

Falcon Heights Environment Commission
July 9, 2012
Agenda

- 1) Approval of Minutes of June 11, 2012
- 2) Urban Chickens - Presentation, Q&A, Discussion
Guest Speakers invited: Erik Stever, City of St. Paul, and Jane McHattie, St. Paul resident
- 3) Model Beekeeping Ordinance - Staff
- 4) Information and Announcements



Falcon Heights Environment Commission

**City of Falcon Heights
Environment Commission
Meeting Minutes
June 11, 2012**

Present: Diane Ross, Brian Goodspeed, Peggy Hall, Isaac Mielke, Ethan Wagner, Mayor Peter Lindstrom, Deb Jones (Staff). Guest: Gary Reuter of the University of Minnesota Bee Lab. One additional resident of Falcon Heights was also present.

Absent: Rebecca Montgomery, Jeff, Connell, Nina Semmelroth, Stan Sveen

1. The meeting was called to order by the Chairs a few minutes after 6:30 p.m. The April minutes were approved.
2. **Beekeeping.** Gary Reuter, a scientist the University of Minnesota's Bee Lab gave a most informative presentation about bees and answered many questions from Commissioners. Some of the things the Commission learned were:
 - Honey bees' pollination of crops is worth over 14 billion dollars a year to U.S. Agriculture
 - Bees provide honey, a nutritious alternative to sugar. Consuming local honey can help reduce seasonal allergies
 - Most stings are not from honey bees but from wasps and hornets
 - With the proper equipment and handling, bees should not be problem for nearby neighbors.
 - Honey bees are not aggressive, but people should be discouraged from invading their "fly way"
 - Solid and vegetation 6 feet high can steer backyard bees up to overhead fly paths
 - Bees need a good water supply nearby. If one is not provided, they will go for water wherever they find it, including outdoor faucets and wading pools.
 - Honey bees are already all around us, but we may not notice them until there is a hive nearby and we are looking for them.
 - Interest in beekeeping is growing. The UM Extension class is very popular.

Commissioners expressed interest in pursuing this topic and asked staff to provide the model ordinance from the Minnesota Hobby Beekeepers' Association for the next meeting.

3. **Mercury Standards.** Mayor Lindstrom reported that he is one of over 90 U. S. mayors to sign a letter to the Environmental Protection Agency expressing strong support for the recently issued Mercury and Air Toxics Standards for Power Plants. Copies of the letter were provided to the Commission.



4. **Prairie Gardens.** Staff Liaison Deb Jones reported that the Council tabled the prairie garden ordinance and asked the Planning Commission to take a look at it for zoning and comprehensive plan implications. Due to a very full agenda, the Planning Commission had not been able to get to the topic at their May workshop and had to postpone to June.
5. The meeting was adjourned at approximately 8:00 p.m.

STAFF REPORT

**Environment Commission
7/9/12
Item 2**

ITEM: Beekeeping in the City
SUBMITTED BY: Deborah Jones, Staff Liaison

Description:

Mayor Lindstrom asked staff to prepare the Environment Commission for discussion on whether the City might take measures to allow beekeeping in residential neighborhoods of Falcon Heights. Last month, Gary Reuter, a bee scientist at the University of Minnesota Bee Lab, visited the Commission to present basic information on beekeeping in the urban environment. Commissioners discussed the topic and requested the model beekeeping ordinance prepared by the Minnesota Hobby Beekeepers Association for this month's meeting.

Attachments: Minnesota Hobby Beekeepers Association model beekeeping ordinance

ACTION REQUESTED:

- Discuss
- Plan next steps
- Advise staff on further resource needs and/or Commission action.

MODEL BEEKEEPING ORDINANCE

prepared by the
Minnesota Hobby Beekeepers Association

This model ordinance is not intended to be adopted without legal review by counsel representing the jurisdiction considering it. Like any proposed ordinance, it must be reconciled with existing ordinances and may be revised to fit community standards and needs. Our purpose in advancing the model ordinance is to offer a document with the apicultural framework we believe will enable hobbyist and sideliner beekeepers to safely and successfully pursue this pleasurable and economically, culturally and agriculturally critical activity in urban and suburban areas.

