

SUSTAINABLE DEVELOPMENT

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Sustainable development is a concept that has become widely popular in recent years. It was used originally at the beginning of the last decade as part of the World Conservation Strategy. It came to the forefront, however, in 1987 with the publication of *Our Common Future*; the report of the Brundtland Commission. Nevertheless, the concept remains elusive in definition and difficult to make operational.

In Canada, the National Task Force on Environment and Economy was established in 1986. It was given the responsibility of reviewing the Brundtland Commission report, from the Canadian perspective, and preparing an official response. The Task Force report outlined 40 recommendations, one of which was the establishment of federal, provincial and territorial Round Tables on Environment and Economy. The recommendations reflect a fundamental belief that environmental and economic planning cannot proceed separately.

The National Task Force concluded that Canadians cannot expect to maintain economic prosperity unless the environment and the resource base on which economic development depends are protected. All resources, including the environment, must be managed for the long term, taking into account their anticipated value in the future as well as their current value.

Rather than try to establish a precise definition of sustainable development, for the purposes of this paper it is considered to be based on a set of values wherein development meets the needs of the present without compromising the ability of future generations to meet their own needs. This view of sustainable development is consistent with the Brundtland Commission report and numerous other documents pertaining to sustainable development and, in particular, a discussion paper prepared by the Natural Resources Advisory Committee (NRAC). NRAC is a long-standing, interdepartmental committee of Assistant Deputy Ministers, in Alberta, reporting to the Deputy Ministers. The primary purpose of NRAC is to coordinate interdepartmental environmental issues from a strategic perspective.

There are, however, many definitions for sustainable development. Morley Connaghan, chairman of the newly established British Columbia Round Table on Environment and Economy, stated that "sustainable development is something like beauty: it is in the eye of the beholder." Earlier this year, Terence Corcoran, a columnist, wrote in *The Globe and Mail* that "sustainable development...is fast becoming a landfill site for every environmental idea in existence and every state economic intervention imaginable."

Mr. Corcoran went on to say that "the snowball of sustainable development is picking up every sector of the economy as it rolls relentlessly forward. Sustainable development appears to offer a middle road between the economy (business, growth, investment, technology and development) and the environment (clean air, water and land)."

Sustainable development is a powerful idea whereby the potential for mutual cooperation between industry and environmentalists is made possible. It also has the promise of building a broad consensus between these groups, stemming from its ability to cut across intellectual, sectoral and political boundaries.

Sustainable development is a descendent of two precepts that evolved during 1960s' conservation movement. First was the belief that nature should be preserved, and second was the moral injunction that man should act as a steward of the land. As a result, man and nature had to be viewed as part of one integrated system. It follows, therefore, that if man analyzes the elements of sustainable development in isolation, he will seriously compromise its attainment. Holistic approaches to sustainable development problem-solving must be employed.

Sustainable development presents highly complex questions for policy-makers. Governments must grapple with the thorny issue of which trade-offs will be supported by the public, knowing the public will not accept anything that compromises its health. The long-term well-being of the environment and the economic future of the country, province or territory must, therefore, include efficiency of resource use, conservation, pricing and lifestyle changes.

For Canadians to move toward a sustainable future, many fundamental changes will be necessary in our approach to economic development and environmental protection. Difficult decisions will have to be made by government, industry, institutions and individuals. Development cannot subsist upon a deteriorating environment. The environment cannot be adequately protected, however, when economic growth does not account for the costs of environmental degradation. Environmental protection and economic development can and must be reconciled, with a single common vision of our future emerging.

Despite the common myth of an approaching environmental maelstrom, the earth has more in its favor now environmentally, than it did 30 years ago when the environmental movement first rose to national prominence. In Canada, there are numerous areas where air and water quality are better now than in 1970. Today there are more people concerned about the earth's environmental health, which offers a positive outlook for the future.

Environmental degradation is, first of all, a scientific issue. The scientific community has established that the earth has a finite capacity to absorb pollutants, whether within air, water or land. Environmental awareness is no longer an option that industry can select if it so chooses; it is an economic necessity.

Sustainable development is not just a scientific issue, it also involves policy making. If sustainable development policy is to be pertinent, it must recognize and properly assess the issues at hand and apply scientifically valid solutions that are consistent with economic growth and other national priorities. Some believe that environmental objectives should take precedence over the requirements for economic prosperity. Sustainable development recognizes that it is not a choice between protecting the environment or developing resources, but rather that the two are intertwined.

