From the desk of

Michael J. Fournier

March 31, 2018

Via Email

Hon. Kathleen H Burgess, Secretary to the NYS PSC Siting Board

> Re. Case No. 17-F-0602: Application of Franklin Solar, LLC for a Certificate of Environmental Compatibility and Public Need Pursuant to Article 10 of the Public Service Law for Construction of a Solar Electric Generating Facility Located in the Town of Malone, Franklin County.

Dear Hon. Burgess,

On behalf of Friends Against Rural Mismanagement (FARM), I would like to submit this comment as a filed document to the DMM, responding to the PIP filed by Franklin Solar (Geronimo Energy) for case no. 17-F-0602.

As mentioned in previous correspondence, I head Friends Against Rural Mismanagement (FARM), being a group of individuals who live either within the boundaries of the project area or within 5 miles of the Town of Malone.

In our Feb 22, 2018 posting to the DMM we reviewed NYS regulations for siting industrial-scale solar panel projects, pointing out that NYS Agriculture & Markets, NYSERDA, and the Franklin County legislature have all made it clear they would not support re-purposing prime agricultural farmland for solar energy. Every state and every developed nation we investigated say the same thing: hands off highly productive agricultural farmland. "The following general principles would ensure that solar development remains consistent with smart growth:

- *Rooftop development is preferable to ground-mounted development.*

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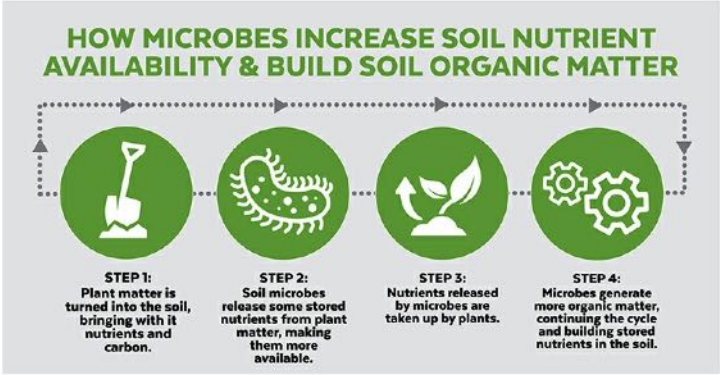
- *Brownfield sites, especially landfills, and other marginal sites, such as under-utilized industrial sites, have great potential for solar development, but considerable attention must be paid to the issue of whether a more active use of a given site, especially in a developed area, might be preferable.*
- *Utility-scale solar development on farmland and other undeveloped land should be further reviewed for long-term land use impacts and benefits before support is continued.*
- *Governments should take special care to enact and enforce regulations mitigating any negative impacts on surrounding land uses from solar developments during construction, use or decommissioning.*[1]

As I say, these guidelines comport with NYSERDA and NYS Ag & Markets recommendations. In short, Geronimo picked the wrong spot. Here is the science backing up this assertion.

A teaspoon of dirt

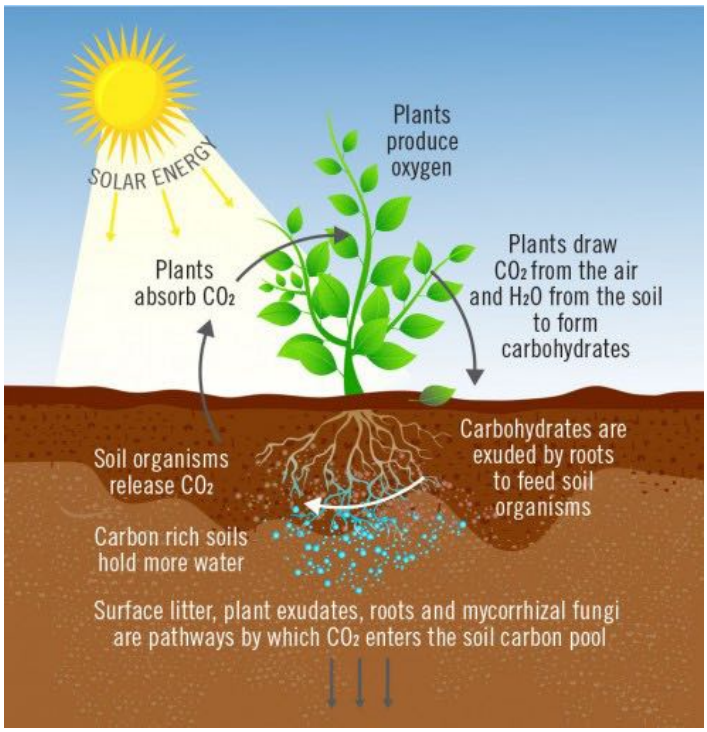
Think of soil as a massive living organism. A massive organism that is the womb and nursery of nearly all terrestrial life. A teaspoon of prime, arable soil, like the farmland being targeted by Geronimo, typically has anywhere from 100 million to 1 billion bacteria, 6 to 9 feet of fungal strands (were they placed end to end), several thousand flagellants and amoeba (Protozoa), 10 to 20 bacterial feeders and several fungal feeders (Nematodes), up to 100 insects (Arthropods), and possibly several earthworms. Ninety percent of these microbes are in the top ½ inch (15 mm). In healthy soil, like the cropland under discussion, the majority of the bacteria are aerobic — meaning, they require a good oxygen supply. This means that soil aeration is paramount.

One must understand that soil—earth—is the product of the combined efforts of all these microorganisms. If they are compromised, damaged, rendered sterile, or killed by toxins, they can't perform their task and soil fertility goes down the drain.



[1] Jedediah Drolet, "Assessment of Solar Facility Siting in New Jersey and Implications for Land Use and Smart Growth" (May 2011), p. 3.

Then there's the carbon cycle. Soil is a carbon sink "Soil is recognized as the largest single store of terrestrial organic carbon, containing more carbon than vegetation and the atmosphere combined."[2] The whole point of the clean, green, renewable energy initiative is to prevent carbon from being released into the atmosphere as CO_2. Ironically, ground-based solar panels, like the ones being proposed by Geronimo, undermine this process.



Photovoltaic Heat Island Effect (PVHI)

They do so by basically cooking the soil beneath the panels. "Cooking" is too strong a word, but it makes the point that photovoltaic panels do in fact raise the ambient temperature significantly. We should not be surprised by this. It's got a scientific name: the Photovoltaic Heat Island effect (PVHI). Similar to the Urban Heat Island (UHI) effect. Barron-Gafford and his colleagues demonstrated this in an open source study published two years ago in the peer-reviewed journal, Scientific Reports (October 2016): "The Photovoltaic Heat Island Effect: Larger Solar Power Plants Increase Local Temperatures."

