## PRAIRIE PERSPECTIVES: GEOGRAPHICAL ESSAYS

Edited by Jacek I. Romanowski

Department of Geography The University of Manitoba Winnipeg, Manitoba Canada

Volume 3, October 2000

©Copyright 2000, The University of Manitoba Department of Geography

> Printed by University of Winnipeg Printing Services

ISBN 0-9694203-4-X

# **Table of Contents**

Preface	v
An early example of globalisation: the Hudson's Bay Company's interlo directorships J. Selwood	<b>cking</b>
Causes of the billion-dollar drought in North America in 1999 - a verifica study	ation
E.R. Garnett	17
The utility of global teleconnection indices for long-range crop forecasti the Canadian prairies	ngon
S.M. Quiring, D. Blair	
Airport infrastructure as an instrument for regional economic developm M.A. Crockatt, J. Ogston	<b>ient</b> 62
Ice-shoved hills and related glaciotectonic features in the Glacial Lake P Basin, Riding Mountain uplands, Manitoba	Proven
R.A. McGinn	
Soil acidity (pH) as influenced by point-source pollution from a base-m smelter, Flin Flon, Manitoba	etal
G.A.J. Scott	97
Public policy in natural resource management: parks, protected areas a network of special places in Manitoba, Canada	and
C.E. Haque, S.D. Reddy, J. Adams	111
Gated communities: coming soon to a neighbourhood near you!	137
From Christianity to Communism: a Russian colony on the banks of the	Rio
Uruguay S. Ciplco, I.C. Lohr	150
5. Сірко, Ј.С. Lenr	

Contested identities: competing articulations of the national heritage settlers in Misiones, Argentina	of pioneer
J.C. Lehr, S. Cipko	
The Tatra Mountains and Zakopane through the eyes of two artists: Witkacy and Tetmajer A. Holub, P. Simpson-Housley	

## Preface

The 23<sup>rd</sup> Annual Meeting of the Prairie Division of the Canadian Association of Geographers in Winnipeg (September 24-26, 1999) was both an intellectually and socially stimulating occasion. The Meeting was hosted by the Department of Geography, University of Manitoba. With regard to the academic component of the Meeting, no fewer than thirty-nine papers and posters were presented in formal sessions. A pleasing feature of the sessions was the participation of not only academic staff members of the institutions included within our Division, but also the level of student involvement. The papers included in this volume afford a representative selection of the diverse presentations at the Meeting which have subsequently been peer-reviewed.

As Head of the host Department, I wish to thank the many people who generously contributed to the success of the Meeting. Particular thanks are due to Michael P. Conzen (University of Chicago) for a most stimulating keynote address entitled Urban Life on the Great Plains: A Historico-Geographical Interpretation, which was immediately preceded by eloquent welcoming remarks from James S. Gardner (Vice-President Academic and Provost, University of Manitoba). I am also grateful to H. Len Sawatzky for a memorable and excellent rural field trip on the Saturday afternoon of the Meeting. Jacek I. Romanowski (Chair, Organizational Committee) not only deserves thanks for working tirelessly to ensure that everything ran smoothly during the Meeting, but for assuming the daunting task of editing this volume. The encouragement of active support of both Raymond F. Currie (Former Dean of Arts, University of Manitoba) and Robert P. O'Kell (Dean of Arts, University of Manitoba) are gratefully acknowledged. Others to whom special thanks are due include Trudy Baureiss, Danny Blair, Alex Morrison, David Mosscrop, John Selwood, Gina M. Sylvestre, Ramesh C. Tiwari, and Janet Vander Kruys. Finally, I wish to express my appreciation to our

generous sponsors who included The Dean's Office of The Faculty of Arts – University of Manitoba, Browning-Ferris Industries (BFI), Casa de Fruta, Manitoba Association for Resource Recovery Corporation, Manitoba Hydro, Pepsi Co., and Tim Horton's.

Geoffrey C. Smith, Head Department of Geography University of Manitoba

## An early example of globalisation: the Hudson's Bay Company's interlocking directorships

John Selwood University of Winnipeg

*Abstract:* The interlocking directorships of Hudson's Bay Company directors are examined for a period of fifty years straddling the beginning of the twentieth century. Throughout the period they exhibited high levels of inter-connectivity with a broad spectrum of business enterprises that had interests over widely dispersed parts of the globe. Further investigation indicated that the nature of the inter-connectivity was complex, sometimes to the Hudson's Bay Company's advantage, but sometimes the reverse. Thus, while interlocking directorships can be a useful indicator of the potential relationships between companies, they do not in themselves necessarily reveal much more than that.

## Introduction

Contrary to current popular opinion, globalisation of the world's economy is not an outgrowth of the post-modern era. It has been a force to be reckoned with at least since the main period of European colonial expansion and the onset of the industrial revolution. The Hudson's Bay Company (HBC), which boasts of being the world's longest surviving corporate entity, is a prime example of an early trans-national commercial institution with extensive ties to other economic entities through its own activities and those of other organizations linked to it through its directors' interlocking directorships. Although the HBC was engaged in an extensive range of commercial activities and exploitation of resources at an international level, this paper will focus on the scope and nature of the global linkages formed by the multiple directorships held by



Figure 1: Forms of cross company linkages.

the various Court members (directors) of the company over a period of some fifty years spanning the turn of the twentieth century.

Cross company linkages can occur in a variety of ways (Figure 1). They can be formal or informal, overt or covert (although not necessarily clandestine), strong or weak, backward, forward or sideways. Based on the methodology adapted and used very effectively in a Canadian context by Semple and colleagues (Semple 1973; Semple 1985; Semple 1996; Green and Semple 1981; Semple and Phipps 1982; Rice and Semple 1993), this paper deals primarily with the HBC's overt formal linkages with other companies through its directors' directorships in other companies as listed in the British *Directory of Directors* (Skinner 1880-1924) published annually since 1880. These cross listings, in effect, represent only the horizontal, or sideways linkages. That is, they imply an association between otherwise independent enterprises. However, the relationships are not necessarily equal. One enterprise may well

#### Table 1: HBC subsidiaries

Winnipeg and Western Transportation Co. Red River and Assiniboine Bridge Co. Vancouver Coal Mining Co. Puget Sound Agricultural Society Ltd. Russian American Co. Hudson's Bay North Russian Trading Co. Canada Land and Irrigation Co. Nascopi Steamship Co. Northern Traders Ltd. Northern Traders Reindeer Co. Northwest Exploration Co. C.M. Lampson and Co. Revillon Freres Trading Co. H.B.C. Overseas Settlement Co. Hudson Bay Oil and Gas Co.

plus Agreements

exert control over the other. A subsidiary company is generally answerable to its parent. From the perspective of the parent, its relationship with the subsidiary company is that of a forward or downward linkage. Conversely, the subsidiary, or company that is controlled, maintains a backward or upward linkage with its parent or dominant partner. The interlocking directorships do not always reveal these relationships, and to appreciate them, it is necessary to investigate further.

