The Center for Profitable Uses of Agricultural Byproducts

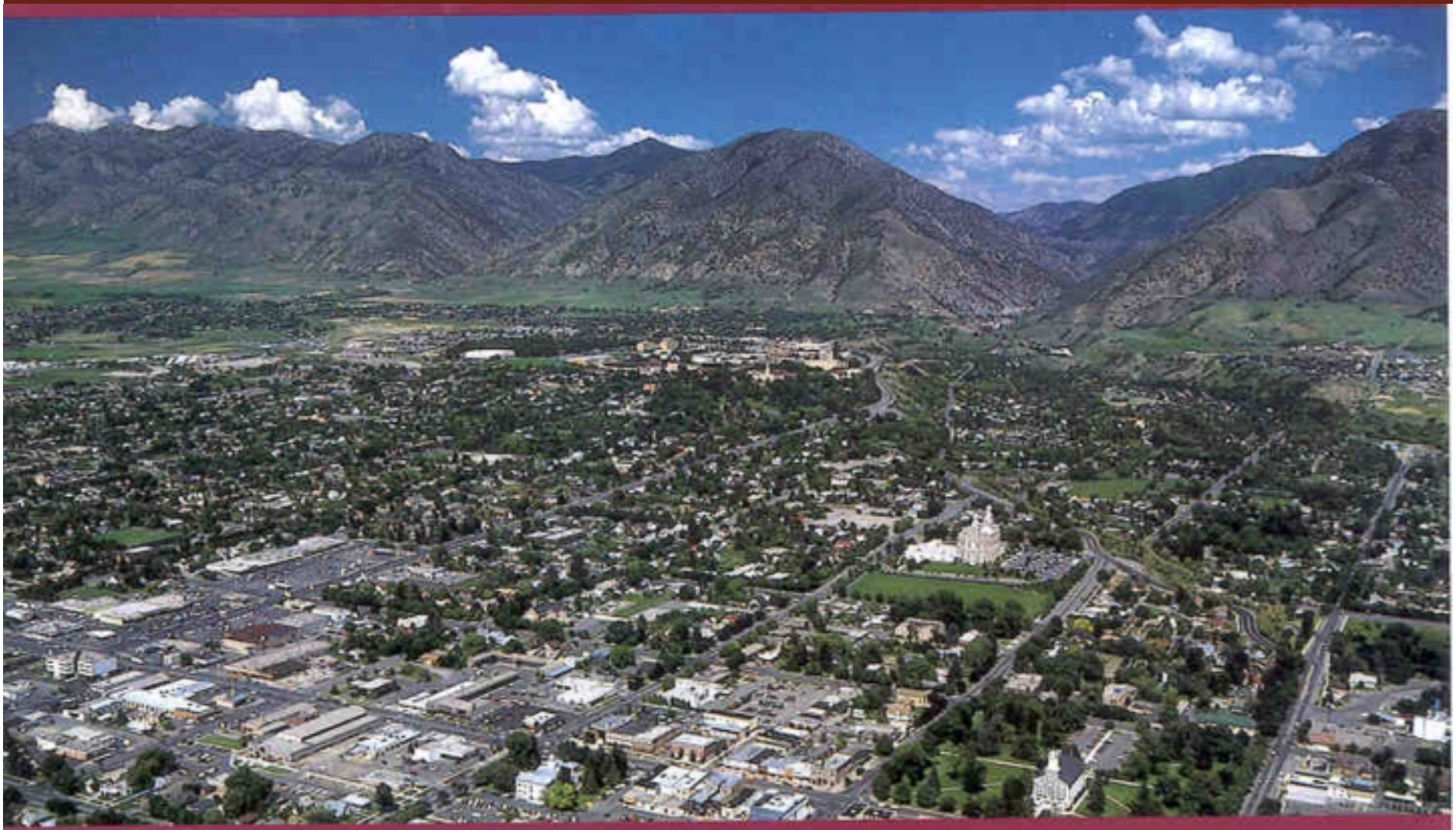
Depts.: Biological and Irrigation Engineering
&
Nutrition and Food Sciences
Colleges of Engineering & Agriculture
Utah State University,
Logan, Utah U.S.A.

Acknowledgement: My talented and dedicated graduate students are always serious??

