University of Oregon

SOLAR INCIDENTS

The Newsletter of the Solar Information Center

Vol. 6 No. 1 FALL 1995

Water in the Built Environment

By Steven Branchflower

Background

> Think how much water you use to flush the toilet, to take a shower, or brush your teeth. Consider where that water came from. Imagine how long it took to move through the stream, lake, river, reservoir, spillway, aqueduct, pump, main, lateral, meter, pipe, valve, tube, and faucet before it finally flows out to fill your glass. Now think about the rest of its trip; down the drain, through the trap, out and down into a network of merging pipes and tunnels, and finally through a treatment plant back into the water course.
>
> Murray Milne (1976)

The flow of water in and out of our lives is maintained by a complex system requiring vast numbers of people, miles of pipes, and huge amounts of energy. Where water supplies are plentiful and more water is needed to supply burgeoning populations, expansion of this system has traditionally been the solution. There is a tremendous cost associated with the building, operation and maintenance of new supply side pumps, pipes, reservoirs and waste end sewage treatment facilities. Where water supplies are not so plentiful we tend to rely on great technological fixes, also at great cost.

An excellent example which illustrates this mindset is groundwater use in the midwest. Approximately 80 percent of consumption of water in western states goes to irrigation and 40 percent of that comes from nonrenewable sources such as aquifers (Reisner 1986, 8). Groundwater in Texas, Kansas, Oklahoma, Colorado, New Mexico and Nebraska comes from one of the largest discrete aquifers in the world, as well as one of fastest-disappearing aquifers in the world, the Ogallala aquifer. The Ogallala aquifer contains as much nonrenewable water as there is in Lake Huron and it took over a half a million years to store that much. But the states have decided that a "reasonable period" to make that last would be twenty-five to fifty years. "What are you going to do with all that water?" asks Felix Sparks, the former head of the Colorado Water Conservation Board. "Are you just going to leave it in the ground?" When questioned about what happens when supplies are gone Sparks responds, "Well, when we use it up we'll just have to get more water from somewhere else" (Reisner 1986, 9).

Similarly state engineer Stephen Reynolds, the man in charge of water in New Mexico, says much the same thing,

> We made a conscious decision to mine out our share of the Ogallala in a period of twenty-five to forty years. Agriculture uses about 90 percent of our water and produces about 20 percent of the state's income, so it wouldn't necessarily be a knockout economic blow. Of course, you are talking about drastic changes in the whole life and culture of a very big region encompassing seven states. On the other hand, we may decide as a matter of national policy that all this agriculture is too important to lose. We can always decide to build some more water projects.
>
> (Reisner 1986, 10)

More water projects (similar to the fifty thousand major dam projects currently in existence) might be a solution. Unfortunately this sort of solution is rather problematic. To begin with dams and water projects are very expensive and government subsidies for multi-billion dollar water projects are becoming more difficult to fund in congress. Also we are running out of free-flowing rivers so the source for these grandiose, technological fix schemes becomes even more

Continued on p. 2

What is the Solar Information Center?

It is a student run organization sponsored by the ASUO and EWEB. The purpose of the center is to serve as a research, education, and information center on solar energy and alternative energies, and their applications in architecture and technology. One of its vital functions is to bring a lecture series on local, regional and global energy issues to promote a higher awareness toward conservation and renewable energy. The center also provides an in-house information source of books, periodicals, abstracts, proceedings, topic-files, and product-files.

SPECIAL THANKS TO **EWEB** FOR THEIR CONTINUED SUPPORT!

SOLAR INFORMATION CENTER
219 Pacific Hall
University of Oregon
(503) 346-3696
e-mail: sic@aaa.uoregon.edu

"Water", *continued from p. 1*

costly and improbable. The environmental problems associated with disturbing the natural flow of water and with damming rivers also need to be taken into consideration.

So it would seem that some tough questions concerning water usage need to be asked. Is it reasonable to seek new sources of water, which are increasingly becoming more costly and complicated since the most easily exploited water sources have already been developed? Or might it make more sense to practice conservation? Is it responsible to continually expand water storage and distribution facilities when conservation offers a viable, inexpensive, and environmentally friendly alternative?

There have been numerous schemes for getting more water into areas where groundwater supplies have been significantly depleted. The North American Water and Power Alliance (NAWAPA) has been one of the most ambitious. This was a scheme which planned on capturing much of the floor of the Yukon and Tanana rivers in order to divert it two thousand miles to the Southwest through the Rocky Mountain Trench. At an estimated cost of over $200 billion dollars, the project was projected to produce 100,000 megawatts of electricity and supply California, the high plains, and Arizona and still have enough to turn half of Nevada green (Reisner 1986, 13).

It is this kind of thinking that has shaped water policy in the U.S. This is unfortunate because it does not look at all of the costs involved in such schemes. The short and long term environmental costs need to be considered as well as the sustainability of such ventures. Perhaps we should first consider whether it is sensible to irrigate and populate the semi-desert and desert regions of our country where a basic resource such as water is not readily available. One has to question whether there will ever be an end to the costly development schemes if demand and consumption continue to outpace supply.

It would seem that the American people need a change in attitude about how we use water so that we can mend our ways. Even though the model of water use discussed above primarily refers to irrigation, while residential and other community water uses account for less than ten percent of water withdrawals worldwide, similar supply problems exist. The demands of a city "are concentrated in relatively small areas and can easily strain the capacity of local water sources" (Postel 1985, 37). As cities grow engineers develop supplies at distant and less desirable sites and at higher costs. The cycle of steady, unsustainable expansion continues.

Conservation

However, conservation offers a relatively new idea for helping to break this cycle and meet our long-range water needs. Conservation focuses on reducing demand as a way to balance the long-term supply/demand equation (Postel 1985, 40). In this paper I will try to focus on conservation solutions that we as designers can embrace.

