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Input and Output Data in Studying the Impact of Meat and Fat on the Land Resource Requirements of the Human Diet and Potential Carrying Capacity: The New York State Example

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SUMMARY

Consumer dietary preferences influence the amount of land needed for food production. We modeled the impact of fat and meat consumption on land requirements for food production in the context of New York State (NYS). This publication contains the input data used to create a spreadsheet-based model and the output data from the program. Per capita land resource requirements were calculated for 42 diets ranging from 0 to 381g/day (0 to12 oz/day) of meat and eggs and 52 to 117 g/day of fat (20 to 45% of total calories). All diets contain equal numbers of total calories, and many meet national dietary recommendations. The potential human carrying capacity of the NYS land base was then derived based on recent estimates of available agricultural land.

PURPOSE OF THIS REPORT

Consumer food preferences influence the amount of land needed for food production and thereby impact the number of people that can be supported by the Earth's natural resources (human carrying capacity). Animal products, in particular, tend to increase the amount of land needed for food production because consuming foods from herbivores is less efficient energetically than consuming plant foods directly. Proponents of plant-based diets have long argued that diets rich in animal products are wasteful of agricultural resources and contribute to the persistence of hunger. Animal scientists have long countered with the argument that livestock, especially ruminants, make use of forages and food byproducts that are inedible to humans. Moreover, they contend that the feeding of grains to livestock serves as a market for excess grain production and keeps production of food grains high. This debate continues to smolder today.

This research aimed at addressing one aspect of the dialogue over the proper place of animal products in the human diet: the land requirements of food production and their impact on human carrying capacity. Unlike earlier research, the efficiency of animal production was not assessed in isolation. Rather, the land requirements of food production were assessed in the context of a complete diet. In addition, the impact of land requirements on carrying capacity takes into account the varying quality of the available agricultural land. The analysis was conducted for a relatively small geographic area, New York State. Thus, conclusions drawn from the study are most appropriately extended only to regions with similar climates, soils, and landscapes.

A spreadsheet model was used to calculate annual per capita land resource requirements for 42 different diets varied in terms of total fat and total servings of meat. The diets were designed to represent a wide range of food consumption patterns – from low-fat, lacto-vegetarian to high-fat, meat-rich omnivorous. Diets contained 0 to 381g/day (0 to 12 oz/day) of meat and eggs, 52 to 117 g/day of fat (20 to 45% of total calories), and 2,308 kcal/day. The balance of energy needs was met from the other major food groups. The design of diets is based on the complete diet approach outlined by Peters et al. (2003). However, not all diets met the recommendations of the Food Guide Pyramid.

Data on crop yields, livestock feed requirements, and food system losses were used to calculate the area of land required per capita to produce each diet in New York State. These estimates were then used to calculate the number of people which could be fed from New York State's agricultural land based on the quality and quantity of land available.

The model relies on input from a variety of published data sources on food nutrient content, food consumption, food system losses, processing conversions, crop yields, and agricultural land use. In addition, it uses expert input on the feed requirements of livestock in the Northeast U.S. The input data fed into the model is reported here in detail in Tables 1 through 9. Output data from the model is also provided in Tables 10 through 13. A detailed explanation of the rationale behind this research, a full description of the methods, a summary of the results, and an interpretation of the findings has been submitted as a research paper to *Agronomy Journal*. The tables reported here are intended to serve as a companion to the formal research report for readers who are interested in specific details of the model or who wish to peruse the raw data.

Table 1. Constituent foods included in the diets and their average caloric value per serving[1], by food group and food subgroup.[2]

Commodity	Serving description	NDB number[3]	Serving size	Energy density	Relative preference	Energy per serving
			(grams)	(kcal/ 100g)	(percent)	(kcal)
GRAINS						
Wheat	1/6 cup flour[4]	20481, 20080	20.4	352	87.8	71.8
Rye	1/6 cup flour, medium	20064	17.0	354	0.7	60.2
Corn	1/6 cup meal, whole	20020	20.3	362	7.0	73.6
Oats	1/4 cup cereal[5]	08120	20.3	384	4.4	77.8
All grains	Average value, weighted					72.1
VEGETABLES, SUMMER						
Carrots, fresh	½ cup chopped	11124	64.0	43	33.8	27.5
Endive/escarole, fresh	1 cup shredded	11213	50.0	17	0.8	8.5
Lettuce, fresh	1 cup shredded	11251	56.0	14	51.1	7.8
Spinach, fresh	1 cup	11457	30.0	23	9.4	6.9
Squash, winter, fresh	½ cup baked squash	11644	102.5	37	4.9	37.9
Green leafy & yellow vegetables	Average value, weighted					15.9
Green peas, frozen	½ cup boiled, drained	11313	80.0	78	5.0	62.4
Green peas, canned	½ cup drained	11308	85.0	69	5.0	58.7
Potatoes, fresh	½ cup diced, boiled	11365	75.0	87	71.2	65.3
Sweet corn, fresh	1 ear boiled, yields	11168	77.0	108	18.9	83.2
Starchy vegetables	Average value, weighted					68.2
Beets, canned	½ cup diced, sliced, or whole	11084	163.3	31	0.9	50.6
Bell peppers, fresh	½ cup, chopped or sliced	11333	60.3	20	5.1	12.1
Cabbage, fresh	½ cup chopped	11109	44.5	25	6.7	11.1
Cauliflower, fresh	½ cup	11135	50.0	25	2.0	12.5
Cucumbers, fresh	½ cup slices	11205	52.0	13	8.1	6.8
Eggplant, fresh	½ cup boiled	11210	49.5	35	1.2	17.3
Onions, fresh	½ cup boiled, drained	11283	105.0	44	14.4	46.2
Snap beans, fresh	½ cup boiled	11053	62.5	35	8.8	21.9
Tomatoes, fresh	½ cup chopped or sliced	11883	90.0	21	52.9	18.9
Other vegetables	Average value, weighted					21.4
All summer vegetables	Average value, weighted[6]					35.1

Table 1. Continued.

Commodity	Serving description	NDB number	Serving size	Energy density	Relative preference	Energy per serving
			(grams)	(kcal/ 100g)	(percent)	(kcal)
VEGETABLES, WINTER						
Carrots, fresh	½ cup chopped	11124	64.0	43	70.3	27.5
Squash, winter, fresh	½ cup baked squash	11644	102.5	37	19.5	37.9
Spinach, frozen	½ cup boiled, drained	11464	95.0	32	10.2	30.4
Green leafy & yellow vegetables	Average value, weighted					29.8
Green peas, frozen	½ cup boiled, drained	11313	80.0	78	5.0	62.4
Green peas, canned	½ cup drained	11308	85.0	69	5.0	58.7
Potatoes, fresh	½ cup diced, boiled	11365	75.0	87	71.2	65.3
Sweet corn, frozen	½ cup boiled, drained	11179	82.0	81	9.4	66.4
Sweet corn, canned	½ cup drained	11172	82.0	81	9.4	66.4
Starchy vegetables	Average value, weighted					65.0
Beets, canned	½ cup diced, sliced, or whole	11084	163.3	31	1.1	50.6
Cabbage, fresh	½ cup chopped	11109	44.5	25	7.8	11.1
Cauliflower, frozen	½ cup boiled, drained	11138	90.0	19	2.3	17.1
Onions, fresh	½ cup boiled, drained	11283	105.0	44	16.8	46.2
Snap beans, frozen	½ cup boiled, drained	11061	67.5	28	5.1	18.9
Snap beans, canned	½ cup drained	11056	67.5	20	5.1	13.5
Tomatoes, canned	½ cup canned whole	11531	120.0	17	61.8	20.4
Other vegetables	Average value, weighted					23.8
All winter vegetables	Average value, weighted[6]					39.6
FRUIT, SUMMER						
Blueberries, fresh	½ cup whole berries	09050	72.5	56	2.9	40.6
Strawberries, fresh	½ cup halves, sliced, and whole	09316	77.0	30	9.9	23.1
Apples, fresh	½ cup raw, slices and chopped	09003	58.8	59	47.6	34.7
Cherries, fresh	½ cup pitted	09070	72.5	72	1.4	52.2
Grapes, fresh	½ cup w/o seeds	09131	46.0	67	13.4	30.8
Peaches, fresh	½ cup slices	09236	85.0	43	12.5	36.6
Pears, fresh	½ cup raw, slices	09252	82.5	59	12.3	48.7

Table 1. Continued.