> *We examined the PVHI empirically with experiments that spanned three biomes. We found temperatures over a PV plant were regularly 3 to 4° C warmer than wildlands at night, which is in direct contrast to other studies based on models that suggested that PV systems should decrease ambient temperatures.... As with the Urban Heat Island (UHI) effect, large PV power plants inducing landscape change that reduces albedo so that the modified landscape is darker and, therefore, less reflective. Lowering the terrestrial albedo from ~ 20% in natural deserts to ~ 5% over PV panels alters the energy balance of absorption, storage, and release of short and longwave radiation.* [3]

[2] Armstrong et al., "Windfarm and Solar Park Effects on Plant-Soil Carbon Cycling: Uncertain Impacts of Changes in Ground-Level Microclimate," Global Change Biology (2014), vol. 20, p. 1700.

[3] Barron-Gafford et al., "The Photovoltaic Heat Island Effect: Larger Solar Power Plants Increase Local Temperatures," Scientific Reports (October 13, 2016), p. 1.

We should…consider the spatial scale and geographic position of a PV installation when considering the presence and importance of the PVHI effect. Remote-sensing could be coupled with ground-based measurements to determine the lateral and vertical extent of the PVHI effect. We could then determine if the size of the PVHI effect reaches surrounding areas like wildlands and neighborhoods….The paucity of data on the physical effects of this important and growing land use and land cover change warrants more studies from representative ecosystems.

With the growing popularity of renewable energy production, the boundaries between residential areas and larger-scale PV installations are decreasing. In fact, closer proximity with residential areas is leading to increased calls for zoning and city planning codes for larger PV installations, and PVHI-based concerns over potential reductions in real estate value or health issues tied to Human Thermal Comfort (HTC).[4]

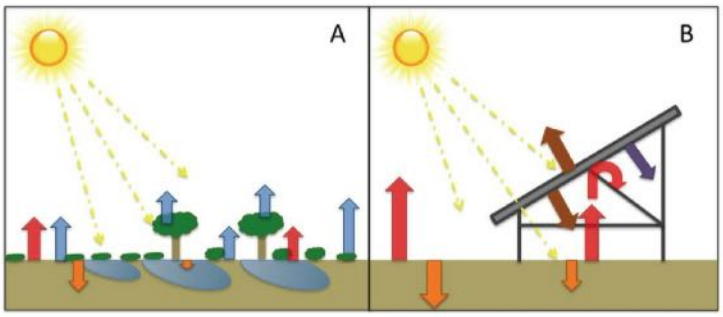
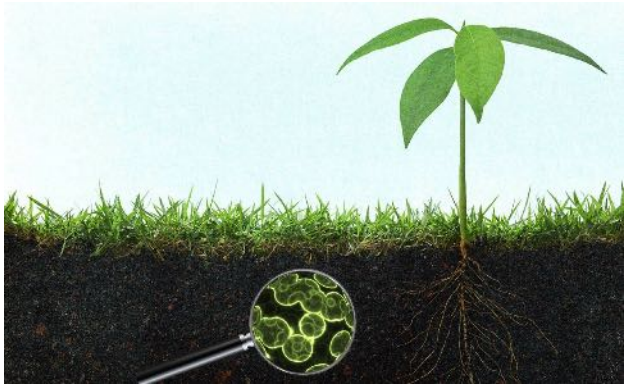


Figure 1. Illustration of midday energy exchange. Assuming equal rates of incoming energy from the sun, a transition from (**A**) a vegetated ecosystem to (**B**) a photovoltaic (PV) power plant installation will significantly alter the energy flux dynamics of the area. Within natural ecosystems, vegetation reduces heat capture and storage in soils (orange arrows), and infiltrated water and vegetation release heat-dissipating latent energy fluxes in the transition of water-to-water vapor to the atmosphere through evapotranspiration (blue arrows). These latent heat fluxes are dramatically reduced in typical PV installations, leading to greater sensible heat fluxes (red arrows). Energy re-radiation from PV panels (brown arrow) and energy transferred to electricity (purple arrow) are also shown.

In "Wind Farm and Solar Park Effects on Plant–Soil Carbon Cycling: Uncertain Impacts of Changes In Ground-level Microclimate," Armstrong et al. are concerned that this Photovoltaic Heat Island effect "could affect the fundamental plant-soil processes that govern carbon dynamics. We believe," they go on, "that understanding the possible effects of changes in ground-level microclimates on these phenomena [e.g., carbon dynamics] is crucial to reducing uncertainty of the true renewable energy carbon cost and to maximize beneficial effects."[5]



[4] Ibid., p. 4.

[5] Armstrong et al., p. 1699.

> *To make sure that this overwhelming opposition is silenced, the [solar energy] companies use well-funded associations to help fund so-called scientists that will tell you that the panels are safe, they will use sheep to control vegetation, that the panels don't impact drainage from the property, and a host of other myths that common sense will tell you can't be entirely true. What they don't say is that there is a lack of local, state or federal oversight on what types of panels are used, how much water is leaving these facilities, how the vegetation control is impacting the environment, etc, who and how these facilities will be decommissioned, and where these panels will go when they no longer are making money. Everyone has bought into this MUST BE A GOOD THING hype and forgotten common sense -- Prof. Ron Heiniger, Dept of Crop & Soil Sciences, North Carolina State Univ. (personal communication)*

North Carolina has the second largest installed solar capacity in America—after California, a far larger state with vast desert sunlight. Unlike the colossal solar plants in California, North Carolina's solar projects are all photovoltaic (PV) and, most important for our purposes, they are not in deserts but chiefly rural farmland. For the state government and a increasing number of communities, the solar bonanza is turning into a nightmare as the environmental and economic realities become apparent. New York, today, is where No. Carolina was a half dozen years ago in utility-scale solar development. There is much to learn from their experience.

