Observations in Vegetable Fields With and Without Line-of-Sight Exposure to 5G within First Year of Introduction

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Abstract

This report presents a passive comparison of biodiversity and agricultural conditions between an area with direct exposure to beam-formed transmissions from fifth-generation mobile communications system (5G) antennas and an area without direct exposure, both temporally (2023 without transmissions versus 2024 with transmissions) and spatially (exposed expanse of fields versus fields sheltered by houses and *satoyama* groves in 2024). Though other factors existed that could impact biodiversity, clear differences could be identified in many species and crops in the comparisons made. These were particularly notable in voles, moderately large frogs, dragonflies and butterflies, with body sizes similar to one of the newly introduced 5G transmission wavelengths of 6.6 cm. Very small flying insects such as mosquitoes, flies and aphids also appeared to be impacted by the newly introduced 5G transmissions as did crop yield (pollination and other causes) and plant viability. Particularly affected crops included nightshades and cucurbits, especially in elevated locations, such as on trellises. There was a tendency to grow strongly, start bearing fruit and then wither before the fruit could mature. Some other crops such as legumes and sweet potatoes benefitted, seemingly from decreased numbers of rodent and insect pests. Since coherence of radiofrequency transmissions has been noted before as an important factor in the severity of effects from radiofrequency radiation, the *satoyama* environment, with its patchwork of groves, noted before for promoting biodiversity, may provide some protection by blocking direct exposure to beam-formed microwave transmissions in certain areas. The possibility should be investigated that this is a result of decreased coherence of the radiation that penetrates. Shielding of plants by dense foliage of other plants in the irradiated area appeared to improve crop yield and plant viability. The author recommends taking these observations into account when siting radiating infrastructure to preserve biodiversity and viability of small-scale mixed-crop gardening, which contributes important nutrition to the human diet.

Key words: coherence, dragonflies, fifth-generation mobile communications system (5G), frogs, radiofrequency radiation, *satoyama*, vegetable gardening, voles

1. Introduction

In anticipation of the inevitable arrival of the fifth-generation mobile communications system (5G) to rural northern Ibaraki Prefecture, and aware of potential impacts that have been reported by others and that I noted in earlier observations of bird and pollinator losses in a vegetable field in Shizuoka Prefecture after numerous smart meters were installed along its periphery during the winter of 2019-2020 (below, "my observations *elsewhere*"), I began keeping track of all birds and beneficial insects (pollinating and predatory) in my neighborhood from 2020 [see Table 1, appended]. I added mollusks as well in 2023 at the urging of Diana Kordas, who reported that their loss on the Greek island of Samos was especially notable. From NTT Docomo's service area map[1], I found that 5G service had not yet arrived as of the summer of 2023. In March 2024, I confirmed that 5G service had begun in our neighborhood. There was no notification to residents, so I do not know the precise timing, but I think it was most likely to have happened during the winter of 2023-2024.

Even prior to the introduction of 5G, strong 4G/4G+ radiation was present from several antennas in different directions, each located more than 1 km away, and possibly from newly installed small cell antennas closer by, and there may have been other sources I do not know about. Hourly observations day and night in 2021 prior to the small cell antenna deployment showed spikes in radiofrequency radiation (RFR) occurring at apparently random times, with no relationship to normal patterns of business or social behavior. (If there had been a pattern, it would have required continuous monitoring to decipher it.) The kind of equipment that would be necessary to get a complete professional picture of the RFR at this location would be prohibitively expensive to obtain, and Japan maintains secrecy regarding locations of antennas, putting the public at a disadvantage when studying their effects. I am relying on the information supplied by the industry regarding the services it has deployed (that 5G service of several frequencies started at some time in the latter half of 2023 or early 2024), my own measurements with equipment I could afford, and my visual observations.

Notice was given in 2022 to residents in our neighborhood when 800 MHz frequency was added to the mix of mobile communications transmissions in the spring (possibly from the newly installed small cell antennas). I observed no distinct impact from that (though two bird species I was monitoring did change their behavior that year, as noted below). In the past, we also received notifications of 4G and 4G+ deployment, with a warning that it might interfere with TV reception. By contrast, no notice was given of 5G deployment either in Naka City or the adjacent Hitachi Ohmiya City, where a friend was keeping track of its deployment. Perhaps this is because 5G is as controversial in

Japan as elsewhere, or perhaps there is a different explanation. Regardless, beginning in early spring 2024, I and other people living in the area began noticing major wide-ranging changes in the environment. I became suspicious, and then confirmed my suspicions that 5G service had commenced.

Below is a description of those changes. The situation is not as clear-cut as that on the Greek island of Samos that was reported by Kordas (2022)[2], who said there was almost no use of agricultural chemicals and no clear change in climate. Thus, below, attempts are also made to identify other possible causes of the observed changes. The present study also suffers from being reactive rather than proactive, meaning many dates are estimated and the focus is on phenomena that have caught my and others' attention. Of particular concern is that a number of the changes are similar to those reported by Kordas after the introduction and commercialization of 5G in Samos. These changes include missing mosquitoes, drastic declines in biodiversity, miniaturized swallowtail butterflies, plant deformities and signs of possible soil acidification.

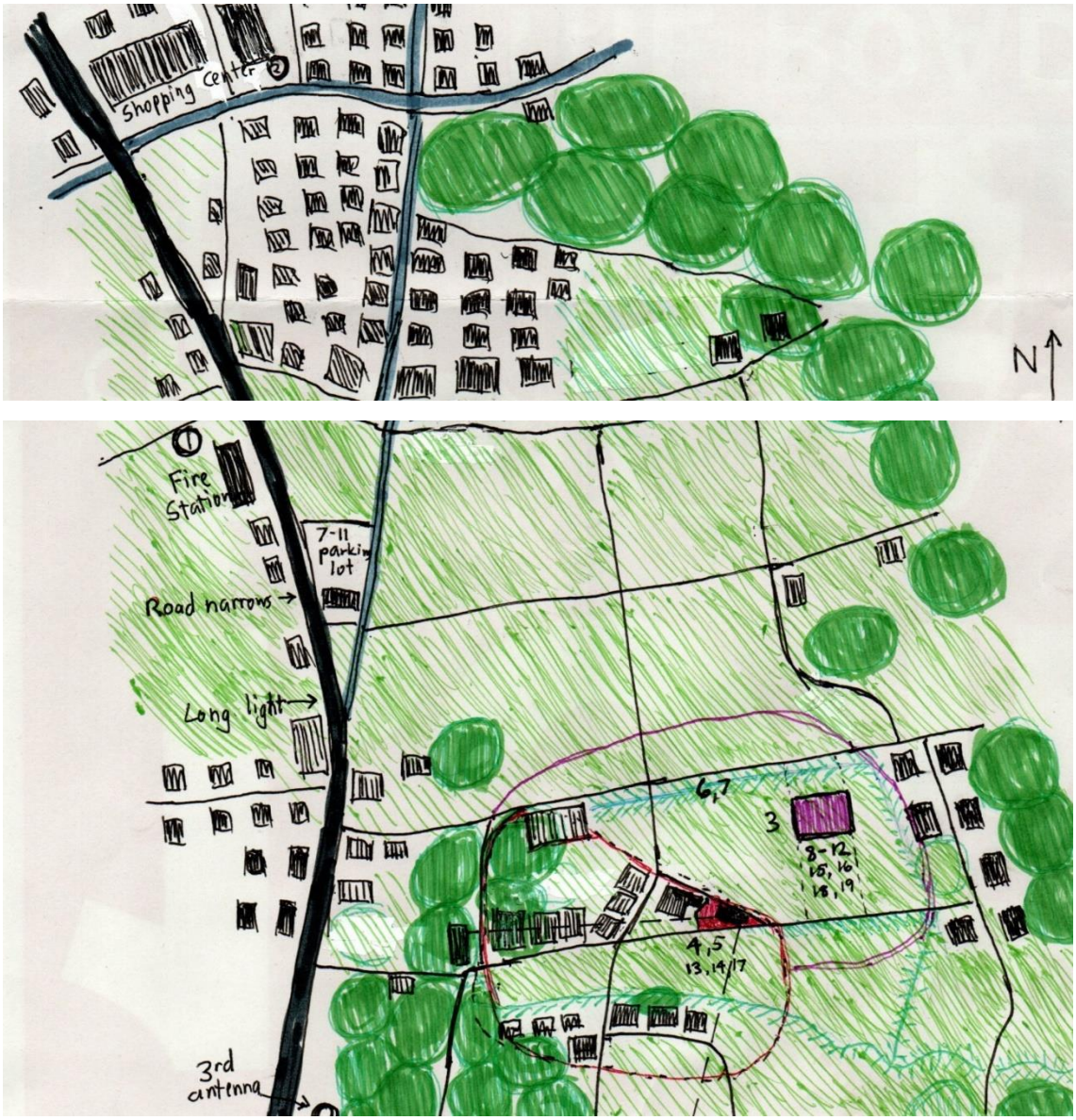
We farm as organically as possible, but the area covered in this study is a conventional farming area. The rice paddies are sprayed once a year in August with a neonicotinoid pesticide (according to materials obtained at the city office), and the use of herbicides around the edges of the paddies has been increasing as farmers cope with greater weed growth due to recent hotter summers and declining manpower as they age. Thus there have been other factors impacting biodiversity here at the same time. Still, I observed certain sharp differences between the exposed and unexposed fields despite these other identified factors being equal between them. Kordas has called for others to speak up when they see damage, and I believe it is important to document the changes that followed the introduction of 5G, for others' consideration.