A national sustainable development policy must obtain a national consensus with respect to sustainable development objectives and set a realistic timetable by which these objectives can be met. The economic costs to the consumer for achieving these objectives, and the impact on national competitiveness in the world market, must be analyzed fairly, realistically and publicly. The role of government in this regard should be to establish standards and time frames for implementation of objectives, and then let industry and the public determine the optimum, cost-effective means to achieve them.

Policy established for sustainable development must be based on the best scientific data and methods available. Arbitrary, mandated programs will not be as effective as those in which their development was shared by industry and the public.

Nonrenewable Resources

With the exception of those forms of renewable energy resources, resources used to meet the world's need for energy, metals and industrial minerals are, by definition, nonrenewable. Their exploration, development, processing, transportation and use can be accomplished within the context of sustainable development. Canada's nonrenewable resources used for energy production comprise natural gas, crude oil, bitumen, coal and uranium. Nonrenewable resources that are not required for energy uses comprise metallic and industrial minerals and structural rock materials.

For nonrenewable resources, sustainable development implies an environmentally responsible approach to resource exploration, production and use. In the longer term, it also implies substitution of

resources to meet essential needs as those currently being used are depleted. Such substitution must also occur without adverse environmental impact.

Sustainable, nonrenewable resource development means using these resources in the most economically efficient manner possible. It means considering environmental impacts and society's needs at all stages of use from initial exploration and preparation for mining, through the actual mining and land reclamation to processing of the mineral. The goal is to minimize negative environmental impacts at all stages of nonrenewable resource activity.

Nonrenewable resource processing must minimize consumption through efficient use, substitution and recycling. Such production efficiencies and recycling will contribute to waste reduction, reduce disposal problems and minimize impacts on the natural environment.

In the eyes of the public, mining is a political issue with respect to sustainable development because of its role as an environmental antagonist. Supply, with respect to metallic minerals and coal, isn't an issue as there is no apparent shortage. A public outcry will not occur until supply becomes a crisis as is now the case with conventional crude oil. The recent events in the Middle East, combined with Canada's dwindling production of conventional oil, are precisely the reasons for Alberta's support for the mining of bitumen.

Some environmentalists believe that environmental considerations clearly outweigh the economic prosperity derived from nonrenewable resource development. As a partial solution, a balance needs to be created between environmental values and the need for such development. As Frank Dabbs stated in the April 23, 1990 issue of *Oil Week*, "It's a precariously short step from environmental responsibility to environmental terrorism – the hijacking of the economic process." What is needed is responsible development of nonrenewable resources, which may mean flattening the demand curve or even reducing use. Canadians need to be aware of the associated costs, however, and agree on a course of action jointly determined by government, industry, and the public.

Sustainable development provides the opportunity for environmentalists and the mining industry to meet on equal terms. Improvements on air and water quality, many initiated by the mining industry, demonstrate that nonrenewable resource companies care more about the environment now than in the past. Having said this, it is still felt by some that the industry does not care enough. If it did, there would be fewer environmental mistakes and better solutions to environmental problems.

Twenty years ago, the mining industry resisted environmental regulations. Today, the industry initiates guidelines with respect to environmental issues. Many companies have restructured their operations to create environmental divisions. This is evidence enough that industry is now moving toward a sustainable development ethic.

Mining in the 1990s

Over the years, numerous public opinion surveys regarding environmental issues have been taken. The 1990 Canadian Gas Association (CGA) Goldfarb Survey found that 53 per cent of Canadians are "very concerned about the environment." The 1989 Mining Association of Canada (MAC) Angus Reid Survey found that 45 per cent of Canadians are "aware of specific mining activities that harm the environment." How, then, can Canadians be convinced that mining is compatible with the concept of sustainable development? Particularly when they do not believe the industry is being truthful in what it says.

The mining industry has two choices in this matter. First, it can try to convince Canadians through rhetoric. This will be difficult. According to the CGA Goldfarb Survey, 86 per cent of Canadians said they "rely on the media to get their facts about the environment." If this survey is accurate, then the mining industry will first have to convince the media, who, in turn, will help to convince the general population. This could be a laborious exercise, and the mining industry would have little control over the agenda. As

Moira Jackson stated in her recently published paper, Pilloried in the Post: The Mining Industry Meets the Press, "It's much easier to control an agenda of one's own choosing than to respond to someone else's."

