

## Designing a Sustainable Regional Diet

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### INTRODUCTION

Recently, Gussow and Clancy (1) have suggested the term "sustainable diet" to describe a diet composed of foods chosen for their contribution not only to health, but also to the sustainability (the capability of maintenance into the foreseeable future) of the U.S. agricultural system. Although Gussow and Clancy did not provide specific food-selection recommendations, they showed how the *Dietary Guidelines* (2) can be used to teach consumers about current threats to the food-producing system. They hoped, thus, to initiate a discussion of the appropriateness of incorporating issues of agricultural sustainability into nutrition messages. Before nutritionists can add such considerations to their educational efforts, however, certain underlying assumptions must be tested. The first of these has to do with the concept of "local" diets. This paper is intended to explore that concept.

Based on a definition of sustainable agriculture as an activity "that uses human and natural resources to produce food and fiber in a manner that is not wasteful of such finite resources as topsoil, water, and fossil energy" (1), Gussow and Clancy reviewed a host of U.S. agricultural problems (energy inefficiency, geographic concentration, pesticide resistance, and ground water depletion) and concluded that consumers should, when possible, buy "locally-produced" foods to support a regional agriculture that preserves farmland and that is less energy intensive. To date, however, there has been no attempt to define the term "locally-produced" explicitly, nor to determine for any given region just what mix of locally-produced and imported foods would be most resource conserving. Haughton, attempting to devise procedures for designing an "ecologically sound" food guide (3), concluded that designing a sustainable diet for New

York State would involve identifying locally-produced foods that would meet local tastes and nutritional needs while optimizing the use of limited resources, such as cropland, energy, water, etc. More recently Stephens *et al.* (4) designed "nutritionally balanced menus that follow current dietary recommendations for health," and that also make extensive use of "local" (in this case Connecticut-grown) produce. Their intention was to demonstrate to state farmers and others the market potential for locally-produced fruits and vegetables.

The main implication of both of these studies is that a state is the appropriate unit within which to examine the possibilities for greater local self-reliance (and hence "sustainability") in food production. In fact, this is probably not ideally the case, since state boundaries are, in many cases, drawn in contravention of, rather than in respect of, watersheds, soil types, climate, and vegetation—all features that have been used in the past to define "regions" and, more recently, to define "bioregions" (5). Nevertheless, since so little work has been done on the dietary implications of "regional" diets—however defined—and since the state is the geographical unit from which production data tend to be available, we decided to use a state—in this case Montana—as the unit of analysis.

Making use of historical and other available data, we attempted to examine, in a state possessing less than optimal climate and soil resources, the often-expressed assumption that agricultural relocation would limit food choices unacceptably. The intent of this exercise was not to develop a Montana food guide, but to describe a method that might be applied in other states or regions to examine the feasibility of encouraging the adoption of more localized seasonal diets.

We began by examining the development and current status of the state's food system in its historical context. Historical study of the sources of food and the diets of a state's early inhabitants provides evidence about the varieties of food production that a state's soils and climates have supported. Current research (conducted in Montana by the Western Agricultural Research Center and

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the Cooperative Extension Service) on suitable varieties of fruits and vegetables furnished additional data. Some states may have available written histories on their food systems. In states like Montana where this is not the case, general histories often contain information on agricultural, food processing, and marketing developments and early food patterns. Primary sources—such as newspapers, diaries, state horticultural and agricultural reports, and Cooperative Extension publications—provided additional historical information. Local newspapers, recent Cooperative Extension and Experiment Station publications, and state crop reports were excellent resources for understanding the current situation.

Our review of the literature about food use by Montana's native tribes indicates that the state's climatic and soil conditions have supported a variety of food plants. Botanists have identified over sixty different species of wild food plants and tree products that were regularly eaten by Native Americans in Montana (6–11). Early Montana State Extension scientists studied Native American food plants in order to discover new species for cultivation (6).