One complication is that most of the HBC's subsidiary companies are not listed – possibly because they were not registered in England and, as a result, not incorporated into Skinner's *Directory*. Table 1 identifies companies that were subsidiaries of the HBC during the period under discussion. However, not all of them had boards of directors that included serving members of the parent board. One example is the Red River and Assiniboine Bridge Company, which was fully controlled by the HBC, but in the trusteeship of Charles Brydges, the Company's Land Commissioner in Winnipeg. Here is an example of a forward linkage that does not appear in the list of cross-directorships. This is not an isolated case. Other examples are the Hudson's Bay Distillers and the Hudson's Bay Russian Trading Co. The HBC also from time to time entered into "Agreements" with other companies wherein the parties committed to managing their affairs to mutual advantage. This could entail an exchange of shares, but need not generate an interlocking directorship. (Hudson's Bay Company Archives (HBCA) Search File, Job and Sons). Some of these associations were of relatively little importance - even failures - as was the short-lived Red River and Assiniboine Bridge Company (Selwood 1981). However, others, such as Hudson's Bay Oil and Gas, would later become major assets of the company. These subsidiary companies are examples of formal, yet sometimes covert, linkages that provide additional insights into the extent of the company's operations.

## The Interlocking Directorships

Figure 2 lists the HBC's directors for the period from 1876 to 1924 and indicates the years through which they held that position with the company. The period was interesting in that it contained times of stability and change. The latter not only represent changes in personnel, they also represent significant transformations in company policy that had considerable bearing on its role in the global economy. In the 1870s the HBC was essentially a company trading largely in furs and other primary resources in exchange for simple trade goods manufactured in Europe, much as it had done for the previous century. Its linkages with other enterprises were also comparatively straightforward. With Canadian confederation, the company found itself in a completely different environment both politically and financially. It was no longer so autonomous and its range of potential assets increased dramatically (Galbraith 1949; Tway 1963; Selwood et al 1980; Newman 1985; Newman 1987; Newman 1991). It became a major landholder and could look forward to servicing a growing population of European settlers in the Canadian west. However, more importantly, it had lost its virtual monopoly in the region and now had to contend with other aggressive business interests muscling in on its territory. These

Hudson's Bay Company Directors 1876 - 1924

	1			1					1					1					1					1					1					1				1					1				1
	8			8					8					8					8					9					9					9				9					9			. '	9
				8					8					9					9					0					0					1				1					2				2
	6			C					5					0					5					0					5					0				5					0			1	4
Goschen	X	х×	x	X																																											
Colvile	X	x x	X	X	х	X	X	х	х	х	х	х	х																																		
Lyall	X	х×	(X	X	х	X																																									
Potter	X	x x																																													
Hamilton	X	x x	x	х	х	X	X	х	х	х	х	х	х	х																																	
Rose	X	х×	x	Х	х	X	X	Х	х	х	х	х																																			
Newman	X	хх	x	Х	х	x	x	х	х	х	х	х	х																																		
Peek	X	х×	x	Х	х	X	x	х																																							
Wilkinson	X	хх	x	Х	х	X	X	х	х																																						
Gassiot			х	х	х	x	х	х																																							
Edridge					х	x	x	х	х	х	х	х	х	х	х	х																															
Fleming							х	х	х	х	х	х	х	х	х	х	х																														
Russe									х	х	х	х	х	х																																	
D. Smith									х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	x	X :	x	<b>x</b> >	x	х											
Lichfield										х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	x :	x	ĸ													
Stephenson													х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	x :	x	<b>x</b> >	x	х	х										
Grant														х	х	х	х																														
Morgan														х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	x :	x	ĸ													
Coles															х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	x	x :	x :	<b>x</b> >	x	х	х	х									
T. Skinner															х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	х	x	x :	x :	<b>x</b> >	x	х	х	х									
Cunliffe																																x :	x	$\sim$	x	х	х	х	х	х							
Burbidge																																		>	x	х	х	х	х	х							
Kindersley																																		>	x	х	х	х	х	х	х	х	х	х	x :	x :	x
Mackenzie																																		>	x	х	х	х	х	х	х	х	х	х			
V. Smith																																		>	x	х	х	х	х	х	х	х	х	х	x :	x :	x
Lubbock																																					х	х	х	х	х	х	х	х	x :	x	
Nanton																																					х	х	x	х	x	x	х	х	x :	x :	x
T.H. Skinner																																							х	х	х	х	х	х	x :	x :	x
Sale																																							x	x	x	x	x	x	x :	x :	x
Oliver																																									x	x	х	x	x :	x :	x
Richmond																																													x	x	×
																																															-

Figure 2: Hudson's Bay Company directors, 1876-1924.

largely externally induced events resulted in the wholesale replacement of the HBC's board of directors. After a short transition period, the new board remained intact and in control of the company for over a decade. Subsequent to this period of stability, came another time of transition when the board again underwent a thorough shakeout with a fresh slate of directors taking control and a series of new initiatives being implemented.

Even at the beginning of the period under discussion, the global nature of the HBC directors' interests is immediately evident. All members of the board held directorships in other corporate bodies. George Joachim Goschen, the Governor (Chairman) of the HBC, was the eldest son of William Henry Goschen, a "leading merchant of London", a member of the merchant banking house of Fruhling and Goschen, a governor of the Bank of England, and was himself a director in the Alliance Marine Assurance Company (HBCA Search File Goschen). Eden Colvile, the Deputy Governor had extensive shipping interests (Skinner 1883; Newman 1991, 87n). George Lyall, of Hedley Epsom, held directorships with the Bank of England, the East Indian Railway Co. and New Ouebrada Co., a mining venture in Venezuela (Skinner 1877, 198). Richard Potter was a railway magnate of considerable stature. Chairman of Britain's Great Western Railway, and a director of the Great Eastern Company, the Canadian Grand Trunk Railway and the International Financial Society, he also held directorships in other companies with a strong interests in postal and telegraph systems (HBCA Search File, Richard Potter). Edward William Terride Hamilton was Governor of the Australian Agricultural Co., Chairman of the Bank of Australasia, and a director of Crown Life Assurance Co., Thomas Holdsworth Newman, of Newman, Hunt and Co. (merchants) was also a director of the Imperial Fire Insurance Co... Sir John Rose was a merchant banker in the house of Morton, Rose and Co. with additional directorships in several other banks. Francis Peek was a tea merchant with Francis Peek, Winch and Co.. The final member of the HBC board as it was constituted in 1876 was Montague C. Wilkinson of Crawford, Colvin and Co., also merchants. In addition, Wilkinson held directorships in the Imperial Continental Gas Association, and the Royal Exchange Assurance Co. (Skinner 1880). Between them, the HBC directors had interests extending over six continents. In addition to their fur trade interests, they were involved with a variety of other ventures in resource development and exploitation, transportation and communications, and, in particular, banking and finance at an international level. Their interests in international finance, centred in London, at that time the world's undisputed financial capital, made them potentially a formidable force to reckon with. On paper at least, the HBC's directors had the capacity to integrate their various company interests to a considerable degree.

Appendix 1 (page 11) illustrates just how extensive the interlocking directorships were over the next five decades. The appendix lists all named companies associated with the various HBC directors through five decades. Duplicated names identify companies on which more than one HBC director held a directorship. Thus the Bank of England is listed three times, indicating that three different HBC directors: George Lyall, Cecil Lubbock and Robert M. Kindersley, served on the Bank's board

on various occasions during the period under discussion. Some of the HBC's directors, particularly those who were Canadian based, held similar positions in more than a dozen other companies.

Listed companies with immediate linkages to the HBC through interlocking directorships have been classified into seven broad groupings. These illustrate very clearly both the breadth and depth of the inter-connections. Virtually all elements of the business spectrum are represented. Thus the HBC is just one of a number of land and resource based enterprises in which its directors had interests. The same can be said for merchandising and transportation. Manufacturing and power generation companies are also well represented among the directors. Again, there is widespread representation on a global scale.