The second, more preferred method is for the mining industry to convince Canadians through direct action. The industry must not just pay lip service regarding its intention to "...operate ... facilities in compliance with all applicable legislation providing for the protection of the environment ...", as stated in the Environmental Policy of the MAC; companies must operate in this manner without exception. Actions always speak louder than words.

Public perception must be changed. In some instances, perception is not based on fact. The MAC Angus Reid Survey found that 40 per cent of Canadians believe that "industry has improved its performance on air pollution over the past ten years", and yet 51 per cent believe that "the mining industry performance on acid rain is worse now than it was ten years ago." Because public opinion is fickle, and if you believe the CGA Goldfarb Survey, controlled by the media, the mining industry, government and the public must develop, implement and monitor a mutually agreed upon national action plan that addresses mining and sustainable development.

Mining in the 1990s can be viewed as a continuum that ranges from exploration and preparation for mining, through the actual mining and land reclamation, to processing of the mineral. As such, some elements of sustainable development, such as environmental protection are applicable at each stage of the continuum. Others, such as recycling are only applicable at specific stages. Any action plan that is developed should address each element of sustainable development at each stage of the mining continuum. Development of the plan should commence by the end of 1990 with completion by the 50th Annual Mines Ministers' Conference in 1993.

Once implemented and adhered to, the action plan will provide the litmus test of credibility for the mining industry, as all Canadians will be able to form their own, independently derived, perception regarding the industry's sustainable development ethic in the 1990s. Such a plan should contain the following components:

- (1) explicit goals with respect to each element of sustainable development;
- (2) identification of the problems and issues associated with each of these goals;
- (3) sufficient comprehensiveness to deal with all of the considerations associated with each of the identified goals, problems and issues;
- (4) flexibility to allow for changing needs and future circumstances;
- (5) ability to recognize need for modification, adaptation and revision as required;
- (6) options with a clear understanding of their implications;
- (7) opportunity for participation by industry, the public and government;
- (8) systematic implementation to ensure commitment at each stage;
- (9) defined responsibilities for implementation; and
- (10) awareness of the limitations and costs of implementation.

Initiatives in Alberta

- The Government of Alberta has taken a number of initiatives with respect to sustainable development. Some of these initiatives, applicable to mining and other resource development projects, are as follows:

Environmental Protection and Enhancement

Earlier this year, the Government of Alberta introduced a discussion paper with appended legislative ideas regarding a proposed Alberta Environmental Protection and Enhancement Act (AEPEA). The AEPEA represents an important step in putting the Government's commitment to sustainable development into practice. This Act consolidates nine existing acts that deal with the environment. It will allow for an integrated approach the management of air, water and land.

This single piece of legislation will result in straightforward, streamlined and effective environmental laws for Albertans and the mining industry and eliminate duplications and redundancies among existing acts. The new legislation, to be introduced in the Alberta Legislative Assembly in the spring of 1991, will provide a consistent framework for future laws and guidelines.

Recognizing that environmental concerns and impacts are not confined by physical or political boundaries, the Government of Alberta is committed to cooperating with other governments in the management of environmental issues that affect our neighboring provinces. The proposed legislation contributes to effective intergovernmental cooperation, while reinforcing Alberta's constitutional responsibilities for environmental management in our province.

Clean Air Strategy

In March 1990, the Government of Alberta announced that the Clean Air Strategy for Alberta would be managed jointly by the departments of Energy and Environment. The purpose of the strategy is to have an informed public discussion on air emissions that result from the production and use of nonrenewable sources of energy, primarily fossil fuels. The strategy has a twofold objective: (1) to help identify and clarify the possible impact of energy-related emissions on the environment, including those from the mining of bitumen and coal; and (2) to outline practical and achievable actions that can be taken by consumers and producers to reduce emissions.

The strategy complements other Government of Alberta sustainable development initiatives as well as national and international endeavors related to air emissions and global warming. The final report will be submitted to Alberta's Round Table on Environment and Economy in 1991. The report will help formulate Alberta's policies on air emissions and will be used in developing Alberta's input to Canadian policies and positions with respect to sustainable development.

The strategy represents one of the most comprehensive and coordinated efforts in Canada to deal with energy-related emissions and the environment. The goal of the strategy is to identify realistic and achievable measures supported by both energy consumers and producers. In developing the strategy, the Government of Alberta has demonstrated its firm commitment to public participation. Through discussions, workshops and the establishment of an advisory group, the Government is determined that the concerns of all stakeholders will be taken into account.