The most outspoken critic of industrial solar in North Carolina is Dr. Ron Heiniger, Professor of Crop & Soil Sciences at North Carolina State University. In an email to FARM last October, Prof. Heiniger spoke with unusual candor:

I am . . . in favor of renewable energy, but this is not science: it is greed. . . . We are in a three-year study of several solar and wind installations here in North Carolina, tracking their use of herbicides, the frequency of mowing and other operations that impact the land, and the amount of water runoff leaving these facilities. We are in the process of publishing a paper on the impact of the solar panels on water leaving these installations. The current soil and water conservation calculations are biased because they do not consider the impact of the panels on channeling water. In fact, the current way of estimating the amount of water runoff only assumes the grass and does not consider the panels at all. This is an example of the lack of science that is going into the permitting and operation of these industrial facilities.[6]

Here in North Carolina we see overflow crowds at County Commissioner meetings opposed to solar facilities in their communities. We see these solar companies targeting minority neighborhoods who don't have the political clout or financial resources to fight back. In a recent meeting, I testified that the small black community will be adversely affected by erosion and flooding because the solar facility is cutting down 30 acres of trees to put in solar panels on the hill above the community. Given my data on the volume of water runoff, we were able to prove that the solar facility would cause flooding of several properties and erosion of the only road into the community. Instead of stopping this insanity, the commissioners asked if the community could put in a pond above their property![7]

I have papers that show that in 20 years the solar waste generated by these industrial plants will overwhelm the ability to recycle these panels resulting in a large amount of waste needing a home. I fear that home will be the fields and farms of these poor rural counties. I attach one of these papers for you to look at.[8]

Interestingly, there have been no comprehensive studies of the impact of solar industrial facilities on CO_2 emissions and ultimately on climate change. Because these facilities require matching electrical generation from coal or natural gas plants, and given the loss of trees and other vegetation plus the need for frequent mowing and other uses of carbon-based power, there is a growing realization that these facilities might actually lead to MORE CO_2 emissions rather than less. The reason for this is

[6] Heiniger to FARM, 10-9-17

[7] Ibid.

[8] Ibid.

that solar power generation in North Carolina is starting to exceed the ability of the utilities to generate backup power. Since the utilities HAVE to accept all solar placed on the grid, they are considering building new natural gas power plants. This has happened already in Germany, where their use of coal has INCREASED due to the excess solar [and wind] capacity.[9]

Heiniger explains the developers' business model:

All of this is caused by the fact that the tax breaks offered to the solar power industry are so lucrative. What happens in North Carolina is a single person with no experience in the power industry can create an energy company. Since the state will give interest-free loans, this person can pay others to help secure the permits and start to find landowners near electrical substations willing to lease their land (usually absentee land owners who don't even live in the community). Once they have the contracts with the landowners signed and the permits from the state and local entities secured, they hire a power company like Duke Energy or Dominion Power to put in the panels and make the connections to the grid. Then they sell the facility to a group of investors—companies like Amazon, Apple, Blue Cross/Blue Shield, Walmart—who will use this investment to lower their taxes and promote themselves as "GREEN." The original guy who did the dirty work gets a profit, the absentee landowner makes a nice payoff, these big companies get nice tax breaks and good publicity. Even the local county gets some more in property tax than they would from farmland (although we found that this is a mirage, since the loss of money from local sales taxes on seed, fertilizer, equipment, etc. that would have gone into producing a corn or soybean crop far exceeds the extra property tax).[10]

[9] Ibid.
[10] Ibid.

He closes with a sobering disclosure:

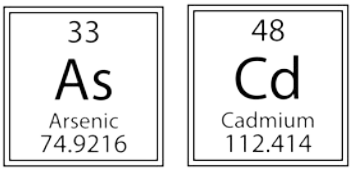
> *Personally, I started with just the observation that this was not a good use of prime farmland. The more I found out the more alarmed I became. I am sick of the whole rotten industry—the lies, the payoffs, the attempt to silence good people (who are only trying to protect their homes) through intimidation or threats. They have tried to have me fired from my job, the industry has insisted that I put all my research through multiple reviews while their scientists get to publish with minimal review from selected reviewers. What kind of science is this, anyway?. . .I fear for our county. I fear for good people—for those who have no voice (personal communication)*

Back to Geronimo's project here in Malone. In December 2015, Prof. Heiniger published an article in "Coastal Agro Business" (North Carolina) titled, "Solar Farming: Not a Good Use of Agricultural Land." The man doesn't mince his words. Under the heading, "Solar Farming Will Change the Future Productivity of the Land," he writes:

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 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.[11]

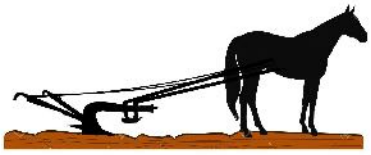
[11] Heiniger, "Solar Farming: Not a Good Use of Agricultural Land," Coastal Agro (North Carolina), Dec 11, 2015.

In another opinion piece he talks about zinc oxide from the galvanized steel platforms poisoning the soil. "Many solar panels are supported by galvanized steel platforms. That steel oxidizes over time and releases zinc into the soil, which can be toxic to plants at certain levels. That has been documented in cases where other types of galvanized steel structures were removed, and crops didn't grow or didn't fare well.... Significant soil remediation had to take place to return that land to production." Adding, "it is uncertain if the solar panel structures would have that same effect, but it is something that demands study."[12]



As panels "weather" and the surface deteriorates over the course of time, the North Carolina Cooperative Extension (NCCE) warns that the toxic heavy metals used in their manufacture can get into and poison the soil. The chief culprits are cadmium and arsenic. "Consider taking soil samples to monitor for potential soil contaminants," recommends NCCE.[13]

In sum, the Photovoltaic Heat Island (PVHI) effect combined with risk of soil poisoning from zinc oxide (from galvanized steel platforms) and even arsenic and cadmium compounds (from degraded PV panels) argue that building an industrial-scale PV array on top of prime agricultural land is not really a good idea, unless one is prepared to have such cropland go out of production forever. The costs of restoring the soil to its previous level of fertility, including microbial good health, would be prohibitive. This explains why state agencies in every state of the union recommend building on land which is otherwise useless: e.g., decommissioned landfills, brownfields, and acres of abandoned asphalt or concrete. Anything but rich, highly productive, fertile farmland.

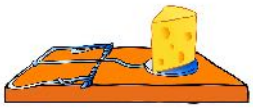


[12] Heiniger, "Big Solar Farms May Be Stressing Agricultural Ecosystem: North Carolina Crop Scientist, Ron Heiniger, Says Taking Cropland out of Production for Solar Has Long-Term Impacts on Overall Ecosystem," Carolina Journal (North Carolina), May 25, 2017.

[13] North Carolina Cooperative Extension, "Considerations for Transferring Agricultural Land to Solar Panel Energy Production," January 2018, p. 7 of attached PDF. Website: https://craven.ces.ncsu.edu/considerations-for-transferring-agricultural-land-to-solar-panel-energy-production/

Ecological Traps & Polarized Light Pollution (PLP)

The phenomenon of ecological traps has gained increasing attention among field biologists owing to the growing number of man-made habitats which, alas, fool wildlife into thinking that these artificial (anthropogenic) habitats or substrates are, to take one example, genuine bodies of water (lakes, rivers, ponds, streams, brooks) where they can safely land and feed and rest, in the case of birds or, in the case of many insect species, consummate reproduction. Dr. Bruce Robertson, a behavioral ecologist at Bard College and one of the principal researchers in the field, explains:



> "Ecological traps are scenarios in which rapid environmental change leads organisms to prefer to settle in poor-quality habitats. The concept stems from the idea that organisms that are actively selecting habitat must rely on environmental cues to help them identify high quality habitat. More specifically, traps are thought to occur when the attractiveness of a habitat increases relative to its value for survival and reproduction. The result is preference of falsely attractive habitat and a general avoidance of high-quality but less-attractive habitats. Such mismatches are not limited to habitat selection, but may occur in any behavioral context (e.g. predator avoidance, mate selection, navigation, foraging site selection, etc) and are more broadly called evolutionary traps."[14]

Robertson has co-authored numerous peer-reviewed journal articles on the subject. I have attached a half dozen or so herewith.

