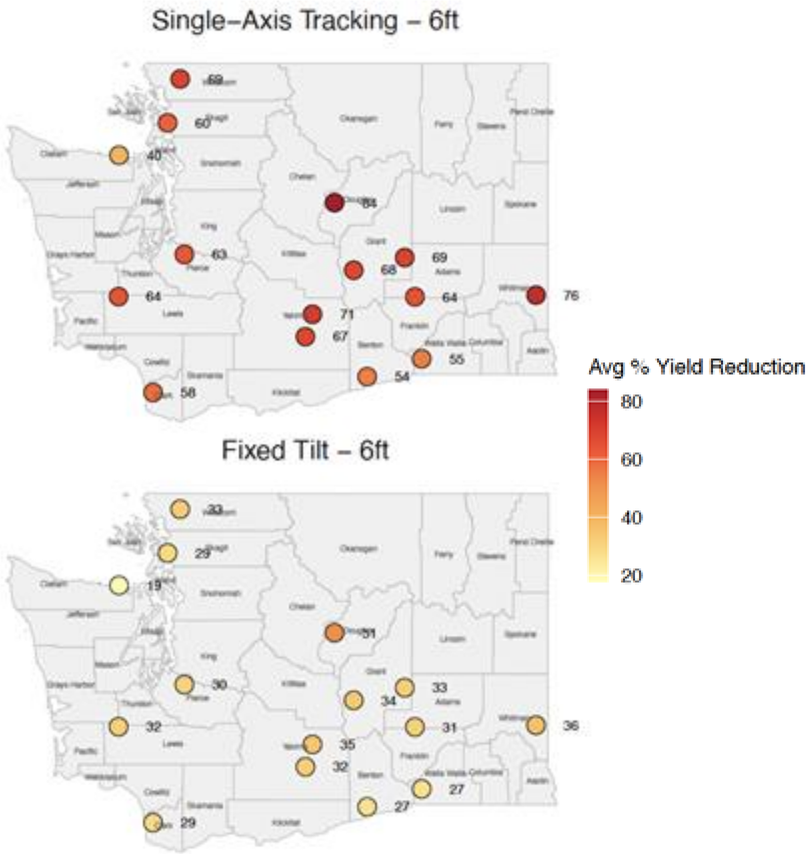
Lettuce


Single–Axis Tracking – 6ft
Fixed Tilt – 6ft
Avg % Yield Reduction
30
20
10

Lettuce



Strawberries



Conclusions

- Apple orchard agrivoltaic systems
  - Can reduce annual sunburn days ~34%-95%, depending on area and design
    - Better than shade cloth
  - Levelized-costs of apple agrivoltaics are 5-30% higher than traditional solar
    - But **costs are competitive with rooftop solar**
    - LCOEs range from $73/MWh (Yakima) to $85/MWh (Okanogan)

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    - LCOEs range from $73/MWh (Yakima) to $85/MWh (Okanogan)
- Lettuce works well in agrivoltaic systems, particularly when raised 6-8ft
- Strawberries work less well, have higher yield reductions
- Large spatial variation in crop impacts for  & 
- Levelized costs are favorable
  - ~3-5% increase in LCOE when raising panels 6ft

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- Large spatial variation in crop impacts for  & 
- Levelized costs are favorable
    - ~3-5% increase in LCOE when raising panels 6ft
- High potential for fruit and livestock agrivoltaics in Washington
    - Distributed energy systems and utility-scale
- Demonstration projects would be valuable
- Financially viable

American Farmland Trust
SAVING THE LAND THAT SUSTAINS US

Methods

Statewide survey

- An electronic survey for farmers, ranchers, and agricultural landowners in Washington was distributed statewide Feb 25-April 18, 2025.
- AFT distributed the survey with the help of 57 partners and organizations across the state (i.e. Washington Farm Bureau, Dairy Comission, WA tree fruit association, etc).