Montana's relative isolation and its limited transportation network allowed the area's food system to develop—for a few years—toward self-sufficiency. And as a result, documents from the late nineteenth century (diaries, state documents, and newspapers) provide evidence that a wide range of crops was successfully grown in the state, including a number of native fruits (12–14). Our historical study indicates that, by necessity, Montana's earliest white inhabitants were self-sufficient in food production, but as transportation costs dropped and overseas markets opened in the 1900s, farmers and ranchers began to produce foods for export, chiefly wheat and beef. Yet, until the early 1950s, much of the state's food supply continued to be produced locally (15–17). It should be noted that we were not able to test the "sustainability" of these different cropping patterns; however, it is clear from our review of food production in Montana that the state's present wheat-exporting/food-importing system may not be sustainable, due to saline seep, erosion, water pollution, drought, and insect infestations (18–22). Table 1 is a list of foods that have been recorded as commercially grown and produced in Montana over the last 100 years.

Having identified the types of foods that had been and were currently being produced and processed in Montana, we wished to examine quantitative data that would allow us to estimate the extent of the state's present and prior self-reliance in food. In Montana, data on local production and marketing, and importation from other states or countries were available only for fresh fruits and vegetables and fluid milk (23–25). For fruits and vegetables not produced in the state, the amount imported was assumed to equal total consumption for the state.

For other commodities, we estimated "Montana con-

**Table 1.** Foods that are or have been commercially grown or produced† in Montana.

<b>Grains</b>	<b>Fruits</b>	<b>Dairy Foods</b>
Barley <sup>1</sup>	Apples*	Buttermilk*
Buckwheat <sup>1</sup>	Apricots	Cheese*
Corn <sup>1</sup>	Blackberries	Cottage cheese*
Millet <sup>1</sup>	Cantaloupe*	Cream*
Oats <sup>1</sup>	Cherries*	Ice cream*
Rye <sup>1</sup>	Currants	Milk*
Sorghum <sup>1</sup>	Grapes	Yogurt*
Wheat*	Huckleberries	
	Peaches	<b>Fats</b>
	Pears	Butter*
	Plums	Lard*
<b>Vegetables</b>	Prunes	Safflower <sup>3</sup>
Asparagus	Raspberries	Sunflower <sup>3</sup>
Beans, green*	Rhubarb*	
Beets*	Strawberries	<b>Sweeteners</b>
Broccoli*	Watermelon	Honey*
Cabbage*		Sugar*
Carrots*		
Cauliflower*	<b>Protein Foods</b>	
Celery	Beans, dried*	<b>Beverages</b>
Corn*	Beef*	Beer*
Cucumbers*	Eggs*	Wine <sup>4</sup> *
Lettuce*	Fish <sup>2</sup> *	
Onions, dried*	Lamb*	
Onions, green*	Mutton*	
Peas, green*	Pork*	
Peppers	Poultry*	
Potatoes*	Veal*	
Radishes*		
Rutabagas*		
Spinach		
Squash		
Sweet potatoes		
Tomatoes*		
Turnips*		

† Meat and dairy products are "produced" rather than grown.

\* Foods currently grown are starred.

<sup>1</sup> Produced for animal feed.

<sup>2</sup> Several trout farms are located in the state.

<sup>3</sup> Production statistics found only for 1980.

<sup>4</sup> A winery was established in the Mission Valley in 1985.

sumption" by multiplying "national per capita food consumption" by Montana's population for the year surveyed. We assumed this quantity was imported unless we could document local production and marketing. In those instances, we calculated the amount imported by subtracting local production and marketing from "Montana consumption," as in the following example:

Cheese consumption	17.6 lbs. per capita (national data)
	× 786,690 (Montana's population)
"Montana consumption"	13,845,744 lbs
	– (minus)
State production (marketed locally)	8,763,000 lbs
	5,083,744 lbs of cheese imported
"Imported" / "Montana consumption" = % imported	
	5,083,744 / 13,845,744 = 37% imported

Although household consumption data (26, 27) have been collected by regions since the mid-1950s, we chose to use the national "disappearance" data (28, 29), available for most foods since 1909, for three reasons. First, we were interested in comparing Montana's current level of local food production to 1941, the year that the earliest Montana importation data are available. Second, household consumption data are derived from surveys of household food supplies "used" during seven days by the sample households. National food consumption data that are based on "disappearance" seemed more appropriate for our state-level analysis. Third, consumption patterns unique to Montanans are not likely to be apparent from the western regional household consumption data since they are collected from eleven dissimilar states, including California.