2. Area of Observation

The area observed in this study, in a northern, mostly rural part of Naka City, Ibaraki, Japan, consisted of two vegetable fields, separated by roughly 50 meters, with 10-fold differing RFR field strengths arising from direct versus indirect exposure to 5G and other mobile communications radiation. The frequencies used for 5G here included 4.5 GHz, 3.7 GHz, 3.5 GHz, 3.4 GHz 2 GHz and 700 MHz, with no "mm wave" transmissions (28 GHz) nearby as of November 2024. The observations also encompassed rice fields, residential areas and *satoyama* groves (traditional Japanese natural/manmade mosaic landscape of farmlands, forests, ponds, grassland, etc.) surrounding the two fields. Combined, this spanned an area of roughly 200 by 200 m. Small streams cut across this flat elevated plain, occupying fairly deep gullies (3-5 m)

with dense weed growth in many places, providing cover.

Fig.1 Map of area of observation (Naka City, Ibaraki, Japan).



Notes: Antennas 1 and 2 by fire station and shopping center, respectively. Town center and train station located to north of map. "Unexposed" field red; "exposed" field purple. Rice paddies and other fields shaded light green; dark green circles indicated locations of *satoyama* groves; black squares indicate buildings, houses and related structures. "Unexposed" area circled in red, "exposed" area circled in purple, both observed closely on daily walks. National highway in black; local routes in gray; farm roads shown by thin lines. Steep banks and gullies with streams in light blue. Dashed black lines indicate field of view in Photo 4 of "unexposed" field. Numbers indicate the respective

locations of photos shown in this report.

Several small-cell antennas had been established in preparation for the 5G rollout in this neighborhood prior to 2023 along a particularly congested stretch of a national highway serving commuters. There are two such antennas visible from the "exposed" areas in this study, one behind a fire station across the highway [see Photo 1], which serves commuters stopped in frequent traffic jams or at a convenience store with a large parking lot. The beams that reach these users also extend across the fields. This appears to be the main source of 5G transmissions in the fields. The second antenna is next to a nearby shopping center [see Photo 2]. It serves the shopping center, a stretch of the highway and houses nearby. The two antennas are located at distances of roughly 650 and 700 m, respectively (based on Google maps) from one vegetable field my family and I tend, which has line-of-slight exposure to both antennas (below, "the exposed field" [see Photo 3]) on a slight rise amid a broad stretch of rice paddies. We also tend another, smaller field next to our house. This field is also adjacent to rice paddies but shielded from all visible antennas ("the unexposed field" [see Photo 4]) by houses and dense *satoyama* groves. NTT Docomo's service map indicates 5G service extending into this "unexposed" area as well, but I have not been able to confirm reception here (friend with 5G phone busy). A careful search with binoculars in May 2024 from an elevated second-story location overlooking the unexposed field turned up no visible small cell antennas. Whatever 5G radiation is present would not be line-of-sight. If coherence is the property of RFR most strongly linked to its biological effects as Panagopoulos et al. (2021)[3] assert, the difference between direct line-of-sight exposure and indirect, reflected exposures should be notable.

Photo 1 Small cell antenna behind fire station, across congested highway from exposed field. It is common in Japan for small cell antennas to be added to public infrastructure such as the public broadcast speakerphone mast shown here.

Photo 2 Small cell antenna serving local community near shopping mall. Both small cell antennas are to the northwest of the exposed field, with about 15 degrees of separation. This is barely visible over rooftops from the exposed field, and might not contribute as much radiation as the first antenna.

Photo 3 The "exposed" field in the middle of a broad expanse of rice paddies with line-of-sight exposure to the small cell antennas (not shown; 3G/4G cell mast in background over 1 km away).

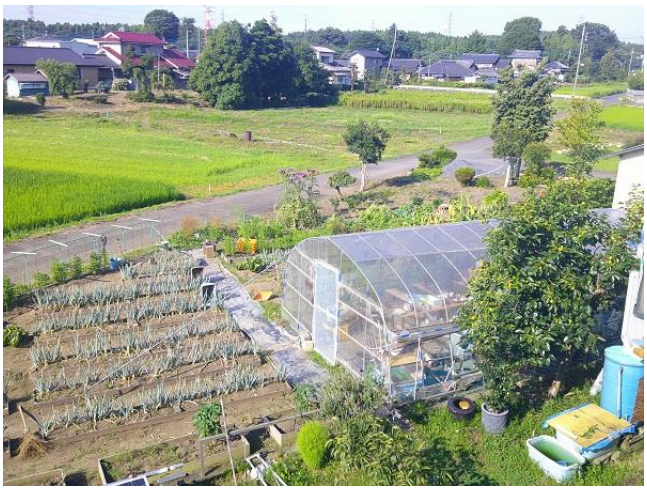


Photo 4 The "unexposed" area, from 2nd floor of author's house. A third small cell

antenna is located about 500 m away behind one of the *satoyama* groves. “Unexposed” field in foreground.

3. Methodology

This study relied on passive reporting of observations, with no attempts made to manipulate conditions (for example, by deliberately attempting to shield crops in the exposed field). Prior to this, I had taken copious RFR measurements using a Safe and Sound Pro II meter (Safe Living Technologies, Inc., 200 MHz~8GHz) in 2021, establishing average readings of 62.6 µW/m2 northeast of the house (exposed) and 5.73 µW/m2 southwest of the house (unexposed) and maximum peak readings of 1083 µW/m2 (exposed) and 88.3 µW/m2 (unexposed), averaged for about 100 readings, showing about a ten-fold difference in field strength. A brief measurement taken in May 2024 showed similar levels, but longer measurements, which might turn up much higher readings when 5G beams are reaching the exposed side of our house, have not been attempted yet. Field strength is said to be of secondary importance, with coherence playing a more significant role in provoking biological responses at non-thermal levels of exposure, as noted above. Most observations reported here are subjective impressions, but quantitative comparisons were also made when possible.

For nearly two decades, I have kept a yearly record of climate-related markers: bird migrations, flowers blooming, frog behavior, etc., for a different project, but only monitored 10 to 20 such markers at any time until recently [see Table 2]. Over the past decade, bird migrations have been disrupted to the extent that I have had to delete several species and try adding others. For example, I once monitored two swallow species in Shizuoka Prefecture, but one failed to return and the other began gathering elsewhere before spreading out to their nesting sites. My husband and I resettled in Ibaraki Prefecture in the autumn of 2020, where I added the dusky thrush, which was common and prominent in winter, and the greater reed warbler, which has a distinct voice and was nesting nearby in summer. The former failed to show up in October 2022 and I saw none until late December. They may have begun skulking in deep vegetation after their migration (in 2023 I listened for their calls instead). The latter stopped nesting nearby in 2022.

Table 2 Climate markers monitored for the past four years, in Naka City, Ibaraki Prefecture.

