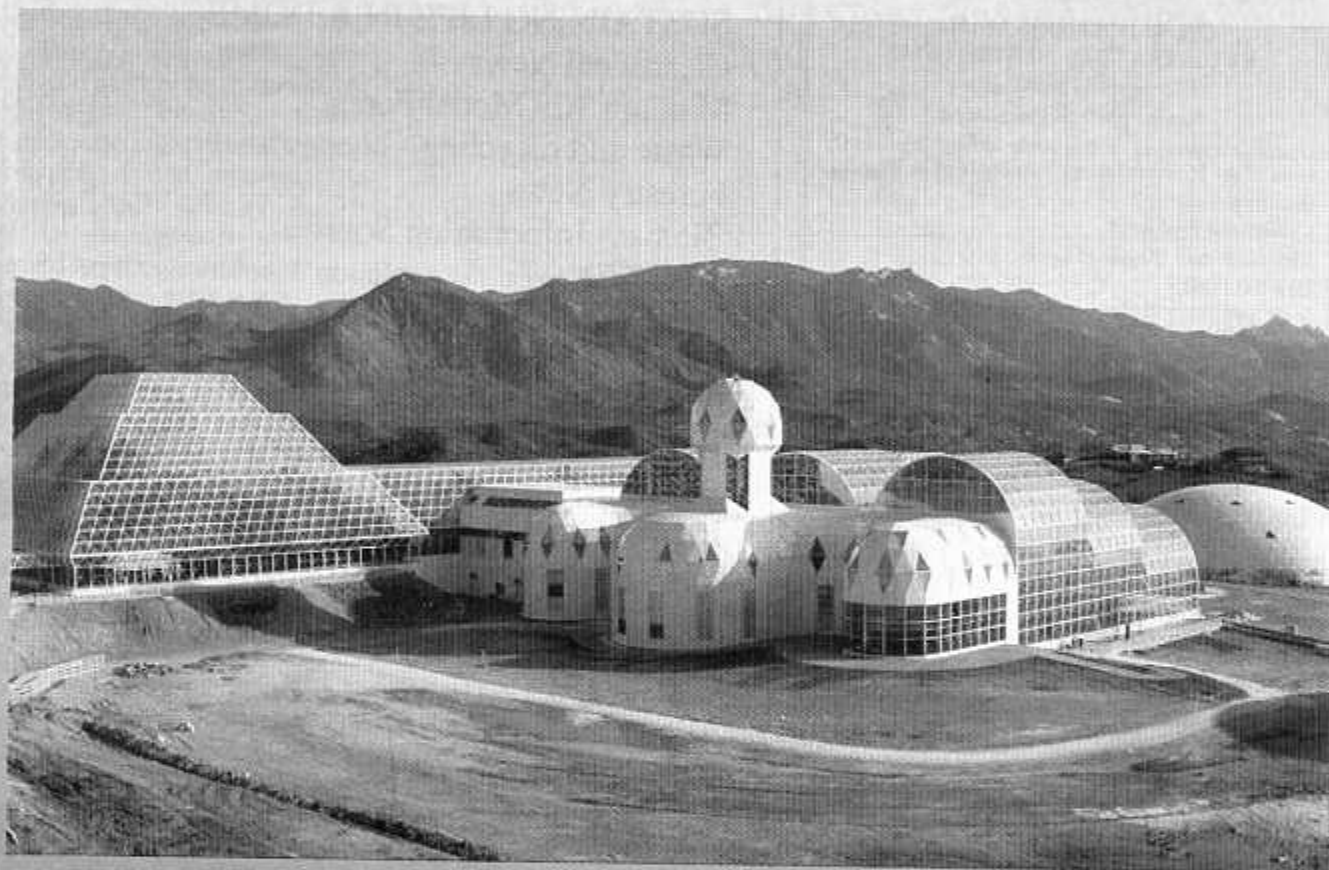


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SUSTAINABILITY: IS IT POSSIBLE?

- BIOSPHERE 2 • CLEAN FUEL
- FORESTS • WASTE/RECYCLING
- WASTENOT • ETHANOL • NEWS

Editorial

There are excerpts of a paper criticizing centralized monetary systems on page 17 of this issue of Bio-Joule. An article of this type would not normally appear in a biomass technology journal, however, I felt the concepts reviewed by the author sufficiently thought-provoking to include portions in this issue. Development of all regions of the world requires examination of as many different concepts as possible. In a diverse country, like Canada, each region should be striving to maximize opportunities. Perhaps these opportunities lie in a self-sufficiency direction. Rather than importing, the long-range solution may be in producing goods and services appropriate to an economic area.