Leak Detection and Repair

One of the most "universally cost-effective measures urban suppliers can undertake" is investing in leak detection and repair (Chaplin 1991, 1). It is estimated that cities with older or poorly maintained water systems such as those in Latin America, Asia, and the eastern U.S.

95

are losing as much as twenty-five to fifty percent of their water supplies. This is because large quantities of water seeps out through broken pipes and other faults in the distribution network (Postel 1985, 45).

A telling example of this is seen in New York City during fiscal year 1990-1991. During that year: "Twenty-six workers surveyed over ninety percent of the cities 57,000 miles of water mains. With a budget of $1.5 million for labor and equipment, they fixed 66 breaks and 671 leaks, yielding an estimated savings of 49 million gallons per day" (Chaplin 1991, 2).

Water-Saving Toilets

Even greater savings can be realized through fairly simple conservation techniques applied throughout our homes and the buildings we design. One of the biggest water wasters in the home is the conventional toilet. Toilet flushing is responsible for forty five percent of total indoor water use (Reynolds, and Stein 1992, 591). The conventional flush toilet uses 5-7 gallons per flush or approximately 32,000 gallons for a four person family per year. Ultra low flush (ULF) toilets use anywhere from 2 quarts to 1.6 gallons (1.6 gallons is the standard for new construction) and provide the same quality of performance as conventional water wasters (Consumer Reports 1991, 121-5).

Installation of ULF toilets can save approximately 23,000 gallons annually and, based on the average cost of water ($1.76 per 1,000 gallons), can reduce a water bill by $40 per year (Heede 1994, 166). In Eugene, the dollar savings would be $16 per year based on $0.687 per 1000 gallons (EWEB 1995).

The cost of ULF toilets is no more than conventional ones and local utilities often offer rebates. It is becoming more and more advantageous for utilities to seek reductions in demand by offering rebates to customers who install water-efficient equipment. This is because of the high costs involved in developing new or expanded facilities as discussed earlier.

An example of the effectiveness of switching from conventional toilets to the ULF toilets through rebates again can be found in New York City. The city had a supply problem and needed $800 million to $1 billion for a new pumping station on the Hudson river to add twenty percent to the average supply. Since all treatment plants were already operating at or above their permitted levels another $1.8 billion would be needed for added treatment capacity. Since water and sewer rates were already high—politically, physically, and economically conservation was clearly the lowest cost option.

The program planners set out to replace one-third of the toilets in the city with water-saving models (1.6 gallons per flush). With a budget of $270 million for 1.5 million rebates the program is predicted to reduce water use by 90 million gallons per day or approximately seven percent of the city's total water consumption. There remains the problem of what to do with a million toilets, but it appears the state's Department of Transportation can crush them and reuse them as a durable road building material.

This program is also very beneficial to the water customers in New York City who take advantage of the rebates. This is supported by the fact that:

> At current water and sewer rates, a single apartment with two people that converts to water-saving toilets and showerheads (discussed later in this paper) is projected to save approximately $60 - $70 on water and sewer charges. If more people live in the apartment, the savings will be proportionally larger (Anderson 1994, 42-5).

Further savings can also be realized since heat from the household is being flushed down the toilet. A manufacturer of water saving toilets has calculated that the "old, outdated toilet" robs the typical household of 16,500 Btu with each flush based on the heat embodied in 5 gallons of water (Vonier 1983, 100).

Composting Toilets

Another type of toilet which actually uses no water is the composting toilet. Composting toilets are a self-contained and much less energy intensive strategy for removing human waste than traditional sewer hook-ups or septic tanks. There are numerous varieties of composting toilets which all function on the same basic principle:

> ...human wastes, when mixed with enough plant matter, like kitchen scraps, and garden wastes, and exposed to enough air, will, in time, decompose and become nutrient-rich, humusy fertilizer. What goes on inside a composting toilet is very similar to what goes on inside a backyard compost pile (Stoner 1977, 98).

The wastes are aerobically digested, so there is no smell, as long as there is a good air supply and the collection tank is somewhat warm. 98 degrees Fahrenheit is optimum. The humus available is about 3-10 gallons of soil per person per year (Reynolds,and Stein 1992, 597).

One of the first composting toilets developed for indoor use is the Clivus Multrum. It was first developed in Sweden in 1939 and revived after World War II when the Swedish government began encouraging the development of composting toilets because they are seen as a valid solution to their country's wastewater problems (Stoner 1977, 97). Composting toilets like the Clivus Multrum not only dimin-

Continued on p. 8

F

Solar Incidents on the Web

The Solar Information Center is pleased to offer our newsletter on the World Wide Web, beginning this Fall. This marks the first step toward bringing our resources electronically to interested parties, saving trees, time, and postage. We will continue to publish our printed newsletters on recycled paper. If you are on our mailing list and would prefer *only* to access *Solar Incidents* electronically, feel free to contact us by phone or e-mail:
(503) 346-3696
sic@aaa.uoregon.edu

Our Web site can be found at::
http://darkwing.uoregon.edu/~sic/

Through our ongoing internship program, the Solar Info Center will be transferring many of our resources onto this Web Page over the next several months. Look for back issues of *Solar Incidents* as well as research papers, library lists, and other files.

