2010 – 2011 On-farm trials

Pre-Farm Visit

We started the on-farm work with information gathering. Each of the nine farms was contacted for a phone conversation during which we reviewed some information about the farm and pinpointed it on a map for further GIS/GPS work. We identified transitioning fields and their important features, conditions at the farm, and the transition plan, including where they are in the process, what crops and cover crops they are growing and where, and what they are applying in the way of compost or manure.

With the help of GIS we found aerial maps of Pennsylvania and overlaid information that helped us plan our sampling locations and add water features, roads, elevation and soil types. A form was created for each farm to select points, receive GPS data from it, and then upload that data on to the computer.

Soil Sampling

Baseline soil samples were collected in the fall of 2010 and spring of 2011.

At each farm we used the prepared GIS map (including information on soil type and fields), balanced with on-site considerations (wet spots, elevation, slope) in order to choose representative locations for the soil sampling. Depending on the farm size, samples were taken from 5 or 10 areas on the farm. From each of the 5 or 10 areas we collected 5 cores in close proximity to each other, 20 cm in length. These 5 cores were bulked, labeled as “FarmName 1” through “FarmName 5(10)” and stored in a cooler until further processing could be conducted. To allow follow-up sampling in the approximate same spot, GPS locations were recorded for each sample.

Follow-up samples were collected in the fall of 2011: The previous sample points were re-located with a GPS unit; and another round of soil samples was taken in the same locations.

Analysis

For both sampling dates, soil samples were dried, weighed and sieved to 2mm to determine bulk density and percent rock fragment for each sample. The sieved samples were also analyzed for total carbon and total nitrogen. This information allowed us to calculate carbon sequestration rates during the project period.

Summary of baseline results -Spring 2011

The conclusions we can draw from the baseline information (Table 1) are limited, because we are mainly studying the change of carbon over time. We can compare fields within a farm, or compare some farms to another. For instance, Farm 3 has very high carbon values, which makes sense considering they are growing almost exclusively in raised beds with horse manure compost as the primary input. On the other hand, Farm 4 was conventionally managed until very recently, and all of the soil carbon values are fairly low, in the 0.7 to 1.3% range. Compare that to Farm 1, which has been managed organically for many years, and its carbon values are generally quite high. Making these kinds of distinctions and keeping in mind the influences of soil types and previous land-use, may be quite important in interpreting changes.

Summary of overall results - Changes from Spring 2011 to Fall 2011

Results were very variable, with carbon increases ranging from 1% to 222% and carbon losses ranging from 1% to 49%. Nitrogen changes were very similar with increases ranging from 1% to 114% and nitrogen losses ranging from 1% to 51% (Table 2). This wide range of results is not surprising, considering the diversity of the farms and the diversity of the sampling locations on each farm. GPS technology allowed us to return to the same sampling area (with an accuracy of about 3 feet) but soil carbon and nitrogen values can vary from year to year and management changes will only manifest as an upward or downward trend in carbon and nitrogen after several years.

Table 1. Results from soil analysis, Spring and Fall 2011:
bulk density, total soil carbon and nitrogen, and kg C/ha.