Commodity	Serving description	NDB number	Serving size	Energy density	Relative preference	Energy per serving
			(grams)	(kcal/ 100g)	(percent)	(kcal)
Whole fruit	Average value, weighted					35.4
Apple juice	6 oz juice	09016	186.0	47	69.9	87.4
Grape juice	6 oz juice	09135	189.6	61	30.1	115.7
Fruit juice	Average value, weighted					95.9
All summer fruit	Average value, weighted[7]					55.6
FRUIT, WINTER						
Blueberries, frozen	½ cup unthawed	09054	77.5	51	3.4	39.5
Strawberries, frozen	½ cup thawed	09318	110.5	35	11.5	38.7
Apples, fresh	½ cup raw, slices and chopped	09003	58.8	59	54.9	34.7
Cherries, frozen	½ cup unthawed[8]	09068, 09076	77.5	67.5	1.6	52.3
Peaches, canned	½ cup drained, heavy syrup	09370	111.0	77	14.4	85.5
Pears, fresh	½ cup raw, slices	09252	82.5	59	14.2	48.7
Whole fruit						44.9
Apple juice	6 oz juice	09016	186.0	47	69.9	87.4
Grape juice	6 oz juice	09135	189.6	61	30.1	115.7
Fruit juice	Average value, weighted					95.9
All winter fruit	Average value, weighted[7]					61.9
DAIRY						
Fluid milk, whole	1 cup	01078	244.0	64	N/A	156.2
Fluid milk, skim	1 cup	01151	245.0	35	N/A	85.8
PULSES, NUTS, AND SEEDS						
Beans, black	½ cup cooked beans, dry weight	16016	32.3	341	43.6	110.3
Beans, kidney	½ cup cooked beans, dry weight	16027	30.7	333	43.6	102.1
Soybeans	½ cup regular tofu	16427	124.0	76	12.8	94.2
Pulses	Average value, weighted					104.7
Sunflower seeds	1 oz seeds	12037	28.4	582	100.0	165.0

Table 1. Continued.

Commodity	Serving description	NDB number	Serving size	Energy density	Relative preference	Energy per serving
			(grams)	(kcal/ 100g)	(percent)	(kcal)
Pulses, nuts and seeds	Average value, weighted[9]					114.7
MEAT AND EGGS						
Beef, regular	1 oz cooked[10]	13004, 23578	28.4	297	39.3	84.4
Pork, regular	1 oz cooked[11]	10188, 07064, 10124	28.4	334	18.9	95.0
Chicken, regular	1 oz roasted, meat and skin	05112	28.4	223	26.4	63.3
Meat, regular	Average value, weighted					80.2
Beef, lean	1 oz cooked[12]	13364, 23558	28.4	199	39.3	56.6
Pork, lean	1 oz cooked[13]	10093	28.4	212	18.9	60.2
Chicken, lean	1 oz roasted, meat only	05114	28.4	167	26.4	47.4
Meat and eggs, lean	Average value, weighted					54.5
Eggs	1 large egg, raw	01123	50.0	147	15.5	73.5
OILS						
Canola oil	1 gram	04582	1.0	884	5.8	8.8
Soybean oil	1 gram	04584	1.0	884	93.7	8.8
Sunflower oil	1 gram	04044	1.0	884	0.5	8.8
All oils	Average value, weighted					8.8
SUGAR						
Beet sugar	1 teaspoon	19335	4.0	387	100.0	15.5

1 – Nutritional data on food commodities obtained from the Nutrient Database for Standard Reference (NDB), release 17 (USDA Agricultural Research Service, 2004). Diets contain only foods which are or can be grown in New York State. Relative preferences for individual foods within food groups is based on consumption data from the Food Commodity Intake Database, version 2.1 (USEPA and USDA Agricultural Research Service, 2000).
2 – In accordance with the USDA Food Guide Pyramid, food is divided into seven groups: grains; vegetables; fruits; dairy; meat, eggs, nuts, and pulses; added fats, and added sweeteners. Vegetables are further subdivided into three categories: dark green leafy and deep yellow vegetables, starchy vegetables, and other vegetables. Distinctions are also drawn between whole fruit and juice. For more information see the 2000 Dietary Guidelines for Americans (USDA and US Department of Health and Human Services, 2000). Additional subdivisions shown in this table are to allow comparison with Table 2.
3 –Reference number used by the Nutrient Database for Standard Reference (NDB).
4 – Average of white and whole wheat flour.

5 – Includes regular, quick, and instant oats.
6 – One-third of total vegetable servings are assumed to come from each subgroup.
7 – Two-thirds of total fruit servings are assumed to come from whole fruit, one-third from juice.
8 – Average of sweet and sour cherries.
9 – Assumes that 5 out of 6 servings come from pulses and 1 out of 6 from nuts and seeds.
10 – Average of the composite of all retail cuts (trimmed to 1/4" fat) and ground beef (75% lean, broiled).
11 - Average of the composite of all retail cuts, sausage, and bacon.
12 – Average of the composite of all retail cuts (trimmed to 0" fat) and ground beef (95% lean, broiled)
13 – Composite of ham, shoulder, and loin cuts.

Table 2. Servings[1] of food from major food groups and selected food subgroups, by diet.