Bioregionalism in the Realm of Architecture

By Mark Serhus

Definitions of Bioregionalism

Bioregionalism is a region governed by nature, not legislature. --Kirkpatrick Sale

A bioregion is a whole life-place, a distinct area with coherent and interconnected plant and animal communities, often defined by a watershed. Bioregionalism provides an effect grass-roots approach to ecology that emphasizes sustainability, community self-determination and regional self-reliance.
--Planet Drum Foundation

Bioregionalism is neither a clearly delineated ideology with a creed, assented to by a cluster of self-conscious adherents, nor is it a simple ideologically neutral 'research tool'.
--W. Donald McTaggart

Bioregionalism is a contemporary North American ecological movement committed to developing communities integrated with ecosystems. --Stephen Frenkel

Lewis Mumford, the early twentieth-century city planner, architect and social reformer, more clearly defines the [bio]region pertaining to architecture. The human [bio]region "is a complex of geographic, economic, and cultural elements. Not found as finished product in nature, not solely the creation of human will and fantasy, the [bio]region, like its corresponding artifact, the city, is a collective work of art". This collective work of art is determined by our ecological and social responsibility. From my world view I define bioregionalism in the realm of architecture very simply as, the watershed which yields our resources and supports our culture.

I see bioregionalism as an emerging ideology that could save us from our social and ecological ills. If we use the uniqueness and diversity of the place in which we live and the ecological limits thereof to define our way of life a newmore whole world will come forth. Our way of life is constructed by our attitudes and ideologies, our education and professions, and by our architecture.

The Elements of Bioregionalism

With a couple of exceptions, all of the reading and research found today on bioregionalism are based on environmental activism, agriculture, ecology and geography. Within each of our bioregions we have a limited amount of natural resources. The crux of this definition in the realm of architecture is how and how much we use our resources. On the pallet of our natural world we have natural resources that yield food for sustenance, materials for our built world, and energy for our daily operations. The materials and energy we use for our built world--our architecture--has profound impacts on the bioregion and can actually determine whether or not a bioregional approach is successful, as well as whether a bioregion is living beyond its means.

History gives us great examples of those societies that failed due to overuse of material resources in their respective bioregions. The parable of the "tragedy of the commons" is one that was fatefully bestowed upon the Mycenaean Greeks, the Roman Empire, and on our continent the Anasazi mesa culture in the Chihuanhuan bioregion of the Southwest. It should be noted that the Mycenaeans and the Anasazi decimated their land from intensive agricultural use (i.e., soil erosion and lack of wood for fire, respectively) and the Romans, who were masters of architectural innovation and materials use, obliterated their stock of materials from an imperially myopic view of their world. But in no previous society did the abandonment of Gaea reach the scale it reached in Europe in the centuries after the Renaissance, a period of exuberant consummation (Sale). Today, at what I hope is the end of the scientific age of the Renaissance and the dawn of a new era of enlightenment, I believe the realm of socially and ecologically responsible architecture will offer substantial contributions to the arena of bioregionalism.

The Forefront of Bioregionalism

At a time when the term ecology was unheard and when nature was still being 'tamed', a group of visionaries were advocating for re-scheming the view of our natural, political and social landscape. From 1923-33, the Regional Planning Association of America established itself as the original planning organization in our country--if not the world.

Continued on p. 5

THE SOLAR INFORMATION CENTER

LECTURE SERIES AND EVENTS CALENDAR

For more information, please contact us at 346-3696.

95

Thursday, October 26, 7:00 pm, room 177 Lawrence Hall, U of O

"Solar- and Hybrid-Solar-Electric Cars, and Efficient Vehicle Fuels"

By Dr. Michael Seal

Founder of Western Washington University's Vehicle Research Institute (VRI), Dr. Seal is a researcher and educator in the field of vehicle engine efficiency and alternative vehicle fuel systems, including both photovoltaics and thermophovoltaics. The VRI is known for designing the Viking automobiles, which have won many awards for performance, low-emissions and fuel economy. The Viking XX, an all-solar car, and the Viking 21, powered by both solar energy and natural gas, have both won in their class at national and international solar electric auto-racing tournaments.

Thursday, November 2, 12:30 pm, room 286 Lawrence Hall

Video Brown Bag: *"Building to Save the Earth: Energy & Resource Flows"* by the American Institute of Architects (96 min.)

Thursday, November 9, 12:30 pm, room 286 Lawrence Hall

Video Brown Bag: *"Building to Save the Earth: Healthy Buildings and Materials"* by the American Institute of Architects (78 min.)

Thursday, November 9, 7:30 pm, room 177 Lawrence Hall

"Greening the Mainstream"

By Sandra Mendler

Sandra Mendler is chair of the "Green Team" at Hellmuth Obata and Kassabaum (HOK), based in Washington, DC. Mendler has been closely involved with the development and implementation of the HOK Green Architecture Program, the development of the HOK Green Building Materials Database, the HOK Sustainable Design Checklist, and the HOK Sustainable Design Guide. As project designer of the EPA Environmental Research Center in Research Triangle Park, NC, and the new headquarters for The Nature Conservancy, she has been integrally involved in the development of significant sustainable design initiatives, developing goals, guidelines and rating criteria for environmentally-sound building materials and practices.

Friday, October 10, Brown Bag Forum: Sandra Mendler

12:00 pm, room 231 Lawrence Hall

Thursday, November 16, 7:30 pm, room 177 Lawrence Hall

"The Draft 1996 Regional Power Plan"

By the Northwest Electric Power and Conservation Planning Council

This Portland-based, interstate agency works with the state governments of Idaho, Montana, Oregon and Washington and with local utilities on regional power planning and fish and wildlife issues in the Columbia River Basin. Its main goals include encouraging cost-effective conservation and renewable energy in the Northwest, protecting fish and wildlife while assuring an adequate, efficient and reliable power system for its residents. Their Draft 1996 Plan, scheduled for completion in November, will be the subject of this lecture and discussion session.