> Traps represent a fascinating yet poorly understood ecological and evolutionary phenomenon whose ultimate causes and ecological consequences remain unclear. Because traps are predicted to trigger rapid and potentially catastrophic population declines in affected populations, a deeper understanding of the mechanisms triggering traps is a high priority for conservation scientists as well. I investigate these fascinating cases empirically and theoretically. My theoretical work has developed conceptual models exposing mechanistic basis for traps, the human activities that trigger them, methods for better identifying them and strategies for preventing and eliminating traps of all kinds.[15]

Polarized Light Pollution (PLP) is one such trap. Robertson and fellow scientists have discovered that a host of man-made structures, including large arrays of photovoltaic (PV) panels, deceive birds and water-associated insects into thinking that what looks like "water" to their eye, isn't. The results can be catastrophic.

The key is water. Lakes, rivers, ponds, and streams refract and polarize sunlight along a single axis, thus serving as a ancient, "baked-in" navigational cue for numerous avian species and arthropods (insects). Geese, for instance, during fall and spring migration are well known for

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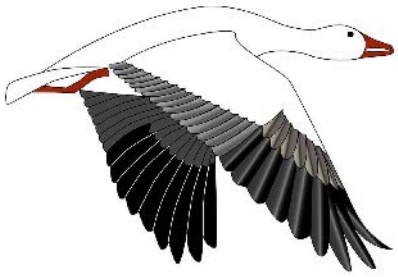
[14] Bruce Robertson, "Ecological and Evolutionary Traps," faculty website: https://brucerobertson.weebly.com/ecological-and-evolutionary-traps.html

[15] Ibid.

navigating by scoping out bodies of water which can accommodate their huge flocks, numbering at times in the tens of thousands.[16]

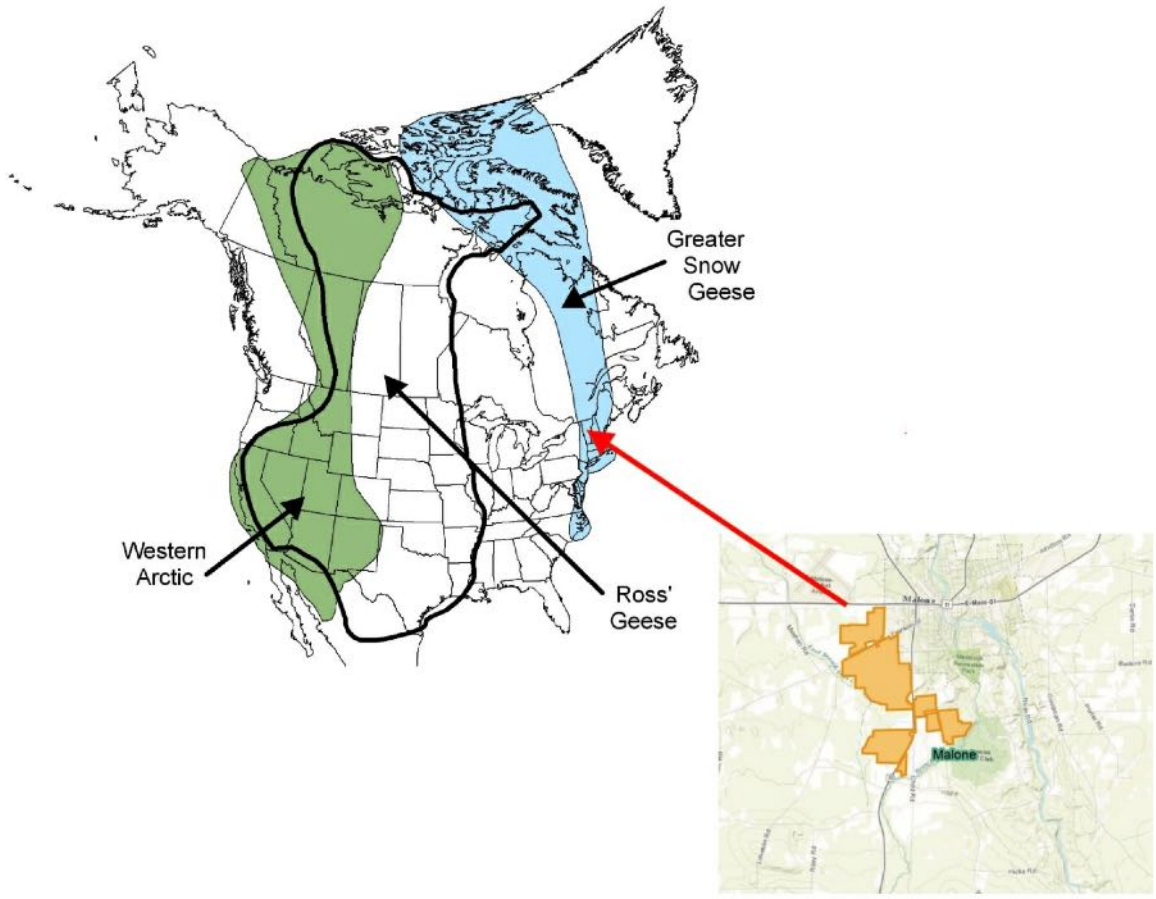
Malone is in the eastern snowgoose flyway. (This photo could have been taken in Malone. Ironically, this is what Geronimo's 900+ acres look like for a month or two in autumn and spring: thousands of snowgeese foraging on these very fields.)

The "snows" tarry in Malone for a month or more, grazing on corn stubble and other forage as they store up fat (energy) for the continued journey south or north. Birders come from afar to witness the magnificent spectacle and cacophony. Click here for a recording of the sound, courtesy of the Cornell Lab of Ornithology. Click here for a YouTube video of snowgeese landing on Rotary Lake in the Village of Malone. Rotary Lake is within 1 mile of the 900+ acres being targeted by Geronimo.