GREETINGS FROM UTAH STATE UNIVERSITY AND CACHE VALLEY

UTAH STATE UNIVERSITY

LOGAN UTAH

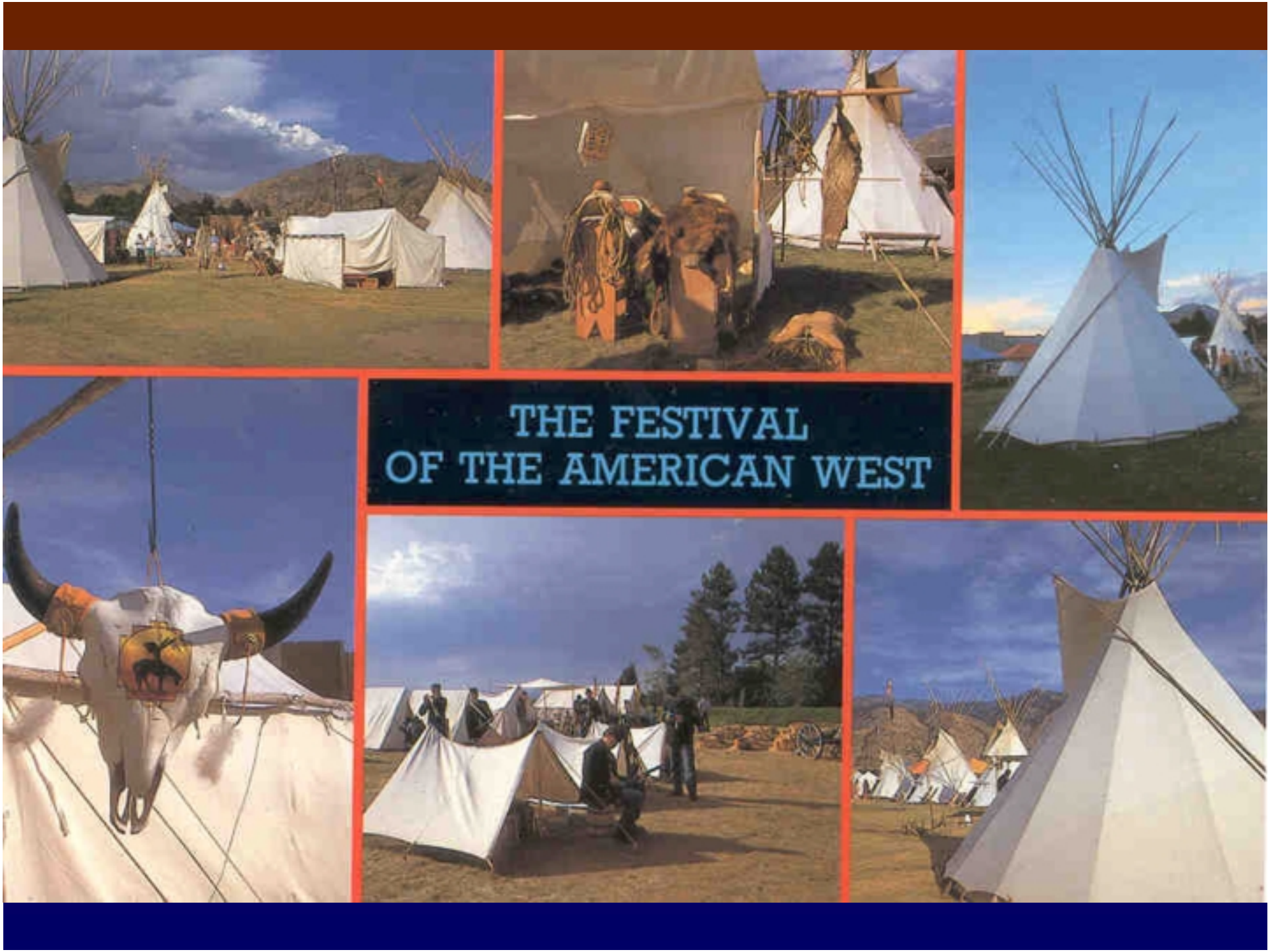


Logan, Utah

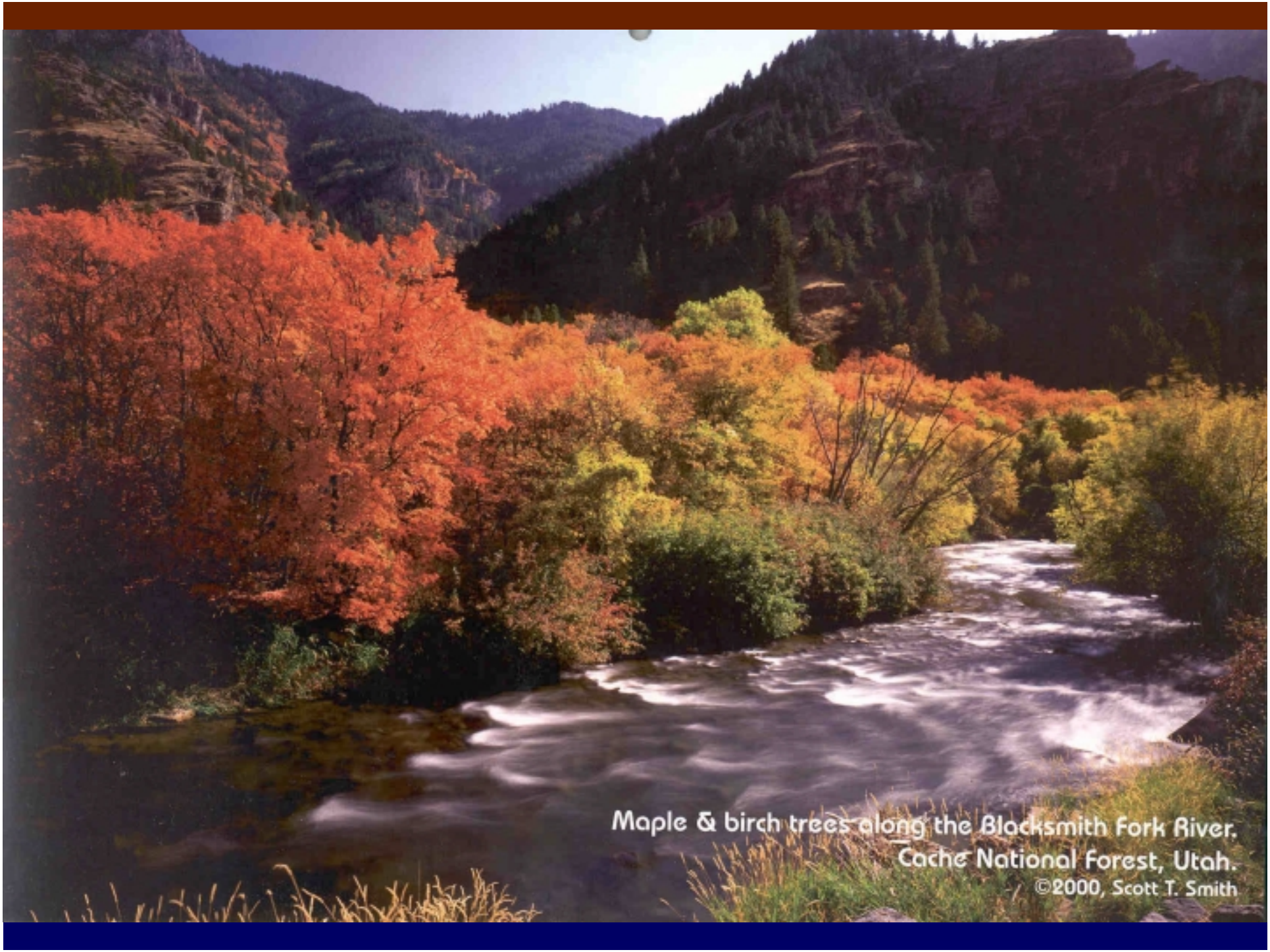
Utah Northern Railroad Depot. Logan, Utah.