Natural Resources Conservation Board

During the 1990 spring sitting of the legislature, the Government of Alberta introduced the Natural Resources Conservation Board Act. This legislation outlines the framework and procedures for reviewing and approving projects involving non-energy resources in Alberta including the mining of metallic or quarriable minerals.

The legislation will create a quasi-judicial, independent Natural Resources Conservation Board (NRCB) with broad powers. It will assess the social, economic and environmental effects of proposed natural resource development projects before their commencement. The powers of the NRCB complement

the intent of the AEPEA and the Clean Air Strategy for Alberta with respect to sustainable development. The legislation will provide Albertans with the most progressive and stringent review and approval process for natural resource projects found anywhere in the world.

Projects approved by the NRCB will be subject to further approval by Cabinet. Following this approval, projects will still have to obtain the necessary licences, permits and approvals from the other regulatory agencies before the project can proceed. NRCB decisions to reject applications or defer consideration cannot be overturned by Cabinet. The decisions can be appealed to the Court of Appeal only on matters of jurisdiction and errors in law.

The NRCB will clearly outline the procedural mechanism that will ensure a balanced and impartial process for reviewing and approving natural resource projects. It will set rigorous new standards for sustainable resource development. Mining and other resource projects will not proceed without a detailed environmental assessment and full public input. Members of the NRCB will have all the powers, privileges and immunity of commissioners appointed under the Public Inquiries Act.

During the spring sitting of the legislature, the Government decided not to bring forward the NRCB Act, because the public requested more time to review the proposed legislation. Therefore, the review period has been extended, and comments received will be evaluated in an effort to make the legislation even more effective.

Energy Efficiency, Conservation and Resource Substitution

In Alberta, resource conservation and efficient energy use are encouraged. Efficient energy end-use practices and technologies are promoted by the Alberta Department of Energy through information and education programs such as industrial energy audits. Services are available for all energy end users in the residential, commercial, industrial and transportation sectors. Energy use databases, telephone hotlines, on-site energy audits, and technical publications are all available to Albertans. Even future energy consumers are addressed through educational programs and resources for school students.

Conservation practices for energy resources in the field, which originated in legislated measures enacted in 1938 and most recently have stressed enhanced oil recovery, are now being complemented by end-use efficiency and new conservation programs. End-use efficiency and conservation programs include the reduction of gaseous emissions, examination of the potential for production of natural gas from coal and the development of technology to meet these ends. These measures are being coupled with initiatives to develop solar and wind resources.

The Energy Resources Conservation Board (ERCB), established in the late 1930s, is responsible for ensuring that provincial energy resources are developed in a safe, orderly manner that avoids waste, controls pollution and is in the public interest. The ERCB ensures that the recovery of energy resources is optimized, or conserved, and not wasted. In addition to providing regulatory control of the production and distribution of all energy resources, the ERCB provides an important interface between the energy industry and government.

Within the energy sector, resource substitution poses a challenge for Alberta where current energy use is focused on relatively clean fossil fuels – oil and natural gas. Bitumen and coal form an immense resource base in Alberta and, over time, have the potential to play an increasingly larger role in the energy mix. Bitumen mining in Alberta presently contributes approximately 33,000 m³ per day (207,000 barrels) of synthetic crude oil to the marketplace, while 30.8 million tonnes of coal were mined in the province in 1989. The challenge of ensuring that bitumen and coal fill this expanded role within a sustainable development framework requires new technology development, increased energy efficiency and energy conservation.

Integrated Resource Management

- Regardless of its definition, sustainable development is only a societal goal. In order that this goal might be achieved, all Canadians must cooperate to develop a comprehensive strategy that encourages long-term prosperity while ensuring a vibrant, sustainable environment. The initial focal point for such a strategy is the resource base that comprises the earth's ecosystem, since it is from this base that economic prosperity is derived. The one common factor in this regard is the land.

Virtually every kind of economic activity is tied to the land. In this sense, land is defined as the earth's ecosystem and includes air, water, land and living organisms. Land use planning and management is, therefore, the most initially valuable instrument for achieving sustainable development. According to Nigel Richardson in his recently published document *Land Use Planning and Sustainable Development in Canada*, planning is "an ordered procedure for making decisions as to how land should be used; a procedure in which the plan, including written policies, standards and criteria, provides guidance."

