Elkhart County Farm Bureau's Position on The New Solar Ordinance

Taken from the 2006 Comprehensive Plan

This comprehensive plan is one of five State statutory considerations for the development or preservation of land(IC 36-7-4-603) :

1. The comprehensive plan;
2. current conditions and the character of current structures and uses in each district;
3. the most desirable use for which the land in each district is adopted;
4. the conservation of property values throughout the jurisdiction; and
5. responsible development and growth.

The primary role of the agricultural zone designation is to protect agricultural operations from conflicting land use. Agricultural zoning districts should be used for agricultural and related business activities and, where appropriate, agritourism. Smaller communities should be supported with land use decisions appropriate to their growth management plans.

Rural character and vistas should be protected by establishing tighter standards for permitting of special uses, and by promoting the stringent standards established under the Use Variance section of Indiana and Elkhart County codes

Lynn Loucks

President Elkhart County Farm Bureau

5745364937

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Updated January 2022

Elkhart County Farm Bureau:

Elkhart County Solar Ordinance Recommendations

Economic:

- Limit abatements – EDC payments designated to decommissioning
- Property Value Guarantee Agreement (Posey County Ordinance) should be required in any Economic Development Agreement

Emergency Response:

- Must create an Emergency Response Plan which includes adequate provisions for site security and safety. The plan should include lockout/tagout procedures for electrical equipment on site. If the plan includes using County services, it should include signatures of the proper authorities indicating they are aware of their role and capable of performing it.
- On site employees must be trained in fire suppression specific to solar panels, battery storage and other associated hazardous material and be available 24/7
- Agreement to pay for emergency services additional training, equipment, and services as needed.
    - Agrees to comply with Local emergency planning committee recommendations and any costs associated

Environmental:

- Hazardous material clean-up contractor must be under contract – must be qualified to work in Elkhart County
- Adjacent property owners' wells within 1 mile must be monitored annually throughout the life of the project to ensure there are no negative impacts to ground or drinking water.
- Ground water monitoring wells should be required on the project site and tested annually
- The site shall be planted and maintained to be free of invasive or noxious species, as listed by the Indiana Invasive Species Council
    - Ground coverage must include native pollinators
- SWIP required
    - Must maintain tile, mutual drains, and right of ways per Indiana drainage code

Property Rights:

- Screening requirements
    - Require a 10 ft berm around the perimeter with Class III buffering on top
    - may require additional screening where it is determined there is a clear community interest in maintaining a viewshed.
- Setbacks –
    - 2,000 ft. between fence and nonparticipating residential building
    - 500 ft. between fence and nonparticipating property line
- Height-

- Ground or pole-mounted solar energy systems shall not exceed 15 feet in height when oriented at maximum tilt.
- Solar carports in non-residential districts shall not exceed 20 feet in height.

Decommissioning:

- Decommissioning – A decommissioning plan shall be required to ensure that facilities are properly removed after their useful life.
- Decommissioning of the system must occur in the event the project does not produce power for 12 consecutive months. An owner may petition for an extension of this period upon showing of reasonable circumstances that have caused the delay in the start of decommissioning.
- The plan shall include provisions for removal of all structures and foundations to a depth of 48", restoration of soil and vegetation and assurances that financial resources will be available to fully decommission the site.
- Disposal of structures and/or foundations shall meet the provisions of the Solid Waste Ordinance and the ownership of the waste shall be maintained by the lessor.
- All waste – solar panel, battery, structure, etc – must be recycled at the time of decommissioning
- County maintains a right to refuse any disposed structures and/or foundations from entering the County landfill
- Require the posting of a AAA insured bond, letter of credit, a parent guarantee, or other financial surety to ensure proper decommissioning.
    - Need language to ensure bond amount is sufficient to cover 100% of decommissioning cost, inflation included, salvage estimates not included
    - Costs should be based on actual quotes from businesses

Zoning:

Ground Mounted Arrays	Less than 10 acres	More than 10 acres
Residential (R-1-4)	Special Use Permit	Prohibited
Nonresidential Districts + E-3, GPUD, DPUD, W	Permitted*	Special Use Permit
Agricultural (A-1, A-3, A-4)	Permitted*	Prohibited

- *Subject to limitations set forth in 5.5.12 (Solar Ordinance)

Updated January 2022

Background :

- According to the Elkhart County Land Use Plan:
  - The primary role of the agricultural zone designation is to protect agricultural operations from conflicting land use. Agricultural zoning districts should be used for agricultural and related business activities and, where appropriate, agritourism.
  - Rural character and vistas should be protected by establishing tighter standards for permitting of special uses, and by promoting the stringent standards established under the Use variance section of Indiana and Elkhart County Codes
  - To promote the county's rural character, results of human activity (excessive noise, artificial light and visual clutter) that take away from the experience of being 'in the country' – for residents, visitors, and commuters – should be recognized and reduced.
  - Development that preserves natural landscapes, indigenous species, and features of topography should be promoted.
- Elkhart County was ranked number one in Indiana for total farm income in Indiana (USDA Census of Agriculture, 2018).
- According to the USDA, in September 2021 food prices were 4.6 percent higher than in September 2020. Any loss of agriculture ground is a significant concern for food security in our county and nation.
- Waste created during decommissioning of large-scale projects poses a great risk to the environment
- A fire or similar disaster could cause immense damage to our environment. The last thing we need in Elkhart County is another Superfund site, especially of large scale.

LARGE SCALE SOLAR FARMS: THEIR WORST EFFECT

There are multiple concerns and issues with the types of large scale solar farms being proposed & built in the Midwest. However, ~ this report will focus on the most concerning impact, ~ Agricultural Economy, the loss of Food Production and the risk of a permanent loss of the land.

Economic Impacts (More Like Devastation) to Indiana:

A. The "supposed" economic benefit:

Solar Developers promise economic benefits to Counties in the form of tax revenue with a down payment (aka bribe of instant money). The calculations underlying their assertions are generally NOT publicly disclosed, so it is difficult to determine if the amounts, as stated, would be in fact, correct.

- The change in land use from an active local enterprise to an investment property where profits will be upstreamed to an out-of-state parent company, the Project may result in more of the land being owned by out -of-state residents. If this occurs, the tax revenues based on payments to landowners will not be taxed in the Indiana County, but rather in the domicile district of the landowner.
- While it is true that the installation of solar equipment will result in new assessed value and tax receipts, it is not necessarily true that the expected tax receipts will continue or remain at the same level.
- Solar Developers state that the Project may be sold in whole or in parts to public utilities. If the Project is sold to a governmentally owned utility, the solar equipment is exempt from taxation.
- There are transactions which can act to reduce the assessed value and thus the tax receipts, including, but not limited to, sale/leaseback transactions, multiple sales, perhaps to a related party and back, where the Fair Market Value is reset with each sale, and some financing transactions that may result in reduced values and corresponding reduced tax receipts.

Conclusion: The economic benefits are illusionary & misleading. Without conditions on transactions that could reduce the asserted tax benefit, approval of solar projects on the basis of level, estimated lifetime taxes is not warranted. (Res#1)

B. The "supposed" economic benefit is NOT new money:

Any supposed economic benefit analysis fails to take into consideration what economic benefits the Project will displace.

- The land has already been developed and it is PRIME FARMLAND. What is being lost by taking PRIME FARMLAND out of Agricultural production for 35 years, OR FOREVER???
- Large Scale Solar projects are displacing an existing economic good producing industry, and the payments to landowners are not new, but simply replace the lost benefits from the agricultural activity. Indeed, given that farming has an economic multiplier effect in that it actively spends and supports other businesses, while the Project will be a passive economic business actor, the economic benefit will in fact be less than what is currently being generated.
- First, ~ understand some Indiana Agriculture Facts:
    1. Indiana is 1 of only 3 States with over 50% of its land designated as Prime Farmland, defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and at the highest yields possible. It is the BEST land in our Nation.
    2. A 2015 Financial Report by Indiana University, Kelley School of Business: Beyond The Farm: A State and Regional Report on the Economic Contribution of Farms, Forests, and Related Industries reveals:
        - ✦ Agriculture contributes an estimated $44.2 billion to Indiana's economy, and approximately $13 billion of that amount is the result of ripple effects such as related supply-chain purchases and spending by workers.
        - ✦ Indiana is the eighth largest agricultural leader in the nation, exporting just over $4.6 billion in 2017.
        - ✦ Indiana's agricultural output supports nearly 190,000 Hoosier jobs, and of those jobs, 107,500 are directly involved in agricultural production and processing.
        - ✦ Using the most recent census data available from the U.S. Department of Agriculture, researchers at the Indiana Business Research Center found that agriculture creates $14.9

billion in value added — an amount equal to nearly 5 percent of Indiana's gross domestic product.

- ✦ "Keep in mind that Indiana's farmers and agriculture-related manufacturers generated these impressive numbers during a tough year (2012) plagued by severe drought. These impacts would likely be higher in a more typical year," said Matthew Kinghorn, economic analyst at the IBRC.
- ✦ Indiana's agricultural output is heavily concentrated in corn and soybean crops, which together account for 63 percent of the state's total agricultural production.
- ✦ Representative Soliday, author of HB1381, states Indiana will suffer economically as limiting renewable energy is hindering corporations from coming to Indiana. However, the IU study says, "Therefore, the degree to which agriculture is able to contribute to Indiana's economic growth going forward will be an important economic indicator for the state." Has Soliday forgotten that he lives in one of the most important Agricultural States in our Nation, or is he just not aware that these mostly foreign Solar Companies are wiping out hundreds of thousands of PRIME farmland in the Midwest? (Res#2)

3. For decades, Purdue University and other Agricultural Institutions have advocated for the protection and preservation of our most precious, finite resource ~ farmland, especially that which has the designation of Prime Farmland. Most Comprehensive Plans in Indiana advocate for the protections of prime farmland. Why are Counties ignoring their duty and responsibility to protect the land? American Farmland Trust has taken on the most recent investigation of how much farmland has been lost in our Nation. Their study, Farms Under Threat was released in 2018 and The State of the States was released in 2020. ALL Government Representatives should be concerned: (Res#3,#4,#5)
   - ✦ **The U.S. converted almost 31 million acres of agricultural land between 1992 and 2012**. By including woodlands associated with farms and low density residential development, this analysis found nearly twice the conversion previously reported. The loss is equivalent to developing most of Iowa or the entire state of New York.
   - ✦ **Overall, development disproportionately occurred on agricultural lands.** More than 70 percent of urban development and 62 percent of all development took place on agricultural land. Expanding urban areas accounted for 59 percent of the loss, including the commercial, industrial, transportation, and high-density residential development which reflect the expanding footprint of U.S. cities and towns. Low- density residential development accounted for 41 percent of the loss and included residential areas with houses built on one- to 20-acre parcels and exurban homes on even larger lots that effectively removed these properties from agricultural uses.
   - ✦ **Urban development favored cropland while low-density residential development posed an equal threat to cropland and pastureland.** Urban development most frequently converted cropland (41 percent) and lower percentages of pastureland (25.9 percent), rangeland (23.8 percent), and woodland (9.3 percent). In contrast, low-density residential development posed an equal threat to cropland and pastureland (34.5 percent each) and favored woodland (19.9 percent) over rangeland (11.1 percent). For forestland, low-density residential development presented a greater threat than urban development.
   - ✦ **The impact of these development patterns puts high quality agricultural land at risk.** The analysis assigned values to reflect the productivity, versatility, and resiliency (PVR value) of agricultural land for cultivation. As the PVR value increased, fewer acres of land qualified. The analysis found that the median PVR value of agricultural land lost to development was 1.3 times higher than the median PVR value of land that stayed in production. These cumulative and irreversible losses of most productive, versatile, and resilient lands have serious implications for agricultural productivity and domestic food security.
   - ✦ **By 2012, the best land to support intensive food and crop production had dropped to less than 17 percent of the total land area in the continental United States.** Only 324.1 million acres of agricultural land had PVR values with the optimal soil characteristics and growing conditions to support intensive food and crop production with minimal environmental limitations. This is slightly more than one third of agricultural land.
   - ✦ **In less than one generation, the United States irrevocably developed nearly 11 million acres of its best land for intensive food and crop production.** While a 3.2

D. <u>Even more concerning is the risk of losing the Agricultural Lands FOREVER:</u>
Solar Developers claim that the lease is temporary and that the farmland can easily be returned to agricultural activity at the end of the life of the project (estimated at 30-45 years). In addition, they claim that Solar Farms protect the prime farmland from residential housing developments and continued urban sprawl.

- IF solar/wind are much-needed energy resources, WHY are they temporary and have decommissioning plans to begin with? This is a hypocritical endeavor if we MUST have renewable energy.
- Many decommissioning plans allow for a plan to replace solar panels, make improvements at the end of life of the project, & continue the energy source. If the energy source does continue, then HOW does this protect the Agricultural Lands when it NEVER gets back to agricultural activity? Most Comprehensive Plans in Counties that are heavily dominated in Agricultural Activity call for the protection of farmland. Therefore, Solar Farms DO NOT meet these stated plans when the Solar Developer has misled the Landowner, County, & Community about their future intentions of the project. This is an irresponsible land use change <u>that could be permanent, risking the loss of our prime farmland FOREVER</u>.
- NOT ONE Agronomist and Soil Scientist has provided ANY documentation that supports the Developer's claims that the land can be farmed again and NONE support the placing of large scale solar farms on prime farmland. To date, not one document, study, or article provided by solar developers references ANY Agronomists and Soil Scientists approving of this endeavor. Check the authors & their credentials! Check the Resources for Agricultural Professionals! Who are you getting your proof, education, and advice from?! Professor Ron Heiniger, Agronomist and Soil Scientist from North Carolina University has written several reports and articles advising AGAINST solar development on farmland. He has taken a stand against the Solar Industry's false claims. (See Res#7). The North Carolina Cooperative Extension has also written a document that includes many cautions of solar being placed on farmland. (See Res#8). And ironically, ~ even some educational links provided by the Solar Industry direct the reader to studies from the United Kingdom, where they adamantly protect farmland and prevent solar farms on Agricultural lands. (See Res#9).
- The American Planning Association has stated that Solar Farms should NOT be placed on prime farmland! The APA is a source and guide to ALL Area Planning Commissions across the U.S. Why is the APA being ignored? (See Ref#6)
- Decommissioning Plans being submitted to Counties state that many items will be abandoned beyond 36" in the ground, such as cabling, cement, broken pylons, and more. Even the BLM (Bureau of Land Management) under the Obama Administration called for the FULL decommissioning of Federal Lands placed in Renewables. Does not our prime farmland, the best land in our Nation that is supposed to grow the food for our Country and the World deserve FULL decommissioning as well? This is more irresponsible behavior of the Solar Industry that will DEFINITELY ruin the future use of the land, whether it's agricultural or developed into housing!
- Michigan State University Cooperative Extension recently released a document giving guidelines and cautions to Landowners considering leasing farmland for Solar Development. The document mentioned that many leases now contain Options and First Rights to purchase the land. Again, ~ the very fact that our prime farmland is being threatened with a permanent land use change is REAL and more likely to occur than most understand. More and more foreign companies are building Renewable projects in America. Who will eventually own our land AND our energy sources is the most concerning effect of all! (See Res#10
- "The ownership of 40 percent of America's agricultural land will be in transition within the next 15 years, putting both family farmers and the land they steward at risk. Meanwhile, would-be farmers often can't afford to enter the field. These financial realities are now coming to a head with a demographic tidal wave the likes of which American agriculture has never seen. American Farmland Trust estimates that 371 million acres of farmland and ranchland could be in transition in the next 15 years, due simply to the age of farmland owners. Much of that land could be lost to agricultural production, unless we can find a way to get it into the hands of the next generation of farmers and ranchers. That's a big challenge." ~ direct quote from American Farmland Trust. (Res# 11). Understanding this grave reality makes the future production of food and the need to protect farmland an utmost and urgent priority! We CANNOT lose farmland to solar farms!!