Marker	**2020**	**2021**	**2022**	**2023**	**2024**
First plum blossoms (nearby)		1/27	1/18	1/2	1/2*/18
Deepest frost		1/7 (-7)	2/5 (-7)	1/26(-7)	1/15(-5)
Spring! (that sensation)		2/9	2/15	2/11	1/20
Skylark song		2/12	2/16	2/7* /11	1/21*2/19
First daffodil (ours)		3/5	3/15	3/6	3/9
Grape hyacinth (ours)		3/17	3/10	3/11	3/16
Swans depart (migratory)		3/22	3/16	4/9**	3/17
First frog song			3/21	3/1*/16	3/29
Swallows arrive (migratory)		4/1?	3/20	3/28	3/28
Reed warbler song (migratory)		4/9	5/30	5/30	5/16
Sakura full bloom (nearby)			4/6	3/25	4/9
Last dusky thrush			Late Apr.	5/3	5/1
Last frost (very light)		4/25	4/16	4/10	4/10
“Frogpoles” (tailed froglets)		6/17	6/18	6/9	6/7
Kanto easterlies				8/6	8/8
Kanto westerlies resume				9/15	9/13
Red spider lilies bloom (ours)		9/14	9/13	9/28	9/29
Last cisticola song(resident bird)		Late Sep.	9/12	Ear.Sep.	9/13
First snow on Mt. Fuji	9/28	9/26	9/30	10/5	11/6
First dusky thrush (migratory)		10/25	12/25	10/16	11/13*
Kogarashi (winter NW wind)	11/4	10/25	10/28	11/13	11/7
Swans arrive (migratory)	10/27	11/17	10/27	11/5	10/17*
Last frog (from 2022, frog song)		11/20	11/21	11/24	
First frost, light	11/10	11/24	12/4	11/14	11/19
First frost, hard (-5)	12/12	12/15	12/15	12/18	

*Just one, tentative, false start. **Remnants: historical departure of swans 2/14-3/14 from Miyagi north of Ibaraki (2009-2012)[4].

Notes: 1) In the “Kanto easterlies,” storms have tracked from east to west across the Kanto area for a few weeks each summer in recent years. I first noticed the phenomenon in 2020 or 2019. The trend has persisted. I use the location and strength of a summertime high pressure area in the north Pacific east of Japan that causes dry weather in our area, plus observations of storm movements in our area and on weather charts as my main

means of identifying it (i.e., no official sources yet). 2) In 2021, reed warblers nested nearby, but stopped in 2022, only visiting briefly on occasion after that. (Shrikes can still be observed imitating them, however.) 3) One dusky thrush heard on 13 November 2024, but departed after that and as of 28 November, no others heard or seen. 4) Two or three swans arrived on 17 October 2024—very early—and then several more arrived on 10 November, but the numbers appear to be drastically reduced from 2023 as of 29 November 2024.

As noted above, I also began keeping a record of all bird and many insect species from 2020 in our area, having seen them disappear in my observations *elsewhere*. In this record, I noted their prevalence, whether they were increasing or decreasing and seasons present. I failed, however, to anticipate just how broad the range of impacts would be after 5G was introduced. That left me scrambling after the fact. I began collecting photographic evidence where possible.

4. Observations

In spring to early summer 2024, voles had gone missing from the exposed field, but were aggressively invading the unexposed field. One frog species observed previously only in the exposed field failed to emerge from hibernation; another species disappeared from the paddies around the exposed field, but throve in an unexposed paddy. Dragonflies emerged as normal, then disappeared. An aphid species I had not been monitoring, but was familiar with, appeared miniaturized out of season. The blueberry bushes burgeoned, but the currant bushes all died. Tiger mosquitoes were absent from both fields until July 18, when they showed up in small numbers among the blueberries in the exposed field. The blueberry bushes were densely foliated and heavy with fruit, and seemed to provide good shielding from direct irradiation. Blessed by a second year of prolonged heat, rice plants and other vegetation grew up very tall and dense, and after plant growth began providing plentiful shelter, I noticed considerable recovery of the two most common dragonfly species in the paddies and *satoyama* groves.

a) Mammals

Each year prior to 2024, the first planting of peanut seedlings in the exposed field would attract **Japanese grass voles** (*Microtus montebelli*) that would eat up all of the seedlings. Then snakes would arrive and deal with the voles. The second planting would produce a small crop, with some further losses to voles. In 2024, not a single seedling was disturbed. Artichokes burgeoned undisturbed, whereas before, it was normal to see

a plant or two die from having their roots devoured.

In 2023, Japan experienced a prolonged hot summer. The temperatures were not record-breaking (38ºC recorded on 15 August 1996 in Mito City nearby, not exceeding 37ºC since, and in fact, 2023 was slightly hotter than 2024[5]), but heat that in the past would have lasted about two weeks persisted for about two months. The result was a second, smaller rice crop after the first harvest from the paddies, but it was just cut down and left in the field. This would have left lots of food over winter for the voles, so we anticipated severe damage. One might think it possible that something else killed off the voles, except that they were numerous and aggressive in the unexposed field in the spring and summer of 2024 [see Photo 5]. On July 14, they reemerged among the blueberries in the exposed field, but didn't appear to have persisted there. I noticed active tunneling there for about two weeks in July.

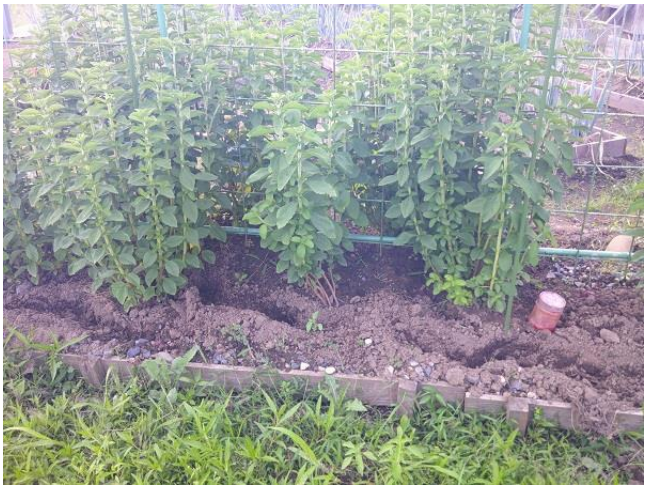


Photo 5 Vole damage in stevia roots, unexposed field (June 2024). My response has been to dig up the tunnels and apply habanero sauce around the roots.

All of the legumes produced abundant foliage, obscuring everything below them. Nevertheless, the voles never reinvaded. In September, when we harvested the peanuts, I could find no tunnels and only minimal damage suggesting failed attempts to reinvade. Walking along the banks of the exposed paddies, my general impression was of much less vole activity in 2024 than in 2023. Their tunnels were more notable in the sheltered hollows. They seemed to make forays into exposed areas and then retreat.

As of November, voles were still active around our house and in the unexposed field, where they devoured all unprotected artichokes that had sprouted from fallen seeds and even some of the peanuts I had grown in planters.

Weasels (*Mustela*), which prey on the voles, have been uncommon but present each

year, and were confirmed in October 2024. **Moles** reacted similarly to voles, but were never very numerous to begin with.

b) Birds

There was less notable change in birds than I anticipated. **Crows (*Corvus corone*)**, **house sparrows (*Passer montanus*)**, **oriental greenfinches (*Carduelis sinica*)**, **Japanese white-eyes (*Zosterops japonica*)** and **bush warblers (*Cettia diphone*)** appeared somewhat, but not catastrophically affected. A few other bird species that were uncommon to begin with, such as migratory and winter-time waders and most raptors, never showed up. I saw **kestrels (*Falco tinnunculus*)** in early spring, and one again in late November. The lone **kite (*Milvus migrans*)** that had long resided in our neighborhood remained. My brother-in-law says there used to be a colony of them patrolling the fields, but they had disappeared several years previously. (Because in my observations *elsewhere*, all birds, starting with the larger ones, left the affected areas, I suspect smart electric meters as the cause.)

The sparrows, most notably, emerged from the dense vegetation in deep gullies, to which they had suddenly retreated in 2019 according to my brother-in-law who was living here then, for reasons that can only be speculated at (again, I suspect smart meters). In March 2024, they all suddenly emerged, forming a huge flock of around 100 birds, moving from tree to tree in a noisy group, sometimes wheeling around over the exposed rice paddies along with similar flocks of **oriental greenfinches** (*Chloris sinica*). These flocks would barely alight and then take off again. My brother-in-law commented that it appeared like they were having trouble finding food.

Subsequently and surprisingly, the sparrows returned to their pre-2019 behavior, even tending a nest high up on a power pole, but that nest appeared to have been abandoned after about a week, and gradually the numbers of sparrows diminished. For a while in late June they were aggressively raiding our blueberries in the exposed field, but these raids by sparrows and other birds decreased soon after that and finally ceased for no clear reason. A few sparrows or other small birds such as bulbuls would show up, then quickly leave. In late summer, small numbers of sparrows could be found still living in the unexposed area around houses In October, they regrouped into a large flock again and foraged in weedy gullies once more.

The greenfinches disappeared in late March, but that seems to be normal for that species in this area. Small numbers returned in November.