RESEARCH AND NON-DEVELOPMENT
From time to time I have tried to be diplomatic in my criticism of government spending. Canada is a small country, population-wise, and can only compete in an expensive area, such as research, if resources are pooled. Previous attempts have fallen on deaf ears, but I do feel the necessity, every once in awhile, to reiterate my point.

The Globe and Mail Report on Business Magazine of September 1992 had an editorial which noted the poor performance of Canadian companies. Studies on R&D indicate the pulp and paper industry spends only 0.3% of revenues on research, and the energy sector's R&D commitment is a mere 0.5% of sales. Canadian steel producers have spent just 0.5% of sales on R&D in the past few years compared with 3.5% for their Japanese counterparts.

Yes, we are told, and recognize, that Canadians are not risk-takers, but we also know that we have a small population, in comparison to the vastness of our country, that restrains customer-hungry companies from investing in R&D here. Canada through the peoples' tax base must finance research and development, or we will not succeed in producing the innovative commercial successes of more populated countries.

The Role of Canadian Forests in the Global Carbon Budget



No.	Ecoclimatic Province	Area in inventory ('000 ha)	Area with biomass values ('000 ha)
1	Arctic	3,499	648
2	Subarctic	136,439	85,238
3	Boreal West	114,663	97,597
4	Cool Temperate	35,584	25,688
5	Moderate Temperate	2,082	200
6	Grassland	6,127	2,592
7	Subarctic Cordilleran	14,733	898
8	Cordilleran	90,676	47,373
9	Interior Cordilleran	19,381	14,627
10	Pacific Cordilleran	20,605	9,147
11	Boreal East	134,483	120,234

Ecoclimatic Provinces of Canada

M.J.Apps, Forestry Canada, Northwest Region, Northern Forestry Centre, 5320 - 122 Street, Edmonton, Alberta T6H 3S5 and W.A.Kurz, ESSA Environmental and Social Systems Analysts Ltd., 1765 West 8th Ave., Vancouver, B.C. V6J 5C6.

(Presented at IPCC workshop on "Carbon balance of World's Forested Ecosystems: Towards a Global Assessment", University of Joensuu, May 11-15, 1992.)

The carbon budget model of the Canadian Forest Sector (CBM-CFS) is believed by the authors to be the first comprehensive attempt to model carbon pools and fluxes for forest ecosystems and forest sector activities at a national scale. Results strongly indicate the importance of both growth-decomposition processes and natural disturbances, particularly wildfire, on annual carbon dynamics of Canadian Forests. The average for the 1980-1989 decade had a significantly higher decadal average for wild fire and slashburning, 2.5 Mha/yr, than any other ten year period since records began. The peak year of 7 Mha/yr was 1989.

Data available is good for above ground biomass. Below ground biomass and peatland data is deficient. Despite its deficiencies, the CBM-CFS1 data does indicate that Canadian forests and the forest sector were a weak net sink of atmospheric carbon in the reference year, 1986. The net sink was found to be unstable with respect to changes in disturbance regimes. The "Hi-Fire" experiment had an 85% decrease in the net sink, whereas the "Hi-Biomass" scenario had only an 11% increase in the carbon sink.

In the reference year (1986), wildfire affected 2.5 million hectares, insect-induced mortality 0.4, and clearcut 0.8 million hectares. Biomass transferred to the atmosphere (18.6 MtC) was about the same as transferred to the soil 21.0 MtC from wildfire events in 1986. More carbon was transferred to the atmosphere from the soil because of wildfire than any other disturbance.

SUSTAINING LIFE IN A DOME

"At sunrise on September 26, 1991 eight biospherians entered Biosphere 2 to begin their unique journey into the heart of life."

BIOSPHERE 2: The Human Experiment

by John Allen, Director of Research and Development for Space Biosphere Ventures. A Synergetic Press Inc.. Production. Penguin Books Canada Ltd., 2801 John Street, Markham, Ontario, L3R 1B4.) 156 pp.

This human experiment is intended to be an aid to dealing with the problems of the environment; to understanding the laws of biospherics; and a prototype for a space colony. The goal of those who have entered Biosphere 2 is to make a major step in discovering the real forces which sustain the survival and evolution of life.