"Bioregionalism", ***continued from p. 4***

They set out to "promote and stimulate a vivid, creative life throughout a whole region--a region being any geographic area that possesses a certain unity of climate, soil, vegetation, industry and culture". All land and resources would be advocated for sound development and populations would be maintained to utilize the natural resources. They saw their ideology as solving problems of our growing nation across political and social boundaries through regionalism.

This movement expanded into the realm of economics through the 1930's under the auspices of Howard Odum who labeled regionalism as "the philosophy and technique of self-help, self-development, and initiative"--that regions could be fully developed under their own resources and capacities. In 1935, regional differentiation was said to be the true expression of American culture. The document, Regional Factors in National Planning and Development, advocated regionalist thinking over the idea of State for national planning and development. Not until the 1960's did the ideas of regionalism manifest in the field of regional planning and development. Ironically, this became a double-edged sword--the age of regional planning embraced the ideas of suburban sprawl and was more often used by developers to rape the land than to bring about a higher consciousness of our [bio]region.

A New Era

Not until the turn of the decade into the 1970's did we see the ideas of regionalism marry with the ideas of nature and ecology. Ian McHarg's Design with Na-

Continued on p. 6

"Bioregionalism",
continued from p. 5

ture became the new ideology for an enlightened architecture student named Pliny Fisk, III, the future founder of The Center for Maximum Potential Building Systems in Austin, Texas.

At about the same time, bioregionalism was developing more into a lifestyle than an ideology. The first images of this are apparent in the "re-mapping" of the continents of the world prepared under UNESCO's Man in the Biosphere Program. Miklos Udvardy created what can be called the closest thing to defining bioregions with The Biogeographical Provinces map. With this information one can clearly see how diverse (and conversely, how alike) our continent (and our world) is.

Udvardy and others used this information to make bioshifts--comparing, for instance, the Temperate Grassland of North America with those of Southern Brazil, or Northern Africa, Central Russia, and Southeastern Australia. With this information one is able to compare existing as well as ancient societies and how they succeeded in individualizing themselves. We can learn from the successes and heed the examples of failure in all realms of life, be it economic, political, social, agricultural, or architectural through a thorough bioregional analysis.

The Link to Architecture

Fisk, an architect and social reformer, used bioshifts and defined biotechnologies for use in architectural design and establishing stable state economic development. The quest was to find a correlation between resources and technologies in similar bioregions and then develop this into a novel approach for technology sharing and regionally based economic growth. The outcome was to generate a global indigenous pattern of technology. The term biotechnology emerged as "a highly available resource utilized at a small or intermediate technology level to provide a long-

Continued on p. 7

F

Renewable Energy Shines at the Fair

Energy Park Projects Gain Momentum

By Sandra Leibowitz

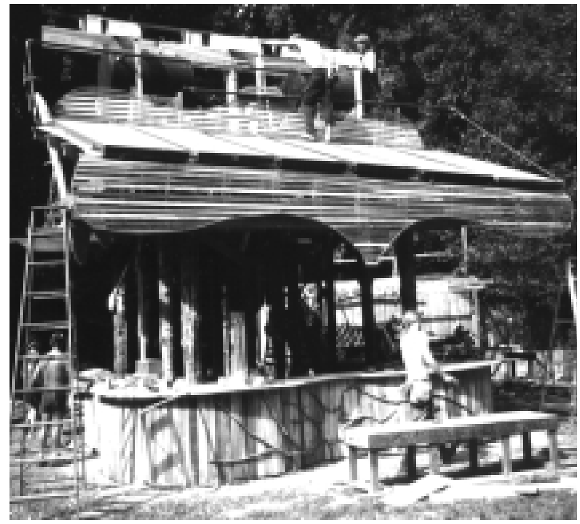
The Oregon Country Fair, a vibrant and much-loved celebration of art, music, community and positive action, lived on for its 26th year this past July. The Fair is held annually for three days on a peaceful, shady site in Veneta, Oregon and is enjoyed by thousands of eager visitors.

The Solar Information Center was privileged to share in the fun for a third consecutive year by holding a booth in Energy Park, a section of the Fair providing information and hands-on demonstrations in renewable energy and appropriate technology. This year, several projects were developed to help Fair-goers realize the potential of renewable energy sources and solar-responsive design, applied both at home and at the Fair itself.

Winning entry, the *Power House*.

Design Charette Winner is Built

The *Oregon Country Fair Design Charette* , a competition co-sponsored last April by the Solar Information Center and Energy Park, awarded prizes to three designs for a new Energy Park Information booth. First Place was awarded to Beth Moore and Jim Whitmarsh for their joint project entitled The Power House. Second place went to Aaron Blake for The Bug, and third place to David Reynolds for The Argonaut.



"Solar Bozos" work on Energy Park's new Information Booth, July 1995.

Beth and Jim, both students in the School of Architecture and Allied Arts at the U of O, saw their design built full-scale this summer, with some adaptation. Matthew Swett created the working drawings for the building permit, Tim Woldon performed the engineering work, and members of Energy Park volunteered their weekends to build and garnish their new structure.

The “Solar Bozos”, an Energy Park team lead by Tom Scott to install the Park’s renewable systems, topped the booth off with solar water heating panels and storage tanks for the Park’s three solar showers, providing hot water for more than 400 showers per day. Also atop the booth were six 60-75 watt photovoltaic panels, three belonging to Real Goods to cool both its own booth and the Info Booth, and three to Home Power to charge batteries for booth lights as well as for the sound systems on two of the Fair’s performance stages. Both companies are long-time Energy Park participants.

New Group Electrifies the Fair

The Energy Park Electric Company was formed to coordinate an effort to provide solar-powered lighting and other electrical needs to the Oregon Country Fair. Real Goods donated low-wattage lights and lent batteries to the program to provide safety lighting to the bathroom areas of the Fair this year. Home Power's Info Booth panels powering sound systems and booth lights were also part of the program.