Each year until 2023, I observed **Japanese white-eyes** in the *satoyama* groves near our house, but not in 2024. I observed one in February in the forest at Lake Kotokunuma

about 2 km away, noted for swans in winter, so I marked it as present. (In February, that lake had a good range of waterfowl. It is set back in forested hills and at least at water level has no direct view of communications infrastructure.) I oberved large noisy flocks of white-eyes in densely forested mountains north of us in the spring of 2024.

At a shrine atop a forested hill about 1 km west of our house, the priest remarked in early spring that the **bush warblers** were missing. These could still be heard, though, in low-lying *satoyama* groves that were not too close to 5G antennas, including at the priest's main shrine. Radiation could reach the hilltop from one of the small cell antennas.

The crows were visibly affected by the prolonged intense heat in the summer of 2023. Before that, a lively family had been raiding the unexposed field and venturing out into the exposed areas. In the fall, however, only one lonely crow remained. In 2024, this crow appeared to be continuing its attempts to attract a new mate to its territory. It remained there all alone throughout the summer and autumn of 2024. A group of three crows from another unexposed area, that appear to be siblings, visited the exposed field to forage. Their visits seemed to become less frequent over time despite abundant blueberries, watermelons and other fruit for them to raid.

c) Reptiles

I had seen three kinds of snakes in the past, two of which, the **Japanese striped snake** (*Elaphe quadrivirgata*) and **tiger keelback** (*Rhabdophis tigrinus*), I saw frequently in summer in 2021-2023. In summer 2024, I only saw only a few frog-eating *Rhabdophis*. The absence of voles probably accounted for the loss of the rodent-eating *Elaphe*. I did see one individual *Elaphe* in September in an exposed paddy, at harvest time. The one lizard species I saw in small numbers in past years in densely overgrown gullies, the **Japanese grass lizard** (*Takydromus tachydromoides*), was still present in spring 2024 and confirmed again in November.

d) Amphibians

In the past I commonly saw three frog species in the neighborhood, *Rana japonica* (**brown frog**), *Glandirana rugosa* (**wrinkled frog**) and *Hyla japonica* (**green tree frog**). Large adult brown frogs were easy to find among the blueberry bushes in the exposed field in 2023, but in 2024 I saw none at all despite spending time each day there. The heat in the summer of 2023 had favored all frog species. The wrinkled frogs grew large and numerous and the tree frogs were so abundant in June and July 2023 that it took real effort to avoid stepping on them in the unexposed field. The tree frogs were actively calling until November 24 in 2023. March 2024 was unusually cold, so it was not too

surprising for the frogs to emerge late, but they were a full month later than in 2023, and when the swallows arrived but the frogs were not yet singing, I became concerned. Still, two of the three species did eventually emerge. The wrinkled frogs seemed to be much less numerous. They used to make a din every night, but this year individual voices could be counted on most nights and large individuals were rarely seen. I did see large adult wrinkled frogs in one of the deep gullies cutting across the exposed area, where the radiation did not reach directly [see Photo 6]. Their young were present in August in one exposed paddy adjacent to the unexposed area, but it is hard to say if they spawned there or migrated in.

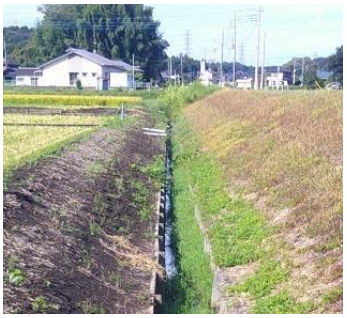


Photo 6 Weedy gully with stream cutting across exposed area. Effluent from the conventional paddies flows directly into it (summer 2023).

Setting traps in the exposed and unexposed areas would be one way to obtain a quantitative comparison. A kind of "trap" happened to occur in the form of cars from sparse local traffic running over wrinkled frogs on the roads among the paddies at night. Walking along these roads each day in 2023, I would find dead frogs at a rate of about two a week in summer. They were most prominent in the exposed area, where they throve, including one particular paddy in which large adult frogs were visible every day. In 2024, there were no frogs living in that paddy. I found squashed frogs at a rate of about two a week in July-September in the unexposed area, but none at all in the exposed area until after the rice harvest in early September. For a few weeks after that I found their bodies adjacent to areas with remaining cover in both areas at a rate of about one a week, but none in October or November.

The tree frogs, the smallest species, fared best of the three. They inhabited both exposed and unexposed fields, but I note it took less effort in 2024 to avoid stepping on them than in 2023.

e) Mollusks

Diana Kordas in a private communication in 2023 identified mollusks as particularly vulnerable to 5G radiation, so I began taking notes on them that summer. Most of the aquatic mollusks that I could identify and my husband recalled from childhood in the area were long gone, and presumed to have been the victims of pesticides. I discovered them, however, living in the streamlets in the deep gullies [see Photo 7]. These gullies receive runoff directly from the rice paddies and herbicides applied at the edges of fields and roads [see Photo 6 above], and that has been going on for decades. Thus, chemicals appear not to have played the decisive role in the loss of mollusks from the rice paddies. Land snails and slugs are still present in small numbers in unexposed areas, but over the previous four years their numbers have clearly decreased. Notably, none of my strawberries in either field were attacked by slugs in either 2023 or 2024 but had been attacked in the unexposed field in 2021 and 2022. Each year for the past two years, I have seen aquatic snails enter a rice paddy (one exposed, one unexposed) via the irrigation ditches, but not persist there. I speculate that they were sensitive to RFR from 4G and earlier systems as well, because they seem to be faring okay in streams at the bottom of gullies where they are sheltered from that.

Photo 7 Snails (mostly *Semisulcospira kurodai*) in the stream shown in Photo 6 (summer 2023, still present in November 2024).

f) Insects

Three species of **hornet** had been present in previous years, two of them making their appearance in spring in 2023. None were observed in 2024 until after the annual pesticide spraying in August, after which we saw one individual of a fourth species that appeared to be seeking a place to build a nest in our house. **Paper wasps** established a

nest in the unexposed greenhouse in June 2024 and remained present in the unexposed field after that was removed. No paper wasps have attempted to nest in the exposed greenhouse in all four years of observation.

There were no **tiger mosquitoes**, which bite during the day, in either field until mid-July 2024, when they showed up among the densely foliated blueberries in the exposed field. In years past, they had been present by early June, and they were present in May 2024 in a garden next to a forest in our municipality, so weather and climate factors do not account for their loss. I was able to spend hours in either field with my ankles exposed and not notice any mosquitoes until 18 July in 2024. After that, I would be bitten in the unexposed field and in the blueberry patch in the exposed field, but not elsewhere in the exposed field. In July, mosquito egg rafts were present atop stagnant water, but no larvae appeared to hatch. A home invading, night-biting species was present from May in small numbers, and small numbers of their larvae could be seen in rain barrels in unexposed areas by the house. The last frost was on April 10 in 2024, having gradually become earlier during the past decade. Mosquitoes typically show up a few weeks after that.

In the summer of 2023, several species of **flies** in our dining room were such a nuisance that we were constantly trying to devise some way to control them. This is normal in a farming area. A friend living in an urban area with much higher RFR levels and earlier introduction of 5G was very disturbed by our flies. In the summer of 2024, we had very few flies in the house. The single fly paper strip in the dining room has picked up so few flies, no one even notices it. It seems that the absence of a nuisance garners very little attention.

Butterflies seemed to have fared relatively well. The number of species present seemed to be slowly diminishing, but as with the birds, it was rarely-seen species that did not show up in the summer of 2024, such that I wonder if I just didn't notice them. The **swallowtail butterfly**, *Papilio xuthus*, seemed to be faring well in the unexposed field, where there are two citrus trees, but my husband and I saw a miniature individual pollinating weeds adjacent to a road in the exposed area. Just as Kordas had described this phenomenon on the island of Samos, it was so small, about half the size of a normal swallowtail butterfly, that it would have been easy to mistake for a completely different species. Like Kordas, I attempted to photograph living specimens, but it is impossible to determine their size from these photos.

My husband removed the cover protecting cabbage plants in the exposed field at the end of August. The cover had always been necessary with organically grown brassicas, which attract **cabbage butterflies** (*Artogeia rapae*) like a magnet, with their larvae soon devastating the plants. Three weeks later, in September, there were a few individual

larvae, but the plants were basically intact [see Photo 8]. There seem to be far fewer cabbage butterflies in general, though I still see them and their close relatives in the neighborhood. This same phenomenon occurred in my observations *elsewhere* as well.