Logan Temple
Utah


Cache County Courthouse. Logan, Utah.
©2000, Scott T. Smith


THE FESTIVAL
OF THE AMERICAN WEST


Bear River near Preston, Idaho
©2000, Scott T. Smith


Maple & birch trees along the Blacksmith Fork River.
Cache National Forest, Utah.
©2000, Scott T. Smith


Buttercups at Bloomington Lake. Bear River Range.
Cache National Forest. Idaho
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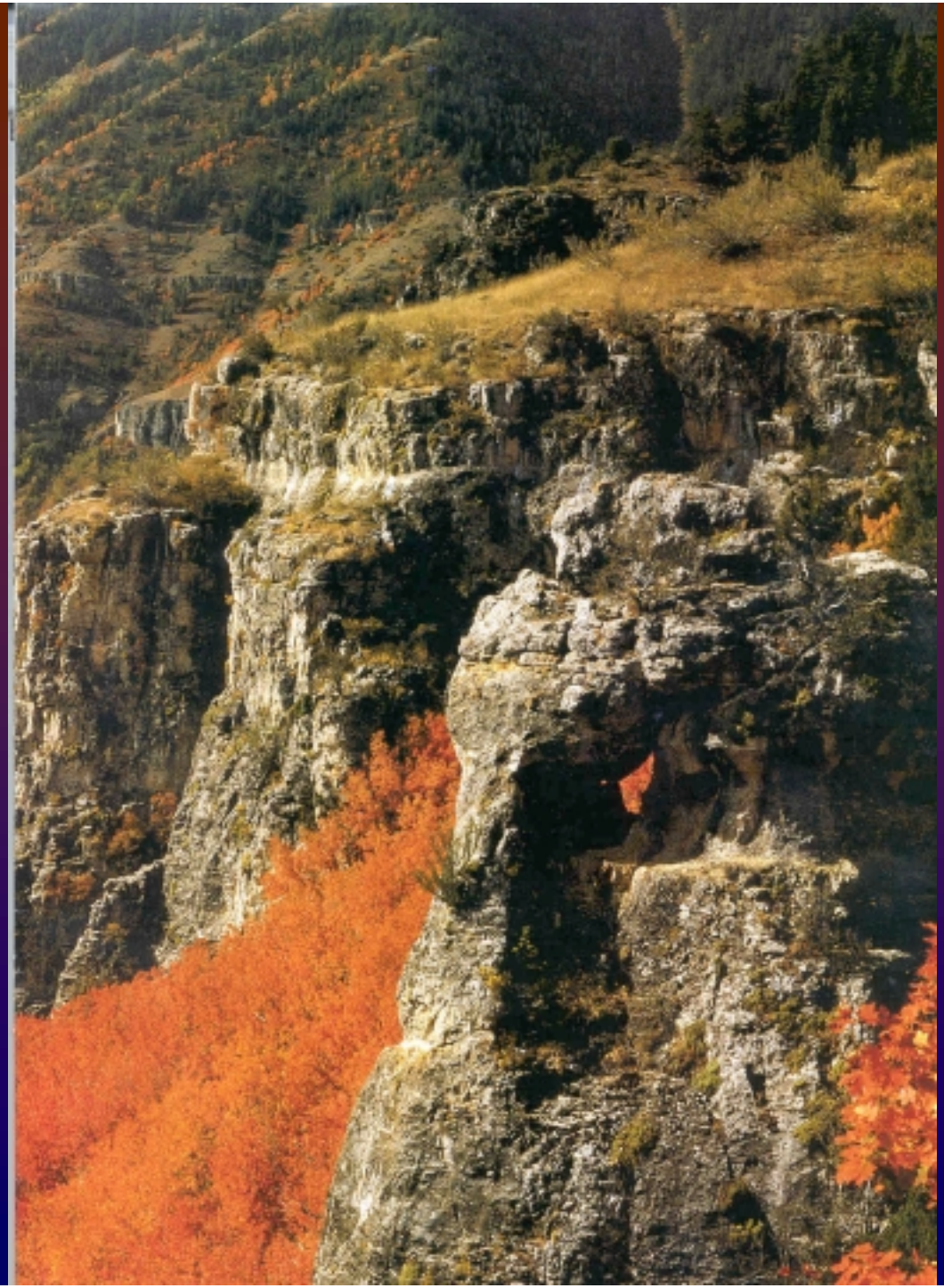
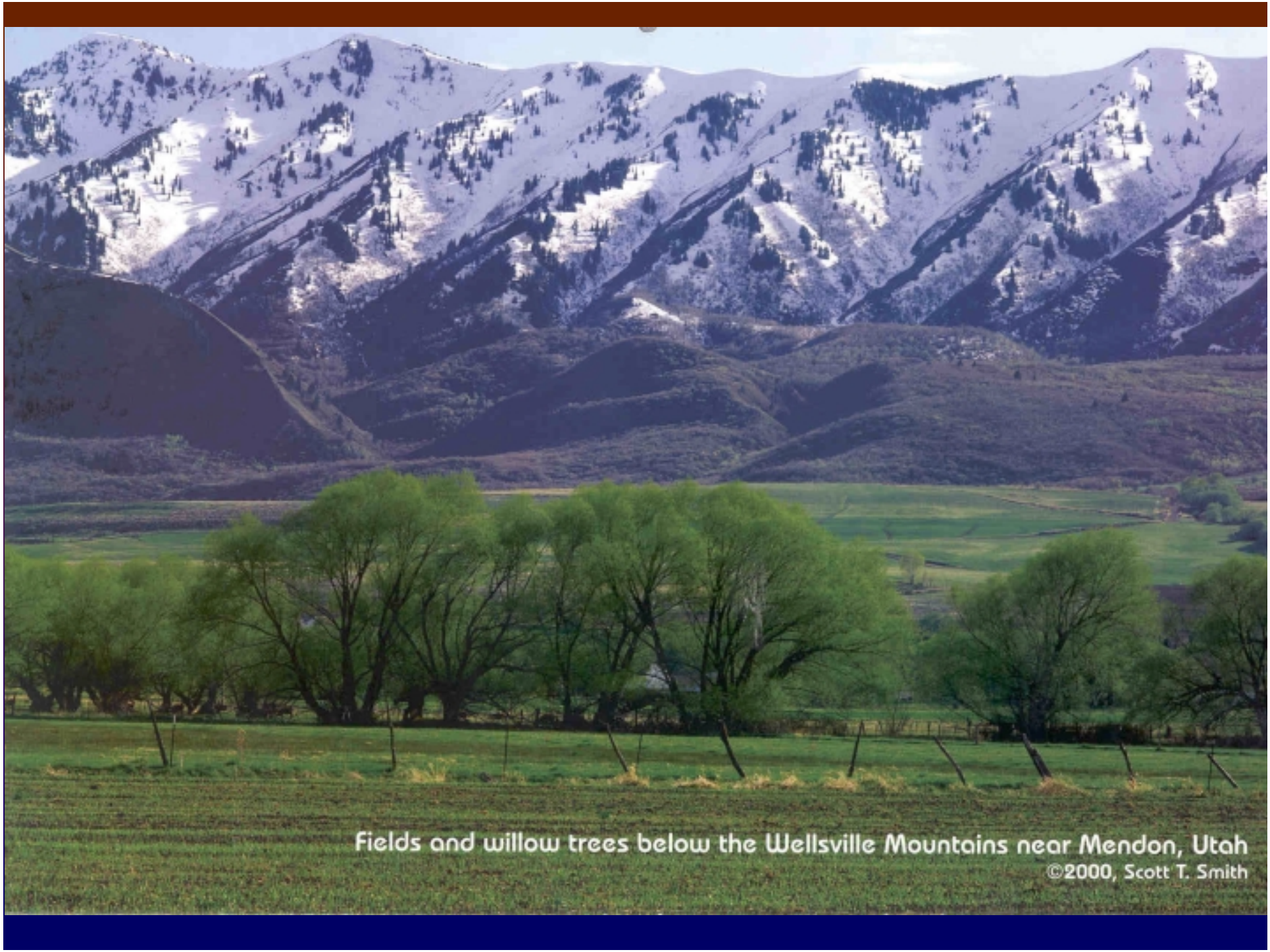


Utah's Cache Valley—*This* Is God's Country!