Future expansion of the program includes illuminating more, if not all, of the information, food and vending booths at the Fair, eventually eliminating their reliance on the currently used kerosene lanterns which are considered too dangerous, bright, hot, noisy, and inefficient. For more information, please contact Tim Woldon at (503) 942-9825.

Eco-Doll House Demonstrates Green Building Design

Ross Leventhal, a graduate student in Architecture at the U of O, put his design skills to work this summer by building a 1/2-inch scale model of a passively heated and cooled, resource-efficient house as a permanent display for the Solar Info Center's booth at the Fair. Features of the 3-bedroom doll-house include: concrete floors and "trombe walls" (south-facing walls with glass on the outside) to absorb heat directly from the sun and release it into the space; shading devices and natural ventilation to cool the space in summer; earth-berming to enhance year-long thermal consistency; solar water heating, rainwater collection, greywater reuse, greenhouse, composting toilets, and photovoltaics—in other words, the works!

The *Eco-Doll House* holds solar collectors on its roof and a grape arbor on its south side to shade the lower floor in summer.

The doll house, complete with dolls and some of their household items (donations welcome!) made its debut this summer, helping Solar Info Center staff explain environmentally responsible building design concepts to Fair-going kids and their parents. Materials for the doll house were provided by Jerry's Home Improvement Center and Greater Goods in Eugene. For your own tour of the Eco-Doll House, or for a free brochure, please contact us at (503) 346-3696.

Solar Info Center Resource Library

We are adding nearly 20 new titles to our library for Fall 1995. Drop by to browse through our current collection of books, periodicals, and other resources, or ask for a free copy of our updated library list.

219 Pacific Hall, 346-3696

95

"Bioregionalism",
continued from p. 6

term stable state means for life support within a given region". When a material or process is applied to a specific duty, let's say in architecture, then it becomes appropriate technology.

Biotechnologies are defined by eight basic human life support categories: food, water, energy, waste disposal, building materials, climatic comfort, clothing, and medicine, the first six of which apply directly to architecture--that is, of course, if one feels that they can grow their own food, process their own waste, harness their own energy, etc. through a holistic, eco-sensitive architectural design.

According to Fisk, the most convenient way to manage and plan these biotechnologies is by the watershed found within each province. This organizing entity, the watershed, also acts as the proverbial "canary in the coal mine". The physical development of a bioregion will be reflected in the water quality, indicating whether actions taken have overstepped nature's own assimilative capacities. From this point human resources,, physical resources and life support needs are assessed from the eight basic human life support categories. Their spatial relationship reflects the integrated activity while respecting the watershed's holding capacity and ultimately defining the limits of the bioregion.

The Roots of Sustainability in Bioregionalism

Fisk declares in the Bioregional Compendium that "the commitment to sustainability as an essential criterion [in the arena of bioregionalism] is proving widespread, permeating the social and life sciences into interdisciplinary efforts as well as international political (e.g., the Green Party) and grassroots movements (e.g., the American Bioregional Congress). Orga-

Continued on p. 10

"Water", *continued from p. 3*

F

ish the demand on wastewater systems, they also reduce the demand of high quality (drinking) water and provide great fertilizer for gardens. Even though the composting toilet collection tank requires a space about the size of a Volkswagen Bug below the kitchen and bathroom to collect wastes, these rooms do not need to be located directly above the tank. This is because a horizontal spiral conveyer pipe can move wastes easily to the tank. This makes installation much easier which in turn makes water conservation more attractive.

Showerheads and Faucets

Water conservation is also made easy through the installation of water-saving, efficient showerheads and faucets. Combined with toilets, shower and faucet use comprise seventy-five percent of water that goes down the drain. So there is a great opportunity for further water conservation. Furthermore, because these fixtures also use hot water, conservation has the added benefit of saving water heating energy.

Efficient showerheads are inexpensive ($10 to $20) and can cut shower water use by one third to one half. Rebates or efficient showerhead replacements also are often offered by utilities. Less than 2.5 gallons per minute is efficient and is currently what is required for new construction. One of the problems with efficient showerheads can be misuse. Sometimes people simply stay in the shower until the hot water runs out. With the efficient shower head they stay in longer than they normally would and use as much water as before. So conservation awareness is important.

Installing aerators or flow restrictors to faucets can conserve a great deal of water. Aerators work by mixing air with the water reducing the flow while making it seem bigger. Bathroom faucets that deliver 1/2 gallon per minute instead of 4-5 gallons per minute work fine. Flow rates for kitchen faucets can be higher, up to 2.5 gallons per minute as regulated by code. Another effective conservation technique for faucets is the foot operated faucet which frees the hands from having to control water flow (Reynolds, and Stein 1992, 599).

For both faucets and showers fingertip control valves allow quick temporary shutoff to save even more water (Heede 1994, 150). These valves are easily installed and where conservation awareness is high, consumption can significantly be reduced. Bob Hammond was aware of the water-savings potential these control valves offered when he built his house off the grid and independent of the public water system in Prescott, Arizona. He has a 1,200 gallon cistern which stores rainwater from the roof and water he hauls by truck at a cost of 7 cents per gallon ($84 to fill the cistern). In the dry climate of Arizona Bob cannot rely on rainwater and hauling is too expensive. So conservation is the necessary, cheap, and simple solution. he installed an ULF toilet (1.4 gallons per flush) and water-saving showerheads and faucets. To further reduce consumption, occupants flip the fingertip control valve to shutoff water while lathering which results in a 3 gallon shower (Casebolt 1993). This is really only a small fraction of the typical households 30 to 60 gallon shower (Reynolds, and Stein 1992, 597).