Diet		Grains	Vegetables	Fruit	Dairy		Pulses, nuts, and seeds	Meat and eggs			Oils	Added sugars
Meat	Fat				Skim	Whole		Lean meat	Regular meat	Eggs		
----g/day----		--------servings--------										
0	52	9.3	4.1	3.1	0.7	1.5	6.1	0.0	0.0	0.0	14.0	11.8
	65	9.3	4.1	3.1	0.0	2.2	6.1	0.0	0.0	0.0	21.0	4.6
	78	8.9	3.9	3.0	0.0	2.2	6.1	0.0	0.0	0.0	34.0	0.0
	91	7.8	3.4	2.6	0.0	2.2	6.1	0.0	0.0	0.0	47.1	0.0
	104	6.8	3.0	2.3	0.0	2.2	6.1	0.0	0.0	0.0	60.1	0.0
	117	5.7	2.5	1.9	0.0	2.2	6.1	0.0	0.0	0.0	73.2	0.0
63	52	9.8	4.3	3.3	0.9	1.3	4.1	0.7	1.0	0.3	14.0	14.9
	65	9.3	4.1	3.1	0.0	2.2	4.1	0.0	1.7	0.3	16.8	11.6
	78	9.3	4.1	3.1	0.0	2.2	4.1	0.0	1.7	0.3	29.8	4.1
	91	8.8	3.9	2.9	0.0	2.2	4.1	0.0	1.7	0.3	42.9	0.0
	104	7.8	3.4	2.6	0.0	2.2	4.1	0.0	1.7	0.3	55.9	0.0
	117	6.7	3.0	2.2	0.0	2.2	4.1	0.0	1.7	0.3	69.0	0.0
127	52	10.8	4.8	3.6	1.1	1.1	2.1	1.7	1.7	0.6	14.0	14.9
	65	9.8	4.3	3.3	0.1	2.1	2.1	0.2	3.2	0.6	14.0	14.9
	78	9.3	4.1	3.1	0.0	2.2	2.1	0.0	3.4	0.6	25.7	11.1
	91	9.3	4.1	3.1	0.0	2.2	2.1	0.0	3.4	0.6	38.7	3.7
	104	8.8	3.9	2.9	0.0	2.2	2.1	0.0	3.4	0.6	51.8	0.0
	117	7.7	3.4	2.6	0.0	2.2	2.1	0.0	3.4	0.6	64.8	0.0
190	52	11.8	5.2	3.9	1.2	1.0	0.1	2.8	2.3	0.9	14.0	14.9
	65	10.8	4.8	3.6	0.4	1.8	0.1	0.8	4.2	0.9	14.0	14.9
	78	9.8	4.3	3.3	0.0	2.2	0.1	0.0	5.1	0.9	21.5	14.9
	91	9.3	4.1	3.1	0.0	2.2	0.1	0.0	5.1	0.9	34.5	10.6
	104	9.3	4.1	3.1	0.0	2.2	0.1	0.0	5.1	0.9	47.6	3.2
	117	8.7	3.8	2.9	0.0	2.2	0.1	0.0	5.1	0.9	60.6	0.0
254	52	11.1	4.9	3.7	1.6	0.6	0.1	5.0	1.7	1.2	14.0	14.9
	65	10.1	4.5	3.4	0.9	1.3	0.1	2.8	4.0	1.2	14.0	14.9
	78	9.3	4.1	3.1	0.2	2.0	0.1	0.5	6.2	1.2	14.0	13.7
	91	9.3	4.1	3.1	0.0	2.2	0.1	0.0	6.8	1.2	23.9	6.5

Table 2. Continued.

Diet		Grains	Vegetables	Fruit	Dairy		Pulses, nuts, and seeds	Meat and eggs			Oils	Added sugars
Meat	Fat				Skim	Whole		Lean meat	Regular meat	Eggs		
----g/day----		---servings---										
254	104	9.1	4.0	3.0	0.0	2.2	0.1	0.0	6.8	1.2	36.9	0.2
	117	8.1	3.6	2.7	0.0	2.2	0.1	0.0	6.8	1.2	50.0	0.0
317	52	10.5	4.6	3.5	2.0	0.2	0.1	7.6	0.9	1.5	14.0	14.9
	65	9.5	4.2	3.2	1.3	0.9	0.1	5.1	3.4	1.5	14.0	14.9
	78	9.3	4.1	3.1	0.7	1.5	0.1	2.6	5.8	1.5	14.0	9.3
	91	9.3	4.1	3.1	0.0	2.2	0.1	0.2	8.3	1.5	14.0	2.3
	104	8.6	3.8	2.9	0.0	2.2	0.1	0.0	8.5	1.5	26.2	0.0
	117	7.5	3.3	2.5	0.0	2.2	0.1	0.0	8.5	1.5	39.3	0.0
381	52	9.8	4.3	3.3	2.2	0.0	0.1	10.1	0.0	1.9	14.0	14.9
	65	9.3	4.1	3.1	1.7	0.5	0.1	7.6	2.5	1.9	14.0	11.9
	78	9.3	4.1	3.1	1.1	1.1	0.1	5.0	5.2	1.9	14.0	4.8
	91	9.0	4.0	3.0	0.5	1.7	0.1	2.3	7.8	1.9	14.0	0.0
	104	8.0	3.5	2.7	0.0	2.2	0.1	0.0	10.1	1.9	15.6	0.0
	117	6.9	3.0	2.3	0.0	2.2	0.1	0.0	10.1	1.9	28.6	0.0

1 – Serving sizes are outlined in Table 1. Note that serving sizes are not consistent across food groups.

Table 3. Proportion of total dietary energy supplied by each food group.[1]

Diet		Grains, fruits, & vegetables	Pulses	Dairy	Meat & eggs	Oils	Sugar
Meat	Fat						
-------g/day-------		-------------------------percent of total dietary energy------------------------					
0	52	43.7	30.3	12.7	-	5.4	7.9
	65	43.7	30.3	14.9	-	8.0	3.1
	78	41.8	30.3	14.9	-	13.0	-
	91	36.8	30.3	14.9	-	18.0	-
	104	31.8	30.3	14.9	-	23.0	-
	117	26.8	30.3	14.9	-	28.0	-
63	52	46.2	20.4	12.0	6.1	5.4	10.0
	65	43.7	20.4	14.9	6.9	6.4	7.8
	78	43.7	20.4	14.9	6.9	11.4	2.8
	91	41.4	20.4	14.9	6.9	16.4	-
	104	36.4	20.4	14.9	6.9	21.4	-
	117	31.4	20.4	14.9	6.9	26.4	-
127	52	50.8	10.4	11.6	11.9	5.4	10.0
	65	46.1	10.4	14.6	13.5	5.4	10.0
	78	43.7	10.4	14.9	13.7	9.8	7.4
	91	43.7	10.4	14.9	13.7	14.8	2.4
	104	41.1	10.4	14.9	13.7	19.8	-
	117	36.1	10.4	14.9	13.7	24.8	-
190	52	55.4	0.5	11.2	17.5	5.4	10.0
	65	50.7	0.5	13.8	19.7	5.4	10.0
	78	45.8	0.5	14.9	20.6	8.2	10.0
	91	43.7	0.5	14.9	20.6	13.2	7.1
	104	43.7	0.5	14.9	20.6	18.2	2.1
	117	40.8	0.5	14.9	20.6	23.2	-
254	52	52.4	0.5	9.9	21.9	5.4	10.0
	65	47.7	0.5	12.1	24.3	5.4	10.0
	78	43.8	0.5	14.3	26.8	5.4	9.2
	91	43.7	0.5	14.9	27.4	9.1	4.4
	104	42.9	0.5	14.9	27.4	14.1	0.1
	117	38.0	0.5	14.9	27.4	19.1	-
317	52	49.3	0.5	8.9	25.9	5.4	10.0
	65	44.6	0.5	10.8	28.6	5.4	10.0
	78	43.7	0.5	12.8	31.4	5.4	6.3
	91	43.7	0.5	14.8	34.1	5.4	1.6
	104	40.3	0.5	14.9	34.3	10.0	-
	117	35.3	0.5	14.9	34.3	15.0	-
381	52	46.1	0.5	8.2	29.9	5.4	10.0
	65	43.7	0.5	9.8	32.7	5.4	8.0
	78	43.7	0.5	11.6	35.6	5.4	3.3
	91	42.2	0.5	13.3	38.6	5.4	-
	104	37.5	0.5	14.9	41.2	6.0	-
	117	32.5	0.5	14.9	41.2	11.0	-

1 – The grains, vegetables, and fruit food groups were merged into a single category to improve the readability of the table. These groups represent the base of the USDA Food Guide Pyramid and, thus, constitute the foundation of a balanced diet.

Table 4. Estimates of food system losses, inedible portions, and yields of processed product per unit input used to calculate the farm weight of commodities needed to provide the consumption outlined in the diets.