However, by far the highest number of connections is with the financial sector, where there continue to be abundant linkages with banking and insurance companies. Without capital it is virtually impossible to survive, let alone grow, or take advantage of investment opportunities as they arrive. It would appear then that the HBC was in a good position to obtain capital according to its needs. Conversely, the weighting of the Company's directors in the financial sector suggests that the HBC was perhaps not at the centre of their concerns, but merely one of a multitude of investments controlled by the financial houses of London. Stanworth et al (1975) and Kotz (1979) have thoroughly documented the widespread and increasing control of other major corporations by the banks at around the turn of the twentieth century. It appears that the HBC was similarly affected. According to Wheeler (1986) and Semple (1996), this general pattern of control persists.

The HBC's linkages with other companies through immediate cross-directorships do not fully divulge all potential relationships between the HBC and other enterprises. Important indirect business linkages through family ties are also of considerable significance. Many of the HBC's directors had close family relationships with other eminent business leaders who in turn had multiple directorships in a variety of operations. For example, several members of the Goschen family had more extensive links to other companies through their association with Fruhling and Co., and similar extended links existed between family members in the firm of Morton and Rose. Both the Roses and the Grenfells had more than one family member with significant banking interests in the City of London. (Bowsfield 1977, 100n; Skinner 1880). The Cunliffes were yet another family with widespread interests in the London financial community (Skinner 1907). It seems reasonable to expect that these family ties and their extended inter-connections and interests would, on occasion, influence business decisions.

The mere presence of linkages, whether they are direct or indirect, provides few insights as to the strength of the linkages: these could be strong, or even purely nominal in nature. Nor do they give any indication of the relative power in whatever relationships may exist. As such they can go only so far in explaining the true nature of the linkages.

Indeed, at times the formal relationship can be the reverse of what might be expected. To illustrate this one needs only to examine the position of long-term Governor Sir Donald Smith, who one might think would have used his multiple directorships on other companies to the HBC's advantage. However, my own research suggests very much the opposite (Selwood et al 1981). Smith certainly used his joint directorships to personal advantage, but it also becomes evident that he quite deliberately sought to prevent the HBC from competing effectively with the Canadian Pacific Railway (CPR) in the potentially lucrative market for townsite lands on the Prairies. By trying to prevent the HBC from collaborating with other railway companies and insisting that the HBC either withhold its land entirely from the market, or price it well above the going rate, Smith ensured that the CPR would profit more readily from its operations. Smith had a much higher stake in the CPR than in the HBC and both he and the railway company stood to benefit immensely from its operations. Peter Newman (1991, 70-130) reaches similar conclusions about Smith's governorship of the HBC.

However, there are several instances where the HBC did benefit from its directors' associations with other companies. Of particular value to the HBC was the appointment of Charles Vincent Sale (Newman 1991, 268-270; HBCA Search File, Sale). Through him, the HBC at one point came to control the world's third largest commercial shipping fleet, becoming responsible for the movement of all supplies into France during the First World War. Although there are conflicting opinions about the benefits afforded the HBC by its linkages with Harrods, the Bay did nevertheless use the London based retailer's expertise in expanding its chain of modern department stores across Canada during the period (Newman 1991, 168). These are but two examples of where the HBC's business linkages and the global nature of its directors' interests are clearly apparent.

Although the London directors did delegate certain responsibilities to their senior officers in Canada and, on occasion. the Canadian officials did act autonomously, they were still answerable to the board. An early example of this was the Board's reaction to their Land Commissioner, Charles Brydges reaching agreement with the Northern Pacific Railway to locate its terminal on the HBC's central Winnipeg property. Brydges was summarily dismissed for taking this initiative (Selwood et al 1980). Even after the establishment of a Canadian Advisory Committee, the more strategic policy directives required London approval. This committee, initially comprising: Augustus Nanton, later a London board member, Sir William Whyte and George Galt, both important shareholders and influential Canadian capitalists (HBC 1912), was given considerable authority, but London was still involved in important decision making. Thus, the decision to proceed with the sale by auction of the Company's remaining, but still very extensive landholding at Edmonton, was made in London - as was the later decision to build homes on the site in an effort to stimulate sales (Selwood et al 1995; Selwood et al 1997). The reversal of Smith's conservative stance on land sales and the massive investment into modern department store retailing were definitely policies initiated by the new members of the London board.

### Conclusions

First, examination of interlocking directorships using Hudson's Bay Company directors as a case study example does provide good *prima facie* evidence to indicate that globalisation was already occurring to a significant degree a century and more ago. The HBC's directors were associated with a considerable range of industries in different economic sectors and in widely different locations on the globe. Second, the company linkages also imply that there was a fairly high degree of integration between the various operations, with individual companies standing to derive significant benefits from their association with others in the "family." However, there are severe shortcomings in the methodology, because the cross-directorships do not identify the actual, functional relationships. They are therefore very much open to misinterpretation.

Nevertheless, a more penetrating supplementary examination of the interlocking directorships of the HBC's directors demonstrates conclusively that there were indeed strong elements of globalisation apparent in the company's operations. The company itself was never at the apex of the power hierarchy: the real power lay in the hands of its directors who were, for the most part, concerned with much larger, more global aspects of development. With their connections in banking and insurance, they were able to marshal huge amounts of capital, directing it into a large variety of ventures that extended far beyond western Canada, into a broad range of endeavours at a greater scale of operations. The Hudson's Bay Company's activities around the beginning of the twentieth century must be interpreted in that global context. It can therefore be said that globalisation is not a particularly recent phenomenon, although the pace has undoubtedly accelerated more recently.

## Appendix 1: Linkages According to Economic Sector

#### **Finance and Insurance**

#### Banking houses:

Bank of Montreal (Vice-President) Bank of England Bank of England Bank of Australasia (Chair) Bank of Montreal (London Committee) Capital and Counties Bank Dominion Bank Fruhling and Goschen & Co. Lazards Brothers and Co. (Chair) Lloyd's Bank London and Brazilian Bank Co. Morgan Grenfell and Co., London Morton. Rose and Co. - Merchant Bankers National Provincial Bank of England Union Bank of London (Governor) Whiteheads and Coles, Stockbrokers, London Yule, Catto and Co. (Chair)

#### Insurance:

Alliance Marine Assurance Co. Alliance British and Foreign Life and Fire Assurance Co. Britsh Empire Trust Co. Central Canada Loan and Savings Co. Clerical. Medical and General Life Assurance Co. Council of Foreign Bondholders Crown Life Assurance Co. Debenture Corporation Founders' Share Co. Debenture Corporation Dominion Securities Corporation. Fire Insurance Association (Canadian Board) Fire Insurance Association Limited (Chair, Canadian Board) General Reversionary and Investment Co. Globe Telegraph and Trust Great West Life Assurance Co. Guarantee Company of North America Home Counties Public House Trust Imperial Life Assurance Company of Canada Imperial Fire Insurance Co. Laurentide Co. London and Canadian Loan and Agency Co. London and Lancashire Life Assurance Co. (Chair, Canadian Board) London and Lancashire Life Assurance Association (Canadian Board) Marine Insurance Co. Mercantile Investment and General Trust Co.