CONCLUSION:

***Solar installations require over ten times more land area than non- renewable sources to generate the same amount of energy, and the requirement of large tracts of land for their construction has become the largest cause of land use change in the United States** (Trainor et al. 2016; Ong et al. 2013). Source of this quote: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0162269

CONSIDER AND UNDERSTAND THIS VERY IMPORTANT FACT:

"The United States is blessed with a remarkably productive agricultural landscape. The precious arable land that sustains life on Earth is a finite and irreplaceable resource that is under heavy stress. Less than six percent of the Earth's surface is suitable for agriculture and growing food. Cropland, pastureland, rangeland, and woodland support a regionally diverse food and farming system capable of ensuring domestic food security. Agricultural land contributes to state and local economies, supplies lucrative export markets, and bolsters the nation's balance of trade. It also supports a trillion dollar/year agriculture economy. Farmland is the foundation of our rural communities, providing jobs, recreational opportunities, and a deep connection to the land. These exceptional natural resources sustain valuable wildlife habitat, provide flood control and fire suppression, scenic views, and resources for hunting and fishing. This land also acts as an enormous carbon sink, drawing down carbon from the atmosphere, which helps combat climate change. Without farmland and ranch land, we can't win the global fight against climate change. Our food, our water, our environment, our survival ~ it all depends on American agricultural land. **By 2050, the demands on agriculture to provide sufficient food, fiber, and energy are expected to be 50 to 70 percent higher than they are now. Given a limited land area in the United States and the need to feed and house an increasing number of people, it is more important than ever to protect the agricultural land and natural resources needed for long-term sustainability. No Farms = No Food = No Future."** ~American Farmland Trust, Farms Under Threat

WE HAVE ALREADY BEEN ADVISED BY EXPERTS:

"Solar facilities can be appropriately located in areas where they are difficult to detect, the prior use of the land has been marginal, and there is no designated future use specified (i.e., not in growth areas, not on prime farmland, and not near recreation- or historic areas). A solar facility located by itself in a rural area, close to major transmission lines, not prominently visible from public rights-of-way or adjacent properties, and not located in

growth areas, on prime farmland, or near cultural, historic, or recreational sites may be an acceptable land use with a beneficial impact on the community." ~ American Planning Association, Planning Advisory Memo, Sept/Oct 2019. AGAIN, WHY ARE PLANNING COMMISSIONS & GOVERNMENT OFFICIALS IGNORING THE GUIDANCE OF THE AMERICAN PLANNING ASSOCIATION? (Res#6)

A FUTURE PREDICTION: WILL YOU HEED THE WISE ADVICE OF EXPERTS?

"In Indiana, and throughout the Midwest, life begins and ends with the LAND. In war, generals often speak about what is happening at the "Front." In the Battle of the Bulge, the Front was at Bastogne, a small town in Belgium. But, in the History books, it was a turning point. It stopped the Nazi's advance. For Indiana, the "Front" is the LAND. In Indiana and the Midwest, the LAND is where the citizens – the Farmers and the Landowners - have to make their stand. If the "Front" folds, the future of the people, the communities, the counties and the states will be changed forever. After the solar power plants are erected, they employ almost no one, except perhaps or a night watchman. Farm related jobs and the supporting businesses will disappear and people will have to go on food stamps. That will become our major industry. The United Nations issued a report in 2019 to protect farmlands or face a hungry future. Over time, food supplies will begin to dwindle and world hunger will begin to raise its ugly head. Just look at what has happened when all manufacturing jobs in Michigan and Wisconsin were exported to China and southeast Asia. Look at the misery that caused. How is the upper Midwest referred to today? It's called the "Rust Belt." If that happens to our Farming States in the Midwest, they will be called the "Dirt Belt." And, for what reason? For 20 or 30 years of intermittent solar power? What are we going to do for power then? Go back to coal? And, we'll be left with miles and miles of rusting solar panels covering the once fertile farmland. And the Solar Developers operating as LLCs will be long gone, leaving the Counties too broke to pay for cleaning up the toxic mess that has contaminated our once fertile soil." ~ Dr. Herbert M. Eckerlin, Emeritus Professor of Mechanical & Aerospace Engineering, North Carolina State University, Raleigh, NC.

"Take care of the land and
the land will take care of you . . . ."
—Soil conservation pioneer,~ Hugh Hammond Bennett, 1947

Please vote NO on HB1381 and allow the Counties and Citizens to plan and control Renewable Energy resources. We know our County better and have done A LOT MORE education than the State has!
Suggested Amendments are:
1) PROTECT PRIME FARMLAND
2) DEMAND FULL DECOMMISSIONING

3) NO SOLAR PANELS TO CONTAIN CADMIUM TELLURIDE, LEAD, AND GEN-X/PFAS CHEMICALS
4) DEMAND INDEPENDENT STUDIES OF ECONOMIC AND ENVIRONMENTAL IMPACTS AND PROPERTY VALUE DAMAGES
5) SETBACKS TO 1000' OF RESIDENTIAL PROPERTIES WITH PROPER BUFFER/SCREENING
6) NO RESIDENTIAL PROPERTY SHALL BE AFFECTED ON MORE THAN ONE SIDE
7) A PROPERTY VALUE GUARANTEE TO ANY HOMES AFFECTED, ESPECIALLY THOSE IMPACTED ON 2, 3, AND ALL 4 SIDES BECAUSE RURAL HOMEOWNERS SHOULD NOT HAVE TO LIVE INSIDE INDUSTRIAL POWER PLANTS. LAWSUITS ARE ALREADY IN THE WORKS FOR AN UNFAIR TAKING OF HOME VALUES. ATTORNEYS ARE BEING CONSULTED ABOUT INVERSE CONDEMNATION!
8) ONLY LANDOWNERS WHO HAVE OWNED THE LAND FOR A MINIMUM OF 5 YEARS CAN BE ELIGIBLE TO SIGN SOLAR LEASES. INDIVIDUALS, COMPANIES, & FOREIGN ENTITIES ARE PURCHASING AMERICAN SOIL FOR THE PURPOSE OF BUILDING SOLAR FARMS.
8) JUST ADOPT THE UNITED KINGDOM GUIDELINES IN RESOURCE #9 BELOW. THEY ARE SMARTER THAN WE ARE REGARDING PROPER CITING OF SOLAR DEVELOPMENT, SCREENING AND BUFFERS.

TOTAL INDIANA FARMLAND SOUGHT =
89,016 ACRES & COUNTING

1,890 acres Madison County
1,400 acres Lake County
1,800 acres Shelby County (north)
1,900 acres Shelby County (south)
1,777 acres Clinton County
1,800 acres White County
1,800 acres Sullivan County
4,000 acres Howard County
9,200 acres Pulaski County
5,000 acres Jasper County
1,400 acres Boone County
1,400 acres Randolph County
700 acres Henry County
300 acres Spencer County
1,439 acres Spencer County
1,200 acres Bartholomew County
1,200 acres Knox County
1,200 acres Pike County
1,600 acres Gibson County
3,000 acres Posey County
210 acres St. Joseph County
1,600+ acres DeKalb County
44,800 acres Starke County (70 sq.miles)

*Information above gathered from online sources, news outlets, & concerned citizens.
*Thousands of rural homes are being surrounded on multiple sides forcing homeowners to live inside industrial power plants. There WILL be impacts to values resulting in lawsuits and appeals to accessed values. Home value declines have already occurred from Turbine Projects. Solar will be even more damaging as it covers thousands of acres.
*The above is an incomplete list as more counties are being solicited to lease farmland.

Resources:

Res#1 * Direct quotes concerning the supposed economic benefits gained from Terry Hall, attorney for Concerned Solar Neighbors, Madison County, IN in April of 2019 and made part of the public record via written documentation submitted for legal proceedings.
Res#2 * https://www.ibrc.indiana.edu/studies/BeyondTheFarm.pdf
Res#3 * https://www.extension.purdue.edu/extmedia/AY/AY-245.html
Res#4 * https://s30428.pcdn.co/wp-content/uploads/sites/2/2019/09/Why_Save_Farmland_1-03_1.pdf
Res#5 * https://farmland.org/project/farms-under-threat/ and https://s30428.pcdn.co/wp-content/uploads/sites/2/2019/09/Why_Save_Farmland_1-03_1.pdf
Res#6 * https://www.planning.org/pas/memo/2019/sep/
Res#7 * https://coastalagro.com/solar-farming-not-a-good-use-of-agricultural-land/ and https://www.carolinajournal.com/news-article/big-solar-farms-may-be-stressing-agriculture-ecosystem/ and Professor Ron Heiniger silences an angry and ignorant Solar Developer here: https://www.clintonnc.com/news/agriculture/6192/farming-and-solar-energy
Res#8 * https://craven.ces.ncsu.edu/considerations-for-transferring-agricultural-land-to-solar-panel-energy-production/
Res#9 * https://www.bre.co.uk/filelibrary/nsc/Documents%20Library/NSC%20Publications/NSC-publication-planning-guidance.pdf. This document was provided by a sub-contractor working for the Solar Industry.
Res#10 * https://energizeohio.osu.edu/sites/energizeohio/files/imce/Agricultural%20Solar%20Energy%20Development%20Understanding%20Lease%20Agreements%20for%20Utility-Scale%20Installations.pdf?fbclid=IwAR155Ood7RcKE2TROn8p1RQqyvlOKj531WVPVdmrpvu46EYt9GAKo8OTl5A
Res#11 * https://farmland.org/keeping-farmers-on-the-land-read-more/

This report compiled and written by Denise Spooner, Madison County, IN ~ Licensed Real Estate Broker & Farmer's Daughter

PLEASE LOOK AT THE PHOTOS ON THE FOLLOWING PAGES AND REALIZE:

1) LESS THAN 6% of the Earth's surface is suitable for Agriculture and growing food!

2) The dark green area on the map is what is left to farm and feed our Nation and other countries! THAT'S IT.....THIS IS ALL THAT IS LEFT!

3) Look at the Red areas on the American Farmland Trust maps and understand what has already been lost due to urban sprawl & development.

4) WHY are so many Renewable Energy projects cited in the Bread Basket of America???

5) WILL AMERICANS EVEN OWN THE LAND AND ENERGY SOURCES IN THE FUTURE?

- **By 2012, the best land to support intensive food and crop production comprised less than 17 percent of the total land area.**

Only 324.1 million acres of agricultural land had PVR values > 0.43 that indicated that the right soil characteristics and growing conditions were present and the land could be farmed with the fewest environmental limitations (Figure 6). This is slightly more than one third of agricultural land.