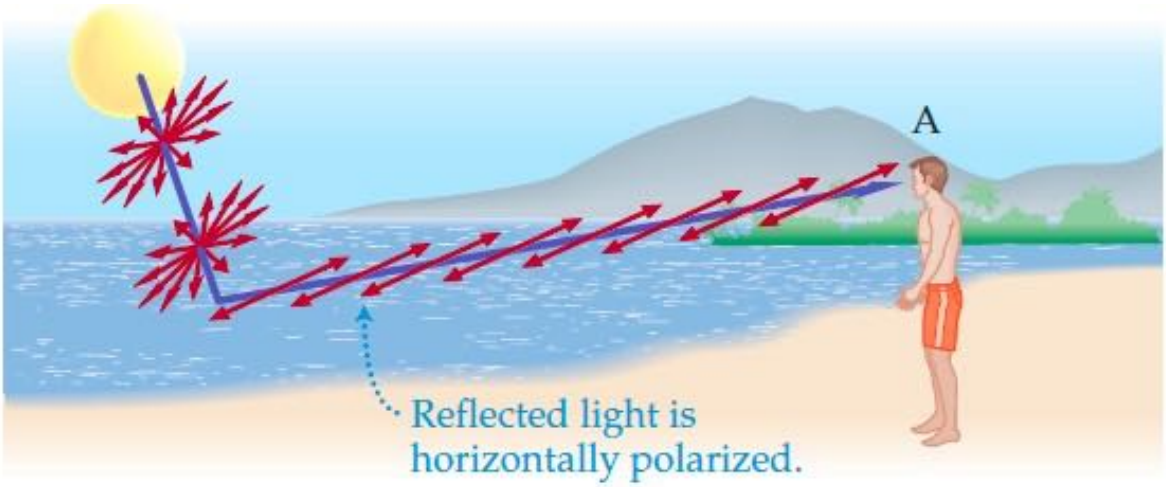


[16] Michael L. Wege & Dennis G. Raveling, "Factors Influencing the Timing, Distance, and Path of Migrations of Canada Geese," Wilson Bulletin, vol. 95, no. 2 (1983), p. 220.

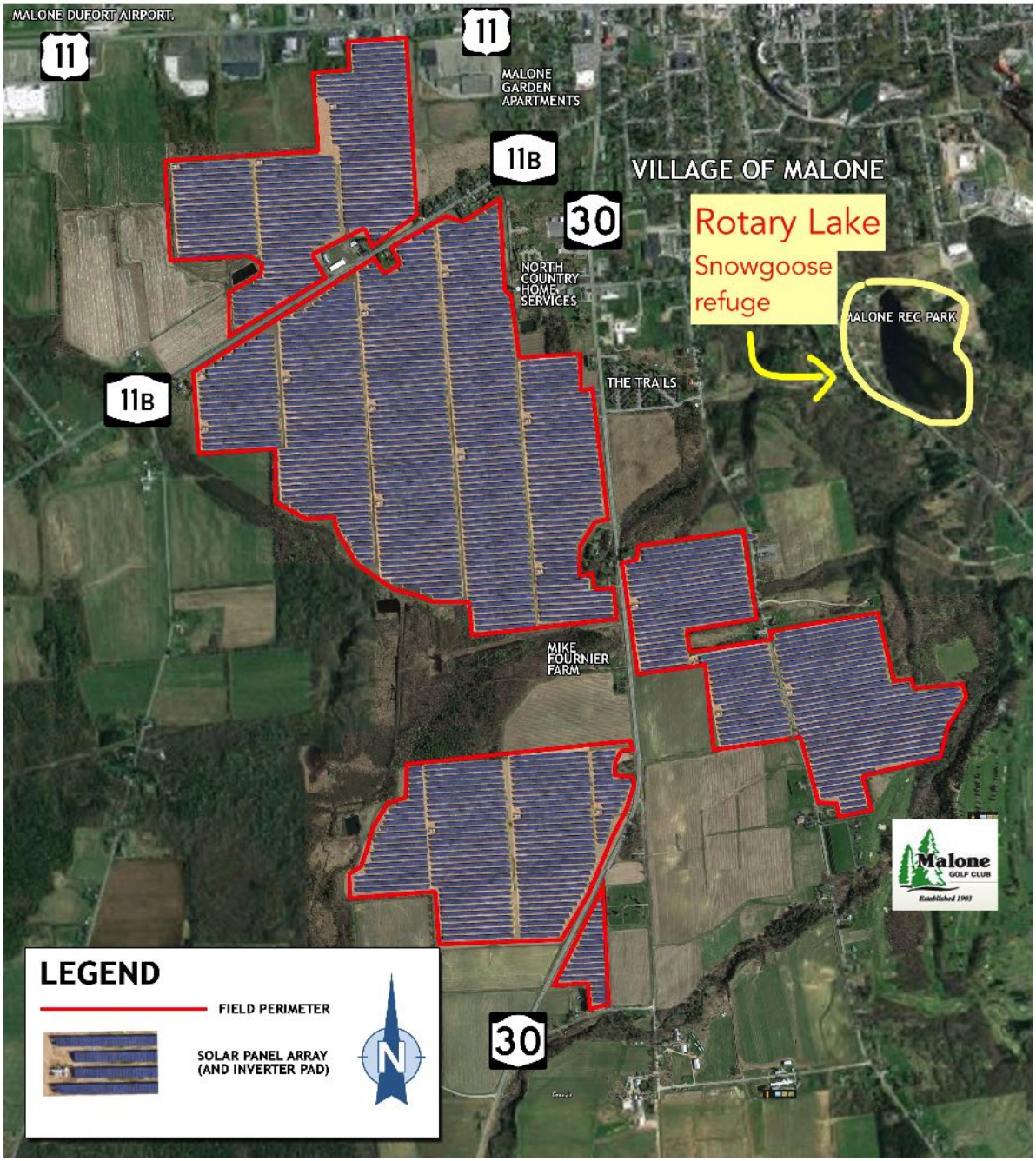
The problem is that Geronimo's solar project would create an ecological trap right, smack in this flyway.



If Professor Robertson and his colleagues are correct, 900+ acres of light-polarizing PV panels will look like a huge lake to the snows.



ARTIST CONCEPTUAL RENDERING - PROPOSED SOLAR FARM



Tragically, it appears that something analogous happened in Dec. 2016 when thousands of migrating snows landed in a snowstorm on the toxic waters of an abandoned, open-pit mine in Butte, Montana. Canada's "Global News" said it looked like "700 acres of white birds."[17]

[17] "Thousands of Snow Geese Killed after Snowstorm Forces Birds To Take Refuge in Old Mine," Global News (Canada), December 6, 2016.