Metropolitan Life Insurance Company of New York National Trust Co. North of Scotland Canadian Mortgage Co. (Canadian Advisory Board) Northern Assurance Co Northern Trust Co. Osler and Nanton Trust Co. Provident Accident and Guarantee Co. Royal Trust Co. CANADA \*\*\*\*\*\* Roval Exchange Assurance Co. Royal Exchange Association Co. (Governor) Roval Trust Co. Scottish Union and National Insurance Co. (President) Second Mercantile Trust Sun Insurance Office Sun Life Assurance Society Trust and Loan Company of Canada Trust Houses Union Assurance Society Whitehall Trust (Chair)

### Land and Resource Companies

Australian Agricultural Co. (Governor) Canada North-West Land Co. Canada North-West Land Co. Irish Land Purchase and Settlement Co. South Australian Land Mortgage and Agency Co. Formerly of Morgan Bros. Mercantile and Banking; Anglo Persian Oil Co. (President) Anglo Danubian Co. Anglo Caucasian Oil Co. (Chair) Canadian Collieries (Dunsmuir) (President) Canadian Western Lumber Co. Dominion Coal Co. Dominion Coal Co. Durham Collieries Electric Power CO Imperial Continental Gas Association Anglo-American Corporation of South Africa (London Committee)

#### Miscellaneous

Anglo-Australian Assets Co. Hedley Epsom Lord Mayor of London Mackay Companies (trustee) Nation City Company New Quebrada Co. Bessler, Waechter and Co. (Chair)

#### Transportation

#### Shipping:

Allan Line Steamship Co. Bay Steamship Co. (Managing Director) Sale and Co. Merchants and Shipowners

#### Railways:

Argentine Transandine Railway Co. Atlantic and North-West Railway Co. Brazil Great Southern Railway Co. British Columbia Electric Railway Co. Canadian Northern Railway Co. (President) Canadian Pacific Railway Canadian Pacific Railway Canadian Pacific Railway Canadian Pacific Railway Chilian Transandine Railway Co. Dominion Atlantic Railway Co. Duluth, South Shore and Atlantic Railway Co. East Indian Railway Co. Great Northern Railway Co. Inverness Railway and Coal Co. (President) Manitoba South-Western Colonization Railway Monterey Railway, Light and Power Co. New Brunswick Railway Co. Rio de Janeiro Tramway Light and Power Co. (Chair) Sao Paulo Tramway Light and Power Co. (President) St. Paul. Minneapolis and Manitoba Railway Co. Toronto Suburban Railway Co. (President) Toronto Railway Co. (President) Winnipeg Electric Railway Co. Winnipeg Electric Railway Co. (President)

### Cable and Telegraph

Commercial Cable Co. Commercial Cable Co. Direct West India Cable Co. Direct West India Cable Co. Eastern Telegraph Co. Halifax and Bermuda Cable Co. Halifax and Bermuda Cable Co.(Chair)

#### Merchandising

Crawford, Colvin and Co. - Merchants Cunliffe Bros. Merchants Debenham, Gardiner and Co., New York Debenham and Freebody - costumiers, drapers and furriers (Managing Director) Debenhams, Canada Debenhams, Continental Co. Debenhams, Australia Debenhams Dickins and Jones Ltd. (Drapers) Francis Peek, Winch and Co. Tea merchants Harrods (Buenos Aires) Harrods (Managing Director) Harrods Stores Founders' Shares Co. Harvey Nichols and Co. (Chair) Mappin Store (Brazil) (Chair) Marshall and Snelgrove (drapers) Merchant Trading Co Newman, Hunt and Co. - Merchants Societe Anonyme Debenham, Paris (Chair) Textile Securities (holding co. owning Debenhams and Marshall & Snelgrove)

#### Manufacturing

British Metal Corporation (Chair) Cockshutt Plow Co. Columbia River Lumber Co. Dominion Steel Corporation Dominion Iron and Steel Co. Edison and Swan United Electric Light Co. Electrical Development Company of Ontario (Vice- President) Ferro Concrete Ship Construction Co. Manitoba Power Co. Manitoba Bridge and Iron Works Morgan Crucible Co, and Publisher of the "Ironmonger" "Chemist and Druggist" Newcastle-Upon-Tyne Electric Supply Co. Oailvie Flour Mills Co. Shawinigan Water and Power Co. Standard Chemical, Iron and Lumber Co of Canada Toronto Power Co. (President) Western Canada Cement and Coal Co.(President) Whitbread and Co. Canadian General Electric Co.

#### References

- BOWSFIELD, H. ed. 1977 The Letters of Charles John Brydges: 1879-1882 (Winnipeg: Hudson's Bay Record Society) Vol. XXXI
- GALBRAITH, J. 1949 'Land policies of the Hudson's Bay Company, 1870-1913' *Canadian Historical Review* 34: 1-21
- GREEN, M.B. and SEMPLE, R.K. 1981 'The corporate interlocking directorate as an urban spatial information network' Urban Geography 2: 148-160
- HUDSON'S BAY COMPANY, 1875---- Reports and Proceedings of the Governor and Committee of the Hudson's Bay Company (London: Sir Joseph Causton and Sons)
- HUDSON'S BAY COMPANY ARCHIVES, Public Archives of Manitoba, Search Files
- KOTZ, D. 1979 'The Significance of Bank Control over Large Corporations' *Journal of Economic Issues* 13: 407-426
- NEWMAN, P. 1985 *Company of Adventurers* (Toronto: Viking Press) Vol. 1
- NEWMAN, P. 1987 Caesars of the Wilderness: Company of Adventurers (Toronto: Viking Press) Vol. 2
- NEWMAN, P.C. 1991 *Merchant Princes: Company of Adventurers* (Toronto: Viking Press) Vol. 3
- RICE, M.D. and SEMPLE, K.R. 1993 'Spatial Interlocking Directorates in the Canadian Urban System, 1971-1989' Urban Geography 14: 375-396
- SELWOOD, H.J. and BARIL, E.1980 'The Hudson's Bay Company and prairie town development' in *Town and City: Aspects of Western Canadian Urban Development*, ed A. Artibise (Regina: Canadian Plains Studies) 61-94
- SELWOOD, J. 1981 'Mr. Brydges' Bridges' The Beaver Summer 14-21
- SELWOOD, H.J. and RICHTIK, J.M.1995 'Bay Day, May 13, 1912: The Hudson's Bay Company's Land Sale in Edmonton' Unpublished paper presented at Edmonton's Bicentennial Conference, Edmonton, May
- SELWOOD, H.J. and RICHTIK, 1997 'Building a better class district: The Hudson's Bay Company's Edmonton housing scheme' in *The Estevan Papers*, eds B.D. Thraves, A.H. Paul and R.W. Widdis Regina Geographical Studies No. 6 (Regina: University of Regina) 221-238
- SEMPLE, R.K. 1973 'Recent trends in the concentration of corporate headquarters' *Economic Geography* 49: 309-318

- SEMPLE, R.K. 1985 'Toward a quaternary place theory' Urban Geography 6: 285-96
- SEMPLE, R.K. 1996 'Quaternary Places in Canada' in Canada and the Global Economy, ed J.W.H. Britton (Toronto: McGill-Queens University Press) 352-373
- SEMPLE, R.K. and PHIPPS, A.G. 1982 'The spatial evolution of corporate headquarters within an urban system' Urban Geography 3: 258-279
- SKINNER, T. 1875----- *The Stock Exchange Yearbook* (London: Cassell, Petter & Galpin)
- SKINNER, T. 1880-1924 *Directory of Directors* (London: Thomas Skinner and Co)
- STANWORTH, P. and GIDDENS, A. 1975 'The Modern Corporate Economy: Interlocking Directorships in Britain, 1906-1970' Sociological Review 23: 5-29
- TWAY, D. 1963 'The influence of the Hudson's Bay Company upon Canada, 1870-1899' Unpublished Ph.D. Thesis, University of California at Los Angeles
- WHEELER, J.O. 1986 'Corporate spatial links with financial institutions: the role of the metropolitan hierarchy' *Annals, Association of American Geographers* 76: 262-274

## Causes of the billion-dollar drought in North America in 1999 - a verification study

E.R Garnett University of Saskatchewan

## Introduction

In August and September, 1999 the Toronto Globe and Mail carried the following headlines: "U.S. drought could last into 2000," "Drought crop losses reach \$800 million, and "More States may get drought aid." The dry spell that began in July 1998 became the worst drought in a generation to affect states from New England to Kentucky leaving some farmers with 100 per cent losses on crops such as corn, soybeans and hay. States affected in August were as follows: Pennsylvania, Maryland, New Jersey, West Virginia, New York, Delaware and Kentucky. Farm disasters were declared in New York, New Jersey, Pennsylvania, Maryland, West Virginia, Connecticut, Ohio, New Mexico and Arizona.