1:1 interviews with diverse stakeholders

- Conducted fourteen ~1 hour video interviews with diverse agrivoltaic stakeholders across Washington state. Interviewees included people from the following sectors

Utilities

Solar

Agriculture

Cattle

Berries

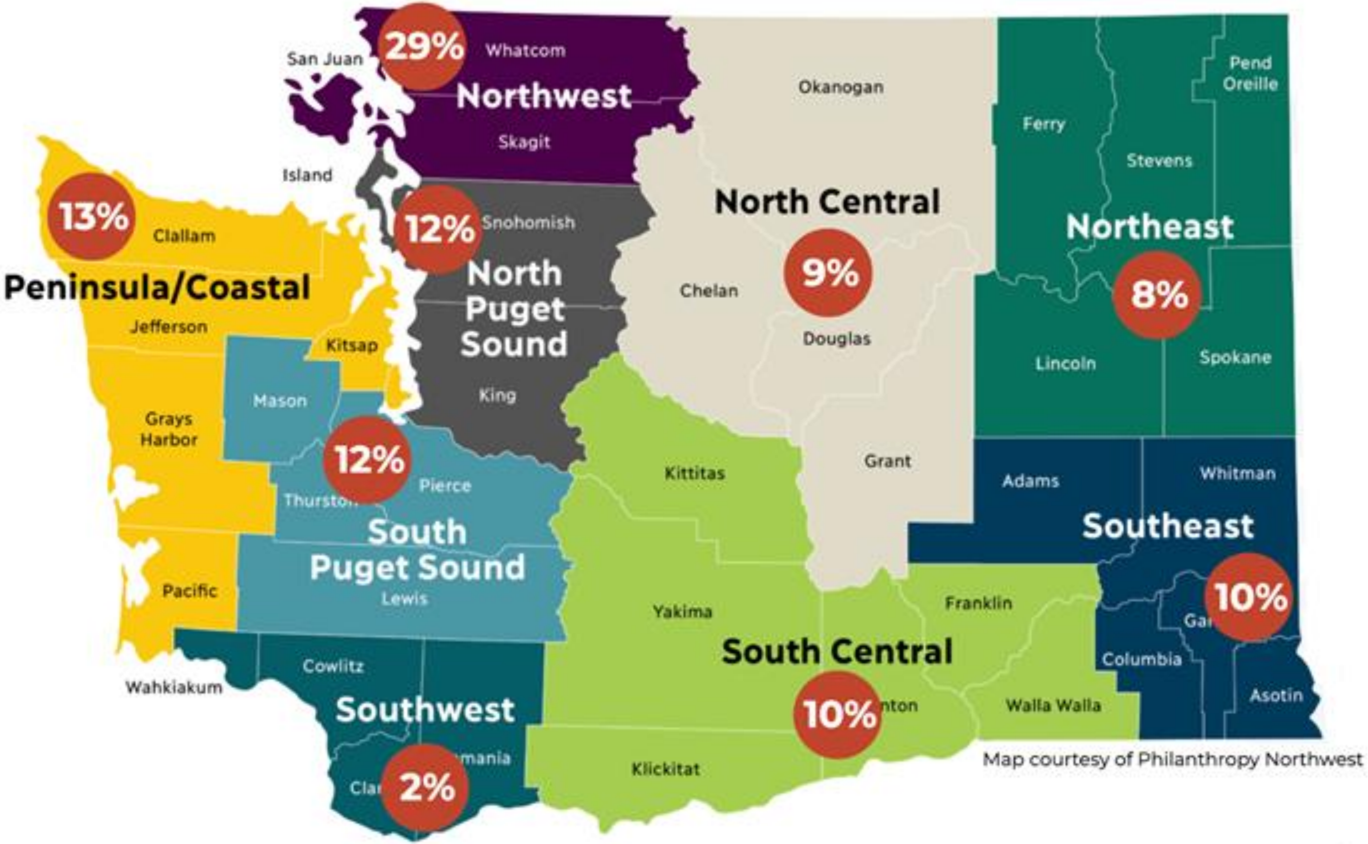
Sheep

Vegetables

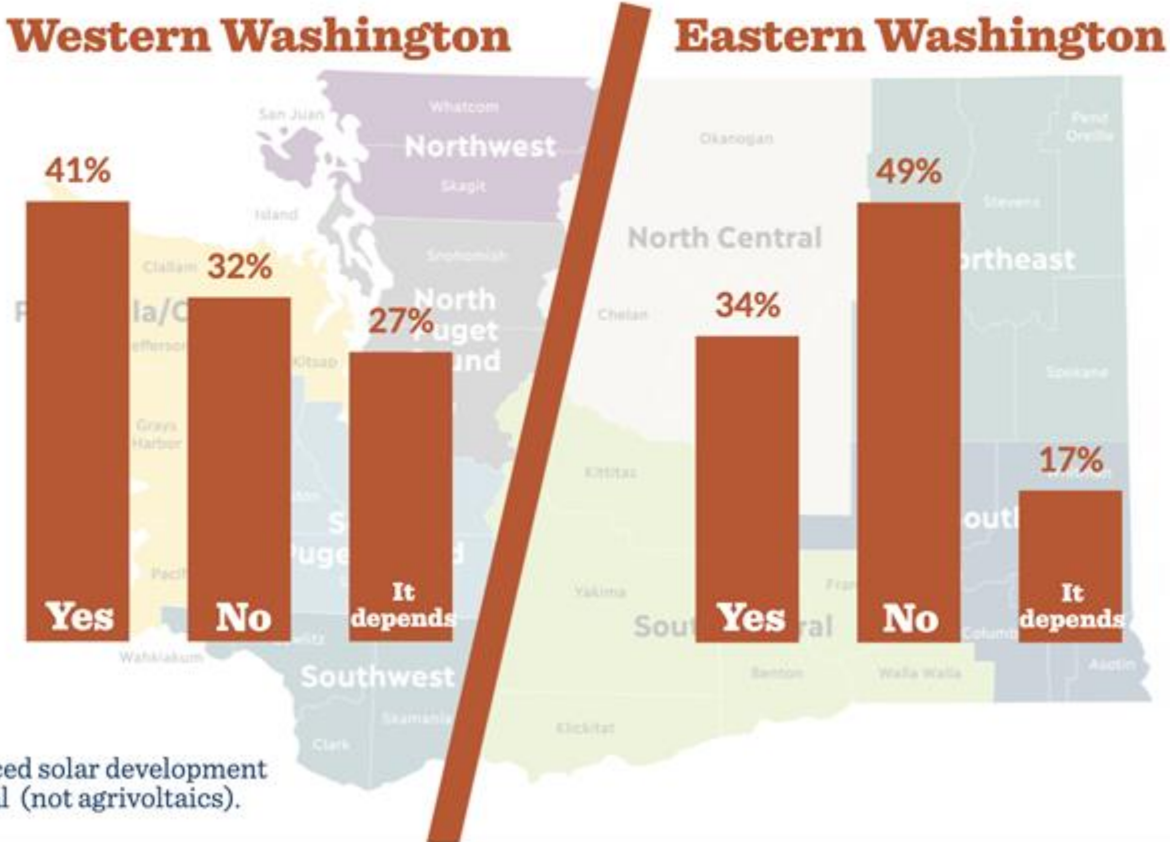
Research

Policy

Almost one third of survey respondents are located in Northwest Washington