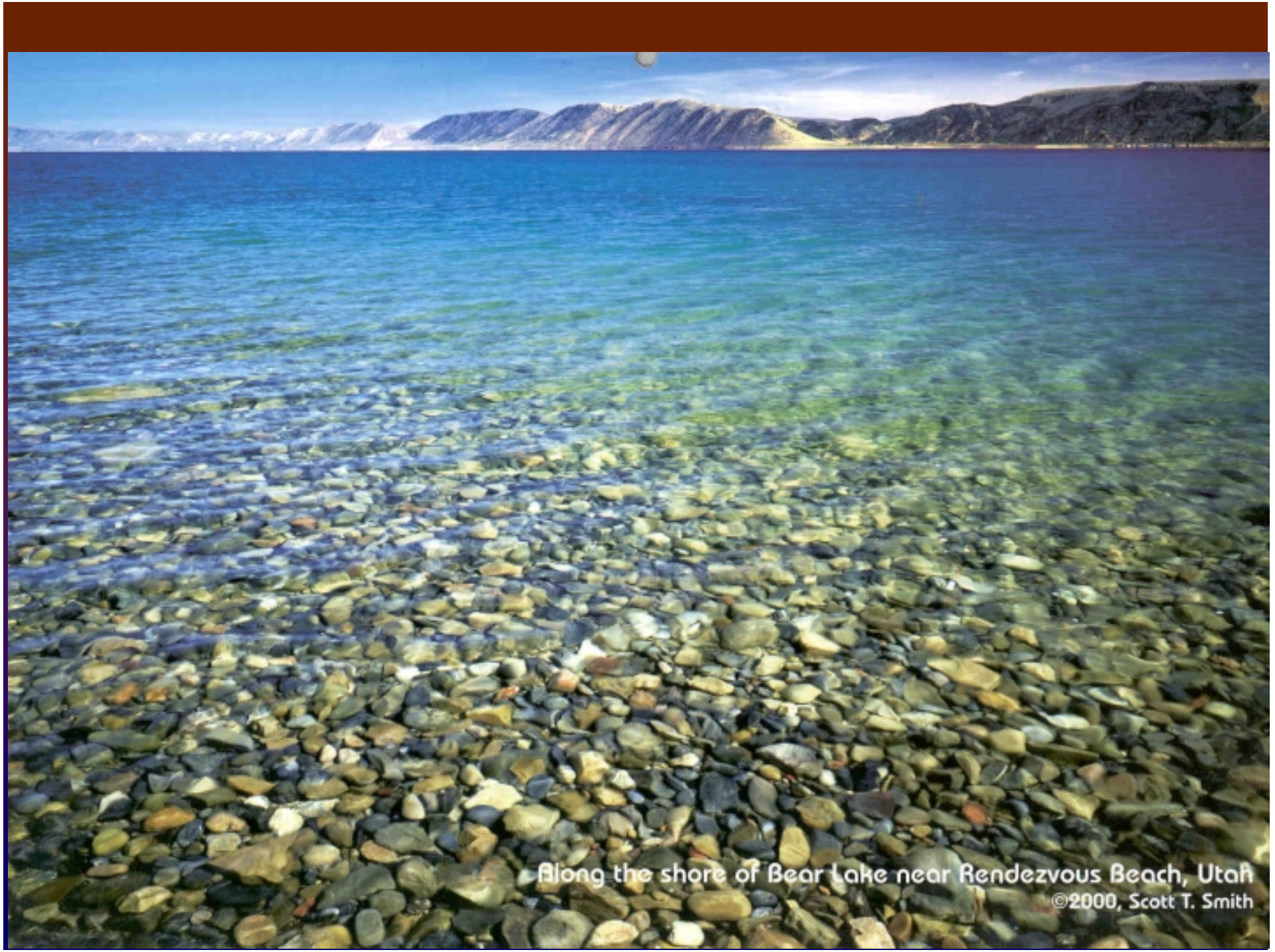
This feature invites readers to tell why they feel their particular part of the country is the best place to live. This time Scott Smith and his wife, Mary Bedingfield-Smith, tell why there's no place like the spectacular Cache Valley in Utah.