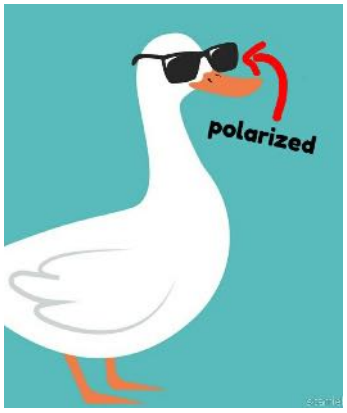
Witnesses said the pit looked like "700 acres of white birds"

Last week as many as 10,000 geese, likely forced to land amid a snowstorm, settled on the toxic waters of the Berkeley Pit in Butte.

Officials are still tallying the death toll, but they estimate that thousands of geese have died from ingesting the contaminated waters of the former open-pit copper mine....

It appears that a combination of circumstances forced the birds to land on the poisonous pool, which is roughly a mile long and half-mile wide. Snow Geese migration has been shifting later as temperatures rise, and when they reached Montana on November 28, their usual stopover site, Freezeout Lake, was mostly frozen over, as was another landing spot near Butte that the birds often use, the *Montana Standard* reported. When a winter storm hit, the birds landed on the only open water in the area: the Berkeley Pit.

A similar scenario occurred 21 years ago, when 342 Snow Geese that landed in the pit died, the metal salts dissolved in the waters turning their snow-white feathers a rusty color. Necropsies revealed that ingesting the metal-laden brew burned the birds' throats and caused kidney damage.[18]



The snows saw water and landed on it. But not so fast! What's revealing is that the Berkeley Pit "lake" has been around for decades, and yet snowgeese avoided it year after year, except when their customary lakes were frozen. In a snowstorm, the polarized light from the pit signaled that this, too, was a lake and would suffice in a pinch.

The fear is that snows in our flyway — many of them first-season juveniles — will get a similar cue from 900+ acres of light-polarizing PV panels, and come crashing down on them if Rotary Lake, Ballard Pond, or Chateaugay Lake are frozen. After all, the signal from both the Berkeley mine and Geronimo panels is the same: "This is water!" Evolutionarily, open water signals "safety" for waterbirds, except when that "water" is a hoax: an ecological trap.

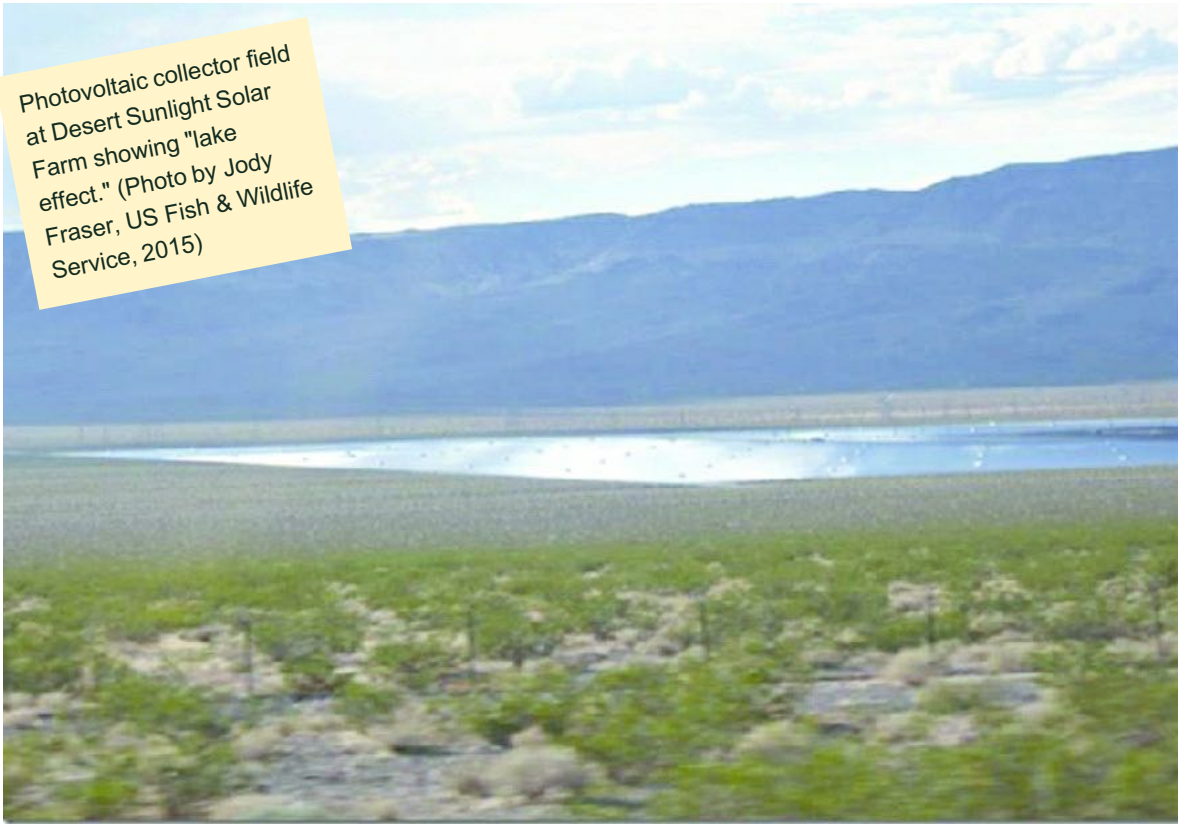
Behavioral ecologists are investigating this phenomenon in southern California, where giant PV panel solar arrays have been killing birds for years. No, I am not referring to the grisly "streamers" resulting from birds' feathers igniting as they fly through a concentrated beam of sunlight, as at the 377-megawatt Ivanpah plant in California's Mojave Desert, where mirrors focus solar beams on receivers atop power towers.[19]

Writing in ReWire in 2013, environmentalist Chris Clarke says, "Big desert solar installations have a

[18] Alisa Opar, Audubon Magazine, Dec 7, 2016.

[19] John Upton, "Solar Farms Threaten Birds: Certain avian species seem to crash into large solar power arrays or get burned by the concentrated rays," Scientific American, August 27, 2014.

problem: They seem to be imperiling water birds. A ReWire investigation has revealed that since mid-March, two large industrial solar plants in California's remote, arid desert may have killed or injured more than 20 birds associated with lakes or wetlands rather than the open desert surrounding the projects.... Water birds accounted for about half of at least 37 reported incidents of bird injury or mortality at the two projects"—one being the 550-megawatt PV Desert Sunlight Solar Farm (owned in part by NextEra), and the other the 250-megawatt "mirror" Genesis Solar Energy Project, also built by NextEra near Blythe CA.



Photovoltaic collector field at Desert Sunlight Solar Farm showing "lake effect." (Photo by Jody Fraser, US Fish & Wildlife Service, 2015)

With millions of years of evolutionary experience telling birds that broad expanses of glare and reflectivity on the ground mean "water," it's not hard to figure out why water birds might veer miles out of their way to head for solar facilities. Both photovoltaic solar panels, as used at Desert Sunlight, and mirrors like Genesis uses pose that reflective glare attractant.