	Spring 2011				Fall 2011			
Farm	% Soil carbon	% Soil nitrogen	Bulk Density g/cm3	kg C/ha	% Soil carbon	% Soil nitrogen	Bulk Density g/cm3	kg C/ha
Farm1-1	1.949	0.202	1.04	36,795	1.840	0.173	1.23	42,304
Farm1-2	3.373	0.345	0.98	62,634	3.078	0.302	1.08	62,282
Farm1-3	5.593	0.532	0.83	86,105	4.585	0.428	0.89	118,422
Farm1-4	3.319	0.338	1.00	53,086	2.459	0.245	1.15	50,517
Farm1-5	2.454	0.253	1.21	49,179	2.840	0.276	1.14	53,644
Farm2-1	3.834	0.340	0.80	40,304	3.658	0.292	1.03	77,021
Farm2-2	2.909	0.253	1.09	30,228	3.645	0.308	0.90	32,653
Farm2-3	3.132	0.310	0.79	41,812	5.130	0.486	0.83	76,672
Farm2-4	4.337	0.412	0.69	45,020	2.220	0.201	0.80	34,394
Farm2-5	4.160	0.336	0.79	42,632	3.879	0.314	0.97	50,247
Farm3-1	1.108	0.112	1.39	30,894	1.101	0.122	1.46	32,259
Farm3-2	0.745	0.073	1.43	20,912	0.712	0.076	1.29	18,168
Farm3-3	0.745	0.073	1.46	21,810	0.745	0.085	1.34	19,798
Farm3-4	0.989	0.103	1.41	27,900	0.995	0.107	1.62	31,666
Farm3-5	1.765	0.186	1.18	41,803	1.786	0.194	1.20	42,769
Farm4-1	1.304	0.139	1.33	34,873	1.183	0.139	1.42	33,767
Farm4-2	1.235	0.121	1.38	34,348	1.234	0.125	1.57	38,944
Farm4-3	1.019	0.106	1.40	26,867	1.043	0.112	1.62	33,735
Farm4-4	1.228	0.135	1.37	33,656	1.243	0.134	1.53	38,034
Farm4-5	1.321	0.131	1.32	35,102	1.232	0.131	1.52	37,713
Farm4-6	1.219	0.162	1.36	30,660	1.067	0.154	1.40	27,296
Farm4-7	1.230	0.148	1.28	24,692	1.293	0.157	1.27	25,332
Farm4-8	1.536	0.183	1.21	27,648	0.956	0.122	1.26	16,415
Farm4-9	1.577	0.220	1.38	39,785	1.732	0.238	1.42	41,121
Farm4-10	1.268	0.145	1.16	16,061	1.585	0.175	1.30	18,410
Farm5-1	1.206	0.161	1.29	29,784	0.911	0.134	1.40	24,241
Farm5-2	1.582	0.187	1.39	43,974	1.402	0.171	1.40	39,126
Farm5-3	1.148	0.164	1.45	33,325	1.273	0.166	1.45	36,639
Farm5-4	1.603	0.187	1.35	43,302	1.566	0.187	1.53	47,344
Farm5-5	1.314	0.163	1.16	30,498	1.681	0.213	1.42	46,982
Farm5-6	3.188	0.318	0.78	38,819	3.193	0.321	1.01	45,706
Farm5-7	4.244	0.396	0.62	45,322	4.428	0.399	0.73	57,537
Farm5-8	3.440	0.313	0.90	54,722	3.206	0.308	1.25	60,750
Farm5-9	2.633	0.252	1.08	42,899	2.244	0.231	1.14	32,091
Farm5-10	2.083	0.215	1.04	31,717	2.091	0.223	1.04	30,191
Farm6-1	3.222	0.246	0.91	28,519	4.741	0.370	0.86	72,978
Farm6-2	2.221	0.175	0.93	31,342	2.705	0.213	0.80	31,932
Farm6-3	0.761	0.063	1.35	16,421	1.441	0.116	1.10	23,704
Farm6-4	2.747	0.212	0.97	41,761	2.844	0.238	0.95	40,183
Farm6-5	4.526	0.335	0.81	51,306	5.163	0.374	0.63	50,805

Table 1 continued

	Spring 2011				Fall 2011			
Farm	% Soil carbon	% Soil nitrogen	Bulk Density g/cm3	kg C/ha	% Soil carbon	% Soil nitrogen	Bulk Density g/cm3	kg C/ha
Farm7-1	1.541	0.181	1.37	34,712	1.661	0.196	1.31	37,148
Farm7-2	1.791	0.204	1.30	40,882	1.856	0.212	1.28	40,497
Farm7-3	1.510	0.140	1.38	39,155	1.495	0.147	1.30	34,822
Farm7-4	2.282	0.246	1.22	44,956	2.136	0.236	1.29	47,176
Farm7-5	1.905	0.193	1.35	46,793	1.804	0.195	1.30	44,648
Farm8-1	1.336	0.148	1.32	32,215	1.461	0.174	1.34	34,584
Farm8-2	2.196	0.222	1.15	48,096	1.991	0.220	1.25	42,287
Farm8-3	1.394	0.161	1.36	37,029	1.453	0.170	1.29	34,341
Farm8-4	1.648	0.186	1.27	37,264	1.620	0.197	1.33	36,353
Farm8-5	2.218	0.249	1.20	50,787	2.290	0.271	1.17	53,492
Farm8-6	1.086	0.132	1.40	24,020	0.978	0.105	1.20	16,968
Farm8-7	1.203	0.140	1.40	27,685	1.619	0.173	1.19	29,381
Farm8-8	1.272	0.146	1.45	28,397	1.188	0.132	1.42	24,829
Farm8-9	1.202	0.119	1.51	31,528	1.262	0.137	1.32	28,220
Farm8-10	1.267	0.143	1.45	31,464	1.339	0.151	1.27	28,458
Farm9-1	7.565	0.583	0.55	69,700	8.059	0.634	0.52	72,786
Farm9-2	12.071	0.994	0.25	48,906	12.009	0.939	0.22	44,609
Farm9-3	5.942	0.459	0.52	48,058	3.599	0.299	0.88	47,483
Farm9-4	3.422	0.242	1.06	57,154	4.171	0.327	0.98	63,309
Farm9-5	8.611	0.707	0.48	76,661	27.729	1.515	0.20	86,288

Table 2. Percent difference between Spring and Fall 2011 soil sampling:
bulk density, total soil carbon and nitrogen, and kg C/ha.