Ski UTAH



Fields and willow trees below the Wellsville Mountains near Mendon, Utah


Plowed field & trees in winter. Mt. Sterling, Utah
©2000, Scott T. Smith


Along the shore of Bear Lake near Rendezvous Beach, Utah
©2000, Scott T. Smith


Bear Lake


Zion National Park

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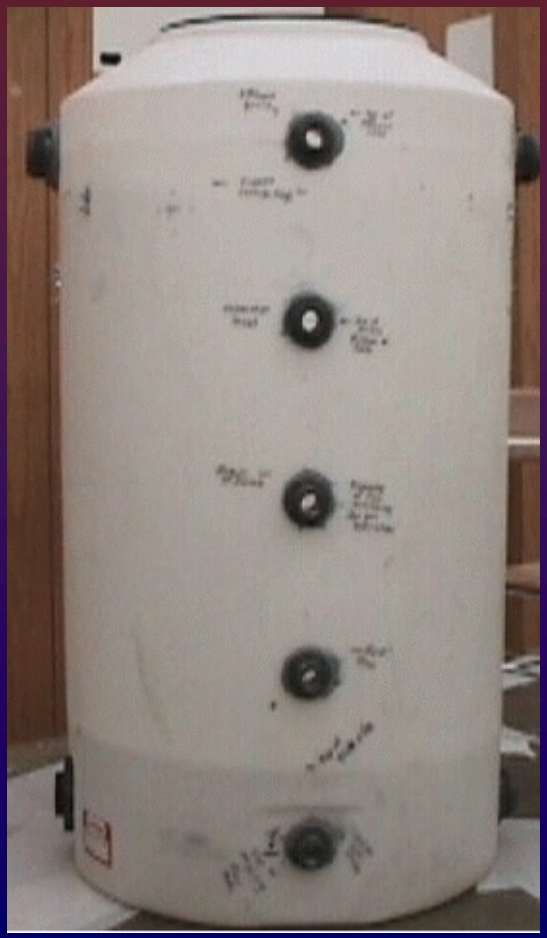
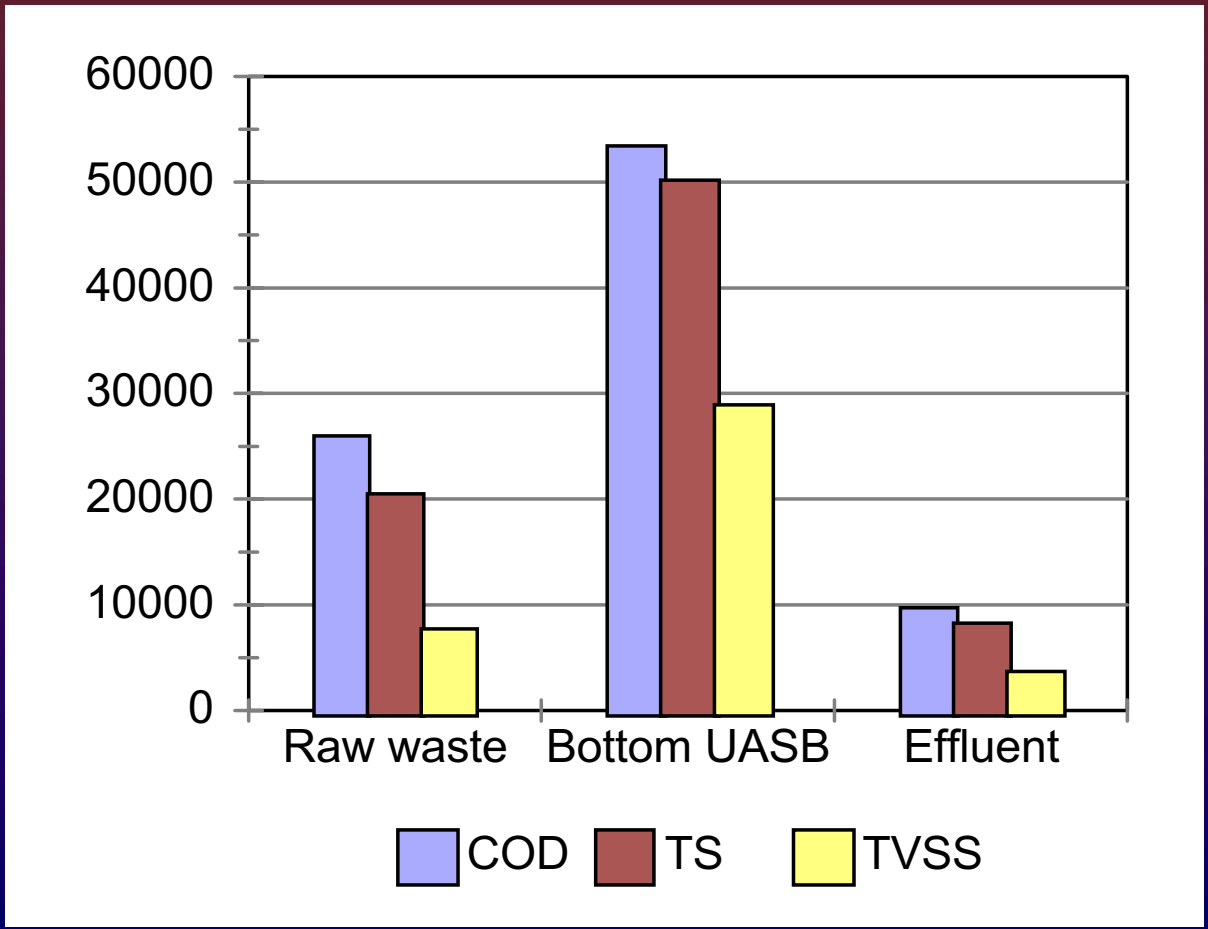
A key objective of the center is to develop technology. Presently, technology is in two major areas.

- **Anaerobic systems** that can produce energy (biogas) and soil amendment from manure and food processing waste
- Components of a **high rate aerobic bioreactor** (drum composter based) system that make the process more cost effective and products produced by the process more valuable.