Food item	Foodservice and consumer loss[1]	Inedible share[2]	Cooking loss[2]	Retail loss[3]	Loss from primary to retail weight[4]	Yield product per unit weight of farm commodity[5]
	-----	-----	-----	percent	-----	-----
Apple juice	15	0	0	1	0	73
Apples, fresh	30	8	0	2	4	100
Beans, black	15	0	0	1	0	100
Beans, kidney	15	0	0	1	0	100
Beef, lean[6]	15	9	22	2	0	41
Beef, regular	15	0	22	2	0	44
Beets, canned	15	0	0	1	0	76
Bell peppers, fresh	30	18	0	2	8	100
Blueberries, fresh	30	2	0	2	5	100
Blueberries, frozen	15	0	0	1	0	97
Cabbage, fresh	30	20	0	2	7	100
Carrots, fresh	30	11	0	2	3	100
Cauliflower, fresh	30	61	0	2	8	100
Cauliflower, frozen	15	0	7	1	0	70
Cherries, fresh	30	10	0	2	8	100
Cherries, frozen	15	0	0	1	0	88
Chicken, lean[7]	15	19	30	2	0	44
Chicken, regular	15	0	30	2	0	44
Corn, grain	20	0	0	2	0	89
Cucumbers, fresh	30	27	0	2	8	100
Eggplant, fresh	30	19	7	2	10	100
Eggs	30	11	0	2	0	100
Endive/escarole, fresh	30	14	0	2	7	100
Grape juice	15	0	0	1	0	81
Grapes, fresh	30	4	0	2	9	100
Green peas, canned	15	0	0	1	0	135
Green peas, frozen	15	0	7	1	0	92
Lettuce, fresh	30	16	0	2	7	100
Milk, skim	30	0	0	2	0	97
Milk, whole	30	0	0	2	0	100

Table 4. Continued.

Food item	Foodservice and consumer loss[1]	Inedible share[2]	Cooking loss[2]	Retail loss[3]	Loss from primary to retail weight[4]	Yield product per unit weight of farm commodity[5]
	---percent---					
Oats	20	0	0	2	0	58
Oil, canola	20	0	0	1	0	41
Oil, soybean	20	0	0	1	0	18
Oil, sunflower	20	0	0	1	0	41
Onions, fresh	30	10	15	2	6	100
Peaches, canned	15	0	0	1	0	109
Peaches, fresh	30	11	0	2	5	100
Pears, fresh	30	8	0	2	5	100
Pork, lean[8]	15	0	39	2	0	35
Pork, regular	15	0	39	2	0	54
Potatoes, fresh	30	23	10	2	4	100
Rye	20	0	0	2	0	*86*
Snap beans, canned	15	0	0	1	0	140
Snap beans, fresh	30	12	2	2	6	100
Snap beans, frozen	15	0	10	1	0	85
Soybeans, for tofu[9]	30	0	0	2	0	592
Spinach, fresh	30	28	0	2	15	100
Spinach, frozen	15	0	33	2	0	70
Squash, winter, fresh	30	26	15	2	8	100
Strawberries, fresh	30	6	0	2	8	100
Strawberries, frozen	15	0	0	1	0	112
Sugar, from sugar beet	30	0	0	1	0	14
Sunflower seeds	15	0	0	1	0	100
Sweet corn, canned	15	0	0	1	0	39
Sweet corn, fresh	30	64	12	2	8	100
Sweet corn, frozen	15	0	4	1	0	27
Tomatoes, canned	15	0	0	1	0	64
Tomatoes, fresh	30	9	0	2	15	100
Wheat	20	0	0	2	0	86

1 – Includes all losses that occur at the consumer or foodservice level in the food system, such as over-preparation of food, plate waste, and spoilage. Estimates of loss are from Kantor (1998).

2 – Estimates of inedible portions and weight losses resulting from cooking are from Matthews and Garrison (1975) and Kantor (1998).
3 – Includes all losses of food that occur at the retail level. Estimates from Kantor (1998).
4 – Reduction in weight that occurs from the farm gate to the retail outlet. Estimates from Kantor (1998).
5 – Yield of processed food product per unit weight of farm commodity. Estimates from USDA Economic Research Service (1992).
6 – Lean beef assumes that fat is trimmed from cuts of meat at processing (yield of product) and that any remaining separable fat is not eaten (inedible share). The quantity of separable fat remaining in trimmed cuts of meat was derived from the Nutrient Database for Standard Reference, Release 17 (USDA Agricultural Research Service, 2004).
7 – Lean chicken assumes that the skin is not eaten (inedible share). The relative quantity of skin to meat was derived from the Nutrient Database for Standard Reference, Release 17 (USDA Agricultural Research Service, 2004).
8 – Lean pork excludes the weight of pork bellies from the yield of product. Pork bellies are often cured and used for bacon.
9 – Yield of tofu per unit weight of soybeans was derived by dividing the dry weight of tofu by the dry weight of soybeans. Dry weights derived from the Nutrient Database for Standard Reference, Release 17 (USDA Agricultural Research Service, 2004).

Table 5. Crop yields used to estimate per capita land requirements of diet, 1999 to 2003. Yields shown are for New York State unless otherwise noted.[1]

Crop	1999	2000	2001	2002	2003
	(lbs/acre)				
Alfalfa hay	4,900	4,600	4,800	5,600	4,600
Apples	17,455	22,364	23,375	22,927	15,366
Barley	2,400	2,736	2,784	2,448	2,256
Beets, processed	24,000	30,740	26,760	30,800	-
Bell peppers	-	-	21,000	23,000	-
Blueberries	2,143	2,286	2,714	2,143	2,714
Cabbage	38,000	41,000	44,000	40,000	35,000
Canola[2]	1,196	1,359	1,358	1,169	1,250
Carrots	30,000	30,000	-	-	-
Cauliflower	19,500	15,000	12,000	14,000	10,000
Cherries, sweet and tart	4,030	5,672	6,345	6,000	4,963
Corn	6,384	5,656	5,488	5,880	5,432
Cucumbers	20,000	18,000	21,000	17,000	18,000
Drybeans	1,420	1,370	1,460	870	1,360
Eggplant	-	-	18,000	23,000	-
Endive/escarole	-	-	28,000	28,000	-
Grapes	7,937	12,952	9,778	9,460	10,000
Green peas, processed	4,400	4,260	4,020	4,540	2,880
Lettuce	27,500	21,000	-	-	-
Oats	1,984	2,176	2,080	2,208	2,112
Onions	30,000	28,000	38,000	33,000	21,000
Other hay	4,100	3,600	3,800	3,600	4,200
Peaches	5,313	7,500	7,063	7,500	5,882
Pears	10,000	11,300	12,900	14,286	14,071
Potatoes	27,000	26,500	28,000	25,500	25,000
Rye	1,960	2,128	2,240	1,512	1,960
Snap beans	6,200	6,100	6,800	5,600	5,500
Snap beans, processed	7,400	6,840	6,740	5,920	5,980
Soybeans	2,460	2,220	1,980	1,980	1,920
Spinach	-	-	8,000	8,000	-
Squash	-	-	22,000	16,000	17,000
Strawberries	3,813	4,875	4,063	3,750	4,500
Sugarbeets[3]	33,300	38,100	41,500	36,400	38,700
Sunflower, non-oil[2]	1,124	1,082	988	1,243	1,150
Sunflower, oil[2]	1,101	1,156	977	1,372	1,178
Sweet corn	9,000	9,500	9,500	11,500	11,000
Sweet corn, processed	11,200	11,040	10,660	11,000	-
Tomatoes	14,000	11,500	18,000	16,000	14,000
Wheat	3,240	3,900	3,180	3,180	3,480

1 – Crop yields are from New York Agricultural Statistics Service (2004) unless otherwise noted. Dash (-) indicates that no data was available for that year. Average yields over the time frame were used to substitute for missing values. Yields have been converted to lbs per acre from their original units.
2 – Yields for "Other states" (which includes New York) from national summaries of crop production (USDA National Agricultural Statistics Service, 2001 and 2004).
3 – Average yields for Michigan and Ohio, the two closest states for which data was available, from national summaries of crop production (USDA National Agricultural Statistics Service, 2001 and 2004).