There are numerous examples of tremendous savings as a result of conservation through replacing older toilets, showerheads and faucets with efficient water-saving models. One example is seen in the retrofit of a the Lenox Hotel in Boston. By replacing conventional plumbing fixtures in 220 rooms with high efficiency fixtures the hotel reduced its average water demand by about forty percent (3.6 million gallons per year water savings and $15,000 annual cost savings). These savings were achieved with no reduction in fixture performance or customer satisfaction

Another telling example comes from Goleta, California where over 17,000 ULF toilets have been installed, most with a rebate of $50 to $80 from the local utility. The utility also distributed 35,000 high-efficiency showerheads, implemented rate structure changes, and conducted onsite water use surveys. These measures, in addition to some emergency drought measures, created a reduction in water use of fifty percent and a reduction in sewage flow of over fifty percent, thus eliminating, for now, the need for a multi-million-dollar treatment plant expansion (Chaplin 1991, 2).

Household Appliances

Household appliances such as dishwashers, and washing machines use roughly twenty percent of household water and a large amount of energy to heat water. Newer models of appliances allow for a wider selection of water quantities and temperatures that can save water and energy.

Recycling and Re-use

Another method for conserving water is recycling. In order to understand what water can be recycled it is useful to clarify the four common grades of water in buildings. First, *Potable water*, which is usually treated and suitable for drinking. All water that comes into the home via the public water supply is potable water, but we only really consume about five percent through drinking, and cooking. Second, *Rainwater* is the water that lands on, or around the house and is considered stormwater. Third, *Graywater* is waste water which does not come from toilets or urinals (sinks, showers, appliances etc.). Fourth, *Blackwater* is water containing toilet or urinal waste (Reynolds, and Stein 1992, 599).

Many uses of water in and around buildings could be met satisfactorily with rainwater. Bathing and laundry, irrigation and toilet flushing are examples. This water would be caught on the roof and stored in a cistern. There are great opportunities to design rainwater collection systems which are both functional and architecturally beautiful. Gutter systems could be designed to enhance the visual and acoustic charm that falling water produces in a building. By capturing runoff linked to a cistern a 1,200 square foot roof can harvest 750 gallons of water for each inch of rain. So a 20 inch season would net nearly 15,000 gallons.

Rainwater collection is a type of recycling which reduces the load on stormwater systems and conserves water by reducing the demand from the public water supply. Pollution and debris can be a problem that can also be mitigated fairly easily with appropriate roofing materials, screens, and filters.

Another simple idea is to conserve by using water more than once. This can be accomplished though the installation of a handbasin toilet. The handbasin is a fixture that fits on the top of the toilet tank and consists of a faucet and sink. When the toilet is flushed water that normally goes directly to fill the tank for subsequent flushing is diverted through the faucet. This enables the person who flushed to wash his/her hands in the sink. The water is drained from the basin directly into the tank ready for the next flush (Milne 1979, 272).

The handbasin toilet is a type of graywater recycling system. Graywater recycling is best used for toilet flushing and irrigation. Water from bathroom sinks, bathing, and laundry water can be reused with only minimal treatment for irrigation, but it would need to be a drip type system located below the surface because of the potential risk from surface exposure to pathogens. Unfortunately graywater recycling has not been approved in Oregon and many other states. However in California, where the consequences of water shortages due to prolonged drought have been witnessed, the state adopted use of graywater for landscape irrigation last November (Kourik 1995, 30).

Though typically viewed as "pollutants", most graywater constituents are nutrients that belong on the land where they originated. Farmers and gardeners spend millions of dollars on fertilizers to give their crops the nitrogen, potassium, and phosphorus that urban wastewater contains in large amounts. It would take 53 million barrels of oil (worth over $2 billion) to replace with petroleum based fertilizers the amount of nutrients yearly disposed in U.S. wastewaters (Postel 1985, 35).

Irrigation water is heavily subsidized by the government (as little as 5 cents per thousand gallons). It would seem that forcing water prices to a reaslistic cost per gallon would force ideas in water conservation like wastewater reuse to be implemented rather than waiting until nonrenewable (or very slowly regenerating) groundwater supplies have been completely depleted.

At a smaller scale, a nicely designed household system can use collected and filtered rainwater and reuse the wastewater. The Swedish Clivus Multrum system not only utilizes the composting toilet mentioned above, but also recycles the graywater. Graywater from the bathroom, kitchen and laundry gets primary treatment in a trickle filter system. It then goes into a solar greenhouse's planting beds where it irrigates and fertilizes plants as it filters thrugh the soil and drainage material. After leaving the greenhouse it is discharged into a small leachfield (Milne 1979, 256).

Graywater recycling may not seem like a huge savings on an individual level, but you can save quite a bit in and around the home considering that approximately fifty percent of water use goes to watering plants and irrigation (Reynolds, and Stein 1992, 592). It is also very useful in helping to control septic tank problems by reducing the liquid that enters the system and for saving landscape plants during prolonged drought (Kourik 1995, 30).

Landscaping

For additional conservation of water appropriate landscaping can provide great savings. The use of drought tolerant species and indigenous species which can grow hearty in the local climate is an essential step for reducing water use outdoors. Lawns use an exorbitant amount of water, especially in the dry part of the year. Landscape water used by lawns can easily reach several hundred gallons per day. It would be useful to evaluate whether we really need green lawns. Children, of course like to play in the grass and it is often pleasant to lay in cool grass, but there are vast areas of the traditional American lawn that don't get used. Water conserving landscape can replace much of our resource draining lawns (gas for mowers, maintenance time, and water). It can be designed to beautifully enhance our outdoor spaces while conserving forty to sixty percent (depending on lot size) of water used outdoors (Robinette 1984, 198-204).

