The Environmental Bi-Weekly

High Country News

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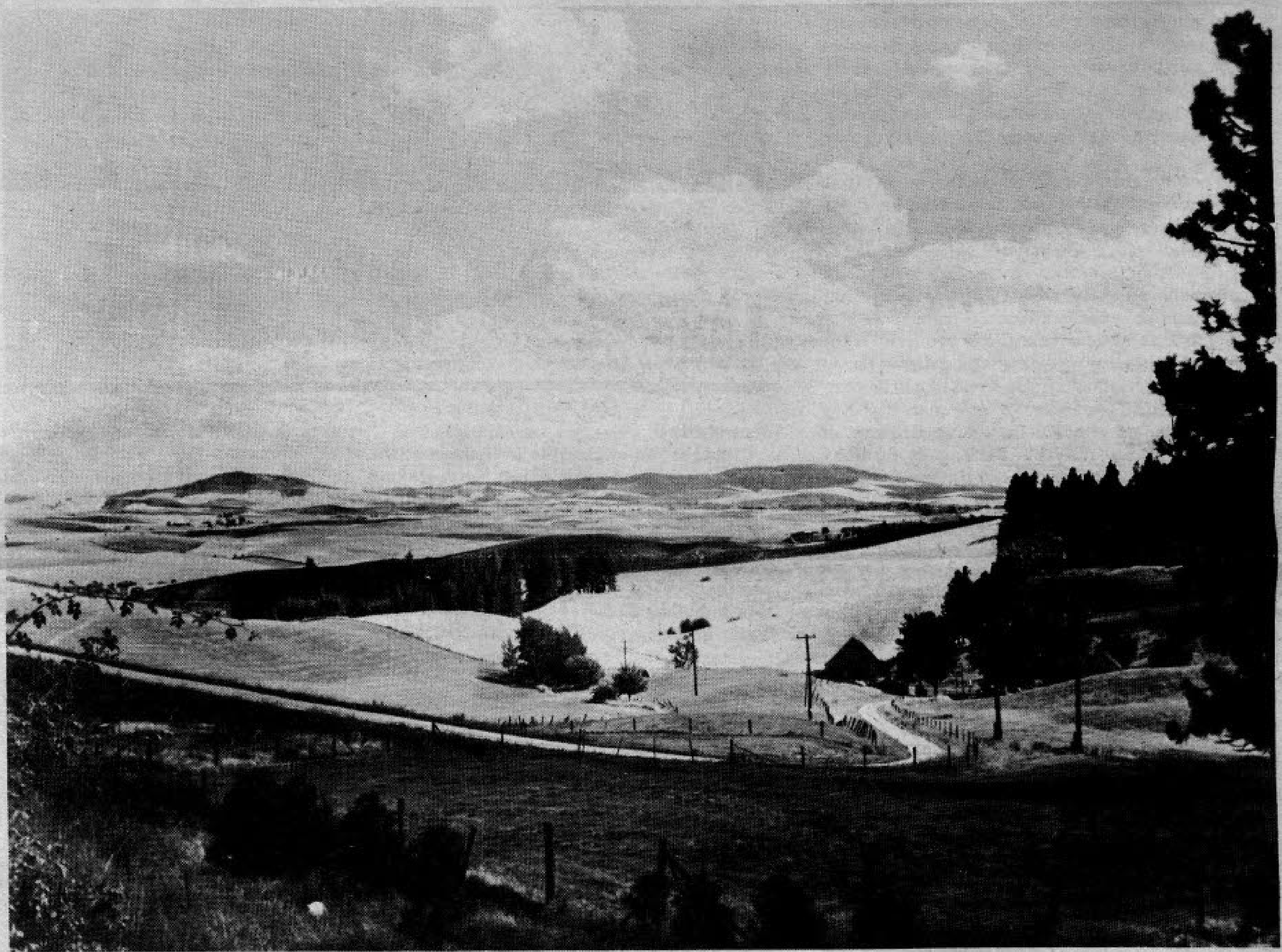


Rural America may someday depend in great part on methane and organic fertilizers from human, animal and vegetable wastes produced in sophisticated methane digesters and sewage treatment plants. The technology is rapidly being developed with great interest being shown. Every farm, like these above in northern Idaho, may someday have its own system for producing energy and fertilizer. We will then approach the natural system of recycling wastes and using the end products.
Photo credit Idaho Dept. of Commerce and Development

It's Chicken Power Tomorrow

by Tom Bell

My high school chemistry prof described it as marsh or swamp gas. Sanitary engineers call it sewer gas. It has recently been tabbed chicken power or pig power. Webster's says it is "a gaseous hydrocarbon, CH_4, odorless and inflammable, a product of decomposition of organic matter in marshes and mines."

Whatever the name or description, methane is sure to be an important energy source in the world of tomorrow. It is an important source in the world of today, being the chief ingredient of natural gas. But there is an important distinction between the methane of today and that of tomorrow.

Natural gas is the result of decomposition of plant and animal (organic) material which existed millions of years ago. It was created in those parts of the earth's continents which had recurring geological eras of luxuriant plant growth in low-lying areas, followed by flooding by ancient oceans. It is always found in varying amounts in conjunction with coal and oil deposits, and is often found alone in huge, underground traps or in large quantities diffused through sandstone or shale.

Natural gas (mostly methane with some propane and butane) is one of the cleanest burning, and therefore non-polluting, energy fuels we have. For that reason, it is in great demand. In fact, when clean air standards began to take effect, many industries switched from coal or fuel oil to natural gas.

But we are running out of natural gas. Within the lifetime of most people living today, the existing reserves of fossil natural gas will be exhausted, or be economically or physically irretrievable. It is then that the methane of tomorrow will become a significant energy source. It will be different from natural gas only

(Continued on page 4)

HIGH COUNTRY

By Tom Bell

Wyoming is at the crossroads. There has never been a time in the entire history of the state when such vital decisions affecting the future of the state must be made.

A small measure of the importance of this time in history is the fact that the two major parties have eight contenders for governor. The Republicans have five candidates and the Democrats have three.

Faced with an industrial juggernaut that could all but erase the character of the state, most Wyomingites appear to be pursuing politics as usual. Only one of the eight candidates has addressed the main issue, Republican Malcolm Wallop, and he is being politely ignored by the party regulars. Instead, the darling of the party pols is former Republican state party chairman and resigned State Attorney General Clarence R. "Bud" Brimmer. It's the old story of he who has labored long and mightily in the party vineyard shall receive the blessing of the mighty. That's Brimmer.

Wallop, a party regular himself and a state senator from a county faced with massive industrialization, is considered somewhat of an upstart. He has dared to be critical (if even in a small way) of the policies of Gov. Stanley K. Hathaway. And that is heresy in the hierarchy of the Wyoming Republican party where Hathaway is considered to be one of the anointed from on high.

Brimmer has that added advantage of being one of the beneficiaries of Hathaway's regime and policies. So, in Wyoming, if you like Hathaway, you must like Brimmer.

Another Republican contender for governor, Rep. Roy Peck, is also a beneficiary (though lesser than Brimmer) of the golden light of Hathawayism. Peck, more than any other, was instrumental in carrying out Hathaway's policy of trying to bring industry to Wyoming. Ironically, it was the energy crisis and not directly the efforts of either that brought Wyoming into the limelight.

Wallop says **Wyoming is my Issue.** And at a recent meeting, he bluntly said, "This may be the last time you can elect a governor who is controlled solely by interests in and for Wyoming people. When heavy industry reaches Wyoming with its vast numbers of people and economic clout, there is no way you can require them to do what is best for Wyoming."

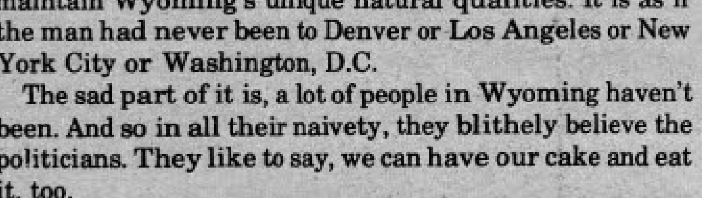
And he added, "So we must do it from this end — before the fact — and we have been warned, perhaps more than any other state in similar circumstances."

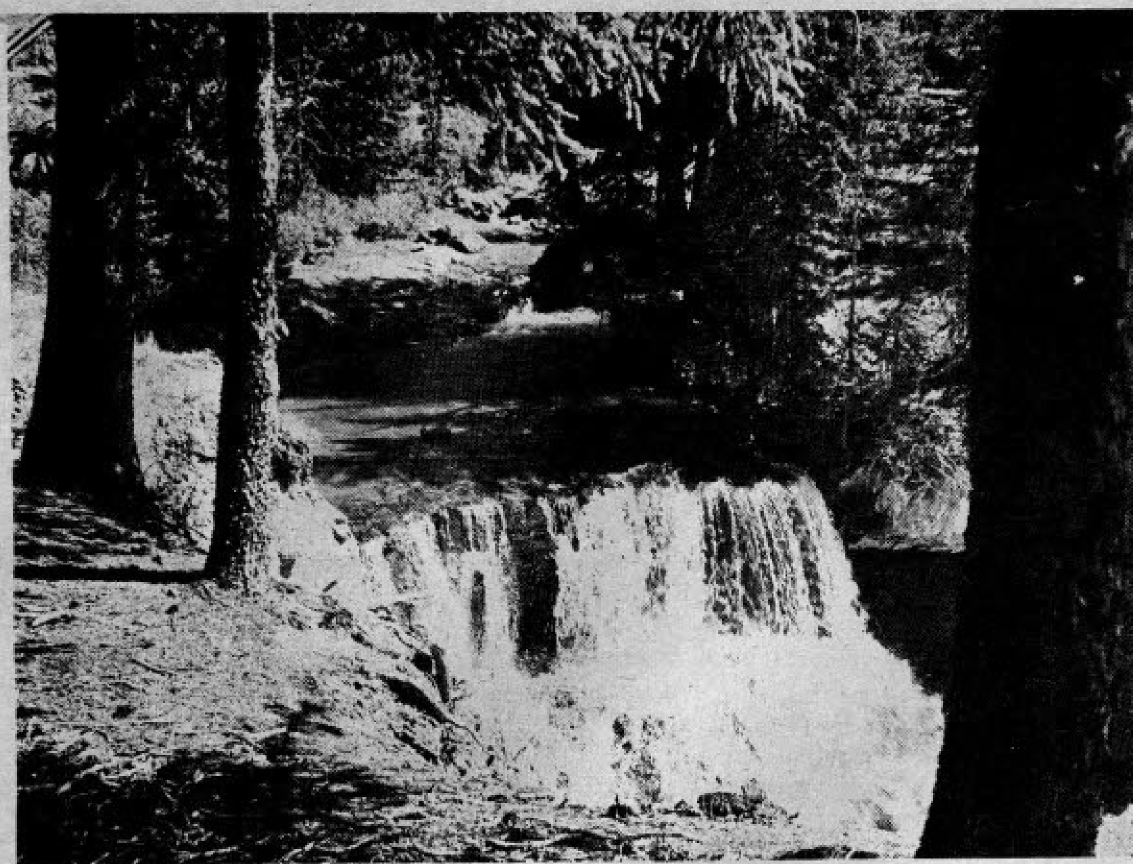
We have been warned, of course, as **High Country News** has tried to document through many issues. But people still won't believe that heavy industry is anything but an unmixed blessing.

One of the Republican gubernatorial candidates, State Sen. Dick Jones, has as his campaign slogan "Peaks, Prairies and Payrolls, we can have them all." And he goes on to declare that we can have all that industry and still maintain Wyoming's unique natural qualities. It is as if the man had never been to Denver or Los Angeles or New York City or Washington, D.C.

The sad part of it is, a lot of people in Wyoming haven't been. And so in all their naivety, they blithely believe the politicians. They like to say, we can have our cake and eat it, too.

Malcolm Wallop emerges as the only statesman. He realistically faces the issues, saying we are going to have growth whether we like it or not, but let's look at all the consequences, both good and bad. He also has something else going for him — a quality called style. He has a way of addressing the issues with just the right touch of humor and insight to come off as a man who could deal with the big-city lawyers of industry without losing his cowboy boots. And that's going to be important in the next four years.





Letters

Dear Mr. Bell:

I thought you might like to hear about the historic move made at the last North Dakota State Water Commission meeting. Following the leadership of Governor Arthur Link, the Water Commission voted unanimously to indefinitely postpone the United Power Association and the Cooperative Power Association application to build a 972 megawatt power complex. This action amounts to a conditional moratorium on all water permits for electrical generation facilities in North Dakota.

At the time of this decision, applications were laid before the Water Commission that would have equalled the size of the Four Corners Plant in Farmington, New Mexico, (the world's worst polluter). Also this decision was made in the face of the stiffest lobbying effort the state has ever seen. Both the Public Power Associations and the Private Utilities joined forces, along with the former Democratic Governor to lobby for the approval of the application. It should also be noted that the North Dakota Public Service Commission, the agency in charge of regulating the utilities, also urged the approval of one of the applications to construct a huge coal fired power generation facility. In spite of this pressure, the Governor and the Water Commission had the honesty, intelligence and courage to postpone the application.

Sincerely,
Ardell Tharaldson
United Plainsmen Assoc.
Bismarck, ND

* * *

Editor's note: The following letter was written to Mr. Donald Cook, American Electric Power System, 2 Broadway, New York, NY 10004. Others may feel similarly moved to write Mr. Cook in regard to the series of ads being placed in all national publications.

Dear Mr. Cook:

Your series of advertisements in the national press have interested me, both as a stockholder of your company and as an academic with professional involvement in the energy-environment area.

Your latest advertisement "Scrubbers described, examined and rejected" raises a great many questions, some of which I would like to put to you for a reply.

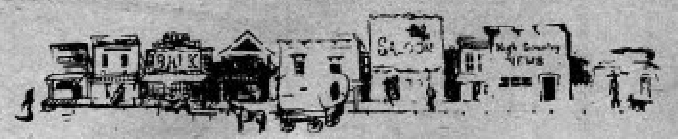
1) You refer to the fact that alkaline scrubber for a 12,000 MW system would produce 10 square miles of "oozy gook" 5 feet deep every five years of operation. That, of course, assumes a throw-away system. An alternative, granted it would be more expensive, would be to recover sulfur or sulfuric acid and regenerate the reagents in which case the solid residuals to be disposed of would amount to but a very small fraction of the volume you estimate.

2) It is my understanding that depending on the location of the power plant relative to the coal mine, the "oozy gook" could be used as landfill in the strip mined areas. Not an ideal solution, but surely preferable to dumping it on farm, or other rural land in an act of "destroying America" as you put it.

3) To some important degree, the reason why scrubbers are, as you put it, "unreliable and impractical for a major electric utility" is that major electric utilities have only belatedly made a research and development commitment to them. Since there are several competing technologies, the effort by the utilities will have to be very broad-based so that an accurate comparison can be made. In this regard, what has been the contribution of AEP to sulfur removal technology? It is not clear that the present state of the art of stack gas scrubbing is any less encouraging than the pulverized coal furnace or for that matter nuclear power plants were at similar pre-commercial stages of their infant technologies.

4) While the disposal of the vast quantities of "oozy gook" do present a massive logistical problem, and great care will have to be taken to ensure that the environment is not unduly harmed, I nevertheless feel that the scale of the land impact involved should have been placed in the context of the other related power plant impacts. 12,000 Megawatts is such a large system that all physical factors will be massive;

Editorial



Is Wyoming Ready for Space Age?

It would be funny if it weren't so tragic. Most Wyomingites still think we are stuck so far back in the sticks that we can do things just as they were done in Grandpa's day.

Take our capital city, Cheyenne, for instance. There the hootin' and hoorahin' is not about some cowboy riding into the nearest saloon and smoking up the place. No, it's much more mundane than that. It's about garbage — whether to burn or not to burn.

Cheyenne doesn't have garbage pits or incinerators. It has — ashpits! And there **everything** is clearly consumed by fire with no resultant air pollution or foul residue, according to the local newspaper editors and a number of solid citizens. (But in defense of one editor, he says if we must abandon our ashpits then let's recycle.)

The trouble is there is a state law against open burning. It was passed in the capital city in 1969 and went into effect in 1970 after two, open public hearings. Wyoming Air Quality Standards and Regulations state specifically: Section 13, No person shall dispose of refuse by open burning, or cause, suffer, allow or permit open burning of refuse.

And so Cheyenne is embroiled in a tempestuous imbroglio with the State Department of Environmental Quality and the federal Environmental Protection Agency. The State DEQ has to enforce the law. (All Wyoming cities have instituted no-burning ordinances.) EPA has to see to it that federal air regulations are not violated.