Table 6. Feed requirements for hogs, broilers, and laying hens.

Livestock class	Corn grain required	Soybean meal required	Mineral supplements	Total feed
	--------------------------lbs per marketable animal---------------------------			
Hogs[1]				
Feeder pigs	598.5	196.7	59.9	855.0
Sows	81.4	26.7	8.1	116.3
Boars	2.4	0.8	0.2	3.5
Total, hogs	682.3	224.2	68.2	974.8
Broilers[2]				
Pullets	6.62	3.86	0.55	11.03
Hens	0.50	0.29	0.04	0.83
Roosters	0.05	0.03	0.00	0.08
Total, broilers	7.16	4.18	0.60	11.93
Layers	---------------------------------lbs per 300 eggs----------------------------------			
Layers, mature[5]	51.07	25.54	8.51	85.12
Layers, immature[5]	8.96	4.48	1.49	14.93
Hens[6]	0.47	0.24	0.08	0.79
Roosters[7]	0.05	0.02	0.01	0.08
Total, layers	60.55	30.27	10.08	100.91

1 – Assumes that pigs are fed to a market weight of 250 lbs at an average feed conversion of 3 lbs feed per 1 lb of live weight. The ration is 70% corn, 23% soybean meal, and 7% mineral supplements. The herd mortality rate is 14%. Breeding stock (sows and boars) are fed the same ration as feeder pigs at a rate of 1 ton feed per year. Sows give birth to an average of 20 piglets per year, and 3 boars are required to service every 100 sows. Personal communication with Tro Bui, Dept of Animal Science, Cornell University (10 August 2001).

2 – Assumes that pullets are fed to a market weight of 5 lbs at an average feed conversion of 2.1 lbs feed per 1 lb of live weight. The ration is 60% corn, 35% soybean meal, and 5% mineral supplements. The mortality rate of the flock is 5%. Breeding stock (hens and roosters) are fed the same ration at a rate of 0.30 lbs per day. Hens lay 155 eggs per year, and 90% of eggs hatch to produce chicks. One rooster is required per 10 hens. Personal communication with Kavous Keshavarz, Dept of Animal Science, Cornell University (4 June 2001).

3 – Assumes that mature layers produce 300 eggs over a 55-week laying period. Mature layers consume 0.22 lbs of feed per day. Laying hens begin producing eggs at 17 weeks of age. During the immature period, layers consume 0.13 lbs of feed per day. The ration is 60% corn, 30% soybean meal, and 10% minerals. The mortality rate of the laying flock is 5% for immature birds and 6% for mature birds. Breeding stock (hens and roosters) are fed the same ration at a rate of 0.22 lbs per day. Hens lay 240 eggs per year, and 90% of eggs hatch to produce chicks, 50% of which are female. One rooster is required per 10 hens. Personal communication with Kavous Keshavarz, Dept of Animal Science, Cornell University (4 June 2001).

Table 7. Feed requirements for beef cattle.

Type of cattle[1]	Feed requirements per marketable animal				
	Corn	Soy	Minerals	Hay	Pasture
	---------------------------lbs----------------------------				ac
Cow and calf to 550 lbs	341	-	155	2,821	2.1
Backgrounded calf to 850 lbs	750	-	-	2100	-
Feedlot cattle to 1300 lbs	2550	150	150	450	-
Total, beef cattle	3,641	150	305	5,371	2.1

1 – Feed requirements compiled by M.W. Hamm, Dept of Community, Agriculture, Recreation and Resource Studies, Michigan State University. Obtained via personal communication with M.W. Hamm (7 June 2004). Confirmed applicability to New York State via personal communication with Mike Baker, Dept of Animal Science, Cornell University (1 September 2004).

Table 8. Feed and forage requirements for dairy cattle fed a forage-rich ration.[1]

Type of cattle	Herd size	Alfalfa silage	Grass silage	Corn	Soybean meal[2]
	No. animals	---------------------Tons as fed per year--------------------			
Milking animals	575	1,765.0	1,471.2	715.5	385.2
Dry Cows	69	-	289.6	-	14.0
Heifers, >500 lbs	310	-	1,058.5	-	101.6
Heifers, <500 lbs	260	-	401.4	-	21.0
		-------------Lbs feed per hundredweight milk-------------			
Feed per unit fluid milk[3]	NA	29.8	54.3	12.1	8.8

NA – not applicable
1 – The Cornell Net Carbohydrate and Protein System (CNCPS), Version 4.0, was used to estimate the feeding requirements of the cattle. The principles and operation of the CNCPS model are described by Fox et al. (2000). Tom Tylutki of the Dept of Animal Science, Cornell University performed the analysis and reported results on 2 October 2001.
2 – In addition to soybean meal, the ration included small amounts of the following food processing byproducts: beet pulp, canola seed meal, corn gluten, sunflower seed meal, and millings of barley, oats, and rye. In total, these miscellaneous byproducts account for an additional 273 tons of feed or 4.6 lbs feed per hundredweight of fluid milk.
3 – Estimated total milk production for the herd was 11.9 million lbs per year (56.5 lbs per cow per day).

Table 9. Comparison of actual land use in New York State with area assumed to be available for agricultural production in the estimates of carrying capacity.

Land use	Area	
	Non-SI units	SI units
	10^3 acres	10^3 ha
Actual land use (average 1999 to 2003)[1]		
Land in farms	7,694	3,116
Cropland	4,948	2,004
Harvested cropland	3,752	1,520
Field crops	3,500	1,417
Hay crops	1,646	667
Cereals, beans, & potatoes[2]	1,434	581
Other field crops[3]	420	170
Vegetables	157	63
Fruits	96	39
Pastured cropland	632	256
Other cropland	564	228
Permanent pasture	630	255
Woodland	1,520	616
Other land[4]	596	241
Land use limits in model[5]		
Productive land available	5,014	2,031
Usable for any crop	1,759	712
Limited to perennial crops or pasture	2,625	1,063
Limited to pasture	630	255

1 – Values for actual land use from New York Agricultural Statistics Service (2004).
2 – Includes corn silage.
3 – Residual value after accounting for hay, cereals, beans, and potatoes. Includes haylage and greenchop.
4 – Includes house lots, ponds, roads, waste, etc.
5 – Assumes that all harvested or pastured cropland and all permanent pasture are available for productive use. For soil management reasons, it is assumed that some cropland must be in perennial crops or pasture at any given time. Proportion of cropland limited to perennial crops is based on the current ratio of perennial crops and cropland pasture to the total of harvested cropland and cropland pasture. Permanent pasture is considered limited to pasture.

Table 10. Estimated[1] annual per capita land requirements for food production in New York State by diet and model year.