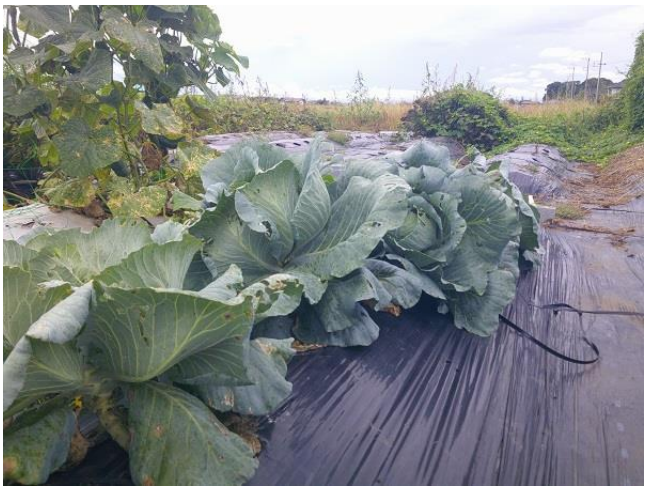


Photo 8 Cabbages left unprotected for three weeks in exposed field. Very few cabbage butterfly larvae present (holes in outer leaves) (September 2024).

My husband said watermelons left rotting in the field attracted no insects at all this year. In the past there would have been many hornets, large beetles and other insects feasting on them. I noticed the same phenomenon in my observations *elsewhere*, but at that time, one rotting watermelon which was sheltered from the radiation source (smart meters) by a concrete embankment attracted hornets and large beetles. Hornets at that location had routinely demolished the entire blueberry crop year after year until the smart meters were installed. That year, there were no hornets on the blueberries and neither were there cabbage butterfly larvae on exposed cabbages.

Dragonflies and damselflies had been disappearing from the area gradually for years. I recorded 13 species (one or two of which might be mature males or a different race of a single species) living within a kilometer of our house. In 2021, gigantic golden-ringed dragonflies (*Anotogaster sieboldii*) were still emerging from unexposed paddies near our house. In 2023, I briefly saw one in September near a wooded stream and struggled to find 10 other dragonfly species. In 2024, the four more common dragonfly species, *Paracercium hieroglyphicum* (blue damselfly), *Orthetrum abystylum* (white-tailed skimmer), *Sympetrum eroticum* (*mayutate* dragonfly) and an unidentified early-emerging black dragonfly, along with the regularly seen but uncommon blue-spotted emperor (*Anax nigrofasciatus*), emerged as normal in late spring or the rainy season, but subsequently disappeared. I encountered dead or weakened female *mayutate* dragonflies

[see Photo 9] near our house before they disappeared. I also began seeing dragonflies much smaller than I'd ever seen before that were residing among the deeply foliated blueberries in the exposed field [see Photo 10]. After searching through the available literature on dragonflies, I determined they were most likely immature male *mayutate*. They had been recorded before as being that small, with a wingspan of about 5 cm—two-thirds the size of the dead female *mayutate* dragonfly I collected. These males would not fly away when approached, and would only fly a short distance when I brought my finger over for size-comparison photos (apologies for poor quality). Maybe they had been stunted by lack of their normal prey such as mosquitoes. They disappeared shortly thereafter.

Photo 9 Dead female *mayutate* dragonfly collected in late June. Small dead male that had weakened and died among blueberries in July 2024. The ruler (credit-card-sized) measures 8 cm, so the male's wingspan is about 5 cm. (Note: the female's abdomen had broken off post-mortem.)

Photo 10 Weakened, very small male *mayutate* among blueberries in July 2024, a couple inches above author's outstretched finger.

White-tailed skimmers have been the most common dragonfly in the area, and they did not disappear entirely. Even in late June I would always see one or two when out walking through the fields. In July, they began to recover a little, perhaps due to better

cover provided by the tall maturing rice plants in the fields and the emergence, finally, of mosquitoes. In August, their numbers rose to normal levels and I could also find a few *mayutate*, mostly in groves and the unexposed area. By October, the *mayutate* had recovered to normal levels.

Friends living in urbanized areas of Naka-shi and neighboring municipalities report that both frogs and dragonflies went missing a number of years ago. They recall times in their childhoods when they could hold up a finger and a dragonfly would alight on it. One friend blamed the loss of frogs and dragonflies on solar panel farms that had been springing up on previously cultivated fields during the past decade. That was the most visible change, and is ongoing. This is a possible contributing factor, but there are no solar farms anywhere near our house. Herbicide use is up along the edges of the paddies and sometimes even in fallow fields as farmers face criticism for allowing weeds to grow, but this is a matter of degree. Herbicides have been sprayed in the area for decades. The paddies are sprayed once a year in August with neonicotinoid pesticides to control stink bugs, but that has been the case for many years. The fact that the environmental havoc that Kordas described occurred on an island with minimal pesticide use when 4G and especially 5G were introduced argues strongly for those being a possible factor in other places including Japan as well.

Flying **snow aphid** adults (*Prociphilus oriens*) are commonly seen in Japan in late autumn, when their white wax secretions make them resemble snowflakes. My husband and I witnessed several very small adults in the unexposed area near our house in July 2024, about four months out of season. The young aphids may have matured earlier than normal. Neither of us had seen or heard of this phenomenon before.

g) Plants

With notable exceptions, the general tendency in the exposed field (2024) as compared with the unexposed field (as well as to the exposed field in 2023) was for larger plants, with more rapid growth, denser foliage and minimal damage from insects and other pests, but with disappointing yields or even failure to fruit and early withering.

The inherent immobility of plants facilitates such a comparison. If many motile species, including ailing ones, are observed in unexposed versus exposed fields, it could indicate a tendency for them to seek such places out or simply survive there long enough to be noticed. Or it could even mean that they are falling sick for some reason in the unexposed areas. Plants lack that choice, so we can see what happens to them when they are stuck in, are moved to, or simply grow upward into an exposed space.

I found a deformed gladiolus at the exposed edge of the exposed field [see Photo 11]

in July 2024. I'd never seen this deformity before in this rootstock that I've grown for about 20 years. I observed deformed weeds along the roads in the exposed area in 2024 as well.

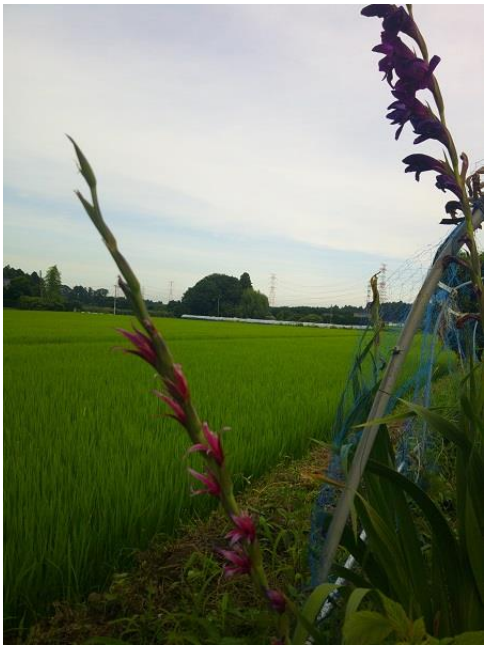


Photo 11 Deformed gladiolus (on left). The petals failed to develop. Normal gladiolus of same stock, with deep purple petals, upper right (late July 2024)

When I realized early in spring that 5G had been introduced, I warned my husband about possible soil acidification, as mentioned by Kordas (2022)[2] so he took that into account when preparing the soil, adding plenty of lime-dolomite powder. Seeds he had planted indoors in February in soil from the exposed field sprouted well, but subsequently all of the seedlings withered and died. After trying again and failing, he wondered if someone had surreptitiously sprayed the soil with glyphosate. That is clearly not the case, but it is hard to say what caused the seedlings to die off.

There were clear winners and losers regarding plant growth and viability. As for crops that depend on pollination, the presence of pollinators was sporadic in both fields, making comparisons difficult.

The biggest winners appeared to have been **blueberries**. One cultivar was attacked and wiped out, apparently by a virus, but that might have occurred anyway, and it is a shame a few of the bushes could not be kept in the unexposed field but the neighbors objected (they don't like birds). The foliage of all the others was more luxuriant than ever and the boughs were heavy with fruit—I estimate about three times the previous year's

volume. I noticed a variety of bees pollinating them in spring. **Raspberries**, which have seemed to thrive among blueberries in the same soil conditions, responded similarly, and the blueberry patch was a riot of red, green and blue, with the most exposed northerly blueberry plants being most generous [see Photo 12]. The summer heat, however, seemed to harm the raspberries, I checked for insect damage, and found a modest amount of stem borer activity. As the heat relented in September, the die-off among the raspberries accelerated, with fruit-bearing canes withering before the fruit could ripen. It remains to be seen if they will survive next year. **Artichokes** also seemed to thrive in both exposed and unexposed fields, at least as far as November. The exposed ones benefited particularly from the absence of voles, and the unexposed ones did well except for vole damage, which occurred even in one of the planters.