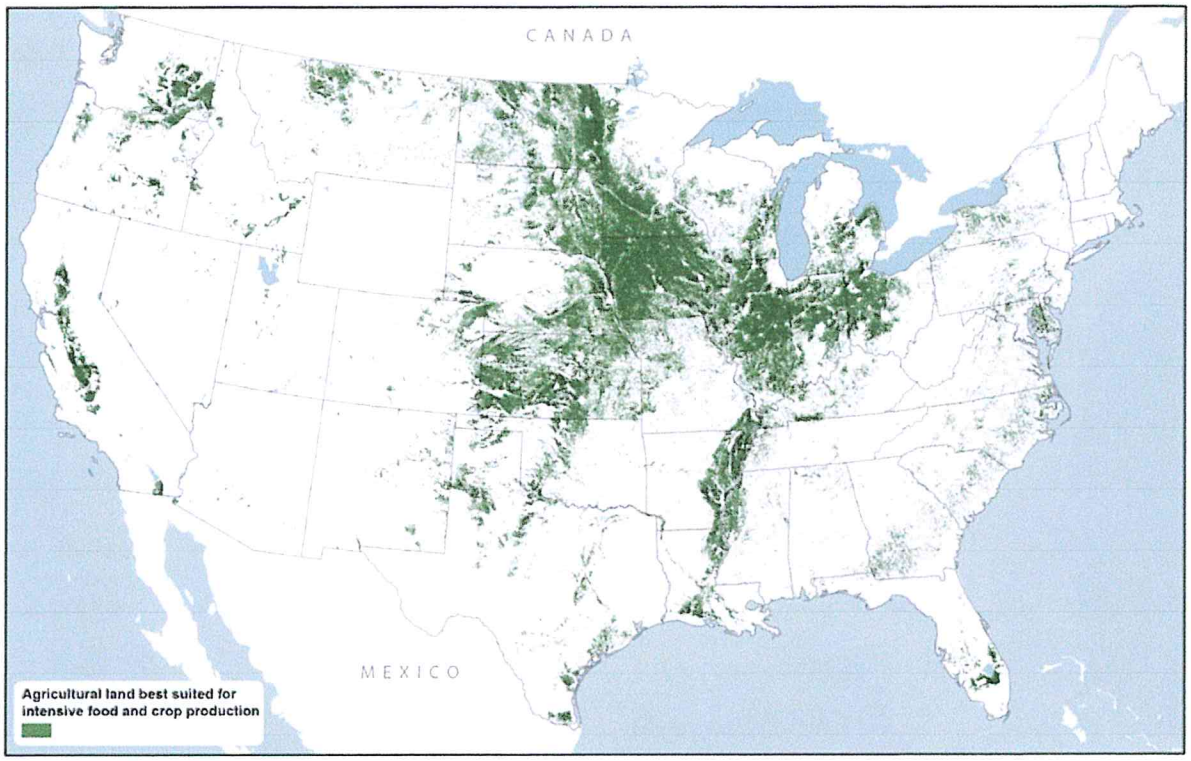
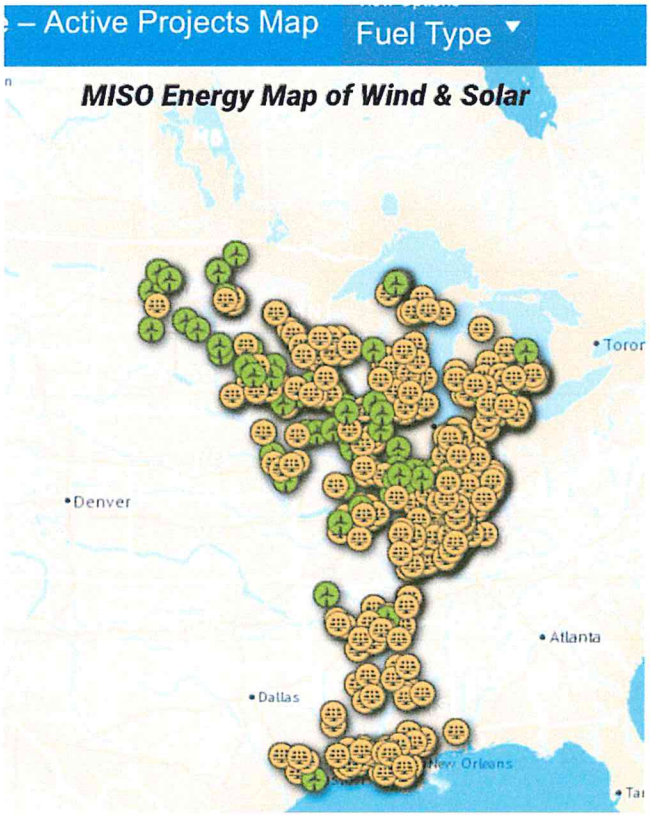
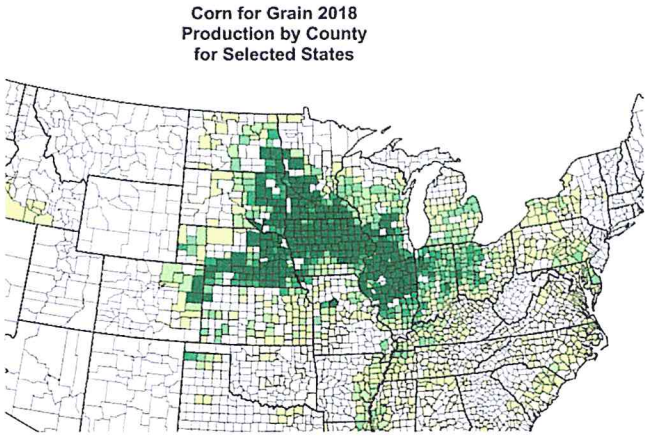
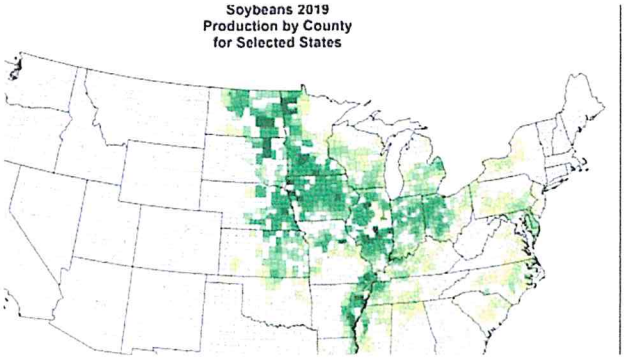


Figure 6: Best agricultural land for intensive food and crop production in 2012.

Agricultural land with PVR values between 0.43 and 1.0 is the land most suited for the intensive production of fruit and nut trees, vegetables, staple foods, grains, and animal feed with the fewest environmental limitations. This land represented about 36 percent of U.S. agricultural land, or only 16.7 percent of the total land area in the continental United States in 2012.







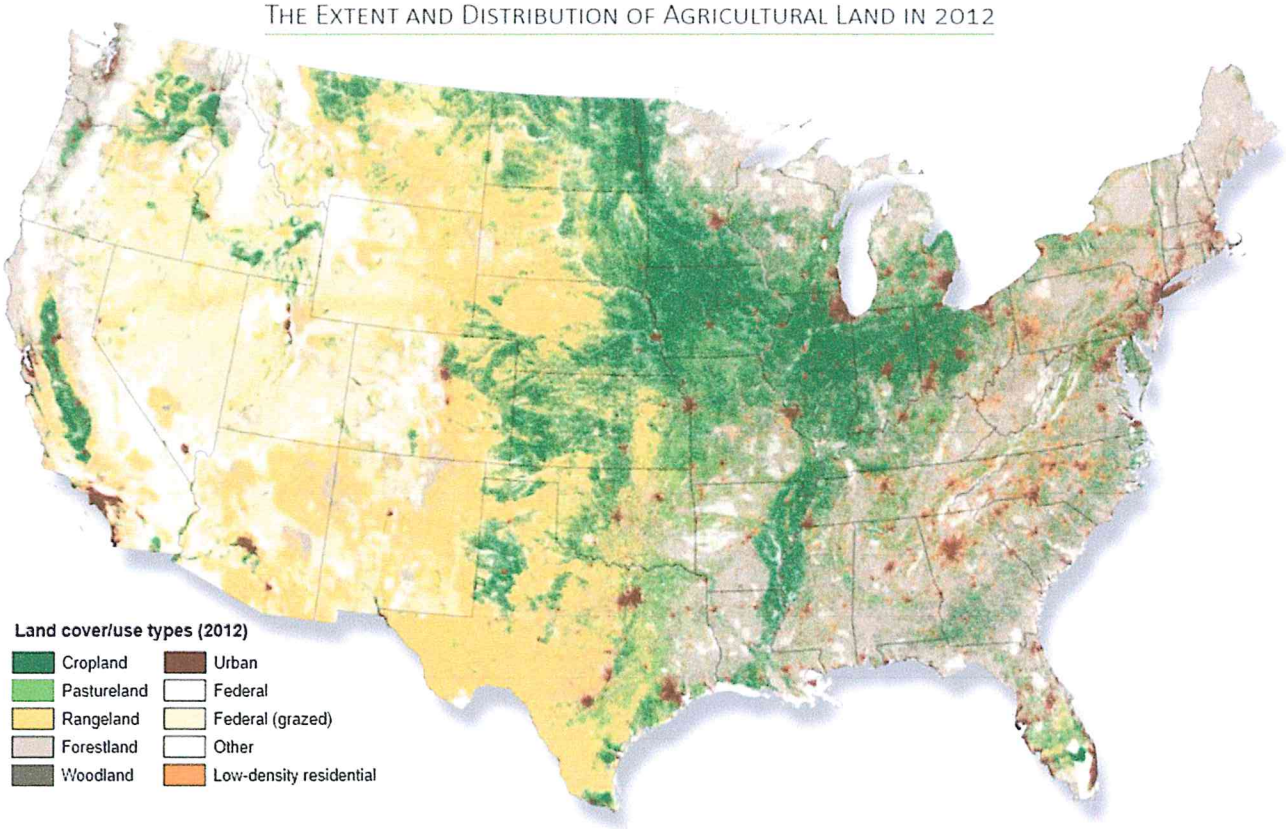
FARMS UNDER THREAT: THE STATE OF AMERICA'S FARMLAND

Farms Under Threat: The State of America's Farmland is a comprehensive spatial analysis of the location, quantity, type, and quality of agricultural land lost to development in the continental United States between 1992 and 2012. It is the first assessment from American Farmland Trust's multi-year initiative examining threats to U.S. farmland and ranchland and evaluating policies and programs to stem the loss.

The Lay of the Land

Agricultural land encompasses about 912 million acres or 47 percent of the total land area in the continental United States. *Farms Under Threat* defines agricultural land as non-federal land that includes a diverse array of land cover/use types: cropland, pastureland, rangeland, and woodland associated with farms. Farmers and ranchers use an additional 158 million acres of federal land for grazing. Agricultural land plus federal land used for grazing comprises 55 percent of the total land area.

THE EXTENT AND DISTRIBUTION OF AGRICULTURAL LAND IN 2012



KEY STATISTICS

Total land area in the continental United States (acres)	1,937,713,000
Agricultural land (acres)	911,666,000
Cropland	313,845,000
Pastureland	108,410,000
Rangeland	409,275,000
Woodland	80,136,000
Agricultural land as proportion of total land area (percent)	47.0
Federal land used for grazing (acres)	158,418,000
Proportion of land used for agriculture (percent)	55.2

American Farmland Trust
www.farmland.org

(800) 370-4879
www.farmlandinfo.org
@farmlandinfo

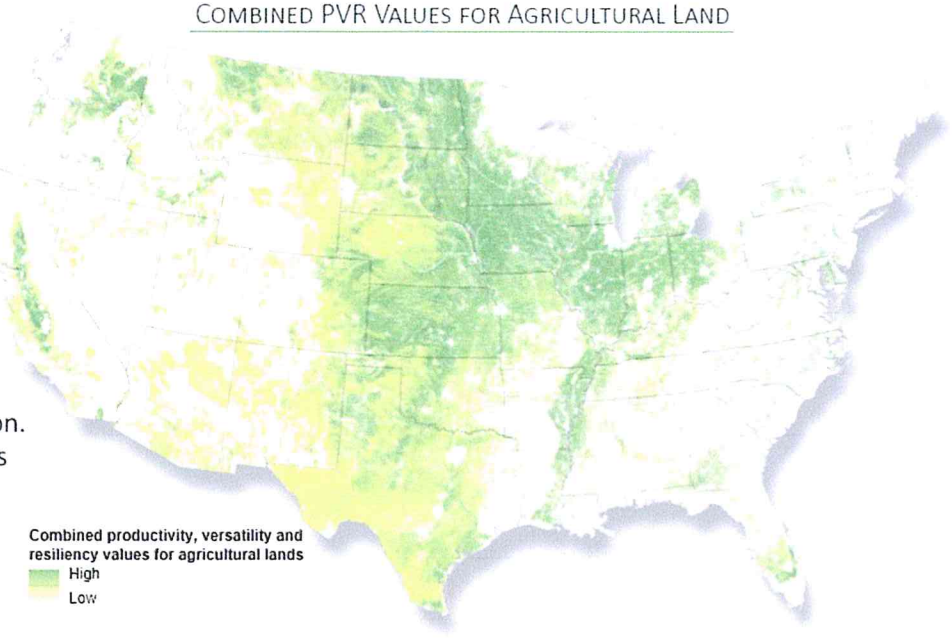
USDA
Natural Resources Conservation Service
www.nrcs.usda.gov

Nationally Significant Agricultural Land

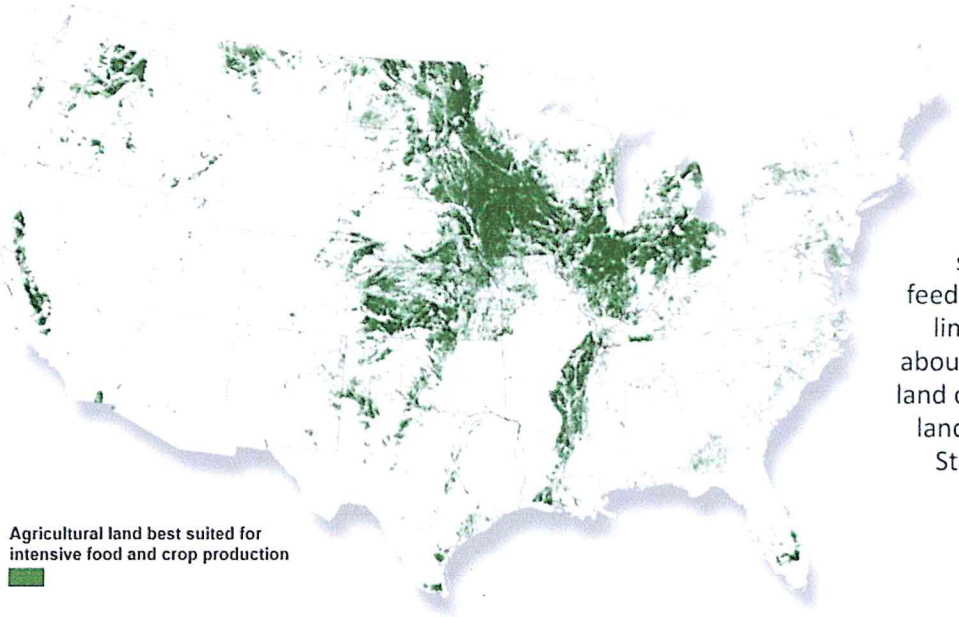
Farms Under Threat classifies agricultural land based on its productivity, versatility, and resiliency (PVR values). We used soil suitability, land cover/use, and food production as factors to assess the land's potential.

Higher PVR values are shown in darker green; lower values in pale green. Lower PVR values indicate land with relatively greater limitations and narrower choices for agricultural production. Farmers may need to adapt crops and practices and increase their level of management to use this land for cultivation.

COMBINED PVR VALUES FOR AGRICULTURAL LAND



BEST AGRICULTURAL LAND FOR INTENSIVE FOOD AND CROP PRODUCTION IN 2012



Agricultural land with PVR values between 0.43 and 1.0 is the land best suited for intensive production of fruit and nut trees, vegetables, staple foods, grains, and animal feed with the fewest environmental limitations. This land represented about 36 percent of U.S. agricultural land or about 17 percent of the total land area in the continental United States in 2012.