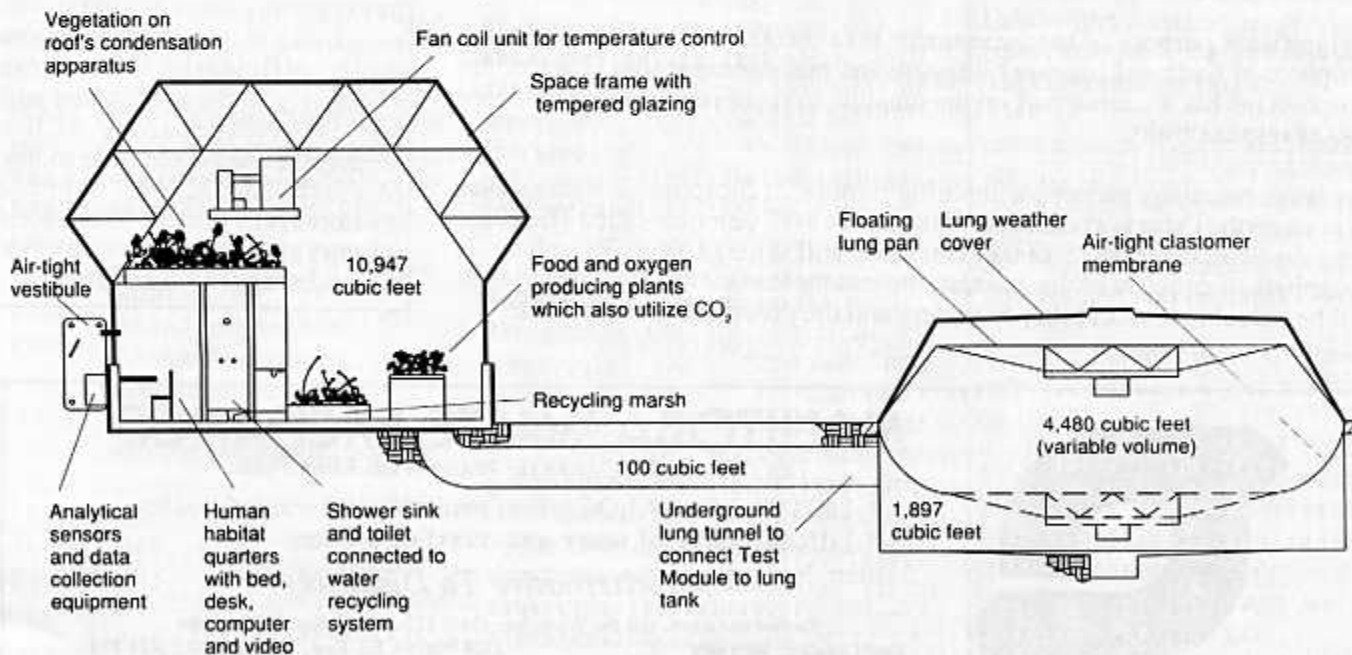
The biosphere describes the zone of life on the planet earth and is a region extending several miles into the sky and several miles below the earth's crust (Biosphere 1). The vision for Biosphere 2 included perceiving the building blocks of the biosphere to be biomes- rainforests, savannahs, oceans and deserts.

Biosphere 2 is the largest self-sustaining ecosystem ever built containing under its 1.2 hectare glass-domed complex a rainforest, a savannah, a marsh, an ocean, a desert, a farm and a microcity -- with 3,800 species of plant and animal inhabitants. For two years all the air, water, plants and animals in the system will feed upon and sustain one another. All of the air, water and waste is recycled.

Space Biospheres Ventures was formed in 1983 for the purpose of building the "vision" of the eight Decisions team members. The site chosen for the building, a more than 800 hectare area in Southern Arizona, north of Tucson. The area is called Sunspace Ranch and is located overlooking the Canyon del Oro, facing the Catalina Mountains.

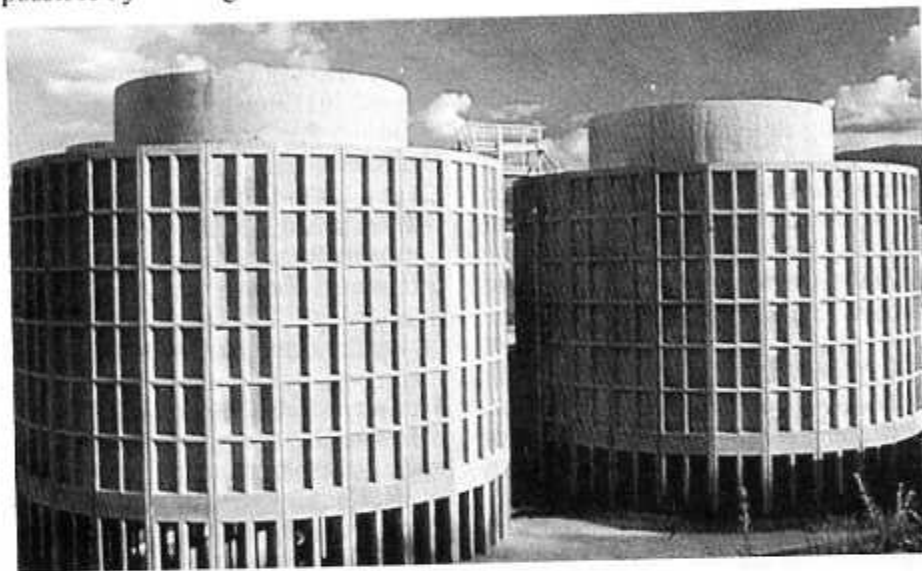
The size of Biosphere 2 had been calculated by taking into account best advice on the minimal possible size of the various biomes. A test module was built and the first tests began in 1987. To move from the size of the test module to Biosphere 2 would be a jump of about three orders of magnitude, a scaling-up by a factor of 1000.