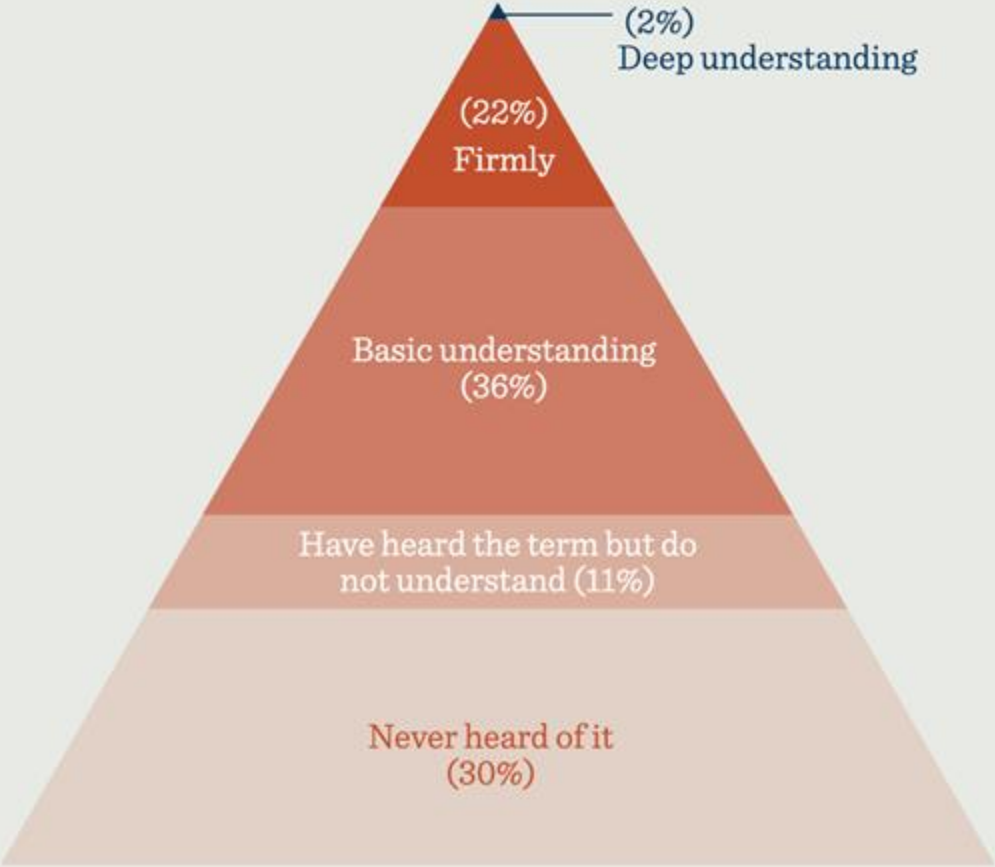


Western Washington producers are more in favor of solar development on ag land than Eastern Washington

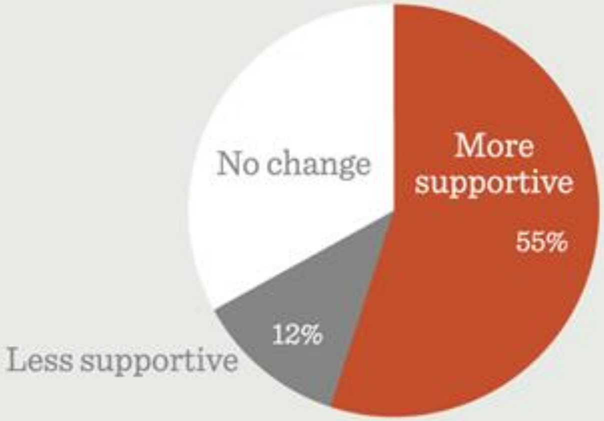


*Note: This question referenced solar development on agricultural land in general (not agrivoltaics).

What is your familiarity with the concept of agrivoltaics?



After seeing these photos, over half of respondents are more supportive of solar projects on Washington farmland