	% difference soil C	% difference soil N	% difference kg C/ha
Farm1-1	-5.6	-14.0	15.0
Farm1-2	-8.7	-12.6	-0.6
Farm1-3	-18.0	-19.4	37.5
Farm1-4	-25.9	-27.5	-4.8
Farm1-5	15.7	8.9	9.1
Farm2-1	-4.6	-14.1	91.1
Farm2-2	25.3	21.7	8.0
Farm2-3	63.8	56.8	83.4
Farm2-4	-48.8	-51.1	-23.6
Farm2-5	-6.8	-6.7	17.9
Farm3-1	6.5	8.8	4.4
Farm3-2	-0.5	-5.5	-8.8
Farm3-3	-39.4	-34.8	-1.2
Farm3-4	21.9	35.2	10.8
Farm3-5	222.0	114.3	12.6

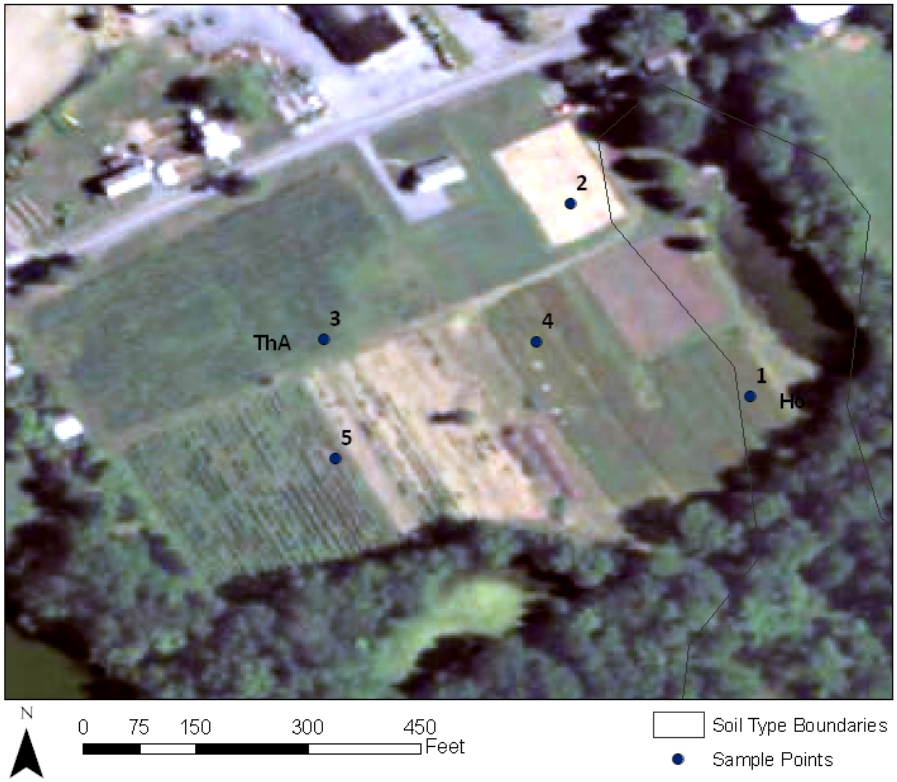
Table 2 continued

	% difference soil C	% difference soil N	% difference kg C/ha
Farm4-1	-0.7	8.6	4.4
Farm4-2	-4.4	4.3	-13.1
Farm4-3	-0.1	16.3	-9.2
Farm4-4	0.6	4.0	13.5
Farm4-5	1.2	4.4	2.3
Farm4-6	-9.3	0.3	-3.2
Farm4-7	-0.1	3.3	13.4
Farm4-8	2.4	5.6	25.6
Farm4-9	1.3	-0.6	13.0
Farm4-10	-6.7	0.1	7.4
Farm5-1	-12.5	-5.3	-11.0
Farm5-2	5.1	6.0	2.6
Farm5-3	-37.8	-33.1	-40.6
Farm5-4	9.8	8.2	3.4
Farm5-5	25.0	20.3	14.6
Farm5-6	-24.5	-16.4	-18.6
Farm5-7	-11.4	-8.2	-11.0
Farm5-8	10.9	1.1	9.9
Farm5-9	-2.3	0.2	9.3
Farm5-10	27.9	30.6	54.1
Farm6-1	0.1	1.0	17.7
Farm6-2	4.3	0.9	27.0
Farm6-3	-6.8	-1.7	11.0
Farm6-4	-14.8	-8.5	-25.2
Farm6-5	0.4	4.1	-4.8
Farm7-1	47.1	50.5	155.9
Farm7-2	21.8	21.6	1.9
Farm7-3	89.3	85.7	44.3
Farm7-4	3.5	12.0	-3.8
Farm7-5	14.1	11.7	-1.0
Farm8-1	7.8	8.1	7.0
Farm8-2	3.7	3.6	-0.9
Farm8-3	-1.0	4.4	-11.1
Farm8-4	-6.4	-4.0	4.9
Farm8-5	-5.3	0.9	-4.6
Farm8-6	9.3	17.6	7.4
Farm8-7	-9.3	-0.9	-12.1
Farm8-8	4.2	5.6	-7.3
Farm8-9	-1.7	6.0	-2.4
Farm8-10	3.3	8.6	5.3
Farm9-1	-10.0	-19.9	-29.4
Farm9-2	34.6	23.0	6.1
Farm9-3	-6.5	-9.6	-12.6
Farm9-4	5.0	14.7	-10.5
Farm9-5	5.7	5.7	-9.6

Results for each farm in detail

Farm 1

This farm is in the midst of transitioning to organic, but has been implementing organic management practices for many years. It specializes in a few, high-value crops like raspberries, strawberries, and asparagus, wreaths and mushroom compost.



