

# AGRICULTURAL RESOURCES

The following Supplemental Materials (created 10/9/13) of the Agricultural Resources Section of the Durham Master Plan 2015 are available to provide valuable background information that helped generate the conclusions and perspectives of this chapter:

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## I. An Agrarian Vision is Returning to Durham

While NH does not grow a large percentage of food consumed locally, NH and New England rank high nationally in the direct marketing of farm products, i.e., products sold through farmers’ markets, farm stands, and pick your own fruits and vegetables. “Direct marketing accounts for 12% of NH farm food sales, in sharp contrast to 0.5% at the national level.”<sup>1</sup> The State of New Hampshire had the highest percentage of farms with direct sales in the nation in 2007 and counties in Seacoast, NH are among the top 1-2% in rankings in the US for the amount of farm to market activity.<sup>1</sup> Today’s farms tend to be more diversified and relatively smaller, at least smaller than in the recent past. Ornamental horticulture is now a top industry sector. According to the US Census of Agriculture, the number of farms in New Hampshire went up from 2002 to 2007, including in Strafford County where the number of farms increased by nearly 8% from 281 to 303. At the same time, the acreage of farms in Strafford County decreased by more than 23%.

Today, agricultural activity in Durham is taking place throughout Town – on land farmed by several generations of the same family, in backyards, on town-owned land, and across the UNH campus. Horses, sheep, pigs, beef and dairy cattle, llamas, chickens, bees, honey, maple syrup, oysters, trees and shrubs, lumber and firewood, hay, and hundreds of varieties of fruits and vegetables are all raised and produced in Durham. Many farmers are part timers with other *day jobs* to support their living in Durham.

**Table 1. State profile of farms, acres of farmland, and average farm size.**

<b>New Hampshire Agriculture – State Profile</b>			
	<b>2002</b>	<b>2007</b>	<b>% Change</b>
<b>Number of Farms</b>	3,363	4,166	24
<b>Land in Farms</b>	444,879 acres	471,911 acres	6
<b>Average Size of Farm</b>	132 acres	113 acres	-14

Source: 2007 US Census of Agriculture

According to Durham’s Agricultural Commission, there are at least 48 active farms identified in Durham. According to the Strafford Regional Planning Commission’s 2010 land use study, agricultural lands, including fields, pastures, row crops, and orchards, made up more than 1,288 acres in Durham. Farm buildings make up another 47.6 acres. Together, they occupy 9.3% of the Town’s total acreage.

Farming activities are conducted on variously sized properties throughout Town. The smallest is only 0.20 acres. The largest is over 108 acres. The average is 13.7 acres and the most common size is 1-2 acres, relatively modest establishments that reflect the family farm nature of most agriculture in Durham. Nearly a fifth (18.2%) of Durham’s

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<sup>1</sup> Home Grown Local Food Systems in New Hampshire: Current Status and Prospects for Growth. Food Solutions New England, University of New Hampshire Office of Sustainability, April 2010.

land has prime farmland soils; more than a quarter (26%) is farmland soils of local importance; and 2.7% is farmland soil of statewide importance – nearly half of Durham is made up of good soils for agriculture. See Figure M-11 Soils.

There are 21 farmland only parcels in the Town's Current Use Assessment, covering 228.7 acres or 2.4% of the Town's total acreage. Another 53 parcels are designated farmland with other current uses, comprising 2,048.2 acres or 14.3% of the Town's total acreage. Together they represent 14.3% of the Town's total acreage.

There are 5 oyster operations off Durham's shores, the oldest receiving its license in 2009. The operations cover 16.6 acres.

Community gardens are thriving in Durham. The largest is operating at Wagon Hill Farm and involves over 50 families. Begun in 2009, the gardens at Wagon Hill are cultivated by people of all ages, including Oyster River High School and UNH students. The Church Hill Apartments at the Durham Community Church), Canney Farms, and Fitts Farm Association maintain community gardens for residents. St. George's Episcopal Church recently sited a community garden on its property.

Community interest in locally produced food includes the food consumed by students and teachers in the Oyster River Cooperative School District (ORCSD). The ORCSD Sustainability Committee includes a food and nutrition subcommittee which is overseeing the development of both teaching and production gardens at each of the District's schools. Funds have been allocated from the ORCSD budget to purchase food from local farms to supply the four school cafeterias. In addition, the ORCSD is establishing a program to compost cafeteria food waste.

Retail grocers and restaurants in Durham now have contracts to sell and serve food from local area farms. In addition, the Seacoast Growers Association (SGA) manages a June through October, one day a week marketplace, one of four area Farmers' Markets, in Durham. The Farmers' Market provides an outlet for fresh local produce, handcrafted goods, and homemade foods and beverages. SGA's Market in Durham is made up of 20 vendors (25 signed up for the 2013 season) who sell berries, fruits, vegetables, flowers and plants, dairy, meat, eggs, fish, honey, syrup, prepared foods, cider, tea, wine, and certified organic products. Recently, Cedar Point Shellfish announced that it has started to bring its first oyster harvest to the Market. Steve Weglarz, owner of Dear Point Shellfish with a background in salmon aquaculture, now prefers to raise oysters because they provide ecosystem services, filtering and cleaning the water in Great Bay as they grow.

Seacoast Growers Farmers' Market in Durham is located in the parking lot at the Durham Town Offices. The Seacoast Growers Farmers' Market in Durham also provides an outlet for the region's fisheries.

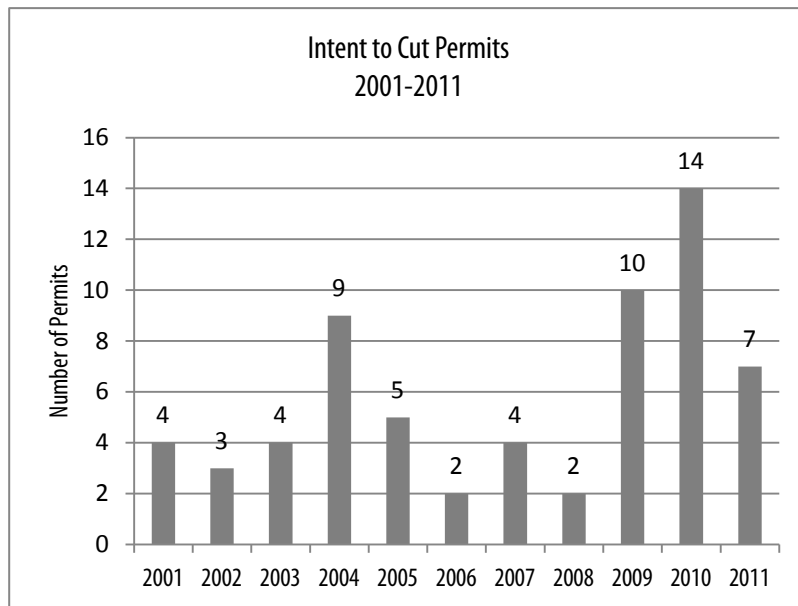
The US Department of Agriculture, other federal and state agencies, and nonprofit groups are working together to help communities build and strengthen local and regional food systems and support small and mid-sized farmers struggling to get their products to market quickly and efficiently. One answer is the creation of *food hubs*. A food hub is defined as a centrally located facility with a business management structure facilitating the aggregation, storage,

processing, distribution, and/or marketing of locally and regionally produced food products. By actively coordinating these activities, food hubs connect growers to local groceries, restaurants, community organizations, and institutions to make local and healthy food more accessible to consumers. As interest, market demand, and production of local and regional agricultural products and food continues to grow, so will the need for organized infrastructure systems, such as food hubs. Activities being initiated by the ORCSD are the beginnings of a food hub in our region. With organized support, it could be leveraged into more than a *buyers' club*.<sup>2</sup>

There are 8,418 forested acres in Durham, 58.8% of the Town's total land area. There are 129 parcels listed as forestry in the Town's Current Use Assessment, covering 2,568 acres or 17.9% of the Town's total land area. Another 89 parcels are designated as forestry with other current uses, covering 2,791 acres or 19.5% of the Town's total land area. Between 2001 and 2011, the Town issued *intent to harvest* 64 permits for some or all of 69 parcels. Of those, all or portions of 10 parcels were harvested. See Figure M-13 Forest Resources.

A glance at Durham's Land Use Map quickly illustrates the extent of forested land cover in the community. There are 8,418 acres of forested land, nearly 60% of the Town's land area. See Figure M-16 Land Use for more information.

**Figure 1. Intent to cut permits**



<sup>2</sup> A buyers club is defined as “Any person, firm, or corporation, which in exchange for any valuable consideration offers to sell or to arrange the sale of goods or services to its customers at prices represented to be lower than are generally available.” North Carolina General Statutes, Chapter 66, Article 22 1. “A group that includes the bulk “purchase at one time, and often at a reduced price, of a large quantity of a particular commodity; the purchase of the whole or greater part of the output of a commodity of a country or state by a single buyer, usually another country or state; state trading.” English Collins Dictionary – English Definition & Thesaurus.

## II. Agricultural Commission’s Baseline Inventory

In 2012, the Durham Agricultural Commission conducted a windshield survey of agricultural resources in Durham. The survey identified the following types of vegetable and fruit farming, animal husbandry, forest agriculture, aquaculture, and agricultural support in Durham:

**Table 2. Agricultural products and farming in Durham<sup>3</sup>**

Vegetables – vegetables including corn and pumpkins
Fruit – apples, blueberries, grapes, strawberries
Animals – beef cattle, bison, chickens, dairy cattle, goats, horses, sheep, eggs, yarn, bees, breeding stock, market lambs
Forest Resources – Christmas trees, firewood, timber
Aquaculture – oyster research
Agricultural support – hay, silage, compost, sawmill, grain dealer
Other – honey, flowers

**Table 3. Types of farms in Durham**

Community garden	Horticultural
Greenhouse	Raised beds
Horse	Student organic garden

**Table 4. Types of farm landscapes in Durham**

Conservation forest	Old pasture
Mixed woodland	Open pasture
Old field	Pond
Old fruit tree	Row crops

The survey also identified land owned by the Town, UNH, NH Fish and Game, The Nature Conservancy, and Mill Pond Center.

The Agricultural Commission anticipates updating the windshield survey in 2013.

## III. Farmland and Forest Soils

There are three levels of prime agricultural soils: prime farmland soils (national), farmland of statewide importance, and farmland soils of local importance. It is important to identify where these soils are for the purpose of carrying out

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<sup>3</sup> Locally grown and harvested oysters, part of the Oyster Restoration Program, are now available at the Durham Farmers’ Market.

the provisions of the New Hampshire Farmland Protection Policy Act of 1981, P.L. 97-98, December 22, 1981. Unfortunately, soils that are prime for agriculture are also, for the most part, prime for septic systems and development. Thus, these soils are some of the most threatened in Durham. Once the soil is developed into housing lots, driveways, parking lots, etc. it is essentially lost for agricultural purposes. The Farmland Protection Policy Act of 1981 was established to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses and to assure that federal programs are administered in a manner that, to the extent practicable, will be compatible with state and local government and private programs and policies to protect farmland.

Prime farmland soils are defined at a national level as land that has the best combination of physical and chemical characteristics for sustained high yields. Farmland soils of statewide importance are lands determined by the State to be nearly prime farmland and that economically produce high yields of crops. Farmland soils of local importance are determined by the local National Resource Conservation Service (NRCS) district.

Prime farmland soils can be used to grow commonly cultivated food and fiber crops throughout the country. Sites represent a special combination of soil quality, location, growing season and moisture supply needed to economically produce sustained high quality and/or high yields of commonly cultivated crops when treated and managed according to acceptable farming methods.

While less productive than farmland soils of statewide importance, soils that are important statewide can be used for the production of food, feed, fiber, forage and oilseed crops. Criteria for defining and delineating farmland of statewide importance are determined by a state committee chaired by the Commissioner, New Hampshire Department of Agriculture, Markets and Food, with members representing the University of New Hampshire Cooperative Extension, New Hampshire Association of Conservation Districts and the New Hampshire Office of State Planning. The Natural Resources Conservation Service (NRCS) State Soil Scientist serves on this committee in an advisory capacity.

Farmland soils of local importance are not prime or of statewide importance, but have local significance for the production of food, feed, fiber and forage. Criteria to identify and delineate farmland soils of local importance are determined on a county-wide basis by individual County Conservation District Boards.