WHEREAS, honey bees (*apis mellifera*) are of benefit to mankind, and to Minnesota in particular, by providing agriculture, fruit and garden pollination services and by furnishing honey, and other useful products; and

WHEREAS, Minnesota is among the leading states in honey production and agricultural by products associated with beekeeping throughout the United States; and

WHEREAS, domestic strains of honey bees have been selectively bred for desirable traits, including gentleness, honey production, tendency not to swarm and non-aggressive behavior, characteristics which are desirable to foster and maintain; and

WHEREAS, gentle strains of honey bees can be maintained within populated areas in reasonable densities without causing a nuisance if the bees are properly located and carefully managed;

NOW THEREFORE, be it ordained and enacted by _____:

Section 1. Preamble Adopted.

That the findings contained in the preamble of this ordinance are hereby adopted as a part of this ordinance.

Section 2. Definitions.

As used in this article, the following words and terms shall have the meanings ascribed in this section unless the context of their usage indicates another usage.

- 2.1 "Apiary" means the assembly of one or more colonies of bees at a single location.
- 2.2 "Beekeeper" means a person who owns or has charge of one or more colonies of bees.
- 2.3 "Beekeeping equipment" means anything used in the operation of an apiary, such as hive bodies, supers, frames, top and bottom boards and extractors.

- 2.4 “Colony” means an aggregate of bees consisting principally of workers, but having, when perfect, one queen and at times drones, brood, combs, and honey.
- 2.5 “Hive” means the receptacle inhabited by a colony that is manufactured for that purpose.
- 2.6 “Honey bee” means all life stages of the common domestic honey bee, *apis mellifera* species.
- 2.7 “Lot” means a contiguous parcel of land under common ownership.
- 2.8 “Nucleus colony” means a small quantity of bees with a queen housed in a smaller than usual hive box designed for a particular purpose.
- 2.9 “Undeveloped property” means any idle land that is not improved or actually in the process of being improved with residential, commercial, industrial, church, park, school or governmental facilities or other structures or improvements intended for human occupancy and the grounds maintained in associations therewith. The term shall be deemed to include property developed exclusively as a street or highway or property used for commercial agricultural purposes.

Section 3. Purpose of Ordinance.

- 3.1 The purpose of this ordinance is to establish certain requirements for beekeeping within the City, to avoid issues which might otherwise be associated with beekeeping in populated areas.
- 3.2 Compliance with this ordinance shall not be a defense to a proceeding alleging that a given colony constitutes a nuisance, but such compliance may be offered as evidence of the beekeeper’s efforts to abate any proven nuisance.
- 3.3 Compliance with this ordinance shall not be a defense to a proceeding alleging that a given colony violates applicable ordinances regarding public health, but such compliance may be offered as evidence of the beekeeper’s compliance with acceptable standards of practice among hobby beekeepers in the State of Minnesota.

Section 4. Standards of Practice.

- 4.1 Honey bee colonies shall be kept in hives with removable frames, which shall be kept in sound and usable condition.
- 4.2 Each beekeeper shall ensure that a convenient source of water is available to the colony so long as colonies remain active outside of the hive.
- 4.3 Each beekeeper shall ensure that no wax comb or other material that might encourage robbing by other bees are left upon the grounds of the apiary lot. Such materials once removed from the site shall be handled and stored in sealed containers, or placed within a building or other insect-proof container.
- 4.4 For each colony permitted to be maintained under this ordinance, there may also be maintained upon the same apiary lot, one nucleus colony in a

hive structure not to exceed one standard 9-5/8 inch depth 10-frame hive body with no supers.

- 4.5 Each beekeeper shall maintain his beekeeping equipment in good condition, including keeping the hives painted if they have been painted but are peeling or flaking, and securing unused equipment from weather, potential theft or vandalism and occupancy by swarms. It shall not be a defense to this ordinance that a beekeeper’s unused equipment attracted a swarm and that the beekeeper is not intentionally keeping bees.

Section 5 Colony Density.