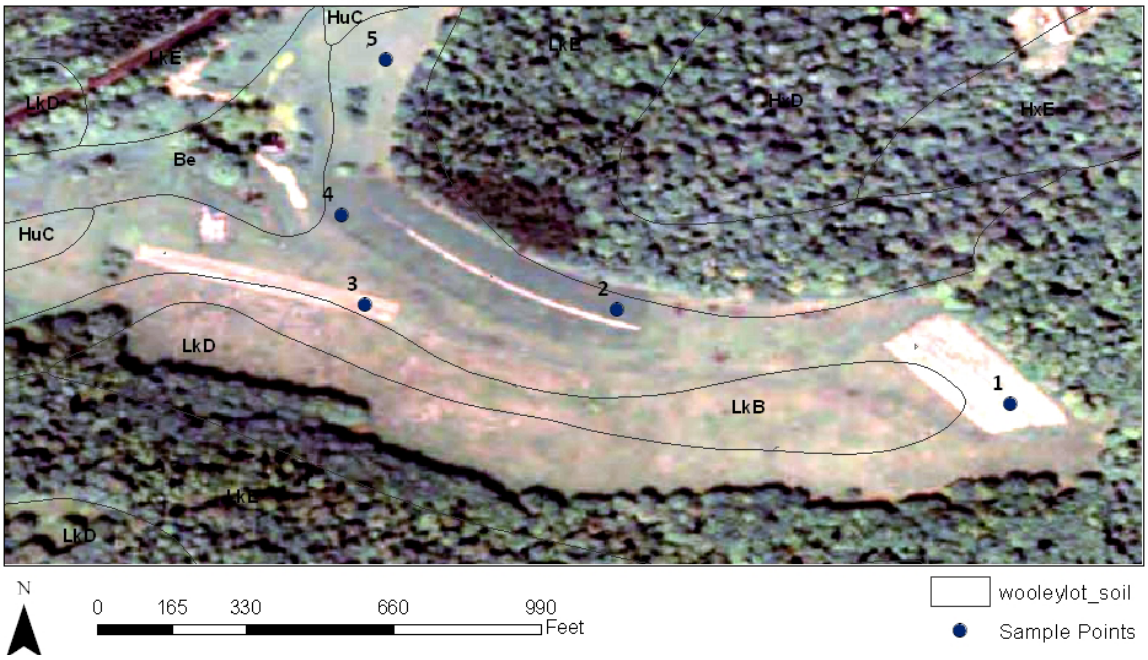
Farm	% Soil carbon-Spring 2011	% Soil carbon-Fall 2011	% Diff C	% Soil nitrogen-Spring 2011	% Soil nitrogen-Fall 2011	% Diff N	kg C/ha Spring 2011	kg C/ha Fall 2011	diff kg C/ha	% diff kg C/ha
Farm1-1	1.95	1.84	-5.6	0.202	0.173	-14.0	36,795	42,304	5,509	15.0
Farm1-2	3.37	3.08	-8.7	0.345	0.302	-12.6	62,634	62,282	-352	-0.6
Farm1-3	5.59	4.59	-18.0	0.532	0.428	-19.4	86,105	118,422	32,317	37.5
Farm1-4	3.32	2.46	-25.9	0.338	0.245	-27.5	53,086	50,517	-2,570	-4.8
Farm1-5	2.45	2.84	15.7	0.253	0.276	8.9	49,179	53,644	4,466	9.1

Carbon (as well as nitrogen) was lost at all sampling points except for 5. The bulk density calculation showed that more carbon was sequestered in points 1 and 3.

Point one was in buckwheat, point two was in mulched strawberries. Point three is in asparagus. Point 4 was moved slightly, from an unplanted field into vegetable production, which probably accounts for the bulk density difference. Point five was blueberries.

Farm 2

Farm 2 is a garlic farm that was previously several small hay farms. It was most recently inactive farm land, until 2010 when the owner started to grow garlic on it.