Upflow Anaerobic Sludge Blanket Pilot Scale Bioreactor-Ballard Farm



Results for Anaerobic system at the Ballard Farm – 4 day HRT

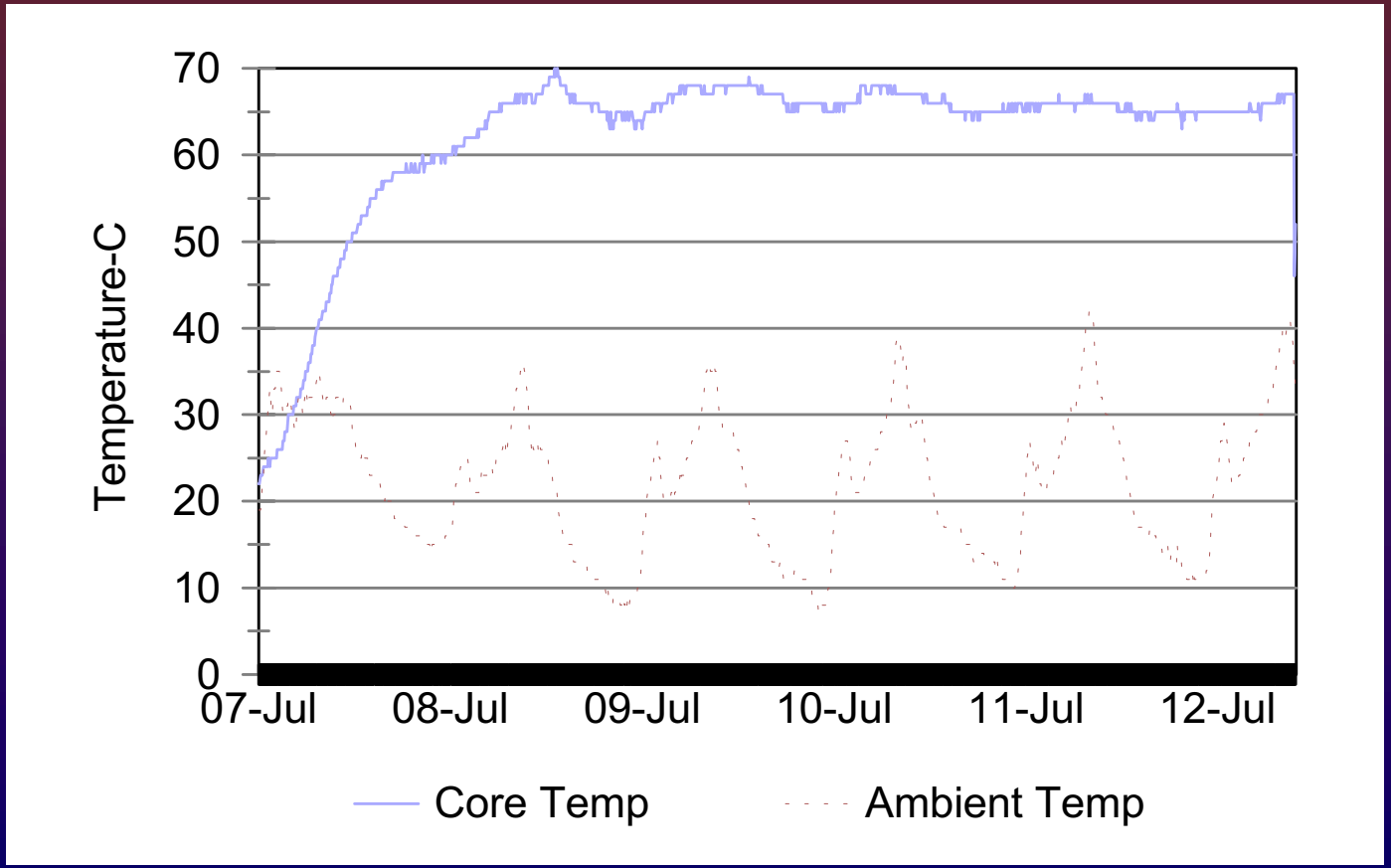


Aerobic Bioreactor at Caine Dairy

Tests for determining compost stability

Test for stability	Purpose	Technique
Carbon to Nitrogen[a]	Monitor the breakdown of solids to organic matter and carbon dioxide and to measure the degradation of nitrogen based toxins.	Tests was preformed by the USU Soil Testing Laboratory using the LECO.
Solvita Test[b]	The test results reveal respiration rate and thus enables anyone to make inferences to the progress of composting and maturity of the end products.	Test was preformed on site using the Solvita test kit distributed by Woods End Laboratory.
Color and Odor	Color of compost indicates the chemical composition of the compost. Biological compost is usually dark brown/black.	The test was preformed on site using the Test methods for the Examination of Composting and Compost, USCC.
Total Solids, Moisture	Constant monitoring is necessary to prevent improper decomposition. When the compost is above 60% moisture, water fills the free air-space and causes anaerobic conditions. In contrast if the moisture level is too low the bacteria cease to have a proper growth environment and decomposition will slow or stop.	The tests were preformed in a Nutrition and Food Sciences Dept., USU, lab using the Test methods for the Examination of Composting and Compost, USCC and standard methods for wastewater testing (APHA-AWWA-WEF. 1992).

This slide shows a typical run in the aerobic bioreactor and demonstrates how fast it reaches “pasteurization” temperature.



This slide show the results of pathogen tests for the aerobic bioreactor.

Sample Type	Culture	Result
Compost Culture	Pseudomonas aeruginosa & Bacillus subtilis	No Pathogens
Compost Culture	Pseudomonas aeruginosa & Bacillus subtilis	No Pathogens
Wet	Few Coliform & Bacillus sp.	No Pathogens
Dry	Few Coliform & Bacillus sp.	No Pathogens