Using USDA conversion factors, we computed retail consumption from primary weight (includes refuse) data (30). In keeping with USDA methodology, we calculated consumption of basic foods (grains, legumes, fruits, vegetables, meat, poultry, fish, eggs, dairy products, fats, oils, sweeteners, nuts, coffee, cocoa, and tea) rather than consumption of their processed forms (31). The computed percentages of importation for the various food groups in 1941 and 1980 are displayed in Table 2.

To calculate the percentage of the total Montana food supply imported into the state, we divided the total food "imported" in pounds by the total "Montana consumption" for basic food commodities. It should be emphasized that because our calculations—for all but fruits, vegetables, and milk—necessarily depended on national consumption data, they do not reflect regional variations in consumption.

We calculated that in 1980, the most recent year for which population and national food consumption data were available, over 55% of Montana's food supply was imported. Further increases in importation for local consumption were estimated for 1985. By extrapolating from the 1980 data and taking into account the closing of the state's major beef and pork processing plants, we calculated that in 1985 Montana's food supply was 66% imported. We estimated that in 1941 approximately half as much, about 32%, of Montana's food supply was imported from outside the state.

Table 2 shows that Montana still produces and processes a wide variety of foodstuffs, but most are produced in insufficient quantity to meet the needs of the population. In 1985, for example, Montana farmers produced enough of only twelve commodities to meet state needs: beef, pork, lamb, milk, cottage cheese, cherries, dry beans, sugar, honey, and flour (bread, cereals, crackers, and pasta are produced only in limited amounts). Although beef, pork, and lamb are raised, little meat is actually processed in the state; so what is available to consumers must be imported from other states or elsewhere. A Montana Cooperative Extension study in 1983

**Table 2.** Estimated food importation to Montana in 1980 and 1941.<sup>1</sup>

Food	% Imported in 1941	% Imported in 1980
Grains	35	54
Legumes	2	23
Fruit/Vegetables	66	93
Bananas	100	100
Processed Fruit/Vegetables	75	100
Meats	0	1
Poultry	0	69
Fish	100	100
Dairy	11	16
Fats & Oils	61	100
Sweeteners	12	32
Others <sup>2</sup>	99	96

<sup>1</sup> Estimates based on data from *Summary of Fruits and Vegetables Inspected and Used in Montana Markets During January, 1980 (Through) December, 1980* by Plant Industry Division (1980) and *Summary of Fruits and Vegetables Inspected and Used in Montana Markets During January, 1941 (Through) December, 1941* by Division of Horticulture (1941).

<sup>2</sup> Includes sherbet, nuts, coffee, tea, cocoa.

found that Montana-based beef processing plants are not economically feasible due to economies of scale (32). Currently, Montana produces for export: grains, livestock, cottage cheese, potatoes, dry beans, honey, and cherries. In 1941, the export products were grains, beef, pork, lamb, turkey, eggs, milk, cottage cheese, butter, lard, potatoes, dry beans, sugar, honey, cherries, green peas, and processed fruits and vegetables. Since the 1930s and 1940s, when food processing was Montana's leading employer, the industry has declined and now includes only a few flour mills, creameries, sugar beet factories and custom meat packers, a sour cherry cannery, and a handful of small processing operations producing jams, cereals, jerky and other specialty foods. Clearly, Montana's loss of food processing capability—meat processing, cheese making, and vegetable preservation—coupled with the marked decrease in fruit and vegetable production is a major factor in the declining use of local foods (33).

Next, we created a seasonal list (Table 3) of potentially available local produce items, in order to provide information to nutritionists and others interested in directing consumers to local foods. We reviewed the monthly marketing reports of the Montana Division of Horticulture for the years 1941–1985 and found the seasonal availability of the produce items listed in Table 3. In the early years, apples, beets, cabbage, carrots, onions, potatoes, squash, turnips, rutabagas, and miscellaneous vegetables were available year round; a wider variety were marketed seasonally. However, by 1980 only locally grown potatoes were available throughout the year. Apples, cherries, tomatoes, green beans, brussels sprouts, cabbage, carrots, corn, cucumbers, lettuce, potatoes, squash, turnips, and rutabagas were available in season.