Forest soils are designated by county. They are identified as one of six groups – IA, IB, IC, IIA, IIB, and NC.

**Table 5. Soil group descriptions from the NRCS New Hampshire Soil Attribute Data Dictionary (June 8, 2001)**

Soil Group	Description
IA	Soils consist of the deeper, loamy textured, moderately well, and well-drained soils. Generally, these soils are more fertile and have the most favorable soil moisture relationships. The successional trends on these soils are toward stands of shade tolerant hardwoods, i.e., beech and sugar maple, less tolerant northern red oak. Due to higher moisture holding capacity and fertility of these soils, sugar maple, white ash, and yellow birch are more abundant on these soils.

Soil Group	Description
	Successional stands frequently contain a variety of hardwoods such as northern red oak, beech, sugar maple, red maple, white birch, gray birch, black birch, yellow birch, aspen, white ash, and black cherry in varying combinations with white pine and hemlock. At higher elevations, some red spruce and balsam fir may be found
IB	Soils are generally sandy or loamy over sandy textures and slightly less fertile than those in group IA. These soils are moderately well and well drained. Soil moisture is adequate for good tree growth, but may not be quite as abundant as in group IA soils. Soils in this group have successional trends toward a climax of tolerant hardwoods, predominantly beech. Successional stands, especially those which are heavily cutover, are commonly composed of a variety of hardwood species such as red maple, aspen, paper birch, yellow birch, sugar maple, and beech, in combinations with red spruce, balsam fir, hemlock, and white pine. Hardwood competition is moderate to severe on these soils. Successful softwood regeneration is dependent upon hardwood control.
IC	Soils are outwash sands and gravels. Soil drainage is somewhat excessively to excessively drained and moderately well drained. Soil moisture is adequate for good softwood growth, but is limited for hardwoods. Successional trends on these coarse textured, somewhat droughty and less fertile soils are toward stands of shade tolerant softwoods, i.e., red spruce and hemlock. White pine, red maple, aspen, paper birch, and grey birch are common in early and mid-successional stands. Hardwood competition is moderate to slight on these soils. Due to less hardwood competition, these soils are ideally suited for softwood production. With modest levels of management, white pine can be maintained and reproduced on these soils. Because these soils are highly responsive to softwood production, especially white pine, they are ideally suited for forest management.
IIA	Soils include many of the same soils as in groups IA and IB. However, these mapping units have been separated because of physical limitations which make forest management more difficult and costly, i.e., steep slopes, bedrock outcrops, erosive textures, surface boulders, and extreme rockiness. Usually, productivity of these soils is not greatly affected by their physical limitations. However, management activities such as tree planting, thinning, and harvesting are more difficult and more costly. Due to the diverse nature of this group, it is not possible to generalize about successional trends or to identify special management opportunities.
IIB	Soils are poorly drained. The seasonal high water table is generally within 12 inches of the surface. Productivity of these poorly drained soils is generally less than soils in other groups. Successional trends are toward climax stands of shade tolerant softwoods such as hemlock. Red maple is common on these soils. Red maple cordwood stands or slow-growing hemlock sawtimber are common. However, due to poor soil drainage, forest management is somewhat limited. Severe windthrow hazard limits partial cutting, frost action threatens survival of planted seedlings, and harvesting is generally restricted to periods when the ground is frozen.
NC	Soils are either so variable or have such a limited potential for commercial production of forest products they have not been considered. Often an on-site visit would be required to evaluate the situation.

Source: New Hampshire Natural Resources Conservation Services. New Hampshire Soil Attribute Data Dictionary. June 8, 2001.

## IV. Wagon Hill Garden Inventory 2012

**Table 6. Inventory of produce and ornamental plants grown at Wagon Hill Farm in 2012**

<b>Fruit</b>	<b>Ornamentals</b>	<b>Greens</b>	<b>Herbs</b>	<b>Vegetables</b>
Cantaloupe	Cosmos	Arugula	Basil	Acorn squash
Raspberries	French Mallow	Chard	Borage	Asparagus
Rhubarb	Marigold	Kale	Catnip	Beans (fresh & dried)
Strawberries	Nasturtiums	Lettuces	Chamomile	Beets
Watermelon	Poppies	Mesclin mix	Chives	Broccoli
	Primrose	Spinach	Cilantro	Brussels Sprouts
	Sunflowers		Dill	Butternut squash
	Zinnias		Feverfew	Cabbage
			Ginger	Carrots
			Hops	Cauliflower
			Lemon Balm	Celeriac
			Lavender	Celery
			Mints	Corn
			Mustard	Cucumbers
			Parsley	Delicata squash
			Oregano	Eggplant
			Rosemary	Garlic
			Sage	Kohlrabi
				Leeks
				Lima beans
				Onions
				Pattypan squash
				Peas
				Peppers (hot & sweet)
				Potatoes
				Pumpkins
				Sweet potatoes
				Tomatoes
				Tomatillo
				Yellow summer squash
				Zucchini

Source: Durham Agricultural Commission, 2013



## V. Durham Farmer's Market

The Seacoast Growers Association (SGA) has provided the seacoast region of New Hampshire with a marketplace for fresh local produce, handcrafted goods, and homemade foods and beverages since 1977. Today, it manages four area Farmers' Markets, including a weekly Farmers' Market in Durham that is open from June through October. Seacoast Growers includes over fifty vendors from Rockingham, Strafford, or York (Maine) counties to provide the "best local goods available." Durham's Market is made up of 20 vendors who sell berries, fruits, vegetables, flowers and plants, dairy, meat, eggs, fish, honey, syrup, prepared foods, cider, tea, wine, and certified organic products. Durham's Market is located in the parking lot at the Durham Town Offices.

**Table 6. Summary of farms at the Durham Farmer's Market (not all farms are listed)**

<b>Farms at Durham Market</b>	<b>Berries, Fruits, and Vegetables</b>	<b>Flowers and Plants</b>	<b>Dairy, Meat, Eggs, and Fish</b>	<b>Honey and Syrup</b>	<b>Prepared Foods</b>	<b>Cider, Tea, and Wine</b>
<a href="#">Applecrest Farm Orchards</a>	X	X	X	X	X	X
<a href="#">Burnt Swamp Farm</a>	X		X			
Cedar Point Shellfish						
<a href="#">Cracked an Egg Farm</a>	X		X	X		
<a href="#">Forty Five Market Street Bakery and Cafe</a>					X	
<a href="#">Hollister Family Farm</a>	X	X	X	X		
<a href="#">McKenzie's Farm</a>	X	X				
<a href="#">Mildred's Drumlin Farm</a>	X	X				
<a href="#">Moriarty's Greenhouse</a>		X				
<a href="#">New Roots Farm*</a>	X		X			
<a href="#">Nottingham Orchard*</a>	X					X
<a href="#">Popper's Artisanal Meats</a>			X		X	
Shagbark Farm*						
<a href="#">Stout Oak Farm*</a>	X	X				
<a href="#">Sugarmomma's Maple Farm</a>	X		X	X	X	
<a href="#">Sweet Baby Vineyard</a>						X
<a href="#">Wake Robin Farm</a>	X	X				
*certified organic	Source: Seacoast Growers Association					

## VI. Food Hubs

The USDA defines a food hub as a “centrally located facility with a business management structure facilitating the aggregation, storage, processing, distribution, and/or marketing of locally/regionally produced food products.”

In 2012, the Community Health Institute/JSI Research & Training Institute reported on its research about NH’s food system, including a feasibility study for the development of a food hub, in *The Intersection of Producers and Consumers within New Hampshire’s Food System*. With the International Institute of NH, they conducted a 31-question survey of NH’s producers and consumers. “About half the producers (51%) said that the time required to coordinate distribution limited their ability to distribute their products. In addition, numerous institutional buyers voiced frustration that the only way to offer locally produced products was for their employees to collect them from the farm. Several regions around the state are currently working on developing food hubs, both formally and informally.”

An important component of food hubs in NH are CSAs. According to the NH Department of Agriculture, there were 47 CSAs in NH in 2011 and 7% percent of consumers identified CSAs as their primary means of accessing local foods. Many suggested ways to improve CSAs to make it easier to “purchase local food, including offering more pickup locations at workplace hubs, having smaller portions available, and offering a wider variety of products (e.g., meat, dairy, and produce).”

**Table 7. Summary of Recommendations**

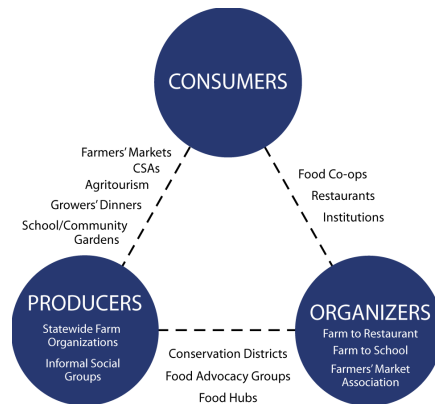
	<b>Recommendation</b>	<b>Practice</b>	<b>Program</b>	<b>Policy</b>
<b>Producers</b>	Enhance Educational and Workforce Development Opportunities		X	
	Connect New Farmers to Land	X	X	X
	Support and Foster Strategies to Maximize New Hampshire’s Growing Season		X	
	Expand In-State Capacity for Meat Processing and Inspection		X	X
<b>Consumers</b>	Increase Efforts to Educate Consumers	X	X	X
	Strengthen Direct Sales Models	X		
	Improve Access to Locally Produced Foods for Low Income Consumers		X	X
<b>Cross-Cutting</b>	Support Multifunctional Farming Approaches	X		X
	Develop Distribution Systems to Meet the Larger Scale Needs of Institutions	X	X	
	Enhance Opportunities to Foster Farm To Institution Programs	X	X	X
	Increase Marketing and Agritourism Efforts	X	X	
	Promote Cross-Fertilization of Ideas, Activities, & Information Across System Levels	X	X	X
	Develop & Communicate Evidence of the Value of Sustainable Local Food Systems	X		X
	Foster Collaboration among Food Systems and Public Health Systems	X	X	X

Source: LaFave, Lea Ayers, PhD, RN, and Alyson Cobb, BA. *The Intersection of Producers and Consumers within New Hampshire’s Food System*. Community Health Institute/JSI Research & Training Institute, Inc. December 2012.

A system of food hubs could make distribution of locally produced agricultural products much easier for both producers and consumers. In the Community Health Institute survey, 82% of producers they would be interested in selling to a food hub. In a survey of institutions like child care centers, schools, hospitals, nursing homes, restaurants, and others in southern NH that was conducted by the International Institute of NH, 82% said they would buy more local food if they could go through a food hub. A food hub can also help both farmers and institutions save time as institutions could work with groups of local farmers rather than with numerous individual farmers. In some cases, schools and hospitals can provide some functions of food hubs, such as farmers’ markets, CSA pick-up points, and educational activities related to healthy eating or preparing fresh foods.

A food hub can help individual farmers by sharing equipment and cold storage facilities that may enhance larger scale, value added production. A food hub may also help ensure that bulk quantities and a consistent supply of agricultural products are available beyond a short harvest season. See description of Coastal Farms and Foods below.

**Figure 2. Food hub diagram**



Source: LaFave, Lea Ayers, PhD, RN, and Alyson Cobb, BA. *The Intersection of Producers and Consumers within New Hampshire's Food System*. Community Health Institute/JSI Research & Training Institute, Inc. December 2012.

*“Farmers don’t want to leave the farm, chefs don’t want to leave the restaurants – a food hub can address this!”*

### HERON POND FARM, SOUTH HAMPTON AND KENSINGTON, NH

Heron Pond Farm produces over 250 varieties of 35 fruits and vegetables, as well as a large variety of herbs and flowers, oats, eggs, and milk and goat milk and cheese. According to its web site, Heron Pond farmers practice sustainable agriculture for local consumption “in pursuit of our commitment to building community through local agriculture.” The farm offers both a summer and winter CSA, with pick ups in Portsmouth, Dover, and 7 days a week at the South Hampton farm stand. It also offers pick-your-own in season and participates in the summer farmers’ markets in Dover, Exeter, Portsmouth, Wentworth Greenhouses-Rollinsford, and Newburyport and the winter Seacoast Eat Local markets in Exeter and Rollinsford. Heron Pond Farm offers a year round, locally sourced food market in Kensington, NH. The Kensington market offers frozen foods, coffee, tea, and fresh baked goodies from local purveyors. In addition, it also includes a community kitchen that provides catering and other services also hosts a community space with yoga, wellness education, and events celebrating local agriculture on the second floor of the year round retail outlet.



