INDUSTRIAL FORESTRY IN A

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SILVERSIDES

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THE FOREST INDUSTRY

Forest industry in north-western Canada has cooperated with Alberta Energy and Natural Resources in providing funds to assist the Faculty of Agriculture and Forestry through sponsorship of outside speakers.,

During the 1976-77 term a seminar course was developed, taught by Desmond I. Crossley and Maxwell T. MacL'aggan. The contribution of these two noted Canadian foresters was much appreciated.

In the fall of 1977 C. Ross Silversides was brought in for a week to visit with students and staff. During this visit he gave several talks to students, and made one major address. We are pleased to be able to make this major address widely available through this printing.

We would like to take this opportunity to express our thanks again to the sponsors of this program-we appreciate very much their support.

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ersides is Chief, Forest Management Technology program, Forest titute, Canadian Forestry Service, Ottawa, Ontario.

from the University of Toronto in 1939 with a B.Sc.F. in agriculture, mployment with the Dominion Forest Service. He also worked as a ith Great Lakes PaperCo. Ltd., before spending 1942 to 1945 with the ry Corps in the Canadian Army. Ross returned to the Great Lakes gging Superintendent until 1945, when he accepted at as Research he Pulp and Paper Research Institute of Canada. In 1948, Ross ee of F.E. in Harvesting from the University of Toronto.

8, Ross Silversides worked for Abitibi Paper Company as Woodlands ineer and Director of Woodlands Development. In 1968, Ross joined Forest Management Institute, first as Chief, Logging Development as Chief, Forest Management Technology Program.

many scientific organizations. He is Co-ordinator, Division 3 rest Techniques), International Union of Forest Research Organizations; oyal Swedish Academy of Agriculture and Silviculture (1976); and National Research Council Associate Committee on Air Cushion

adian Institute of Forestry, in recognition of Ross's contributions him the Canadian Forestry Achievement Award. Ross is a member of itute of Forestry and the Ontario Professional Foresters Association. is well known and experienced nationally and internationally. In he ts gained from an international perspective and from a

INDUSTRIAL *FORESTRY W* A CHANGING CANADA

C.R. Silversides*

In the, beginning I would like to explain why the adjective industrial has bee the title of this paper. It is simply to indicate that I will be discussing forest management standpoint of the production of wood for industrial purposes rather than from that related wildlife or recreation.

Forest management has almost always been product oriented. The vario management systems have evolved around different products such as charcoal, saw pulpwood, piling, etc. The systems may be coppice, coppice with standards, large tree over long rotations, even-aged stands of monocultures of pulpwood size, and so forth.

The silvicultural systems developed in Europe were transferred to North A forestry schools via teachers and textbooks of European origin. There was little or no inter to actual conditions in North America and as a result, In the light of existing forests and p social and economic conditions, little so-called forest management was practiced. Basica was no place for forest management systems, all of which were based upon a shortage of a land where there was a great surplus into the Indefinite future. Today, 75 years later, in some regional shortages are beginning to appear. They may be in species, In specificati absolute shortages in volume. Shortages produce concern, concern produces c management

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pattern which developed in Europe and elsewhere. Forests were used and became short in supply, then and not really until then were conscious efforts forests under some sort of management, to extend their use or to rebuild esource.

Forest management is a term which can mean all things to all people or

e. Sometimes the terms "extensive" and "intensive" forest management are s are subjective and cannot be defined specifically. Canada to date I would rs have been trying, against considerable odds, to promote the concepts of of sustained or Increased yield d applied silviculture with minimal success. ccessful, we would then be the inheritors of 28.3 million hectares (283 000 ufficiently)eked burned-over and cutover forest lands in Canada.

en suggested that North American forestry may be well off radition or successful past practices because it will not then be necessary to nents in practices resulting from changes in industrial A economic conditions. lem, particularly In the United States, is that early legislation !aling with n the statute books, constrains current practice. Probably the outstanding the Monongahela decision which forbade e cutting of any but diseased or S. National Parks and forest serves. By old legislation modern forest ds were outlawed.

ation has not developed in Canada, at least to the same degree.

Stability is the classic goal of forestry. Sustained yield and the normal fo dominant themes which have guided the development of forestry since the theoretica managed forests first began to emerge in Germany several hundred years ago (Zivnus

However, the problems facing foresters in Canada have been well ex John Waiters, Director of the University of British Columbia Forest at Haney, B.C. 1965 issue of the Forestry Chronicle, Waiters published a paper entitled "The Uncertai I personally feel that this paper should be made compulsory reading for all forestry Canada. In this paper he points out a number of things which are known, but have not accepted. Our forestry practices, inherited from Europe, were developed when immobilized by lack of change.