Innovative Designs

Earth Shelters and Bioshelters provide excellent examples of building designs which drastically reduce their water needs. They both utilize rainwater collection and natural systems for all the water supply and waste treatment needs (assuming a mini-

Continued on p. 10

"Water", ***continued from p. 9***

mum annual rainfall of approximately 8 inches). The Earth Shelters' "jungle tanks" and composting toilets take care of its waste. The Bioshelter system designed by John and Nancy Jack Todd also utilize biological systems to grow their food, clean their water, regulate humidity and purify the air. The use composting toilets and the humus as fertilizer and graywater to reduce irrigation needs. So the overall water reduction in these forward thinking buildings is over seventy percent that of a conventional home.

Another system designed by the Todds is a toilet system for an elementary school. They installed a series of several plexiglass, cylindrical shaped tanks and filled each with water and an appropriate biological group like bacteria, algae, microscopic animals, fish, snails, shellfish and higher aquatic plants such as floating water hyacinths. The blackwater from the school's toilets worked its way through these tanks having toxins and organic matter removed through natural biological processes. The water then spilled into a lower tank/pond with lillies and a little fountain, and the purified water was clean enough to drink. However they used it to resupply the toilets, so it was a closed system. The children could watch the whole process and understand how their waste can be recycled back into nature (Todd, and Todd 1980, 78). Architecturally the system was a beautiful addition to the school's lobby and it was educational for everyone.

Other similar sewage treatment systems have have also been designed by the Todds for urban neighborhoods. They incorporate a treatment system called the solar sewage wall. In a space configured similar to a greenhouse, are three rows of planting beds. Sewage enters the system at the back wall on the first row, which is stepped up higher than the other two. Then the waste water flows with gravity down to the second row and again to the third. The filtration process is similar to the example of the school discussed above. Bullrushes and Sedges added to this system will take up harmful metals. The water then flows to a final tank and through a sterilization process resulting in pure water. The sewage wall can be accomodated on a wide sidewalk and has the added benefit of attractive plantings in the urban landscape. Larger systems for communities can also be designed utilizing these natural processes in the form of constructed wetlands for sewage treatment. (Todd, and Todd 1980).

One final innovative design provides a good example of conservation by utilizing stormwater. Michael Corbet designed a subdivision outside of Davis, California in the mid 1970s called Village Homes. The streets of Village Homes are only 21 feet wide and they slope to direct stormwater runoff. Water is designed to run off the streets and through sloped backyards through bioswales and channeled culverts to recharge areas which fill the nearby aquifer. The recharge areas were located early in the design process and the development was built around these areas. Weirs were engineered to ensure water would stay and filter into these areas. There are small front lawns or yards, with shared lawns in the back irrigated by stormwater runoff. There is also a wonderful community center and stage with outdoor seating. After rainstorms the space between the seating and the stage is flooded, providing a beautiful setting for performances and community activities. The landscaping consists of drought tolerant, indigenous species and many edible plants. There is also agricultural land as part of the development. The local community is invited to help at harvest time (Jones 1995).

Village homes adds no stormwater to the public system because all of it is used for irrigation and recharge. The subdivision is much greener than other areas in Davis and there is a stronger sense of community as a result of the common spaces formed by the stormwater catchment in addition to the coming together at harvest time.

Conclusion

As one can gather from the many examples discussed in this paper, there are numerous ways to reduce the amount of water we use in the built environment. Conservation is a method which simply reduces the amount of water we use by reinventing conventional methods without actually changing our lifestyles. Recycling and re-use explore new ways in which we can get more for less. Innovative design explores new ways of thinking about water and waste, offering exciting potential solutions for reductions in water use and waste. All of these methods must be considered in the design process if builders are genuinely concerned about helping to preserve one of our most precious resources.

Bibliography

Anderson, Abba. July/August 1994. "The Big Flush: Saving Water in the Big Apple" Home Energy Magazine Online DOE's Energy Efficiency and Renewable Energy Network.

Calthorpe, Peter. 1993. The Next American Metropolis: Ecology, Community, and the American Dream. New York, New York: Princeton Architectural Press.

Casebolt, Cathlene. May/June 1993. "Home Alone—Living Off the Grid" Home Energy Magazine Online DOE's Energy Efficiency and Renewable Energy Network.

Chaplin, Scott. 1991. "Water Efficiency Sampler" Rocky Mountain Institute Water Program December::2

_______. 1991. "Low Flush Toilets" Consumer Reports February: 121-125.

"Bioregionalism", *continued from p. 7*

nizations with a wide array of disciplines such as UNESCO, the World Bank, the Sierra Club and The American Institute of Architects have embraced the perspective that we need to examine the interrelationships between ecology, agriculture, economics and architecture. The North American Bioregional Congress has the most refined objective to support sustainability: to set up an organized representation of delegates from different biomes to support alternative legislation, provide information transfer on environmental and development issues, and to perform other tasks that represent the actual variety of conditions indicative of the respective ecological systems. Their creed "encourages people to become aware of where they live and adapt to the natural systems that exist in those places: inhabiting or reinhabiting life-places. The idea of reinhabiting a life-place is to redefine how and by what means we are living.

The Necessary Shift

As Sale declares, it will take a lot of grassroots politicking, backyard democracy, citizen empowerment and community control to change the status quo policies that prevent us from fulfilling the dream of living lightly upon our bioregions. I believe that we could effect the necessary changes one household at a time--and there is nothing to say that businesses could not and are not taking steps in this same direction and in their architecture as well.