## COASTAL FARMS AND FOODS, BELFAST, ME

Coastal Farms and Foods is an incubator business that serves as a food hub for farmers and food processors within a 50-mile radius in Midcoast Maine. Coastal Farms and Foods is housed in a 50,000 square foot former sardine packing space. At the urging of Jan Anderson, a Belfast City Councilor and future founder of the food hub, the City and the county USDA organization Time and Tide conducted a feasibility study to answer the question of whether there was the capacity to increase farm production in the region and, if so, what stood in the way. 90% of the farmers that responded to the survey said they curtailed production because of a lack of appropriate, climate-controlled storage facility and food processing facility in the region. Ultimately, local investors and a loan from Farmer Credit Union allowed for a \$2 million renovation of the facility and in June, 2011 Coastal Farms and Foods was incorporated in Maine.

Today, Coastal Farms and Foods rents space for dry, state of the art frozen food storage, a shared use kitchen as well as processing, canning, and freezing infrastructure for berry growers, farmers, food processors and food entrepreneurs. Coastal Farms and Foods does not replace existing grocery stores, food coops, farmer's markets, or CSA's. Instead, it provides an additional market for locally-grown produce that is less than perfect, increasing farm income and contributing to the security of farmland for farming.

By offering dry storage for farm products, Coastal Farms and Foods is extending the processing season to twelve months and allows producers to work year round. Coastal Farms and Foods also provides frozen storage for seafood and value-added potatoes, broccoli and carrots, blueberries and cranberries. Coastal Farms and Foods processes create frozen berries, frozen vegetables, canned tomato products, canned soups, frozen soups, and frozen entrees from raw ingredients grown in the region. Every entrepreneur *must* obtain his or her own food processing license and *insurance to rent* space in the shared kitchens.

Facility Prior to Construction



Facility Today



Sources:

Coastal Farms and Foods, Belfast Maine <http://www.coastalfarmsandfoods.com/>

<https://www.facebook.com/heronpondfarm>

[http://www.seacoastlocal.org/seacoastharvest/index.php?page=farm&farm\\_id=75](http://www.seacoastlocal.org/seacoastharvest/index.php?page=farm&farm_id=75)

LaFave, Lea Ayers, PhD, RN, and Alyson Cobb, BA. *The Intersection of Producers and Consumers within New Hampshire's Food System*. Community Health Institute/JSI Research & Training Institute, Inc. December 2012. [http://hfhpccoalition.org/wp-content/uploads/2013/04/Intersection-of-Producers-and-Consumers-Within-NHs-Food-Sys\\_FINAL.pdf](http://hfhpccoalition.org/wp-content/uploads/2013/04/Intersection-of-Producers-and-Consumers-Within-NHs-Food-Sys_FINAL.pdf)

<http://www.newburyportnews.com/local/x1746091259/Growth-headFeature36-bhf-spurt?mobRedir=false>

## VIII. Current Use Tax Designation and Intent to Harvest Permits<sup>i</sup>

In 1973, the NH Legislature adopted current use assessments to provide a property tax incentive to landowners who assess these lands based on their capacity to produce income based on their current uses or undeveloped state. According to NH Space, a not-for-profit (501(c)(4) coalition of natural resource conservation organizations, agricultural groups, recreational user groups, and concerned landowners and individuals, current use is the “cornerstone of the state’s land conservation efforts, with over half the land in New Hampshire enrolled in this valuable program.”

Under the state’s Current Use Program, there are three different classifications of current use – farmland, forest land, and unproductive land. Forest land has three sub-classifications – hardwood, white pine, and all other. Wetland is a sub-classification of unproductive land. Most parcels in Durham that have a current use designation have a combination of more than one current use classification on the same property. These combinations are identified on the land portion of the Town’s assessment record card.

Based on statistics provided by the NH Department of Revenue Generation, there were approximately 6,921 acres of current use designated in Durham in 2002; approximately 5,980 acres in 2011. There was a slight increase in current use acreage between 2002 and 2003 (approximately 175 acres), but a continuous loss in designated acreage since then, resulting in a reduction in current use designated acres of nearly 890 acres between 2002 and 2011. The most significant delisting involved approximately 660 acres in the forest land designation. There was also about 79 acres of agricultural land delisted, about 29 acres of wetlands delisted, and about 13 acres of unproductive land delisted in Durham. See Figure M-14 Current Use.

Durham requires those intending to cut forest land to notify the Town. Between 2001 and 2013, there were 65 intent to cut notifications, involving 70 parcels. Not all of these parcels nor all of the land included in these parcels were actually cut.

**Table 8. Current Use Assessment Value**

<b>Durham’s Current Use Assessment Ranges, 2012-2013</b>		
<b>Farmland</b>	\$25 - \$425 per acre	-
<b>Forest land</b>	With Documented Stewardship	Without Documented Stewardship
White Pine	\$91 - \$137 per acre	\$125 - \$188 per acre
Hardwood	\$31 - \$46 per acre	\$47 - \$71 per acre
<b>Unproductive land</b>	\$20 per acre	-
<b>Wetland</b>	\$20 per acre	-

Source: Durham Town Assessor, 2013

Sources:

<http://www.nhspace.org>

[http://www.revenue.nh.gov/munc\\_prop/current\\_use/reports.htm](http://www.revenue.nh.gov/munc_prop/current_use/reports.htm)

Durham Town Clerk

## IX. Cost of Serving Farms VS Revenue Generated

On its website, the NH Office of Energy and Planning has posted a cost of community service study methodology, which attempts to shed some light on how different types of land use affect a community's fiscal position (see <http://www.nh.gov/oep/resourcelibrary/referencelibrary/c/costofcommunityservicesstudy/index.htm>). The studies provide a snapshot of the net fiscal costs of broad categories of land uses (i.e., residential, commercial, etc.), for a single year. The methodology was developed by the American Farmland Trust which, in general, found that agricultural uses generally generate more revenue than they require in public service expenditures. Unfortunately, the methodology is limited in assessing agricultural uses – often failing to acknowledge workers or residents living on farms. Predictably, overall costs associated with these uses will be low, a little higher than leaving the land in a natural state but, for the most part, well below other forms of *development*.

UNH Cooperative Extension and Rockingham County Conservation District recently conducted a cost of community service study for the towns of Fremont and Deerfield. The Extension Service also helped Stratham complete a similar study and Kingsley completed a study in Dover in 1993. Open space lands in the Deerfield, Fremont, and Stratham studies were defined as those lands enrolled in the Current Use Assessment program. Dover also included lands eligible to be enrolled in the Program. In each community, revenues exceeded expenditures in the open space category. In Fremont expended 36 cents, Stratham 40 cents, Deerfield 35 cents, and Dover 94 cents for each dollar of revenue generated.

Durham has not conducted a cost of community service analysis.

## X. Why Do We Need to Enhance and Protect Durham's Working Landscape?

Durham's agricultural heritage goes back almost three centuries. It remains visible today in the working landscape that exists on the UNH campus and throughout the community in various locations. Increased awareness of the importance of local agriculture and access to locally grown food and agricultural products underpins strong citizen support for the maintenance and promotion of actively managed farm and forest land as well as backyard and community gardens.

Durham's working landscape is its wealth. It is or can be a source of food, a source of fuel, a source of jobs and income, a source of physical recreation, a source of pleasure, and, given its immediate location all around us, an important influence on our psyche and our spirit.

Furthermore, distance is money. Thus, that which is immediately at hand, that which is geographically and physically closer to us than are other places, holds a special value for us.

Reflecting resident support, the Durham Town Council, joining 35 or more New Hampshire towns, established an Agricultural Commission in July 2011. The Appendix includes a copy of Resolution 2011-14, which established the

Commission. The goal of the Agricultural Commission is to “promote the production, availability, and sale of locally grown food, fiber, and forest products” in Durham. The Commission has embraced the charge, prescribed by NH RSA 674:44-f, to encourage farming, forestry, and gardening throughout Town, including on private, Town, and state property. As part of its charge, the Commission has and/or may conduct surveys; prepare inventories; conduct activities to “recognize, promote, enhance, and encourage agriculture, agricultural resources, and agricultural-based economic opportunities;” assist the Planning Board with the Master Plan; advise local agencies and boards on matters potentially affecting agricultural resources, coordinate activities with service organizations and nonprofit groups, publicize and report on its activities; hire consultants and contractors, receive gifts to assist with its purpose, and hold meetings and hearings.

Today, local regulations allow agriculture in some zones and not in others. Commercial agriculture, commercial animal husbandry, plant nurseries, forestry, and temporary sawmills are permitted in all Research/Industry Zones, except for the Durham Business Park, as well as in the Rural and Residence C Zones (forestry is also allowed in Residence A and B Zones), but are not permitted in Retail/Commercial Zones. Kennels and stables are generally conditional uses in these districts, though stables are permitted in both Rural and Residence C Zones. Retail sale of farm products is conditional in the Rural and Residence C Zones and is permitted in the Research/Industry Zones.

Animal husbandry, in general, is subject to greater regulation and scrutiny than plant-based agriculture or forestry, in spite of the reality that the tradition and survival of agriculture in New England highly integrates plant and animal agriculture and is essential to support plant agriculture. Recent experiences with developing ordinance provisions that allow chickens in backyards demonstrate the tensions associated with expanding animal husbandry in Durham. The Town needs to continue to modify regulations to promote the expansion of local agriculture by allowing animal agriculture more broadly in the community while protecting immediate neighbors from unreasonable impacts. The Agricultural Commission has a role to play in educating residents about how local food can be produced in neighborhoods throughout Durham.

## **ECONOMIC AND SECURITY BENEFITS OF COMMUNITY AND REGIONAL FOOD PLANNING**

Olivier DeShutter, United Nations Special Rapporteur, in an address on the Right to Food at Tufts University on November 2012, asserted that all persons have a basic right to have access to adequate and nutritious food. This right is based on the 1948 Universal Declaration of Human Rights, written largely by the US Delegation to the United Nations under the leadership of Eleanor Roosevelt. Thus it follows that all persons have a right to produce food to feed themselves and their neighbors. Food is a sustaining and enduring necessity of life; it is required on an ongoing basis for us to survive. Yet among the basic essentials for life – air, water, shelter, and food – only food has been largely absent over the years as a focus of professional planning interest. Yet recently, numerous concerns about food sources and production have emerged – food safety and contamination; the high demand for energy to produce and transport products; the need to protect land, water, and air; challenges to the bee community, among others. The

focus of planners and decision makers at all levels of government are directing attention to the importance of local and regional food planning.

**Food safety** – refers to growing, handling, preparation, storage and transportation of food in ways that prevent food-borne illnesses.

**Food security** – The World Food Summit of 1996 defined food security as existing “when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life.”

The American Planning Association (APA) has identified the following factors to support this focus:<sup>4</sup>

- Recognition that food system activities take up a significant amount of urban and regional land.
- Awareness that planning can play a role to help reduce the rising incidence of hunger on the one hand, and obesity on the other.
- Understanding that the food system represents an important part of community and regional economies.
- Awareness that the food Americans eat takes a considerable amount of fossil fuel energy to produce, process, transport, and dispose of.
- Understanding that farmland in metropolitan areas, and therefore the capacity to produce food for local and regional markets, is being lost at an alarming rate.
- Understanding that pollution of ground and surface water, caused by the overuse of chemical fertilizers and pesticides in agriculture, adversely affects drinking water supplies.
- Awareness that food insecurity and lack of access to healthy foods in low-income areas is an increasing problem for which local and urban agriculture can help address.
- Recognition that many benefits emerge from stronger community and regional food systems.