It may be that photovoltaic arrays resemble lakes more closely than do mirrors, at least to the eyes of birds. Light reflecting off non-metallic surfaces tends to become polarized. Both water and the semiconducting surfaces of photovoltaic panels are non-metallic, which means the glare from one might well resemble the glare from the other if birds are sensitive to light polarization, which many are.[20]

[20] Chris Clarke, "Water Birds Turning up Dead at Solar Projects in the Desert," Re-Wire, July 17, 2013.

The California Energy Commission was so alarmed by these bird deaths at the (photovoltaic) Desert Sunlight Solar Farm, it insisted that NextEra explain them before getting approval for its (mirror) Genesis Solar Project near Blythe. Citing the work of Robertson and his colleagues, staff for the Commission wrote the following under the heading, Operational Impacts:

> Polarized light pollution, an impact associated with photovoltaic (PV) technology, is an environmental impact that may have adverse effects on birds. Polarized light occurs when ordinary white light becomes strongly aligned in a single, often-horizontal plane by reflection from artificial surfaces that alters the manner in which organisms would normally receive light. Light is naturally polarized by large bodies of water, but light is often artificially polarized by smooth, large, dark surfaces such as roads, large glass windows, buildings, and PV panels. Many taxa of birds, reptiles, fish, insects, and crustaceans utilize artificially polarized light; polarized light has been shown to play a role in habitat selection and may affect foraging behaviors, navigation, and orientation in birds (Horvath, et al., 2009; Horvath, et al., 2010).
>
> Studies at several PV solar power-generating facilities identified that solar modules, or panels, could cause an increase in polarized light pollution and therefore could pose a possible risk of collision for birds. At the Desert Sunlight Solar Farm project site, a PV installation of approximately 4,000 acres, over 50 birds have been documented to have collided with the panels. Of these, the majority consisted of waterbirds, species that would not typically be found foraging in desert habitat, and whose presence would not have been expected at the project site. A federally endangered species, the Yuma clapper rail, was among the recorded mortalities.[21]

I have attached a copy of NextEra's querulous, sloppy reply, dated August 1, 2013.[22]

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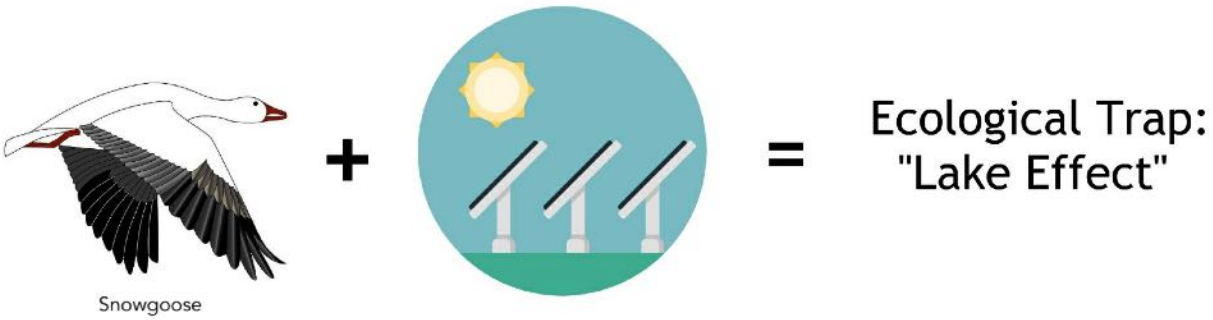
[21] Andrea Martine and Carol Watson, Blythe Solar Power Project (09-AFC-6C), Data Request Set No .2 (Nos. 20-25), California Energy Commission, Docketed 09-AFC-6C, TN 71556, July 12, 2013.

[22] NextEra Blythe Solar Energy Center, Blythe Solar Power Project (09-AFC-6C), Data Responses to Data Requests—Set 2, August 1, 2013.



In the 5 years since NextEra and the Calif. Energy Commission had this exchange, Robertson and others have done considerably more research on the subject, adding further evidence to their Polarized Light Pollution (PLP) "ecological trap" thesis. In personal correspondence to a member of FARM on March 15, 2018, Prof. Robertson notes that birds migrating over industrial PV arrays, especially in the desert SW, are "dying in large numbers" (his words) for reasons unclear. He's currently investigating whether PLP is the culprit.[23]

[23] Robertson to Martin, personal correspondence, March 15, 2018.

Polarized Light Pollution (PLP) ⟹ Polarization Captivity Effect

Polarized Light Pollution (PLP) can be disastrous for numerous Arthropods (insects), especially those that require water for part of their life cycle.

> Water is the primary naturally-occurring source of polarized light on earth and most species [of] insect[s] that reproduce in water bodies have evolved eyes capable of seeing polarized light as a way of accurately locating streams and ponds in which to lay their eggs. However, man-made objects like asphalt, glass buildings, automobiles, solar panels (anything smooth and dark-colored) are supernormal sources of polarized light that aquatic insects perceive as supernormally attractive ponds. They lay their eggs upon these objects where they fail to hatch, and adults frequently die from exhaustion as a result of their inability to leave the area.[24]