The preamble [of the NABC] may suggest the tone:

Welcome Home

> A growing number of people are recognizing that in order to secure the clean air, water and food that we need to healthfully survive, we have to become stewards of the places where welive. People sense the loss in not knowing our neighbors and natural surroundings, and are discoveringthat the best way to take care of ourselves, and to get to know our neigh bors, is to protect and restore wherewe live (Sale).

The future rests on our commitment to the environmental ethics and ideologies of a bioregionalist's view. It requires neither a paradigm shift nor any new technology--only a rediscovery of what our innate values and social responsibilities are as "dwellers in the land".

Contributing aspects that would help foster this change would be a localized movement to support policy intervention in the institutions and bureaucracies that govern us. Economic development and incentives in the field of sustainable architecture in the way of supporting products and processes would certainly help as well.

Sale uses words such as gradualism, evolution, and realism when developing a philosophy that will work for the future of bioregionalism. A respect for the diversity in our landscape and our cultures, getting to know intimately one's region and its respective ecological imperatives, and finally to go through one's life with the basic Gaean principles in check, will insure that the bioregionalist's dream will become a reality.

Bibliography

Alexander, Donald Bioregionalism: Science or Sensibility Environmental Ethics v. 12, Summer 1990, pp. 161-174.

Architecture Magazine, Committee on The Environment, June 1993.

Andruss, Van et al. Home! A Bioregional Reader.

Berg, Peter et al. A Green City Program.

Coates, Gary, Editor Resettling America.

Eckersley, Robyn Environmentalism and Political Theory

Frenkel, Stephen Old Theories in New Places? Professional Geographer, v.46, n.3, pp. 289-295.

Fisk, III, Pliny Bioregional Compendium.

Oliver, Paul Dwellings, The House across the World.

Sale, Kirkpatrick Dwellers in the Land.

95

"Water", *continued from p. 10*

Eugene Water and Electric Board. 1995. Home Water Use Guide.

Gavelis, Bill, Miller, Bill, and Proctor, John. 1994. "Savings and Showers: It's All in the Head" Home Energy. July/August: 37.

Heede, Richard, and staff of Rocky Mountain Institute. 1994. Homemade Money: How to Save Energy and Dollars in Your Home. Snowmass, Colorado: Rocky Mountain Institute Publications.

Horan, N.J. February 1991. Biological Wastewater Treatment Systems: Theory and Operation. West Sussex, England.: John Wiley and Sons, Ltd.

Jones, Stan. July 17, 1995. Interview regarding Village Homes.

Kourik, Robert. 1995. "Graywater for Residential Irrigation" Landscape Architecture. January: 30-33.

Milne, Murray. March 1976. Residential Water Conservation. University of California Davis: California Water Resources Center Report No. 35.

Milne, Murray. September 1979. Residential Water Re-use. University of California Davis: California Water Resources Center Report No. 46.

Meier, Alan. July/August 1994. "Low-Flow Showerheads, Family Strife, and Cold Feet" Home Energy Magazine Online DOE's Energy Efficiency and Renewable Energy Network.

Postel, Sandra. September 1985. "Conserving Water: The Untapped Alternative" Worldwatch Paper 67 Washington, D.C.: Worldwatch Institute.

Reisner, Marc. 1993. Cadillac Desert: The American West and its Disappearing Water. New York, New York: Penguin Books

Reynolds, John S., Stein, Benjamin. 1992. Mechanical and Electrical Equipment for Buildings: 8th Edition. New York, New York: John Wiley and Sons, Ltd.

Robinette, Gary, and Sloan, Kevin. 1984. Water Conservation in Landscape Design and Management. New York, New York: Van Nostrand Reinhold Company Limited.

Stoner, Carol Hupping. 1977. Goodbye to the Flush Toilet: Water Saving Alternatives to Cesspools, Septic Tanks, and Sewers. Emmaus, Pennsylvania: Rodale Press.

Todd, John, and Todd, Nancy Jack. 1980. Tomorrow is Our Permanent Address. New York, New York: Harper and Row, Publishers.

Todd, John, and Todd, Nancy Jack. 1984. Bioshelters, Ocean Arks, City Farming: Ecology as the Basis of Design. San Francisco: Sierra Club Books.

Vonier, Thomas. 1983. "Let them Drink Wine" Progressive Architecture. April: 98-101.

CALENDAR

Thursday, October 26
"Solar- & Hybrid-Solar-Electric Cars & Efficient Vehicle Fuels"
by Dr. Michael Seal
7:00 pm in 177 Lawrence Hall

Video:*"Building to Save the Earth":*
Thursday, November 2
Part 1: "Energy & Resource Flows"
Thursday, November 9
Part 2 "Healthy Buildings & Materials"
12:30 pm in 206 Lawrence Hall

Thursday, November 9
"Greening the Mainstream"
by Sandy Mendler
7:30 pm in 177 Lawrence Hall

Thursday, November 16
"The 1996 Draft Regional Power Plan"
by the Northwest Power Planning Council
7:30 pm in 177 Lawrence Hall

S	M	TU	W	TH	F	S
			18 OCT	19	20	21
22	23	34	25	**26**	27	28
29	30	31	1 NOV	**2 Video**	**3**	4
5	6	7	8	**9 Video**	10 **Brown Bag**	11
12	13	14	15	**16**	17	18

SOLAR INFORMATION CENTER

(503) 346-3696 e-mail: sic@aaa.uoregon.edu wwb:http://darkwing.uoregon.edu/~sic/
219 PACIFIC HALL, U OF O
Office Hours MWF 9:00-1:00 TH 9:00-4:00

NON-PROFIT
ORGANIZATION
US POSTAGE PAID
PERMIT No. 63
EUGENE, OR
97403-5236

Solar Information Center
University of Oregon
Eugene, OR 97403-5236