**Figure 3. Vegetable gardens are part of a rooftop garden at the Fletcher Allen Hospital in Burlington, VT.**



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<sup>4</sup> APA Policy Guide on Community and Regional and Food Planning, May 2007 <http://www.planning.org/policy/guides/adopted/food.htm>



Recognizing that food system activities, including traditional New England farming practices, take up a significant amount of urban and regional land, Durham's agricultural future is more likely to reflect small scale, intensive agriculture rather than large scale, industrial farms. The extension of traditional land cultivation techniques to include green roofs and green walls (also known as rooftop gardens, biowalls, vertical gardens, vertical vegetated complex walls),<sup>5</sup> techniques long used in Europe and other countries, is an emerging trend in the US. In addition to providing space for cultivation in densely developed areas as well as green space that improves overall aesthetics, rooftop gardens and green walls filter air and water, soak up carbon dioxide, extend the life of roofs, and help lessen the *heat island* effect of built up areas while producing food and reducing air conditioning and heating costs. The Fletcher Allen Hospital in Burlington, VT is a northern New England example of a successful rooftop garden that supports hospital initiatives to adopt green health care practices. Patients and visitors enjoy fresh herbs and vegetables that are grown on-site by members of the hospital's nutrition services staff, while also providing a healing garden.

Also in Burlington and other northern New England communities, agricultural activity in the central business district can be found in the increasing number of restaurant gardens, sometimes including poultry, at the restaurant site itself or on adjacent roof tops and greenwalls, similar to that on the roof of Holloway Commons. The Agricultural Commission believes that it is important to allow those businesses and residents who are interested in pursuing appropriate agricultural opportunities in the core of Durham to do so.

**Even small gardens can supply a significant amount of food!**



**If you put a lot of them together it can be considered a farm.**

Harvest from two, 4'x10' raised beds at Wagon Hill Farm Community Gardens from May 25-July 9, 2012:

- Beets: 4 lbs
- Broccoli: 1 lb
- Cabbage: 2.8 lbs
- Cucumbers 2 lbs
- Lettuce: 8 lbs
- Peas: 4 lbs

2012 was not a great summer growing season. Some vegetables hadn't really started their peak production by July 9th, so there was a lot more harvested from the garden patch as the summer went on. This six week harvest provides an example of what can be grown in a *hobby* situation. The farmer canned 24 pints of pickles from the cucumbers and other vegetables harvested from just two beds last year. In just the first 2 weeks of the 2013 season, the farmer harvested 5.5 lbs of lettuce and spinach. Some was fed to chickens to produce a *value added* 2 dozen eggs.

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<sup>5</sup> Green roofs/walls are constructed for various purposes – to extend outdoor space, aesthetics, stormwater management, energy conservation, or food production, among others. See discussion of rooftop gardens/green walls in Appendices of both the Agricultural Resources and Energy Chapters of this Master Plan Update.

Such creative techniques expand opportunities to introduce local food production to compactly developed areas where the limited supply and cost of land is in high demand while, at the same time, beautifying and infusing an area that is largely made up of hard, constructed surfaces with the respite of productive, attractive, and nurturing green spaces.

Agriculture in New Hampshire has a significant impact on New Hampshire's economy, employment base, and tax revenue. According to 2007 USDA Census of Agriculture, agriculture in New Hampshire generates \$935 M, 11,606 jobs, and \$43.8 M in tax revenue.<sup>6</sup>

Food has tangible economic value in Durham, though it may only be at the small scale of a family vegetable garden. While farming/gardening may be a job, it may sometimes be a hobby. Home grown or locally grown food replaces in value food purchased from away and likely will play a growing role in Durham's economy for at least two reasons.

Local food production and processing plays a role in stemming the flow of wealth out of the area and in the creation of new wealth and jobs in Town. According to UNH, Holloway Commons, the largest restaurant operating in the state, serves approximately 100,000 meals per week during the school year, perhaps 30,000 meals per week or more in the summer. Given its commitment to serving as much local food as it can access, UNH creates a very large market demand for food from Durham and surrounding towns in order to feed itself from local sources as much as possible. Similarly, the ORCSD, which includes Durham, Lee, and Madbury, is rapidly increasing its purchase of local food, meat, dairy, vegetables, fruit, and grains and is searching for more local sources. Both of these realities make clear the economic development potential of Durham land and the importance of maintaining Durham's food production potential.

In considering the impacts of chemical fertilizers and pesticides on the health of the Lamprey and Oyster Rivers and Great Bay, it is important to understand that suburbanization of the watersheds, including increased population density, road pavement, and impervious surface, is more closely related to nitrogen loading than current farming activities. Mismanagement of chemical fertilizers and pesticides in residential landscaping, as well as agriculture, can adversely affect these water bodies, coastal fisheries, and drinking water supplies.

Agriculture in Durham also supports and is supported by businesses and services in the community and region. Farmers require access to large equipment suppliers and repair services and large animal veterinarians. They need to purchase seed and plant stock, fowl, hay, grain, feed supply, and compost. Some farmers provide and some require access to boarding and riding stables and trails. Community resources include community gardens, community kitchens, and food pantries, which either provide food or opportunities to grow or prepare them commercially.

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<sup>6</sup> [http://www.agcensus.usda.gov/Publications/2007/Full\\_Report/Volume\\_1,\\_Chapter\\_2\\_County\\_Level/New\\_Hampshire/](http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/New_Hampshire/)

Durham farmers have an expanding list of outlets for their products including the Durham Farmers' Market, Durham Marketplace, Emery Farm Stand, Holloway Commons, ORCSD, Tecce Farm Stand, Young's Restaurant, UNH Dairy Bar, and UNH Organic Gardens Farm Stand. The 2013 National Locavore Index, published in Brattleboro, VT, moved New Hampshire's ranking up from #13 (last year) of the fifty states to #3 (this year).<sup>7</sup> The Agricultural Commission sees the opportunity to expand these markets in coming years. Among these are opportunities to commercialize UNH's agricultural research efforts, which directly support the Town's interest in creating new local jobs.

Agriculture in Durham operates on a range of scales from home gardens that provide and/or add to the household table to somewhat larger, but largely part-time, *ancillary* operations that supplement household income with products that generate small sales and bartering to even larger commercial agricultural operations that require the filing of a Schedule F as part of a farmer's federal income tax return and may include the sale of products to neighbors through farmers' markets, farm stands/stores, and local institutions. It makes sense to consider local agriculture that extends beyond the immediate boundaries of Durham to include products produced at farms within the region, most often thought of as including farms in Strafford, Rockingham, and York counties. Residents and workers within this area connect with each other as they move back and forth across municipal, county, and state lines regularly in these naturally extended communities (see discussion of regional foodhubs in inset box). Safe, locally grown food reflects the premise that everyone should know where their food comes from and who grew it in order to protect ourselves as *smart consumers*. Supplementing food from away with locally grown products supports the benefits of regional food planning.

#### LOCAL FOOD OUTLETS IN DURHAM

Young's Restaurant, a revered local gathering place and a popular family restaurant, is leading the way for commitment and dedication to local food at a restaurant scale in Durham. Not only is this well known eatery buying a significant variety of food from local farmers but, importantly, Young's is now producing its own food on land the restaurant owns in nearby Dover. Young's Restaurant is investing in the latest, new season extension technology (grow tunnels, hoop houses) to further support this effort. Likewise, UNH's Dairy Bar Restaurant at the Durham AMTRAK Station, an equally popular eatery, is now dependent on food grown in its own new and especially dedicated greenhouses on UNH farmland within walking distance of the restaurant. This effort has created new jobs in local food production. In addition, the Three Chimneys Inn recently announced that it will start a garden right next to the historic 1649 building to supply its restaurant. A host of restaurants in Portsmouth, as well as in Newmarket, Dover and Kittery, ME, are following suit.

At the retail grocery level, Durham Marketplace has pioneered significant food sales from local farmers for over two decades, increasing the expectation and the appreciation of Durham grocery shoppers for the great taste of fresh local product and a sense of connectedness to area farms and to area farmers.

<sup>7</sup> [http://www.agcensus.usda.gov/Publications/2007/Full\\_Report/Volume\\_1,\\_Chapter\\_2\\_County\\_Level/New\\_Hampshire/](http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/New_Hampshire/)

## **DURHAM AS THE CENTER OF AGRICULTURAL RESEARCH, INNOVATION, AND EDUCATION IN NEW HAMPSHIRE**

While not necessarily the largest producer of agricultural products in New Hampshire, from the 1890's to the present, Durham has hosted most of the state and federal support system for agriculture in New Hampshire. Agricultural research, teaching, cooperative extension, and farmer training are part of an enormous agricultural support system, which in itself an agricultural resource for the people of Durham. Recently, UNH announced that it has established a new professorship devoted to food sustainability issues.<sup>8</sup> Partners in this system are the UNH Land Grant College of Agriculture (the first college at UNH), Agricultural Experiment Station, Cooperative Extension Service, and state headquarters of allied agencies of the US Department of Agriculture.

Most agricultural research in New Hampshire has been and is today conducted in Durham, largely at UNH farms, often by scientists and farm staff who live and work in Durham. Durham is state headquarters for important soils, water quality, watershed, farm assistance, veterinary, and farm and ranchland protection programs. Many of New Hampshire's pioneers of agricultural research and teaching and authors of various renowned agricultural texts and bulletins lived in Durham.<sup>9</sup>

Durham's deep agricultural history persists today in the recognition of UNH as the #1 agricultural research center in the state, further underlining commercialization opportunities in the community.

Beyond state and federally supported research and technical assistance, agriculture in Durham today is largely undertaken by those living in the community to produce food for those living in the community and beyond.

The changing face of agriculture in New Hampshire includes more:

- niche agriculture of unique, unusual, and uncommon products
- direct sales to feed local and area people with product grown locally and distributed through farm stands, harvest your own, summer and winter farmers' markets, CSAs, garden centers, greenhouses, plant nurseries, and local restaurants and institutions
- focus on eating local, urban agriculture, and ethnic markets
- agri-tourism.

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<sup>8</sup> According to an article in the Portland Press Herald (*UNH creates professorship in sustainable food systems*, 8/27/2013), the primary responsibility of the food sustainability professorship "will be to advance the mission of Food Solutions New England. The organization is a regional network dedicated to advancing a sustainable New England food system. Its vision calls for the region to build the capacity to produce up to 70 percent of its food in ways that are environmentally and socially sustainable and promote health by 2060."

<sup>9</sup> For more information on the vast agricultural research that has been conducted for over a century on Durham land, often by Durham residents, see "A History of the New Hampshire Agricultural Experiment Station, 1887-1987", by Walter M. Collins. NH Agricultural Experiment Station Bulletin No. 529, 1990. <http://archive.org/stream/stationbulletin529newh#page/2/mode/2up>

## XI. Development Potential for Agriculture

*Home Grown*, a study released by Food Solutions New England in 2010, identifies the significant economic potential for local agriculture and food manufacturing in New Hampshire. The study proposes a goal of increasing the contribution of local agriculture and food manufacturing to the state's economy by 25%. It notes that New Hampshire has strength in the retail sector and must be a central part of any strategy to promote increased local food production and consumption. It also points out that Maine and Vermont economies' strength in food retailing and local production illustrates the potential for New Hampshire. The study identified New Hampshire's consumers' strong interest in the *buy local* movement, strong consumer demand for locally produced foods, strong interest in preserving open space, strong interest from institutional partners, e.g. hospitals, coops, hotels in supporting local food, and a relatively high income population as opportunities for increased agriculture. The study also notes that while New Hampshire and New England do not grow a large percentage of food consumed locally, New Hampshire and New England rank high nationally in the direct marketing of farm products, sold through farmers' markets, farm stands and pick your own fruits and vegetables. Direct marketing accounts for 12% of NH farm food sales, in sharp contrast to 0.5% at the national level.

Sources:

Home Grown Local Food Systems in New Hampshire: Current Status and Prospects for Growth. Food Solutions New England, University of New Hampshire Office of Sustainability, April 2010.

## XII. Local Foods Movement

According to the USDA, "There is no consensus on a definition of 'local' or 'local food systems' in terms of the geographic distance between production and consumption. But defining 'local' based on marketing arrangements, such as farmers selling directly to consumers at regional farmers' markets or to schools, is well recognized." (<http://www.ers.usda.gov/publications/err-economic-research-report/err97.aspx>) Wikipedia defines the *Local Food Movement* as a "collaborative effort to build more locally based, self-reliant food economies – one in which sustainable food production, processing, distribution, and consumption is integrated to enhance the economic, environmental and social health of a particular place." ([http://en.wikipedia.org/wiki/Local\\_food](http://en.wikipedia.org/wiki/Local_food)) Only one legal definition exists, a clause in the 2008 Food and Farm Act that says that a product can be called "locally or regionally produced" if it travels either less than 400 miles from its point of origin or is produced within the same state.