Diet[2]		Land required per capita to meet annual food needs[3]					
Meat	Fat	1999	2000	2001	2002	2003	5-year Average
------g/day------		ha (acres)					
0	52	0.1727 (0.4265)	0.1739 (0.4293)	0.1753 (0.4327)	0.1983 (0.4896)	0.1766 (0.4361)	0.1794 (0.4429)
	65	0.1756 (0.4336)	0.1776 (0.4385)	0.1800 (0.4445)	0.2028 (0.5007)	0.1815 (0.4481)	0.1835 (0.4531)
	78	0.1830 (0.4519)	0.1867 (0.4609)	0.1905 (0.4705)	0.2132 (0.5263)	0.1923 (0.4748)	0.1931 (0.4769)
	91	0.1882 (0.4648)	0.1938 (0.4786)	0.1988 (0.4908)	0.2214 (0.5467)	0.2008 (0.4958)	0.2006 (0.4953)
	104	0.1934 (0.4776)	0.2010 (0.4963)	0.2070 (0.5112)	0.2296 (0.5670)	0.2093 (0.5167)	0.2081 (0.5138)
	117	0.1987 (0.4905)	0.2082 (0.5140)	0.2153 (0.5316)	0.2379 (0.5873)	0.2178 (0.5377)	0.2155 (0.5322)
63	52	0.2608 (0.6439)	0.2684 (0.6627)	0.2710 (0.6692)	0.2867 (0.7079)	0.2702 (0.6672)	0.2714 (0.6702)
	65	0.2473 (0.6105)	0.2546 (0.6287)	0.2570 (0.6346)	0.2726 (0.6731)	0.2562 (0.6326)	0.2575 (0.6359)
	78	0.2489 (0.6145)	0.2569 (0.6344)	0.2600 (0.6420)	0.2753 (0.6798)	0.2592 (0.6400)	0.2601 (0.6421)
	91	0.2561 (0.6322)	0.2658 (0.6563)	0.2703 (0.6674)	0.2855 (0.7049)	0.2698 (0.6661)	0.2695 (0.6654)
	104	0.2613 (0.6451)	0.2730 (0.6740)	0.2785 (0.6878)	0.2937 (0.7252)	0.2783 (0.6871)	0.2770 (0.6838)
	117	0.2665 (0.6580)	0.2801 (0.6916)	0.2868 (0.7081)	0.3020 (0.7456)	0.2868 (0.7081)	0.2844 (0.7023)
127	52	0.3563 (0.8797)	0.3707 (0.9153)	0.3753 (0.9267)	0.3835 (0.9470)	0.3725 (0.9199)	0.3717 (0.9177)
	65	0.3321 (0.8199)	0.3458 (0.8537)	0.3497 (0.8634)	0.3579 (0.8838)	0.3469 (0.8567)	0.3465 (0.8555)
	78	0.3262 (0.8055)	0.3402 (0.8401)	0.3441 (0.8495)	0.3522 (0.8696)	0.3412 (0.8425)	0.3408 (0.8414)
	91	0.3241 (0.8002)	0.3384 (0.8355)	0.3424 (0.8454)	0.3503 (0.8649)	0.3394 (0.8381)	0.3389 (0.8368)
	104	0.3291 (0.8126)	0.3449 (0.8516)	0.3501 (0.8643)	0.3578 (0.8835)	0.3473 (0.8574)	0.3458 (0.8539)
	117	0.3343 (0.8254)	0.3521 (0.8693)	0.3583 (0.8847)	0.3660 (0.9038)	0.3558 (0.8784)	0.3533 (0.8723)
190	52	0.4531 (1.1187)	0.4744 (1.1715)	0.4811 (1.1879)	0.4818 (1.1897)	0.4763 (1.1761)	0.4734 (1.1688)
	65	0.4244 (1.0479)	0.4447 (1.0979)	0.4505 (1.1124)	0.4513 (1.1144)	0.4458 (1.1008)	0.4433 (1.0947)
	78	0.4088 (1.0094)	0.4290 (1.0593)	0.4343 (1.0724)	0.4352 (1.0745)	0.4296 (1.0606)	0.4274 (1.0553)
	91	0.4052 (1.0004)	0.4259 (1.0515)	0.4311 (1.0645)	0.4318 (1.0661)	0.4262 (1.0523)	0.4240 (1.0470)
	104	0.4030 (0.9951)	0.4240 (1.0469)	0.4294 (1.0604)	0.4299 (1.0615)	0.4244 (1.0479)	0.4221 (1.0423)
	117	0.4021 (0.9929)	0.4240 (1.0470)	0.4298 (1.0613)	0.4301 (1.0621)	0.4247 (1.0488)	0.4222 (1.0424)
254	52	0.5699 (1.4071)	0.6013 (1.4846)	0.6092 (1.5043)	0.6095 (1.5050)	0.6023 (1.4872)	0.5984 (1.4776)
	65	0.5379 (1.3281)	0.5679 (1.4022)	0.5750 (1.4198)	0.5754 (1.4208)	0.5682 (1.4030)	0.5649 (1.3948)
	78	0.5066 (1.2508)	0.5351 (1.3212)	0.5414 (1.3369)	0.5419 (1.3381)	0.5348 (1.3204)	0.5320 (1.3135)
	91	0.4979 (1.2293)	0.5262 (1.2992)	0.5326 (1.3150)	0.5329 (1.3157)	0.5259 (1.2985)	0.5231 (1.2916)

Table 10. Continued.

Diet[2]		Land required per capita to meet annual food needs[3]											
Meat	Fat	1999		2000		2001		2002		2003		5-year Average	
-------g/day------		---ha (acres)---											
254	104	0.4951	(1.2225)	0.5238	(1.2933)	0.5303	(1.3094)	0.5304	(1.3096)	0.5235	(1.2925)	0.5206	(1.2855)
	117	0.4894	(1.2084)	0.5188	(1.2810)	0.5250	(1.2962)	0.5250	(1.2963)	0.5179	(1.2789)	0.5152	(1.2722)
317	52	0.6897	(1.7030)	0.7314	(1.8058)	0.7407	(1.8289)	0.7406	(1.8286)	0.7316	(1.8064)	0.7268	(1.7945)
	65	0.6552	(1.6178)	0.6952	(1.7167)	0.7037	(1.7375)	0.7037	(1.7375)	0.6947	(1.7154)	0.6905	(1.7050)
	78	0.6235	(1.5394)	0.6616	(1.6335)	0.6695	(1.6532)	0.6695	(1.6530)	0.6608	(1.6316)	0.6570	(1.6222)
	91	0.5924	(1.4627)	0.6285	(1.5518)	0.6361	(1.5706)	0.6359	(1.5702)	0.6276	(1.5495)	0.6241	(1.5410)
	104	0.5859	(1.4467)	0.6224	(1.5368)	0.6298	(1.5551)	0.6296	(1.5545)	0.6211	(1.5337)	0.6178	(1.5253)
	117	0.5801	(1.4323)	0.6174	(1.5244)	0.6243	(1.5416)	0.6241	(1.5410)	0.6155	(1.5198)	0.6123	(1.5118)
381	52	0.8097	(1.9991)	0.8616	(2.1275)	0.8723	(2.1539)	0.8718	(2.1525)	0.8611	(2.1261)	0.8553	(2.1118)
	65	0.7767	(1.9177)	0.8268	(2.0415)	0.8369	(2.0663)	0.8363	(2.0650)	0.8258	(2.0389)	0.8205	(2.0259)
	78	0.7436	(1.8361)	0.7915	(1.9544)	0.8012	(1.9782)	0.8006	(1.9767)	0.7903	(1.9515)	0.7854	(1.9394)
	91	0.7094	(1.7517)	0.7553	(1.8648)	0.7644	(1.8873)	0.7637	(1.8858)	0.7537	(1.8611)	0.7493	(1.8501)
	104	0.6766	(1.6706)	0.7210	(1.7802)	0.7292	(1.8005)	0.7287	(1.7992)	0.7187	(1.7746)	0.7148	(1.7650)
	117	0.6708	(1.6563)	0.7159	(1.7677)	0.7237	(1.7870)	0.7232	(1.7857)	0.7131	(1.7607)	0.7093	(1.7515)

1 – Per capita land requirements for annual food production were derived based on the input data shown in Tables 1 through 9.
2 – Diet parameters shown in SI units (grams of meat and fat consumed per day). In non-SI units, the meat treatments are 0, 2, 4, 6, 8, 10, and 12 ounces of cooked meat per day. The fat treatments are 20%, 25%, 30%, 35%, 40% and 45% total dietary calories from fat.
3 – Both SI and non-SI units are shown to for allow easy comparisons with published data.