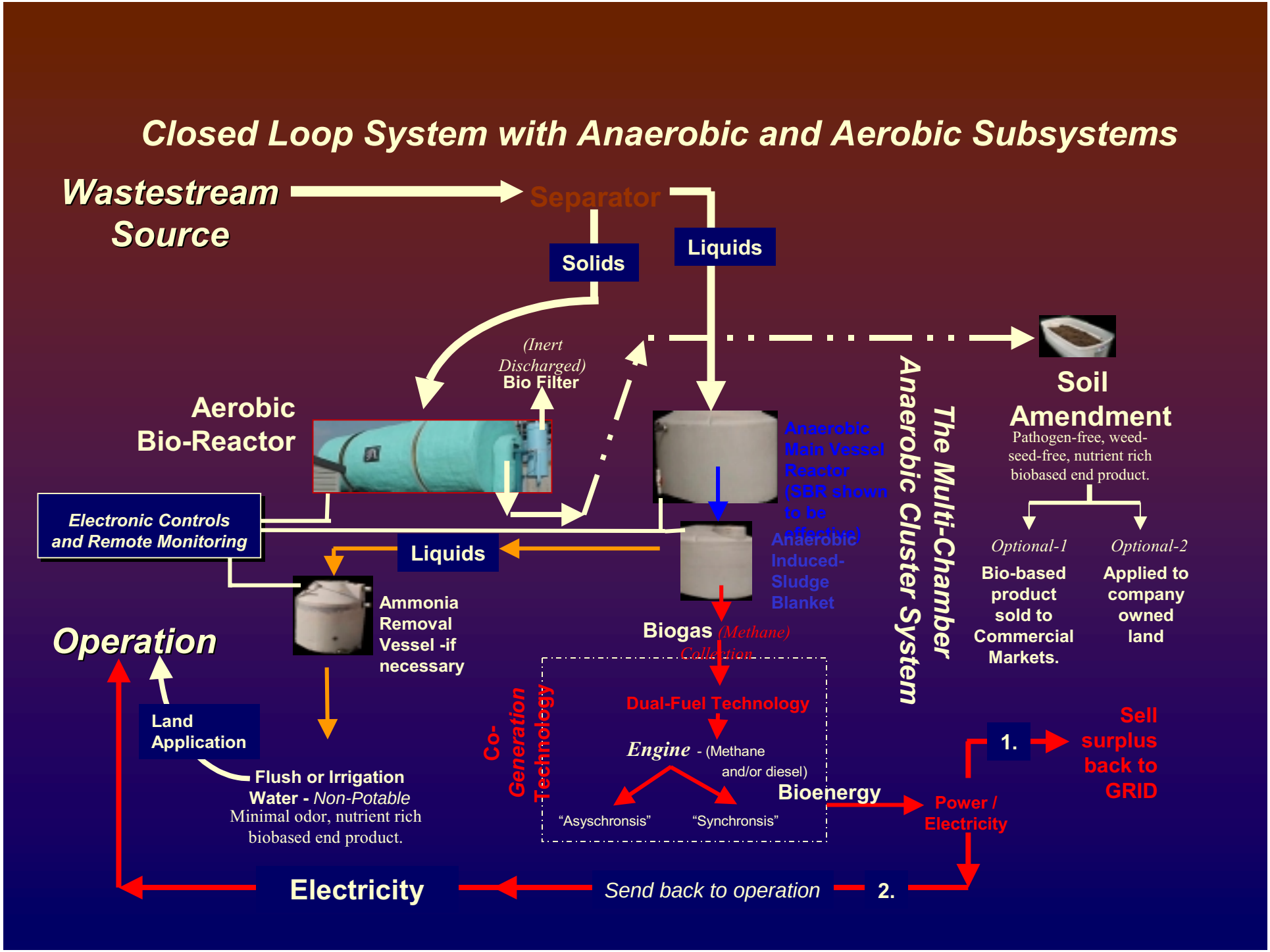
Solvita (respiration) test results

A result of 7 or 8 indicates mature compost.

DATE	NUMBER
June 18	7
June 21	7
July 10	8
July 12	8

The two major areas put together make a “closed loop” system

Closed Loop System with Anaerobic and Aerobic Subsystems



Drs S. Hwang and C. Hansen have agreed to cooperate on research at the Center. This will most likely involve:

I. Help design build and test a unique, prototype closed loop system consisting of anaerobic and aerobic bioreactors. The unit will be built at a swine farm

1. The anaerobic "cluster" system will be a multi-stage bioreactor made up of three tanks with a total capacity of 0.1- 0.5 ML. The main bioreactor will be operated as an induced sludge blanket reactor (IBR). The design for the IBR is proprietary. The anaerobic system will be electronically controlled and can be remotely monitored.

2. The aerobic bioreactor will be 10 ft in diameter by 24 foot long. It will be an EPT rapid throughput, energy conserving, oxygenated, rotating drum composter.

3. A solid liquid separator will be used to separate liquids from solids.

Cooperative work cont.

4. Anaerobically digest the liquid portion of swine manure to produce energy and soil amendment.

- a. Analyses to determine effectiveness of the process will include, chemical oxygen demand, volatile suspended solids removal, pH, hydraulic retention time, volatile organic acids, and quantity, quality, and energy content of biogas produced.
- b. Burn biogas to produce heat and/or electricity.

5. Compost swine manure solids with adjunct bedding.

a. The automated system includes computer control of O_2, loading rate, and rotation.

b. Manure and adjunct bedding materials will be composted in 3 days or less.

- c. Compost will be analyzed to insure it is pathogen free and will not cause objectionable odor or have other adverse effects when used as soil conditioner/fertilizer.

Cooperative work cont.

6. Perform an economic analysis.
7. Transfer the technology to the general public.

   a. Many people visit university facilities and thus it helps to demo the technology. Pertinent data, parameters about the system and a system description will also be made available on an Internet site.

   b. A presentation will be prepared that can be presented to groups to explain how swine farmers can benefit from this technology.

This slide shows the more recent version of the aerobic bioreactor

Site at Caine dairy showing construction of building that will house IBR anaerobic digester. The lagoon is shown in background.

Close-up of IBR anaerobic digester

This picture demonstrates how bales are added to the walls.

In addition the system has to be modeled

IN SUMMARY, THE CENTER OF EXCELLENCE CAN:

- Develop organic waste management technologies to produce valuable products from organic material we now call waste.
- Provide training and educational opportunities for students and working professionals.
- Transfer technology - helping non technical people understand and actually see the best technology in operation.
- Be a facilitator, bringing together scientists and engineers to solve solve difficult problems in waste treatment.