KEY STATISTICS

Agricultural land best suited for intensive food and crop production in 2012 (acres)	324,103,000
Agricultural land best suited for intensive food and crop production in 1992 (acres)	335,032,000
Land area in the continental United States that qualifies as best land for intensive food and crop production in 2012 (percent)	16.7
Agricultural land classified as best land for intensive food and crop production in 2012 (percent)	35.6

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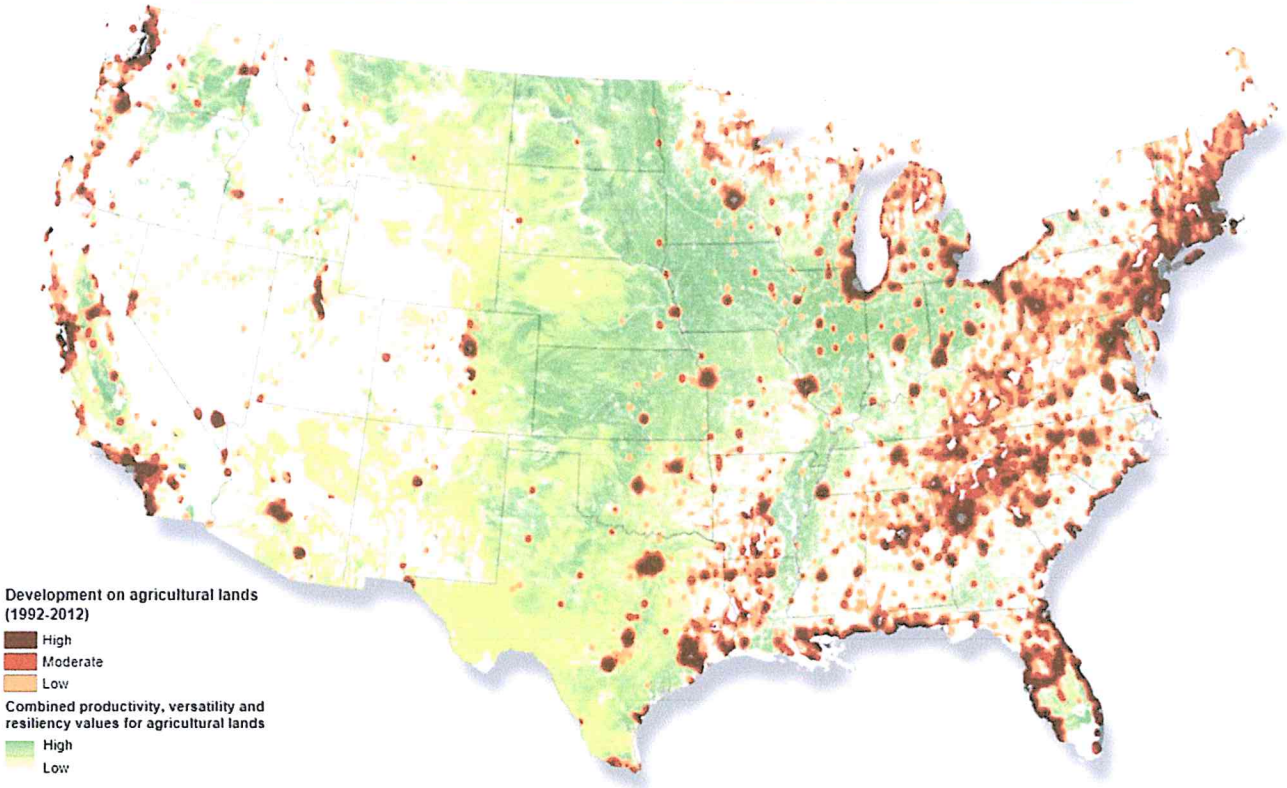
Agricultural Land Lost to Development

Between 1992 and 2012, the United States converted about 31 million acres of agricultural land to development—nearly double the amount previously reported. This is equivalent to all of the agricultural land in Iowa and roughly the size of the state of New York. Development disproportionately occurred on agricultural land—62 percent of development occurred on agricultural land even though agricultural land only accounted for 49 percent of the total land area in 1992. Lastly, during the same time period, the United States lost nearly 11 million acres of its best land.

Development is shown in dark brown (High, 25% conversion of agricultural land in a 10-kilometer radius), red (Moderate, 10–25% conversion), and orange (Low, 5–10% conversion).

CONVERSION OF AGRICULTURAL LAND TO DEVELOPMENT BETWEEN 1992 AND 2012



KEY STATISTICS

Agricultural land converted to development between 1992 and 2012 (acres)	30,727,000
Acres converted by urban development	18,029,000
Acres converted by low-density residential development	12,698,000
Average rates of conversion to development	1.5 million acres/year 175 acres /hour 2.9 acres/minute
Proportion of development on agricultural land (percent)	62.3
Percentage of urban development on agricultural land (percent)	70.4
Percentage of low-density residential development on agricultural land (percent)	53.5
Nationally significant agricultural land developed between 1992 and 2012 (acres)	10,928,000
Median PVR value of agricultural land lost to development	0.39
Median PVR value of agricultural land that stayed in production	0.31

DEVELOPMENT BY LAND COVER/USE (THOUSANDS OF ACRES)

Land cover/use		Urban Development			Low-Density Residential			Total Developed		
	% of ag land	Acres lost	% by land type	% of ag land type converted	Acres lost	% by land type	% of ag land type converted	Acres lost	% by land type	% of ag land type converted
Cropland	34.3%	7,408	28.9%	41%	4,385	18.5%	34.5%	11,793	23.9%	38.4%
Pastureland	11.9%	4,662	18.2%	25.9%	4,379	18.5%	34.5%	9,041	18.3%	29.4%
Rangeland	44.9%	4,285	16.7%	23.8%	1,408	5.9%	11.1%	5,693	11.5%	18.5%
Woodland	8.8%	1,674	6.5%	9.3%	2,527	10.6%	19.9%	4,201	8.5%	13.7%
Total on ag land		18,029	70.4%		12,698	53.5%		30,727	62.3%	
Forestland		5,107	19.9%		9,739	41%		14,846	30.1%	
Other		2,463	9.6%		1,297	5.5%		3,761	7.6%	
Total		25,600			23,735			49,335		

About the Project

Farms Under Threat: The State of America's Farmland is the first report from a multi-year initiative to evaluate threats to agricultural land and the policies and programs that address them. This analysis advances our understanding of the nation's agricultural land base by:

1. Estimating woodland associated with farm enterprises
2. Mapping grazing on federal land
3. Assigning values to agricultural land based on its productivity, versatility, and resiliency, and identifying a subset of nationally significant land best suited to intensive food and crop production
4. Showing spatial patterns of agricultural land use and conversion to development
5. Mapping the pattern and extent of low-density residential development

American Farmland Trust partnered with Conservation Science Partners (CSP), a nonprofit scientific collective, to ensure the spatial analyses are grounded in reliable data and strong science. A national Advisory Committee provided additional guidance.

Farms Under Threat combines county-level estimates of land cover/use from the USDA Natural Resources Conservation Service (NRCS) National Resources Inventory (NRI) and the spatially explicit National Land Cover Database (NLCD). Additional datasets include:

- National Agricultural Statistics Service (NASS) Cropland Data Layer
- NASS Census of Agriculture farm size
- NRCS Soil Survey Geographic Database
- U.S. Census housing density
- U.S. Geological Survey Protected Areas Database

For a complete list of datasets, see the technical report: https://www.farmlandinfo.org/farms-under-threat-technical-report

Farms Under Threat: The State of America's Farmland is supported by the USDA Natural Resources Conservation Service (NRCS) and the members of American Farmland Trust. For more information about the initiative, visit AFT's website: https://www.farmland.org/initiatives/farms-under-threat.

The Farmland Information Center (FIC) is a clearinghouse for information about farmland protection and stewardship. The FIC is a public/private partnership between USDA NRCS and American Farmland Trust.

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MICHIGAN STATE
UNIVERSITY

Area of Expertise:
Policy Impact Modeling

Degree:
Ph.D, Oklahoma State University
B.A., Oklahoma State University

Fixed-term assistant professor Dr. Steven R. Miller specializes in applied economic methods for forecasting and impact analysis. Dr. Miller is also the Director of the Center for Economic Analysis. As a graduate, Steven maintained and programmed the Oklahoma State University Econometric Forecasting model and served as investigator on several Oklahoma Department of Human Resources studies of TANF funding, and child support studies for impact and needs assessments. He has produced numerous impact assessments of Wichita, Kansas area businesses seeking state and local sponsored incentives, produced papers on aviation demand across competing regional airports, and papers on alternative estimation methods of systems modeling. He is currently working on: Development of Profitable Michigan-Based Meat and Livestock Value Chains.

Research and Outreach Interests

- Building models for and producing national, state and local economic forecasts
- Impact assessment of industry and policy
- State and local incentives for economic development
- Spatial estimation models
- Bayesian vector autoregression models for forecasting
- Impact assessment of recreation destination

Center for Economic Analysis draws on expertise of the faculty that makes up the Department of Agricultural, Food, and Resource Economics, and the center's objectives include linking research questions to appropriate faculty. The center works with department faculty to push through stakeholder requests for economic analysis & has been successful in pushing projects along a wide swath of topics including public policy, health care, agriculture policy, environmental policy and economic development. Steven's personal area of interest is in projects and programs around economic growth and development, including community- and regional-based entrepreneurship programs.

Authored Documents & Articles:

- Analysis of Healthy Food Incentive Programs' Impact on Farmers Market Vendors in Michigan, December 4, 2017
- Economics of Healthy Food Incentives at Michigan Farmers Markets: Study Highlights, August 8, 2017
- Opportunities and Barriers to Growing Michigan's Local Food System: The Case of Meat Processing, August 8, 2017
- Regulatory Routes to Purchasing Michigan Meat, July 13, 2017
- Developing Michigan Meat Processing, Part 1: Processing and Regulation, June 29, 2017
- Michigan Meat Processing Capacity Assessment Final Report, September 26, 2016
- Trey Malone: Travels of the Pilsner in the Michigan Economy, March 28, 2019

Projects:

- Development and Optimization of Solid-Set Canopy Delivery Systems For Resource-Efficient, Ecological
- Effect of Cover Crops on Nitrous Oxide Emissions, Nitrogen Availability and Carbon Accumulation in O
- IR-4 Field Research [2014]
- Minor Crop Pest Management Program - Interregional Research Project No. 4
- Translational Genomics in Cucumber-Tool Development & App. for Recessive Disease Resistance A
- Trunk Injection: A Discriminating Delivery System for Tree Fruit IPM [2013 - 2015]

Articles Featuring:

- Del Monte's Quest to Change How Americans Feel About Canned Produce, February 10, 2020
- What's craft beer worth to the state of Michigan?, May 15, 2019
- What's on tap? Michigan's economy, May 7, 2019
- Trey Malone: Travels of the Pilsner in the Michigan Economy, March 28, 2019
- Craft Beer as a Means of Economic Development: An Economic Impact Analysis of the Michigan Value Chain, February 26, 2019
- Economic Forecast Provides Critical Information for Michigan Stakeholders , December 21, 2018

Lone Oak Solar Installation Estimated Economic Impacts of Reduced Agricultural Production

The Lone Oak Solar project is for the installation of solar photovoltaic (PV) electric generating facility in Northwestern Madison County, IN, encompassing the townships of Monroe and Pipe Creek. This is a 120-megawatt (MW) PV deployment on approximately 850 acres of least lands. Up to 13 disjointed installation sites in proximity will be used spanning a total of 1,890 acres.

This brief economics assessment is a partial analysis, limited to measuring only the value of subverted agricultural production following the installation and operation of the Lone Oak Solar project. As such, this analysis is not to be taken as an economic impact assessment of the Lone Oak Solar project but rather that of the loss of existing agricultural uses of the 1,890 acres of leased lands that will be diverted to PV operations. We assert that the PV panels have a life of 35 years, which is consistent with the expected life of commercial panel installations that range from 30 to35 years. At the end of the project's life, the panels will be partially or fully replaced with the most up-to-date PV systems, or the PV fixtures will be removed with cost. Who bears that cost of transitioning back to agricultural uses depends on the nature of the land-lease agreements. In this study, such end-of-life expected costs are not included in the analysis.[1]

We used typical crop rotations for Madison County and commodity expenditure and revenue profiles developed at Purdue to estimate the economic direct effects of forgone agricultural production. Accordingly, the crop rotation modeled was corn-corn-soy beans, indicating that corn is grown on two out of three years, while soybeans are grown one of every three years. This rotation and associated crop production budgets were selected to be representative of the crop production activities currently practiced on crop-producing acreage to be diverted. Other major crops also appear on the USDA CropScape tool for Madison County, including winter wheat, wheat/soy bean double crop, alfalfa/hay and tomatoes, though their absolute numbers, in terms of acres planted, sum to less than 10 percent of production agricultural land in Madison County.[2]

Hence, we estimate that the direct annual loss of agricultural output and associated economic measures are: [3]

- **1,890 acres taken out of agricultural crop production and placed in PV-electricity production**
- **$1,038,051 in gross farm revenues (cash sales of farms)**
- **$363,321 in farm net revenues (Farm revenues to proprietor, farm capital and farm land)**
- **$75,600 in farm labor earnings (excluding proprietor earnings)**

Over 35 years of operation, this represents a decline in (2020 $ values held constant):

- **$36,331,800 in gross farm revenues**
- **$12,716,200 in farm net revenues**
- **$2,646,000 in farm labor earnings**

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[1] See Heiniger, R.W. 2017. *Cost of Reclaiming Land Currently Used for Solar Panels Back to Farmland.* Department of Crop and Soil Science, North Carolina State University. Plymouth, NC.

[2] See https://www.nass.usda.gov/Research_and_Science/Cropland/sarsfaqs2.php

[3] Estimates provided by the Center for Economic Analysis at Michigan State University under the directorship of Steven R. Miller. For more information contact Steven Miller at 517.355.2153 or by email at mill1707@msu.edu.

Lone Oak Solar Installation Estimated Economic Impacts of Reduced Agricultural Production

We simulated how the loss in annual farm sales translates to economy-wide impacts on Madison County, IN. Economy-wide impacts are larger than direct impacts because dollars recirculate throughout the economy. For example, the sales revenues earned by the grower are partially re-spent in the local economy to purchase seed inputs to the next year's harvest, to purchase fuel, maintain or expand capital like tractors and enclosures, etc. Those receiving payments from the farmers will also re-spend a share to restock on inventories, pay labor, taxes and operating expenses. Households increase their expenditures from labor and proprietary income, creating a second channel of impacts. Together, the business to business transactions and household to business transactions that occur locally make up what we call secondary expenditures (indirect and induced effects, respectively). The cycle continues, decreased only to the extent that purchases are made to suppliers from outside of Madison County. The table below shows estimates using annual estimated economy-wide decreases associated with decreased agricultural activities described above.

Impact Type	Employment	Labor Income	Regional Income	Output
Direct Effect	1.8	$163,511	$505,412	$1,038,051
Indirect Effect	2.0	$41,566	$324,011	$665,476
Induced Effect	1.5	$35,756	$301,368	$641,210
Total Effect	5.3	$240,833	$1,130,791	$2,344,737

Model simulation: Lost Farm Sales Impacts on Madison County, IN

Direct loss of agriculture sales of $1,038,051 will create a decrease in total transactions in Madison County, totaling $2.34 million per year. This would result in a reduction of regional income of just over $1.13 million per year.[4] Total labor income will be expected to decline by $240,833 per year, impacting just over five local workers.[5]

These estimates only take into account of expected impacts tied to reduced agricultural activities as currently exercised on these farms and do not take into consideration employment by Lone Oak Solar in maintaining and operating the solar panel installation. It also does not take into consideration the expected impacts of any annual payments made on behalf of Lone Oak Solar for personal property taxes, income taxes and land lease payments. Finally, the estimates do not take into account any substituted economic activity that may be applied to these lands in the presence of the solar panel installation.

[4] Regional income is the combined labor income, proprietor's income, payments to capital and landowners and indirect business taxes.