Farm	% Soil carbon-Spring 2011	% Soil carbon-Fall 2011	% Diff C	% Soil nitrogen-Spring 2011	% Soil nitrogen-Fall 2011	% Diff N	kg C/ha Spring 2011	kg C/ha Fall 2011	diff kg C/ha	% diff kg C/ha
Farm2-1	3.83	3.66	-4.6	0.340	0.292	-14.1	40,304	77,021	36,717	91.1
Farm2-2	2.91	3.65	25.3	0.253	0.308	21.7	30,228	32,653	2,425	8.0
Farm2-3	3.13	5.13	63.8	0.310	0.486	56.8	41,812	76,672	34,859	83.4
Farm2-4	4.34	2.22	-48.8	0.412	0.201	-51.1	45,020	34,394	-10,625	-23.6
Farm2-5	4.16	3.88	-6.8	0.336	0.314	-6.7	42,632	50,247	7,615	17.9

Carbon values decreased in samples 1, 4 and 5, along with the nitrogen. Calculating kilograms of carbon per hectare, however, shows only sample 4 had an actual loss of carbon between the two sampling dates.

Sample 1 was planted with a mustard cover crop, and then tilled and planted with garlic in the fall. Tillage probably increased the bulk density so much that a decrease in percent carbon becomes a large increase in kilograms of carbon per hectare. Sample 2 and 4 were planted with a rye cover crop in the fall. Sample 3 was in garlic in the spring, and managed intensively (tilled, manure application, cover crops before and after the main crop) all of which resulted in an impressive increase in percent carbon. Sample 5 is an unmanaged grassy area in a riparian zone.

Farm 3

Farm 3 is a therapeutic horsemanship program. It features riding paths, stables, as well as raised beds, berry bushes, and pumpkin patches. We sampled 5 areas, mainly raised beds, where they grow most of their produce, as well as a field for pumpkins and another area with berry bushes.

Farm	% Soil carbon-Spring 2011	% Soil carbon-Fall 2011	% Diff C	% Soil nitrogen-Spring 2011	% Soil nitrogen-Fall 2011	% Diff N	kg C/ha Spring 2011	kg C/ha Fall 2011	diff kg C/ha	% diff kg C/ha
Farm3-1	7.56	8.06	6.5	0.583	0.634	8.8	69,700	72,786	3,085	4.4
Farm3-2	12.07	12.01	-0.5	0.994	0.939	-5.5	48,906	44,609	-4,297	-8.8
Farm3-3	5.94	3.60	-39.4	0.459	0.299	-34.8	48,058	47,483	-575	-1.2
Farm3-4	3.42	4.17	21.9	0.242	0.327	35.2	57,154	63,309	6,155	10.8
Farm3-5	8.61	27.73	222.0	0.707	1.515	114.3	76,661	86,288	9,627	12.6

Samples 2 and 3 decreased in carbon and nitrogen, as well as kilogram of carbon per hectare. Samples 1, 4 and 5 increased in all three categories.

The first two points are in raised beds, filled with composted horse manure. The third point was in a field planted with potatoes. The loss of carbon in sample 3 is probably due to the fact that large quantities of compost had just been applied prior to the spring sampling but not in the fall. The fourth sampling point is under elderberry bushes.

The fifth point was taken in the compost pile and will only serve as a comparison.

Farm 4

This farm is quite diverse, with an organic garden and a hoop house area from which they run a CSA. We sampled the fields that are in conventionally-managed corn and alfalfa that are being transitioned to organic.

Farm	% Soil carbon-Spring 2011	% Soil carbon-Fall 2011	% Diff C	% Soil nitrogen-Spring 2011	% Soil nitrogen-Fall 2011	% Diff N	kg C/ha Spring 2011	kg C/ha Fall 2011	diff kg C/ha	% diff kg C/ha
Farm4-1	1.11	1.10	-0.7	0.112	0.122	8.6	30,894	32,259	1,365	4.4
Farm4-2	0.74	0.71	-4.4	0.073	0.076	4.3	20,912	18,168	-2,744	-13.1
Farm4-3	0.75	0.74	-0.1	0.073	0.085	16.3	21,810	19,798	-2,013	-9.2
Farm4-4	0.99	0.99	0.6	0.103	0.107	4.0	27,900	31,666	3,766	13.5
Farm4-5	1.76	1.79	1.2	0.186	0.194	4.4	41,803	42,769	965	2.3
Farm4-6	1.30	1.18	-9.3	0.139	0.139	0.3	34,873	33,767	-1,106	-3.2
Farm4-7	1.24	1.23	-0.1	0.121	0.125	3.3	34,348	38,944	4,596	13.4
Farm4-8	1.02	1.04	2.4	0.106	0.112	5.6	26,867	33,735	6,868	25.6
Farm4-9	1.23	1.24	1.3	0.135	0.134	-0.6	33,656	38,034	4,378	13.0
Farm4-10	1.32	1.23	-6.7	0.131	0.131	0.1	35,102	37,713	2,611	7.4

Six of the ten samples decreased in carbon. Once bulk density is factored in, however, only 3 samples decreased in kg carbon per hectare. Only one sample decreased in nitrogen.

These samples represent small, standard fluctuations in soil carbon. The nitrogen increase is probably due to the nitrogen-fixing plants such as hay being in rotation. Samples 1 to 4 were on the west side, more recently conventionally managed, and two of four samples decreased in kg carbon per hectare, whereas in samples 5 to 10, only one out of six samples decreased. This may indicate it takes a few years to get consistently improving results from organic practices.