If one thinks back, the aim of the German and Scandinavian forest manag and still is, in many Instances, to produce very high quality large trees as a source lumber and other sawn products. At that time in history, and this is for a period of sever years, this was the only conversion of wood. Pulp and other fibre products came mu France, for example, they are still growing oak on a two hundred year rotation. The existed to supply timber to the French Navy but today go mainly into logs for the furnitu The conversion has changed but the forestry practices haven't. To quote from Waiters: " we used as models grew and matured while time stood still. Today, forests grow at tradi to mature In a strange market under non-traditional conditions of continuous and a change and the forester rightly questions the reality of the future market assured by trad Change is now measured in geometric progressions. New principles, techniques, and give birth to new industries which become giants before tree seedlings become saplings.

onstant change is now inevitable and normal. To state that forestry th its long exception is an exercise in restraint. As foresters, with r purposes always in the t not only accept more change, but we must anticipate it. We must get into the nological progress and re-examine e principle of intensifying forestry practice in the Golden Age. Only)od could come from studying the past and only disaster ere".

ny short lifetime I have seen the Canadian pulp and paper industry range th in its logging practices and in the species utilized. For (example, when Abitibi y Ltd. started operations in Iroquois Falls in 1912 :I the pulpwood was produced because the woods workers came from timbering operations, mainly in the

wood is being delivered to mills in tree lengths, in full tree, and even in the form which Include bark and foliage. Most transport of wood to sills today is by land tly by truck. The pulp and paper industry initially located its mills on rivers, at a , downstream from the woodshed ributary to the mill. Today with Intraprovincial ial power grids, with and transport taking over from water, many mills are poorly nust live with the inheritance from an earlier technology.

e, originally, was the only wood acceptable by the mills. As spruce regionally upply it was reluctantly established that balsam fir could make acceptable pulp. ed a weed species until the kraft pulping process was introduced and it has if a preferred species. As you all know, aspen is currently the cinderella species. conversion process to a new end use to give it value In our economy. and to at how best to manage it.

Particle or wafer boards are a post World War 11 phenomenon a some Impact on the utilization of aspen but the requirement is small compared the resource.

To continue from Walters, "the forester becomes uncertain of the wis action, less because of a lack of knowledge of silviculture than because of h visualize the fruition of traditional practice In terms of the bewildering and ev speed of social and Industrial change. Regardless of a natural reluctance of honed on European conditions, to desert the Golden Age of forestry, he would be if he failed to acknowledge that his plantation (forest) will be harvested, utilized, very different ways to very different standards, from those now prevailing. I somewhat unique with respect to the time period with which he must deal. The u forestry purposes imposes a large measure of inflexibility in management due to time between successive crops. ' Under such circumstances where decisions h reaching far into the future, it Is vital that these decisions be the best for wh industry is capable. The forester of the Golden Age had the immense advantage of biological change was not perceptibly outpaced by the rate of technolog Walters goes on to analyze this situation at greater length but I think you get the m

An element of the change taking place in Canadian forestry, is the consideration of forest biomass as a source of energy. The concept of the total forest biomass has already raised a substantial resistance by foresters in t environmental damage, loss of soil nutrients, competition with conventional forest u as been stated that social systems resist change with an energy proportional to of the change that is threatened (Schon, 1971). It is not due to the stubborness s involved, such resistance Is built in and is a unction of the system itself.

d has been used as a source of energy since pre-history, and still is. "The most of recovering energy from wood is to simply burn the material in an excess of e heat so produced. Of all the wood removed from the forests in the world today, For many years statistics on the ise of wood as a fuel have been used as an evel of industrialization of i country; the less developed a country, the greater its wood as a fuel. For example, the use of wood as a fuel in the U.S. is 5%. In the e, it averages 50% and in developing countries it is as high as 80%. We may he use of this indicator.

difference between the direct combustion of wood as a fuel and utilization of r energy Is very great. The former is primitive and relatively inefficient; the latter cated Industrial engineering :technology. Technology is the process of applying actical purposes.

des direct combustion, forest biomass can be utilized through classification, enation, hydrogasification, hydrolysis and the results can be In solid, liquid or

oncept of the utilization of Canadian forests as a source of largescale energy evolutionary Implications for foresters. It will directly affect our Ideas of forest od values and energy forms and distributions.

The use of the forest for energy will have an immediate effect provinces devoid of fossil fuels, such as Ontario and Quebec. These provinces ar totally dependent on imports for fossil fuels, Ontario obtaining its coal from the U.S and gas from Western Canada and Quebec being dependent upon imports fro countries for its oil. However, both these provinces have extensive forest resour which they can call. The energy-producing patterns can be appreciably changed re The form in which forest biomass can make its greatest contribution may b Indications are that Canada has enormous reserves of coal and gas to carry on 21st century or further but all estimates indicate a short fall in oil by the mid 1980 one form of energy that forest biomass can supplement.