[5] Employment may include self-employed proprietors.

labor Costs	10%							
acres	1890	Per acre	Corn		Soy	Corn	Three-yr	
Buffer	0%	Prices		$3.40	$8.35	$3.40		
	1890	Yields		176	54	176		
		Gross Revenues		$598	$451	$598	$549	
		Variable Costs		$418	$235	$418	$357	
		Labor Costs		$45	$30	$45	$40	
		Gross variable Costs		$463	$265	$463	$397	
		Per acres contrib. to margins		$135	$186	$135	$152	
		Sales		$1,130,976	$852,201	$1,130,976	$1,038,100	$1,038,051
		Net Rev		$340,956	$408,051	$340,956	$363,300	$363,321
		Labor Pay		$85,050	$56,700	$85,050	$75,600	$75,600
		Proprietor Income plus capital		**$255,906**	**$351,351**	**$255,906**	$287,700	$287,721
		Life (yrs)		35				
		Gross revenues		$36,331,800				
		Lost farm revenue		$12,716,200				
		Lost labor pay		$2,646,000				

Model simulation

Impact Type	Employment	Labor Income	Regional Income	Output
Direct Effect	1.8	$163,511	$505,412	$1,038,051
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Solar Farming: Not a Good Use of Agricultural Land

Industry Resources

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Solar Farming: Not a Good Use of Agricultural Land

By: Ron Heiniger
NCSU Professor and Extension Specialist,
Corn/Soybeans/Small Grains
Crop Science

You can't help but notice changes on the landscape of agriculture in North Carolina in the form of solar farms. The question arises are these uses of agricultural land a good thing or something we will come to regret. As an agronomist who works with crops and soils every day and as one who has gone through a life-changing event that changed my future from being a farmer in Kansas to my present position as an extension specialist, I feel it is important to point out a few facts that should be considered before signing that contract to lease your land for solar farming.

Fact 1. Solar farming will change the future productivity of the land.

Because solar panels only capture 20% of the light for only about 5 hours of the day the rest of that solar energy will pass through to the ground. As a result grasses, broadleaf weeds, and eventually woody shrubs will grow. There are only three ways that solar farms can deal with this unwanted vegetation: herbicides, mowing, or ground cover or a combination of all three. All of us who have farmed this land understand how hard it is to control weeds in crops that intercept over 80% of the solar radiation. You can only imagine how hard it will be to control this

Southern Crop Production Association

CropLife America

NC Agricultural Aviation Association

Government
NC Department of Agriculture

Other Posts

- **Advance Equipment Program Is Back!** January 21, 2021
- **MorYield 2020 Contest Winners Announced** January 20, 2021
- **Special Offer Trilogy Tobacco Trays** January 4, 2021
- **National Corn Yield Contest Winners** December 16, 2020
- **Ginny Barnes Receives Distinguished Woman in Southern Agriculture Award** November 11, 2020
- **Coastal AgroBusiness, Inc. Welcomes Charles Burnett** September 20, 2020
- **MorYield 2020 Yield Contest** September 8, 2020

vegetation in a solar farm. High rates of herbicides, frequent mowing, and the use of mulches, rock, or plastic will all have negative impacts on the land from herbicide residues, soil compaction and erosion, and particles of damaged panels left in the soil resulting in contamination from heavy metals and rare earth elements used in solar panels. Remember, you still own this land and you will be held responsible for water runoff, cleanup, and off site effects not to mention the accumulation of weeds like Palmer Amaranth over time and the eventual need to replace fertility lost. Make sure your contract with the solar farm has a clearly stated plan for dealing with unwanted vegetation. Plans that just state the use of herbicides, mowing or even the use of goats or sheep should be specific about types of herbicides, timing, rates, etc. Make sure these specific plans make sense for your land! Don't accept anything that will harm the soil or its future productivity.

Fact 2. Because of this lost productivity and the resulting changes in the farming communities caused by the loss of land, it is highly unlikely this land will ever be farmed again.

Loss of a scarce resources like farmland will have significant impacts on you and your community. Land rents are increasing and will increase even more as solar farms compete for agricultural land. Currently, solar farms are leasing land at prices ranging from $400 to $1200 an acre. Not many farmers can afford to pay these kind of prices to farm the land. With the loss of land comes the loss of business for seed, fertilizer, and chemical dealers, hardware and lumber suppliers, equipment manufacturers and others in your community who depend on agriculture for their living. It is highly likely that our grain markets will have to adjust by moving livestock out of the state to areas with better grain supplies resulting in lower prices for grains in North Carolina. In short, over the span of the current 20-year lease agreements, agriculture will change such that even when the land becomes available, you will not be able to afford to put it back into production. Make sure you have a viable plan for how you will move forward with your farming enterprise. Today, farming depends on size of scale to make a profit. As you scale down, expect it to become more and more difficult to remain in the farming business. If you aren't going to continue farming, what are you going to do? Have a future plan and execute it while you have the financial resources to do so. I had the idea that I would farm again when I took the payments in the dairy buyout in Kansas. How foolish I was to think you could go back again. This is life-changing money. Be prepared to handle the consequences.

Fact 3. You could be stuck with the cost of decommissioning these solar farms

Currently, most solar operators are not required to have a decommissioning plan or to post a bond to cover the costs of decommissioning. Their current statement is: "this will all be taken care

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of in the future." Have you ever considered why they are paying such high lease payments and not just buying the land? The fact is that these panels are considered toxic waste due to the use of metals like cadmium and rare earth elements. These panels only have an expected life span of 20 years. Since they cannot be placed in landfills and are not accepted for recycling by any plant in the United States, it is highly likely that they will be either abandoned at the site or you (as the land owner) will be forced to pay for them to be shipped to third world countries for recycling. Don't trust others when they tell you this will be solved. It hasn't been in the last 20 years and I wouldn't bet my future on it being solved in the next 20 years. Make sure that the solar company has a viable decommissioning plan that spells out the terms of disposal, land grading, and restoration of the site to its original condition. Require them to post a bond to make sure they are still around at decommissioning time. By watching how fast they leave your driveway, you can tell how serious they are about the future of farming on your land.

Fact 4: Solar farming is not a good use of our land

Solar farms are highly inefficient at producing energy. It is only through generous tax credits, the waving of property taxes, zero interest start-up loans, federal and state mandates that require utility companies to pay for the power at generous rates, etc. that these solar farms even have a chance of operating. Right now, it is costing North Carolina taxpayers $124 million dollars in lost tax revenues. This loss is expected to grow to $2 billion by 2020 to enable these farms to remain viable. In other words, you and the schools in your community are paying the bill. It doesn't make sense to pay for solar before paying teachers" salaries. How much longer this can go on is anyone's guess. I think it is unlikely that this can continue for very long and once this taxpayer largess ends it will end the era of the solar farm. For what? Not for green energy. Because solar power only occurs for 5 hours on sunny days. There are no batteries at any of these solar farm sites. The traditional utility companies still have to produce their normal power load for the remaining 19 hours on a sunny day. And, on a cloudy rainy day, they have to provide power for all 24 hours. They still have to be prepared to generate the same amount of electricity using fossil fuels with or without the solar farm! So let's get this straight – we pay the taxes, we pay higher utility rates, we change our agricultural communities to accommodate these solar farms, and we don't improve our climate or our environment. And, it can potentially ruin the land for our children and grandchildren. NO, THIS IS NOT A GOOD USE OF OUR LAND!

This article is posted with the permission of Ron Heiniger.

By admin | December 11th, 2015 | Categories: Home

Yearly loss of revenue to the local economy

This data was all derived from the USDA Economic Research Services for crop year 2020. The costs below represent the USDA's estimate to produce 1 acre of corn, all estimates are based on a 178 bushel per acre average. The USDA average sale price per bushel for 2020 was $3.61 making the gross profit for 1 acre of corn $642.58. The total cost of production, which represents the amount of money put into the local economy for every acre of corn planted is $601.20. The proposed solar project is approximately 850 acres making the loss to the local economy in yearly revenue $511,020.00. Over the life span of the 30 year project the loss of revenue would be $15,330,600.00.

Seed	$91.83
Fertilizer	$116.91
Chemicals	$32.62
Fuel & Electricity	$27.18
Repairs	$35.55
Custom Applications	$22.95
Hired Labor	$5.27
Machinery/ Equipment	$126.03
Land Cost	$161.78
Taxes & Insurance	$11.95
Drying	.20 per bu $35.60
Trucking	.12 per bu $21.36
Irrigation	$4.00

Corn fields help clean up and protect the environment

Kurt Thelen, Michigan State University Extension, Department of Crop & Soil Sciences - June 7, 2007

Editor's note: This article is from the archives of the MSU *Crop Advisory Team Alerts*. Check the label of any pesticide referenced to ensure your use is included.

Reports of climate change, global warming and greenhouse gas emissions have been all over the news lately. What does this have to do with agriculture? After many decades of being pointed to as a source of environmental issues, field crop agriculture is being looked to as one of the solutions to global climate change. The basis for this environmental remediation affect is corn's and other crops' tremendous potential to remove carbon dioxide (CO2), a major greenhouse gas, from the atmosphere. In fact, Michigan growers can now receive payment for storing carbon in the soil via private sector carbon credit trading managed through the Chicago Climate Exchange.

How much carbon dioxide does an acre of Michigan corn absorb in a growing season? That is a question that is often asked, and the answer may surprise many people. Our calculations show that number to be in excess of 36,000 lbs. of carbon dioxide per acre! Of course, much of that carbon is eventually returned to the atmosphere as the corn crop residue decomposes or the grain is

consumed as feed or burned as biofuel, but farmers can maintain a significant amount of carbon in the soil with proper management including implementing reduced or no-till cropping systems. Currently, the Climate Exchange bases Michigan carbon payments on approximately 0.4 to 0.6 tons of carbon dioxide equivalent per acre per year depending upon your location and the specific management practices implemented. The price paid per unit of carbon is based annually upon current market prices.

When used as a renewable fuel source such as ethanol, corn also displaces petroleum-based gasoline, a significant contributor of carbon dioxide to the atmosphere. Each gallon of gasoline burned emits 19.4 lb. of carbon dioxide (5.3 lb of C) to the atmosphere. In fact, the USEPA estimates that the average car in the United States emits approximately 6 tons of carbon dioxide to the atmosphere annually. Current estimates put U.S. gasoline consumption at about 140 million gallons per year and climbing. The carbon emitted from gasoline is new additional carbon in the atmosphere – carbon that was formerly buried deep under the earth's surface. Conversely, burning renewable fuels such as corn ethanol has the potential to be carbon neutral since emissions would be essentially recycled carbon.

Finally, in addition to the atmospheric environmental advantage of carbon sequestration, there are land-based environmental/agronomic benefits as well. Increased carbon levels in the soil provide better water infiltration, enhance nutrient cycling, help alleviate compaction and reduce surface run off.

To learn more about carbon credit trading, visit the Michigan Conservation and Climate Initiative web page.

This article was published by **Michigan State University Extension**. For more information, visit

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MARY MCCLINTON CLAY, MAI
218 Main Street
Paris, Kentucky 40361
859-987-5698

September 3, 2021

Senator Paul Hornback
Chairman
Agriculture Committee
702 Capital Avenue
Frankfort, KY 40601-3415

Dear Senator Hornback:

My name is Mary McClinton Clay and I am a real estate appraiser from Paris, Kentucky specializing in eminent domain and environmental damage studies.

As requested, I am attaching a summary chart of examples of diminution in property value as a result of proximity to utility scale solar farms.

I have documented these case studies in a report entitled "A Summary of Solar Energy Generation Power Systems (Solar Farm) Damage Studies as of May 25, 2021," which I prepared for the Clark Coalition for a hearing before the Clark County Planning Commission on May 25, 2021. The report summarizes peer review journal articles, professional appraiser's reports, and solar developer's neighbor agreements, as summarized on the attached chart.

I have also documented additional examples of value diminution in four recent reviews of Impact Studies prepared by appraisers for solar developers as part of their applications to the Kentucky Siting Board.

In addition to five previously published studies, indicating property decline of up to -20.0 percent, four case studies, prepared by my office, are included.

The North Branch, MN case study analyzes a developer buy-out of 7 abutting properties purchased by North Star Solar. The sale-resale analysis compares the sale prior to and after the purchase by the developer. The data indicates a property decline of -6.3 to -28.0 percent with an average and median decline of -17.0 percent.

The McBride Place solar farm case study from Midland N.C. includes the analysis of single family sale-resales indicating value declines ranging from -15.5 to -16.8 percent.

The Sunshine Farms case study analyzes 13 single family lots from a subdivision that abuts a solar farm in Grandy, N.C. The sales that adjoin the solar farm sold for -15.5 percent less than the lots that did not abut, despite a required 300.0 foot set back from the rear property line.

The Spotsylvania Solar case examines single family lot sales before and after the announcement of the 6,350 acre 617 MW solar facility. The adjoining sales sold for -30.00 percent less than those not abutting the solar farm.

Solar developers use "Neighbor Agreements" to limit local opposition to their solar farms. The Western Mustang Solar Agreement consists of a monetary offer of $17,000 to adjacent property owners to not oppose their solar farm

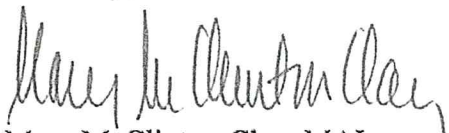
The Lighthouse BP Neighbor Agreement offers $5,000 to $50,000 to adjacent property owners depending on proximity to the solar farm.

The Posey Solar, LLC agreement offer is equal to 10.0 percent of appraised value for neighbors within 300 feet of the solar field, plus an annual $1,000 payment, or $35,000 for the life of the project. Apparently, Posey Solar considers any property within 300.00 feet of a solar farm to be at risk of value decline.

These payments are significant because the developers' own appraisers have determined that solar farms will have no adverse impact on adjacent property values. However, the payments can only be interpreted as a tacit admission of value impairment.

The evidence to date, indicates the need for a more robust and comprehensive analysis of the effect of utility scale solar farms on property values than that presented by solar developers; and prior to the approval of additional solar farms in Kentucky.

Sincerely,



Mary McClinton Clay, MAI

SUMMARY OF INDICATED VALUE DECLINE

DATE	STUDY	RESULT
2018	University	Assessor survey respones ranged from value impact of zero
	of Texas	to estimation of negative impact associated with close
		distance between the homes and the facility, and
		impact increased with increased size of the solar plant.
2020	University	Average decline within 3.0 mile radius was **-1.7%**, or $5,671.
	of Rhode Island	Average decline within 0.1 mile was **-7.0%**, or $23,682.
		The "results suggest extremely large disamenities for
		properties in very close proximity."
2013	Fred H, Beck &	Strata Solar Case Study: Potential Purchasers cancel contract
	Associates, LLC	upon learning of the solar facility.
		Clay County Case Study: Lot sales stopped after announce-
		ment of solar plant. Clay County Board of Equalization
		reduced affected property assessments **-30.0%**.
		Non-residential Use View Impariment Study: Adjacent
		incompatible use adversly impacted nearby properties **-10.7%**
		to **-25.1%**, or an average of **-15.2%.**
		AM Best Solar Farm Study: No diminution in value due to
		pre-existing industrial zoning for solar farm.
2020	Mark W.	Adams County, PA View Case Study: The loss of view results in
	Heckman, R.E.	a **-15%** to **-20.0%** loss in value.
	Appraisers	
2019	Madison County	Potential purchaser offered **-16.43 %** less than
	Indiana	appraised value upon learning of the proposed solar plant.