Farm 5

Farm 5 is a large dairy with over 170 acres in rotation. Each field is rotated between three years of crops, such as corn, soybeans, and alfalfa and then one year as pasture, with cows grazing on them.

Farm	% Soil carbon-Spring 2011	% Soil carbon-Fall 2011	% Diff C	% Soil nitrogen-Spring 2011	% Soil nitrogen-Fall 2011	% Diff N	kg C/ha Spring 2011	kg C/ha Fall 2011	diff kg C/ha	% diff kg C/ha
Farm5-1	1.22	1.07	-12.5	0.162	0.154	-5.3	30,660	27,296	-3,364	-11.0
Farm5-2	1.23	1.29	5.1	0.148	0.157	6.0	24,692	25,332	640	2.6
Farm5-3	1.54	0.96	-37.8	0.183	0.122	-33.1	27,648	16,415	-11,233	-40.6
Farm5-4	1.58	1.73	9.8	0.220	0.238	8.2	39,785	41,121	1,336	3.4
Farm5-5	1.27	1.58	25.0	0.145	0.175	20.3	16,061	18,410	2,349	14.6
Farm5-6	1.21	0.91	-24.5	0.161	0.134	-16.4	29,784	24,241	-5,543	-18.6
Farm5-7	1.58	1.40	-11.4	0.187	0.171	-8.2	43,974	39,126	-4,849	-11.0
Farm5-8	1.15	1.27	10.9	0.164	0.166	1.1	33,325	36,639	3,314	9.9
Farm5-9	1.60	1.57	-2.3	0.187	0.187	0.2	43,302	47,344	4,042	9.3
Farm5-10	1.31	1.68	27.9	0.163	0.213	30.6	30,498	46,982	16,485	54.1

Each sample represents a different field, but all the fields are relatively consistently managed. The carbon difference was split half and half between increasing and decreasing in carbon, while nitrogen increased in seven out of ten samples.

While there is no clear upward trend, the average of the difference in carbon is positive, indicating greater increases than decreases in carbon. Nitrogen increased in most samples, most likely dependant on where in the rotation that field was.

Farm 6

Farm 6 is a diverse vegetable/grain farm, featuring everything from apple trees to vegetables to grains to potatoes. This land was a conventional farm and orchard in the 1950s that is now being reactivated.

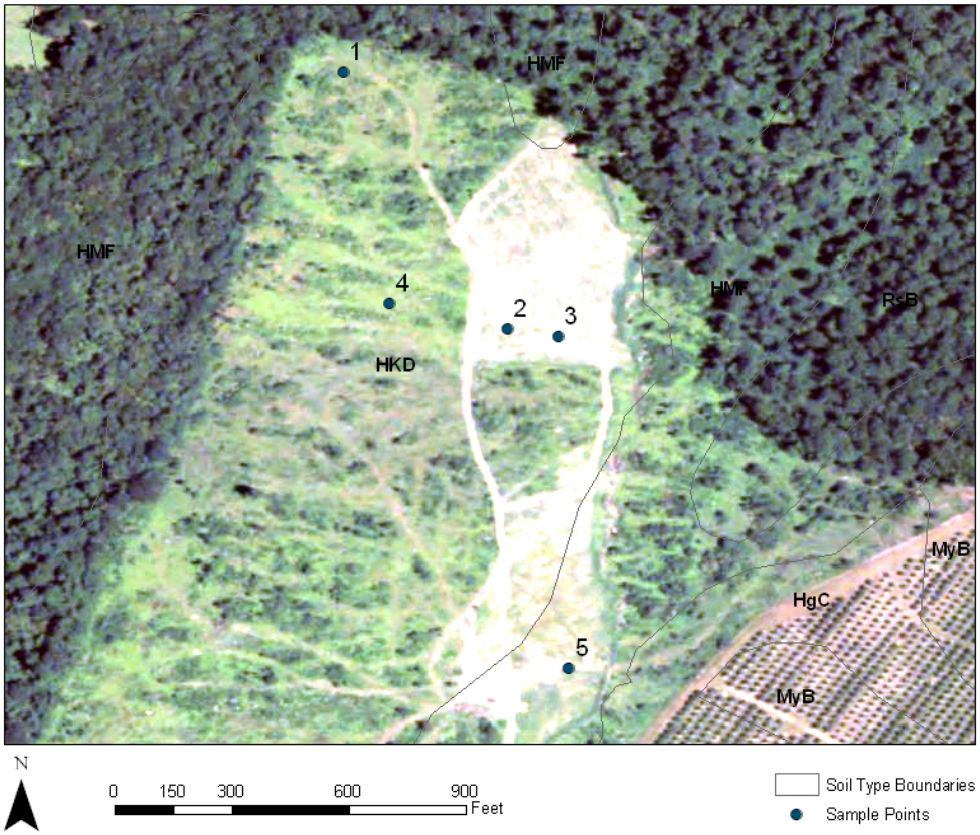
Farm	% Soil carbon-Spring 2011	% Soil carbon-Fall 2011	% Diff C	% Soil nitrogen-Spring 2011	% Soil nitrogen-Fall 2011	% Diff N	kg C/ha Spring 2011	kg C/ha Fall 2011	diff kg C/ha	% diff kg C/ha
Farm6-1	3.19	3.19	0.1	0.318	0.321	1.0	38,819	45,706	6,888	17.7
Farm6-2	4.24	4.43	4.3	0.396	0.399	0.9	45,322	57,537	12,215	27.0
Farm6-3	3.44	3.21	-6.8	0.313	0.308	-1.7	54,722	60,750	6,027	11.0
Farm6-4	2.63	2.24	-14.8	0.252	0.231	-8.5	42,899	32,091	-10,809	-25.2
Farm6-5	2.08	2.09	0.4	0.215	0.223	4.1	31,717	30,191	-1,527	-4.8