Cheyenne finally passed a no-burning ordinance last February after three months of "study," deliberation and haggling, and after being warned by EPA. The mayor finally signed the ordinance when it became apparent that national clean air standards were not going to be relaxed for nice little old western towns like Cheyenne.

The city had six months to comply with its own ordinance. But now that the time is drawing close, there is more hue and cry. It doesn't matter that some 8 tons of air pollutants are dumped into the air every day through open burning in a city the size of Cheyenne. And it doesn't matter that Wyoming's capital city is the only one in the country that still allows open burning of trash and garbage within the city limits.

The city of Cheyenne tells something about the attitudes of many people in Wyoming, including the governor who maintains residence there. The mayor of Cheyenne once suggested that because his city was nowhere near the "federal levels of being too polluted," it would be more fair to allow the air to become that polluted and then do something about it. A city councilman was once asked, what if the city never stopped burning trash? And he allowed that possibly Cheyenne's winds would pick it up and take it somewhere else.

Sen. Clifford P. Hansen recently polled his constituents. One of his questions asked, do you favor relaxing clean-air standards to permit greater use of coal to ease the energy shortage? An overwhelming majority said yes. (54%, yes; 34%, no; 12%, undecided.)

It is a sad commentary on Wyoming's electorate as a whole. The state is on the threshold of industrialization of frightening magnitude. But our people view it as of little consequence in their personal lives. And they see no relationship between their personal polluting habits and the voluminous emissions from a power plant smokestack.

We finally approach the space age and find our horse and buggy habits too ingrained to save us from our own folly. —T.B.

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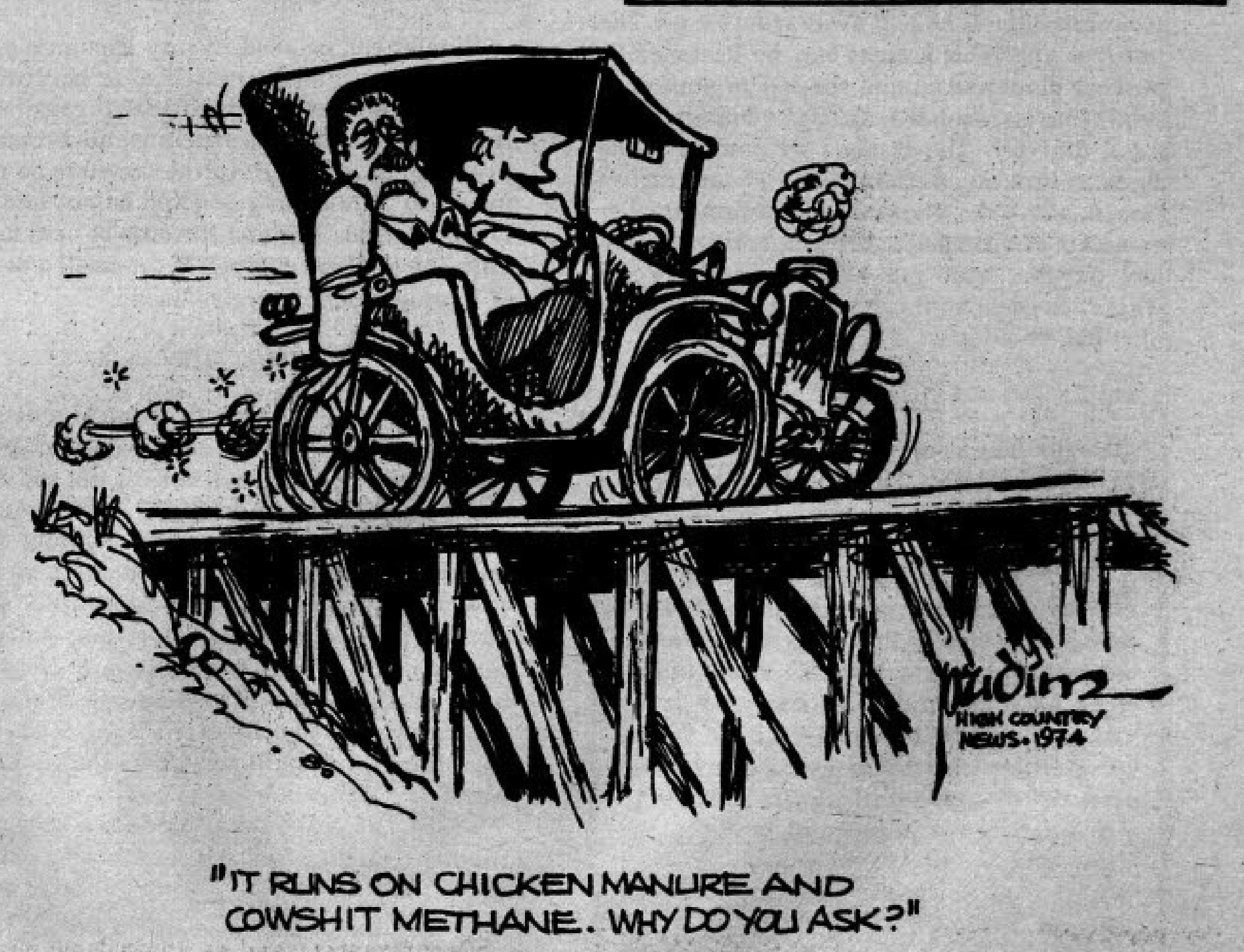
the acres of land stripmined, tons of coal consumed, gallons of water withdrawn, tons of ash to be disposed of, and so on. Merely to focus on the "oozy gook" may, therefore, give some of your readers insufficient information to fully appreciate the physical parameters of a major coal-burning power system.

5) Your claim that the better way to "solve" the sulfur emission problem is to burn "government-owned low sulfur coal in the west" is to say the least, not substantiated in the advertisement. Firstly, much of the coal is not government-owned but underlies either Indian Reservation, state-owned or privately-owned land. Use of that coal does not depend entirely or even principally on decisions made at the federal level. In any case, burning 0.5% sulfur coal in 12,000 MW system consumes 144,000 **tons** of coal per day and will emit about 1,200 tons of sulfur oxides **per day** if no sulfur removal equipment is installed. In the humid eastern regions a combination of sulfur dioxide, particulates and large quantities of water vapor from natural draft cooling towers can interact synergistically to give some very unpleasant consequences, meteorologically as well as ecologically.

6) There seems to be general agreement that the best way to go from a technical standpoint is to remove the sulfur **prior** to combustion rather than to try to work with the far more dilute voluminous gases. What is the AEP research and development commitment to fuel desulfurization either by gasification or solvent refining or any other approach?

I apologize for the length of my letter but, as earlier stated, your advertisement does raise a large number of questions.

Sincerely,
Carlos D. Stern
Assistant Professor
Environmental Economics
The University of Connecticut



"IT RUNS ON CHICKEN MANURE AND COWSHIT METHANE. WHY DO YOU ASK?"

Chicken Power...

(Continued from page 1)

in that it will be generated from today's wastes, rather than from the decayed plants and animals of the dinosaur age.

Methane (CH_4) is an indirect (decomposition) product of solar energy. Green plant cells trap incoming solar energy. Through the natural process known as photosynthesis, the green chlorophyll in the plant cells is able to combine the atoms of carbon (C), hydrogen (H), and oxygen (O) into molecules of starch and sugar or carbohydrates ($C_6H_{22}O_{11}$, as an example). The atoms of carbon, hydrogen and oxygen are obtained by the plant principally from water molecules (H_2O) and carbon dioxide molecules (CO_2).

Through the action of enzymes, plants are further able to convert simple sugars and starches into the cellulose and fatty acids of plant fibers and seeds. With the addition of nitrogen and small amounts of sulfur, plants make simple proteins, the building blocks of animal and plant tissue.

When animals eat sugars, starches and fats, these molecules break back down into water and carbon dioxide but release energy. And so they are known as energy foods. But animal digestive systems are not completely efficient. Not all of the food is broken down in the process of digestion. Animal wastes can go through further stages of decomposition.

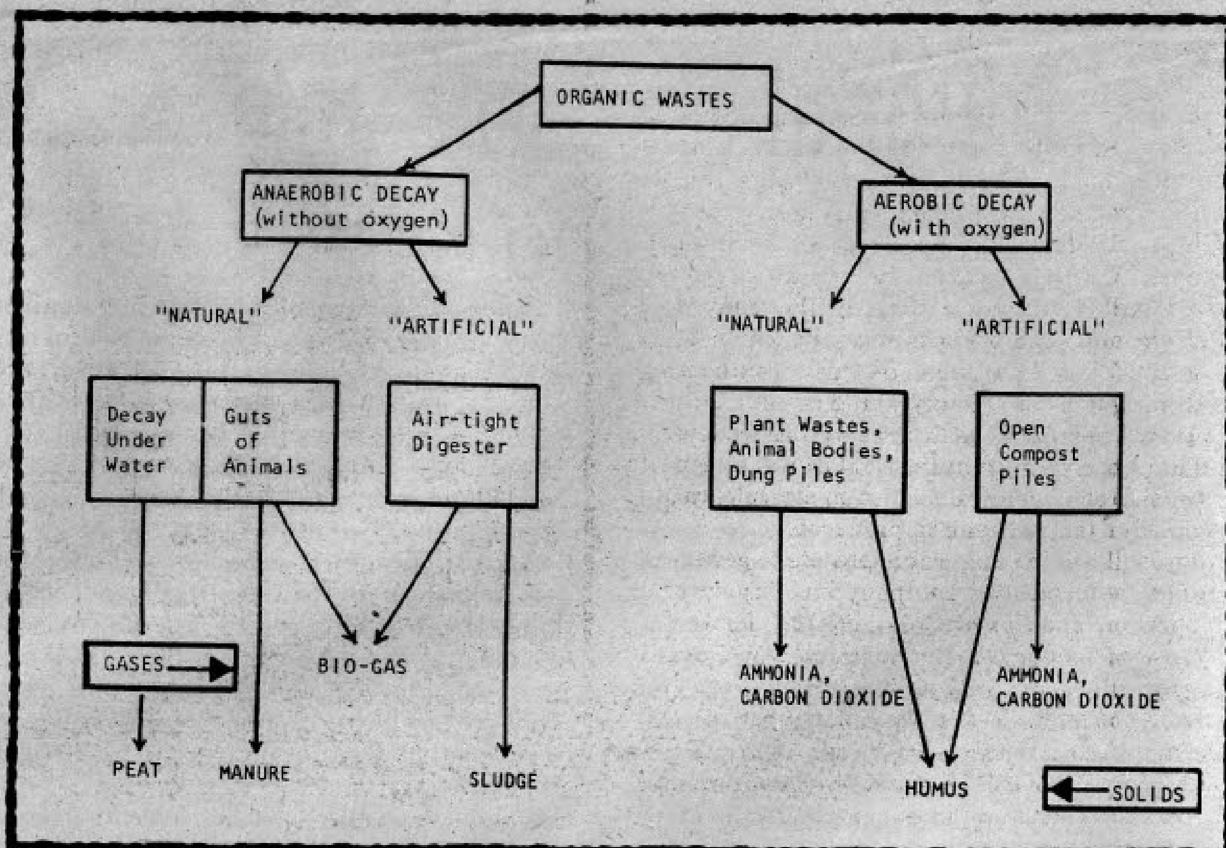
Not all plant material is eaten by animals. Most of it falls to the ground, and is there decomposed through the action of fungi and bacteria. Decomposition is merely the breaking down of larger units of matter (carbohydrates, fats, proteins) into smaller units such as carbon dioxide, water, ammonia (NH_3), hydrogen sulfide (H_2S), and methane.

The bacteria which work on plant and animal tissue (actually breaking it down and digesting it for their own use) are of two general kinds. If oxygen is present aerobic bacteria do the decomposing. If oxygen is not present, such as when plant material is covered by water or soil or when the plant material is contained, the bacteria are anaerobic.

Methane is created only under anaerobic conditions. That means, if you want to generate methane it has to be kept away from the air. The natural anaerobic process can be hastened by putting plant and animal wastes (organic material) into an insulated, air-tight container called a digester. The gaseous by-product of the digester is mostly methane (54-70%) and carbon dioxide (27-45%). The gas also contains smaller amounts of nitrogen, hydrogen, carbon monoxide, oxygen, hydrogen sulfide, ammonia and water. Because of this composition, the gas is also called bio-gas.

BIO-GAS

Bio-gas has a fuel value of about 540-700 BTU's per cubic foot. Pure methane has a value



End Products of Organic Decay. (Diagram from Methane Digesters for Fuel Gas and Fertilizer, New Alchemy Institute, 1973.)

of about 900-1100 BTU's per cubic foot. Bio-gas can be refined by bubbling it through limewater to remove the carbon dioxide. The latter will not burn and therefore has no heat value.

The other products of a methane (bio-gas) digester are sludge and a watery effluent. Most of the solids not digested and converted to gas settle out as a sludge. Depending upon the raw materials used, the sludge is a fairly rich source of fertilizer which can be recycled back to the land. It contains such essential elements for plant growth as nitrogen, phosphorus and potassium, plus small amounts of magnesium and calcium and such trace elements as iron, copper, sulfur, zinc, boron, etc. Most of the nitrogen in sludge is mainly in the form of ammonium (NH_4) which is readily available to plants.

Anaerobic digesters are considered to be about 60-70% efficient in converting organic matter to methane. If some of the methane generated has to be used to maintain temperature in the digester (in colder climates, for instance), then efficiency drops to about 50%.

Bio-gas can be used in any appliance or for any purpose that uses natural or bottled gas. However, bio-gas is very difficult to compress or liquefy so storage of large amounts becomes a problem. On-site use would therefore be most practical unless the gas could be put into distribution lines. The gas can also be used to run gasoline or diesel engines if the small amounts of hydrogen sulfide are removed.

HISTORY

True to the old adage that there is nothing really new under the sun, Louis Pasteur, famed for his work in pasteurization of milk and other discoveries in the mid-1800's, once discussed the possibilities of producing methane from barnyard manure. The East Indians have used cow manure in home-made digesters since about 1900. Some of the most innovative research being done in methane technology has been at the Gobar Gas Research Station in northern India. The director of the station, Ram Bux Singh, has gained world renown for his work.

There, the goal was to produce a cheap and readily available fuel while disposing of some 800 million tons of cow manure produced annually. The Indian Agricultural Research Institute initiated studies of anaerobic digestion in the 1940s. By the 1950s simple digester models had been developed which could produce both cheap fuel and fertilizer locally.

Another pioneer in the effort to develop technology is L. John Fry, a South African pig farmer. Fry became interested when he was faced with disposing of manure from 1,000 head of pigs. He went to the sewage treatment plant at Johannesburg to learn how sewage was treated and methane was produced from it. He had his first digesters going in the summer of 1956.

Fuel shortages in Germany during World War II led to research and development in methane technology for use in tractors. When cheap fossil fuels again became available, it was dropped. However, some farmers in Germany, England and France still have home digesters to produce their own fuel.

Fastidious and squeamish Americans tend to look upon human and animal wastes as undesirable and offensive nuisances. Here, the emphasis is on getting all solid wastes out of sight and out of mind. Only recently, when solid waste problems and disgraceful pollution of our nation's rivers, streams and lakes became a national scandal did we turn to consideration of some alternatives.

Sewage treatment plants have been turning out a rich composted material for years. Some of it has been bagged and sold under such names as Milorganite. The methane produced during treatment was normally allowed to escape or was burned off. Some plants use the methane to fuel engines for power generation and run pumps. The Los Angeles primary treatment plant produces enough gas to fuel 24 two thousand horsepower diesel engines.

RENEWED INTEREST

Earlier this year, when the Senate was considering a $20 billion energy research and development bill, Colorado Sen. Peter Dominick called attention to methane. And he introduced an amendment to the bill which would emphasize a research priority in determining "the economics and commercial viability of the production and use of methane gas."

Dominick said, "We have more than 400 million cattle, pigs and chickens, which produce over 2 billion tons of manure a year. That is enough to spread four feet deep over an area of 500 square miles. This valuable natural re-

**We would replace the belching incinerators, stinking land fills and sewage filled streams of the present waste disposal system with small, silent units that turn our garbage directly into valuable fertilizer and fuel. With biogas plants we can recycle our waste and use it again and again in a very simple, direct and natural way.
Ram Bux Singh, Director
Gobar Gas Research Station
Ajitmal, India**

source can be used to generate both combustible gas, thus relieving part of our reliance upon fossil fuels, and a fertilizer richer in nitrogen than raw manure."