Over half (59%) of survey respondents would be willing to host solar panels on their land if they can continue farming under and around the panels

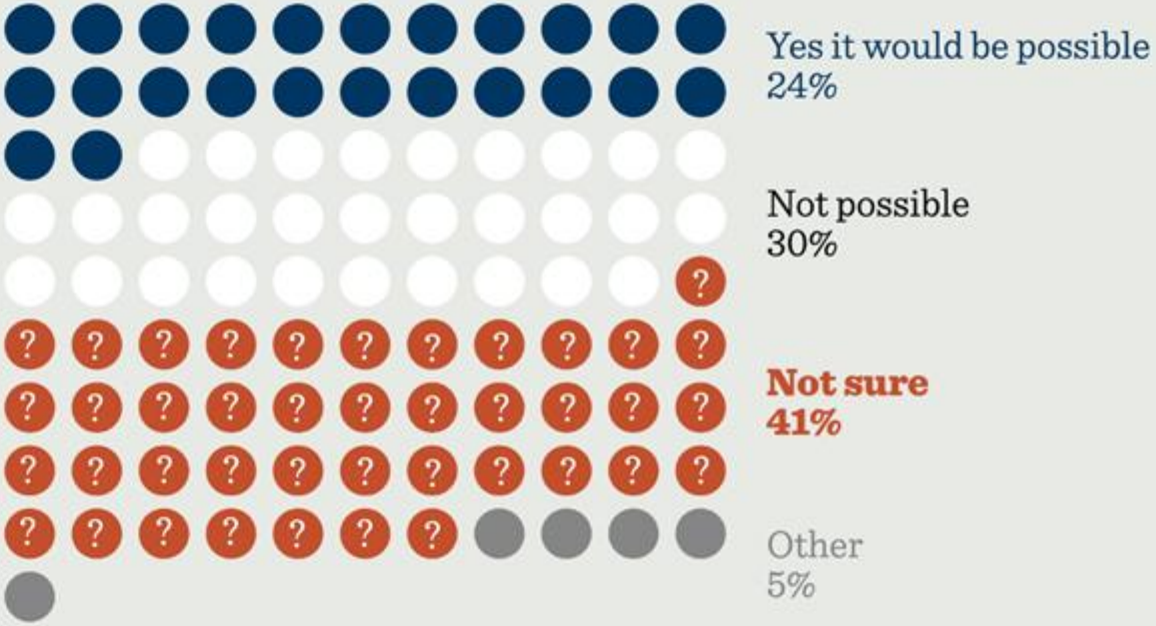
Most farmers and ranchers don't know if agrivoltaics would be possible in their current production system

"I have large areas of grasslands near power lines"

"In very limited area, out of sightline for passersby and residents."