Among the aspects of a local food system is the belief that it is more sustainable, which requires networks of local and regional food production and distribution. Another aspiration is to empower communities to take back responsibility for their local food economies. And yet another facet of the local foods movement is the consumers' desire for a stronger connection to the farmers who grow their food and it is creating a demand shift in the US.

Local markets for the *locavore* include:

- Direct to Retail
  - Grocery Stores
  - Hospitals
  - Restaurants and chefs
  - Schools
  - Other institutions
- Direct to Consumer
  - CSAs with local food delivered to your doorstep or at fixed pick up locations
  - Family Farms and Community Gardens
  - Farmers’ Market – summer and winter
  - Rural Farm Market Stands and On-Farm Stores
  - U-Pick Produce

Government, industry groups, and news outlets are reporting a shift in farming trends with claims that the local foods movement is luring new, young farmers into the industry, giving a new generation of farmers a foothold in the market. Recent US Census of Agriculture statistics for northern New England bear this out. There is growing consumer interest in local foods and people are willing to pay a premium for local foods.

The local foods movement is spreading and is now a potent force. It isn’t a fad, but a megatrend that rural farm stands, supermarkets, and more mainstream retailers, like WalMart, are trying to tap into. There is “. . . little surprise then that large grocery chains and big-box retailers worldwide have begun to take notice, as more shoppers are willing to pay a premium for local food – seeing it as better-tasting, more trustworthy, and more sustainable.”

Communities all over the Northeast are beginning to realize the economic benefits of local food economies, as serious money, serious investment capital, begins to flow into the establishment of local food hubs. Whether in Brunswick or Portland, Maine, in the City of Burlington or rural Northeast Kingdom of Vermont, in the very urban Boston's North End and other Massachusetts municipalities, or on the Seacoast of New Hampshire, food hubs are rising. These hubs encompass food production in all five forms (vegetable, fruit, meat, dairy, and even grains), food processing and value added, local storage and distribution, marketing, and even the culinary arts, home and restaurant, schools, and institutions. Durham is centrally situated in the geographical midst of this food revolution, has a heritage that supports it, and could not be better positioned to benefit economically. With every molecule of local food consumed displacing an equal molecule of food from afar, local food and local farming can keep real money and jobs in the community.

Sources:

[http://www.atkearney.com/paper/-/asset\\_publisher/dVxv4Hz2h8bS/content/buying-into-the-local-food-movement/10192](http://www.atkearney.com/paper/-/asset_publisher/dVxv4Hz2h8bS/content/buying-into-the-local-food-movement/10192)

### XIII. Recycling Money Within Town/Region

Since the 1990's discussion has occurred about the value of retaining and recycling local dollars in the local economy as a more effective way to create wealth and jobs in an area than by spending those dollars at institutions that are based elsewhere in the nation and the world. Michael Shuman, JD, who has authored numerous books on the subject, espouses two points:

- “The wealthiest communities are those with the highest percentage of jobs in businesses that are locally owned. A growing body of evidence suggests that local ownership in businesses pumps up the multiplier effect of every local dollar spent, which increases local income, wealth, jobs, taxes, charitable contributions, economic development, tourism, and entrepreneurship.
- The wealthiest communities are those that maximize local self-reliance. This doesn't mean that they cut themselves off from global trade. But they rely on trade only for the diminishing universe of goods and services that they cannot competitively provide for themselves.<sup>10</sup>

This understanding has spawned numerous *buy local* initiatives and organizations, which have been particularly successful in northern New England, among other places. The Strolling of the Heifers organization, which is based in Brattleboro, VT, recently published its second annual *Locavore Index*, which rates the 50 states and the District of Columbia on the strength of their local food systems. The top five states for *locavorism*, according to the 2013 index, are VT, ME, NH, ND, and IA. The group uses census and US Department of Agriculture data, along with a per capita comparison of farmer's markets, CSAs, and food hubs in ranking the states. Every New England state ranked in the top 15. In 2013, NH moved up 10 places from 13<sup>th</sup> in the 2012 index to third in the nation.

In 2007, USDA National Agricultural Statistics (NASS) data ranked NH highest in the nation for the percentage of all farms reporting direct-to-consumer sales. In 2012, NASS' statistics indicate that NH had the highest of the six New England states for farm stands (54%) and the highest percentage of growers reporting pick-u-own sales (29%). The 26% selling at farmers' markets was second to VT (34%). For CSAs, NH was just above the region average (10%).

One in five NH growers sold produce direct to retailers and 17% sold to wholesale markets. According to the NH Department of Agriculture, Markets & Food, the high ratio of direct-to-consumer sales may be a factor in NH growers reporting higher prices compared to neighboring states for a number of crops—including sweet corn, tomatoes, pumpkins, carrots, cantaloupe, cabbage, asparagus and peaches.

While there is no consensus on the definition of local, the Seacoast Buy Local organization defines “a business as locally owned if at least 50% of its owners live within 25 miles of Portsmouth Harbor. . . encompass[ing] 25 towns that share a natural watershed, agricultural region, and commuter-shed, from Barrington to York, from Seabrook to South

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<sup>10</sup> Shuman, Michael. H., JD, *The Competitiveness of Local Living Economies*, Federal Reserve Bank of San Francisco, volume 5, number 2, pages 81-84, 2009.

Berwick. It's a large enough area to build a movement and make an impact, and yet a close enough community that it depends on a network of relationships. In fact, it's these relationships that make it work." Seacoast Buy Local maintains that "Every dollar spent at a local independent generates up to 2-3 times as much economic activity locally than if that dollar were spent at a national chain. A 10% shift per household this year would create hundreds of new jobs and millions in new economic activity on the Seacoast. Across New England, we could generate more than \$5 billion in increased economic activity, decrease thousands of tons of greenhouse gas emissions, and revitalize local communities."<sup>11</sup> On its website, Seacoast Buy Local also notes that a recent study showed that if Vermonters substituted local products for only 10% of the food they import, it would result in \$376 million in new economic output, including \$69 million in personal earnings from 3,616 jobs. Currently, less than 5% of the food eaten in NH is grown or harvested there. It also describes the Maine State Legislature's 2006 decision to include a goal for ME to grow at least 80% of the food it eats by 2020.

#### XIV. Resolution #2011-14 of Durham, New Hampshire:

##### **ESTABLISHING A "DURHAM AGRICULTURAL COMMISSION"**

**WHEREAS**, IN 2008, in response to the 2000 Master Plan goal to "Retain as much of the current farmland and prime agricultural soils in productive use as possible" the Conservation Commission asked the Town Council to consider establishing an agricultural commission to advocate for not only the retention of farmland in productive use but for the restoration of some recently abandoned prime agricultural soils to productive use – and to provide practical advice and support to accomplish this goal; and

**WHEREAS**, the Durham Town Council discussed this issue at its meetings held on January 28 and February 4, 2008 and June 20, 2011 and desires to establish a "Durham Agricultural Commission" whose purpose would be to promote the production, availability, and sale of locally grown food, fiber, and forest products; and

**WHEREAS**, New Hampshire Revised Statutes Annotated (RSA) 673L4-b allows local governing bodies to establish agricultural commissions;

**NOW, THEREFORE, BE IT RESOLVED** that the Durham Town Council, the governing body of the Town of Durham, New Hampshire, hereby adopts Resolution #2011-14 establishing a "Durham Agricultural Commission" as follows: The Durham Agricultural Commission shall consist of three (3) to seven (7) regular members and up to five (5) alternate members as provided by state statutes. These members shall be appointed by the Town Council for terms of three (3) years, such terms to be staggered. One member may be a Town Council representative appointed by the Council for a one (1) year term, and one member may be a Planning Board representative designated by the Planning Board for a one (1) year term.

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<sup>11</sup> <http://www.seacoastlocal.org>



**BE IT FURTHER RESOLVED** THAT THE Durham Town Council hereby adopts the follow charge for the committee as prescribed in RSA 674:44-f:

1. Survey and inventory all agricultural resources.
2. Conduct activities to recognize, promote, enhance, and encourage agriculture, agricultural resources, and agricultural-based economic opportunities.
3. Assist the planning board, as requested, in the development and review of those sections of the master plan which address agricultural resources.
4. Advise, upon request, local agencies and other boards in their review of requests on matters affecting or potentially affecting agricultural resources.
5. Coordinate activities with appropriate service organizations and nonprofit groups.
6. Publicize and report its activities.
7. Hire consultants and contractors as needed in accordance with the Town of Durham purchasing policies.
8. Receive gifts of money to assist in carrying out its purpose.
9. Hold meetings and hearings necessary to carry out its duties.

**PASSED AND ADOPTED** by the Town Council of the Town of Durham, New Hampshire this 11<sup>th</sup> day of July 2011 by **Eight (8)** affirmative votes, **Zero (0)** negative votes, and **Zero (0)** abstentions.

**Diana Carroll, Chair**  
Durham Town Council

**Attest:**  
Lorrie Pitt, Town Clerk

## XV. Best Management Practices

Best management practices, or BMPs, are state of the art practices intended to reduce environmental problems associated with a particular land use activity and are often intended to reduce nonpoint source pollution. A BMP is likely to include a schedule of activities, prohibited practices, and maintenance procedures. See the NH Department of Agriculture, Markets & Food's *Manual of Best Management Practices for Agriculture in New Hampshire: Best Management Practices for the Handling of Agricultural Compost, Fertilizer, and Manure*.

## XVII. Microgardening

The United Nations Food and Agriculture Organization (FAO) views microgardens, defined as intensely cultivated small spaces, as a critical way to help the urban poor get more food on the table. Plastic lined wooden boxes, trash cans, old car tires, and other containers can turn urban balconies, small yards, patios and rooftops into a victory garden, the kind of food gardens that thousands of citizens of the US, UK, and elsewhere planted during WWI and WWII to improve their food security. FAO research shows that a well-tended microgarden of 11 square feet can produce as much as 200 tomatoes a year, 36 heads of lettuce every 60 days, 10 cabbages every 90 days, and 100 onions every 120 days. Microgardening has enormously high potential for the production of food, given a combination of decentralized production and high speed of production.



For those who need a little help, several companies are also making it easy to start a microgarden with an array of new products, including plug-and-play hydroponic systems for indoor microgardening, ranging from aeroponics, a method of growing plants in hanging containers with little to no soil, to aquaponics, which involves growing plants (or fish) directly in water. Other products include polypropylene bags – designed to be porous and lightweight – for growing potatoes, tomatoes, peppers and other crops. One new product includes the *Nourishmat*, a roll out mat with seeded plugs, to make planting easy. John Gorby and Phil Weiner, who founded the company in 2011 while they were undergraduates at the University of Maryland, College Park, believe that there's a big market of people who want to garden but need this kind of help. Based on beta-tested of the product with people in 22 states, they estimate that users can grow \$200 worth of produce in one season and 25 to 30 pounds of food in a year. The mats can be replanted for three to five years.

Sources:

Barclay, Eliza. *Why Micro-Gardening Could Go Big*. The Salt: What's On Your Plate. 2013.

<http://www.npr.org/blogs/thesalt/2013/07/02/197998315/why-micro-gardening-could-go-big>

## XVIII. UNH Dining Services

The UNH Dining Services serves roughly 2.8 million meals during the academic year. According to Jon Plodzick, Director the UNH Dining Services, most of the food used to provide those meals comes from contracted vendors who were awarded the contract based on pricing, sustainable practices, safety and experience. Groceries, meats, and cheeses come from a broad-line distributor named Performance Food Group Northcenter from Bangor, ME. Seafood comes

from Northcoast out of Boston, MA. Most produce is supplied by Costa Produce out of Boston, MA; but UNH is acquiring a growing amount from local farmers with whom they have agreements (for example, Dwayne Family Farm, on-campus sites). Dairy comes from Garelick.

UNH Dining Services typically receive 25 deliveries a week during the school year for most properties with all of the vendors. Just about 23% of food purchases are from vendors within a 250 mile radius of the campus. The Dairy Bar serves produce grown on campus in Durham.

Food waste is converted to pulp and then to compost on the Kingman Farm on campus under a program operated by Dining and the College of Life Science & Agriculture.