Early last month, Monfort of Colorado, Inc. at Greeley, granted an option to Shelley B. Don and Associates of Denver (1025 Capitol Life Center) for construction of a facility to produce 4 million cubic feet of methane gas per day from manure. Monfort operates the world's largest cattle feedlots. It will provide all the manure from one of its two feedlots with the option to purchase 70 million cubic feet per month of methane gas. That amount would be sufficient to operate Monfort's feedlots as well as its beef and lamb processing plants. Monfort will retain ownership of all manure for use on agricultural lands after the methane is produced.

Don will use the anaerobic process to generate the methane. The company has formed a corporation, Bio-Gas of Colorado, Inc., for the purpose of manufacturing methane gas from organic substances. It says that a conservative estimate of the yield of gas produced from the manure of one animal on feed is about 40 cubic feet per day. Monfort's lot has a daily population of 100,000 head of cattle.

A spokesman for the company, G. Hank Brown, says, "For years we have known that manure could be used as a source of energy. While the dried product has been used as a fuel for centuries, it has only been recently that the technology for large-scale production of methane gas has been perfected. Three major production methods have been developed. These include pyrolosis, gasification, and anaerobic digestion. With the fuel pinch and the skyrocketing cost of energy, it appears that the time is right for development of this source of energy.

"The techniques for converting manure into gas vary widely in efficiency and cost. Estimates on the cost of producing a thousand cubic feet of pipeline quality gas from a large efficient plant range from a low of 60 cents to $3. While this is above current charges by one of Northern Colorado's major wholesale suppliers, it is likely that gas users face significantly higher prices in the future. . ."

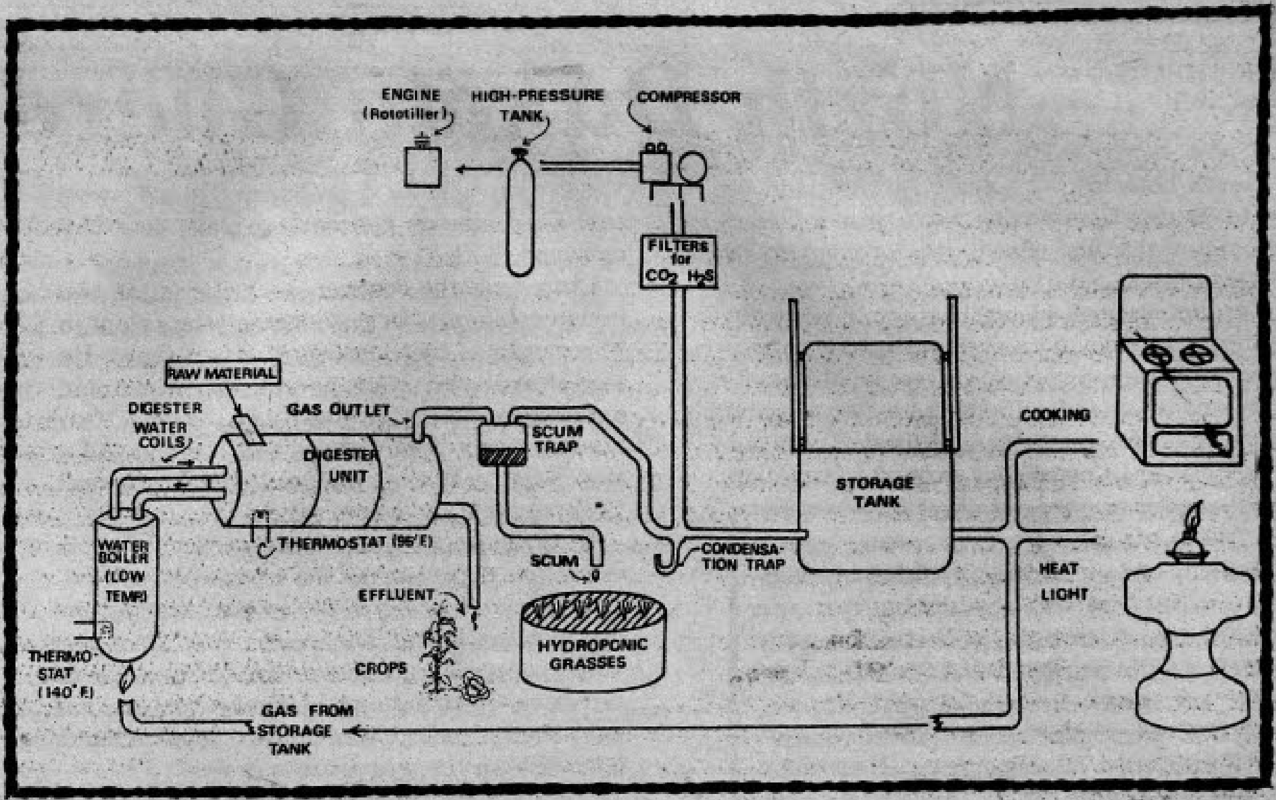
The project is believed to be the first of this magnitude at a feedlot. Monfort spokesmen emphasized the project is part of the company's efforts to meet the challenges of the national energy situation while providing Monfort with an assured source of fuel at a stable price.

Methane production on the smaller scale of individual farms seems to be equally possible. Dr. Ed Hoffman, a former researcher in coal gasification at the University of Wyoming, says, "I'm as concerned with small-scale production as I am with large-scale. We're going to be hurting for gas in the rural areas. When this happens, we should have in existence a technology engineered for the small-scale production of methane from agricultural wastes that can be used on an individual farm."

A farmer who has done it is Richard Shuttleworth of Redkey, Indiana. Shuttleworth built a methane digester from scrap material around his 144-acre farm. Under the sponsorship of **The Mother Earth News** (Box 70, Hendersonville, NC 28739), Shuttleworth called on L. John Fry and Ram Bux Singh to build a prototype digester.

PROBLEMS

There are problems in developing a methane technology, and going on from there to producing the equipment needed for methane production. Hoffman, who is now an energy consultant (Box 1352, Laramie, WY 82070), says part of the problem is a reluctance on the part of private enterprise to devote the capital funding needed. But he has hope that bills before Congress will give much needed help.



Integrated Organic Digester Operation, Using 50-gallon Drums for Digester. (Diagram from Methane Digesters for Fuel Gas and Fertilizer, New Alchemy Institute, 1973.)

Hoffman says cooperative ventures at the local level should be formed to pool efforts. He points to existing farm organizations as likely catalysts, somewhat along the lines of rural electric cooperatives.

Part of the problem is the psychology of Americans generally, who look upon wastes as a problem rather than a resource. The "throwaway society" will eventually be forced by economics alone to consider recycling and use of wastes. And deepening energy problems, as well as economics, will make alternative energy sources such as methane (bio-gas) look much more attractive.

The use of wastes for production of methane could have considerable impact on energy supplies. A Bureau of Mines study says the organic wastes of the country's urban areas alone amounted to 129 million tons in 1971. **Environmental Science and Technology** (April, 1970 and May, 1971) points out that the annual production of animal wastes in the U.S. runs about 1.3 billion tons. Estimates now place total U.S. solid wastes at over 2 billion tons annually.

Hinrich L. Bohn, writing in **Environment** (Dec., 1971), says, "The potential methane production is more than considerable. The combined urban and agricultural solid-waste production is about 1.5 billion tons annually. Each pound of organic waste yields about 10 cubic feet of methane during anaerobic digestion; the combined solid waste could yield 30 trillion cubic feet annually. This amount is half again as much as the current natural gas consumption in the U.S. and would be worth $6 to $9 billion at current prices."

The City of Indianapolis financed research on refuse processing by the Institute of Gas Technology, Chicago. Donald Klass spoke of that research at the Alternative Energy Conference in Billings, May 11, 1974. He said the 1600 tons per day of organic wastes would produce 6 million cubic feet of methane per day, with a net energy production efficiency of 1,630%.

Solid wastes, both urban and from large-scale animal feedlots, are one of the most pressing environmental problems the country faces. At the same time, energy shortages pose critical problems in the months and years ahead. It would seem most timely for the country to seek

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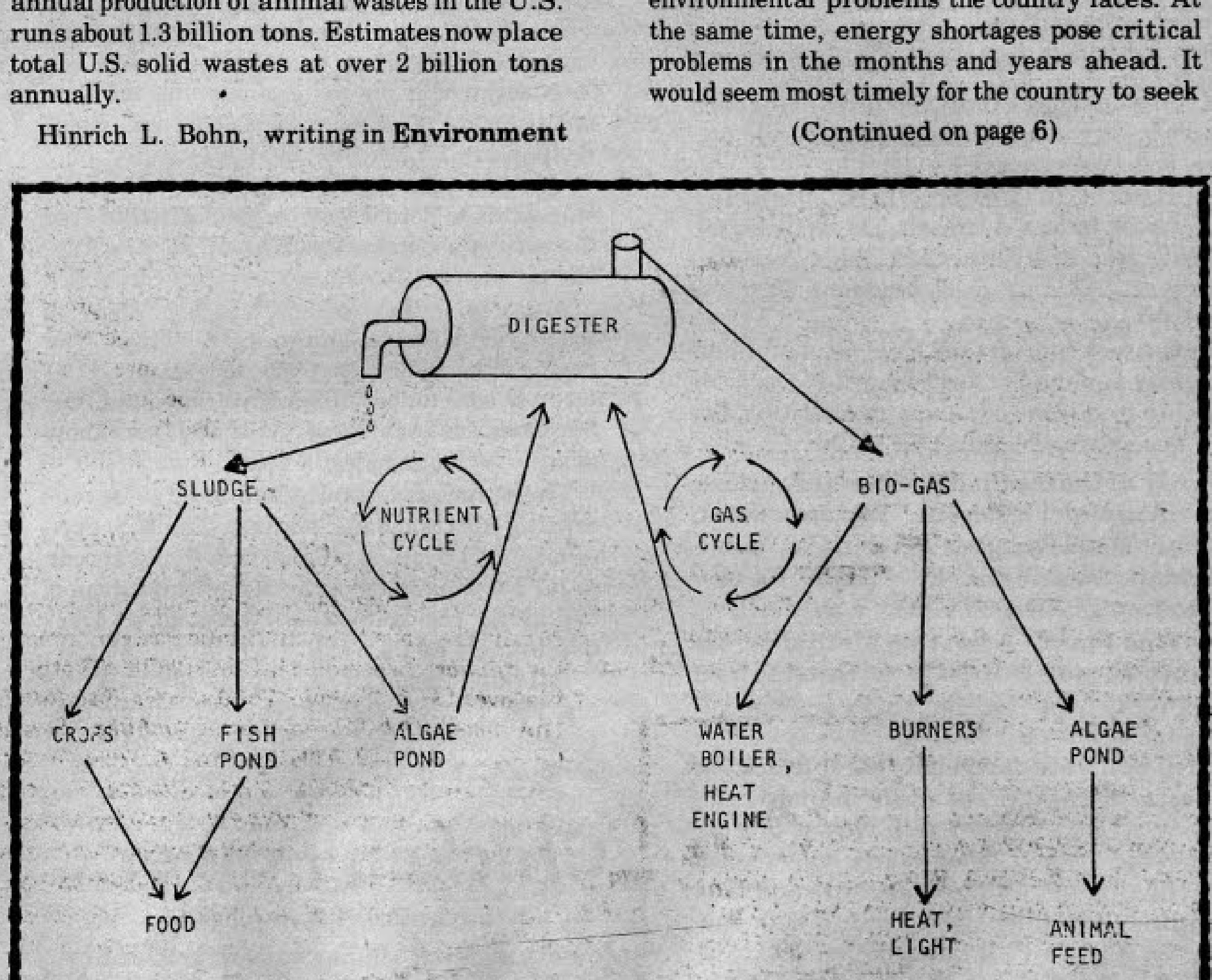


The Closed Nutrient System of a Complete Digester Operation. (Diagram from Methane Digesters for Fuel Gas and Fertilizers, New Alchemy Institute, 1973.)

North Dakota Guards Water

North Dakota Gov. Arthur A. Link and the State Water Commission have put a "conditional moratorium" on coal development in that state.

The action took place on May 28 when the Water Commission voted unanimously to postpone action on an application by two Minnesota power companies for 15,000 acre-feet of water annually. The companies, United Power Association and Cooperative Power Association, want the water for a proposed 976 megawatt coal-fired electric generating plant near Underwood, N.D.

Link took the occasion to criticize the two power companies for not locating their plant in Minnesota as they had originally planned. He said that another plant near Underwood would endanger ambient air quality in the area. "Our air should not be considered available for pollution because Minnesota consumers do not want their air contaminated," said Link.

Link and the Water Commission members expressed concern over the recent national advertising campaign by power companies against the federal Clean Air Act. They also were concerned about a recent Pennsylvania Supreme Court ruling on sulfur scrubbers that said the technology was not available to make power plant flue gas scrubbers work.

The power companies objected to "being condemned" because of eastern utilities' campaigns against scrubbers and clean air laws. They said since North Dakota's lignite was so low in sulfur content, that scrubbers might not be necessary in their case to meet federal and state standards. They pledged they would adhere to federal and state standards. But the governor noted that companies could tell North Dakota they would meet federal standards, and then launch an effort to have those standards reduced.

"That's not good enough for us," said Link. He said granting "a big complex like this a permit to operate just under the wire" was something he and the Water Commission were opposed to.

Just saying you'll meet the standards indicates that you are more interested in meeting legal restrictions than keeping the state's air as pollution-free as possible, said Link.

"They'll have to come to the commission with definite proposals, not just say 'We'll meet the standards,' " said Link.

Today's society faces four great problems: energy supply, loss of irreplaceable natural resources through waste production, pollution, and a lack of life support systems designed for minimal environmental impact. The energy problem permeates society because of the over-reliance on non-renewable fossil fuels (e.g. coal, petroleum and natural gas). Methane (or bio-gas) is a renewable fuel that requires no expensive discovery, production, refinement, and transportation processes, each with its concomitant pollutants and expenditures of energy, labor and other resources. Methane used as a heat source at the point of production at homesites is a renewable fuel which can be produced inexpensively throughout society. Such a decentralized system could be independent of existing power systems, not subject to using costs, supply restrictions or rationing, and would be free once initial construction was accomplished. In addition, methane, unlike other substances burns clean and produces carbon dioxide and water, the products of complete combustion.
Les Auerbach, et al
A Homesite Power Unit: Methane Generator

*** More on Methane ***

If you would like to learn more about the state of technology, particularly in small-scale projects, the following can be helpful.

A Homesite Power Unit: Methane Generator by Les Auerbach, Dr. William Olkowski, and Ben Katz. Obtainable from Les Auerbach, 242 Copse Road, Madison, CT 06443 for $5.00

Methane Digesters for Fuel Gas and Fertilizer by L. John Fry and Richard Merrill. Obtainable from The New Alchemy Institute, Box 376, Pescadero, CA 94060 for $3.00

Study of Current and Proposed Practices in Animal Waste Management, Environmental Protection Agency, U.S. Waterside Mall, Washington, D.C. 20460. Ask for publication EPA-4309-74-003.

Bio Gas Plant, Generating Methane from Organic Wastes, R. B. Singh. Obtainable from James Whitehurst, Ral-Jim Farm, Benson, VT 05731 for $5.00

Three publications regularly carry articles in reference to methane and waste management. Those are **The Mother Earth News,** Box 70, Hendersonville, NC 28739, yearly subscription (6 issues) $8.00; **Compost Science** and **Organic Gardening and Farming** both published by Rodale Press, 33 E. Minor St., Emmaus, PA 18049.

If you are interested in methane systems, you can write Mr. William H. Delp, Independent Power Developers, Box 618, Noxon, MT 59853, or Mr. George Oberst, Biogas Systems, Noxon, MT 59853.

Survey Surprises

Wyoming Sen. Clifford P. Hansen sent some 60,000 questionnaires to his constituents in April. Some 13,000 (21.7%) had replied by June. The replies from generally conservative, Republican Wyoming were about as would be expected. But there was a surprise or two.

The question was asked, Which of these most nearly expresses your view concerning the President? Fifty-four percent responded, he is doing a good job and should stay in office. When asked how they rated Watergate, 45% of the respondents said it was not important, 21% said somewhat important, and the remaining 34% said it was important or vital.

Question: Do you favor amending the Constitution so that abortions would be prohibited? Response: 62%,No; 26%,Yes.

Question: Do you favor relaxing clean-air standards to permit greater use of coal to ease the energy shortage? Response: 54%, Yes; 34%, No.

A question was asked, which of these is mainly responsible for the energy crisis? The ratings: Oil companies, 15%; Government, 11%; Over-consumption, 10%; Environmentalists, 3%; Combination of these, 55%; and Don't know exactly — too complex, 6%.

The surprises certainly had to be those concerning abortion and clean air. The U.S. Supreme Court decision on abortion would appear to be a true reading of the American psyche if Wyoming residents would respond so overwhelmingly as they did.