**Table 3.** Seasonal availability of Montana produce.<sup>1</sup>

Food	Seasons Available <sup>2</sup>	Food	Seasons Available
Apples	Sp, Su, F, W	Onions, dry	Sp, Su, F, W
Asparagus	Sp, Su	Onions, green	Sp, Su, F
Beans, green	Su, F	Peaches	F
Beets	Sp, Su, F, W	Pears	F
Blackberries	Su	Peas, green	Su, F
Broccoli	Su, F	Peppers	Su, F
Cabbage	Sp, Su, F, W	Plums-prunes	Su, F
Cantaloupe	Su, F	Potatoes	Sp, Su, F, W
Carrots	Sp, Su, F, W	Radishes	Sp, Su, F
Cauliflower	Su, F	Raspberries	Su, F
Celery	Su, F	Rhubarb	Sp
Cherries	Su, F	Spinach	Su, F
Corn	Su, F	Squash	Su, F, W
Cucumbers	Su, F	Strawberries	Su, F
Currants	Su	Sweet potatoes	Su
Fruit, misc. <sup>3</sup>	Su, F	Tomatoes	Sp, <sup>5</sup> Su, F, W
Grapes	F	Turnips-rutabagas	Sp, Su, F, W
Lettuce	Su, F, W <sup>4</sup>	Vegetables, misc. <sup>3</sup>	Sp, Su, F, W

<sup>1</sup> Based on data from *Summary of Fruits and Vegetables Used in Montana Markets* by Montana Division of Horticulture, 1943-1977 and the Montana Plant Industry Division, 1978-1985.

<sup>2</sup> Sp = spring; Su = summer; F = fall; W = winter.

<sup>3</sup> Unspecified miscellaneous produce.

<sup>4</sup> Unexplained.

<sup>5</sup> Hydroponically grown.

In most states (as in Montana), it is likely that many of the foods once locally-grown are no longer produced in commercial quantities and so would not presently meet local demand. Although many of these foods are available year round in supermarkets, increased consumer demand for local foods in season would open up new markets for area farmers. Montana Extension agents have subsequently used our list as a supporting document for farmers attempting to secure bank loans for vegetable production.

To test the nutritional adequacy of a diet based on Montana-produced foods, we created eight menus (34), two for each season, based roughly on the *Dietary Goals* (35)—the only quantitative dietary recommendations for macronutrients available at the time. King *et al.* (36) used a similar methodology to evaluate the nutrient composition of menus based on the *Basic Four*. For this analysis we arbitrarily set the kilocalorie level at 2,000 kilocalories and defined nutritional adequacy as 100% of the U.S. RDA for micronutrients, since this would guarantee that the menus met the micronutrient needs of virtually any user. Fat made up 30% of the kilocalories in those menus, and cholesterol was calculated to be no more than 300 mg (35, 37, 38). Vitamins B-12, D, and E levels were not calculated because the data base was incomplete. Nutrient analysis of the menus indicated that they were nutritionally adequate (39). The winter menus, which included such winter staples as potatoes, cabbage, and sprouted seeds, averaged 216% of the U.S. RDA for vitamin C without the use of citrus fruits or out-of-season fruits and vegetables.

## DISCUSSION

The analyses described above raise a number of questions. In most states, eating locally-produced foods would result in restricted fruit and vegetable choices, especially during the winter and spring months when the only fruits and vegetables available would be those that store well—apples, pears, potatoes, cabbage, carrots, parsnips, rutabagas, etc.—or can be grown indoors—e.g., sprouted seeds. The fact that we were able to create nutritionally-adequate menus using only locally-available seasonal foods does not indicate that consumers will know how to choose an adequate diet from such foods or that they will find it acceptable or economical to do so. Nor do we suggest that a completely local diet is the optimal choice either nutritionally or ecologically.

The question of what is the optimal level of food self-sufficiency remains unanswered. Total self-reliance is not likely to be acceptable to consumers or necessary in a sustainable food system. Studies of neighboring states' food systems would reveal foods that are or can be grown without negative environmental impacts and that could be imported without substantial use of fossil fuel. Additionally, studies of neighboring states would indicate whether regional cooperation would increase the variety of foods available within a reasonable radius.