Samples 3 and 4 decreased in carbon, as well as nitrogen. Kilograms of carbon per hectare decreased in samples 4 and 5.

Point one is in vegetable production, with cover crops and rotation probably contributing to the modest increase in carbon. Point two is in the garden area, managed carefully and organically for many years by the farmers, which is probably why it is so high in carbon. Point three is in the old orchard area. Point four and five are in potatoes and buckwheat, in a rotation with cover crops.

Farm 7

This land is forest that is being converted into an orchard. Much of this area has been timbered but not cleared enough to be farmed. We sampled areas that were scheduled to be transitioned, but were still covered in stumps and rocks, which occasionally made the sampling a challenge. We sampled five locations, two samples were taken in areas planted with apple and peach trees (2 and 3), two were taken in a hedge-row of native plants to encourage biodiversity (1 and 4), and one was taken in a cleared, unplanted area (5).



Farm	% Soil carbon-Spring 2011	% Soil carbon-Fall 2011	% Diff C	% Soil nitrogen-Spring 2011	% Soil nitrogen-Fall 2011	% Diff N	kg C/ha Spring 2011	kg C/ha Fall 2011	diff kg C/ha	% diff kg C/ha
Farm7-1	3.22	4.74	47.1	0.246	0.370	50.5	28,519	72,978	44,459	155.9
Farm7-2	2.22	2.71	21.8	0.175	0.213	21.6	31,342	31,932	590	1.9
Farm7-3	0.76	1.44	89.3	0.063	0.116	85.7	16,421	23,704	7,283	44.3
Farm7-4	2.75	2.84	3.5	0.212	0.238	12.0	41,761	40,183	-1,578	-3.8
Farm7-5	4.53	5.16	14.1	0.335	0.374	11.7	51,306	50,805	-501	-1.0

For each of the samples, the percentage of carbon and nitrogen increased. However, kg of carbon per hectare decreased in the hedgerow and cleared/unplanted area of samples 4 and 5, due to a decrease in bulk density at those areas.

At this farm, sample 1 was taken in recently cleared land, with lots of branches, stumps, leaves, and rocks. The increase in carbon content is probably due to an increase in the proportion of recent, decayed plant material. Both points two and three saw a large increase in carbon content as well, probably due to the careful management of the trees in that area.

Farm 8

This dairy farm has over 200 acres in use. Fields are rotated between hay, two years of cover crops, which are tilled under, and two years of corn. It was managed conventionally for many years until 15 years ago when the owners switched to intensive grazing and are now making the change to being certified organic.