Relaxing clean air standards is something else. Evidently Wyoming residents are not convinced that huge coal-burning power plants will seriously affect the quality of their clean air.

Chicken Power...

(Continued from page 5)

at least a partial solution to both problems by thoroughly exploring the technology of bio-gas production from wastes. The effort should be directed at both large-scale and small-scale production units. The effort could be of more practical value than all the moon-shots, at far less cost.

SST Alert

by George Alderson
Coordinator of the Coalition Against the SST

Environmentalists in England have asked world citizens to submit their views on the Concorde SST (super sonic transport aircraft) to the British government, which is about to make a decision on continuation of the Concorde project. If the Concorde is flown by commercial airlines, British environmentalists point out, it will affect far more than the people of the two sponsoring countries, Britain and France. The excessive fuel consumption, loud airport noise, sonic boom, and possible hazard to world climate will affect all of us.

The British official in charge of the project, Anthony Wedgwood Benn, has invited public views on the Concorde. The project is already in trouble for economic reasons, and is being reevaluated by the new Labor government. The two governments have spent more than $1.28 billion in developing the Concorde, but the only airplanes ordered so far are those for the British and French government airlines. Even these, it is now admitted, will not operate at a profit. The two governments face the realization that they will never recover the money spent on development of the project. The only question is whether to go in deeper, hoping that the prestige will be worth it.

Environmentalists are urging Benn to consider also the factors that make the Concorde unacceptable to citizens of other nations. The fuel consumption of the plane is more than twice as great per passenger-mile as that of the existing alternatives, the Boeing 747 and similar wide-bodied jets. The Concorde is also a noisier airplane than the 747, according to noise measurements taken when the Concorde landed at Dulles International Airport last fall. In addition, scientists have found that SSTs could potentially cause changes in world climate and ultraviolet radiation as a result of their exhaust emissions in the upper atmosphere.

The sonic boom would be felt wherever the Concorde flew at supersonic speeds. Although the British government has announced that no boom-producing flights will be made over British soil, the aircraft are expected to fly supersonically over oceans and over other nations whose governments are perhaps less sensitive to public opinion.

Three years ago the United States decided against building the Boeing SST. The British and French may now be on the verge of dropping their SST project.

Letters may be addressed to:
The Right Hon. Anthony Wedgwood Benn, M.P.
Secretary of State for Industry
1 Victoria Street
London S.W. 1, England

The Kofa Game Range

Bighorn Sheep Enter Politics

**by Neil B. Carmony,
John J. Levy, Richard L. Small
and Stephen M. Williams**

You can't imagine a bighorn sheep. You have to see one first hand. Somehow a bighorn ram looks almost out of place in dry parts of Arizona. You might expect such an animal to live in a more forgiving habitat with lots of water. Then ... all of a sudden on a trip through Arizona's Kofa Mountains, there he is! The granddaddy of them all, right on top of a high pinnacle about half a mile away. Sunlight glistens from behind onto massive, curved horns. He bobs his head to threaten one or two other rams away from the "boss' spot."

The future of these magnificent creatures, and the other unique plants and animals that are found in this area, was recently put before the public at hearings on the proposed Kofa Game Range Wilderness. The Bureau of Sport Fisheries and Wildlife (BSFW) is required by the Wilderness Act of 1964 to review all roadless areas of 5,000 acres or more in the National Wildlife Refuge System. Such areas must be reviewed to determine their suitability or nonsuitability as wilderness.

More than 50 individuals attended the public meeting at the Phoenix Civic Plaza on April 27th in Phoenix. The federal agency proposed to add four units of land in the Kofa Game Range to the National Wilderness System. Approximately 800,000 acres in the Game Range lie northeast of Yuma, Arizona, on the California border. The four wilderness units proposed total 542,000 acres of desert uplands and rugged mountains.

President Franklin Roosevelt established the Range by executive order in 1939. He withdrew this area from the public domain to be set apart for the conservation and development of wildlife resources. Special management emphasis was supposed to be placed on the preservation and maintenance of the magnificent desert bighorn sheep and the frail desert ecosystem.

It is a known fact that bighorn sheep were once found over most of Arizona. They now live in only the western one-third of the state. This is due to the fact that your public lands are managed politically and not professionally. There is no doubt that the only viable populations of bighorn sheep in the state of Arizona exist in areas of wilderness character.

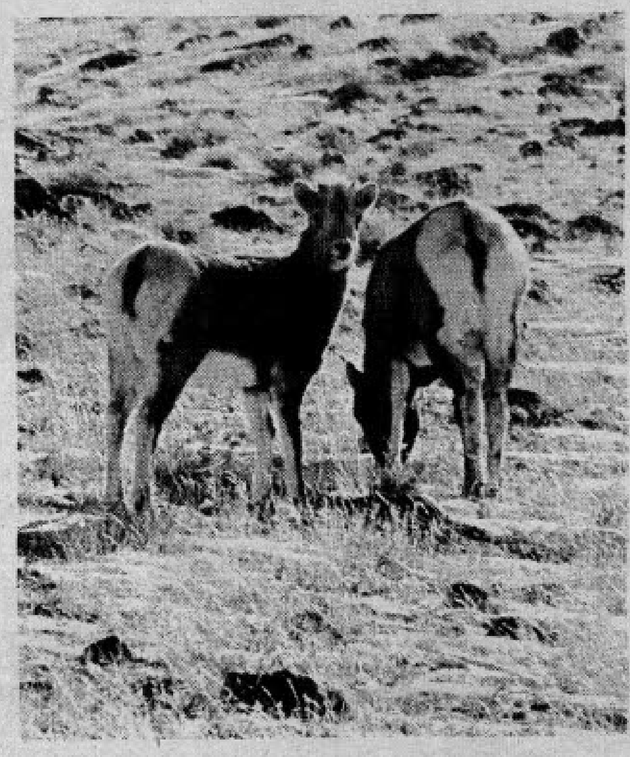
Besides being a home for wildlife, the Kofa presently provides many forms of recreation including hiking, photography, hunting and wildlife observation. Camping and rock hounding are permitted. The Kofa is the only part of Arizona with native palm trees. Visitors come from all over the world to see these unique plants.

In 1939, wildlife conservationists thought that they had indeed achieved something of significance with the Kofa. Federal agencies allow economic exploitation of most of the millions of acres of national forest, public domain and other public lands in the United States. Wildlife receives minor consideration, at best. The Kofa Game Range is a fraction of that acreage where wildlife was to be the primary concern. Unfortunately, this has not been the case. Wildlife doesn't even come first in an area established specifically for its benefit.

Forty-one people testified at the day-long session in Phoenix. Twenty-five supported the agency proposal. Sixteen opposed it.

Margaret Lane, a spokeswoman for Arizona's Senator Paul Fannin, began the testimony. She said that Senator Fannin feels there is enough wilderness in the U.S. and that a serious economic hardship would be imposed on Yuma County residents if the Kofa were designated a wilderness. The essence of the Fannin testimony was "to hell with bighorn sheep and all the people who appreciate their beauty."

A representative from the Crowder Cattle Company, who claimed he spoke for Senator Goldwater and Representatives Steiger, Conlan and Rhodes, opposed the wilderness. One of the Crowder Company operations grazes cattle on part of the Kofa Game Range. The operation has been the subject of recent controversy and, according to government figures, returns less



than $1,400 per year.

The grazing controversy has led to several studies. In March, 1965, the Bureau of Sport Fisheries and Wildlife and the Bureau of Land Management completed a joint study of the Kofa. This report came to be known as the Harper-Wiseman study. The evaluation concluded that "livestock grazing should be phased out within seven years."

An Arizona Game and Fish Department study and two memoranda also document the cattle grazing problem on the Game Range. On May 25, 1972, a state game and fish biologist submitted a study report to his supervisor. The document presented field information on the Kofa wildlife and concluded that "yearlong, active cattle allotments negatively influence wildlife populations on the Kofa Game Range."

The two memoranda agree with the 1972 investigation. On June 1, 1973, the acting Kofa Range manager, a federal employee, wrote that "the heavy utilization by cattle has deprived wildlife on the Kofa of feed and cover." On September 7, 1973, the director of the Arizona Game and Fish Department, Robert Jantzen, wrote that livestock competition with wildlife on the Kofa is being perpetuated at this time. Jantzen reasoned that wildlife is forced to move into less desirable situations to find feed when cattle have utilized the forage.

Not to be outdone by the Crowder cattle baron, mining companies came to the hearing, too. Magma's man, T. G. Chilton, described the location and development of open-pit mines in other areas of Arizona. Most mining speakers claimed that significant mineral deposits lay under the Kofa and that several open pits were possible. They all said the wilderness proposal would stymie their pits. This might be true, but open pit mines and associated activities in the Kofas would seal the fate of the most magnificent and probably the only desert sheep population that will be left in Arizona for our posterity to see.

Conservation and environmental groups, as well as many individuals, strongly supported the wilderness. They asked that significant bighorn sheep areas be included in the wilderness proposal. All supported a complete wilderness of 778,790 acres. Men and women from Friends of the Earth, Tucson Wildlife Unlimited, the Mearn's Wildlife Society, the Audubon Society, the Wilderness Society, the University of Arizona Student Chapter of the Wildlife Society, Arizonans for a Quality Environment, the Southern Arizona Hiking Club, the Arizona Habitat Association, the Sierra Club, and others testified in favor of reclassification as wilderness.

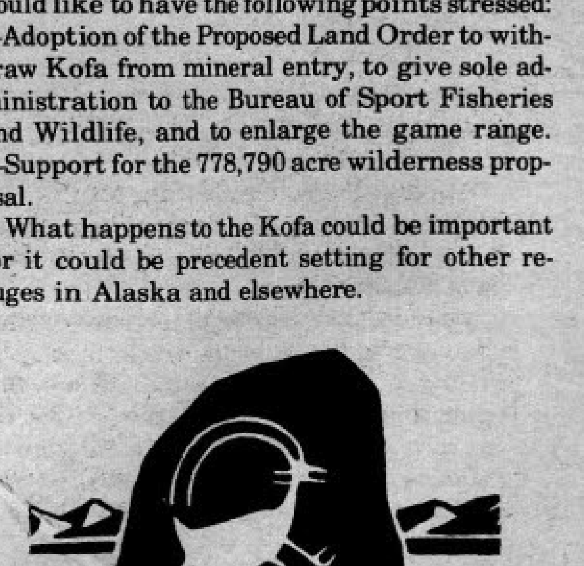
People at the hearing also urged the Secretary of Interior to give the Bureau of Sport Fisheries and Wildlife (BSFW) sole administrative jurisdiction of the Kofa Game Range. The Secretary proposed such a change in withdrawal application A7950. BSFW and the Bureau of Land Management (BLM) jointly manage the land now. BLM administers grazing and mining operations, while the BSFW does its best to help the wildlife.

Testimony at the hearing pointed out that the number of bighorn sheep hunting permits has not declined for the last nine years on the Kofa. Ten permits have been issued each year for the Game Range by the state Game and Fish Commission. Data also showed that sheep permits declined by almost 50% in other areas under sole BLM management. The permits for this much larger area of BLM land dropped from a high of 35 in 1967 to a low of 19 in 1973. This year the number is even lower.

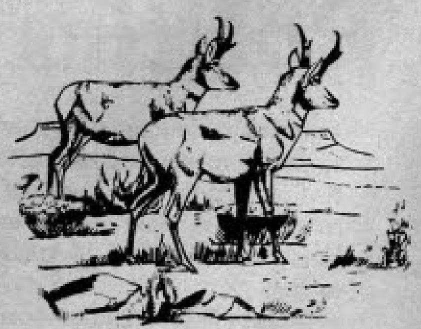
One conservationist at the hearing said, "In our book that can only mean one thing. Sport Fisheries and Wildlife is a group of men and women that we can depend on. Without their efforts you and I wouldn't have such a healthy sheep herd in this remote corner of our country."

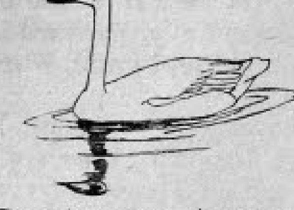
Editor's note: Conservationists in Arizona need support on the Kofa. Even though the hearings were held in April, letters to the Regional Director, Bureau of Sport Fisheries and Wildlife, 500 Gold Avenue, SW, Albuquerque, NM 87103, would be helpful. Specifically, they would like to have the following points stressed:
—Adoption of the Proposed Land Order to withdraw Kofa from mineral entry, to give sole administration to the Bureau of Sport Fisheries and Wildlife, and to enlarge the game range.
—Support for the 778,790 acre wilderness proposal.

What happens to the Kofa could be important for it could be precedent setting for other refuges in Alaska and elsewhere.



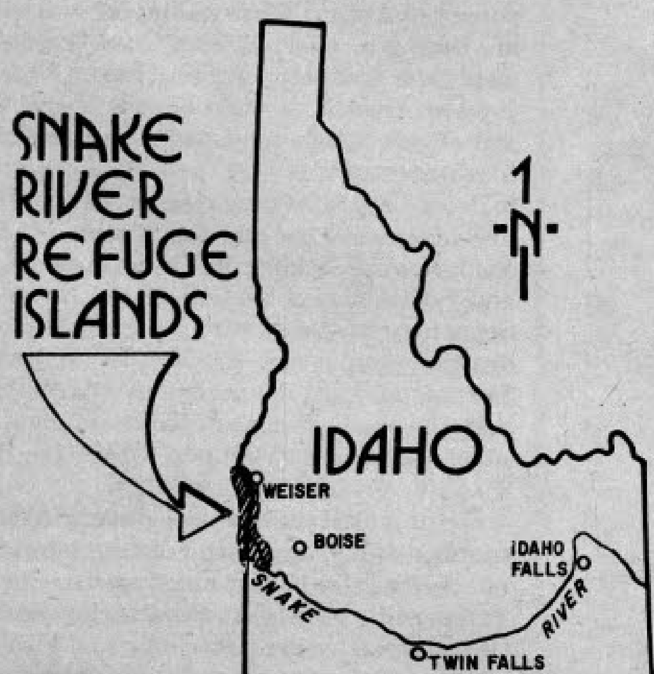
Wilderness in the Wildlife Refu





RED ROCK LAKES
WILDERNESS PROPOSAL

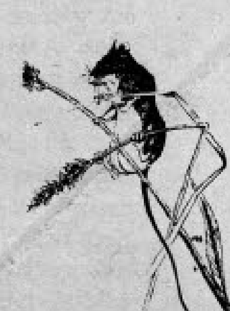
Red Rock Lakes National Wildlife Refuge
MONTANA

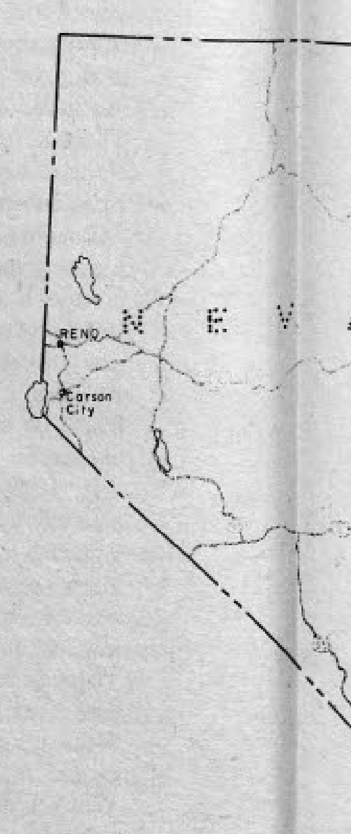


The proposals sent forward today stretch from Vermont to Alaska to Hawaii. Their diverse ecosystems — from alpine glaciers to upland desert, from volcanic pinnacles to rain forests — display the breathtaking variety of America's landscape. The myriads of wild creatures which make these areas their habitats include whales and seal, osprey and trumpeter swan, elk and bear. Their presence is the most eloquent testimony possible to the primeval quality of these lands. . .

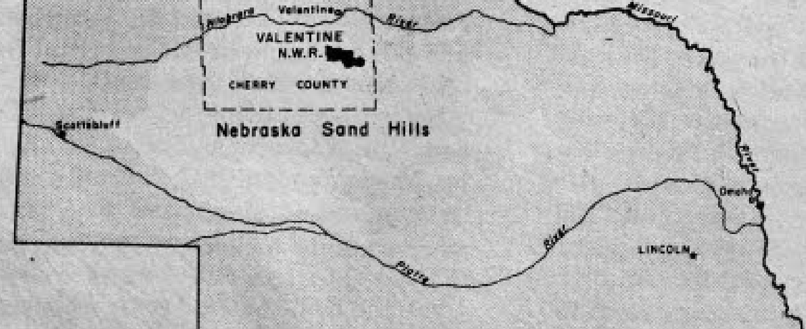
An abundance of wilderness insures that there remains in this country ample opportunity for solitude, for attentiveness to the endowment of nature rather than the works of man. Even for those Americans who may never visit wilderness areas, their existence can be a comfort, their study by others a source of enlightment. To set aside a wilderness area is to acknowledge that there are things which man cannot improve upon. This acknowledgement, I believe, is a profound act of wisdom.