"We have pasture and marginal lands that could work with agrivoltaics"

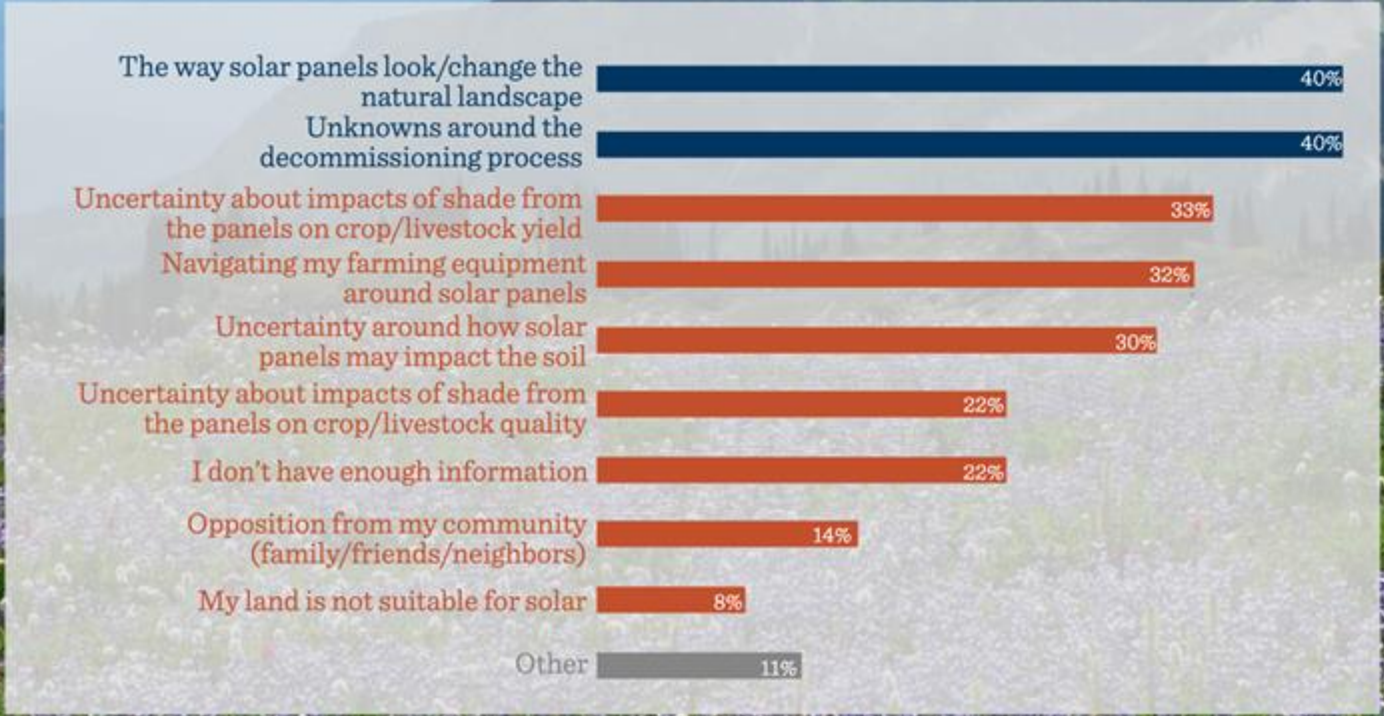
"Research has provided me with enough positive soil and forage health benefits that I would welcome the added viability a agrivoltaic installation would provide."