- 5.1 Except as otherwise provided in this ordinance, in each instance where a colony is kept less than 25 feet from a property line of the lot upon which the apiary is located, as measured from the nearest point on the hive to the property line, the beekeeper shall establish and maintain a flyway barrier at least 6 feet in height. The flyway barrier may consist of a wall, fence, dense vegetation or a combination there of, such that bees will fly over rather than through the material to reach the colony. If a flyway barrier of dense vegetation is used, the initial planting may be 4 feet in height, so long as the vegetation normally reaches 6 feet in height or higher. The flyway barrier must continue parallel to the apiary lot line for 10 feet in either direction from the hive, or contain the hive or hives in an enclosure at least 6 feet in height. A flyway barrier is not required if the property adjoining the apiary lot line (1) is undeveloped, or (2) is zoned agricultural, industrial or is outside of the City limits, or (3) is a wildlife management area or naturalistic park land with no horse or foot trails located within 25 feet of the apiary lot line.

- 5.2 No person is permitted to keep more than the following numbers of colonies on any lot within the City, based upon the size or configuration of the apiary lot:

- a. One half acre or smaller lot 2 colonies
- b. Larger than 1/2 acre but smaller than 3/4 acre lot 4 colonies
- c. Larger than 3/4 acre lot but smaller than 1 acre lot 6 colonies
- d. One acre but smaller than 5 acres 8 colonies
- e. Larger than 5 acres no restriction

- 5.3 Regardless of lot size, so long as all lots within a radius of at least 200 feet from any hive, measured from any point on the front of the hive, remain undeveloped, there shall be no limit to the number of colonies. No grandfathering rights shall accrue under this subsection.

- 5.4 If the beekeeper serves the community by removing a swarm or swarms of honey bees from locations where they are not desired, the beekeeper shall not be considered in violation the portion of this ordinance limiting the number of colonies if he temporarily houses the swarm on the apiary lot in compliance with the standards of practice set out in this ordinance for no more than 30 days from the date acquired.

Section 6. Inspection.

A designated City official shall have the right to inspect any apiary for the purpose of ensuring compliance with this ordinance between 8 a.m. and 5 p.m. once annually upon prior notice to the owner of the apiary property, and more often upon complaint without prior notice.

Section 7. Presumed Colony/Hive Value.

For the purpose of enforcing City ordinances against destruction of property, each colony/hive shall be presumed to have a value of \$275.

Section 8. Compliance.

8.1 Upon receipt of credible information that any colony located within the City is not being kept in compliance with this ordinance, [the designated City official] shall cause an investigation to be conducted. If the investigation shows that a violation may exist and will continue, [the designated City official] shall cause a written notice of hearing to be issued to the beekeeper, which notice shall set forth:

- a. The date, the time and the place that the hearing will be held, which date shall be not less than 30 days' from the date of the notice;
- b. The violation alleged;
- c. That the beekeeper may appear in person or through counsel, present evidence, cross examine witnesses and request a court reporter, and
- d. That if [the designated City official] finds that they have been kept in violation of this ordinance, and if the violation is not remediated within the time allowed, the bees may be ordered removed and/or destroyed.

Notices shall be given by certified US Mail return receipt requested or personal delivery. However, if the beekeeper cannot be located, then notice may be given by publication in a legal newspaper for the county in which the apiary property is located, at least seven days before the hearing.

8.2 The hearing shall be conducted by [the designated City official]. The burden shall be on the City to demonstrate by a preponderance of evidence that the colony or colonies have been kept in violation of this ordinance. If [the designated City official] finds a violation, then he/she may order that the bees be removed from the City or such other action as may address the violation, and that the apiary lot be disqualified for permitting under this ordinance for a period of 2 years from the date of the order, the apiary lot ownership changes, in which case the prohibition shall terminate. If the order has not been complied with within 20 days of the order, the City may remove or destroy the bees and charge the beekeeper with the cost thereof. Upon destruction of bees by the City, all equipment shall be returned by the City to the beekeeper, with expenses of

transportation to be paid by the beekeeper. The City's destruction of the bees shall be by a method that will not damage or contaminate the equipment, include wax foundation.

8.3 The decision of the hearing officer may be appealed by the beekeeper as provided in the City's rules and procedures. If no provision for appeal exists, then the beekeeper may file a notice of appeal with the City secretary within 15 days of the date the order is placed in US Mail to the beekeeper, or 10 days if the decision is announced at the hearing by [the designated City official]. An appeal shall not stay [the designated City official]'s decision, and the beekeeper shall be required to comply with such order pending the outcome of the appeal.

8.4 No hearing and no order shall be required for the destruction of honey bees not residing in a hive structure that is intended for beekeeping.

Section 9. Savings Clause.