Richardson suggests that land use planning and management contributes to sustainable development in the following ways: (1) promoting efficient use of land; (2) allocating resources; (3) protecting lands and resources; (4) resolving competing demands; (5) encouraging and facilitating environmentally sound economic development; and (6) reducing environmental pollution.

Although Alberta became a province in 1905, ownership of the province's resources was not transferred from the Government of Canada to Alberta until 1930. Since that time, the process of land use planning and management moved from single-sector management in the 1930s and '40s, to multiple-use management in the '50s and '60s, to integrated management in the '70s and '80s. For the '90s and beyond, management that ensures sustainable development will be what is demanded by Albertans.

The integrated resource management framework now used by Alberta was endorsed by the government in 1978 in a document entitled, *A System for Integrated Resource Planning on Public Lands in Alberta*. The central tenet of the framework is that it "endeavors to optimize use of the provincial resource base to achieve maximum benefits for Albertans, now and in the future." The integrated resource planning system is based on the following principles: (1) a comprehensive approach to resource management; (2) shared, hierarchical decision-making; and (3) commitment to public involvement. Although not originally conceived as such, the integrated resource management framework employed by the Government of Alberta provides, according to Richardson, "within its limits, almost a model land use planning system" for achieving sustainable development.

Issues of General Concern

Carbon Tax

Federal Finance Minister Michael Wilson has expressed concern about the cost of environmental programs currently being proposed by the Government of Canada. An Environics opinion survey conducted in April 1990, suggests that 73 per cent of Canadians would be "very willing" or "somewhat willing" to pay higher taxes if they knew the money would be spent on protecting the environment. Some individuals have speculated, therefore, that the Government of Canada may impose a tax on carbon-based fuels to pay for the federal initiatives on the environment.

Alberta is not in favor of a carbon tax at this time for the following reasons:

- (1) not enough work has been conducted to determine if a carbon tax would be effective in meeting environmental objectives;
- (2) a carbon tax focuses on a single environmental pollutant, rather than recognizing other contributors to greenhouse gases, some of which are increasing faster than carbon dioxide;
- (3)

a carbon tax should be evaluated with a variety of options including regulatory approaches, tradeable emission permits and tax incentives; and

- (4) the Clean Air Strategy for Alberta initiative needs to be completed and assessed before considering a carbon tax.

Environmental Assessment Act

The proposed Canadian Environmental Assessment Act will permit the Government of Canada to exercise jurisdiction over environmental aspects of major nonrenewable energy projects, including the mining of bitumen, given that the legislation applies to all projects involving federal assistance. The act does not permit environmental approval processes to be delegated to provincial jurisdiction, even when federal involvement in the project is minor or administrative only.

Federal and provincial environment ministers have agreed that a cooperative approach to environmental assessment that will respect traditional provincial and federal jurisdictional responsibilities is necessary. Decision-making processes such as environmental impact assessments, must be cost-effective, provide for minimum overlap and duplication, and encourage cooperative action. Governments at all levels need to recognize each other's strengths and capabilities and cooperate in the spirit of partnership, particularly in the development of environmental legislation, regulations, policies, programs and projects. Alberta is prepared to undertake joint environmental reviews of energy projects with the Government of Canada only where the federal government is a significant player.

Minesite Reclamation

Beyond the topographical disturbance associated with the development of mineral resources and possible usability of abandoned minesite locations, is the very serious problem of the pernicious effects of acid drainage. Although it is agreed that minesite reclamation should occur, the approaches to reclamation and the enforcement of obligations varies among the provinces.

There is general agreement among the provinces that responsibility for minesite reclamation lies with the mining company, although minesites have often not been reclaimed and the mining companies have disbanded, either through corporate failure or termination of operations. Alberta has avoided this problem through legislation which requires a reclamation plan for coal and bitumen mines to be submitted as a precondition to the issuance of an operating permit. Reclamation activity is monitored during the life of the project. In addition, further security may be required under the Land Surface Conservation and Reclamation Act in the form of bank guarantees, letters of credit or cash deposits based on the reclamation costs of specific sites.