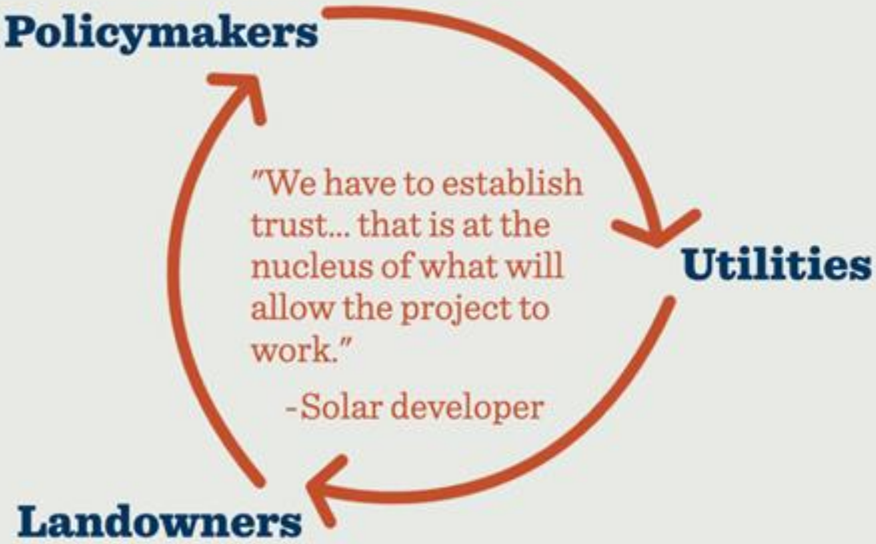
Most respondents would not consider changing production systems for agrivoltaics
... but 5-20% would consider it or aren't sure

3 respondents might switch to perennial food crops
2 respondents might switch to grazing sheep
1 respondent might switch to raising other livestock (cattle, poultry)
1 respondent might switch to growing annual food crops (vegetables)

The way solar panels look and unknowns around decommissioning are top concerns



Communication and **trust** between landowners, utilities and policymakers is key.



AFT Agrivoltaic Policy Goals

- Ensure Farming Can Take Place for the **Full Life of the Solar Projec**t
- Incentivize Projects Designed and Installed to Afford Agrivoltaic Farmers the **Flexibility to Change what they Grow or Raise**
- Keep Land in Farming and **Conserve** Soil and Water Resources
- **Expand the Breadth of Production Systems** Compatible with all Scales of Solar Array
- Eliminate Potential for **Program Loopholes**

Recommendations for Agrivoltaic Incentives

Recommended Statutory Definition:

- "**Intentionally** planned and designed"
- "Constructed and operated to achieve **integrated and simultaneous** production of solar energy and **marketable agricultural products**":

✓ crop production, grazing, animal husbandry

X pollinator habitat, and apiaries without array redesign that would enable other production systems in the future

- "As soon as feasible… and **continuing until decommissioning**"

Incentive Policies Must Include

1. A **strong definition** for what qualifies
2. Authority and capacity for **monitoring, and penalties** should production cease
3. Amounts that increase with the a) percent of array in production and b) cost of integration

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WA Solar Summit - Ecovoltaics

CASCADIA
RENEWABLES

Introductions

What we're covering

Framing:

- **Callum McSherry — Managing Partner, Cascadia Renewables & Sulis Energy**
  - Design firm and GC focused on solar, storage, and microgrids across WA.
  - We turn feasibility concepts into constructable projects.
- **My perspective:** Not policy or ecology — *integration.*
  - How vision meets code, budget, and construction reality.
- **What I'll cover today:**
  - The EWU Ecovoltaic project — what it actually is.
  - What we were trying to achieve.
  - What we learned trying to design it — the practical realities of dual-use solar.

EWU Ecovoltaic Feasibility Study

Project Overview

- **System Size:** 1.45 MW DC, three ground-mount arrays across campus.
- **Technology:** Fixed-tilt racking, bifacial modules, central inverter architecture.
- **Location:** Perimeter of Eastern Washington University's Palouse Prairie Restoration Zone, Cheney, WA.
- **Purpose:**
  - Generate renewable power for campus load.
  - Serve as a *research and educational platform* for long-term study of native plant–solar interactions.
- **Partners:** EWU Facilities, Cascadia Renewables (technical lead), MW Engineers, TD&H Engineering, Mike Terrell Landscape Architecture, City of Cheney Light Dept., WA Department of Commerce.

- **Timeline:** Feasibility 2024 → Engineering 2025 → Construction planned 2026.