Studies made by the Department of Energy, Mines and Resources indicate that in relative amounts forest biomass can make a relatively small contr the total energy supply, perhaps only 5-6% of the total supply. However, in absolu the amount of biomass required will be very great.

One of the many factors which will affect forest management if the bi used for energy will be In the units of measurement and the manner in which the Itself is considered. (n considering biomass, species and volume are of little cons and oven-dry weight is the unit of importance. Another unit is the expression of BTUs or metric equivalents. Again our concepts of rotation age will be drastically from 50 to 80 years to perhaps 5 to 25 years.

cent estimate of Canada's energy demand shows that we use approximately 8 uals 1 quadrillion BTUs and Is usually designated as I x 1015Q. The potential ts forest, based upon an estimate for the total biomass use in the country is approximately 2.06Q per year. However, it has been pointed out that energy an those in use today can supply no more than probably 1096 of our energy r 2000. New technologies with few exceptions require very long introduction ey make a significant impact on society or the economy.

latest estimate available to us for wood, as used by the conventional forest s estimated by conventional techniques is shown in Tables 1 and 2. These are ry recent study (Reed and Associates, 1977).

le I is self explanatory showing the allowable annual cut, the average harvest l reserve. In Table 2 the physical reserve is broken down into accessible and od. These tables are the best guesstimates available to us at the present time.

n forests are Inventoried, such Inventories are normally done to a predetermined minimum tree diameter, maximum stump height, minimum top diameter s, minimum volume per acre, etc., and these inventories are eventually mes such as board feet, cubic feet, or more recently in cubic metres.

orests are utilized for energy there Is only a peripheral Interest in volume but weight, and the tons of dry tons equivalent (DTE). There are no limitations or to size, taper, back thickness, etc., as these factors are irrelevant to biomass

Table 1. Summary of Allowable Annual Cuts, Average **Harvests**

Apparent Physical Reserves (1 000 m3)

	Softwood Allowable Physical		Aver
British Columbia	99 365	68 !52	31
Alberta	11 385	6 495	4
Saskatchewan	4 512	2 285	2
Manitoba	5 354	1 875	3
	27 795	17 651	10
Ontario	41 460	25 465	15
Quebec			(80
			(3
New Brunswick Nova	6 428	7 230	9
Scotia Prince Edward	3 200	3 235	4
Island Newfoundland+	227	137 3	
	5 720	300	
	205 446	1 T5 8-2	

	Hardwood		
British Columbia			
Alberta	13 531	28 9	
Saskatchewan	3 240	55 5	
Manitoba	2 202	20 4	
	15 368		
Ontario	11 445	7 330	
Quebec	2 665 1	9 385	
	445		
New Brunswick Nova	170	2 070	
Scotia Prince Edward	793	625	
Island Newfoundland	50859	50	
		50	
		20 558	30

() Deficit included with softwood Expressed as depletion at the AA
* utilization standard Includes Labrador Average harvest is the
** average of the best two years in the 3-year period 1973-75
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Economic **Accessibility Estimates for the Physical Timber Reserve (1 000 m3/a)**

	Softwood Reserves		
	Accessible	Inaccessible	Total
	15 065	16 148	31 213
	4 032	858	4 890
	1 097	1 130	2 227
	1 905	1 574	3 479
	7 861	2 283	10 144
	2 705	13 290	15 995
	(802)	n.	(802)
	(35)	n.	(35)
d	90	n.	90
	1 224	1 196	2 420
		6 479	69 621
	Hardwood Reserve		
	* *	* *	* *
	9 377	3 865	13 242
	2 295	390	2 685
	1 618	380	1 998
	7 108	930	8 038
	700	1 360	2 060
	595	n.	595
	820	n.	820
nd	120	n.	120
	743	n.	743
	23 379-	6 925	

rador
Softwood

'

No Inventory of forest biomass, provincial or federal exists. This conc Is under intense study at this time. It Is estimated that in the normal course of conventional forest operations only some 40% of a tree is remove sawtimber or pulpwood. In turn the utilization of this portion of the tree may agair 40-50%. The utilization of the forest stand itself will vary from perhaps 50-90% depending upon the nature of the stand, species utilized and the species left. On should remember that inventories give data on so-called merchantable stands bu or nothing is recorded on the so-called unmerchantable stands or waste areas. T magnitude of these areas is shown in Table 3.

Table 3. Areas of conventionally unmerchantable stands
y

Class	Description	Area(ha)
Wildland	This Includes barrens, muskeg rock and scrub and/or land with forest cover substandard to the category forest land.	519 105 00
Provincial Lands	Areas suitable for harvest but unstocked to trees and areas . unsuitable for regular harvest.	
Federal Lands	Areas suitable for harvest but un stocked to trees and areas suitable for regular, harvest.	1 574 00
	TOTAL	616 483 00

There is every indication that in most provinces there is a substantial amount of forest biomass remaining after all legitimate requirements c conventional forest-based industries are met. One important fact not available to at present is the local distribution of this material and its physical relationship to population centres where, energy demands exist.