Because of the problems resulting from abandoned, unreclaimed minesites elsewhere in Canada, the idea of mandated contributions to reclamation funds, similar to that occurring in Alberta, has received serious consideration by other provinces. Unfortunately, existing income tax legislation does not permit contributions to reclamation funds to be deducted from taxable income when it is calculated. The Government of Alberta advocates appropriate amendments to Federal income tax legislation that would provide equitable treatment of contributions made to provincial minesite reclamation funds. These changes would achieve the desired attainment of social and environmental goals and create fairness in the fiscal structures affecting taxation of reclamation activities.

Tailings Reprocessing

Tailings deposits often contain significant quantities of recoverable minerals. There is potential that the reprocessing of tailings dumps could be a part of the reclamation of minesites, including those previously abandoned. Such a reprocessing project must be economically attractive, and while that attractiveness may stem primarily from strong commodity pricing and reasonable operational costs, income tax treatment is also a factor.

At present, tailings deposits are not classified as “mineral resources” for income tax purposes, thus restricting them from receiving the same treatment for tax purposes as for other “mineral resources”, such as ore deposits. Although tailings may not be developed in the same manner as ore deposits, the significant risks associated with their reprocessing warrant comparable income tax allowances. Alberta believes that tailings reprocessing is environmentally desirable and can be economically beneficial. Therefore, the Government strongly supports modification of federal income tax regulations to permit classification of tailings deposits as “mineral substances.” This would then accord them the same treatment as ore deposits under the provisions of the Income Tax Act.

NATMAP: CANADA'S NATIONAL GEOSCIENCE MAPPING PROGRAM

Mike Cherry, Geological Survey of Canada

Introduction

NATMAP is a cooperative federal-provincial program to improve the quality, relevance and completeness of the bedrock and surficial geological database for the Canadian landmass. NATMAP will meet this objective by supporting coordinated, multidisciplinary geoscience programs to resolve concerns about environmental trusteeship, hazards amelioration and sustainable resource development.

Although faced by the difficulties inherent to the implementation of any complex, multi-agency program, NATMAP has evolved steadily since first being presented to the Canadian geoscience community in March 1990. The program's development will be accelerated by experience gained in the planning and operation of pilot projects in 1991.

History and Scope of NATMAP

NATMAP has been developed to address the problem of a widening gap between the demand for and publication of geoscience maps in Canada (Andrews and Lawton, 1988; Canadian Geoscience Council Review Committee, 1988). The concept for the program originated in 1988-89 with an ad hoc committee of the Geological Survey of Canada. A proposal drafted by this committee was the subject of a workshop convened by the GSC in Toronto in March 1990, and attended by representatives from all parts of Canada's geoscience community (federal, provincial and territorial surveys, mineral explorationists and universities). The results of the workshop were published as Open File 2256 of the Geological Survey of Canada (St-Onge, 1990a), and summaries of the proceedings have appeared in the Northern Miner (Ward, 1990) and Geoscience Canada (St-Onge, 1990b).

The 70 workshop participants reached general agreement on an ambitious NATMAP program. Their principal recommendations were that:

- NATMAP should emphasize regional bedrock and surficial geological mapping of the continental landmass. Systematic regional geophysical and geochemical mapping projects would not be undertaken as NATMAP projects. All available information from such surveys would be used to assist mapping, and new information would be acquired where essential. Similarly, transect studies and major compilation programs would not be the principal components of NATMAP projects, but would be supported where they supplemented mapping activities.
- NATMAP should foster coordination of mapping activities among government agencies. It should emphasize multidisciplinary studies, taking advantage of shared logistics and assembling teams of geoscientists for data acquisition and interpretation.
- NATMAP should ensure a future supply of geoscientific mappers in Canada by supporting university-based projects, and by employing undergraduate and graduate students, thereby providing high quality, continuing field training. NATMAP should also lobby NSERC to recognize geoscience mapping as research and provide funding for mapping.

Other recommendations included establishing a permanent NATMAP secretariat and a management committee, establishing national cartographic standards, and encouraging digital data capture and storage, including the development of national standards for such capture and storage. However, the workshop recommended that NATMAP not undertake the development of digital mapping technologies. It also acknowledged that an overall goal of complete national map coverage at any one scale was inappropriate, given Canada's size and the very different mandates of the federal and provincial surveys.

Analogous Programs

- The problems faced by Canada's geoscience mapping agencies are not unique to Canada. National mapping programs have been established in the United States and Australia in response to similar needs.