Biosphere 2 Test Module System Schematic



Biosphere 2 is open to energy inputs: sunlight provides the basic energy for photosynthesis and electrical energy for technical systems. Heating and cooling is generated outside the Biosphere and delivered to the inside. All the systems depend on electrical power and the heat exchange made possible by flowing water.

The Energy Center is a two-story building made up of a series of opaque vault structures. It sits against the ridge immediately to the west of the Intensive Agriculture Biome with its three huge concrete cooling towers a short distance away on its north side.



To prevent power loss at all costs, the Energy Center has three separate generators. The total capacity is about 5.5 megawatts, but Biosphere 2 could operate on about one-third of that. The local town of Oracle has a power grid which provides another source.

The farm consists of eighteen garden plots ranging in size from about 50 to 90 square meters. To comfortably feed eight people, three crops a year must be grown on each plot, except for plots set aside for perennial crops and fruit trees.

A significant purpose of the experiment is to create a dialogue between the biosphere of Earth and another biosphere and make comparisons. Each of the biospherians has a counterpart on the outside, so there is a dialogue on every area of responsibility.

The book has many pictures comparing biomes in Biosphere 2 with similar areas on earth. There is also a book designed for 8-12 year olds called The Glass Ark. In September 1993 the Biospherians will emerge from Biosphere 2. Regardless of criticism of this process, the lessons learned from this experiment will be valuable to our ability to understand the processes of our planet.

BACKS TO THE FUTURE. U.S. Government Policy toward Environmentally Critical Technology. G.R. Heaton, Jr. et al. 1992. 35 pp. World Resources Institute, P.O. Box 4852, Hampden Station, Baltimore, MD 21211 USA. ISBN 0-9158-2575-9. Price US\$12.95.

Japanese, European and United States lists of national critical technologies are compared, criteria for defining environmentally critical technologies are defined and environmentally critical technologies are identified.

There is no Executive Summary or abstract at the beginning so I headed to the conclusions and policy option section. One of the first sentences I read states, "As recently as 1991, the vast bulk of federal R&D funding was devoted to fields with little relevance to environmental quality: five areas—defence (60%), health (13%), space (11%), science (4%), and energy (4%)—accounted for 92 percent of the national total".

Each one of these five areas could have a tremendous relevance to the environmental quality, such as when oil was burned during the Gulf War sending clouds of pollution into the atmosphere. We are striving to use energy resources more efficiently and more effectively so the atmosphere will not be affected negatively. All five areas mentioned could be spending research funds to improve environmental quality. Much good information is lost when a person is not encouraged to read further.



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- * DIRECTORY of waste and recycling services

— *An Alternative To Disposal* —

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Beth Candlish, Manager 1329 Niakwa Rd. East, Winnipeg, MB R2J 3T4

Sponsored by the Manitoba Hazardous Waste Management Corporation

MANITOU ABI MODEL FOREST

Situated one hour's drive from Winnipeg, the Manitou Abi Model Forest includes the principal supply area for the Abitibi-Price Inc. newsprint mill at Pine Falls, Manitoba, as well as other regional operators. The forest consists of one million hectares and contains boreal ecosystems, commercially important stands, protected areas, essential wildlife habitat and species, and aquatic ecosystems. The area is also characterized by uses such as recreation, wild rice production, hunting, fishing and traditional Aboriginal pursuits. The Stakeholders' Partnership, including Abitibi Price, Pine Falls Division, envisions building on present unique attributes to create and demonstrate an operationally viable, ecologically sustainable and broadly supported model of Boreal forest management. (taken from description in Canada's Model Forest Network, published by Forestry Canada)

The Process

The forest management operations of Abitibi-Price at Pine Falls have recently been the subject of an intensive environmental impact assessment (EIA) as required under the Manitoba Environment Act. This was a costly process, two years and \$600,000. It was the first such investigation in Canada. The EIA concluded that the proposed operation over the next eight years was ecologically sustainable.