EWU Ecovoltaic System

Target System Benefits

Target Objectives:

1. **Educational value:** Create a *living laboratory* for EWU students and faculty to study solar–ecology interactions.
2. **Ecological value:**
   - Extend the Palouse Prairie restoration area.
   - Establish native, low-stature groundcover to support pollinators and improve soil health.
   - Reduce erosion and runoff from previously disturbed land.
3. **Community & Equity value:**
   - Demonstrate campus sustainability leadership.
   - Channel system savings into a **means-tested scholarship fund** via a community-solar ownership model.
4. **Energy value:**
   - Supply on-site renewable power to campus buildings.
   - Serve as a pilot for **resilient campus microgrids**.

Challenge #1: Fire Code vs. Ecology

Balancing safety and dual-use goals

EWU Reality:

- 2021 International Fire Code: IFC 1205.5.1 Vegetation Control

  "A clear, brush-free area of 10 feet (3048 mm) shall be required around the perimeter of the ground-mounted photovoltaic arrays. A maintained vegetative surface, or non-combustible base, approved by the fire code official, shall be installed and maintained under the photovoltaic arrays and associated electrical equipment installations."

- The City of Cheney Fire Marshal interpreted this to mean vegetation must stay ≤ 12 in and PV array leading edge must be 5'.
- Fire-access lanes (20 ft wide) must be provided around the array and every 200'
- Fire Marshal was supportive and pragmatic, but bound by code and public-safety mandate.

Challenge #1: Fire Code vs. Ecology

Balancing safety and dual-use goals

Unique or Ubiquitous?

- EWU specific:
  - The site was on the edge of a large expanse of prairie that was subject to periodical grassland fires.
  - The site was also in close proximity to housing and the university.
  - Native grasses can grow up to 4'.
- *Ubiquitous:*
  - Conflict between "maintained vegetation" conflict language and some ecological restoration activities; limitations on seed mix.
  - Plant height and type will be an important factor, and could make it hard to seed/maintain a native plant mix.
  - Fire code officials have to *approve* the proposed vegetative surface.

Challenge #1: Fire Code vs. Ecology

Balancing safety and dual-use goals

Path Forward:

- **Engage fire authorities early — during concept design, not after.** Interpretation varies by jurisdiction and local fuel risk.
- Use **low-stature native species mixes** and define grazing or mowing plans in writing before permit submittal.
- Explore **alternative access designs** (gravel ribbons or hammer-head turn-arounds) that meet code without fragmenting habitat.
- Long-term goal: statewide guidance clarifying how "maintained" can apply to native systems without requiring active irrigation or over-mowing.

Challenge #2: Fencing and Micro-Ecology

Unintended consequences

EWU Reality:

- The academic focus group agreed fencing was essential — for **student/staff safety**, **equipment security**, and **controlled research access**.
- Access is managed by keys and a sign-in sheet; the area is effectively closed to daily human or animal movement.
- That enclosure creates a **microclimate**: species that can slip through the fence are protected from those that can't.
- The team predicted a likely **increase in rodent populations**, due to exclusion of predators.
- Discussed mitigation measures included **raptor boxes** on fence posts and **predator access gates** (e.g., for coyotes), with plans to study impacts over time.

Challenge #2: Fencing and Micro-Ecology

Unintended consequences

Unique or Ubiquitous?

- EWU-specific:
  - Security was heightened because of public access to the campus and liability concerns.
  - We incorporated both module-mounted wire management screens and a fully fenced area into our design.
- Ubiquitous:
  - Any fenced array can alter local ecology — fencing can change airflow, shade, and predator-prey balance.
  - What begins as a safety requirement can unintentionally create **isolated micro-habitats** with different species composition inside vs. outside the fence.

Challenge #2: Fencing and Micro-Ecology

Unintended consequences

Path Forward:

- **Design for permeability:** raise the bottom of fencing or include small predator gates where safe.
- **Integrate mitigation features:** raptor perches or owl boxes can restore predator presence.
- **Monitor and document:** partner with academic or community ecologists to study internal vs. external habitat effects.
- **Balance risk:** choose fencing strategies proportionate to the level of human activity and security need — not default “industrial” fencing everywhere.

Challenge #3: Construction and Soil Conditions

Low-disturbance ideals meet real-world ground

EWU Reality:

- The EWU project site was previously disturbed fill, with variable compaction, buried debris, and shallow basalt in some areas.
- Lower impact ground-screw foundations were evaluated but refusal rates in test pits were high — we had to consider alternative foundations (concrete or ballast).
- Grading restrictions to protect the prairie edge limited the potential to smooth or over-excavate problem zones.
- Sequencing of construction site preparation and restorative tilling and hydroseeding posed logistical challenges and cost increases.
- These conditions increased cost, added to the schedule, and forced design changes late in the study

Challenge #3: Construction and Soil Conditions

Low-disturbance ideals meet real-world ground

Unique or Ubiquitous?