SUMMARY OF INDICATED VALUE DECLINE

DATE	STUDY	RESULT
2021	Mary McClinton	North Star Solar Case Study (MN): An Analysis of the 7 adjoining
	Clay, MAI	properties purchased by North Star PV, LLC. A sale-resale
		analysis of the sale prior to and subsequent to the purchase
		by the solar developer. The sale-resales indicate a range of
		diminution from **-6.3%** to **-28.0%** with a median decline of
		of **-16.9%** and an average decline of **-16.8%.**
2021	Mary McClinton	McBride Place Solar Farm Case Study (NC): Analysis of 3 sale-
	Clay, MAI	resales and a comparison of the sale price and tax assessment.
		The sale-resales indicate **-15.65%, -15.51% and -16.44 percent**
		diminution in value. The sale price/tax assessment indicates
		a **-16.81%** loss of value.
2021	Mary McClinton	Sunshine Farms Case Study (NC): Analysis of 13 vacant single
	Clay, MAI	family lot sales from a subdivision that abutts a solar farm. The
		sales that adjoin the solar farm sold for **-15.5%** percent less than
		the lots that did not abutt the solar farm.
2021	Mary McClinton	Spotsylvania Solar Case Study (VA): Analysis of 5 vacant single
	Clay, MAI	family lot sales from a section of Fawn Lake Subdivision that is
		adjacent to the solar farm. The lots that adjoin the solar farm
		sold for **-30.0%** less than those that did not adjoin.
2020	Western Mustang	Monetary offer of **$17,000** to adjacent property owners to
	Neighbor Agreem't	quel opposition to the proposed solar facility.
2020	Lighthouse BP	Monetary offer of **$5,000 to $50,000** to adjacent property
	Neighbor	owners depending on proximity to the solar facility to quel
	Agreement	opposition.
2021	Posey Solar, LLC	Monetary offer equal to **10% of appraised value** for neighbors
	Neighbor	within 300 feet of the solar field, plus an **annual $1,000**
	Agreement	payment (**$35,000** for project life).

MARY MCCLINTON CLAY
PROFESSIONAL QUALIFICATIONS

Mary McClinton Clay, MAI
218 Main Street, Paris, KY 40361
859-987-5698/Cell: 859-707-5575
mclayky@bellsouth.net

Market Area: Commonwealth of Kentucky

Primary Practice Focus: Litigation and zoning support with an emphasis on damage studies, including environmental and eminent domain.

Appraisal Experience:
1985 to Present: Self-employed - engaged in commercial, industrial and farm valuation.
1979-1984: Employed by Realty Research - engaged primarily in income property appraisal.
1976-1979: Residential appraisal experience with fee appraisers.

Previous assignments include: Eastern State Hospital; Gateway Shopping Center; Lakeside Heights Nursing Home, N. KY; L&N Office Building, Louisville; Alltech Biotechnology Center, Nicholasville, Paris Stockyards; Conrad Chevrolet, Lexington; CSX Rail Yards in Mt. Sterling and Paris; First Baptist Church, Cold Spring; Lusk-McFarland Funeral Home, Paris; Feasibility Study of proposed Hamburg Place Office/Industrial Park, Lexington; Rent Analysis of IRS Service Center, Covington; Surtech Coating, Nicholasville; Clem Refrigerated Warehouse, Lexington; Bluegrass Manufacturing, Lexington; Finley Adhesives, Louisville; Central Manufacturing and Central Light Alloy, Paris; Review Appraisal of Rand McNally Plant, Versailles and Timberland Distribution, Danville; Old Scott County Jail; Millspring Battlefield; Truck Terminals, Fast Food Restaurants, Retail Centers, Lumber Mills, Car Wash, Multi-Family Residential, Mobile Home Parks, Convenient Stores and Subdivision Analyses.

Thoroughbred Horse Farms including Pin Oak Farm, Bunker Hunt Farms, Pillar Stud Farms, Elmendorf Farm, Summer Wind Farm, Hidaway Farm, Stoner Creek Stud, Runnymede Farm, Wilshire Farm, Lynnwood Farms, Stonereath Farm, Idle Hour Farm, Canefield Farm, Elk Creek Farm, Lochness Farm, Stoneleigh Farm, Elizabeth Station Farm.

Right of Way Experience: Rose Street Extension, Lexington, 1986-87; AA Highway: Greenup Co., 1989, Carter Co., 1990-91; U.S. 27 Campbell Co. 1991-1992, 1993; Bridge Realignment, Walton, 1992; Industry Rd, Louisville, 1993; 19th St. Bridge, Covington, 1994; U.S. 27, Alexandria, 1994; S. Main St., London, 1995; Paris Pike, Paris and Bourbon County, 1995-98; KY Hwy 22 at I-75, Dry Ridge, 1996; Bridge Projects on KY Hwy 19, Whitley County, 1997; US 150, Danville, 1998; US 460 Morgan Co., 1999; US 62 South, Georgetown, 2000; Bluegrass Pkwy and KY 27 Interchange, Anderson Co., 2001; KY 519, Rowan County, 2002; US 641, Crittenden County, 2005; US 25, Madison County, 2008-09; US 68, Bourbon County, 2009-10; Clark County, 2011; US 68 Millersburg By-pass, Bourbon County, 2012-13; US 119, Bell County, 2014-15; US 25, Madison County, 2016-17; Excess Land, Georgetown By-pass, 2020; Access Break, Industrial Drive, Lebanon, 2020.

Railroad Right of Way Experience: CSX in Floyd, Perry, Clark, Woodford, Franklin, Montgomery, Johnson, Magoffin, Breathitt, Fayette, Madison, Mason, and Bourbon Counties, 1987-2016.

Rails to Trails: Rowan County, 2005; Montgomery County, 2009, Franklin County, 2014; Floyd County, 2016.

MARY MCCLINTON CLAY
PROFESSIONAL QUALIFICATIONS

Environmental Damage Studies: *Yellow Creek Concerned Citizens v. Middlesboro Tannery*: effect of tannery contamination on 350 properties along Yellow Creek, Bell County, KY, 1988; *James E. Sullivan, et al v. Board of Regents, et al*: effect of Animal Waste Fermentation Project at the Organic Pasteurization Plant at North Farm of Murray State University on Sullivan's Executive Par 3 Golf Course and Sports Center, Murray, KY, 2003; West Farm Subdivision, Pulaski County: effect of contamination of groundwater from underground storage of dry cleaning solvents on residential lot values, 2004; *Gene Nettles, et al v. Environmental and Public Protection Cabinet: Division of Water, David Morgan, Director and J.P. Amberg Hog Farm*: Diminution of Value Analysis As a Result of Proximity to Hog Facilities in Daviess, Warren, Calloway, Graves, Hickman and Carlisle Counties, Kentucky, 2006; *Terry Powell, et al v. Tosh, et al*: Diminution of Value Analysis as a Result of Proximity to Hog CAFOs in Marshall County, KY, 2007; City of Versailles v. Prichard Farm Partnership, Ltd,: effect of sewage treatment pump station and ancillary easements upon Woodford County cattle farm, 2008; *Kentucky Utilities Company v. James and Mary Jent, CDH Preserve, LLC and Farm Credit Services of Mid-America, FLC, Violet Monroe:* the effect of High Voltage Transmission Lines on three Hardin County agricultural properties, 2011; *Terrence G. Kerschner, et al v. Burley Oil Company, et al:* the effect of Leaking Underground Gasoline Tanks on Country Lane Estates, Frankfort, KY, 2013; *Jerry Whitson v. Donnie Cross:* effect of Drainage Encroachment upon Adjacent Property, 2013; the effect of Cell Tower on Bourbon County Farm, 2014; *Steve D. Hubbard v. Prestress Services Industries, LLC*: effect of Fugitive Particulate Emissions upon a Single Family Dwelling, 2016; *Henderson City-County Airport v. Mary Janet Williams, et. al.*: the effect of Proximity of a Regional General Aviation Airport on Agricultural Values, 2019; *Patricia Kushino, et al v. Federal Aviation Administration, et al*: the effect of Stormwater Drainage on Woodland Value, 2021.

Additional Damage Studies:
Faulty Construction: 172 Post Oak Road, Paris, KY; 152 Cross Creek Drive, Paris, KY; Hartland Subdivision, Lexington, KY
Flood Damage: 208 Cary Lane, Elizabethtown, KY
Blasting Damage: Chicken Farm, Tolesboro KY
Super Fund Sites: KY Wood Preserving, Inc., Winchester, KY; River Metals Recycling, Somerset, KY

Expert Witness: Circuit Courts of Bourbon, Carter, Fayette, Franklin, Hardin, Laurel and Woodford Counties

Court Testimony:
Laurel Circuit Court: *Yellow Creek Concerned Citizens v. Middlesboro Tannery*, 1995.
Franklin County Circuit Court: *Richard McGehee v. Commonwealth of Kentucky Transportation Cabinet*, 2008; *Terrence G. Kerschner, et al v. Burley Oil Company, et al, 2014*.
Hardin County Circuit Court: *Richard McGehee v. Commonwealth of Kentucky Transportation Cabinet*, 2008.
Woodford County: *Horn v. Horn*, 2009
Bourbon County Circuit Court: Blasting Case, 1980s; Waterway Impediment Case, 2000; Faulty Construction, 2009, *Hadden v. Linville*, 2015.
Fayette County Circuit Court: Faulty Construction, 1980s; Bluegrass Manufacturing (Divorce Case), 1999, *Whitson v. Cross*: Drainage Encroachment, 2013.
Carter County: Condemnation for Commonwealth of KY Transportation Cabinet.

MARY MCCLINTON CLAY
PROFESSIONAL QUALIFICATIONS

Conservation and Wetland Easements: Bluegrass Heights Farm, Fayette County: Conservation and Preservation Easement; Wetland Easements in Pulaski, Lincoln, and Fulton Counties for NRCS.

Zoning Support: *John Vance, et al v. Paris City Commission* 2019; *Citizens for Progressive Growth and Development v. Paris Bourbon County Planning Commission* 2004-2007 and 2016; *Paris First v. Paris Bourbon County Planning Commission* 2003-2006; *Paris First v. Paris City Commission* 2002-2003; *Coppers Run Historic District, Inc. v. Abundant Life Worship Center* 1995; *Sugar Grove Farm v. East Kentucky Power* 1994-1996; *Lawrence Simpson, et al v. Harry Laytart* 1986-1996.

Professional Organizations:
Appraisal Institute: MAI, 1985; SRPA, 1982; SRA, 1980

Appraisal Institute Education Certification:
The Appraisal Institute conducts a voluntary program of continuing education for its designated members. I am certified under this program through December 31, 2023.

Education: Hollins College, B.A., 1972

Appraisal Education: Society of Real Estate Appraisers Course 101, 1977; SREA Course 201, 1978; SREA Course 301, 1981; AIREA Course VIII, 1979; AIREA Course VI, 1979; AIREA Course II, 1980; AIREA Course in Investment Analysis, 1980; AIREA Course in Valuation Litigation, March, 1986; Appraisal Institute Standards of Professional Practice, 1992; AIREA Comprehensive Examination, August, 1983; Courses in Real Estate Finance, Income Property Appraisal, Real Property Valuation, and Investment Analysis, 1977-1978, Eastern Kentucky University; Appraisal Institute Course 400G, Market Analysis/Highest and Best Use, 2008, Conservation Easement Certification, 2008.

Attended numerous seminars covering a variety of topics including investment analysis, feasibility and market analysis, eminent domain and condemnation, valuation of lease interests, component depreciation, risk analysis, current issues in subdivision and zoning law, Yellow Book and appraiser as expert witness.

From: **James Kuhlenschmidt** jakuhl@comcast.net
Subject: Additional Comments for Solar Ordinance
Date: January 30, 2022 at 7:37 PM
To: dps@elkhartcounty.com
Bcc: Commissioner Brad Rogers brogers149@gmail.com, Brad Showalter showalterfarmsinc@gmail.com, Lynn Loucks toppiggy@aol.com, Jim weeber jweeber@hotmail.com, Alex Wait alwaitservices@gmail.com, Robert Newcomer ROBENEWC@aol.com

Not sure if this belongs in the ordinance itself (though it does seem appropriate place to protect the community).

Nevertheless, project approval must assure:

1) Approval of any large installation of solar panels for the purpose of a community electrical power source must clearly place the ownership of waste from the project site with the current project developer/owner.

This is consistent with hazardous waste rules which define the generator as owner of hazardous waste from cradle to grave. If ownership of the project changes, ownership of any waste from the site must transfer to the new owner.

Ownership of the waste includes transport of the waste to an approved treatment/disposal facility.

2) Responsibility of emergency response operations related to the solar installation site must also be with the project developer or current owner. This responsibility should include an Emergency Response Plan including at minimum:

- A contract with a professional emergency response service that remains in effect for the duration of the project through decommissioning and disposal.
- PPE for any site employees
- Emergency response contact information
- MSDS's for the solar panels, batteries, and any chemicals used on site
- Lockout/Tagout procedures for electrical equipment on site
- A fire safety and evacuation plan
- A detailed site plan with location of all disconnects and necessary electrical safety and hazard information
- Regulatory notification and reporting responsibilities
- Financial assurance for any fees, penalties, or remediation costs related to the emergency
- On-site supervision of the emergency response and coordination with local emergency response units

3) Approval of a large scale solar "farm" project should be conditioned on agreement of the owner/operator to **recycle** any solar panel waste, battery waste, or electronic waste from the site.

James Kuhlenschmidt
Goshen, IN

Benton Township Volunteer Fire Department
68073 US Highway 33 Goshen, IN 46526

Elkhart County Officials,

This letter is in response to the request for public input on a proposed solar ordinance for Elkhart County. As you know, the planned solar facility rejected in 2021 was going to be built in our Township. As a result of this proposed facility, we as a department received numerous questions from the public if we are able to handle the possibility of being called to the facility in case of emergencies; the short answer is NO.