--- but its not over yet!

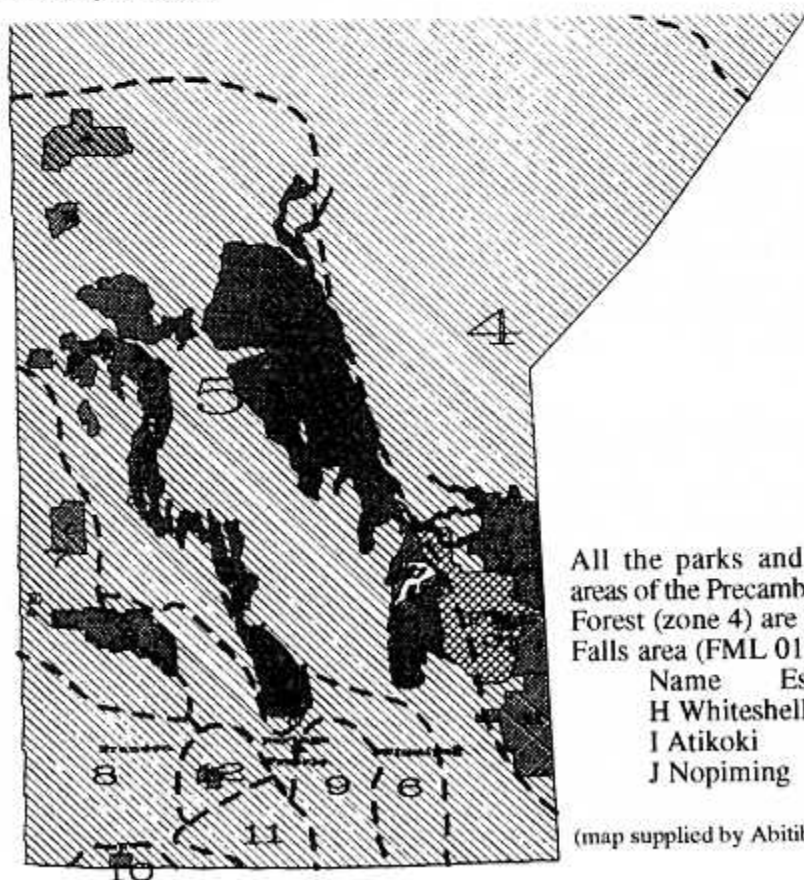
Following a period of public hearings and extensive deliberations, the Manitoba Clean Environment Commission (CEC) made recommendations to the Minister of the Environment concerning terms and conditions for the Abitibi-Price forest management licence.

The recommendation of most concern to the company is that timber harvesting and forest management should be phased out of Nopoming Park, along the Manigotagan River and along the Riparian zones of the forest management licence waterbodies in favour of reserving these areas for park recreational purposes. This will lead to closure of the Pine Falls Mill, the loss of 1250 jobs, and major uncertainty with respect to the economic future of other major forest product operations in the province, as well as numerous smaller forest-based enterprises in rural Manitoba.

Since 1989 the Forest Industry has been in trouble and Abitibi-Price has developed a strategic plan that does not include the Pine Falls operation. A local management-led buyout team has put together a business plan and attracted investors. When the CEC made recommendations that would have meant the demise of the operation, the local people reacted by mounting a campaign to inform the people of Manitoba the facts.

Although the government did issue a licence to the Pine Falls operation that was workable and would allow the operation to be environmentally and economically sound, the decision on logging in parks will be decided after public input in the Natural Land and Special Places Workshops held in September and October. These parks were created in the 60's and 70's on traditional logging areas that had been developed since 1927 and were intended to be multiple use in some areas and protected areas in others.

Why protect areas where development has already taken place? Why not set aside the areas where development has not taken place as wilderness and protected areas? Another question to be asked is what is wilderness -- does it include recreation, camping and/or cottaging? If recreational activity is acceptable and industrial activity is not, those committed to sustainable development and making these decisions must be oblivious to the harm humans cause!



All the parks and protected areas of the Precambrian Boreal Forest (zone 4) are in the Pine Falls area (FML 01)

Name	Established
H Whiteshell	1961
I Atikoki	1985
J Nopiming	1976

(map supplied by Abitibi-Price)

Waste and recycling

Energy analysis

Two articles have appeared, in recent issues of Resource Recycling and Waste Age, which state facts about energy savings and the realities of trying to calculate energy needed to produce given materials. Both articles appeared in the November issues of the publications.