- <u>EWU-specific:</u>
  - Campus fill and utility corridors added complexity and unpredictability.
  - Restoration of the site added cost and complexity.
- <u>Ubiquitous principle:</u>
  - Almost every dual-use or ecovoltaic site faces tension between **low-disturbance goals** and **constructability.**
  - Native or restored soils are fragile; installers are trained to work fast, not delicately.
  - “Do no harm” and “build efficiently” often conflict in practice.

Challenge #3: Construction and Soil Conditions

Low-disturbance ideals meet real-world ground

Path Forward:

- **Early geotech testing:** Identify refusal zones before array layout is finalized.
- **Adaptive foundation palette:** allow for multiple foundation types within one project (screw, helical, ballast) depending on soil conditions.
- **Low-compaction construction planning:** define access paths, laydown areas, and restoration protocols *before mobilization*.
- **Sequence restoration activity:** understand necessary ecological work and the appropriate construction window.
- **Train crews:** communicate the ecological sensitivity of the site — success measured by *what you don't disturb.*

Challenge #4: Cost and Funding Reality

Economics vs Ecology

EWU Reality:

- **Ecological restoration is costly:** native seed mixes, ecological design consulting, and multi-year monitoring a significant cost beyond a typical PV installation, without a clear economic recovery mechanism.
- Interconnection was the largest single cost driver: roughly 0.25 miles of trenching to reach the tunnel system, then over 0.5 miles of conduit run through existing campus tunnels to reach a tie-in point.
- The research component (setting up monitoring and long-term data collection) offered major value but represented a soft cost absorbed by the university, not part of the construction budget.
- These additional scopes—ecology, restoration, long interconnection runs, and research setup—significantly increased total project cost without expanding generating capacity.

Challenge #4: Cost and Funding Reality

Economics vs Ecology

Unique or Ubiquitous?

- EWU-specific:
  - Long, complex interconnection path.
  - University research overlay.
  - Extend of ecological restoration required.
- Ubiquitous:
  - Dual-use projects may routinely face unbudgeted “good-intentions” costs—restoration, ecological design, and coordination—outside incentive eligibility.
  - Current economic mechanisms reward kilowatt-hours, not ecosystems; it is hard to imagine an economically driven project bearing substantial additional ecology drive costs without mandates or incentives.

Challenge #4: Cost and Funding Reality

Economics vs Ecology

Path Forward:

- **Budget ecology and access early:** treat restoration and interconnection as explicit scopes, not afterthoughts.
- **Stack complementary funding sources:** combine energy grants with habitat or research funding streams.
- **Quantify outcomes:** use pilot data to demonstrate measurable public benefit beyond energy yield.
- **Consider incentive/permitting reform:** Currently there is no financial driver for ecological restoration. An incentive structure or mandates for ecological restoration in specific zones may be necessary for widespread adoption. *Further research from constructing and monitoring projects like EWU are needed to understand if the ecological benefits justifies this approach.*

Don’t let the perfect be the enemy of the good.

Progress over perfection in dual-use solar

It may be impossible to perfectly restore or maintain native ecology under PV systems. But we can absolutely do better than gravel, bare soil, and herbicide.

Key Takeaways:

- **Engage early:** Bring fire marshals, landscape architects, and installers to the table before design is finalized.
- **Design with humility:** Accept that ecological and construction priorities will conflict; plan for compromise, not purity.
- **Build and learn:** Every project teaches something. Document outcomes — what worked, what didn’t — and share it.
- **Iterate:** Use lessons from pilot projects like EWU to inform permitting, incentive design, and code updates statewide.

Any Questions?

CASCADIA RENEWABLES

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Washington State 2025
SOLAR SUMMIT

Advancing Solar in a Time of Uncertainty

October 24, 2025 | South Seattle Community College

Session 4

Dual-Use Solar in Washington: How Do You Like Them Apples?

Moderator: Justin Allegro, The Nature Conservancy

Featuring: Addie Candib, American Farmland Trust;

Max Lambert, The Nature Conservancy;

Callum McSherry, Cascadia Renewables