Photo 12 Most exposed (northwestern) blueberry bush, heavy with fruit (July 2024).

Soil acidification, which is said to be caused by 5G radiation, would benefit blueberries, at least short-term. The longer term effects remain to be seen. According to Balmori (2003)[6], this acidification occurs through a process of electrolysis, with the leaves absorbing the radiation and the charge migrating into the ground, where it changes the ion balance and inhibits soil microorganisms. The end result is that calcium and magnesium leach out of the soil, and fruits rot before ripening or fail to develop. Kordas reported that compost failed to rot in exposed soil and that there were no insects in it. Discarded plant matter, she said, just withers.

On the other hand, all forms of **peas and beans** throve in our exposed field, including **peanuts**. The threatened arrival of what was predicted in 2024 to be 280 times the number of stink bugs than in normal years, failed to occur (modest numbers noted among

the exposed artichokes and blueberries), and in the absence of voles, the peanut plants grew up splendidly, some reaching 4 meters in length—the longest I've ever seen.

After the pesticide spraying of the adjacent rice fields in August, however, a cloud of stink bugs relocated to our field and obliterated the beans (except for one adzuki plant I noticed standing out by itself exposed to the radiation north of the field), but the peanuts continued thriving. My husband said he noticed some vole damage to the peanuts, but when I harvested ten plants at random, groping through the soil around them, I found no tunnels. One plant lacked peanuts and may have been attacked earlier on. The yield of the rest was good,

Maize performed better in the exposed field than the unexposed one, where it was attacked by stem borers and other insects [see Photo 13].

Photo 13 Insect damage in corn harvested in unexposed field (July 2024). (Would you believe I'm satisfied with this?)

Sweet potatoes performed very well, with huge tubers [see Photo 14]. My husband found only one that had been partially eaten by voles.

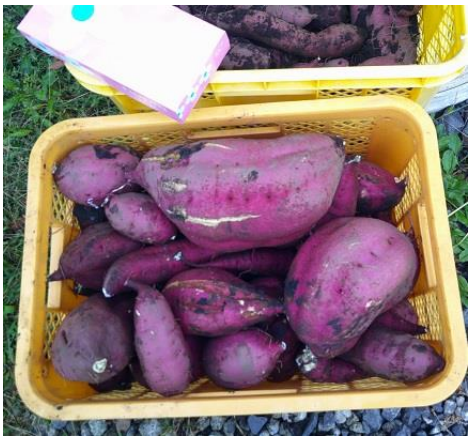


Photo 14 Sweet potato harvest. Very large tubers with no vole damage (September 2024). Tissue box (23 x 11 cm) shown for size. An adjacent commercial sweet potato field had similar results, with enormous tubers.

Among the losers were ten **currant** bushes next to the blueberries. They may have been harmed by the prolonged heat in 2023, but one did survive the winter, only to succumb in June 2024 before the heat resumed.

Squash, melons and cucumbers fared poorly in general in 2024. Mostly it appeared to be problems with pollination, but in the exposed field one squash plant south of the greenhouse, which blocked direct 5G radiation, was thriving and producing massively, until it climbed up too high on the trellis, where it was exposed [see Photo 15]. It then withered along with all but three not fully developed fruits. Neighbors reported getting no cucumbers at all. We had mixed success with melons and cucumbers in the exposed field. Meanwhile, a squash planted in the unexposed field in May throve and produced abundant fruit.

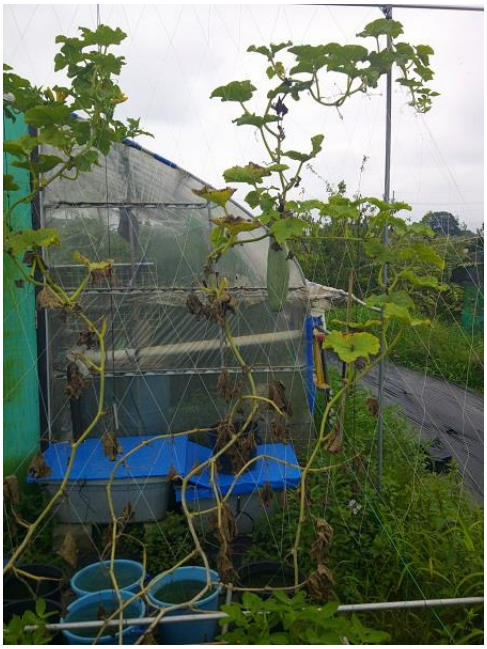


Photo 15 Squash plant that grew beautifully at first, shielded by the greenhouse, but withered after growing too high on the trellis, where it was directly exposed (July 2024).

Bitter melons planted along a trellis on the north side of the exposed field produced a very dense wall of foliage, which protected other plants, but they bore very few fruits themselves. All fruits on the trellis withered without maturing and only a few on the ground between rows could be harvested. Similar results were obtained with melons.

Sunflower plants grew huge with big flowers in the exposed field [see Photo 16], but produced no seeds. These sunflower plants were so large and woody, like small trees, that my husband had to chop them down. We've never seen them grow like that before. Heat could be a factor, but we had the same amount of heat in 2023.

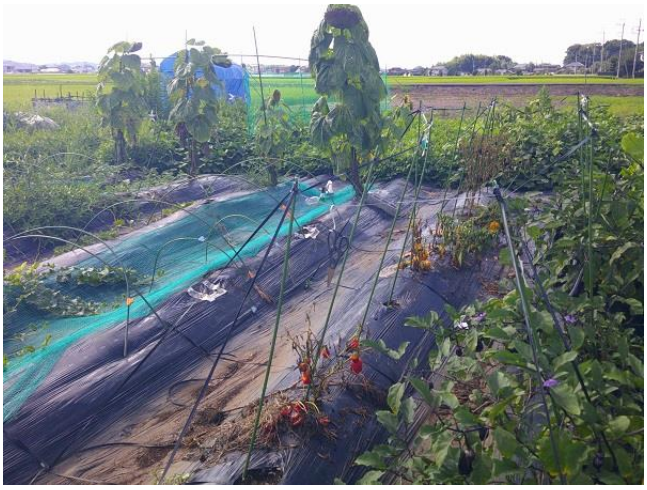


Photo 16 Background: sunflowers, grew tall and produced huge flowers, but no seeds. Foreground: withered row of chilies and peppers in exposed field. They grew well at first, then all withered in July, many of them before they could bear fruit (July 2024).

I grow a few **chili** varieties from which I attempt to secure viable seeds, which are otherwise unavailable in Japan. I keep a few of these in planters, which can be moved if someone else decides to put in peppers nearby. These plants are kept by our house in the unexposed field. As of November 2024, all were thriving despite considerable insect damage in July, the intense heat in August and the need to check frequently for stink bugs. Some of these chilies experienced problems with pollination, but I was able to obtain good fruits from them [see Photo 17]. Meanwhile, in the exposed field, one mixed row of chili and pepper plants grew tall and magnificent when there was a plastic cover placed around them early on, but a month after that was removed, all of them withered, many of them before they could bear fruit [see Photo 16, above]. A second row, about five meters removed, fared better. They were the last seedlings set out, and may have benefited from tall plants (corn, cucumbers, peas, bitter melons) north and northwest of them blocking the radiation [see Photo 18]. However, one variety ("amigo" ancho) failed to fruit in that location as well, though it produced a good yield in the unexposed field. (See Table 3.)

Photo 17 Ancho chili in unexposed planter. Ripening fruit (about 15 cm length) circled. (July 2024).