Lifecycle analysis (LCA) is often proposed for determining whether one product is "greener" than another. One needs to know how many direct inputs are required to manufacture each product efficiently and the environmental impact of each process. "It may be quixotic to devote scarce resources to extensive attempts to compute lifecycle impacts of various products and determine which ones are 'green'," say the authors of the Resource Recycling article.

The cost of an item should be an indicator of the sum of the costs of producing the item, but for various production and marketing reasons this cost-to-the-consumer relationship to production costs does not often exist.

Energy requirements are quantifiable and many studies done during the energy crunch of the seventies focused on using waste materials as substitutes for virgin materials in manufacturing commonly used products such as newsprint, aluminum cans or glass food and beverage containers.

The procedure necessary to follow a complete energy balance, and the complexity of this analysis is discussed in the Resource Recycling article.

"After the energy used to obtain the raw material inputs is taken into account, as well as the energy used in the production process itself, one still must account for the energy needed to make production machinery and buildings, to produce intermediate material inputs to feed humans involved in the various stages of production."

Energy balance data based on the primary energy used to extract, process and transport virgin raw materials, as well as the full heat, light and power requirements of production processes for recycled-content versus virgin-content products is presented in the Resource Recycling article. Just to give one example of the data provided, the energy conserved by substituting old newspapers for virgin fiber in newspaper production is 1878 kilowatt hours per ton. To incinerate the newspaper generates 708 kilowatt hours per ton. There are twenty-four waste stream materials reviewed for energy comparison. Wood waste is the only waste which yields more energy through incineration. So for most waste materials, more energy is conserved through recycling secondary materials than is generated from municipal solid waste (MSW).

The second article, appearing in Waste Age, is a good companion article because it deals with the energy from MSW and how recycling efforts affect the results. Energy from MSW is captured through the generation of steam in a boiler.

Steam can be used:

- to heat water;
- for space heating;
- as process heat for industrial applications;
- in municipal district heating/cooling systems; and
- to run a turbine for electricity generation.

The hierarchy of waste management alternatives is:

- reduction;
- recovery through recycling
- reuse
- reclamation;
- waste-to-energy; and
- landfill.

Comparative lifecycle energy analysis: theory and practice by J.Morris and D.Canzoneri in Resource Recycling, VolXI, No.11 November 1992, p 25-31.

Energy from municipal waste: Picking up where recycling leaves off by J.V.L.Kiser and B.K.Burton in Waste Age, Vol.23, No.11, November 1992, p.39-46.



Winpak, Winnipeg, Manitoba moving plastic rolls originally landfilled to a destination in the Seattle, Washington, United States for recycling

WASTENOT

the evolution of solutions

a conference on waste technologies and initiatives
Held November 4 and 5, 1992 in Nanaimo, B.C.

By Beth Candlish

It was with pleasure that I accepted an invitation to speak about the Biomass Energy Institute and the Manitoba Waste Exchange to this conference. In my initial statement I mentioned that the Islands off the mainland of British Columbia are well-known for their enthusiasm about recycling and making use of waste.

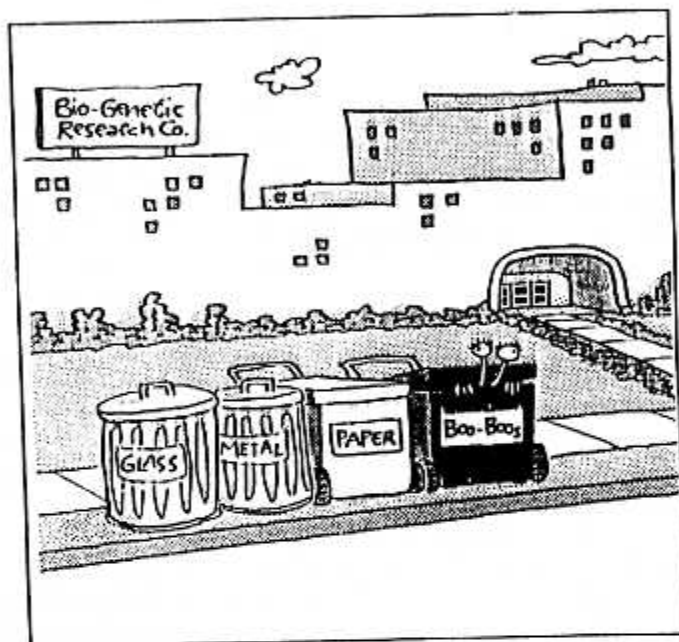
The conference was sponsored by the Association of Vancouver Island Municipalities, a collective body of municipal and regional political representatives from Vancouver Island and the Sunshine Coast, and the Nanaimo Environmental Technology Centre (NETC), a registered non-profit consortium of Vancouver Island businesses and organizations with broad interests and expertise in environmental technology, industry and services. NETC was formed to strengthen competitiveness through collaborative research, development and marketing.