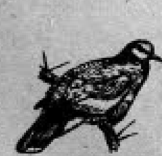
Interior Secretary Rogers C.B.Morton, in forwarding Administration proposals for winderness in national parks and national wildlife refuges to Congress, June 13, 1974.



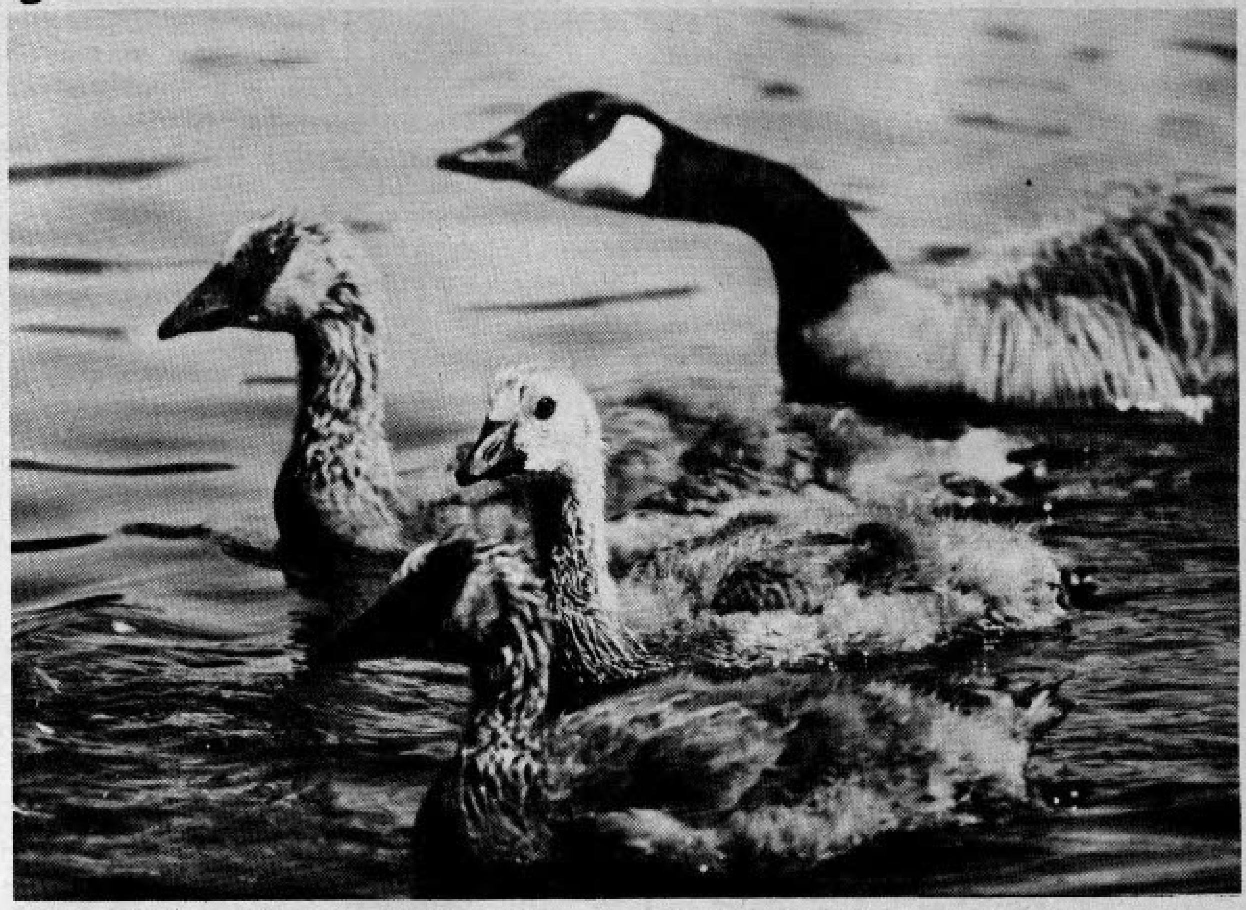


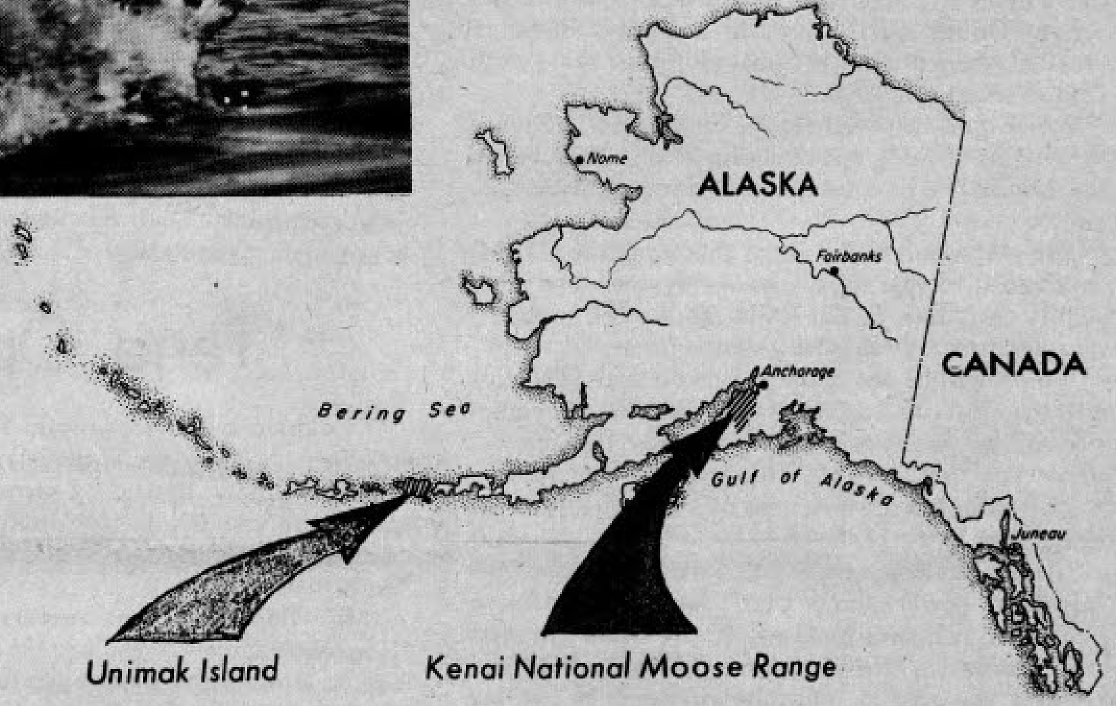
WILDERNESS STUDY
VALENTINE NATIONAL WILDLIFE REFUGE
VALENTINE, NEBRASKA

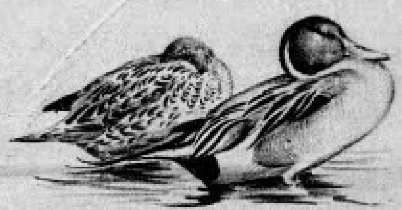


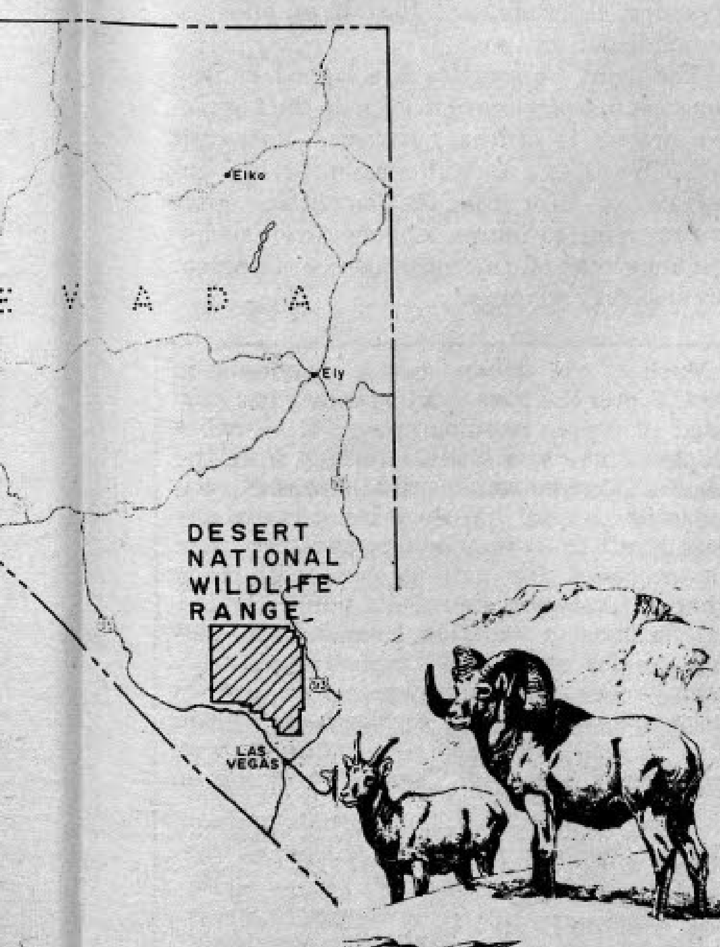


Refuges – A National Treasury









In what was once the great wilderness of the North American continent, teeming millions of wild animals and birds made their home. Today, passenger pigeons which once darkened the skies in passage over the Midwest are gone. And there are only remnants of many more species of both birds and animals.

What are left are mainly dependent upon remnants of their once vast habitat, scattered mainly in bits and pieces across the continent. In an effort to preserve these few remaining critical areas, the United States established a national wildlife refuge system.

Within many of these refuges, there are remnants of undisturbed and unexploited lands, waters, and forests. These have been studied and considered for wilderness in further attempts to protect the ecosystems. Even so, our efforts at protection are a study in contradictions. President Nixon's recent actions in recommending additional wilderness for some national wildlife refuges was marked by several exceptions. He did not recommend wilderness designation for either of two large Southwestern game ranges, capitulating to the desires of the mining industry. This was in spite of the fact that the U.S. Fish and Wildlife Service had recommended a 744,000-acre wilderness for the Cabeza Prieta Game Range in the Sonoran Desert of southern Arizona, and a 1,443,100-acre wilderness for the Desert National Wildlife Range of southern Nevada. Both are important sanctuaries for the desert bighorn sheep.

President Nixon did recommend wilderness designation for Unimak Island, a part of the Aleutian Islands National Wildlife Refuge. The 973,000-acre island harbors the Alaskan brown bear and the once-rare sea otter. Further south, some 1,742 species-rich acres of various islets and reefs of the Hawaiian Islands National Wildlife Refuge were recommended. The wilderness will stretch across some 800 miles of Pacific Ocean and protect a number of unique and rare species of birds and sea animals.

Red Rock Lakes National Wildlife Refuge in Montana is an important sanctuary for the once-threatened trumpeter swan. But it also gives protection to moose, elk, deer and antelope, as well as various species of ducks. Missisquoi National Wildlife Refuge in Vermont protects some 100 white-tailed deer and numerous ducks. Crab Orchard National Wildlife Refuge in Illinois, Valentine NWR in Nebraska, and the Snake River Refuge Islands in Idaho and Oregon are all dedicated to waterfowl. Crab Orchard is particularly important for migrating geese.

The Charles M. Russell National Wildlife Range and UL Bend National Wildlife Refuge are both along the Fort Peck Reservoir (Missouri River) in Montana. The range contains populations of elk, mule deer, white-tailed deer, antelope, bighorn sheep, and Merriam turkey, as well as many species of smaller animals and birds.

Altogether, the refuges and their proposed wilderness units compose a rich treasure for posterity.

Reckoning from Washington

by Lee Catterall

Another government study on coal activity in the Powder River Basin brings industry a step closer to its first major thrust on that area.

Industry is expected to mine 12 percent of the strippable coal in the area around Gillette and Douglas by 1990. Plans call for fourteen new strip mines, four power plants, two coal gasification plants, a coal slurry pipeline, a railroad spur and lots of roads and powerlines.

All that activity won't go unnoticed, as the government's draft environmental statement on it makes clear. The five-volume document tells the story — in charts and figures and tables — of the transformation of that area from a sparsely-populated ranching area to an industrial complex.

The population of Campbell and Converse Counties will nearly quadruple from the 1970 census figure, as Douglas will approach the size of Sheridan and Gillette will be more than half again as big, with a population of 28,000.

While one in seven people in Campbell County worked in farming and ranching jobs in 1970, before too long they'll be outnumbered in the county forty to one.

The statement warns about the population crunch that could cripple schools, sewer systems and other public facilities. It also talks about the problems more commonly regarded as environmental.

Water will be one of the main concerns. The area will soon have to start importing water to take care of the energy facilities and the population boom.

By 1990, a quarter of a million acre feet of water — half as much as the area uses now — will need to be brought into the basin.

The air could become so filled with pollution flowing from power plants that "serious impacts on health" of residents could result, the statement says. An "inversion," in which that polluted air is held close to the ground, probably will occur in two-day spells fifteen times a year and in five-day periods four times yearly. That's fifty days of air that's equal to quite a few packs of cigarettes.

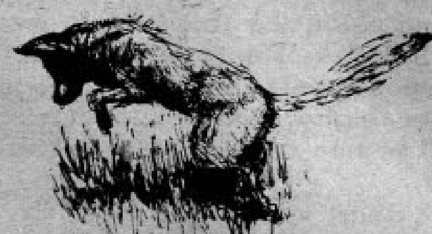
According to the statement, wildlife won't be able to stand much of that activity. The statement predicts the loss of 850 deer, nearly 3,000 antelope and up to 1,250 sage grouse by 1990, and the "disappearance" of the prairie's entire elk herd of 300.

The land itself can be "successfully rehabilitated," the statement says, but adds that doesn't mean it can be put together quite the same as it was.

"Reestablishment of vegetative conditions that existed previous to mining is technically impossible at present," it says, agreeing with — and using as support — a recently-released study by the National Academy of Sciences.

Carl Bagge of the National Coal Association disagrees. "While surface mining indeed disrupts existing natural communities, it is an overstatement to say they are destroyed completely," Bagge responded to the Academy. "Revegetation equal or better than previously existed can be achieved."

The government is required to issue statements like these before allowing projects that "significantly" affect the environment. This one won't be the last on coal activity in Wyoming.



Who Dictates Energy Policy?

The Northern Plains Resource Council of Billings, Mont. has accused the Department of the Interior of attempting to dictate national energy policy.

Bob Tully, chairman of NPRC, said, "Interior's newly released impact statement on federal coal leasing is a blatant example of bureaucrats deciding national policy behind closed doors when it should be made in public by the Congress of the United States."

A proposed federal coal leasing program "takes for granted massive federal coal leasing and a synthetic fuels industry in the West," an NPRC spokesman said. "Interior has decided to lease enough coal to not only make the U.S. self-sufficient, but also to embark on a major export program of coal and synthetic fuels to foreign countries."

NPRC, a three-state citizen organization, argues that a westward shift in coal production and the development of a synthetic fuels industry would create tremendous national problems, including:

1. In the Northern Plains Region, the agricultural base is seriously threatened. Interior's impact statement is figuring on at least 36 coal gasification plants in operation in the West by 1985. Each plant would require an 8 million ton year strip mine, 17,000 acre feet of water a year, a permanent population influx of 6,000.

2. The eastern coal states would be seriously hurt by a federally promoted "East-West shift" in coal production. They have 80 billion tons of high BTU, low sulfur, deep minable coal: enough to supply the nation's present demand for 133 years. If the coal industry is encouraged to move west, Appalachia will lose thousands of jobs in mining and secondary industries. Governor Shapp of Pennsylvania has predicted that massive western coal development "will mean the eventual destruction of the Appalachian region."

3. Interior's promotion of a western synthetic fuels industry may well threaten the whole country's economic stability. Interior itself admits, in its EIS, that incentive capital and government subisidies poured into a synthetic fuels industry would seriously increase inflation.

Tully summed up his group's demand by saying: "Our region's agricultural base is at stake; the eastern coal states' future is at stake; the United States' economic stability is at stake. With this much to lose, Congress had better take a long, hard look at the consequences and decide what is really in the public interest, before it allows Interior to act. Congress must reassert its control over Interior. We will be asking Mike Mansfield and other congressional leaders to initiate hearings to establish sound national energy policy which can guide the executive branch's actions."