In the event any part of this ordinance or its application to any person or property is held to be unenforceable for any reason, the unenforceability thereof will not affect the enforceability and application of the remainder of this ordinance, which will remain in full force and effect.

Section 10. Effective Date.

This ordinance shall become effective on _____, 20_____.

STAFF REPORT

Environment Commission
7/9/12
Item 1

ITEM: Chickens in the Falcon Heights
SUBMITTED BY: Deborah Jones, Staff Liaison

Description:

Mayor Lindstrom asked staff to prepare the Environment Commission for discussion on whether the City might take measures to allow the keeping of chickens (i.e. hens) in residential neighborhoods of Falcon Heights. Several metro area cities do allow the keeping of chickens under various conditions. Usually a permit is required.

Two guest speakers have been invited: Erik Stever of St. Paul Animal Control and a St. Paul resident who keeps hens.

Mayor Lindstrom and Nina Semmelroth also provided some interesting articles on the topic, which are attached.

Commissioners are encouraged to do additional research online. Here are some starting points:
<http://www.doitgreen.org/article/food/RaisingUrbanChickens>
http://www.ansci.umn.edu/poultry/resources/small-scale_production.htm

A more “hands-on” source might be a visit to EggPlant Urban Farm Supply, 1771 Selby Ave., St. Paul, (651) 645 0818

Attachments:

“Baby chicks, know-how in high demand” – *Pioneer Press* article by Andy Greder
“Twin Cities: Backyard chickens welcome, Watchdog says, as long as owners follow rules” - *Pioneer Press* article by Debra O'Connor

ACTION REQUESTED:

- Discuss
- Plan next steps
- Advise staff on further resource needs and/or Commission action.

Baby chicks, know-how in high demand

By Andy Greder agreder@pioneerpress.com TwinCities.com-Pioneer Press

Posted:

TwinCities.com

Cartoonish metal chickens with plumes of primary colors are staked into the Selby Avenue boulevard outside EggPlant Urban Farm Supply. Inside the St. Paul store, fuzzy week-old Barred Rock, Buff Orpington and Silver-Laced Wyandotte chicks are scurrying under a heat lamp. Out back, class is in session for about a dozen urbanites wanting to learn what it takes to keep chickens in the city.

"I have chicken fever," said Sarah Marquardt, a Minneapolis woman who has never raised the birds. "I think it's a more sustainable way to live. I'm very concerned about our food system and where my food comes from. The more local we can get, the better, and there is really nothing more local than your backyard."

The number of people interested in raising backyard chickens across the nation -- and in the Twin Cities metro area -- has spiked in the past decade. Anoka Ramsey Farm & Garden store in Ramsey saw fowl sales more than triple from about 2,500 in 2000 to about 9,000 last year, said owner Tom Tidrick. EggPlant sold 600 chickens through June 2011, and will exceed that total this year, said co-owner Bob Lies.

"It's a lot more popular than it's ever been," said Tidrick, who has owned the store in Ramsey for 32 years. "We have people almost daily from St. Paul or Minneapolis that come in here."

It could be a fad, Tidrick said, "but I don't think it's going to go away for a while."

EggPlant, which opened two years ago, caters to the hobbyists by offering supplies, feed and baby chicks straight from the hatchery. Classes, such as the one Sunday, June 3, give attendees tips on care and how to house the birds, a guide to startup costs and how to meet city ordinances, as well as other basic know-how.

"We are trying to pass on good animal-husbandry practices to make sure that people understand what the birds need," said Lies, who owns EggPlant with his wife, Audrey Matson.

Mary Britton Clouse, founder of Chicken Run Rescue in Minneapolis, says city dwellers have shown they don't know what it takes to raise chickens, or often quit once they find out, usually about a year in.

"They figure it out that it's no longer sweetness and light," Britton Clouse said.

Chicken Run Rescue started in 2001 as the only urban chicken rescue organization in the country, she said. After fewer than 50 surrender requests in the first seven years, the numbers spiked to more than 300 in 2009. Rescues have been below 100 in the past three years.

Lies says he hasn't seen much abandonment of birds.

"Most of the people that come to us and take this class are all thinking about it the right way," he said, adding that most view a chicken as a "pet with benefits."

Jennifer Wohl and her 11-year-old daughter, Lizzie, are "fascinated" with chickens and are planning a small coop in their tiny St. Paul back yard.