Monitoring of sea surface temperature anomalies in the Niño-3 region of the east equatorial Pacific for the period September-July 1998/99 revealed weak to moderate La Niña conditions.

In 1969 Bjerknes suggested that regular monitoring of the sea surface temperatures in the tropical east Pacific was indispensable for long-range forecasting in North and South America. Since then hundreds of studies have confirmed his hypotheses. Garnett and Khandekar in 1992 found that El Niño (La Niña) conditions during the summer months tended to favor the spring wheat crop. In 1997 Garnett, Babb and Khandekar substantiated this when they found correlations of +. 59 and +. 56 between Nino-3 SST anomalies in April and May and July rainfall over the Canadian prairies. Hsieh, Benyang and Garnett found a correlation of +. 63 between June and July precipitation and spring wheat yield. A similar El Niño/ La Niña impact is expected south of the Canada/U.S.A. border during the summer months.

## U.S.A. Drought in Some Respects Forecast a Year in Advance

Based on La Niña conditions during the fall of 1998 Professor James E. Newman an Emeritius Professor of Purdue University speculated that dry out in 1999 could occur all the way from Texas into Alberta.

According to the U.S. Drought monitor as of September 1999 moderate to extreme drought prevailed from Texas up into the northeast of United States along the Appalachian Mountains. Minor drought was also evident in the northwestern U.S.A.

## Drought Its Causes and Effects

In the book <u>Drought Its Causes and Effects</u> by Ivan Ray Tannehill in 1947 (written ten years before the noteworthy 1957/ 58 El Niño/Southern Oscillation event) Tannehill makes a number of what now seem to be timeless suggestions:

- 1)"In almost every national (U.S.A.) dry year the Pacific High Pressure is expanded. High Pressure goes with low temperatures, and there is now a suspicion that a relatively cold Pacific causes our desert areas to expand and tends to reduce the rainfall over the nation as a whole."
- 2)"Thus while we see that the Pacific largely controls the amount of rain which is precipitated over the United States, the Atlantic High controls to some degree the distribution of the rainfall. At times there is a westward extension of this high in the neighborhood of Bermuda. This extension is known as the Bermuda High."
- 3)"We strongly suspect that the Pacific Ocean is the monster in the back yard which seems to control our national rainfall, exerting a power that is second only to the sun itself."

Along similar lines Jerome Namais (1980) proposed what Daniel Cayan of Scripps Institute of Oceanography has coined the "Namais Triad" whereby three anticyclones develop one over the Pacific Ocean, one over the Atlantic Ocean and one over continental U.S.A. In 1980 in the <u>Journal of Interdisciplinary History</u> he wrote, "Whatever the mechanism involved, there is some statistical evidence suggesting that dry, warm springs over the plains of the United States tend to be followed by hot, dry summers. Further, hot, dry summers in the plains have a tendency to persist from one year to the next."

As research analyst in the Weather and Crop Surveillance Department of the Canadian Wheat Board the writer observed the "Namais Triad" like patterns in 1980, 1983 and 1988 years of serious drought in North America.

### How Did These Three High Pressures Behave in 1999?

In March the Pacific High was pronounced while the Atlantic was non-existent. There was a slight high pressure anomaly south of Hudson Bay.

During April all three high pressures intensified with the Pacific High beginning to encroach over western North America.

During May the Pacific High retreated and weakened while the Atlantic High or its extension the Bermuda High migrated over the Maritimes of Canada.

In June the Pacific High Pressure anomaly vanished while the Atlantic High and its counterpart the Bermuda High intensified over eastern North America. It appeared that the Bermuda High moved north from its normal position causing the extreme drought in the eastern U.S.A.

During July the Pacific High Pressure gained some strength while Atlantic and Bermuda High disappeared.

Based on sea surface temperature anomalies at the Niño-3 region during this period La Niña appeared to weaken, strengthen, weaken, strengthen and then weaken in July with the Climate Prediction Center in Washington D.C. rating the event during this period as weak to moderate La Niña event.

## Predictions and Verification over the Canadian Prairies

Based on composite analysis published by Garnett et al in 1998, E.R. Garnett speculated in March 1999 at the Canadian Association of Geographers meeting in Lethbridge that dryness problems would occur along the Alberta-Saskatchewan border and Peace River district much like they did in 1998. The techniques presented were suggesting a very cool but dry June and July over the Canadian Prairies.

Similarly the Canadian Institute for Climate Studies in Victoria was suggesting dry conditions in that region of the Canadian Prairies.

By early August it was evident that the Canadian Prairies had experienced a cool and wet June and July with the Canadian spring wheat crop being about two-four weeks late in development. July was about 2°C. cooler than normal over most of the Canadian Prairies. The dryness problems of 1998 persisted in the Peace River District. The region considered to be drought prone (Saskatchewan-Alberta border) experienced 125-200% of normal rainfall during June. The flow over the Pacific North American teleconnection region had been strongly zonal each month since September of 1998.

## Forecast for the Winter of 1999/2000

In September during the Prairie Division of the Canadian Association of Geographers Meeting in Winnipeg, La Niña was re establishing itself suggesting that the winter would be cooler than normal with higher than normal precipitation over the Canadian Prairies. It was also suggestive of continuing multiseason multiyear dryness problems in North America.

It was also stated that if this forecast was correct it would have marked the fourth out of five winters that Garnett and Khandekar had forecast over the Canadian Prairies. This forecast was based on the work of Halpert and Ropelewski, 1992. Shabbar and Khandekar, 1996 and the writers experience. The winter of 1998/99 was milder than Garnett had anticipated because of factors related to the Aleutian Low.

## Conclusions

- 1. The drought that affected North America in 1999 was probably the most severe since the 1988 drought.
- 2. The main causes were La Niña, the North Atlantic Oscillation and its extension the Bermuda High.
- 3. The Pacific High though dominant in the spring months appeared not to play a major role in the drought as both it and La Niña weakened between spring and summer.
- 4. The strongest zonal flow in decades over the Pacific North American (PNA) teleconnection index region brought cool, wet conditions to key spring wheat and U.S. corn growing regions of North America.
- 5. Temperature levels were correctly forecast over the Canadian prairies but June and July rainfall was much greater than anticipated in March.