Teno Opens Joint Committee

"Thanks to Congressman Teno Roncalio (D-Wyo.), the winds of reform have finally reached the last bastion of secrecy in the Congress, the Joint Committee on Atomic Energy," said Friends of the Earth Legislative Director Ann Roosevelt.

Ms. Roosevelt was referring to Rep. Roncalio's success in getting the Joint Committee on Atomic Energy to open its doors for the first time to the public for a mark-up session on a piece of legislation.

The bill was H.R. 1523, designed to extend the Price-Anderson Nuclear Insurance Act from 1977 to 1997. The bill provides $560 million in insurance to the victims of accidents at nuclear power plants. "This is only a small percentage of the possible damage that could result from such a disaster," Ms. Roosevelt said. "It is paradoxical that the nuclear industry, which insists that nuclear reactors are perfectly safe, also insists that the government indemnify them against any possible loss resulting from a nuclear reactor accident."

The bill had been scheduled to be marked-up in an executive session on June 11, until Roncalio, protesting the unnecessary secrecy of the meeting, asked that it be opened to the public. The Chairman of the Joint Committee, Rep. Melvin Price (D-Ill.), acquiesced to the Wyoming Democrat's request, and rescheduled the meeting for June 13.

At the open mark-up, Rep. Roncalio led the debate on the bill, arguing that it should be delayed until the results of a $2 million Atomic Energy Commission Study on the probabilities and consequences of nuclear power plant accidents are released this July. He was successful in getting an amendment to the bill that cut its extension to ten years, but was rebuffed in his efforts to provide fuller and stricter protection for potential victims of damage caused by the underground explosion of nuclear devices. Such activity is planned on a wide scale basis for Wyoming, Colorado, and Utah in an effort to stimulate natural gas.

"The Joint Committee has lagged behind Congress in every move to open up the legislative process to ordinary citizens," Roosevelt said. "We thank Rep. Roncalio for his endeavors, both in opening the Committee's docrs and in trying to increase public coverage for, and knowledge of, the consequences of nuclear power plant accidents."

Help Stripping Bill

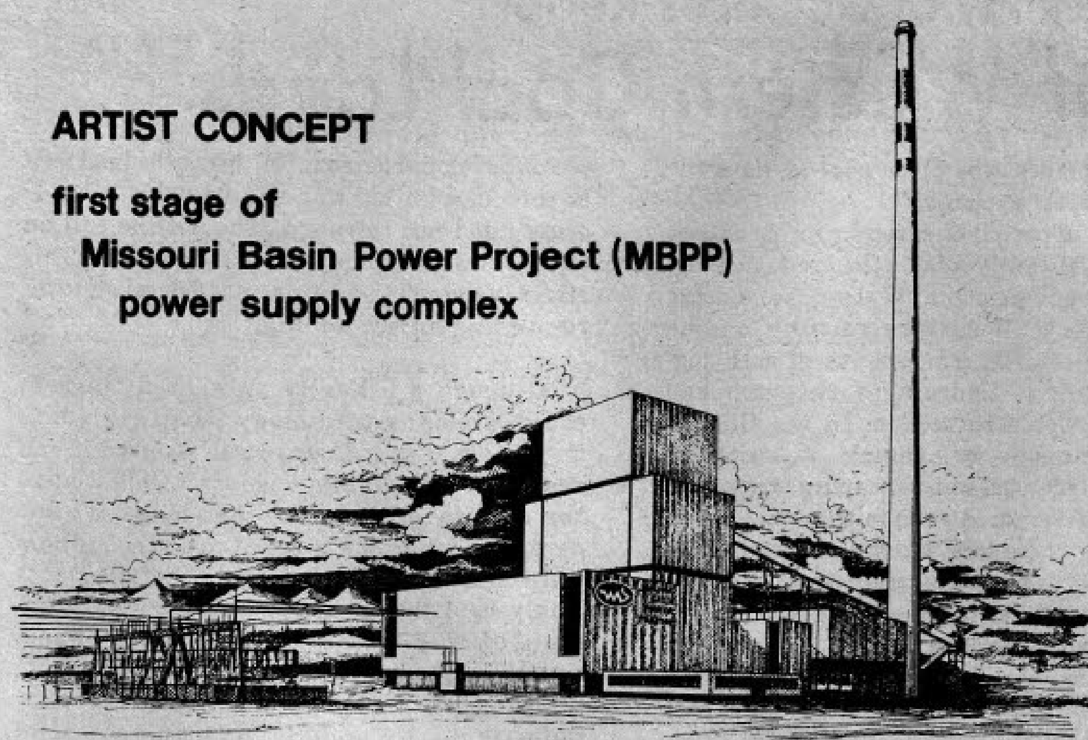
Strip mining legislation in the U.S. House of Representatives is coming up for some vital decisions. The Rules Committee will consider the strip mining bill (HR 11500) Tuesday, June 25. Given the green light by the Rules Committee, the bill could come up for full House consideration as early as June 26 or 27. But many observers feel the showdown vote will be delayed until July 2. It is **imperative** that you write your representative in Congress and let him know that HR 11500 is a critical piece of legislation. It is a must if devastation of strip mined lands is ever to be prevented.

Much of the urban growth experience in the U.S. over the past quarter century has consisted of people running away — from other people in the older cities, now even from the suburbs to the mountains and the seas. Now it is dawning on us that there is not really any place to run to. It may be time to reinvigorate our processes for getting along with each other. . . Clustering, greenbelts, public services and facilities in vacation communities, new communities with a full mix of uses, more inclusive decision-making processes, impact analyses — all of these involve higher levels of social interaction and cooperation than we have usually achieved. There is no hiding on two-acre lots.

William K. Reilly
Executive Director
Task Force on Land Use
and Urban Growth

ARTIST CONCEPT

first stage of
Missouri Basin Power Project (MBPP)
power supply complex



The Missouri Basin Power Project (MBPP) filed with the Wyoming Public Service Commission this month to build a 1,500 megawatt power complex in Platte County near Wheatland, Wyo. or in Goshen County. An artist's conception (above) shows one-third of the planned complex — one 500 megawatt unit, scheduled to be in service by 1979. "A fourth unit will probably be necessary, but it is not included in the present application to the Public Service Commission," says James Grahl, general manager of Basin Electric. Part of the project's water will come from a proposed dam and reservoir with a capacity of 100,000 acre feet on the lower Laramie River. Power from the project will go to eight states — Wyoming, Colorado, Nebraska, Montana, North and South Dakota, Minnesota and Iowa.

Emphasis ENERGY

in the Northern Rockies and Great Plains

Nebraskans are fighting for their air this month — and they've won the first round.

The victory came when a hearing officer recommended denial of a construction permit for the **Gerald Gentleman Electric Generating Station** planned near North Platte, Neb. The grounds for denial: possible violation of the Clean Air Act.

The Platte Valley Group of the Sierra Club requested the hearing. They claimed that the proposed 650 megawatt plant would cause significant deterioration of the existing air quality in the Platte River Valley and would violate new stationary source performance standards for particulate opacity and sulfur oxides.

As a result of the club's challenge, two weeks of evidence were taken in Nebraska District Court. The hearing officer determined that Nebraska Public Power District, the utility seeking to build the Gentleman Station, has failed to meet the burden placed upon it by the Clean Air Act to show that such air pollution will not occur.

The hearing officer's findings and recommendations now go to the Director of the Department of Environmental Control for his decision on the permit.

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The **Colorado Interstate Gas Co.** wants to pipe natural gas from a reserve in Montana to its customers in Wyoming, Kansas, Oklahoma, and Texas. Montana says the gas is necessary for in-state use.

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Peter Rutledge has been named the **Oil Shale Mining Supervisor** by the Department of the Interior. Rutledge will be responsible for the supervision of oil shale operations under the federal leasing program "with special emphasis on industry compliance with regulations aimed at the protection of the environment during oil shale mining operations." Rutledge was the Interior Assistant Secretary's reclamation task force chairman before assuming this position.

A **geothermal well** being drilled northwest of **Brigham City, Utah** "looks promising" according to the drilling company, Geothermal Kinerics. The 10,000 foot well is the first deep geothermal well to be drilled in Utah. Utah Power and Light is a partner in the project.

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Panhandle Eastern Pipeline Co. lost out in its bid to purchase North Platte River water rights, but it still plans to build a $400 million coal gasification plant in Wyoming. **The Wyoming Board of Control** rejected Panhandle Eastern's plan to buy water rights from the Rock Ridge Ranch near Torrington, Wyo. A company spokesman said the firm is "actively pursuing other water acquisition programs," including well drilling in Converse County.

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No one came to bid on the second and final **Wyoming oil shale tract** when it was put up for lease earlier this month. Even though record bids in the millions of dollars were offered for tracts in Colorado and Utah, no company was interested in either of the lower grade tracts in Wyoming. The Wyoming oil shale isn't rich enough to warrant open pit or underground mining, but the federal government had hoped some industry would like to try their hand at in-situ shale oil recovery.

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The **Atomic Energy Commission** and its industrial sponsors on the nuclear-stimulated **Rio Blanco** gas well are drilling back into the well from a new angle this month. Last fall the project sponsors drilled into the top explosion zone to recover natural gas, but found no connection between the top zone and the two nuclear explosion zones below it. The new drilling will be angled into the second explosion zone. "Fractures around this middle zone will be studied to learn more about nuclear explosive rock fracturing mechanics," an AEC spokesman says. The well is 30 miles southwest of Meeker, Colo.

The Hot Line

across the country

Environmentalists should be relieved to learn that Congress has passed **Clean Air Act amendments** which are consistent with the spirit of the original act. It was feared that under pressure from industry about the energy crisis, Congress would gut the clean air law. But strong amendments written by the Senate-House conference committee passed both houses. The clean air amendments are part of the Energy Supply and Environmental Coordination Act of 1974, "the emergency energy bill." The amendments spell out the terms under which the Federal Energy Administration (FEA) may order a conversion from fuel oil to coal. They allow the FEA to order a one-year conversion until June 30, 1975, only when the conversion will not cause or contribute to a violation of the primary health standards of the Clean Air Act. Richard M. Lahn, coordinator for the National Clean Air Coalition, predicts that because of the passage of this law the number of conversions will be "minimal."

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Natural gas supplies will fall nearly 10% short of demand in the months just ahead. That word was given to a House subcommittee by Federal Power Commission chairman John Nassikas. He also told the congressmen that reduced supplies will mean major gas shortages in the year ahead for several areas of the country. Nassikas said the natural gas shortage has worsened in the past year and will become a "severe crisis" within the next five years. Government figures indicate natural gas reserves had dwindled to an 11.1-year supply in 1973.

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A draft chapter of the **Federal Power Commission National Gas Survey** says the most promising source for substitute natural gas is coal. A technical committee on coal gasification, headed by James Garvey who is president of Bituminous Coal Research, wrote the report.

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Two industrialists will try turning used **automobile tires** into oil and new tires at the Rocky Flats Research Center near Golden, Colo. H. I. Koolsbergen, chairman of The Oil Shale Corp. (TOSCO), and Charles J. Pilliod Jr., chairman of Goodyear Tire and Rubber Co., have announced plans for a joint pilot project to reclaim scrap tires. There's a potential of 15 million gallons of oil, 73 million pounds of carbon black and 2 million pounds of steel in 8 million scrapped tires, they estimate. A full-scale plant could recover enough from 8 million tires to make 2 million new tires — and the energy necessary to produce them, Pilliod says.

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Wayne Glenn, president of **Continental Oil Co.** Western Hemisphere Petroleum Division doubts the U.S. can become energy self-sufficient by 1980. He said it would mean a 37% increase in domestic oil and gas production and a 176% increase in coal production. "That's 190,000 more oil and gas wells and 9,000 coal mines in just six years," said Glenn.

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A member of the Arizona House of Representatives, **Michael Goodwin,** says that between 20 and 25 percent of the annual U.S. energy expenditure could be saved if banks changed their thinking on housing loans. Goodwin told the **Deseret News** in Salt Lake City, "Loans for construction should be based on long-term operating costs. If a decision on whether to make a loan were based on operating costs over a 10-year period, companies would be interested in installing more expensive (but more efficient) fixtures that might have a long-range energy-saving."

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Last year, Americans burned up 8.1 billion gallons of fuel in **vacation and play** activities. A survey by the National Motor Sports Committee attributed most consumption to vacation and recreation travel.

National Academy of Sciences Report

Rehabilitation of Western Coal Lands

The following is an edited version of a summary of a newly issued report, **Rehabilitation Potential of Western Coal Lands.** A preliminary version of the report was presented to the House Interior Committee last fall as it was considering the strip mine bill. The initial impact of the report was to considerably strengthen the bill (HR 11500), but as time went on extensive, unrelenting pressure from the coal industry and the Nixon Administration brought about a number of weakening amendments.

Environmental groups now say they will work to kill the bill unless strengthening amendments can be reinstituted on the House floor. The coal-oil-utility lobby says it will work to kill the bill regardless, because they cannot live with it.

Rehabilitation Potential of Western Coal Lands is a report to the Energy Policy Project of The Ford Foundation. It was done by a study committee of the Environmental Studies Board of the National Academy of Sciences-National Academy of Engineering. The study committee worked eight months on the report, under the chairmanship of Dr. Thadis W. Box of Utah State University.

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Can western coal lands be reclaimed after they are surface-mined? The answer depends upon, first, geography, and second, institutions. In areas where soil is good and rainfall adequate, revegetation can take place. But the political and technical effort that is required surpasses any yet undertaken in this country for land reclamation.

This study concludes that the rehabilitation potential in desert areas is extremely low. In the sagebrush foothill regions rehabilitation is chancy; even the best methods would be subject to failure during drought years. Only in the mixed grass prairies and in the areas of pine and mountain brush is there a high potential for successful revegetation.

The authors qualify their optimism about the more promising areas on several counts. Successful rehabilitation of the land depends on an intensive, coordinated effort that has never been made anywhere in the United States and requires strong new federal and state laws. There are other difficulties. Long-term experimental results and other pertinent data, as well as experience and equipment, are lacking. Each proposed mining site, even in the favorable zones, must be evaluated individually. A standard of "complete restoration" cannot be met anywhere, and the chances of approaching the original ecosystem are only moderate even on the best of sites. But with effective legislation, and given a "safety factor" of sufficient rainfall and good soil, satisfactory rehabilitation has a high chance of success in certain sections of the West.

Other important conclusions, dealing with broader issues of water and land use, emerged from the research. There is enough water in the West for both mining and rehabilitation, the study concludes. But there is not enough water for large-scale energy conversion operations such as gasifying and liquefying coal, or generating electric power. The authors recommend that alternate locations be considered for such operations.

They also warn that operations like these would stimulate economic development and population growth, creating environmental impacts potentially far greater than that of surface mining itself. Options other than placing conversion plants, where the coal is, have not been adequately explored.

Decisions to permit or extend mining cannot be made intelligently outside the context of regional development plans. Water use and the off-site effects of surface mining on the watershed are vital components of such regional planning. Hydrologic research and monitoring would be needed. In the Gillette, Wyoming area — for example — strippable coal seams intersect water-bearing strata that serve several hundred wells in the area. A subtle but major, long-term impact of surface mining could be to alter adversely the hydrologic patterns of local and regional watershed areas.

Inadequate water information is only one of many gaps in vital data. Society may wish to base its decisions about developing western coal on all the pertinent physical, chemical, hydrologic, biotic, and climatic requirements. But these basic facts are still virtually unknown and are likely to be poorly understood for many years to come, unless research activities are stepped up to keep pace with development decisions.

The effects of those decisions can be seen in the West today. Some large low-sulphur coal beds, up to 200 feet thick and lying near the surface, are already being surface mined. Coal companies have acquired leases for huge areas of land. Power companies are obtaining water rights, and elaborate schemes for water diversions have been proposed to meet projected industry requirements. Unit trains are in operation to the Midwest; a coal slurry pipeline has been built (in Arizona); a number of mine-mouth generating plants are in operation and several more are planned; and the first coal gasification facilities have gone into pilot production.

The area of all this activity extends from the Canadian border in the north to near the Mexican border in the south, concentrated in the Rocky Mountain and Northern Great Plains area, but extending westward nearly to the Pacific. The area includes all or part of nine states: Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, Washington, and Wyoming. (Minor coal deposits occur in California, Idaho, Nevada, Oregon and Texas, but these are small and are not likely to become targets for immediate development.)