"Most of the things we do with our kids are something that we've done before," Wohl said. "It's more us teaching them something. This would be something that none of us know anything about."

Of the 12 women, one man and two children in the EggPlant class, several mentioned a desire to save money by eating the eggs.

Lies dispelled that notion. "I've joked that I'm eating \$42 eggs," he said.

Marquardt figures a dozen eggs will cost about \$6 for three hens with average laying ability and feed costs. EggPlant estimates backyard chicken enthusiasts should budget about \$500 for startup costs and \$30 in monthly costs for three hens. And don't forget veterinary care.

One woman in the class questioned if chickens should go to the vet, and Lies asked, "Are you a person who would take a \$5 chicken to a vet?"

"Yes," the woman replied.

Twin Cities: Backyard chickens welcome, Watchdog says, as long as owners

follow rules

By Debra O'Connor watchdog@pioneerpress.com TwinCities.com-Pioneer Press

Posted:

TwinCities.com

A reader recently squawked to the Pioneer Press after noticing chickens in the back yard of a St. Paul home.

"Very cute," the writer said. "But is this legal?" The Watchdog saw the post on SeeClickFix, an online feature on TwinCities.com that lets users alert their communities about quality-of-life issues. The Watchdog investigated to see whether a Chicks Fix was needed in the Macalester-Groveland neighborhood.

As it turns out, the chickens are owned by the DuBois family, and the city of St. Paul confirmed the birds are legal. Homeowners Jacques and Katie DuBois followed the city ordinance when they first got chickens two years ago: They filed the paperwork, paid the fee, housed the chickens in an acceptable coop and secured the agreement of at least 75 percent of the neighbors living within 150 feet of their home.

Jacques DuBois told the Watchdog that two of 10 neighbors did decline, with one claiming, "People in (ZIP code) 55105 don't want to have chickens there," while another said she didn't like the idea of having "livestock" around, DuBois said. But, he noted, that neighbor now brings her grandchildren over to observe Mario, Luigi and Oreo scratch and cluck.

Across the nation, backyard chickens -- part of what's called "urban farming" -- are all the rage. In St. Paul, the population is exploding, said animal-control supervisor Bill Stephenson.

"A lot of people like them as pets, and the eggs are a benefit," he said.

In St. Paul, there's been a permit process in place for more than 20 years, but the city used to see only three or four requests per year from people wanting to set up backyard coops. Now, it can be that many per week. One animal-control employee works two days a week checking the living conditions and sanitation of chickens, beehives and other less-common animals kept in the city, Stephenson said.

Some other metro-area cities allowing chickens in a regular-sized back yard are Minneapolis, Anoka, Burnsville, Farmington, Hastings, Rosemount, Roseville, West St. Paul and Maplewood. Some communities that don't allow them include Apple Valley, Eagan, Stillwater, Woodbury, Inver Grove Heights and, thus far, Cottage Grove. That's according to a survey done by the city earlier this year, when resident Rykna Olson, who grew up on a farm, asked that Cottage Grove consider allowing chickens. As she said in an email to the city, "I miss some of the amenities that a farm provides, especially fresh eggs."

The Watchdog did some research herself and found some ordinances to be fussier than others: Ham Lake, for example, requires the color of the coop to blend with that of the house. Bayport's extensive regulations note that chickens can't be kept in the house. Several cities that are still largely rural require lots to be 3 or more acres. The upscale community of North Oaks, which used to be railroad magnate James J. Hill's farm, doesn't allow the birds at all.

Most cities that allow chickens require a permit, charge a fee and check on the chickens' welfare regularly. Ordinances describe an acceptable coop's configuration, along with its placement on the property.

Most ordinances recognize some neighbors may not be enthusiastic about living near a miniature farm. Most don't allow roosters because they're noisy and can be aggressive. In East Bethel, which doesn't bar roosters, spokeswoman Stephanie Hanson notes: "We have no complaints on chickens; however, we have numerous complaints on roosters." Most require some or all of the neighbors to sign off on the idea. In Maplewood, which adopted an ordinance last year, the owner of every property adjacent to the applicant's must agree, or the applicant has to prove his property lines are at least 150 feet from anyone's house.

And most cities limit the number of chickens to three or four -- but not Minneapolis, where there's no official limit if

a resident can convince 80 percent of the neighbors to sign off on the number and the city agrees they're properly kept. Minneapolis also allows roosters, but that has to be disclosed to neighbors and their signatures must be notarized.