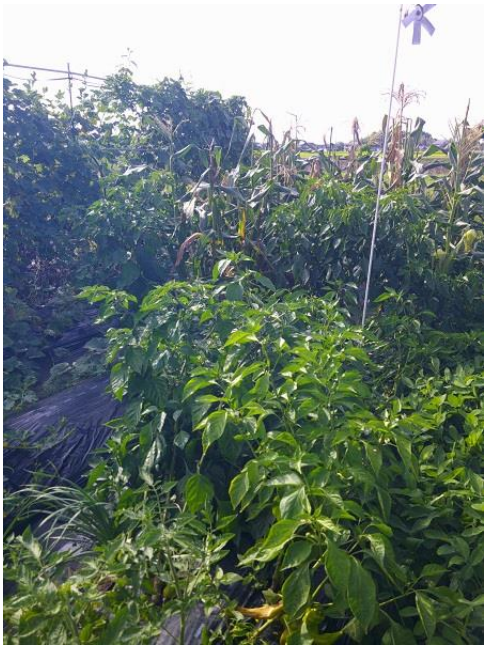


Photo 18 Chilies in exposed field, 5 m away from the row that withered, but sheltered by tall corn, cucumber and bitter melon plants to the northwest. Note that these were not shaded during the morning or afternoon and the fruits showed heat damage, but the plants throve here while they failed nearby where direct exposure to the small cell antennas to the northwest occurred (late July 2024).

Table 3 Comparing outcomes of planted chilies.

Variety	Location	Date out	Quant.	Size and yield on July 7
Brown amigo	Planter	Early May	3	60 cm, 3 large fruits
	Exposed 1	Mid-May	3	1 m, 1 immature fruit
	Exposed 2	Early June	4	50-80 cm, 1 tiny fruit
Red amigo	Planter	May 1	1	60 cm, 7 large, 2 immature
Fukumimi	Planter	Mid-June	2	30-60 cm, 1 large, 3 immature
	Unexposed	Mid-June	5	50-60 cm, 3 large, 9 immature
	Exposed 2	Early June	14	40-60 cm, 7 immature fruits

Notes: "Exposed 1" was a row of mixed chilies and peppers protected by a plastic cover for one month in April-May 2024, then fully exposed to direct 5G; the immature fruit of the chilies never developed before the whole row withered [see Photo 16]. "Exposed 2" was a row in the exposed field, but protected the entire summer by tall plants to the north and northwest [see Photos 18, 19]. The planters [see Photo 17 for one] were all set in unexposed locations by our house. As of November, none of the exposed amigos had developed mature fruit, but I estimate about 20 mature fruits from the unexposed amigos.

“Amigo” is an ancho variety developed in Japan. “Fukumimi” is a Japanese chili with enormous thin-skinned moderately hot fruits.

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h) Humans

One of the concerns scientists have expressed regarding 5G is possible harm to the eyes. My husband and I noticed changes in vision in 2024. I obtained some degree of relief by wearing protective glasses. When checking Internet forums for advice on improving vision, I noticed commenters frequently asking what could be done about floaters, but not receiving any response, suggesting it is a rather new issue.

I also noticed a tendency toward elevated blood pressure after working for many hours a day in the exposed field.

g) Machinery

This might also be related to the increased coherence of 5G beams for enhanced data transmission. My husband purchased a small cheap quadcopter drone and was practicing with it outside. When operated in unexposed airspace, the drone responded properly to his commands. Twice, however, when it strayed into airspace with direct line-of-sight exposure to the small cell antennas, he lost control of it. The second (and final time), despite being programmed to land within about 20 m if contact was disrupted, it flew out over the exposed paddies and disappeared into the middle of one about 100 meters away.

5. Discussion

Japan has been basing its future economic development, including its agriculture, on digital technology, a field in which, lacking natural resources, Japan has excelled for a long time and has every reason to be proud of. The same trend has been happening in other nations as well, including some that have abundant natural resources. In a globalized economy, it seems, there is more money to be made from organizing, overseeing and brokering production than from actual production itself. This is probably an inevitable phase in development, but does not bode well for future productivity.

Within living memory, we have seen technological breakthroughs, particularly in chemistry, that have solved so many long-standing serious problems that it became axiomatic that more technology would solve more problems. (“They’ll think of something.”) However, physical limits do exist, and vexing issues caused by the very technology that was supposed to save us have arisen and continue to arise at an accelerating pace as we ignore the red flashing signs that we’ve passed a point of

diminishing returns.

What remains of the technological juggernaut strikes me as a good example of a "cargo cult." Now the high priests of technology bring us "artificial intelligence," which is supposed to be superior to the natural intelligence God gave geese and us, perhaps the same way artificial foods are supposed to be superior to natural ones, right? And to power this flamboyant endeavor, they propose to revive the fading nightmare of nuclear power.

Given the human need to believe in a bright future, my approach as a "luddite" who has lost faith in technology as a *deus ex machina* savior in chintzy chrome-plated armor, has been to try to revive hope in older traditions, where people strove together to find enjoyment and deeper meaning in what can be a very harsh world, by embracing its very harshness with gusto. I find few takers.

So, I join the growing Cassandra chorus.

Anyway, there exist abundant, solid data indicating serious biological problems arising from exposure to RFR at levels too low to cause any measurable heating. Much of that came from the Soviet Union, so it was easy to dismiss for purely political reasons, and Oleg Grigoriev, Chairman of the Russian National Committee for Non-ionizing Radiation Protection, recently remarked that he approached the WHO, offering to translate some of their literature for them—world standard research—and they said they were not interested. Victims forced from their homes by their bodies' reaction to RFR at field strengths below official standards (notoriously established and guarded by industry insiders in most Western countries) are victimized further by mischaracterization as mentally ill[7], or they are simply ignored[8].

Every time I turn around it seems someone else is declaring "Cell phones are here to stay!" as if stating one's faith in this energy-intensive, extractive technology's sustainability were crucial somehow. Given its overwhelming popularity, I think we will need to cope with it somehow for quite a long time. With my study only adding one drop more of evidence to an already overflowing cup, I want to emphasize ameliorative measures and preservation of protective environments. If, however, the addition of hundreds of thousands of 5G satellites entrains the Schumann resonances as some scientists fear[9], or overwhelms the ability of forests and oceans to provide shelter, then we will be in real trouble. (As of 2024, Oleg Grigoriev in a private communication said he sees no signs of this happening yet, at least where he is in Russia.)

The creatures most clearly affected by exposure to whatever is affecting the "exposed field" versus the "unexposed field" have been voles and moderately large frogs, with dragonflies and large butterflies also showing notable effects. What these creatures share in common is size, roughly 8-10 cm. What they are affected by is most probably

beam-formed 5G transmissions from two visible small-cell antenna masts, in an area said by the industry to be served by 5G now (no date of introduction given, but 5G was not yet available when I checked in the summer of 2023). Given that the species most visibly affected in my observations *elsewhere* (crows, kites, cats) had body sizes of roughly 30 cm, and the newly introduced RFR from smart meters turned out to have a wavelength of roughly the same size, I would expect that to indicate that at least one of the frequencies responsible for the effects noted above would translate to a wavelength of about 8-10 cm. (In fact, the highest frequency, 4.5 GHz, turns out to be 2.6 inches[10], which is 6.6 cm, and the other frequencies employed, would be somewhat longer.)

Real problems encountered by EMR scientists and activists are the invisibility and imperceptibility (to most people) of the causal agent, the inconspicuousness of the radiating infrastructure in the case of smart meters and 5G small cells, the deliberate concealment of the latter on occasion, and the secretiveness of industry and governmental agencies. Some people, not all, are aware of the decreasing number of familiar species such as sparrows, dragonflies and frogs, and they tend to attribute that loss to whatever salient changes have occurred around them or what has been featured in the news, such as the hotter summers in recent years, the multitude of solar arrays being built, a farmer spraying more glyphosate than before, or the nebulous "climate change." (Note: I believe climate change is real, but I can also understand why others do not or if they do, dispute its cause.) One friend said crows had disappeared from her neighborhood several years before, and the media noted such and attributed it to less food being left out due to COVID. "But," she said, "The crows disappeared before COVID."

It is therefore important for anyone who is aware of a connection between newly deployed EMR sources and a sudden decline in biodiversity or other signs of ecological harm, to approach the public with this information. Thus I bring forth the data I have gathered here, despite the conditions being less than ideal. That differences occurred in the flora and fauna of our area between the summers of 2023 and 2024 that were clear enough for average citizens to be remarking on them, and that differences between locations with direct exposure and only indirect exposure to beam-formed transmissions from visible small-cell antennas were salient, not to mention that there have been disastrous effects on agriculture already noted elsewhere with potentially much more to follow, are sufficient reasons to step forward.

6. Conclusions

Changes were observed in a vegetable field and surrounding areas exposed directly to 5G radiation from two small-cell antennas at 650-700 m distance during the first year

after commencement of 5G service. These changes were thought possibly the result of the new form of coherent beam-formed, high-frequency radiation that 5G employs. They included sharply reduced presence of voles, complete loss of brown frogs, sharply reduced presence of wrinkled frogs, the near elimination of dragonflies in late spring, miniaturized swallowtail butterflies, miniaturized snow aphids out of season, drastic reduction in one mosquito species, fewer flies in general, the near complete disappearance of hornets, failure of pollination of certain plants, deformed plants, impressive leafy growth in some plants, sudden die-off in some plants (including some with impressive growth), and generally poorer yields in nightshades and cucurbits, but on the other hand, outstanding growth and yield of blueberries, which favor acidic soil, and fewer insect and rodent pests.