Approximately 1.5 million acres could be surface mined using present methods, yielding enough coal for a 45-year supply if **all** national production were made from that source. Current projections of coal production indicate that 140 square miles would be disturbed by surface mining by 1990, and 300 square miles by the year 2000. This does not include mining for gasification and liquefaction projects.

Rough estimates indicate that most production between now and the year 2000 will occur in Wyoming and Montana, with significant but lower amounts in New Mexico, Arizona, and North Dakota.

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The authors warn that rehabilitation (of strip mined land) on this unprecedented scale will not occur simply because society wishes it, but only if society demands it. The authors recommend strong federal and state laws, vigorously enforced, emphasizing pre-planning, public participation, and long-term monitoring and assessment.

No surface mining would be permitted on either public or private lands until environmental impacts were assessed and detailed plans developed for rehabilitating the land as it is mined, with top soil and valuable subsoils segregated and salvaged. The authors call on the federal government to take the lead in this effort, by prompt enactment of federal statutes regulating surface mining.

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Although a federally subsidized program could develop the technology, the study predicts that the mining industry itself should and can readily bear the full expense of rehabilitation in the western coal area with the addition of a few cents per ton to the price of coal. The authors deliberately avoided doing a detailed cost analysis of the various rehabilitation techniques, because of the meager amount of reliable cost data, the uncertainties in scaling up costs due to potentially rapid changes in the technologies, and the preliminary nature of results from current studies of the price-sensitivity of energy consumption.

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Costs per ton of coal would vary according to the thickness of seams and overburden, with economic considerations naturally favoring thick seams with a thin layer of overburden. In such cases land disturbance would be severe but limited in extent, and intensive rehabilitation efforts could limit the severity of the impact.

Successful rehabilitation would require the establishment of a comprehensive, non-industry program to monitor the rehabilitation of all coal surface mining operations. Interdisciplinary teams would have to be developed for these and other appraisals. The authors suggest that these activities could be financed through fees charged to mining operations.

The authors warn that certain scenic and historic features of the landscape cannot be restored at any price. Where irreplaceable artifacts can be protected, the authors suggest that the mining operation pay these salvage costs as part of the total cost of rehabilitation. In vital cases where salvage is impossible, or landscapes will be ruined, or species face extinction, they recommend that surface mining be prohibited.

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The total disturbance caused by roads, railroads, power and transmission lines, townsites and municipal services needed for surface mining may far exceed the disturbances at mine sites themselves. As a rule of thumb, lands affected by mining might amount to twice the acreage disturbed by mining itself. The suggests the advantages of developing mines in clusters, so that one set of facilities could serve a large number of mines.

The problem of developing coal while maintaining environmental values is aggravated in the West by the tangle of overlapping ownership of land and minerals. The owners are the federal government, the states, railroads and other private parties, and the Indian nations. Many of the private holdings are in "checkerboard" patterns with public or Indian lands, with the administration of both private and public rights inextricably bound together.

The authors suggest that policy for coal development on the federal lands should encourage the states and private industry to preserve important values where coal is mined, and to prevent mining where historic, scenic, or other values outweigh the value of coal development. They warn that neither the federal agencies nor the states are presently equipped to carry out the rhetorical mandates of "development consonant with environmental management" with which the people have entrusted them.

Western Roundup

Rocky Road for Big Sky

The road to Chet Huntley's Big Sky resort isn't paved with good intentions — in fact it isn't paved at all. The road is only slightly better than a logging road, "hopeless" as one ski shop owner put it. This deplorable entrance has put the multi-million dollar resort "on the brink of disaster," according to Big Sky President Gustav F. Raaum.

The highly controversial ski area near Bozeman, Mont., has been gambling on state or federal funding of the $5 million, 9.5-mile road into the resort from Highway 191. At first the federal government had pledged $2 million but environmentalists felt the taxpayers shouldn't pay for a road to provide private corporation profits and filed suit. In late 1972 a federal judge sided with the environmentalists and federal support was withdrawn.

Now Raaum says, "I've no doubt that the state will pave the road; it's the only logical thing for them to do."

But the state is also balking. Highway Department Director H. J. Anderson says the state positively will not approve any more funding for the road. He told Big Sky in May, "I suggest that Big Sky, because of the urgency, underwrite the cost of this project and recover from the state later if the state is liable.

Water Projects Approved Again

New life was injected into old water projects early in June, when the House passed a Public Works Appropriations Bill for 1975. The bill provides $1.3 million in additional funding for the Fryingpan-Arkansas Project and start money for both the Dallas Project in Western Colorado and the Savery-Pot Hook Project in Northwestern Colorado and Southwestern Wyoming. Money for "general investigations" was provided in the bill for the Uncompahgre Project and the Closed Basin Project in the San Luis Valley. The Senate has yet to vote on the bill. Then it's in the hands of the Office of Management and Budget. Whether or not it will release the money for these projects remains to be seen. Colorado Congressman Frank Evans predicts that Congress will pass anti-impoundment legislation "that will keep the President from tying up such funds as he has done in the past (through the OMB)."

Soils Expert Condemns Oahe

"The public interest and the interest of landowners would be best served by an abandonment of the Oahe project (in South Dakota on the Missouri River)," says Robert Eikleberry, internationally known soils scientist, in an affidavit sent to United Family Farmers (UFF). Citing the level topography of Lake Plain Soils, their clayey texture, high sodium content and poor drainability, Eikleberry asserts that soils in the project area are predominantly unsuitable for irrigation, and that the project is likely to be both an environmental disaster and an economic failure.

Eikleberry observes that Bureau of Reclamation project failures in other states have not only been expensive but have permanently ruined soils. He also points out that insufficient drainage systems have been characteristic of Bureau irrigation projects in the Missouri River Basin and that drainage system capacity has had to be increased at great cost soon after the projects began operation.

A spokesman for UFF said that Bureau plans for spacing of drain tiles have varied from 275 feet in 1952 to 790 feet in 1967 to 620 feet in 1973. A consultant hired by the Bureau in 1954 concluded that the distance should not be more than 220 feet. "Drain tiles are expensive," say the UFF, "and it appears to us that the present plans for spacing of drain tiles are motivated by the exigencies of the cost-benefit ratio rather than by the drainage needs of soils."

Turner Calls for Wildlife Study

Wyoming state Rep. John Turner has recommended that the Game and Fish Commission in his state take quick action to find out what current population growth and planned energy development will do to hunting and fishing.

Speaking before the annual convention of the Wyoming Wildlife Federation, Turner said, "In assuring the continuing well being of our unsurpassed wildlife resources, we must have a better look at how many resident sportsmen there are going to be, where they will be hunting and fishing, and when."

Turner said there are a number of environmental impact studies presently being done around the state but added, "Because of broad scopes and different priorities, these seldom give in-depth consideration to wildlife or any projections on potential numbers of sportsmen who will be taking to the field in the years to come."

A string of scenic Idaho lakes, including Lake Coeur d'Alene (above), continue to be threatened by man-caused pollution. The beauty of the lakes and their settings are part of their downfall. People gravitate to the shores, to recreate in state parks and live in permanent or summer homes. Sewage treatment is not only difficult but costly. At the same time, northern Idaho's famous lake country, often referred to as the Emerald Empire, is the scene of much mining. Zinc, iron, lead and silver are carried in solution from mining areas on the St. Joe River and the South Fork of the Coeur d'Alene River into Lake Coeur d'Alene. The Environmental Protection Agency has put water discharge permits on a number of mining and milling companies to limit the amount of dissolved metals which can be released into streams.

Briefly noted . . .

University of Utah researchers are trying to make coyotes so sick of lamb they won't even sniff at a sheep. Tests are being conducted with lamb's meat laced with lithium chloride. The initial taste is good to the predator, but later on the chemical makes it vomit violently. "The long-term result is one coyote which not only avoids hunks of non-treated lamb's meat, but also keeps a long distance between himself and the lamb-on-the-hoof," reports **Colorado Business.** Some animal behaviorists think a mother coyote who has had a bout with this vile bait will teach her young to avoid sheep, too.

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A tortured, rainbow-hued shale formation that harbors the delicately sculpted imprints of fish that lived millions of years ago will be dedicated as Fossil Butte National Monument at ceremonies near Kemmerer, Wyoming, on Saturday, June 29.

Fossil Butte was declared a National Monument on October 23, 1972. Located 11 miles west of Kemmerer, in southwestern Wyoming, the rugged butte preserves one of the most extensive concentrations of fossilized freshwater fish in the nation and is one of few such repositories in the world.

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A birds of prey rehabilitation and research center is starting up in Caldwell, Idaho. The center will rehabilitate injured and sick birds of prey and find suitable homes in accordance with prescribed laws dealing with possession. Birds will be released promptly when rehabilitated. This center will service Idaho and hopefully Utah, Oregon and Montana.

More detailed information, including membership applications in the non-profit organization, can be obtained from: Birds of Prey Rehabilitation and Research Center, 2502 S. Kimball, Caldwell, Idaho, 83605.

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Montana's largest employer and largest air polluter, the Anaconda Company, wants to delay implementation of tough clean air standards for its copper smelter in Anaconda, Mont. The state wants 90% control of the 700 tons of sulfur oxides released daily. Anaconda says it can only control 59%. "There is no way we can go faster," says their vice-president for legal affairs.

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The Colorado Department of Health is surveying the state's streams to determine present water quality. The department's environmental staff will return to the streams in three years to see what changes have occurred. Surveys have already been completed on the Roaring Fork, Colorado and San Miguel Rivers.

Thoughts from the Distaff Corner

by Marge Higley

There are several good TV series, and occasional specials, which document various aspects of wildlife behavior. They are interesting and educational, and, to me, they come as a welcome counterbalance against the somber newscasts filled with world-wide woes.

As I watch a bear amble awkwardly down to the river's edge to catch a salmon for his dinner, the doomsday predictions of inflation and depression temporarily fade from my mind. Mentally, I'm sitting right on that river bank, and spiraling prices mean as little to me as they do to old Bruin himself.

The devastating environmental cost of producing ever more energy is a constant nagging worry. But an hour with Jacques Costeau, or the "Flight of the Snow Goose" serves to allay the worry for a little while.

The black cloud of Watergate hangs over the nation, and looms closer and darker with each daily newscast. But the darkness recedes momentarily as I watch two playful otters chase each other up a snowbank, then slide happily down to splash into the pond below.

The haunting spectre of starving children in today's world can't be erased. Nor can the knowledge that man is still killing his brother in senseless wars. The TV screen brings into my living room a pair of beavers who build their home and raise their young in a remote mountain valley, as beavers have been doing for centuries. And I can reflect that there is at least one little corner of the earth where all seems bright and beautiful.

Yes, those wildlife shows can give a real lift to the spirits. Most of the time — but not always. In the past couple of weeks I've seen two which left me depressed.

The pelicans of Anacapa Island, off the California coast, are becoming extinct. Many miles away, man has sprayed plants with DDT. The long-lived chemical has traveled by air and water into the sea, to become part of the ocean food chain. And DDT prevents the mother bird from producing calcium, so she lays soft-shelled, infertile eggs. DDT is banned now, but it's too late for the pelicans of Anacapa.

The film of the Galapagos Islands was spellbinding. It showed how the wildlife on these remote and rugged islands had actually changed to fit into their harsh environment. Some of the changes were physical, others were habitual. The coloring of the gulls, for instance, has changed over hundreds of years, to match the rocky shores. But the V-tail gull has, instead, changed his habits and has become a night feeder in order to avoid his natural enemies. Through the centuries, one species of turtle has evolved into a long legged creature, better adapted to climbing over the large rocks. And in some species of birds, the beak has gradually changed to a quite different shape, better fitted to getting at the available food.

At first glance, the Anacapa film was the more depressing. But on second thought, the implication of the Galapagos film came to me.

What will man become if he physically adapts to the environment which he himself is now creating? Might he eventually develop gills to strain the pollution from the air he breathes? Will his devotion to the auto render his leg muscles unnecessary? With agriculture crowded out of existence, what kind of digestive system must he develop? Will the chemicals he creates react on the calcium of his bones and teeth as the DDT affected the eggshells?

It sounds pretty gruesome, doesn't it? But I don't want to end this with such a somber thought, so let me add this:

Cheer up! Some species of animals don't change to fit their environment at all. They merely become extinct!

States Aid the Endangered

The timber wolf in Minnesota, the red wolf in Texas, and the American alligator in the Southeastern United States are three typical endangered species now under discussion in a scheduled series of meetings between Interior's Fish and Wildlife Service, all 50 State governments, major conservation groups, and other Federal agencies.

The meetings were set up by Lynn A. Greenwalt, Director of the Fish and Wildlife Service, and are being held in FWS regional offices. The discussions focus on the implementation of the Endangered Species Act of 1973, a stronger law than the 1969 Act and one that carries specific requirements for both State and Federal agencies to meet within restricted time periods. All States will be consulted by June 7th.

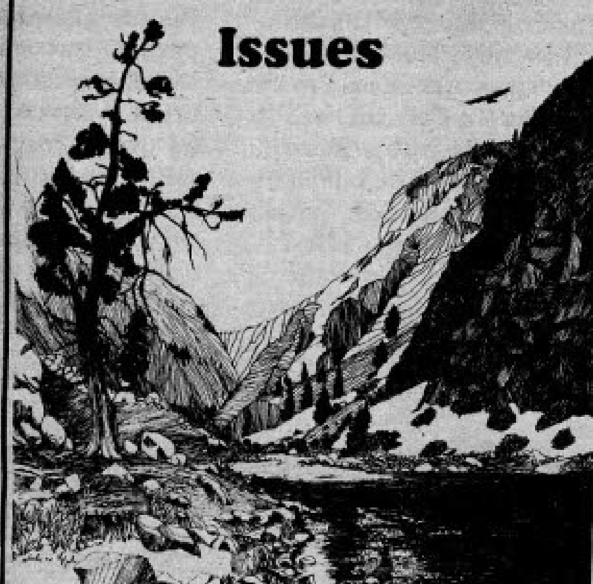
"We are particularly interested in reaching cooperative agreements with State governments for the local management of endangered species programs," Greenwalt said. "States which qualify for such agreements retain authority to regulate the 'taking' of resident 'threatened' or 'endangered' species and become eligible to participate in a Federal grant-in-aid program authorized by the new law."

A section-by-section analysis of the law is being provided to all States, with particular attention given to whether new State legislation may be required to meet the requirements of the Federal Act. These would involve such areas as a State's ability to acquire land, its authority to conserve resident species of fish and wildlife, its scientific capability for setting up and conducting a program, and its provisions for public participation in designating resident species as endangered or threatened.

Federal Aid will now be available under the new act to State governments in amounts up to two-thirds of the costs of their endangered species programs, and States are being provided with details of how this part of the act will be implemented. A total of $10 million for three years was authorized by the act to support State activities.

Most State governments have only until autumn to conclude a formal agreement with the Secretary of the Interior on the conservation of resident endangered fish and wildlife species. The Endangered Species Act, which was signed into law on December 28, 1973, stipulated that a State has 120 days after adjournment of its first regular legislature or 15 months, whichever occurs first, to enter into an agreement with the Secretary.

Idaho Environmental Issues



Idaho Environmental Issues is a new publication describing possible losses to the high quality environment of that state. An introduction to the 100-page booklet says, "Pressures are and will be intense to make decisions that would rob our children and future generations of much of the quality of Idaho's natural environment." Contributors to the volunteer effort include such nationally known outdoor writers as Ted Trueblood and Mike Frome. It can be obtained for $2.00 from the Idaho Wildlife Federation Environmental Education Fund, 1304 Eastman St., Boise, ID 83702.

House Land Use Bill Killed

Legislation which would have provided about $800 million to states for development of land use planning, H.R. 10294, was rejected by the House early in June. The vote was close — 211 to 204.

Rep. Morris Udall (D-Ariz.), chief sponsor of the bill, and Sen. Henry Jackson (D-Wash.), sponsor of the Senate land use bill, say the fight is not over. Jackson says he will try to tack the land use measure to a "must bill" in the Senate which the Administration needs.

Udall and Jackson place the blame for defeat of the bill on impeachment politics. They say that Nixon mortgaged "the country's land for conservative votes on impeachment" and warn that he has begun to "do the same kind of jig on the strip mining bill."

M-44 Poisoners Back on Land

Emergency use of a cyanide device for killing coyotes has been authorized for use in restricted areas of the West to provide relief to livestock producers who have suffered high losses this year, according to Secretary of the Interior Rogers C.B. Morton.

"I must stress that this is an emergency measure consistent with the provisions of Presidential Executive Order 11643. The M-44 cyanide device will be used only after Fish and Wildlife Service personnel document the local need for its employment to cut high sheep and goat losses," Morton said.