## References

- BJERKNES, J., 1969 'Atmospheric teleconnections from the equatorial Pacific' *Mon. Weath. Rev.*, 97: 163-172
- GARNETT, E.R. and KHANDEKAR, M.L. 1992 'The impact of largescale atmospheric circulations and anomalies on Indian monsoon droughts and floods and on world grain yields- a statistical analysis' *Agricultural and Forest Meteorology*, 61: 113-128
- GARNETT, E.R., KHANDEKAR, M.L. and BABB, J.C. 1998 'On the utility of ENSO and PNA indices for long-lead forecasting of summer weather over the crop-growing region of the Canadian Prairies' *Theor. Appl. Climatol.* 60: 37-45
- HALPERT, M.S. and ROPELEWSKI, C. 1992 'Surface temperature patterns associated with the Southern Oscillation' *Journal of Climate*, 577-593
- HSIEH, W. H., BENYANG, T. and GARNETT, E.R., 1999 'Teleconnections between Pacific sea surface temperatures and Canadian prairie wheat yield' *Agricultural and Forest Meteorology*, 209-217
- LEFAIVRE, L., KHANDEKAR, M.L. and GARNETT, E.R., 1997 Proceedings of the Long-range Weather and Crop Forecasting Working Group, Dorval, Quebec, Canada.

NAMAIS, J. 1980 'Severe drought and recent history' Journal of Interdiscilinary History, X:4 697-712

SHABBAR, A. and KHANDEKAR, M.L. 1996 'The impact of El Niño-Southern Oscillation on the temperature field over Canada' *Atmosphere-Ocean*, Vol.34 No.2

TANNEHILL, I.R. 1947 *Drought, its Causes and Effects,* Princeton, N.J. University Press

# The utility of global teleconnection indices for long-range crop forecasting on the Canadian Prairies

#### Steven M. Quiring (Centre for Earth Observation Science), University of Manitoba) Danny Blair, University of Winnipeg

Abstract: This study examines the link between Red Spring wheat yields in Saskatchewan and global teleconnection indices and local meteorological conditions. The development of a long-range crop forecasting model indicates that a combination of teleconnection and meteorological variables can be utilized to successfully explain much of the variance in crop yield in Saskatchewan's crop districts. Overall, this model explains more than 62% of the variance in crop yield. However, this relationship contains a considerable amount of spatial variation. The relationship between crop yield and teleconnection indices and local meteorological variables is strongest in the northern and western regions of Saskatchewan, and weakest in the central and southeastern districts. It is apparent that the physical mechanisms that link the teleconnection and local meteorological variables to crop yield may operate on a relatively small spatial scale because many variables were only important in welldefined subareas of the study region. Importantly, the study shows that teleconnection indices other than those currently used (e.g., ENSO, PNA, and North Pacific SSTs) may be able to contribute to the forecasting of prairie crop yields. Especially noteworthy is that Atlantic sector teleconnection patterns may have more of an influence on prairie climate and, therefore, crop yield than the literature suggests.

### Introduction

Interannual and spatial variability of crop yields on the Canadian prairies -- or anywhere, for that matter -- is almost always largely determined by variability in the weather, particularly in the growing season (Babb et al. 1997). Consequently, an accurate forecast of average weather conditions (i.e., climate conditions) likely to occur in upcoming months and seasons is a holy grail, of sorts, for agricultural producers, for it would facilitate better decisions about what to plant, when to plant (and perhaps even whether to plant), and how best to make use of fertilizer, water and financial resources (Duvenaud 1995). Furthermore, reliable long-range forecasts could also provide substantial economic benefits to agricultural marketing agencies (Rimmington and Nicholls 1993; Babb et al. 1997; Meinke and Hammer 1997), including the Canadian Wheat Board (CWB). These agencies could incorporate climate forecasts into their cropvield models, the output of which is used to develop competitive marketing strategies. Unquestionably, there are many means by which accurate long-range forecasts of anomalous climate conditions and their impacts on crop production could help producers maximize their profits (Garnett 1997).

One of the most promising developments in climate forecasting is the inclusion of teleconnections in forecast models. Indeed, most long-range forecasts are, in one way or another, based on teleconnections (Nicholls and Katz 1991). A teleconnection, or a teleconnection pattern, pertains to a persistent, large-scale circulation anomaly within the atmosphere (and usually the oceans). Teleconnection patterns are often referred to as preferred modes of low-frequency variability, typically lasting for weeks, months, or even years, and are associated with changes in planetary-scale wave patterns. Hence, they commonly affect very large areas, including entire ocean basins and continents. All teleconnections are naturally occurring aspects of the quasi-chaotic atmospheric system and it is generally thought that they arise as a result of internal atmospheric dynamics (Glantz 1991), although it is becoming increasingly apparent that sea-surface temperatures and ocean circulation patterns play a vital role in the creation of, and persistence of, teleconnections. However they are created, teleconnections are often associated with widespread and anomalous temperature and precipitation patterns, in response to anomalous pressure and wind patterns, which are, in turn, usually associated with anomalous jet-stream locations and intensities.

Given the connection between weather and crop yields, it is not surprising that many researchers have investigated the utility of teleconnections in long-range crop forecasting (e.g., Abawi et al. 1995; Meinke et al. 1996; Meinke and Hammer 1997), as opposed to long-range *climate* forecasting, but few of these studies have considered the Canadian situation. Those which have done so have either used only a limited number of teleconnection indices (e.g., Bonsal et al. 1993; Garnett et al. 1997, 1998) or coarse spatial resolutions (e.g., Shabbar and Khandekar 1996; Shabbar and Barnston 1996). Thus, in the opinion of the authors, there is a need for further research into the utility of teleconnections in longrange crop forecasting for Canada. Some of the more well-known teleconnection indices, such as the Southern Oscillation Index (SOI). the Pacific/North American (PNA) index, and Pacific sea surface temperature (SST) have been used in Canadian-based cropprediction schemes (Babb et al. 1995, 1997), but there is, in our opinion, a need for investigations into the utility of some of the other major indices. Additionally, there is a need for an examination of the relationship between crop yields and teleconnections at the crop-district level, rather than prairie or province-wide. A finer spatial resolution may result in more accurate models by contributing to a better understanding of which teleconnections have the greatest influence on regional crop yields.

In response to these needs, the research reported here investigates the utility of teleconnection indices in the forecasting of Red Spring wheat yields at the crop-district level in Saskatchewan, where much of Canada's grain is produced.

## **Teleconnections and Forecasting**

The discovery of what we now recognize as teleconnections is attributed to Sir Gilbert Walker (1923, 1924), who, in his attempts to explain drought-producing variations in the Indian monsoon, identified a number of low-frequency circulation systems within the global climate. However, the term teleconnection was not actually used until 1935, when Angstrom used it to describe an "atmospheric seesaw" now known as the North Atlantic Oscillation (NAO) (Glantz 1991). Moreover, the importance of teleconnections was not widely appreciated until the early 1970s, following intensive research into the 1972-73 El Niño event (Glantz 1991).

Without doubt, El Niño -- or, more correctly, El Niño/Southern Oscillation (ENSO) -- is the most widely known and extensively studied teleconnection pattern (Lamb and Peppler 1991). As is the case with most teleconnections, ENSO involves large-scale oceanatmosphere interactions. Indeed, it has become abundantly clear that the tropical-Atlantic and tropical-Pacific SST patterns have much influence on the atmospheric circulation of the tropics (Lamb and Peppler 1991; Rasmusson 1991). These effects then pass through the rest of the global climate system as a series of planetaryscale waves (Mo and Livezey 1986). Of particular significance is that climate events with major social and economic impact are, almost without exception, the signature of long-lived planetary scale circulation pattern anomalies (Mo and Livezey 1986). These quasistationary flow patterns are maintained either remotely from the tropics, or through natural variability in the extratropical atmosphere.