The Benton Township Fire Department is a 100% volunteer department. As most of you know, many nationwide volunteer fire departments struggle to get volunteers; we are no different. Our department has a 30-man roster, and we are currently able to fill 22 of those positions; of those 22 members, more than half of our 22 members were able to respond to less than 15% of our 182 total calls last year for service. Upon doing some research during the previous 25 years, the average employment span of a volunteer firefighter on our department is 9.8 years. We are concerned that if our current staff is trained to respond to the unique hazards associated with a solar facility, we may not have trained members by the end of the 30-year lifespan of the facility. After extensive research and consulting with our local hazardous materials response team, we have the following concerns if a large-scale power plant was built in our community.

- Solar panels contain many hazardous materials; in the event of a fire, these materials could create a dangerous gas that would harm the community and first responders. Water runoff from extinguishing a hazardous materials fire is also very toxic and can contaminate the soil and the groundwater if not properly contained.
- Industrial solar facilities contain many "semi-trailer" size batteries to store the energy. These batteries can be made of several different materials that pose a fire or explosion risk if they become overheated. Many of these types of batteries require particular kinds of extinguishment foams.
- Industrial solar facilities require the construction of a multi-acre electrical substation. In the event of a fire at an electrical substation, traditional firefighting tactics are ineffective due to the inability to apply water due to the risk of electrical shock. This means waiting an unknown amount of time for someone from the facility who is trained for this situation to arrive on-scene to mitigate the issues and turn off the power. Solar panels can continue to produce power even when disconnected from the power grid making them very dangerous during an emergency.
- Due to the size of solar facilities, sometimes thousands of acres, we are concerned about access to the facility. The average weight of a fire engine or tanker truck is 20 to 30 tons. Are the access roads capable of safely handling that much weight? Will the access roads be plowed in the winter after a snow event? Will they be accessible in the spring and summer after a significant rain event?
- A large portion of a solar facility is covered in grass and natural vegetation. When the grass and vegetation are dead in the spring and fall, our department responds to several

large-scale grass fires in our Township and surrounding areas. These fires fueled by dead vegetation can spread very quickly. What steps will be taken to ensure that a grass fire does not occur? Again, will we have safe and acceptable access to every facility area to extinguish such a fire before the solar panels and transformers become involved?

- Most fire departments carry and refer to the "Emergency Response Guide" (ERG) book during the initial phases of hazardous material incidences. The book is published and distributed by the United States Department of Transportation. ERG books give first responders the ability to look up hazardous materials and identify the best way to mitigate a spill or fire; they also tell you how far to evacuate an area in the event of a spill or fire involving individual materials. A few of the many hazardous materials solar panels often contain include Cadmium, hexafluoroethane, and silicon tetrachloride. According to the ERG book, if any of these chemicals are involved in a fire incident, the recommended evacuation zone is ½ mile (2640 feet) in every direction.

Considering all these potential hazards and concerns, we, as a fire department, would propose the following stipulations IF a large-scale solar facility were to be allowed in Elkhart County.

- Solar facilities should be required to have an employee on-site 24/7 that can ensure the power is disconnected in the event of an emergency. This employee would also ensure the roads were always accessible for emergency personnel.
- Solar facilities should be required to have a contract with a specialized hazardous material team that is available for response 24/7 in the event of an emergency. This hazardous materials team must be credentialed to work in Elkhart County.
- Solar Facilities should be required to have on-site any specialized equipment or supplies needed to extinguish a fire involving any hazardous material on site.
- Solar facilities should be required to provide yearly training to the closest responding fire department and the surrounding fire departments that could potentially respond for mutual aid. This training should include a facility tour pointing out potential hazards and electrical disconnects. They should also provide each department with MSDS documents.
- Any access roads within the facility should be built to a specification that allows safe travel for multiple large fire apparatus. The facility should have numerous entrances to ease the response in case of a significant incident.
- Any solar panel, battery storage facility, or electrical substation should be constructed no less than 2000 feet from any adjacent structure to protect the community from possible hazardous material exposure.
- Any expense accrued outside of normal firefighting activities should be reimbursed to the fire department by the solar facility. These expenses include loss of gear, equipment, and apparatus due to contamination by hazardous materials.
- It would be our recommendation for the solar company to provide its own on-site fire brigade to remove the responsibility for response from already overburdened fire and EMS services.

In closing, we would like to thank you for considering our concerns when drafting ordinances and regulations for large-scale solar facilities. We want to urge you to think of these facilities not as pollution-free green energy sources but to consider them as multi-acre power facilities that pose several dangers to the community, emergency responders, and the environment. We feel the construction of a large-scale facility in rural communities would be an unwanted additional burden on rural volunteer fire departments already struggling with funding and personnel issues. While the probability of a large-scale hazardous material event is not high or imminent, it would be ignorant and foolish to think over 30 years that it is not at least possible.

Jason Dunlap – Chief

Brad Showalter – Assistant Chief

Why Everything They Said About Solar Was Wrong

Solar Panels Will Create 50 Times More Waste & Cost 4 Times More Than Predicted, New Harvard Business Review Study Finds

Michael Shellenberger

Three years ago I published a long article at *Forbes* arguing that solar panels weren't clean but in fact produced 300 times more toxic waste than high-level nuclear waste. But in contrast to nuclear waste, which is safely stored and never hurts anyone, solar panel waste risks exposing poor trash-pickers in sub-Saharan Africa. The reason was because it was so much cheaper to make new solar panels from raw materials than to recycle them, and would remain that way, given labor and energy costs.

My reporting was near-universally denounced. The most influential financial analyst of the solar industry called my article, "a fine example of 'prove RE [renewable energy] is terrible by linking lots of reports which don't actually support your point but do show that the RE industry in the West considers and documents its limited impacts extremely thoroughly.'" An energy analyst who is both pro-nuclear and pro-solar agreed with her, saying "I looked into this waste issue in the past and concur with [her]."

The Guardian said solar panel waste was a "somewhat ironic concern from [me], a proponent of nuclear power, which has a rather bigger toxic waste problem" adding that "broken panels… are relatively rare except perhaps in the wake of a natural disaster like a hurricane or earthquake."

But when reporters eventually looked into the issue they came to the same conclusions I had. In 2019, *The New York Times* published a long article about toxic old solar panels and batteries causing "harm to people who scavenge recyclable materials by hand" in poor African communities. In 2020, *Discover* magazine confirmed that "it is often cheaper to discard them in landfills or send them to developing countries. As solar panels sit in dumps, the toxic metals they contain can leach out into the environment and possibly pose a public health hazard if they get into the groundwater supply."

Still, each of those articles stressed that some solar panels were already being recycled, and that more of them one day would be, which was what many of my original critics had pointed out. "The European Union requires solar companies to collect and recycle their panels," noted *Discover* magazine, "with the cost of recycling built into the selling price." The solar analyst who accused me of making unsubstantiated claims said the reason "there are few solar panels being recycled to date [is] because most of them are still working fine."

But a major new study of the economics of solar, published in *Harvard Business Review* (HBR), finds that the waste produced by solar panels will make electricity from solar panels four times more expensive than the world's leading energy analysts thought. "The economics of solar," write Atalay Atasu and Luk N. Van Wassenhove of INSEAD, one of

Europe's leading business schools, and Serasu Duran of the University of Calgary, will "darken quickly as the industry sinks under the weight of its own trash."

Conventional wisdom today holds that the world will quadruple the number of solar panels in the world over the next decade. "And that's not even taking into consideration the further impact of possible new regulations and incentives launched by the green-friendly Biden administration," Atasu, Wassenhove, and Duran write in *HBR*.

But the volume of solar panel waste will destroy the economics of solar even with the subsidies, they say. "By 2035," write the three economists, "discarded panels would outweigh new units sold by 2.56 times. In turn, this would catapult the LCOE (levelized cost of energy, a measure of the overall cost of an energy-producing asset over its lifetime) to four times the current projection."

The solar industry, and even supposedly neutral energy agencies, grossly underestimated how much waste solar panels would produce.

The *HBR* authors, all of whom are business school professors, looked at the economics from the point of view of the customer, and past trends, and calculated that customers would replace panels far sooner than every 30 years, as the industry assumes.

"If early replacements occur as predicted by our statistical model," they write, solar panels "can produce 50 times more waste in just four years than [International Renewable Energy Agency] IRENA anticipates."

The *HBR* authors found that the price of panels, the amount solar panel owners are paid by the local electric company, and sunlight-to-electricity efficiency determined how quickly people replaced their panels.

"Alarming as they are," they write, "these stats may not do full justice to the crisis, as our analysis is restricted to residential installations. With commercial and industrial panels added to the picture, the scale of replacements could be much, much larger."

What about recycling? It's not worth the expense, note the *HBR* authors. "While panels contain small amounts of valuable materials such as silver, they are mostly made of glass, an extremely low-value material," they note. As a result, it costs 10 to 30 times more to recycle than to send panels to the landfill.

The problem is the sheer quantity of the hazardous waste, which far exceeds the waste produced by iPhones, laptops, and other electronics. The volume of waste expected from the solar industry, found a team of Indian researchers in 2020, was far higher than from other electronics.

"The totality of these unforeseen costs could crush industry competitiveness," conclude the *HBR* authors. "If we plot future installations according to a logistic growth curve capped at 700 GW by 2050 (NREL's estimated ceiling for the U.S. residential market) alongside the early replacement curve, we see the volume of waste surpassing that of new installations by the year 2031."

It's not just solar. "The same problem is looming for other renewable-energy technologies. For example, barring a major increase in processing capability, experts expect that more than 720,000 tons worth of gargantuan wind turbine blades will end up in U.S. landfills over the next 20 years. According to prevailing estimates, only five percent of electric-vehicle batteries are currently recycled – a lag that automakers are racing to rectify as sales figures for electric cars continue to rise as much as 40% year-on-year."

But the toxic nature of solar panels makes their environmental impacts worse than just the quantity of waste. Solar panels are delicate and break easily. When they do, they instantly become hazardous, and classified as such, due to their heavy metal contents. Hence, used solar panels are classified as hazardous waste. The authors note that "this classification carries with it a string of expensive restrictions — hazardous waste can only be transported at designated times and via select routes, etc."

Beyond the shocking nature of the finding itself is what it says about the integrity and credibility of IRENA, the International Renewable Energy Agency. It is an intergovernmental organization like the Intergovernmental Panel on Climate Change, funded by taxpayers from the developed nations of Europe, North America, and Asia, and expected to provide objective information. Instead, it employed unrealistic assumptions to produce results more supportive of solar panels.

IRENA acted like an industry association rather than as a public interest one. IRENA, noted the HBR reporters, "describes a billion-dollar opportunity for recapture of valuable materials rather than a dire threat." IRENA almost certainly knew better. For decades, consumers in Germany, California, Japan and other major member nations of IRENA, have been replacing solar panels just 10 or 15 years old. But IRENA hadn't even modeled solar panel replacements in those time frames.

IRENA wasn't the only organization that put out rose-tinted forecasts to greenwash solar. For years, the solar industry and its spokespersons have claimed that panels only "degrade" — reduce how much electricity they produce — at a rate of 0.5% per year.

But new research finds that solar panels in use degrade twice as fast as the industry claimed. And that report came on the heels of a separate report which found that solar panels have been suffering a rising failure rate even before entering service. "One in three manufacturers experienced safety failures relating to junction box defects, an increase from one in five last year," noted an industry reporter. The "majority of failures were prior to testing, straight from the box."

Blinded by the Light

Dealing with the problem requires that government regulators clamp down on solar. "A first step to forestalling disaster," write the *HBR* authors, "may be for solar panel producers to start lobbying for similar legislation in the United States immediately, instead of waiting for solar panels to start clogging landfills."

But that's unlikely since such legislation would significantly increase the cost of solar, and thin profit margins mean that many solar companies would likely go bankrupt. The result is a self-reinforcing feedback loop. "If legislation comes too late, the remaining players may be forced to deal with the expensive mess that erstwhile Chinese producers left behind."

As such, taxpayers will likely have to subsidize the clean up of solar panel waste. "Government subsidies are probably the only way to quickly develop capacity commensurate with the magnitude of the looming waste problem," they write.

None of this means there's no role whatsoever for solar panels, nor that they are not ingenious machines. Like many others I have long been filled by a sense of wonder in how they convert sunlight, photons, into electrons, and I have solar panels in my backyard. Solar panels power satellites. And they can be an important way to generate electricity in off-grid areas.

But solar panels cannot be a primary energy source like nuclear, natural gas, or coal, for inherently physical reasons relating to the unreliable and dilute nature of their "fuel," sunlight. Low power densities *must* induce higher material intensity and spatial requirements, and thus higher physical costs.

Even as the cost of solar panels has come down, the cost of producing reliable grid electricity with solar panels has risen, due to their weather-dependent nature, something that became evident in 2018, was recognized by University of Chicago economists in 2019, and was further supported by spiraling costs in renewables-heavy Germany and California in 2020.

The new research on the coming solar waste crisis, along with rising blackouts from renewables, reinforces the inherent flaws in solar and other forms of renewable energy. Over-relying on solar panels, and underestimating the need for nuclear and natural gas, resulted in California's blackouts last summer. It's now clear that China made solar appear cheap with coal, subsidies, and forced labor. And in the U.S., we

pay one-quarter of solar's costs through taxes and often much more in subsidies at the state and local level.

And none of this even addresses the biggest threat facing solar power today, which are revelations that perhaps both key raw materials and the panels themselves are being made by forced labor in Xinjiang province in China.

The subsidies that China gave solar panel makers had a purpose beyond bankrupting solar companies in the U.S. and Europe. The subsidies also enticed solar panel makers to participate in the repression of the Uyghur Muslim population, including using tactics that the US and German governments have called "genocide."

Today, many companies, including Facebook, Google, and Microsoft, buy immense quantities of solar panels with no awareness of their impact. "I tried to bring up this issue [of solar waste] when I worked at Microsoft," said a former employee. "I was told 'That's not the problem we're trying to solve.'"

The *Guardian* reporter claimed, "it's valid to note that end-of-life solar panel recycling and disposal is an issue that we'll have to address smartly, but unlike climate change, it's not a big or urgent concern," but the *Harvard Business Review* study shows that this was never the case.

The idea that humankind should turn our gaze away from urgent problems like genocide, toxic waste, and land use impacts because they complicate longer-term concerns is precisely the kind of unsustainable thinking that allowed the world to become dependent on toxic solar genocide panels in the first place.

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Great research, Michael. The 'renewable energy market" dynamics have offered a great opportunity for unscrupulous salesmen to over-promise and under-deliver. That is the problem with an emotionally-appealing narrative that lacks a fact basis. The problem that only 5% of EV batteries being recycled is

Paul Taylor Jun 21 Liked by Michael Shellenberger

Manufacture, array land footprints and waste disposal life-cycle environmental impacts have been wholly ignored in the rush to "renewable" energy installations.

'Solar trash tsunami': How solar power is driving a looming environmental crisis

Remember when flatscreens yielded mountains of trashed CRT monitors? This could be worse.