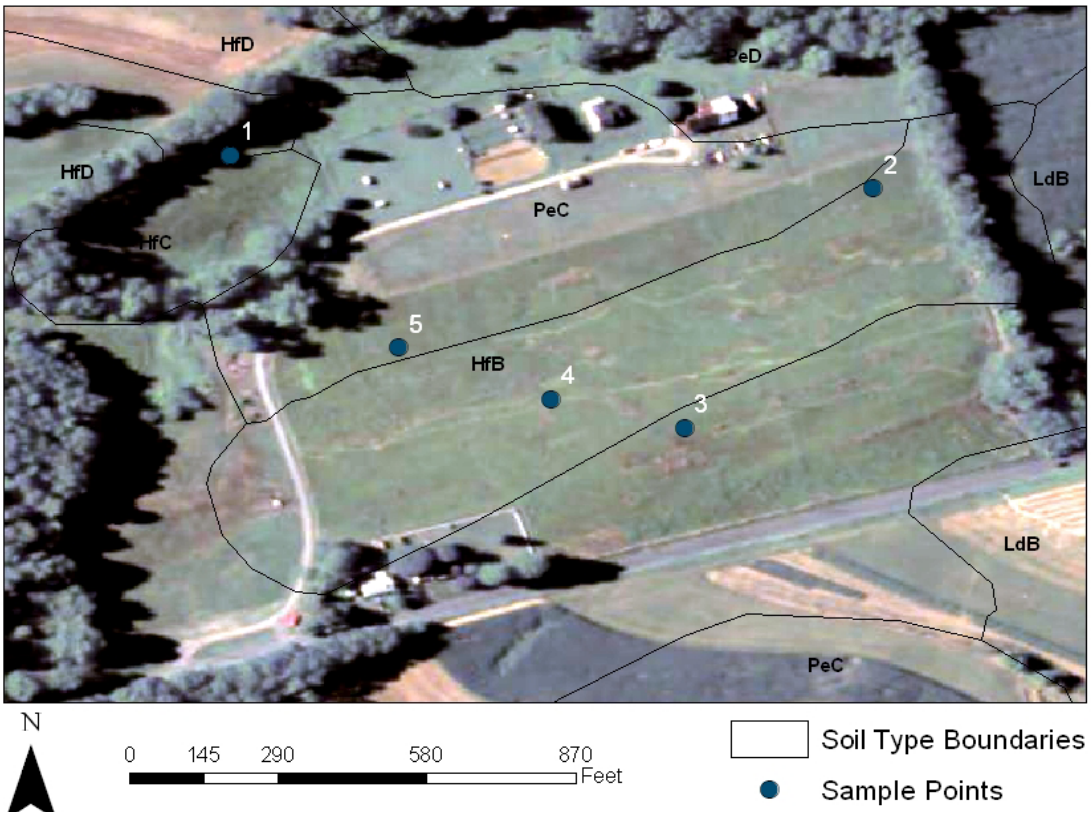
Farm	% Soil carbon-Spring 2011	% Soil carbon-Fall 2011	% Diff C	% Soil nitrogen-Spring 2011	% Soil nitrogen-Fall 2011	% Diff N	kg C/ha Spring 2011	kg C/ha Fall 2011	diff kg C/ha	% diff kg C/ha
Farm8-1	1.54	1.66	7.8	0.181	0.196	8.1	34,712	37,148	2,437	7.0
Farm8-2	1.79	1.86	3.7	0.204	0.212	3.6	40,882	40,497	-385	-0.9
Farm8-3	1.51	1.49	-1.0	0.140	0.147	4.4	39,155	34,822	-4,334	-11.1
Farm8-4	2.28	2.14	-6.4	0.246	0.236	-4.0	44,956	47,176	2,219	4.9
Farm8-5	1.91	1.80	-5.3	0.193	0.195	0.9	46,793	44,648	-2,145	-4.6
Farm8-6	1.34	1.46	9.3	0.148	0.174	17.6	32,215	34,584	2,369	7.4
Farm8-7	2.20	1.99	-9.3	0.222	0.220	-0.9	48,096	42,287	-5,809	-12.1
Farm8-8	1.39	1.45	4.2	0.161	0.170	5.6	37,029	34,341	-2,688	-7.3
Farm8-9	1.65	1.62	-1.7	0.186	0.197	6.0	37,264	36,353	-911	-2.4
Farm8-10	2.22	2.29	3.3	0.249	0.271	8.6	50,787	53,492	2,704	5.3

Carbon changes were split evenly between increase and decrease. Nitrogen increased in all but two samples, 4 and 7. Kilograms of carbon per hectare decreased in six samples but most samples were relatively consistent from the baseline to the follow-up sampling.

Each sample was taken from a different field, but almost all fields are rotated and managed similarly.

Farm 9

This is a grass-fed beef operation with several pasture areas. We sampled five locations, all in pasture fields transitioning from fallow fields that were in a conservation program.



Farm	% Soil carbon- Spring 2011	% Soil carbon- Fall 2011	% Diff C	% Soil nitrogen- Spring 2011	% Soil nitrogen- Fall 2011	% Diff N	kg C/ha Spring 2011	kg C/ha Fall 2011	diff kg C/ha	% diff kg C/ha
Farm9-1	1.09	0.98	-10.0	0.132	0.105	-19.9	24,020	16,968	-7,052	-29.4
Farm9-2	1.20	1.62	34.6	0.140	0.173	23.0	27,685	29,381	1,696	6.1
Farm9-3	1.27	1.19	-6.5	0.146	0.132	-9.6	28,397	24,829	-3,568	-12.6
Farm9-4	1.20	1.26	5.0	0.119	0.137	14.7	31,528	28,220	-3,307	-10.5
Farm9-5	1.27	1.34	5.7	0.143	0.151	5.7	31,464	28,458	-3,006	-9.6

Two out of five samples decreased in carbon, and one decreased in nitrogen. However, calculating in bulk density, all but one sample was lower in kilograms of carbon per hectare than it had been at the baseline sampling.

Sample one was taken in a smaller, less-managed field that has been in a conservation program for 8 years. Other than that, a general average increase in % carbon is evident. However, the sample areas have all been planted with grasses and are relatively unmanaged as they are still, for one more year, enrolled in the conservation program.