Plenary sessions were held in the morning of the two days. Following lunch were panel discussions and interactive focus sessions completed the agenda for both afternoons. The BEI/MWE presentation was on Wednesday morning and I participated on a panel discussion - incineration or pyrolysis: alternatives to landfill. Later on Wednesday afternoon **Rene D'Aquila**, B.C. Waste Exchange and I met with a group interested in finding out more details about waste exchanges and how to get one started. Much of the discussion related to how local exchanges could cooperate with the provincial exchange.

B.C. WASTE MANAGEMENT ACT

The government of British Columbia amended the Waste Management Act through Bill 29 brought into force on July 24, 1992. **Ron Driedger**, Director Municipal Waste Branch, B.C. Ministry of Environment, Lands and Parks described the Waste Management Act and **Jane Ingman-Baker**, a lawyer with Singleton, Urquart and MacDonald, Vancouver explained some of the ramifications of the changes. Jane Ingman-Baker said, "These amendments are viewed by the Union of British Columbia Municipalities as delegating to the Regional Districts, rather than the Municipalities, the responsibility for preparation of solid waste management plans".

Aldyen Donnelly, Environmental Industries Champion for the Science Council of B.C. SPARK Initiative, gave a spirited response to previous speakers' analysis of Bill 29.



SPARK is an initiative to encourage the effective application of science and technology for the economic development of British Columbia. Four concerns identified by Aldyen arising from previous comments were:

- a vision is needed;
- education and communication are required;
- regulations do not make an industry; and
- financial facts.

Value must be added through a good technology base to generate wealth. Waste minimization, she added, should be addressed through process change. Aldyen gave an example of how to insure costs are included in company planning. Industries using water have to draw their water downstream from the plant. Another idea is to direct the stack emissions into the office of the CEO!

Susan Peterson, President, Ecological Engineering Associates, Marion, Massachusetts described how her company is commercializing natural systems technology for treating polluted water. A wide variety of microbes are used for the anaerobic digestion of wastewater flowing through a greenhouse growing a diverse plant population.

The microbes are encouraged to grow well and initially the plants chosen are ornamentals rather than food types. Oxygen is fed to the system at the front end to reduce the odour associated with anaerobic digestion. Ultraviolet light is used to disinfect. This interesting project deserves further attention in a later issue of Bio-Joule.

FOREST FERTILIZATION

Malaspina College, Nanaimo is involved in a Forest Fertilization project with the Regional District of Nanaimo and the Greater Vancouver Regional District. This is the first full-scale silvicultural spray application of municipal sludge on forest land in B.C. It follows a research project conducted at the University of British Columbia Malcolm Knapp Forest in Haney. The research concluded that sludge can be safely utilized in this way provided that proper environmental guidelines are followed.

Approximately 2000 dry tonnes of sludge will be applied to young stands of trees at Malaspina College's 1300 hectare woodlot on the slopes of Mount Benson, north of Nanaimo. A typical liquid manure odour is present for the first week after application and forest applications are visually harsh until rains wash it into the forest floor. (Paul Lucas or Dave Smith, Forestry Department, Malaspina College, 900 Fifth Street, Nanaimo, B.C. V9R 5S5 Tel. 604-753-3245).

The creative reuse of recyclables can stimulate business development and Charles Papke, President, Resource Management Associates, Napa, California has illustrative examples! Hamilton Manufacturing, Inc., Twin Falls, Idaho uses waste newspaper for manufacturing cellulose insulation, a hydromulching product and worm bedding material to keep worms moist for fish bait. Used Rubber, USA, San Francisco, California offers durable and waterproof handbags and belts made of post-consumer inner-tubes salvaged from disposal sites. Recently the company began a line of clothing using post-consumer sailing cloth as material and rubber inner-tubes as lining and fasteners.



Charles Papke, Francis Veilleux and Chair, Marjorie Stewart

HOW TIMES CHANGE!

One example of innovative glass use provided by Charles Papke illustrates how the time of introduction of a product influences acceptability. Twenty years ago the U.S. Bureau of Mines examined a material called foam-glass. Crushed glass is mixed with a foaming agent and heated to the molten state of glass. Small gas bubbles are released by the foaming agent. When cooled, the mixture forms a rigid, lightweight mass material which can be drilled, sawed and nailed.