## XIX. Oyster River Cooperative School District (ORCSD) Dining Services

On average, the ORCSD serves 87 breakfasts and 470 lunches per day during the academic year. The dining services also sell milk, juice, and water at the elementary schools and meals, snacks, milk and other beverages at the middle and high schools. According to Doris Demers, Director of ORCSD Food Services, the high school sells almost as many ala carte entrees as they do lunches. The District's prime vendor for groceries is Sysco Boston; bread comes from Fantini Bakeries; milk is from HP Hood; bottled water and other beverages for the middle and high school come from both Great State Beverage Co and Coca-Cola; ice cream from New England Ice Cream; pizza from Original Pizza Co. Local foods are sourced from Tuckaway Farm in Lee, Pinewoods Yankee Farm in Lee, Miles Smith Farm in Loudon, J & F Farms in Derry, Wiggin Eggs in Stratham, and Giles Farm in Alfred, ME.

Doris Demers estimates that about 5% of delivery vehicles come from Strafford, Rockingham, and York Counties or within 25 miles of the District with another 15% coming from other parts of New England.

**Table. 9 Local and regional deliveries to schools**

Vendor	Deliveries	Schools
Sysco	1/week	4 schools
Fantini	1/week	4 schools
Milk	2/week	4 schools
Great State	2/month	2 schools
Coca Cola	2/month	2 schools
New England Ice Cream	1/month	1 school
Original Pizza	1/month	1 school
Wiggin Eggs	1/month	3 schools
Tuckaway Farm	1/month	1 school, then distributed
Pinewoods Yankee Farm	1/month	1 school, then distributed
Miles Smith Farm	1/month	1 school
J & F Farms	1-2/year	1 school
Giles Farm	1/month (ran out in March)	Pick up apples in Kittery, then distributed
Source: Oyster River Cooperative School District, 2013		

With the advent of food waste composting in ORCSD schools, as organized by the ORSD Sustainability Committee, everybody wins: the school budget saves money from the reduced tipping fee at the land fill (waste food being heavy, that can be a considerable savings); the recipient firm, EcoMovement of Portsmouth, NH, makes money and creates local jobs; school students who are studying Sustainability Science and Environmental Science within their curriculum benefit from real world experience; the school receives a return of excellent compost for its school gardens; and the schools, their principals, District Superintendent, District Food Service Director, members of the School Board, and even the school contractors, receive recognition for their progressive accomplishment in the interests of sustainability and resilience, of students' health, and taxpayer savings, as the schools continue their central role of educating our district's students. Everyone truly wins. The composting program was recently started at ORCSD and should generate some pretty accurate information about food waste disposal in the school system within the next year.

### FIVE GREAT REASONS TO SERVE LOCAL FOOD IN LOCAL SCHOOLS

- 1. Schools already provide breakfast and lunch to our children:** From preschool through high school, wouldn't it be an amazing transition if every child was served a wholesome, delicious meal, every day? Some families can't afford or don't have the time to feed their children whole foods—schools have taken on the role. Good food is a right, not a privilege. Providing it every day brings children into a positive relationship with their health, their community, and the environment.
- 2. Food is an academic subject:** A school garden, kitchen and cafeteria are great places to learn. Our food traditions, biology and ecology can help bring alive every subject—from reading and writing to science and art. Celebrating our local food teaches children about our history and heritage.
- 3. Children learn by doing:** Students in schools that improve school lunch and connect those changes with classroom learning and cooking and gardening classes scored higher on nutrition knowledge than those in schools with lesser-developed local foods programs. Recent studies show child preference for fruits and vegetables, especially those leafy greens or veggies that they recognize from gardens and taste in the raw, are clearly higher in schools that have a local foods program.
- 4. Schools support farmers and fishermen:** School cafeterias are banding together to buy seasonally fresh food from local, sustainable farms and fishermen, not only for reasons of health and education, but as a way of strengthening local food economies.
- 5. Food is a common language, we all eat:** A naturally beautiful environment, where deliberate thought has gone into everything from the classrooms to the garden paths to the plates on the tables, communicates to children that we deeply care about them and their future health and goodwill.

## XX. Industries/Businesses that Support Agriculture and/or Forestry in Durham

### Equipment

- Engine repair – Barrington
- Large equipment – Brentwood, Dover, Eliot, Kensington
- Rental - Lee
- Sawmill (UNH, Woodward Farm)

### Services and Resources

- Boarding, Riding Stables, Trails – Linden Woods Farm
- Boarding, Riding Stables, Trails (Madbury)
- Boarding, Trails – UNH
- Community Garden – Canney Farms
- Community Garden – Church Hill
- Community Garden – Fitts Farm
- Community Garden – Wagon Hill
- Community Garden – St. George’s Episcopal Church
- Community kitchens – available at schools in summer, not currently used
- Education – two year vocational college of agriculture, engineering applied to equipment (Thompson School, UNH)
- Education – vocational education in animal science available to ORCSD high school students through the Regional Career Technical Center at Dover High School
- Food Pantry – St. Thomas More’s Catholic Church
- Food Pantry – Waysmeet United Campus Ministry
- Greenhouses – Lee, Rollinsford, UNH
- Large animal veterinarian (Lee, Epping)

### Supplies

- Animal feed – Linden Woods Farm
- Compost - Eco-Movement (Portsmouth)
- Compost – Linden Woods
- Compost – UNH
- Nursery – Lee, UNH
- Seed and plant stock, fowl, hay, grain, feed supply – Agway (Dover)
- Seed buyers club – (online)
- Seed exchange – St. George’s Episcopal Church

### Markets

- Durham Market Place

- Emery Farm Stand
- Farmers' Market
- Holloway Commons, Philbrook Dining Hall, Stillings Dining Hall
- Oyster River Consolidated School District
- Tecce Farm Stand
- Three Chimneys Inn
- Young's Restaurant
- UNH Organic Gardens Farm Stand

#### Organizations

- Durham Garden Club
- Food Solutions New England – UNH
- Organic Gardening Club – UNH
- Training –Thompson School, UNH Vocational College, UNH School of Engineering

#### Products

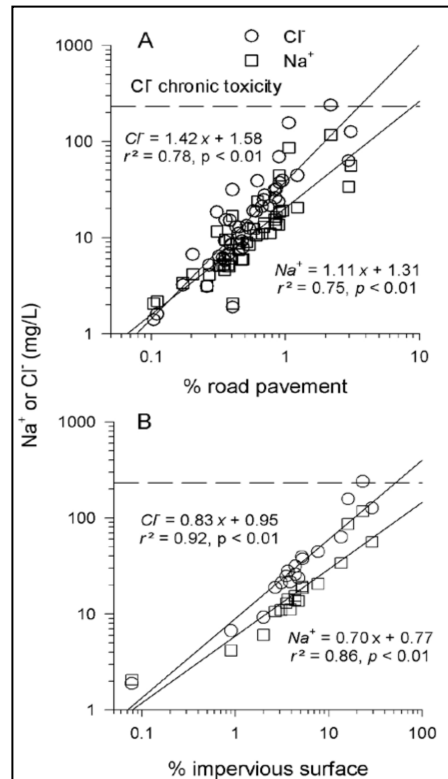
- Berries, fruits, vegetables, including strawberries for local gardens
- Flowers and plants
- Cider, tea, and wine
- Dairy, meat, eggs, fish
- Fire wood and wood sales
- Hay sales to regional farmers
- Honey and syrup
- Certified organic products

## XXI. Summary of Study on Sources of Loading of the Bay and Damages to Coastal Fisheries

Stream chemistry analysis of the Lamprey and Oyster Rivers indicates a significant increase in nitrate concentrations over a decade of water quality monitoring (2000 – 2010). Studies by the Water Resources Research Center (NH WRRRC) at the University of New Hampshire document that “stream water nitrate is related to watershed density and since suburbanization continues to occur throughout the greater Lamprey River watershed, population growth is likely responsible for the increase in stream water nitrate.” The increase in nitrate in the Lamprey and Oyster Rivers has implications for the Great Bay estuarine system, which is already impaired by elevated nitrogen, low dissolved oxygen, and significant loss of eelgrass which provides important habitat.

According to Bill McDowell, Director of NH WRRC, the WRCC “looked hard for any effect of farms on the adjacent Lamprey River and could find none...Agriculture is a minor player in the nitrogen issue on Great Bay...” (email communication about pollution from UNH farms, 2/5/2013).

**Figure 4. The relationship between both average concentrations of Na<sup>+</sup> (squares) and Cl<sup>-</sup> (circles) and a.) % road pavement (College Brook, Lamprey and Ossipee sub-basins) and b.) % impervious surfaces (College Brook and Lamprey sub-basins only)**



(Source: Daley, M.L., J.D. Potter and W.H. McDowell, 2009, Salinization of urbanizing New Hampshire streams and groundwater: impacts of road salt and hydrologic variability, *Journal of the North American Benthological Society*, 28(4), 929–940.)

Sources:

McDowell, William, Director of NH Water Resources Research Center, (email communication to John Aber, Mark Huddleston, Megan Davis, and Jon Wraith regarding pollution from UNH farms, 2/5/2013).

*Water Resources Research Center Annual Technical Report FY 2010.*

[http://water.usgs.gov/wrri/AnnualReports/2010/FY2010\\_NH\\_Annual\\_Report.pdf](http://water.usgs.gov/wrri/AnnualReports/2010/FY2010_NH_Annual_Report.pdf)

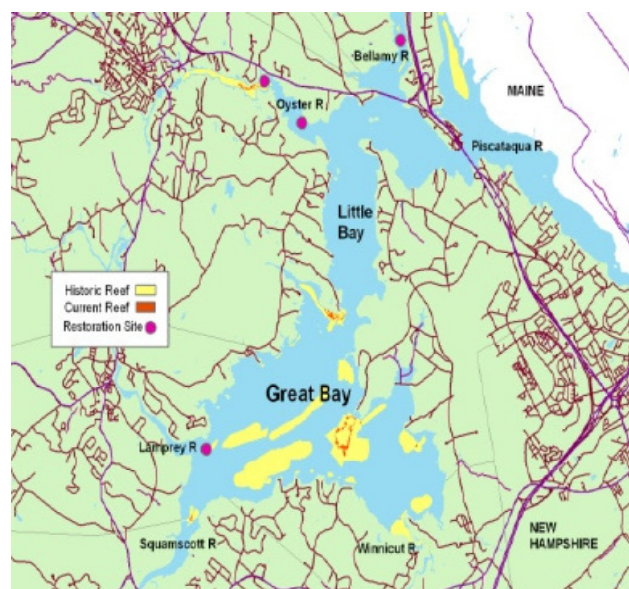
## XXII. Impacts of Aquaculture

Oyster farming is the only type of aquaculture that is currently operating in Great Bay. Historically, the eastern oyster (*Crassostrea virginica*) played a significant role in the ecology of Great Bay. As filter feeders, Gulf of Maine scientists believe that oysters played an important role in maintaining the water quality of the estuary. In 1970, as many as 1,000 acres of oyster reefs may have lived in the Estuary. Now, only about 50 acres remain, having been lost to pollution, harvesting, and disease. Without the oysters, it is difficult to reestablish eel grass beds, which are also important to the overall health of the Estuary. The Nature Conservancy (TNC) and UNH have teamed up with other organizations like the Piscataqua Region Estuaries Partnership, to restore local oyster reefs to improve water quality by filtering excess nutrients and suspended solids and to provide fish habitat. TNC calls the restored reefs *spawner sanctuaries for the Bay*. To date, restoration efforts have rebuilt reefs in the Bellamy, Oyster, and Lamprey Rivers with plans to restore reefs in the Squamscott and Winnicut River. Base material for the reefs is provided by placing surf clams and ocean quahogs in the channel bottom at the end of June. In the fall, oyster shells with live spat are placed on the reef. Volunteer *Oyster Conservationists* raise hatchery oyster spat on their private docks for use on the reefs.

While aquaculture holds significant promise for agricultural production, it can have negative environmental impacts if not managed well. The most significant negative environmental impacts of aquaculture are associated primarily with high input, high output intensive systems (e.g. culture of salmonids in raceways and cages). Unlike oyster and other mollusk farming, in intensive systems, fish are fed a diet of artificial feed in pellet form, which is spread onto the surface of the water. Because not all of the feed is eaten, it settles on the bottom of the water body where it is eaten by benthic creatures or decomposed by microorganisms, which enriches the water, depletes oxygen, builds up anoxic sediments, and changes benthic communities (ie., seabed fauna and flora). Antibiotics and other chemicals added to feed, often introduced to inhibit the growth of organisms which foul netting and reduce water flow, can affect organisms when the drugs are released as the uneaten pellets decompose.