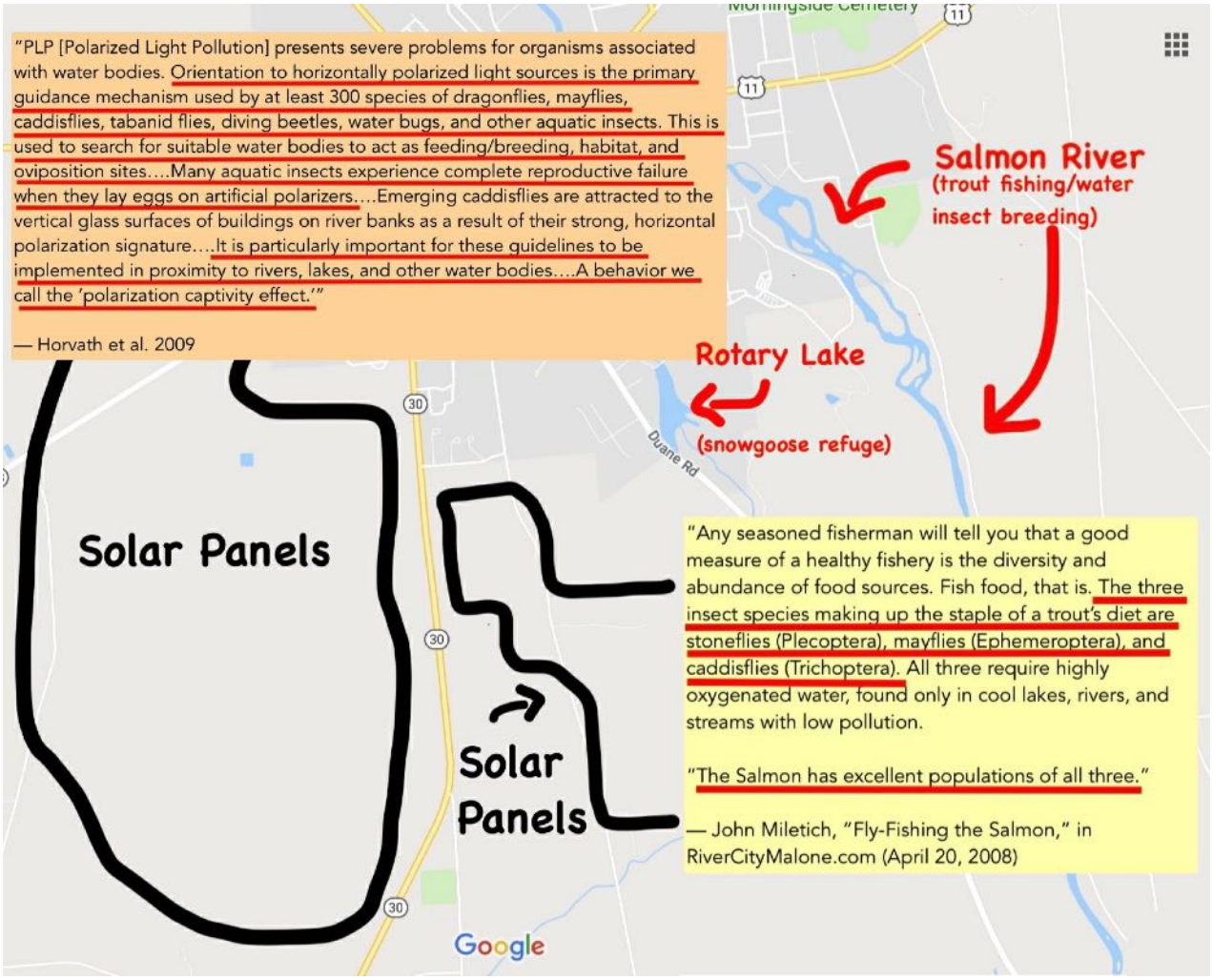
Robertson and his research group have explained the phenomenon in numerous articles, though it's perhaps best summarized in the abstract of an article they published in *Conservation Biology* in 2010 (red highlights are mine):

> Solar panels are a new source of polarized light pollution. Using imaging polarimetry, we measured the reflection–polarization characteristics of different solar panels and in multiple-choice experiments in the field we tested their attractiveness to mayflies, caddis flies, dolichopodids, and tabanids. At the Brewster angle, solar panels polarized reflected light almost completely (degree of polarization d ≈ 100%) and substantially exceeded typical polarization values for water (d ≈ 30–70%). Mayflies (Ephemeroptera), stoneflies (Trichoptera), dolichopodid dipterans, and tabanid flies (Tabanidae) were the most attracted to solar panels and exhibited oviposition behavior above solar panels more often than above surfaces with lower degrees of polarization (including water), but in general they avoided solar cells with nonpolarizing white borders and white grates. The highly and horizontally polarizing surfaces that had nonpolarizing, white cell borders were 10- to 26-fold less attractive to insects than the same panels without white partitions. Although solar panels can act as ecological traps, fragmenting their solar-active area does lessen their attractiveness to polarotactic insects. The design of solar panels and collectors and their placement relative to aquatic habitats will likely affect populations of aquatic insects

[24] Robertson, "Ecological and Evolutionary Traps," faculty website: https://brucerobertson.weebly.com/ecological-and-evolutionary-traps.html

that use polarized light as a behavioral cue.[25]

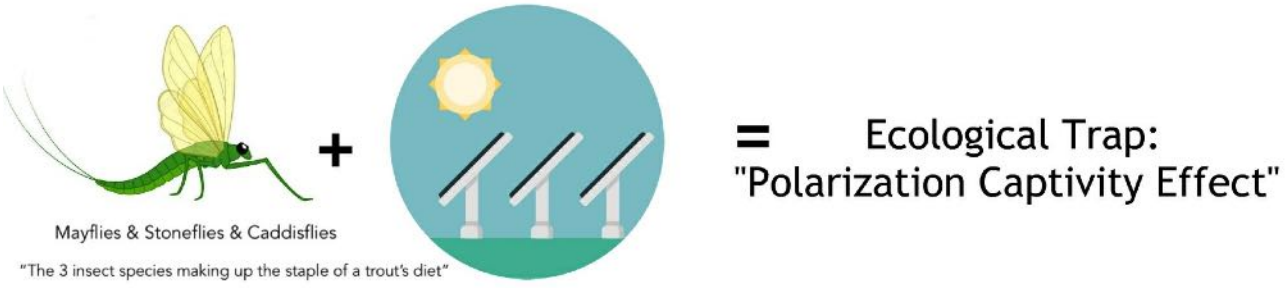
The map, below, graphically demonstrates the problem. Notice the proximity of the Salmon River to the Geronimo 900+ acres— the Salmon being one of the premier trout fishing rivers in the Adirondacks as described in one of our previous submissions to the DMM. (Click here for "Fly-Fishing the Salmon," in RiverCityMalone.com. The passage in the lower-right corner of this map is quoted from "Fly-Fishing the Salmon.")



Notice, as well, the proximity of Rotary Lake to the Geronimo project. (Click here for a YouTube video of thousands of snow geese landing in Rotary Lake.)

[25]Gabor Horvath, Miklos Blaho, Adam Egri, Gyorgy Kriska, Istvan Seres, and Bruce Robertson, " Reducing the Maladaptive Attractiveness of Solar Panels to Polarotactic Insects," Conservation Biology, vol. 24, no. 6 (2010), pp. 1644.

In sum, it's highly likely that Geronimo's PV panels will create an ecological trap for migrating snow geese and polarotactic ("drawn to polarized light") insects breeding in the Salmon River.



One can reasonably say that Geronimo chose the least suitable site in Franklin County for its solar project:

- ✓ *on some of the best agricultural soil in North America*
- ✓ *next to one of the finest trout-fishing (plus mayfly, stonefly, caddisfly-breeding) rivers in the Northeast*
- ✓ *in the bullseye of the spectacular snowgoose flyway and foraging habitat*
- ✓ *at the northern gateway of the tourist and sportsman-themed Adirondack Trail*

Sincerely,

Michael J. Fournier

Michael J. Fournier
President of FARM and party to case no. 17-F-0602

Calvin Luther Martin, PhD
Member of FARM and party to case no. 17-F-0602