Consequently, an understanding of the physical mechanisms that allow local anomalies to be extended globally is essential to long-range forecasting (Gray and Sheaffer 1991; Tribbia 1991). Walker's pioneering work initiated our understanding of these processes, and laid the groundwork for those studies which have since contributed to our understanding of the connections between mid-latitude temperature and precipitation anomalies and largescale circulation systems, including those studies by Bjerknes (1969), Namias (1978, 1980), Wallace and Gutzler (1981), Yarnal and Diaz (1986), Ropelewski and Halpert (1986, 1987), Barnett and Preisendorfer (1987), White *et al.* (1993), Yin (1994), Hurrell (1996), Shabbar and Barnston (1996), Shabbar and Khandekar (1996), and Stone *et al.* (1996), to name but a few.

It is important to keep in mind that teleconnections do not assist in the production of long-range *weather* forecasts but, instead, longrange *climate* forecasts. That is, teleconnections facilitate the forecasting of the *average* weather conditions to be expected over some period of time, typically on the order of months or seasons. They do not present opportunities for long-range forecasting of the timing and characteristics of specific, short-period meteorological events. Because the atmospheric system is substantially chaotic, the forecasting of weather events beyond 10-15 days is extremely limited (Cane 1991), but teleconnections allow the time frame of predictability to be lengthened, largely because of the thermal inertia of the oceans, the long life-cycle of SST anomalies, and the phase-locking of the SST variations to the annual cycle (Nicholls and Katz 1991). In other words, the coupling between the atmosphere and the more slowly varying oceans facilitates *climate* prediction over time scales of months, seasons, years, and even decades (Uppenbrink 1997; Sutton and Allen 1997). Still, it must be appreciated that climate forecasts, by definition, are less resolved than weather forecasts, both spatially and temporally. Hence, the same limitations apply to long-range cropyield forecasts.

Whether they be used in climate forecasts or crop-yield forecasts, the state of teleconnections must be represented in some quantitative fashion. To this end, teleconnection indices are routinely calculated by several climate-data distribution centres, most notably for the northern hemisphere, by the Climate Prediction Center (CPC) in the United States. It is not within the scope of this paper to provide detailed explanations and discussions of all available teleconnection indices. Instead, the reader is advised to connect to that part of the CPC website dedicated to Northern Hemisphere Teleconnection Indices, currently at http:// www.cpc.ncep.noaa.gov/data/teledoc/telecontents.html. Other useful sources of information regarding teleconnection indices used in the research reported here include Wallace and Gutzler (1981), Mo and Livezey (1986), Leathers et al. (1991), and Hurrell (1996). The reader should also note that the acronyms for the teleconnections discussed within this paper are listed in Table 1.

### Long-Range Forecasting for the Canadian Prairies

Canada lags somewhat behind the other major grain-growing nations in its efforts to produce long-range forecasts and to predict grain yields. This may be because the influence of many of the major global teleconnections on Canadian weather is not as clear as in other parts of the world (especially Australia). Nevertheless,

Name of teleconnection pattern	Period of prominence measurement	Description									
North Atlantic Oscillation (NAO)	all months	North-south dipole of pressure anomalies; centred over Greenland and 35-40°N.									
East Atlantic pattern (EA)	all months except May to August	Structurally similar to NAO, but anomaly centres are positioned to the southeastward.									
East Atlantic Jet (EAJET)	April to August	North-south dipole of anomalie centred over the eastern North Atlantic and Northern Africa/th Mediterranean.									
Western Pacific pattern (WP)	all months	North-south dipole of pressure anomalies; centred over the Kamchatka peninsula and southeastern Asia (in summer and fall a third centre is added over the Beaufort sea).									
Eastern Pacific pattern (EP)	all months except August and September	North-south dipole of pressure anomalies; centred near Alaska/ west coast of Canada and Hawaii.									
North Pacific pattern (NP)	March to July	Two anomaly centres; one spans western and central North Pacific and the other is centred over eastern Siberia									
Pacific/North American pattern (PNA)	all months except June and July	Pattern of height anomalies; centres with similar sign are found south of the Aleutian Islands and over the southeast U.S. and centres of opposite sign are located near Hawaii and over the inter-montane region of North America.									
Tropical/North Hemisphere pattern (TNH)	November to February	Two anomaly centres; one centred over the Gulf of Alaska and the other over Hudson Bay									
Pacific Transition (PT)	May to August	Wave-like pattern of anomalies which extends from the Gulf of Alaska to the Labrador Sea and is aligned along 40°N									
Southern Oscillation Index (SOI)	all months	Standardized difference between sea level pressure in Tahiti and Darwin.									
Pacific SST (specifically: Niño-1+2, Niño-3, Niño-4, and Niño-3.4 regions)	all months	Expressed as temperature departures from the monthly long-term mean.									
North Atlantic, South Atlantic, and Tropical SST	all months	Expressed as temperature departures from normal.									

*Table 1:* A description of the teleconnection patterns used in this study (CPC, 1999)
some notable teleconnection-related research has been done. For example, Shabbar and Khandekar (1996) analyzed the impact of the ENSO on the temperature field over Canada. Shabbar and Barnston (1996) used canonical correlation analysis (CCA) to forecast three-month mean surface temperature and precipitation across Canada. Their predictors were quasi-global SST, NH 500 mb geopotential heights, and antecedent temperature values.

Furthermore, a number of studies have linked North Pacific SSTs to winter weather over North America. For example, Namias (1969, 1972, and 1986) demonstrated that the occurrence of a large area of anomalously cold water in the North Pacific combined with a large area of anomalously warm water off the coast of California and down into Central America produces a unique Rossby wave pattern. This Rossby wave pattern results in warm and dry conditions over western North America and cool and wet conditions over eastern North America. If the SST pattern is reversed, the related weather patterns tend to be reversed, too.

Knox and Lawford (1990) used the PNA, the NAO, and NP teleconnection indices to investigate the relationship between NH circulation and pressure patterns at the 500 mb level. They established that the phase of the PNA is strongly related to prairie precipitation. Wet months are associated with the negative phase and dry conditions are associated with the positive phase. They also found that the NAO and NP are strongly related to spring precipitation on the prairies.

Bonsal *et al.* (1993) used north Pacific SST anomalies to predict the occurrence of extended growing-season dry-spells on the Canadian prairies. Their study verified the previous work of Knox and Lawford (1990), and showed that dry-spells on the prairies are associated with positive height anomalies in the mid-troposphere (Knox and Lawford 1990). Anomalies in the north Pacific SSTs, North American snow cover, or soil moisture conditions may be responsible for these changes in the large-scale circulation patterns. Bonsal *et al.* (1993) also found that the severity of the dry-spells was influenced by the duration and persistence of the SST anomaly, and the height of the 500 mb ridge. Interestingly, it was noted that when the SST anomaly persisted for longer than nine months a dry-spell always occurred. Garnett *et al.* (1997) examined a variety of teleconnection relationships for the Canadian prairies. A relationship was found between SSTs in the eastern equatorial Pacific in April and July precipitation on the prairies. This is particularly important because July precipitation very much affects both the quantity and the quality of the Red Spring wheat yield. In a subsequent study, Garnett *et al.* (1998) developed a predictive model, using PNA and ENSO, that explains up to 64% of the summer temperature variation and 47% of the summer precipitation variation. They suggest that these regression models can be used to develop a skillful forecast of summer weather over the Canadian prairies with a lead time of two to four months.