Furthermore, the quality of water of the water surrounding rearing pens for intensive fish culture may be further degraded from high concentrations of fish excrement combined with nutrients released from excess feed. These effluents raise nutrient levels and potentially support the growth of algal blooms. Once the algae die, they settle to the bottom where their decomposition further depletes oxygen, possibly producing algal toxins like *red tide*, which can be concentrated in filter-feeding bivalves such as mussels

**Figure 5. Map of oyster reefs in Great and Little Bays**





and oysters, creating a serious health risk to people consuming contaminated shellfish (e.g. paralytic shellfish poisoning).

In addition to shellfish contaminated with toxic algae, cultured seafood can pose additional concerns from disease transmission. Most fish pathogens are not hazardous to humans, but some fish pathogens such as *Streptococcus* bacteria can infect humans. High levels of antibiotics and genetically-engineered components in fish feed can also pose risks. Furthermore, government oversight of both seafood quality control and addressing the basic problem of pollution generated by culture operations is increasingly common.

The impact of coastal aquaculture depends on a number of physical, chemical, and biological factors, most notably the local hydrodynamics. Where there are strong currents, waste accumulation is minimized by dispersal into the surrounding area. Water movement also helps replenish oxygen in the water column and seabed.

The impact of escaped, managed stocks on the health and genetic diversity of natural stocks is of significant concern. Parasites and cultured stocks that have been genetically manipulated to favor abnormally high growth rates or other characteristics raise concerns that contaminated stocks that escape may undermine the adaptation of native species that are critical to survival in nature. The escape of managed stocks may also compete with native species for food and space. Although ship ballast water has often been the cause of introduced species, importing non-indigenous animals for culture can also introduce diseases and invasive species.

Whether aquaculture species are native or not, the operations introduce a high concentration of potential prey which may significantly alter the local ecology. Birds, seals, crabs, and starfish can significantly benefit from farmed species, consuming commercially raised fish.

The pressure to use resources efficiently, increase competitiveness, and respond to market forces sometimes has resulted in intensification of aquaculture production. There is an increased risk that such intensification will increase environmental impacts if inappropriate planning and management of such farming systems and, in particular, the inefficient use of resources and inputs such as equipment and chemicals, are not avoided.

Sources:

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<http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/newhampshire/oyster-restoration/index.htm>  
<http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/newhampshire/50thanniversary/great-bay-oyster-fact-sheet.pdf>  
<http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/newhampshire/50thanniversary/great-bay-oyster-restoration-flyer-2011.pdf>  
[http://www.seagrants.unh.edu/oyster\\_restoration](http://www.seagrants.unh.edu/oyster_restoration)  
<http://www.wri.org/publication/content/8383>

## XXIII. Value to Wildlife Habitat

Farmland provides critical habitat for many species of wildlife. The first two centuries of settlement in New Hampshire converted the landscape from what had been 90% forested to 60% farm fields by the mid-1800s. As development of the US moved westward, most farms were abandoned and grew back to forests and the amount of wildlife that inhabited the farms declined. Farming and wildlife habitat can be compatible if well managed.

There are a number of habitats used by wildlife on farmland, including:

- Upland fields that are used as pastures because they are too wet or rocky to cultivate. Habitat for eastern bluebirds, field sparrows, eastern moles, and American goldfinches, bobolinks, ground-nesting birds, songbirds, turkey vultures, meadow voles, and meadowlarks.
- Orchards with stands of fruit trees and a grassy floor. Habitat for yellow-bellied sapsuckers, eastern kingbirds, eastern bluebirds, orchard orioles, and woodland voles.
- Cultivated lands provide cover and food. Habitat for deer, geese, wild turkey, ring-necked pheasant, killdeer, red fox, and northern flicker.
- Abandoned fields with overgrown shrubs and trees. Habitat for rabbits, deer, and many songbirds.
- Edges between different habitats. Habitat for cardinals, indigo buntings, catbirds, rabbits, and towhees.
- Hedgerows and fencerows between fields. Habitat for eastern kingbirds, meadowlarks, kestrels, red-tailed hawks, eastern phoebes, and rabbits. Travel corridors for small mammals.

Farmers can pursue opportunities to enhance farmland habitats for wildlife, including:

- Food plots for a variety of wildlife – corn, clover, alfalfa, other legumes, sunflower beds.
- Fallow fielding and crop rotation for food and cover.
- Mowing hayfields benefits many by creating diversity within the fields, but may harm others if cut too low.
- Grassy and shrubby borders along hayfield edges or uncut areas in wet swales for nesting and cover.
- Controlled burning of old fields and pastures periodically improves grass and brush habitat.
- Hedgerows provide escape cover, food, rest areas, and travel corridors.
- Snags, cavity trees, and perches.
- Brush piles provide dense cover, escape, resting, feeding, and nesting areas.
- Artificial nest boxes can supplement wildlife habitats where natural cavities are scarce.
- Plantings eroded areas to enhance food and cover.
- Wild apple trees for food.
- Farm ponds for water.

Integrated pest management reduces the use of chemicals, which are harmful to wildlife, and provides for other strategies to reduce and control pests such as using natural enemies like pest predators, parasites, and diseases.

Sources:

*Wildlife Habitat Improvement: Farmlands*. University of New Hampshire Cooperative Extension. September 1995.  
[http://extension.unh.edu/resources/files/Resource000453\\_Rep475.pdf](http://extension.unh.edu/resources/files/Resource000453_Rep475.pdf)

## XXIV. Threat to Bees and Other Pollinators

Increasingly, the media is reporting on the loss of wild insect populations, particularly honey bees, and the resulting impact on crop yields. Thus far, the 2013 season is reported to be “the worst season for beekeepers in anyone’s memory . . . Much of this recent spike in bee mortality is attributed to Colony Collapse Disorder, a mysterious condition where all the worker bees in a colony simply fly off as a group and never make it back to the hive.”<sup>12</sup>

Something is killing them and the leading suspect is certain pesticides, fungicides, and herbicides, singly or in combination. A number of recent studies have pointed to a class of pesticides called neonics, the world’s leading insecticides, are applied on 75% of the farmlands in America. The neonics, which contains a chemical related to nicotine that attacks an insect’s nervous system, have been demonstrated to kill bees. Beekeepers and activist groups are suing the US Environmental Protection Agency to ban neonicotinoids.

An added pressure to resolve this issue was provided in a recent study published in *Science* magazine where it was reported that the proportion of flowers setting seeds or fruits was considerably lower in sites with less wild insects visiting the crop flowers even when hives of honeys were sited to improve pollination. The leading author of the study, Lucas A. Garibaldi, Universidad Nacional de Río Negro - CONICET, Argentina commented, “We found that wild insects consistently enhanced the number of flowers setting fruits or seeds for a broad range of crops and agricultural practices on all continents with farmland. Long term, productive agricultural systems should include habitat for both honey bees and diverse wild insects.”

## XXV. Climate Change

Climate change in the world and New England are described in the Energy Appendix.

Early research concluded that the initial stages of climate change would benefit agriculture because of carbon fertilization and a longer growing season. According to Frank Ackerman and Elizabeth A. Stanton, senior economists at Synapse Energy Economics, this conclusion has been challenged because of overly optimistic estimates of the effects of carbon fertilization, the effect of increased temperature on many crops, and significant changes in precipitation, including amount, intensity, and seasonality.

“A new paradigm is emerging in recent research on climate and agriculture . . . A warming world may experience food crises much sooner than expected, a threat that should inspire immediate responses.” According to Vern Grubinger of the University of Vermont Cooperative Extension, New England is comparatively well positioned to absorb the anticipated Impacts of climate change, both because of the specific changes that are anticipated and because of some

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<sup>12</sup> <http://www.nationofchange.org/neglecting-bees-could-endanger-humans-1367509038>

of the work that is being done on those issues in the region. Changes that will affect specific crops generally are not a short term problem, as farmers will adopt varieties that grow better to cope. Most family farms in New England grow crop varieties that have adapted to a relatively cool climate – winter wheat, sugar maple, apples, Concord grapes, potatoes, cabbage, and sweet corn. While New England farmers may still be able to produce crops such as these in a warmer climate, New England’s competitive edge in the marketplace could be lost due to lower yields or quality. Farmers might adapt by switching to longer growing season varieties, but those varieties may not always be available or there may be problems marketing them. Some important crops require winter chilling. Warmer winters and/or an increase in winter *thaws* could have negative consequences for spring flowering and yield of these crops, whether or not spring and summer temperatures are optimum for their growth. Some crops will do better in a warmer, longer summer – watermelon, tomatoes, peppers, peaches, and European red wine grape (*V. vinifera*) varieties, which could create new opportunities for some farmers. However, a warmer climate is likely to increase the frequency of high day or night temperature stress events that can negatively affect flowering, fruit set, and quality. And increased temperatures will tend to increase crop water demand (evapotranspiration or ET).

In addition, there may be more pressures relative to changes in precipitation and erratic weather. Some farmers have or are investing in irrigation. Additional precipitation may cause issues with more field flooding, soil compaction, drainage of heavy soils, and loss of oxygen for roots, and disease problems associated with wet conditions, and while farmers can turn to tilled systems, they can be expensive. An increase in the size of floodplains may require farmers to stabilize fields to avoid losses.

Pest pressures have increased with greater international trade, but will also be affected by milder winters. There is evidence that warmer winter temperatures are reducing the incidence of ground freezing, which may cause a build up of fungus that causes root rot in berry crops and can harm some native plants, shrubs, and trees.<sup>13</sup> Grubinger noted a need for a greater focus on integrated pest management (IPM), including more scouting, monitoring, and action to eradicate pests when found. While the horticultural season may be extended, there will also be more high temperatures to contend with. Farmers may respond with more microclimate controls including high tunnels, hoop gardens, and other techniques to protect crops.

Climate change is likely to result in the loss of many of New England’s common tree species in a pattern of slow decline. Technological improvements and advances may help current producers to stay in business, for example, maple sugaring; but their grandchildren may not be able to do the same. Ultimately the greatest challenge may be New England’s capacity to provide the products that we currently obtain elsewhere which may be harmed or displaced. This will require greater focus on land use management and agricultural/forestry management.

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<sup>13</sup> <http://www.warrenfarmnh.com/blog>

In addition to these impacts, climate change and increased CO<sub>2</sub> could favor some invasive species and alter important interactions between plants and pollinators, insect pests, diseases, and weeds.

Climate change is expected to affect dairy, poultry, and other livestock industries indirectly by impacting the availability and price of crops produced elsewhere that are used for feed, such as corn silage and corn grain. The health and productivity of livestock that are important to New England will be negatively stressed by higher summer temperatures which can affect both milk production and birthing rates. Dairy farmers could adapt by cooling barns, but costs would have to be weighed against potential risks and benefits.

Adaptation is not cost or risk free. Some ways to adapt include:

- Changing planting, harvest dates. The major risk is that this will put farmers into a different market window with lower prices.
- Changing varieties grown. In some cases, seed for new varieties is more expensive or require new equipment or adjustment in practices. In some cases, new varieties may not be available or the market may not accept them.
- Increasing water, fertilizers, herbicides, and pesticides.
- Changing crops or livestock, which might be risky because the necessary infrastructure and market may not be available.
- Providing new irrigation or drainage systems, other major investments that carry a moderate to high cost and could be risky as to where and when to make these investments.

Climate change could generate some new opportunities for both the farmer and the environment, including:

- Conserving energy and reduce greenhouse gas emissions;
- Increasing soil organic matter to reduce the amount of this greenhouse gas in the atmosphere;
- Improving efficient use of nitrogen to replace synthetic fertilizers that emit greenhouse gases and are energy-intensive to produce, transport and apply; and
- Entering the expanding market for renewable energy using marginal land.

Those farmers that are most vulnerable would include those who:

- Produce crops that are poorly adapted to the new climate or have little market potential;
- Have few resources to adapt;
- Produce crops where weeds, disease, or insects gain an advantage;
- Are already in a fragile industry such as the dairy industry.

Some actions that address climate change are simply good management practices such as efficient nitrogen fertilizer and manure use, farm energy efficiency, cover cropping, and development of local markets. In addition to using about

one third less fossil fuel than conventional cropping systems, there is evidence that organic farming is far more effective at sequesters carbon in the soil than is conventional farming, which reduces carbon dioxide, a major greenhouse gas. Innovative practices that may address climate change can also enhance profitability and/or air or soil quality (such as use of bio-diesel and alternative fuels, on-farm energy generation, and reduced tillage systems).