Author of the article:
Tristin Hopper
Publishing date: June 23, 2021

The meteoric rise of solar power is set to spark a "tsunami" of unrecyclable trash as consumers trade out their obsolete solar panels for better ones, according to new research out of the University of Calgary.

"Put simply, we can expect a lot more solar panel waste within the next decade than we are prepared for," wrote a team led by Calgary-based supply chain researcher Serasu Duran in a pre-publication paper.

'Solar trash tsunami': How solar power is driving a looming environmental crisis

The study — which attempted to estimated the raw tonnage of solar panels set to hit landfills in coming years — warned that if the solar industry doesn't get a handle on its trash problem, "we may soon face the dark side of renewable energy."

While hydroelectricity remains by far Canada's largest source of renewable energy, solar capacity has skyrocketed in recent years. Driven in large part by government incentives, at the end of 2019 Canada had 3,310 MW of solar panels as compared to just 221 MW in 2010 — an increase of 1,500 per cent. If the sun is shining, all those panels technically have a capacity matching that of Ontario's Pickering Nuclear Generating Station.

However, solar panels have a short lifespan and are particularly ill-suited for recycling. They contain very few materials worth recovering, and as bulky sheets of glass, they're expensive to transport to a recycling facility.

"To the best of our knowledge, there is no consensus regarding an effective recycling technology for 90+ per cent glass panels. Nor there are any widespread established regulations," Duran told the National Post. "Anyone can pretty much take a tv to a municipal recycling center, not so much with a rooftop solar panel."

The International Renewable Energy Agency (IREA) was sounding the alarm on solar waste as early as 2016, warning that by 2050 the world would need to figure out a way to deal with up to 78 million tonnes of outdated solar infrastructure. For context, New York City — one of the most trash-producing cities on the entire planet — produces only 14 million tonnes of waste each year.

Nevertheless, Duran's team pegs the IREA number as a vast underestimate because it assumes that most of the world's existing solar panels will remain bolted to roofs for at least 30 years.

The more likely scenario, they estimate, is that millions of people can be expected to rip out their solar panels early in order to install replacements that are cheaper and more efficient. In that case, by 2030 the volume of solar waste could be up to 50 times higher than anticipated by IREA.

By 2035, the solar industry could be generating 2.5 tonnes of waste for every tonne of solar panel it installs — overwhelming municipalities and homeowners with disposal costs. "The economics of solar — so bright-

seeming from the vantage point of 2021 — would darken quickly as the industry sinks under the weight of its own trash," she and her co-authors wrote in a recent review of their research for the Harvard Business Review.

And Duran's team only studied the solar panels bolted to residential homes. Add in industrial solar farms and the replacement costs become "much, much larger."

The study compared the coming global tide of solar trash to the ongoing e-waste crisis. The sudden rise of quick-to-obsolescence computers, televisions and mobile phones has spawned literal mountains of difficult-to-recycle trash loaded with harmful chemicals, such as lead and cadmium. In the worst instances, shipping containers full of black market e-waste find their way to unregulated dumps in the developing world. Roughly 90 percent of electronic waste recycling in India is handled by the so-called unorganized sector, which is highly inefficient, puts workers' health and safety at risk, and is highly polluting.

"History appears to repeat itself with renewable energy installations, and very likely much sooner than we thought," reads the paper.

With each year bringing cheaper and more efficient solar technology, solar panels are plagued by many of the same lifespan issues as consumer electronics. In the same way that computers get progressively faster each year, solar panels get progressively better at generating electricity — roughly 0.5 per cent more efficient each year.

Rapid technological advancements also make it "nearly impossible to imagine a strong market for used solar panels," reads Duran's study.

Duran's team has noted that none of this is a reason to abandon solar technology, writing in Harvard Business Review that a trash crisis is still a relatively small problem compared to leaving a "damaged if not dying planet to future generations" as a result of unchecked fossil fuel use. The "tsunami" is also expected to stabilize once the rapid advances in solar technology slow down and it becomes less attractive to swap out still-functioning rooftop panels for a more modern alternative. "This will likely be a big but temporary problem," said Duran.

Nevertheless, the paper urges the green technology industry to "seriously anticipate this tsunami of solar panel waste" and consider new designs and end-of-life-cycle processing that could prevent the coming mountains of obsolete solar panels from simply being sunk into landfills.

The researchers also note that solar isn't the only aspect of the green economy with a looming and unaddressed waste problem, pointing to a coming tide of obsolete electric vehicle batteries and wind turbines, both of which similarly have no easy conduit to recycling.

Cost of Reclaiming Land Currently Used for Solar Panels Back to Farmland

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Introduction

Across North Carolina, many farmers have leased their farmland to *solar* developers *so that the land can be covered with solar panels* (Fig. 1). *Farmland is highly valued by the solar developer because it is usually flat which makes panel installation easier and less expensive*. Eventually the solar panels at these sites will deteriorate and fail requiring either the replacement or retirement of the *solar power* facility. Most solar panels manufactured have a projected lifespan of between 20 and 25 years. Several sites in North Carolina have already been operational for 8 to 10 years and are already approaching half their expected lifespan. In the coming years, as solar sites across North Carolina are retired or decommissioned, the cost of returning the land to crop production will have to be considered. This paper seeks to review some of these costs with the goal of preparing landowners for this eventuality.

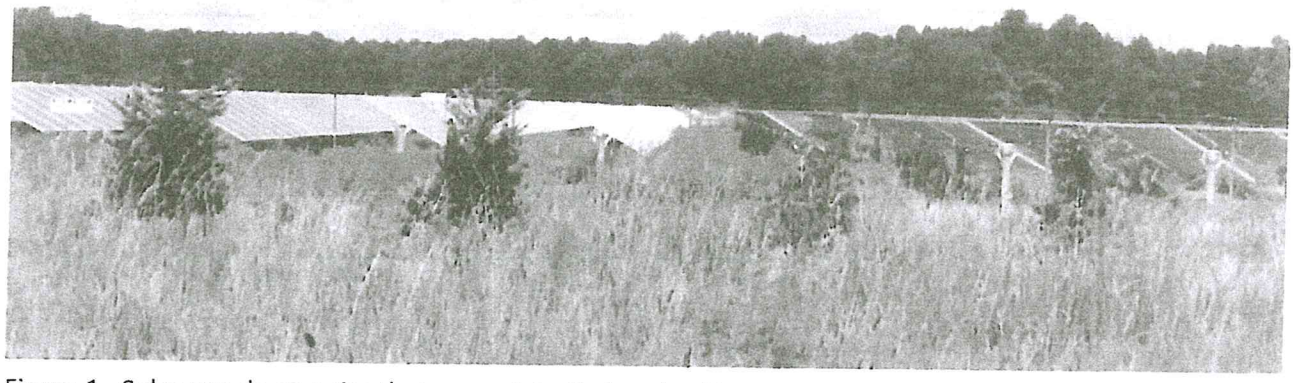

Figure 1. Solar panels on a site that was originally farmland in eastern North Carolina.

The Costs of Reclaiming Solar Facilities

There are **three main areas** that must be addressed in returning solar facilities back to productive agricultural activities. First, there is the cost of the removal of equipment including the solar panels, the support structure, wiring, concreate stands, inverters, poles, fencing, and buffer vegetation. The second step is mitigation of any heavy meal or herbicide residues. Finally, there are the costs of restoring the soil properties that are essential to supporting crop productivity. Each of these areas involves the expenditure of time and money in order to restore the site to farmland.

Cost of Removing Solar Equipment From a Site

Estimates *for* removing the solar panels and related equipment from a site vary widely. While the cost of removing and recycling solar photovoltaic modules (PV modules) has been studied and the overall costs of decommissioning a solar facility have been estimated based on construction costs,

these figures are a closely guarded secret within the solar industry. The reason for this is that most studies have shown that in 15 to 20 years as a number of solar facilities are retired the cost of recycling PV modules and decommissioning a site will be substantial (McDonald and Pearce, 2010). Since investors are less likely to invest in a technology that has the risk of substantial future costs the decommissioning costs are often hidden or ignored. *A good estimate of these decommissioning costs can be found in a report funded by the National Science Foundation entitled DECOMMISSINING "US" POWER PLANTS – Decisions, Costs, and Key Issues by Daniel Raimi of Resources for the Future.*

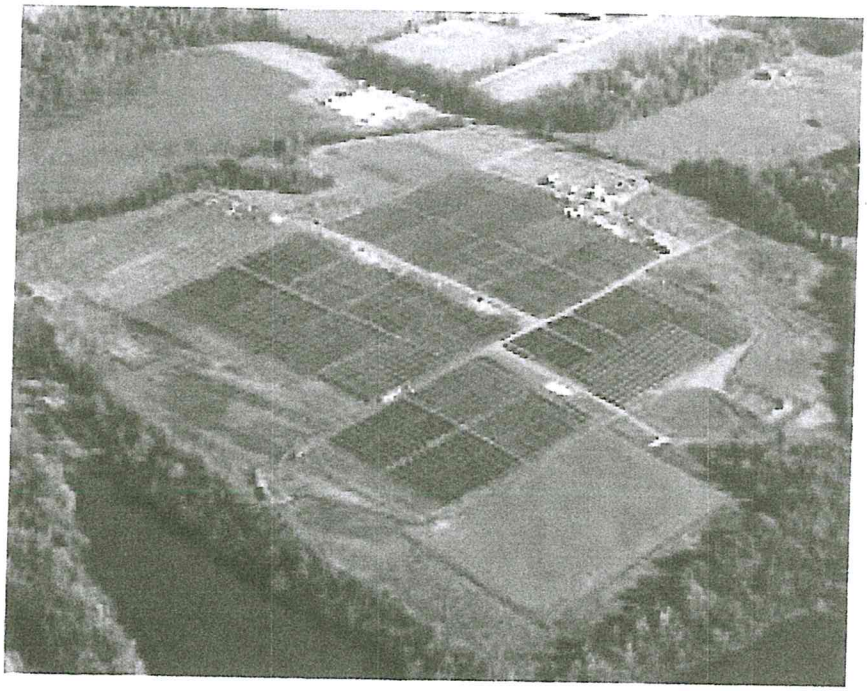

Figure 2. Thirty-acre solar facility in western North Carolina.

Cost of Mitigation of Heavy Metals or Herbicide Residues

The costs of mitigation of potential residues either from heavy metals such a zinc from the support structures, cadmium from decaying panels, or from the use of herbicides to sterilize the soil is largely unknown. This is due to the fact that it is not clear if any of these residues will be present at the time of decommissioning. Most engineers and construction specialists acknowledge that there is a potential for zinc contamination from the galvanized metal support structures that are placed through the landscape. However, the potential for zinc residues from these types of structures when used across a large landscape has not been studied. Residues from galvanized roofing in the immediate vicinity of the building structure have been shown to reach over 600 ppm

in as little as 10 years and costs of mitigation of toxic levels of zinc in the soil can exceed $1,500 an acre.

Similar observations can be made about cadmium. Environmental Protection Agency tests have shown that the Cadmium in Cadmium-Telluride panels is stable under severe conditions but whether these tests are suitable simulations of field conditions is still to be determined. Cadmium is highly toxic to plants and would require removing large amounts of soil to waste sites. This would be extremely expensive. Most likely any Cadmium contamination would render a site unusable for agricultural production.

Mitigation of strong herbicides used under the panels to sterilize the soil and prevent weed growth would be less costly to achieve. This could be done by deep tillage to mix the sterilized soil with soil deeper in the soil profile that had not been touched by the herbicide. The cost of deep tillage would average between $30 and $50 an acre.

Cost of Restoring Soil Properties for Profitable Crop Production

The costs associated with restoring soil properties suitable for profitable crop production are the easiest to estimate with some certainty. The **first issue** to be addressed would be the issue of soil compaction. If properly managed, the vegetation under the solar PV modules should help reduce the amount of soil compaction from frequent mowing between the panels. However, the use of heavy equipment to remove the panels and the support structures will result in a great deal of soil compaction despite the benefits of the ground cover. To reduce compaction, a grower would have to use a ripper or other deep tillage tool at a cost of $30 to $50 an acre. This would also have the benefit of mitigation of any herbicide residues (see above). However, despite the use of deep tillage, research has shown that it will take from 3 to 5 years of cropping to reach the full yield potential of a site once the soil has been compacted (Soane and Ouwerkerk, 1994). Yield losses of 20 to 40% were commonly found in situations where soil compaction has occurred due to trafficking with heavy equipment. These yield losses will need to be considered as part of the cost of restoring the site.

The **second issue** that must be addressed is soil pH and nutrient levels. Under natural conditions of weather and rainfall, soil pH on North Carolina soils declines over time. This is due to frequent rainfall events that leach calcium and magnesium from the soil profile. In the 20 to 25 years of *solar* operation, the soil under a solar facility will see declines in pH from 6.0 (the level associated with productive agricultural soils) to as low as 4.5 depending on rainfall and any nitrogen fertilizer that is applied to the grass under the solar panels. To restore the site, lime will need to be applied at rates ranging from 1 to 2.5 tons per acre. At a cost for lime and spreading of $65 a ton, this operation must be considered as essential to the restoration of a solar site. Depending on the soil and how the site has been maintained, other nutrients such as sulfur, magnesium, nitrogen, and

manganese may be lacking and will need to be applied prior to growing the first crop. This could add another $50 to $100 per acre in fertilizer costs.

Conclusions

The overall cost of returning a solar facility back to farmland must include a consideration of all three issues:

- *removal of equipment,*
- *mitigation of contamination, and*
- *restoring soil properties.*

This report focuses on the latter two, since the decommissioning costs are largely indeterminate at this time. A reasonable estimate of the per acre current costs of mitigation of contamination and restoring soil properties to farmland is shown below.

Reclamation Issue	Cost per acre
Mitigation of Zinc	$ 1,500
Mitigation of Herbicide and Compaction	$ 50
Application of Lime	$ 130
Fertilizer Cost	$ 100
Total Cost (excluding Equipment Decommissioning)	$ 1,780

To date, most of the attention at the end of a Solar Farm's life has focused on Equipment Removal and Decommissioning. This report adds another dimension to the "end-of-life equation," namely the activities and costs involved in returning the land to its original agricultural purpose. This latter function has here-to-fore been largely ignored.

Of course, if other contamination is found or other issues such as the need to install new ditches or drainage structures are discovered then these costs could be substantially higher or the site may no longer be suitable for agricultural production. Clearly, no grower could afford to decommission a site on his own. The cost of equipment removal alone would be greater than any potential gain from returning it to agricultural production. Therefore, it is essential that the solar operator be held responsible *for the entire process.* However, in some cases even when the cost of mitigation and restoration of soil properties is covered by the solar operator additional factors such as the loss of agricultural markets and suppliers of seed and fertilizer will make it difficult for the farmer to return the land to its original use.

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