Table 11. Potential[1] carrying capacity of New York State by diet and model year.

Diet[2]		Estimated carrying capacity[3]					
Meat	Fat	1999	2000	2001	2002	2003	Average
--------g/day--------		-----------------------------------million persons------------------------------------					
0	52	6.4097	6.4108	6.2328	5.1938	6.1434	6.0781
	65	6.2168	6.1677	5.9532	5.0075	5.8673	5.8425
	78	5.8045	5.6938	5.4476	4.6493	5.3605	5.3912
	91	5.4885	5.3296	5.0709	4.3713	4.9777	5.0476
	104	5.2051	5.0091	4.7429	4.1246	4.6459	4.7455
	117	4.9495	4.7250	4.4547	3.9044	4.3556	4.4778
63	52	5.3835	5.2593	5.0394	4.5867	4.9684	5.0475
	65	5.6938	5.5606	5.3300	4.8253	5.2556	5.3331
	78	5.6222	5.4635	5.2134	4.7372	5.1415	5.2356
	91	5.2873	5.0925	4.8263	4.4189	4.7524	4.8755
	104	5.0238	4.7991	4.5283	4.1670	4.4490	4.5935
	117	4.7853	4.5377	4.2649	3.9423	4.1821	4.3425
127	52	4.4854	4.3021	4.0710	3.9606	4.0147	4.1667
	65	4.8539	4.6576	4.4121	4.2747	4.3498	4.5096
	78	4.9849	4.7719	4.5178	4.3758	4.4537	4.6208
	91	5.0608	4.8323	4.5657	4.4275	4.5038	4.6780
	104	4.8547	4.6061	4.3322	4.2103	4.2682	4.4543
	117	4.6317	4.3647	4.0905	3.9810	4.0219	4.2180
190	52	3.8318	3.6273	3.4032	3.4732	3.3566	3.5384
	65	4.1453	3.9248	3.6834	3.7575	3.6323	3.8287
	78	4.3552	4.1167	3.8650	3.9425	3.8095	4.0178
	91	4.4330	4.1792	3.9204	4.0029	3.8641	4.0799
	104	4.4929	4.2254	3.9564	4.0461	3.9017	4.1245
	117	4.4876	4.2044	3.9299	4.0205	3.8735	4.1032
254	52	3.1237	2.9175	2.7374	2.8059	2.6966	2.8562
	65	3.3521	3.1294	2.9371	3.0100	2.8926	3.0643
	78	3.6104	3.3693	3.1623	3.2406	3.1142	3.2994
	91	3.7051	3.4523	3.2354	3.3194	3.1878	3.3800
	104	3.7531	3.4892	3.2658	3.3546	3.2188	3.4163
	117	3.8321	3.5522	3.3256	3.4174	3.2758	3.4806
317	52	2.6233	2.4273	2.2776	2.3417	2.2417	2.3823
	65	2.7949	2.5841	2.4253	2.4934	2.3865	2.5368
	78	2.9730	2.7478	2.5767	2.6505	2.5366	2.6969
	91	3.1711	2.9300	2.7440	2.8249	2.7030	2.8746
	104	3.2320	2.9794	2.7895	2.8734	2.7473	2.9243
	117	3.2910	3.0257	2.8337	2.9200	2.7892	2.9719
381	52	2.2612	2.0780	1.9500	2.0092	1.9180	2.0433
	65	2.3808	2.1865	2.0512	2.1141	2.0177	2.1501
	78	2.5141	2.3078	2.1628	2.2307	2.1285	2.2688
	91	2.6689	2.4481	2.2926	2.3659	2.2570	2.4065
	104	2.8384	2.5999	2.4350	2.5134	2.3967	2.5567
	117	2.8838	2.6351	2.4686	2.5489	2.4285	2.5930

1 – Potential carrying capacity derived based on the input data show in Tables 1 through 9 .

2 – Diet parameters shown in SI units (grams of meat and fat consumed per day). In non-SI units, the meat treatments are 0, 2, 4, 6, 8, 10, and 12 ounces of cooked meat per day. The fat treatments are 20%, 25%, 30%, 35%, 40% and 45% total dietary calories from fat.

Table 12. Area of surplus[1] perennial forage land and permanent pasture by diet and model year.

Diet[2]		Surplus perennial forage land[3]											
Meat	Fat	1999		2000		2001		2002		2003		Average	
------g/day------		------10^6 ha (10^6 acres)------											
0	52	0.9235	(2.2802)	0.9160	(2.2617)	0.9383	(2.3168)	1.0007	(2.4709)	0.9457	(2.3350)	0.9448	(2.3329)
	65	0.9390	(2.3186)	0.9353	(2.3095)	0.9591	(2.3681)	1.0152	(2.5067)	0.9659	(2.3849)	0.9629	(2.3776)
	78	0.9684	(2.3910)	0.9678	(2.3897)	0.9927	(2.4510)	1.0396	(2.5669)	0.9999	(2.4689)	0.9937	(2.4535)
	91	0.9976	(2.4632)	0.9976	(2.4633)	1.0226	(2.5250)	1.0629	(2.6244)	1.0312	(2.5463)	1.0224	(2.5244)
	104	1.0238	(2.5279)	1.0238	(2.5280)	1.0487	(2.5894)	1.0835	(2.6754)	1.0584	(2.6133)	1.0477	(2.5868)
	117	1.0474	(2.5863)	1.0471	(2.5854)	1.0716	(2.6460)	1.1020	(2.7210)	1.0821	(2.6720)	1.0701	(2.6421)
63	52	0.6268	(1.5476)	0.6192	(1.5289)	0.6649	(1.6418)	0.7157	(1.7672)	0.6881	(1.6989)	0.6629	(1.6369)
	65	0.6228	(1.5377)	0.6147	(1.5179)	0.6608	(1.6316)	0.7153	(1.7663)	0.6842	(1.6894)	0.6596	(1.6286)
	78	0.6315	(1.5593)	0.6270	(1.5482)	0.6752	(1.6671)	0.7263	(1.7934)	0.6980	(1.7234)	0.6716	(1.6583)
	91	0.6768	(1.6712)	0.6771	(1.6720)	0.7261	(1.7929)	0.7691	(1.8991)	0.7486	(1.8484)	0.7196	(1.7767)
	104	0.7181	(1.7731)	0.7207	(1.7796)	0.7693	(1.8996)	0.8067	(1.9919)	0.7926	(1.9571)	0.7615	(1.8803)
	117	0.7555	(1.8654)	0.7596	(1.8755)	0.8075	(1.9939)	0.8403	(2.0748)	0.8314	(2.0528)	0.7989	(1.9725)
127	52	0.4327	(1.0684)	0.4359	(1.0764)	0.5027	(1.2413)	0.5117	(1.2634)	0.5350	(1.3211)	0.4836	(1.1941)
	65	0.4188	(1.0341)	0.4203	(1.0377)	0.4878	(1.2044)	0.5006	(1.2360)	0.5215	(1.2877)	0.4698	(1.1600)
	78	0.4045	(0.9988)	0.4071	(1.0051)	0.4763	(1.1760)	0.4896	(1.2088)	0.5111	(1.2620)	0.4577	(1.1301)
	91	0.3906	(0.9645)	0.3955	(0.9766)	0.4674	(1.1540)	0.4798	(1.1846)	0.5020	(1.2396)	0.4471	(1.1038)
	104	0.4330	(1.0692)	0.4420	(1.0914)	0.5141	(1.2695)	0.5242	(1.2942)	0.5485	(1.3543)	0.4924	(1.2157)
	117	0.4823	(1.1908)	0.4940	(1.2197)	0.5650	(1.3951)	0.5734	(1.4159)	0.5999	(1.4812)	0.5429	(1.3405)
190	52	0.2946	(0.7273)	0.3097	(0.7648)	0.3934	(0.9713)	0.3572	(0.8819)	0.4319	(1.0664)	0.3573	(0.8823)
	65	0.2714	(0.6700)	0.2855	(0.7049)	0.3712	(0.9165)	0.3348	(0.8267)	0.4113	(1.0156)	0.3348	(0.8267)
	78	0.2502	(0.6178)	0.2645	(0.6531)	0.3520	(0.8691)	0.3151	(0.7779)	0.3942	(0.9735)	0.3152	(0.7783)
	91	0.2346	(0.5793)	0.2510	(0.6196)	0.3406	(0.8409)	0.3022	(0.7463)	0.3839	(0.9478)	0.3025	(0.7468)
	104	0.2200	(0.5431)	0.2391	(0.5905)	0.3316	(0.8188)	0.2913	(0.7192)	0.3747	(0.9253)	0.2913	(0.7194)
	117	0.2261	(0.5582)	0.2479	(0.6120)	0.3415	(0.8433)	0.3013	(0.7439)	0.3854	(0.9516)	0.3004	(0.7418)
254	52	0.2506	(0.6187)	0.2765	(0.6828)	0.3629	(0.8962)	0.3204	(0.7910)	0.4065	(1.0038)	0.3234	(0.7985)
	65	0.2276	(0.5619)	0.2535	(0.6259)	0.3419	(0.8441)	0.2987	(0.7375)	0.3871	(0.9557)	0.3017	(0.7450)
	78	0.2018	(0.4982)	0.2278	(0.5624)	0.3185	(0.7865)	0.2746	(0.6779)	0.3653	(0.9019)	0.2776	(0.6854)
	91	0.1860	(0.4592)	0.2142	(0.5288)	0.3075	(0.7593)	0.2619	(0.6466)	0.3542	(0.8747)	0.2648	(0.6537)