According to the Council on Agricultural Science and Technology, agriculture can help:

- reduce greenhouse gas concentrations by sequestering CO<sub>2</sub> from the atmosphere in biomass and soils;
- reduce the rate of clearing land and take marginal lands out of production;
- change agricultural practices on productive, established agricultural lands;
- increase efficiency of farm inputs such as fuel, fertilizers, and pesticides;
- increase production of agricultural biofuels to replace fossil fuel emissions;
- improve the efficiency of nitrogen to help decrease N<sub>2</sub>O emissions; and
- decrease methane emissions from manure storage and increase the efficiency of producing livestock.

A recent comprehensive analysis of climate trends in New England found that:

- average annual temperatures have increased,
- greater rate of warming during the winter months compared to the annual average,
- average 8 day increase in length of the growing season, and
- increase in the frequency of extreme precipitation events.

Durham's farmers will have to adapt to sea level rise and a mid to southern Atlantic climate. They will need to create a market for new products. Durham also needs to do its part to mitigate the impacts of climate change. While New England agriculture will feel the impacts of climate change directly, the impact of climate change on agriculture in other areas of the country may actually be far more significant than the direct impact of climate change on New England agriculture. Since so much of New England's food supply comes from *away*, and thus is vulnerable to interruption of supply, Durham and other New England towns and cities have an increasingly insecure food supply which argues for a substantial increase in New England local agriculture, and should be considered in Durham's new Master Plan.

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## XXVI. Permaculture

Permaculture is a branch of ecological design that strives for sustainability in all aspects of human endeavor - how we build our homes, grow our food, restore diminished landscapes and ecosystems, catch rainwater, build communities, and more; focusing on the interconnections between things more than the individual parts. Permaculture seeks to minimize waste, human labor, and energy input by designing systems that achieve a high level of synergy among the various elements. The Permaculture Institute identifies the following key concepts of permaculture:

- **Food Forests and Guilds** – mimic the architecture and beneficial relationships between plants and animals found in a natural forest or other natural ecosystem. They are rich in biodiversity and productivity. Each guild participant (a combination of plants, animals, insects, fungi, and people) contributes something valuable to the entire composition.
- **Poultry and Backyard Animals** – animals, birds, and wildlife are a critical component of a sustainable ecosystem. Much of the work of producing food can be accomplished through well managed relationships between animals and food plants.
- **Rainwater Harvesting** – strive to design landscapes that absorb rainwater. Rainwater harvesting, an alternative to shedding runoff, is simpler, less costly, and provides water during dry spells.
- **Designing for Multiple Functions** – everything should be designed for multiple functions to allow us to capitalize on the investment of work and resources.

- **Heirloom Plant Varieties and Animal Breeds** – design for gardens and farms focuses on using and preserving heirloom plants and animals to keep them thriving; where seeds are saved on-site and animals are allowed to breed.
- **Watershed Restoration** – repairing watersheds by purifying water, reducing flood danger, slowing erosion, and increasing water availability.
- **Natural Building** - designing and constructing buildings to improve the ecological health of the ecosystem where it is sited through architectural design, including climate specific design, using biological resources before technological solutions such as solar heating and breezes and vegetation for cooling.
- **Waste Management** – waste is turned from pollution to a resource through permaculture design.
- **Ecological Economics** – since permaculture focuses on connections between things more than the parts, the design of resilient economies relies on each contributor to build a strong network – many small businesses and contributors, decentralization of money flow, local business alliances, empowered individuals who supply needs of the local community, while meeting many of their own needs in the same community, and sometimes alternative currencies.

Sources:

Taken from <http://www.permaculture.org/>

## XXVII. Silvopasture

Silvopasture is an agroforestry practice that integrates livestock, forage production, and forestry on the same land to maximize the economic benefit of both trees and animals. A silvopasture can be established by either enriching open pastures with trees or through managing forests to develop forage plants in the understory.

Silvopasturing is relatively new in New England as a deliberate and recognized practice, but it is becoming more widespread. Though relatively common in some regions of the world, silvopasture is not common in the Northeast. This is in part due to discouragement of commonly practiced unmanaged woodland grazing over the last half century by extension professionals and foresters due to environmental concerns consistent with all unmanaged grazing practices. Historically, the introduction of livestock into woodlands lacked the characteristics of silvopasturing that ensure its sustainability, including sound livestock husbandry and sustainable woodland practices.

Silvopasture can work with a variety of livestock in a variety of woodlands. Relatively small operations can be efficiently run and integrated with existing operations. Furthermore, the rapidly growing market for local foods provides a niche opportunity as some specialty products are ideally produced in silvopastures – all while complementing conventional agriculture and woodland production.



As the world population increases, other factors like land conversion, increased costs for petroleum based products, biofuel production, and decreased soil fertility increase the need for more efficient use of available arable land. Silvopasturing is one way to produce more benefits for the farmer while at the same time controlling undesirable vegetation while integrating some wooded areas with the overall farm operation.

Silvopasturing:

- Increases farm viability by optimizing efficiency and providing ways to generate new income without compromising future productivity.
- Uses modern technology and production systems to support rotational grazing and managed intensive grazing.
- Increases opportunity to feasibly harvest low-grade timber and reduce the amount of debris left in the understory which could impede the growth of invasive plants.
- Helps restore degraded forestland and control interfering plant species.
- Increases the stocking capacity of the farm by increasing total production and gross income.
- Provides cost-effective vegetation control.
- Provides greater shelter from extreme heat and cold and improved resting areas, which improves animal productivity.
- Improves animal health through higher quality and diverse forages.
- Balances seasonal forage curves during periods of greatest nutritional need (the hot summer months) by providing a greater variety of quality forage and microclimate and as an emergency food source during extreme drought.
- Is an aesthetically pleasing practice which encourages consumer-producer relationships.

Silvopastures can provide a variety of food sources for livestock, such as:

- Forages – Broad-leaf herbaceous plants, grasses, sedges
- Browse - The edible portions of woody plants
- Mast - Fruits, nuts, pods, seeds
- Other – Roots, bulbs, tubers, fungi, insects, and invertebrates (especially for pigs and poultry)

### **Benefits of Growing Quality Trees in a Silvopasture**

The benefits of growing trees in a silvopasture include:

- Provide diversified products to be harvested at financial maturity for premium prices and can also yield products like fruits, nuts, lumber, firewood and fence posts for sale.
- Shelter livestock from weather extremes and reduce forage quality losses from frost and heat.
- Provide savannah like forest structure, thus increasing landscape level diversity.

- Increase soil quality by uplifting of nutrients and stabilizing soils with roots.
- Provide palatable and nutritious food throughout the growing season and emergency food source during mid-summer droughts.
- Provide attractive agrarian landscapes, which can increase property values and generate public support for farming and forestry.

Sources:

<http://www.silvopasture.org/>

<http://www2.dnr.cornell.edu/ext/info/pubs/MapleAgrofor/Silvopasturing3-3-2011.pdf>

## XXVIII. Organic Farming

Organic farming is a term that embodies several different approaches to agriculture. It includes both operating definitions as well as a legal description. In general, organic farming specifies the type of amendment that can be applied to an agricultural field to help it grow things. Amendments include:

- seeds
- transplanted growth (seeds grown in a greenhouse then transplanted into fields)
- water
- fertilizers
- herbicides (used to control weeds)
- pesticides (used to control bugs and pests)
- fungicides (used to control fungi)

One definition of organic farming addresses only the issues of materials that are used in farming. Others also encompass concepts of sustainability and biodiversity and consider whether the methods of farming are harmful or beneficial to the environment.

In general, there are three functional types of organic farming:

- Pure organic farming, which includes the use of organic manures and bio-pesticides with complete avoidance of inorganic chemicals and pesticides;
- Integrated farming, which involves integrated nutrient management and integrated pest management; and
- Integrated farming systems, which involves the effective recycling of local resources by involving other components such as poultry, fishpond, mushroom, goat rearing, etc., apart from crop components. This is low input organic farming.

When considering the term *certified organic* it is important to understand that it has a legal definition. To claim that a product is *certified organic*, a business that is involved in the production of agricultural products, including seed suppliers, farmers, food processors, retailers, and restaurants, must meet specific production standards. Certification

requirements vary from country to country, but generally involve a set of standards for growing, storage, processing, packaging, and shipping that requires:

- no use of human sewage sludge fertilizer in cultivation of plants or feed of animals
- avoidance of synthetic chemicals (e.g. fertilizer, pesticides, antibiotics, food additives, etc.), genetically modified organisms, and irradiation;
- use of farmland that has been free from prohibited synthetic chemicals for a number of years (often, three or more);
- keeping detailed written production and sales records (audit trail);
- maintaining strict physical separation of organic from non-certified products; and
- undergoing periodic on-site inspections.

Organic agricultural methods are internationally regulated and legally enforced by many nations, based in large part on the standards set by the International Federation of Organic Agriculture Movements (IFOAM), an international umbrella organization for organic farming organizations established in 1972.

The USDA's National Organic Program (NOP) establishes a set of standards that define *USDA Organic* for all organic crops, livestock, and agriculture. Organic certification agencies inspect and verify that organic farmers, ranchers, distributors, processors, and traders comply with USDA regulations. USDA conducts audits and ensures that the more than 90 organic certification agencies operating around the world are properly certifying organic products.

USDA regulations recognize four categories of organic products:

- crops – plants grown to be harvested as food, livestock feed, fiber, or to add nutrients to the field;
- livestock – animals used for food or in production of food, fiber, or feed;
- processed products – Items handled and packaged (i.e. chopped carrots) or combined, processed, and packaged (i.e. soup); and
- wild crops – plants from a growing site that is not cultivated.

In order to sell, label, or represent a product as organic, certification is required for:

- farms that sell more than \$5,000 in organic products per year (gross sales);
- handlers that sell more than \$5,000 of organic processed food, including handlers that place bulk products into smaller packages or that repackage/relabel products;
- processors that sell more than \$5,000 of organic processed products, unless all products contain less than 70% organic ingredients or only identify the organic ingredients in the ingredient statement; and
- vendors that handle (e.g. package) and sell products online (but not in stores) or otherwise deliver organic products.

If a farm or business' gross agricultural income from organic sales does not exceed \$5,000 per year, it is considered to be exempt, which means it does not need to be certified in order to sell, label, or represent its products as organic. However, it must follow all other USDA organic regulations.

In order for a crop to be certified organic it must be grown on land that has not had inorganic materials applied to it for at least three years. Land that has used only organic materials for less than three years is considered to be in transition. Crops produced on it will not be certified organic until three years since the date when prohibited material was last applied to the field.

The USDA also provides definitions for other voluntary labels for livestock products, such as meat and eggs and requires that animal raising claims must be truthful and not misleading. These definitions include:

- *Free-range* – Indicates that flock was provided shelter in building, room, or area with unlimited access to food, fresh water, and continuous access to the outdoors during their production cycle. Outdoor area may or may not be fenced and/or covered with netting-like material. Label regulated by USDA.
- *Cage-free*. Indicates that flock was able to freely roam building, room, or enclosed area with unlimited access to food and fresh water during their production cycle.
- *Natural*. As required by USDA, meat, poultry, and egg products must be minimally processed and contain no artificial ingredients; however, label does not include standards regarding farm practices and only applies to processing of meat and egg products. No standards or regulations for label if food products do not contain meat or eggs.
- *Grass-fed*. Indicates animals receive majority of nutrients from grass throughout their life, while organic animals' pasture diet may be supplemented with grain. USDA regulated, Label does not limit use of antibiotics, hormones, or pesticides. Meat products may be labeled as grass-fed organic.
- *Pasture-raised*. Due to number of variables involved in pasture-raised systems, USDA has not developed definition.
- *Humane*. Multiple labeling programs claim animals were treated humanely during production cycle, but verification varies widely. Not regulated under single USDA definition.
- *No added hormones*. Similar claim includes "*Raised without Hormones.*" Federal regulations have never permitted hormones or steroids in poultry, pork, or goat.

Seacoast Eat Local also provides a glossary of definitions, including terms such as biodynamics, certified naturally grown, heirloom hybrid, heritage breeds, no till, raw milk, and good agricultural practices (GAP).

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