There are many skeptics regarding the use of forest biomass for energy. In the
n province of Alberta I'm sure this is true. Forests are a most diffuse source of
mpared with fossil fuels. In the latter case conversion plants can be erected at
or wellhead while biomass will have to be transported over substantial distances
rsion plant. Being a diffuse source of energy, the utilization of forest biomass
ome evident, in the manner of clear-cut forests. Such is not the case with oil wells
ound mining of coal.

Forest biomass will present problems in transport and in storage. It has been
at, to date at least, commercial harvesting of biomass for energy alone is
c. However, if combined with other uses of the forest such as sawtimber and
it can be produced economically. This, however, greatly restricts the location of
energy.

Three possible distinct phases of the use of biomass for energy are: (1)
of logging and mill residues. This is Immediately possible with a minimum of
estment. Its effect on forest management practices would be to almost eliminate
nd to leave cutover sites in better condition for reforestation. (2) The utilization of
biomass taken in from logging operations at the mill would include currently
pecies and small and deformed trees not up to current merchantable
ons. The utilization of stumpwood for energy purposes by mills is under active
material being hogged and burned with other wood residues. This stage in
nt would capitalize on the infrastructure resulting from conventional logging
. (3) The third phase would be the development of an energy industry quite
m present woodusing mills, distributed across the country to supply energy to the
which they are located.

The subject of this paper is "Industrial Forestry in Changing Canada"
good deal of time has been spent discussing energy from forest biomass. This is b
any move to this end will have important implications, good and bad that will char
concepts of forest management completely. It has already been stated that stabilit
classic goal of forestry and that sustained yield and the normal forest have be
dominant themes of our forestry philosophy.

Now we have a compelling use for forests which is not concerned
degree with tree quality, tree species, tree size but primarily with the site's capa
maximize its conversion of solar energy through photosynthesis into cellulosic materi
product required has no particular specification, unlike sawtimber, pulpwood, pole an
and other forest products. The product may be chipped, hogged, crushed, pulver
however for use, the form depending upon the manner in which the energy is
extracted.

It may soon be possible to state that there is no noncommercial forest,
areas or tree components - all of the material will have value. This will require the reth
of many of our forest practices.

Forest biomass, as a perennial, has many advantages over agric
residues as a feedstock for energy. As a crop it can be harvested at any time of the ye
over a period of years. It has characteristics that make it possible to convert it into en
a solid, liquid or gaseous state. It therefore has a potential for wide use in one or other
various forms in which energy is used in Canada.

. Distribution of Energy Use In Canada Today (Hart, 1977)

	15%
city	25%
Heating	30%
ial (other than electric)	25%
ortation	4%
Equipment	2%

hat this distribution of uses will change much in the near future. Looking at seen that biomass can be used in all of the energy forms shown.

r aspect of forest management that has not yet been touched upon is the rest energy plantations. These are under study in a number of countries and appear to have a real potential. Forest energy plantations have the ntrating maximum cellulose production on relatively small areas. The sites good agricultural land to primarily peat and wet areas. The boreal forest has up to 1/10 of 1% of the solar energy falling upon It in the conversion of such ynthesis into cellulosic material. Using hybridization and what may be gricultural techniques, the use of herbicides and fertilizers, It Is estimated ble to generate an efficiency In solar conversion of up to 4-5%. This Is an cy of the order of 40 and 50 times. At present In Sweden there are some 20 ned to study the regional aspects of such efficiency.

With hybrids of Populus, Sallx and Alnus it is possible to produc 22.5t/hectare per year. This will work out to approximately 50kW-h/(m 2.a) energy equi

It was mentioned earlier that harvesting of forest biomass for energy ma environmental impacts which are undesirable. One point that might be mentioned co energy plantations is that the environmental impact on minicotation culture would be agriculture rather than to forestry and should generate a minimum response from t concerning environmental damage.

One of the problems faced by our conventional forest management conventional forest-based industries is that the industries are subject to wild fluct demand whether it be for lumber or for pulp and paper. Forest management to a de suffered as a result of these fluctuations. It may well be that if forest biomass is ut energy it will generate a very stable, slightly increasing level of forest consumption whi have very few, if any fluctuations. This could serve as a solid base upon which to devel management practices.

The above indicates, I think, the fact that our forest management pract faced with challenges that never existed in the past. In the next decade we will be rewri of the textbooks on this subject and 1 hope we will be applying new concepts and techn the forest to meet the country's needs in the not too distant future.

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