Table 12. Continued.

Diet[2]		Surplus perennial forage land[3]											
Meat	Fat	1999		2000		2001		2002		2003		Average	
------g/day------		----------10^6 ha (10^6 acres)----------											
254	104	0.1724	(0.4256)	0.2031	(0.5015)	0.2988	(0.7377)	0.2514	(0.6209)	0.3457	(0.8537)	0.2543	(0.6279)
	117	0.1552	(0.3832)	0.1878	(0.4636)	0.2849	(0.7034)	0.2365	(0.5840)	0.3340	(0.8248)	0.2397	(0.5918)
317	52	0.2213	(0.5465)	0.2554	(0.6307)	0.3436	(0.8484)	0.2965	(0.7321)	0.3906	(0.9645)	0.3015	(0.7445)
	65	0.1995	(0.4925)	0.2341	(0.5779)	0.3240	(0.8001)	0.2761	(0.6818)	0.3726	(0.9201)	0.2813	(0.6945)
	78	0.1770	(0.4371)	0.2128	(0.5254)	0.3055	(0.7542)	0.2562	(0.6326)	0.3545	(0.8753)	0.2612	(0.6449)
	91	0.1520	(0.3754)	0.1893	(0.4674)	0.2852	(0.7043)	0.2342	(0.5784)	0.3344	(0.8256)	0.2390	(0.5902)
	104	0.1370	(0.3384)	0.1763	(0.4352)	0.2738	(0.6761)	0.2216	(0.5472)	0.3243	(0.8006)	0.2266	(0.5595)
	117	0.1216	(0.3001)	0.1627	(0.4017)	0.2615	(0.6456)	0.2083	(0.5143)	0.3139	(0.7750)	0.2136	(0.5274)
381	52	0.1998	(0.4934)	0.2402	(0.5930)	0.3296	(0.8138)	0.2791	(0.6892)	0.3791	(0.9361)	0.2856	(0.7051)
	65	0.1815	(0.4482)	0.2229	(0.5503)	0.3141	(0.7757)	0.2627	(0.6485)	0.3645	(0.9000)	0.2691	(0.6645)
	78	0.1611	(0.3979)	0.2040	(0.5038)	0.2979	(0.7355)	0.2449	(0.6046)	0.3484	(0.8603)	0.2513	(0.6204)
	91	0.1373	(0.3389)	0.1817	(0.4487)	0.2783	(0.6872)	0.2237	(0.5524)	0.3295	(0.8136)	0.2301	(0.5682)
	104	0.1102	(0.2722)	0.1562	(0.3857)	0.2551	(0.6299)	0.1992	(0.4918)	0.3082	(0.7610)	0.2058	(0.5081)
	117	0.0963	(0.2377)	0.1441	(0.3558)	0.2441	(0.6027)	0.1872	(0.4623)	0.2990	(0.7382)	0.1941	(0.4793)

1 – The model assumes that 64.8% of the productive land in New York State is limited to production of perennial forage crops or pasture (see Table 9). However, the proportion of land needed for perennial crops and pasture is less than 64.8% in all diets. As a result, a surplus of forage and grazing land exists after calculating potential carrying capacity.

2 – Diet parameters shown in SI units (grams of meat and fat consumed per day). In non-SI units, the meat treatments are 0, 2, 4, 6, 8, 10, and 12 ounces of cooked meat per day. The fat treatments are 20%, 25%, 30%, 35%, 40% and 45% total dietary calories from fat.

Table 13. Additional variables used as predictors in multiple linear regression analysis.

Diet		Regression variable	
Meat	Fat	Added oil[1]	Discarded fat[2]
---g/day			---
0	52	5.1	6.1
	65	12.1	0.0
	78	25.2	0.0
	91	38.2	0.0
	104	51.3	0.0
	117	64.3	0.0
63	52	0.9	32.1
	65	1.1	7.8
	78	7.0	0.0
	91	20.0	0.0
	104	33.1	0.0
	117	46.1	0.0
127	52	0.9	55.9
	65	0.9	27.4
	78	1.6	13.8
	91	2.4	2.1
	104	14.9	0.0
	117	27.9	0.0
190	52	0.9	80.0
	65	0.9	50.8
	78	1.4	31.6
	91	2.2	19.8
	104	3.0	8.1
	117	9.7	0.0
254	52	0.9	118.9
	65	0.9	89.2
	78	0.9	59.6
	91	1.5	43.5
	104	2.3	31.7
	117	3.1	20.0
317	52	0.9	158.1
	65	0.9	128.2
	78	0.9	98.2
	91	0.9	68.2
	104	1.7	55.3
	117	2.5	43.6
381	52	0.9	196.1
	65	0.9	167.5
	78	0.9	137.2
	91	0.9	107.0
	104	1.0	79.0
	117	1.8	67.2

1 – “Added oil” is a measure of the amount of oil consumed in the diet that came from soybeans grown exclusively for oil. None of the high-protein concentrate from these soybeans was used as livestock feed.
2 – “Discarded fat” is a measure of the quantity of fat produced by the model food system but excluded from the diet because of limits on total fat intake. It includes fatty portions of meat and dairy products and oil leftover from producing soybeans for protein concentrate (a livestock feed).

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