Another concern is whether or not the selection of locally-produced foods would increase the cost of the consumers' food budgets. Because the true costs of environmental degradation are not considered in economic calculations regarding the "profitability" of local food pro-

duction/processing, it is difficult to assess the long-term economic feasibility of systems of varying sizes, types, and locations. Low-input sustainable agriculture, which was once dismissed as simply expensive backyard gardening, is being taken quite seriously, due to a rising concern over the environmental costs of "conventional" agriculture. Transportation, which accounts for almost 20% of the total petroleum used in the food and fiber system, will account for an even higher percentage of the food dollar when—as is inevitable—the cost of petroleum rises to its true replacement value (40). Mottern (41), in a study of the potential economic impact of implementing the *Dietary Goals*, concluded that changes in the food system, similar to those suggested in this paper, would reduce the cost of food to consumers. He argued that increasing the number of small and part-time farmers and local processing plants would reduce the current concentration in processing and retailing operations that creates higher food prices.

However, we would predict that purchasing food from local producers would initially result in increased food prices associated with, among other things, the high cost of farmland located near urban areas, and the loss of economies of scale. But then, as recent analyses predict, our current food system will also yield more expensive food as the cost of irrigation, land reclamation, transportation, and other inputs continues to rise (40). If the true long-term costs of our present system of food production—soil and water depletion, heavy fossil fuel use, and so on—are counted (as they should be) as part of the cost of food, then it is reasonable to expect that over the long term a reversion to local food production and processing will result in comparatively less expensive food.

Even in the short term, however, it is important to ask if higher food costs might be justified if they are necessary to support a sustainable food-producing system, thus trading off slightly higher food costs for our generation against astronomically increased costs for future generations. Reference is usually made, when rising food costs threaten, to the plight of the poor. But it is well to keep in mind that Americans currently spend less than 15% of their income on food, among the lowest percentages in the world (42). Yet these bargain food prices have not eliminated hunger as a serious problem in the U.S. We cannot hope to solve the problems caused by poverty by keeping food prices too low to support sustainable production systems. While a discussion of how to address the problems associated with poverty is not appropriate here, current suggestions include increased public employment, job training, and expanded funding for food programs, such as Food Stamps, WIC (Women, Infants and Children), and school breakfast and lunch programs.

A usable food guide based on concerns for sustainability remains to be developed. Although the generation of a list of foods that could be produced locally does not

constitute a food guide or even necessarily indicate that these foods could or would be produced using resource-conserving methods, the fact that a nutritionally adequate diet could be created from this list indicates that such a guide could be developed. The next step in developing the guide would be to specify serving numbers and sizes, and then to test the food guide for nutrient adequacy, usability, and consumer acceptability.

Nutritionists are well-trained to analyze the nutritional value of foods and to suggest how diets may be altered to best influence health; they have not been trained to ask or answer questions pertinent to the continued production of the food that carries the nutrients. Yet without sustainable food production, questions about nutrition are moot. With an understanding of the promise and limitations of local food production, nutritionists could begin to temper their advice about food choices with an awareness of how the selection of specific foods could contribute to sustaining the food system. Communication of this aspect of food choice to consumers is a first step in creating a market for sustainably produced foods. Additionally, nutritionists armed with an understanding of local food production would be better equipped to enter into local and state policy discussions on issues related to sustainable food production. Cooperative Extension nutritionists are one group of educators who are being challenged by Extension's 1988 National Initiatives to make many of these issues part of their educational messages by helping consumers to understand the food system, the health/environmental aspects of food production and processing, and the need to sustain a productive natural resource base (43).

As for whether people can be motivated to eat such a diet, we submit this as a question that can not, for now, be answered, since it is not clear what causes significant social change. The growing concern over food safety has motivated an interest in "organic" foods that would have been thought impossible only a few years ago. The large and affluent generation, just now coming into its middle years, joins the present elderly population in being significantly concerned about health. Who can predict what sorts of demands they will put on the food system or how the food system will respond. Surely it will be useful if nutritionists are able to help people understand how and where food is grown, and how these factors affect the environment. This paper is meant to encourage that kind of dialogue. □

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