A pilot plant was built in California in 1972 to manufacture foam-glass panels and other materials used in building. The plant closed after a couple of years due to lack of demand. There was an underlying bias against using recycled

content materials. Pittsburgh-Corning Corporation in Pittsburgh is the only company in the United States today producing foam-glass products. Foam-glass products are attractive for recycling operators because the colour of glass is unimportant and the product is highly tolerant of contaminants.

INCUBATOR PROGRAMS

This popular concept established in many U.S. cities involves helping entrepreneurs and small business through minimizing overhead and infrastructure needs. Some examples are free rent and utilities for six months followed by a gradual increase over the next three to five years of the business, free business and marketing assistance and access to government financing programs.

Charles listed five ways governments can assist new companies by:

- Direct assistance (services or facilities free);
- Financial assistance (reward use of recycled material);
- Technical assistance and information;
- Government procurement policies; and
- Regulatory.

HEIRARCHY OF STEWARDSHIP

Francis Veilleux, President of the Bluewater Recycling Association, Grand Bend, Ontario outlined the priorities for protecting the environment.

REDUCE REUSE RECYCLE COMPOST INCINERATE LANDFILL

There are 41 municipalities cooperating to meet their environmental commitments efficiently and effectively. These municipalities consist of a total population of 102 thousand and over 5000 km². Marketing cooperatively allows good use of collection, processing and shipping infrastructure. Because of the uniqueness of the Association, management provides consulting services for a fee.

ENVIRONMENTAL ACCOUNTING

The Four Laws of Ecology were described by David Weston during the Wednesday morning session of the Nanaimo, B.C. WASTENOT conference. In the afternoon, David led an interactive focus session on re-thinking the three R's of reduction, re-use and recycling in which the topic of including environmental pollution potential in cost accounting of projects predominated. David supplied a paper he had written for the New European, a quarterly review, published by MCB University Press in association with the Centre for European Studies. This article consists of excerpts from this paper. Ed.

Money as a tool is a brilliant human invention. As a "means of exchange", money enables people to exchange goods and services beyond barter -- the double coincidence of wants and needs. Money enables people to delay gratification of certain needs and wants. Money, however, has become a commodity for rent and for trading. In its rental function it extracts interest, and in its trading function, it facilitates a profit or a loss on the value of the currency itself. Money is a tool to achieve an end.

Money an environmental problem

There is growing evidence that the use of money as a commodity not only denigrates the potential for useful human exchanges, but also undermines human social, economic and political relationships and, most importantly, humans' relationship with the environment. The current debate over the desirability, or otherwise, of the European Community adopting a single currency provides an excellent demonstration of this.

Centralisation of money and banking is a prime candidate for the cause of

by David J. Weston, Lecturer
Simon Fraser University
Community Economic Development
Centre, Nanaimo, B.C.

community and regional and environmental decline. A centralised system, by definition, takes its basic orders from Head Office. Through the network of branches (to "Head Office") local wealth and value is siphoned off into their central (head office) vortex. Centralised banks collect money from all regions, rich and poor, in a nation, and make it available to those who are investing in the one or two places which are booming, causing further booming. Concurrently, the poorer communities and regions are deprived of their wealth to feed the voracious appetite of the centre. Even if some of that money is reimported into the community or region, it is an externally controlled capital. In the process the communities/regions lose control of their economy, their political decision-making process, their culture and their environment, becoming expendable "Regions of Sacrifice".

Local production discouraged

A single currency not only discourages diversified local production and distribution, including recycling and reuse, but also encourages centralisation of production into fewer and fewer centres that are highly dependent on environmentally damaging mass distribution systems.

Road transportation currently accounts for one-fifth of CO₂ emissions, and the full impact of air transport has yet to be documented.

Is big better?

The combination of large corporations and currency centralisation constitutes a major threat to the environment. Managers of the large centralised banks are confronted every day with the challenge of placing large deposits in secure but financially attractive projects. Because the cost of processing a loan for a large project is often similar to the cost of processing a loan for a small one, and because some large loans are government-backed, the tendency is to fund large projects such as dams, clear-cut, logging, airports, roads and the vehicles which ply them, high-rise buildings, nuclear and coal power plants, and large infrastructure in general. These are all environmentally destructive.

The "ideology of centralism", practised both under so-called "communism" and under so-called "capitalism" undermines not only local democratic decision making, but also people's community and regional culture, language, environment and economy.

If we simply allow our political and financial institutions free rein, we shall continue to see the growth of some communities and regions at the expense of the disempowerment, impoverishment and depopulation of others; we and our children will suffer from the environmental consequences of excessive concentration. If we encourage yet more centralisation, the impoverishment will extend to nations, and even continents. Instead, we should insist that the priority for decision making and action taking should always be at the most local level possible.