Minneapolis, which has allowed backyard fowl as far back as anyone in animal control can remember, now has a population of about 1,500 chickens, with an average of six to eight birds per household, according to permit coordinator Ann Thelen. Growth is still booming, with six to 10 application requests per week.

"Hens are wildfire this year," Thelen said.

And beehives, another part of the urban-farming movement, are gaining momentum. "They're coming in droves, too," Thelen said.

On Tuesday, June 5, a Stillwater family who had been cited for illegally keeping chickens appeared before the city council to ask members to consider making chickens legal. The council agreed, 3-2, to look into the matter, and will charge the standard \$500 to have the city research a resident's request.

"There's enough illegal chickens out there that they're having a fundraiser to change the ordinance," said Mayor Ken Harycki. "They're pretty passionate about it. Apparently, there's a groundswell going on."

Both Jacques and Katie DuBois grew up living in apartments, so having hens and a backyard garden at their St. Paul house is a way to experience something new and promote their children's health, Jacques DuBois said. The children, ages 9, 5 and 3, see the chickens as pets and will casually pick them up and carry them around. The family boxer and poodle mingle with the hens wandering in the yard.

The family keeps different varieties, including the Ameraucana, nicknamed the "Easter Egger" because it lays blue-, green- and pink-tinted eggs. The hens are "dual-purpose," fit for both eggs and meat. They give enough eggs to satisfy the family's need and when, after three years or so, their laying days are done, there are companies that will process poultry for stew. The DuBoises' hens have the run of their fenced-in yard, but most have been able to flap over their 3-foot-high fence; they've lost one to a neighbor's dog and one to a hawk.

And once, the family accidentally got a rooster from their chick supplier. Since noise and aggression make roosters illegal in St. Paul, they couldn't keep him.

So they ate him.

Editor's note: Feel like an underdog because of a problem with a business, government agency or school? To ask the Watchdog for help, go to TwinCities.com/watchdog, call 651-228-5419 or email watchdog@pioneerpress.com. Follow her at pioneerwatchdog.



True North

Living in the natural world with Josephine Marcotty

Environmental reporter Josephine Marcotty writes about our place in nature through her coverage of the outdoors, wildlife, pollution and sustainability.

Carbon exchanges in the burbs

Posted by: Josephine Marcotty Updated: June 28, 2012 - 4:37 PM

Do you want to slow climate change? Plant evergreens.

Plants, especially trees, play an enormously important role in the regulating climate change by capturing the carbon released by the burning of fossil fuels. Some have described them as the earth's lungs.

But not much is known about the role they play in the urban and suburban landscape, the one that most of us know and that is growing at a rapid rate around the world. It's one of the questions that must be answered for cities to figure out how to reduce carbon emissions and to set up carbon exchange systems.

Now, researchers at the University of Minnesota and University of California Santa Barbara, have gone to great heights to try to answer that.

They found that suburban plantings do play a role -- depending on the season.



View in summer and winter of a suburban St. Paul landscape from the 500 ft tall KUOM tower where measurements for the study were made.



"We know cities and suburbs are net emitters of CO₂ due to fossil fuel emissions, and vegetation cannot offset this completely," said Emily Peters, a postdoctoral fellow with the university's Institute on the Environment "However, our study shows that vegetation is an important player in suburban CO₂ exchange, and can even cause the suburban landscape to be a CO₂ sink in summer."

She and her co-researchers put sensors way up high on a tower above a St. Paul suburban neighborhood. It measured tiny changes in CO₂, temperature, water vapor and wind. They found that for nine months of the year, the suburban landscape added CO₂ to the atmosphere from cars, engines and other sources. But during the summer, however, suburban greenery absorbed enough CO₂ to balance out fossil fuel emissions within the neighborhood. Peak daily uptake was close to the low end of what hardwood forest would absorb.

Different kinds of plants were better at it than others. For lawns, peak carbon uptake was in the spring and fall because they were stressed by summer heat. But trees had higher CO₂ uptake throughout the summer. Evergreen trees maintained their CO₂ uptake longer than deciduous trees did because they keep their leaves year-round, they found.

The study was published this week in the Journal of Geophysical Research – Biogeosciences.