Contrasts were noted when possible with flora and fauna in areas with no direct exposure to 5G radiation. Considerable improvement was also noted in places where the growth of plants to the northwest of the field blocked direct view of the antennas. This might offer a temporary solution to gardeners noticing damage and hoping to ameliorate it.

In mid-November, in the exposed field, the bitter melon plants were still growing on the trellis—a fading wall of green, and behind that, shielded for several months from direct exposure to the 5G small cells was a vivid island of bright green chili and tomato plants [see Photo 19], yielding edible fruit to one degree or another. A sprawling cherry tomato plant about 8 meters away clung to life, but during the preceding five months it had produced not one edible fruit: the fruit was abundant but every last one rotted before it could mature.

Photo 19 Fading bitter melon vines, on the left, continue to provide spotty shielding to the bright green “island” of chili and Roma tomato plants on the right (November 2024). These are the same plants as shown in Photo 18 in July 2024.

It bears noting that this form of radiation has the immense advantage over pesticides in that its influence disappears completely when the source is turned off, while chemical pesticides persist in the environment, where they continue to exert a negative effect, spreading to humans as well. If we were a truly rational species, we would try utilizing these properties of RFR in limited, rational ways minimizing collateral damage, such as by use at night, to reduce the need for pesticides and improve yields, while keeping a close eye on the overall effects. Also, if 5G acidifies soil, why not use it on blueberries in place of the non-renewable resource of peat moss? Again, however, the long-term effects of this have yet to be observed in the current case and those have to be considered.

Japan's *satoyama* groves appear to be playing a role yet again in preserving biodiversity, by blocking radiation in this case, but that might not be sufficient in the long term or in the case of flying creatures. We don't know how these groves will fare under prolonged irradiation. While I suggest ameliorative measures such as growing a green wall of densely foliated plants to shield sensitive plants, that should only be a temporary measure. The 5G rollout clearly needs to be reconsidered in terms of its ecological impact. Humanity needs to work toward a consensus on scaling back otherwise laudable schemes for universal access to high-speed broadband wireless telecommunications—an energy-intensive, extractive technology in itself, even if we ignore the biological impact. This should have no place in a sustainable vision for society. As a first step, areas free from highly coherent modern telecommunications transmissions need to be established where biodiversity can thrive and people experiencing unpleasant health effects from this technology can relocate to recover.

As a final note, my observations above appear to support shielding and minimizing direct exposure to 5G radiation as useful strategies that would also apply to people finding themselves affected. The "electrosensitive" commonly find that shielded garments, while not offering full protection, make a notable difference in their health. This may be because they disrupt signal coherence. That is another point that needs confirmation.

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About the Author

Patricia A. Ormsby obtained her BSChE in 1981 from the University of Colorado, Boulder. After a year of graduate studies in linguistics, she moved to Tokyo, Japan, where she provided language services, such as teaching, translating and rewriting. A keen environmentalist, she organized and led ecotours to several destinations of ecological significance such as Lake Baikal in Russia. She is fluent in Russian and Japanese and speaks several other languages too. She and her husband left Tokyo in 2001 and took up organic farming for their health, which has thereby improved considerably.

Table 1 Summarized trends in birds, beneficial insects and mollusks in the area under observation during the past six years. Detailed data available on request. We relocated to the observed area in November 2020, so earlier data are from memory or other records (I'm an avid birder). An overall trend can be seen in biodiversity peaking in 2023, which had a prolonged hot summer, but declining in 2024, which also had a prolonged hot summer[5].

Birds (total 59)	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**Notes**
Total no. species observed	37	40	38	49	53	50	
- Waterfowl & coots (15)	12	12	13	14	11	12	All but 2 at lakes >1km away,unexp
- Shorebirds & herons (8)	4	4	4	6	8	5	Inhabit paddies and gullies
- Raptors & falcons (5)	3	3	2	4	5	4	
- Passerines (23)	15	16	16	16	20	19	

- Other orders (8)	4	3	3	5	7	8	
Resident (32)	21	21	20	25	28	24	All year (some rare)
Winter (17)	13	13	14	15	15	15	Mostly waterfowl
Summer (7)	4	4	4	6	7	7	
On migration (3)	--	--	0	1	2	0	2019-2020 absent too much to judge
Invasive (1)						1	Hwamei audible in groves
No. of abundant species	16	16	16	16	17	16	A few gains and losses
Number of rare species	5	4	3	6	11	11	Some decreased, others turned up
Number skulking	1	1	1	4	4	2*	If not characteristic
Increased presence	--	1	2	1	6	5	Including a few reappearances
Decreased presence	2	2	1	6	7	11	2 waterfowl sp. seen prior to 2019
Number gone missing	2	1	0	1	5	7	Among the decreased

*Since 2022, *Turdus euphonius* has tended to skulk in groves and gullies after migration in October and later on gradually start its normal paddy scavenging, so it awaits to be seen whether it will do that again in 2024 (as of Nov. 30 they simply haven't returned to this area). *Passer montanus* stopped skulking in the spring of 2024, but currently they are foraging in weedy gullies again, which may just be seasonal. That awaits to be seen.

Pollinators (total 47)	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2019-2021 from memory**
Total species observed	1	1	13	32	39	32	Abundant honeybees 2019-20
- Bees & wasps (10)	1	1	5	9	9	9	
- Flowerflies (5)			1	4	4	3	Incl. hoverflies
- Butterflies (27)			7	18	22	19	
- Hawk moths (5)				2	5	3	Larger sp. decr, 1 tiny sp. increased
On clover or in gardens	1	1	0	1	3	1	All unexposed
Unexposed near house			11	25	22	18	
In woody groves			1	1	1	4	All rare, single individuals
In weedy gullies					3	4	None rare, overlap with roadsides
In greenhouses				1	3	0	Excluded by net 2024
In exposed vegetable field			2	7	13	4	
Roadsides (mostly exp.)						11	
□Commonly seen	1	1	3	5	7	8	
■Rare			2	6	12	9	
▼Gone missing				1	3	10	2024: mostly rarely seen lepidopt.

Notes: Overlap in locations. All species were recorded for each location category that they

were found in. In 2021, I was just getting started with this project. In 2022, I knew where to look for many of the species and because of the introduction of 800 MHz transmissions, was more motivated to pay attention to them.

Predatory ins. (23 total)	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2019-2021 from memory**
Total species observed	1		5	18	18	17	
Hornets & wasps (5)	1		1	3	3	2	
Ladybugs (2)			2	2	2	2	
Dragonflies (13)			2	11	11	10	And damselflies
Others (3)				2	2	3	Robber fly, lacewing, mantis
In gardens				1			Mostly unexp, - hornets
Unexposed near house			4	8	4	5	Much overlap in locations
In woody groves				4	2	5	
In weedy gullies						1	
In greenhouses	1			1	1	1	Hornets & wasps
Exposed vegetable field			3	8	7	6	
By ponds (>800 m away)				2	3		Exposed, checked each Aug.
Roadsides (mostly exp.)						3	
□Commonly seen			3	4	4	3	
■Rare			1	4	4	9	
▼Gone missing		1	0	0	2	4	Dragonflies & hornets

Notes: Overlap in locations, except ponds, where only species not seen elsewhere were recorded.

Mollusks (8 species)				**2022**	**2023**	**2024**	
Yellow snail				U	U	U	Euhadra?
Small gray round snail				U	U	U,E	Unidentif. land snail
Garden slug				U	U	U	Ambligolimax
Spotted slug					U		*Limax maximus*
Hitachi maimai tree snail				U	U		*Euhadra brandtii*
Conical river snail				G	G	G	*Semisulcospira kurodai*
Tanishi river snail				G	G	G	*Bellamya japonica*
Shijimi clams				G	G	G	*Coribula*

Notes: For mollusks, U=unexposed area, E= exposed field, G=gully streams (unexposed). The unidentified round gray snail invaded the exposed field under dense plant cover in 2024; while other land snails decreased or disappeared. (In my observations *elsewhere*,

the yellow snail exploded in numbers, probably due to loss of predators.) The river snails and clams seem to be stable in their restricted habitat. **Red=rare, green=abundant.**