The growing demand for geoscience information in the United States and the difficulties of meeting this demand are clearly described in a brief report published by the United States Geological Survey (USGS, 1987). The USGS has developed a National Geological Mapping Program to resolve these difficulties. This program, in which the USGS has the lead role, has 3 main goals: (1) to increase geological mapping in the U.S.; (2) to improve coordination among federal, state, and university producers of geologic maps; and, (3) to adopt new technologies and innovative methods for improving geologic mapping, map production, and integration of different geoscience data sets. The program sets clearly defined roles for its participants, which include the USGS, state geological surveys, universities, the National Academy of Sciences, and the private sector. It also recognizes that a significant improvement to the national geoscience database will require time (estimated to be a minimum of 15 years). The program is anticipated to have its greatest impact by improving the organization and direction of existing mapping endeavors, and through the establishment of a formal USGS mapping program.

Australia's National Geoscience Mapping Accord was developed by the federal and state/territory geological agencies in response to a recommendation by industry to the Woods Review of the federal Bureau of Mineral Resources. The Accord is meant to assist in developing an integrated approach to sustainable development of Australia's petroleum, mineral, soil and water resources by fostering cooperative activity between federal and state surveys, in consultation with industry. Most of Australia has been mapped at 1:250,000 scale, and one long term goal of the Accord is to produce digital geoscience databases and maps of all of Australia by 2010, through 5-year programs in high priority areas. Computer technology will be used for all data handling, enabling data updating and manipulation, and integration of different data sets. Maps will be produced in both digital and traditional paper formats.

These three national mapping programs have been developed in response to essentially the same problems — growing demands for geoscience information (in both traditional and new formats) from both traditional and new clients, escalating costs of acquiring and publishing new geoscience information, and constant or declining financial and human resources. All three contain similar strategies to resolve these problems. All stress cooperative federal-provincial/state programs, to reduce logistical costs and make better use of human resources. Each recognizes the invaluable training role of mapping for the next generation of geoscientists. And all three state the necessity of developing computer technologies for all aspects of mapping, from initial data capture through data manipulation and storage to map publication.

Progress and Planned Activities

An interim Steering Committee was established after the Toronto workshop to refine the NATMAP concept and to develop an organizational structure to manage its implementation and growth. This committee, which is co-chaired by Sandy Colvine (GSC) and Dave McRitchie (Manitoba Geological Services Branch), met in June 1990 to begin actions that will move NATMAP from concept to reality.

Since that June meeting, the NATMAP secretariat has been established at the GSC in Ottawa, with the appointment of a NATMAP Coordinator. Several pilot projects will operate in the 1991 field season: these will be selected by the Steering Committee from proposals that have been received from both the provinces and the GSC. Experience gained from the pilot projects will help shape guidelines for the implementation and long term operation of NATMAP, including such requirements as project criteria, approval mechanisms, management and methods of increasing both professional and public awareness.

It was generally acknowledged at the workshop and at the initial meeting of the Steering Committee that NATMAP's ultimate success will depend in large part upon an infusion of resources. However, major

new financial support for NATMAP is unlikely in the immediate future. Nonetheless, an opportunity exists now to use existing resources for pilot projects that can be used to demonstrate NATMAP's importance to the Canadian geoscience community.

NATMAP can significantly increase the level of geoscience mapping activity in Canada. This goal can best be met by developing mechanisms that result in truly cooperative, multidisciplinary investigations that make the best use of the vast range of geoscience knowledge and expertise that resides in Canada's government geological surveys, universities, and minerals industry. The different strengths of these institutions have long been recognized, but seldom combined effectively. NATMAP can have perhaps its greatest impact by making that integration common.

References

- Andrews, A.J. and Lawton, S. 1988. Prospectors need better maps, says PDAC. Prospectors and Developers Association of Canada Digest, Autumn Issue, p.1-2.
- Canadian Geoscience Council Review Committee. 1988. Preliminary report on the activities of the Geological Survey of Canada.
- St-Onge, M.R. (editor). 1990a. NATMAP Canada's National Geoscience Mapping Program. Geological Survey of Canada, Open File 2256, 83 p.
- St-Onge, M.R. 1990b. Canada's National Geoscience Mapping Program (NATMAP): Toronto 1990 Workshop. Geoscience Canada, vol.17, no.2, p.98-99.
- USGS. 1987. National Geological Mapping Program. United States Geological Survey Circular 1020, 29 p.
- Ward, Mary-Claire. 1990. PDAC participates in national mapping program. The Northern Miner, 10 September 1990, p.4.