The M-44 is a spring-loaded cyanide ejecting tube placed in the ground. It is among the most humane and selective control tools known as death occurs almost instantly when scented bait triggers a puff of cyanide into the coyote's mouth when it tugs at it. When used professionally, it is safe and selective. There is little hazard to human beings. The toxicant either decomposes or is metabolized immediately. It does not persist in the environment or enter the food chain. Areas where these devices are used will be clearly marked with warning signs.

The Federal agencies involved have jointly developed new procedures to permit the use of the M-44 in the emergency period. Under the new procedure a rancher, land user, or land administrator, when faced with losses that cannot be avoided by the usual methods, would request emergency consideration from Regional Directors of the Fish and Wildlife Service.

Hans Meyer and Windworks

by Bruce Hamilton

"Building an energy system, whether it's to tap wind or another alternate energy source, is a lot like using wood for your heating system. Every time you put another log on the fire, you have to go out and cut another log eventually. And so you suddenly become very conscious of how much energy it takes to keep your body warm," says Hans Meyer.

"What is really more significant than having a windmill that produces pollution-free energy is the kind of consciousness that comes with the windmill system. . . . When you go out and build your own system to provide your own power, suddenly you're going to become acutely aware of what energy is . . . and how great our negligence has been in the past in the use of energy," he says.

Meyer and five companions live and work in a house, an office, and a shop near Mukwonago, Wis., that is powered by two home-built windmills and a waterwheel. The group, called Windworks, works on research, development and design prototype construction of windmills.

"Home-building windmills is where we started out back in 1970-1971," says Meyer. "We first started with the encouragement, sponsorship and enthusiasm of Buckminster Fuller. He encouraged us to work on wind as an energy source for the reasons that have become more obvious with today's energy shortage.

"Back then, with limited resources, limited funding and limited capabilities, we felt the strongest thing we could do was to develop windmills that could be built by anyone . . . preferably with minimal tools, minimal materials, and at minimal cost."

"What we try to do is get information out on windmill systems, to make a wind experiment available to people," says Meyer. The experiment with wind helps people realize what energy systems are all about where flicking on a switch or plugging into an outlet doesn't allow a person to relate to the whole energy system, he says.

"There is a tremendous degree of complexity in any of our energy systems — from wind, to methane, to solar, to nuclear, to fossil fuels. A really strong emphasis has to be put on what we get from an outlet, a socket, or a switch that we take for granted. With oil it is drilled, pumped, shipped, refined, burned, converted to electricity through a complex generator, transmitted over tons and tons of copper wire all over the country, and finally consumed in the house.

"It's not enough to ask what it costs to make the energy in terms of dollars. You have to look at it as a total process from the oil rig or strip mine clear down to where it shines out as light in a light bulb," says Meyer.

"The energy crisis doesn't have a physical solution," says Meyer. "If energy consumption continues its spiraling growth then nuclear, solar, geothermal, coal, wind, separate or combined, cannot keep up. "It's definitely a non-physical solution that we're looking for," he says.

"Estimates have been made that show we could provide all of this country's energy demands with windmills. We can certainly provide say 10% of this country's requirements with wind in the next five, ten or fifteen years. The point is though, that what's going to have to change more radically than the amount of energy we get from windmills is the way we consume the energy we are already getting," says Meyer.

Meyer is also concerned about the net energy output of any energy technology. "Serious questions have been raised that nuclear plants may

not be net positive energy producers. After you look at all the materials and effort that goes into producing a nuclear plant and then you look at the maximum output that plant will have, it just may be that it takes more energy to produce the plant and its product than its worth.

"Windmills and other alternative energy sources also have to be examined in this light," says Meyer.

"We can break windmills into the (categories of) high speed electric generating windmills (from 50-1000 r.p.m.) and the low speed windmills that were typical of Crete and Greece and Portugal (below 50 r.p.m.). The low speed windmills we feel are tremendous net energy producers. High speed windmills we feel are very marginal net energy producers. That's only an intuitive guess," says Meyer.

Another vital question is the economics of producing windmills — the cost in dollars per kilowatt of electricity. "The cost of present foreign systems is about $2,700 per kilowatt capacity for the complete system. To give you a feeling for that number, the typical house in Wisconsin will consume between 500 and 600 kilowatt hours per month and will have a peak demand of about eight kilowatts.

"If you want to handle that peak load of eight kilowatts you'd need to have a storage system or a windmill that is capable of putting out eight kilowatts. That's a very large windmill," he says.

Windworks operates on 500 kilowatt hours per month. They make a big effort to only use what they need. They have a 12 foot diameter home-built windmill that they designed which puts out a maximum of 3,734 watts in a wind speed of 25 miles per hour. A second sail windmill on the property "is suited more for mechanical than electrical power, but we use it for electrical because that's what our needs are," says Meyer.

These home-builts are a lot cheaper. The 12 footer can be built for around $425-$475. The sail windmill, without the sails, costs about $500. Sails from a professional sailmaker would cost an additional $350.

"There are perhaps 10 companies who are very close at present to commercial production. Now, there are principally two major wind electric producers — both are foreign. These are Dunlite of Australia and Elecktro of Switzerland. These systems are very expensive, partly because they're made overseas, but primarily because they are not truly mass production situations," says Meyer.

"To compare this $2,700 per kilowatt, nuclear stations have been estimated to cost $300-$400 per kilowatt. So you see there may be a factor of roughly nine between wind systems and nuc-

(Continued on page 16)

Eavesdropper

LOONEY LIMERICKS

by Zane E. Cology

The Arabs have us on our knees
For fuel we'd flip-flop over to please
Have we lost our taste
For transforming waste?
Methane could relieve the squeeze.

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William D. Ruckelshaus, former Assistant Attorney General and former Administrator of the Environmental Protection Agency, is forming a Washington, D.C. law firm. The firm will specialize in environmental and energy law.

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Men are having some success mothering whooping crane eggs in Patuxent, Md. The 13 eggs picked up late in May from nests in the wilds of Canada are now peeping and pipping in incubators at the Fish and Wildlife Service research center. In cooperation with the Canadian Wildlife Service, U.S. scientists stole single eggs from the two-egg nests they located. The removal of one of a pair of eggs does not affect the number of young whoopers arriving on the wintering ground, scientists say. The wild flock of whoopers now numbers only 48 birds. Breeding in captivity could build up this endangered species.

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"We should measure progress in terms of Gross National Benefit rather than solely by Gross National Product," says Russell W. Peterson, chairman of the President's Council on Environmental Quality. Peterson also told the Expo '74 world's fair audience that solutions to the world's environmental problems depend on stopping population growth. The world's population should be stabilized at 7 billion, he said.

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North Carolina Sen. Sam J. Ervin became an environmental advocate recently when he pleaded with the Senate to stop a dam project on a river near his hometown. He won Senate approval of legislation that will block for at least two years the massive Blue Ridge Power Project in Grayson County, Va. The project would have dammed the New River, the oldest river in the U.S. "Senator Sam, stop the dam," wrote a 12-year-old constituent. "I am an expert as to its (the river's) beauty," Sam said. He called the river "one of the most beautiful pieces of handiwork by Almighty God on this earth."

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Certain pesticides are stored in the fatty tissue of human beings says Dr. Frederick W. Kutz. Kutz is the project officer of the Environmental Protection Agency's human monitoring program. People take in the pesticides through food eaten, breathing and absorption through the skin and other membranes. A study of fatty tissue collected by pathologists in 32 representative cities shows that there are high incidences of DDT, beta-hexachlorocyclohexane, dieldrin, and heptachlor epoxide in the general population.

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Penguins swallow stones to adjust their hydrostatic balance. This enables them to dive into the water for their food.

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Alfalfa juice could give meat substitutes more protein than a prime cut steak. The juice would be converted into a powder that is 90% protein and used to boost the protein content of breads, pastries, pastas, soups, stews, milk substitutes, ground meats and other processed foods. At a test plant in California, the U.S. Department of Agriculture can make three pounds of the white powder in an hour. A centrifuging and heating process separates the white from the green, strong-tasting, grassy pigment.

Meyer and Windworks . . .

(Continued from page 15)

lear at present," he says. "Bill Heronemus (see **High Country News**, May 24, 1974 pages 15 and 16) estimates that in quantity building systems in the 20 kilowatt capacity range, the cost of windmills could be brought down to $100-$150 per kilowatt. That's very favorable, if it could be done."

In looking at the existing windmill systems, Windworks felt that on a home-built basis you could get by with existing electrical equipment, but the main problem was in producing a home built inexpensive airfoil (windmill blade). To overcome this obstacle Windworks developed the honeycomb blade which is paper inside and covered with a stretch fabric and fiberglass. The expandable paper honeycomb is the same weight as a grocery shopping bag. You buy it in block form, cut in on a band saw in your shop and expand it out into the honeycomb structure. The paper is sprayed with a polyester resin to seal and waterproof it and then it's fiberglassed. This process is fully explained in the November, 1972, **Popular Science** article "Wind Generators: Here's an Advanced Design You Can Build" by Hans Meyer. Since the article was printed, Windworks has refined the 12 footer honeycomb model and plans are available for $15 from Windworks, Box 329, Route 3, Mukwonago, Wis. 53149. Windworks has most of the materials and components if you find them difficult to obtain.

Windworks has also researched various blade, tail and tower configurations. The 12 footer is a three blade "downwind" windmill. The windmill has no tail. Wind hits the bullet shaped housing, then the tower and then the blades. Most water pumping windmills that you see on older farms have a tail and are upwind windmills where the wind strikes the blades, then the tower and then the tail.

"People see our 12-footer three-bladed windmill plans and write in asking if they can get twice the power if they put on six blades. The answer is no. The power output is really independent of the number of blades unless you carry it to an extreme," says Meyer.

"We also played around with a venturi or a ducted windmill where the blades rotate inside a shroud. The venturi serves to accelerate the air flow and allows you to minimize tip losses around the rotor. It also lets you control the expansion of the slip stream downstream of the blades (where major losses in efficiency occur)," says Meyer.

Windworks couldn't measure the effect of the venturi too exactly with the instrumentation they had, but they thought they were getting an increase in power of 40-50% over a rotor the same size that was standing free (without the venturi).

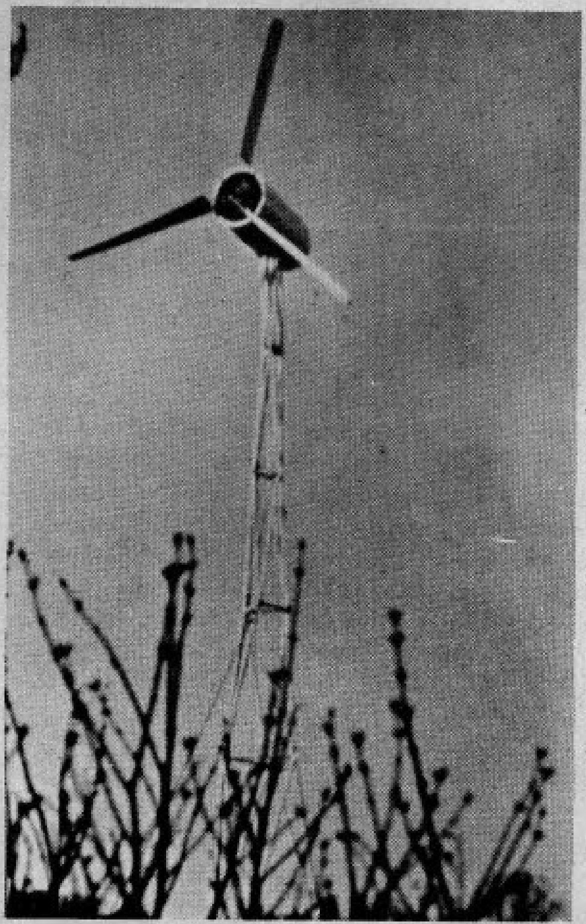
"It looks to us," says Meyer, "like the effort and expense of building and installing a venturi are just not justified by the increase in power output unless you want to protect people from the rotating blades. The shroud could serve that function."

The tower on Windworks' 12 footer is made of one-inch electrical conduit pipe in ochtahedron configuration. The ochtahedron is one of the three stable solids so the tower can be built in modular form. "You can build the tower standing up in place," says Meyer. "Build a module, climb on top of it. Build another, climb on top of it."

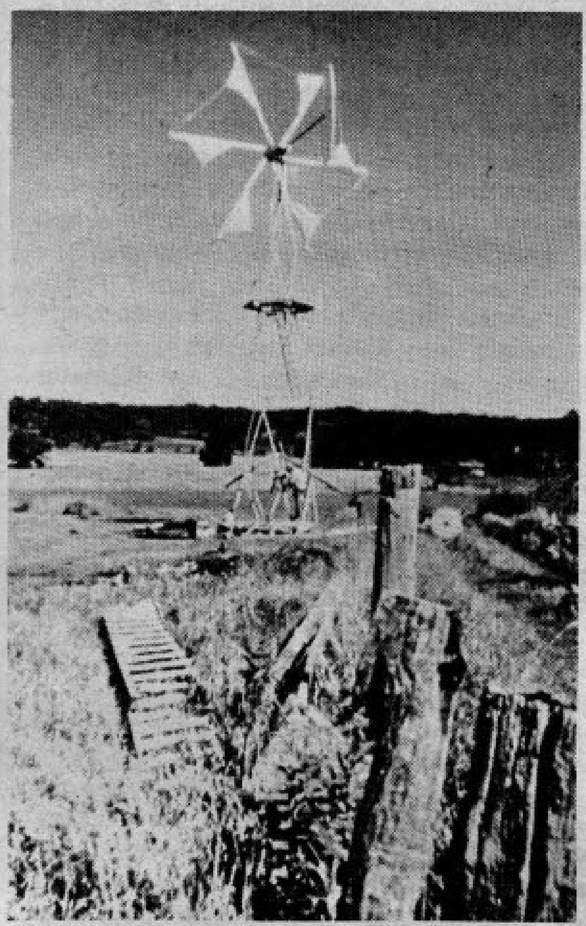
"It's also economical," he says. "Two dollars a foot for material and labor costs."

The end result is a flimsy looking tower whose secret strength lies in its confusing geometry. The tower design was inspired by Buckminster Fuller's work on geodesic domes.

Windworks is not too excited about the vertical axis Savonius rotor windmill (for a picture and description see **High Country News**, May 24, 1974, page 9). "The idea behind the Savonius rotor is that it can be very inexpensive. But the feeling has been from the Brace



The 12-footer windmill developed by Windworks. The blades are paper honeycomb blocks with a fiberglass covering. Plans available from Windworks tell you how to build this windmill in your home shop.



A sail windmill developed by Windworks in cooperation with Buckminster Fuller and the Brace Research Institute of McGill University in Quebec. This windmill is a low speed windmill developed for mechanical uses in less developed countries, but Windworks uses it to help power their operation with electricity. The sails are reefed manually in high winds.

Research Institute and VITA (Volunteers in Technological Assistance), two groups that were planning on introducing the system into the less developed countries, that the power output is so meaningless its use has been discouraged," says Meyer.

Meyer has some interesting thoughts on tying windmills into the present power system. "When everyone gets on an elevator at the top floor and the elevator is coming down, the motors that drive the elevator up run backwards and in effect become generators that send power right back to the power companies. The direct current (DC) is converted to alternating current (AC) and the AC is injected back into the system running the meter (that registers electricity consumption) backwards. Of course you never get ahead on that deal unless you can convince everyone to walk upstairs. But it does save in the elevator situation.

"The same thing could be done with windmills. You could use the power from your windmill for your needs and any surplus could go to the power company. Anytime there is a deficient amount of power from the windmill, you could draw on the power company supply.

"That system exists, is feasible and is palatable to the power companies with one exception. If a tremendous number of people were to use windmills and they all had this system it would present peaking problems to the power company that are very serious.

"So it's not as if everyone can use that kind of system. It's an irresponsible system because it puts the storage responsibility with the power company — and that's neither a fair nor a practical solution.

"Because of this peaking problem it's a system that is particularly well suited to any area where there is a good deal of hydroelectric power installed. If there is sufficient reservoir capacity, any time the wind is blowing you slow down on the hydro production and use the wind energy. When the wind isn't blowing you pass more water through.

"Bill Heronemus has talked about farmers having a second crop which would be windmills along fence lines. The farmer would do a certain amount of minimal maintenance work and be able to have these windmills produce power and feed it right into the company lines."

But big power systems that remove the individual consumer from the windmill that produces his power is not what concerns Windworks. "People say, 'Well, you're building windmills,' but in fact what we do has very little to do with windmills . . . . What's really important for us doesn't have to be with windmills, that just happens to be one of the vehicles we use," he says.

Windworks doesn't sell windmills, they promote windmill consciousness.

In the NEWS