Babb et al. (1997) used monthly temperature and precipitation variables to develop a model of Red Spring wheat yields on the They note that precipitation and temperature prairies. characteristics over the growing region have a major influence on wheat yield and protein content. They examined the entire prairie growing region, and found a relatively strong relationship between July mean total precipitation and mean yield. Two different models were developed. The first model incorporated observations taken up to the end of June and used four regressor variables: mean total precipitation for September through May, mean total precipitation in June, mean temperature for May, and mean temperature for June. The model produced an  $R^2$  value of 0.53. The second model utilized data up until the end of July. It used the four variables named above as well as July precipitation. The inclusion of July considerably improved the fit of the model ( $R^2 = 0.71$ ). Of course, as more of the growing-season climate data is incorporated into the modeling process, one should expect more accurate forecasts of yield. The cost of waiting, however, is a reduction in the utility of the forecast. This is one of the problems that faces modelers, as a whole.

Largely as a result of research of the sort just noted, there appears to be general agreement that fluctuations in ENSO, PNA, and SSTs provide the best opportunities for the creation of good long-range forecasts of Canadian climate and crop yields. To date, however, very few studies have investigated the link between crop yield and many of the less well-known teleconnection indices. It is this that we are attempting to address in the research reported here.

Of course, factors other then those represented by the teleconnection and SST variables used in this study have a major influence on the quality and quantity of Canadian prairie wheat yields. The inclusion of variables measuring soil fertility, soil moisture, plant diseases, insects, and weeds would undoubtedly help to reduce the unexplained variance in Red Spring wheat yields (Bushuk 1982). These variables were not included because they are outside of the scope of this paper.

# Study Area

Red Spring wheat is the dominant wheat class grown in Western Canada, accounting for 69.3% of the total wheat production in the prairie region (Babb *et al.* 1997). Saskatchewan accounts for more than 50% of the 25 million tonnes of annual spring wheat production on the Canadian prairies (Garnett *et al.* 1997). Thus, our study area consists of the 20 crop districts in the province of Saskatchewan (Figure 1).

The selected study region encompasses a wide range of climate conditions. The southwestern corner of Saskatchewan is relatively arid, while the northeastern corner is relatively moist. This distinct moisture gradient has a strong influence on the average yield across the region. Overall, summer evapotranspiration rates exceed the climate's ability to supply moisture, so there is a negative moisture index (Scott 1995).

The study region is associated with extreme continentality. Monthly average temperatures range from colder than  $-15^{\circ}$ C to warmer than  $+20^{\circ}$ C (Scott 1995).

There is a wide variety of soil types found within Saskatchewan. The transition from semi-arid to subhumid moisture zone also marks a transition in the dominant soil groups from Brown and Dark-Brown, to Black and Dark-Gray Chernozems according to the Canadian Soil Classification System (Scott 1995). This sequence represents the relationship between increasing levels of moisture, organic material and soil organisms, and soil type. Gleysols may also occur in areas of poor drainage and Solonetzic soils occur



*Figure 1:* Distribution of meteorological stations within Saskatchewan crop districts.

where the parent material is highly saline. Chernozemic soils have high amounts of organic material, good structural properties, low available moisture contents and high nutrient levels. They are wellsuited for growing cereal grains with low moisture demands.

## Data

#### **Crop Yield Data:**

Red Spring wheat yield (1961-1997) was selected for study because it is the most abundant wheat class grown in Western Canada (Babb *et al.* 1997). All yield data was provided by the Canadian Grain Commission (CGC). The crop yield and precipitation conditions over the 37 year study period are summarized for each crop district in Table 2.

**Table 2:** Summary of crop district yield and precipitation conditions, 1961-1997. (Source: Atmospheric Environment Service, Canadian GrainCommission)

Crop Districts	Mean Yield (bu/a)	Min. Yield (bu/a)	Max. Yield (bu/a	Mean Precip. (mm)	Min. Precip. (mm)	Max. Precip. (mm)
1a	23.98	3.6	34.7	439.36	253.21	650.75
1b	25.49	5.7	37.3	449.91	237.60	646.24
2a	22.84	7.8	35.4	412.36	254.03	598.33
2b	26.75	11.2	37.6	398.54	220.16	548.03
3an	23.04	5.9	33.4	373.48	241.68	502.57
3as	22.71	3.3	31.7	382.62	228.93	509.36
3bn	23.58	7.2	33.5	354.82	221.09	506.50
3bs	22.68	3.2	35.1	350.84	206.89	492.49
4a	20.30	4.7	33.4	380.13	242.73	551.54
4b	22.49	6.0	36.4	349.42	230.61	474.91
5a	26.45	6.3	35.6	433.77	211.09	575.85
5b	27.40	8.6	35.8	445.40	243.14	591.44
6a	24.66	7.9	32.4	379.41	230.69	540.96
6b	25.19	7.0	36.4	359.84	251.51	499.06
7a	26.55	8.7	38.6	320.75	220.83	439.64
7b	27.10	13.6	37.9	375.84	293.15	502.70
8a	28.16	13.8	41.9	452.81	311.89	636.49
8b	28.43	12.7	40.2	404.09	216.42	559.93
9a	26.90	9.9	39.0	415.36	288.15	555.62
9b	28.02	14.9	36.2	406.30	308.26	499.41

# Meteorological Data and the Year of Harvest Variable

The monthly precipitation totals and mean monthly temperatures were acquired from Environment Canada's Atmospheric Environment Service (AES). A total of 548 meteorological stations were used to calculate the averages of the monthly mean temperatures and precipitation totals for the crop districts in every month (Figure 1). Representative stations were chosen in locations having more than one meteorological station and every attempt was made to choose stations that provided the best areal coverage for each crop district in order to prevent undue weighting.

It has been noted in other studies (Babb *et al.* 1997) that there has been a linear increase in average annual yield over time. This trend has been attributed to advances made in farming, including the use of improved varieties of wheat, increased use of fertilizers, and better weed control and tillage practices. With this in mind, the year-of-production was included as one of the independent variables in the regression models. It serves as a proxy variable representing these technological advances in farming.

## **Teleconnection Data:**

The monthly teleconnection data were obtained from the Climate Prediction Center (CPC) of the National Oceanographic and Atmospheric Administration (NOAA) in Washington, D.C.. It monitors thirteen prominent teleconnection patterns that can be identified in the extra-tropical northern hemisphere throughout the year. The following teleconnections and climatological indices were selected for inclusion in this study: Southern Oscillation Index (SOI), Pacific sea surface temperatures (SSTs) (specifically: Niño-1+2, Niño-3, Niño-4, and Niño-3.4 regions), tropical SST, North Atlantic Oscillation (NAO), northern and southern Atlantic SST, East Atlantic pattern (EA), East Atlantic Jet (EAJET), Pacific/North American pattern (PNA), Western Pacific pattern (WP), Eastern Pacific pattern (EP), North Pacific pattern (NP), Tropical/Northern Hemisphere pattern (TNH), and Pacific Transition (PT). Many of these particular indices, especially the ENSO-related and SST indices, were selected because they are statistically correlated to the North American climate. The rest of the teleconnections were selected for exploratory purposes. That is, although the literature does not contain specific evidence that connects them to the Canadian prairie climate, it was thought that it would be worthwhile to determine whether they are useful for improving long-range forecasts over the study area.

It should be noted that there is an important difference between SSTs and atmospheric teleconnections. The Niño and tropical SSTs are based on the surface temperature of the earth's oceans during a given month while teleconnections, as defined earlier, are persistent atmospheric anomalies. Although SSTs are not teleconnections in the true sense of the word, they can affect atmospheric flow and weather patterns around the world. Therefore, they have been included in the model.

The CPC uses the Rotated Principal Component Analysis (RPCA) of Barnston and Livezey (1987) and applies it to 700 mb height anomalies in order to calculate its teleconnection indices (excluding the SOI and SST indices). Ten patterns, or eigenvectors, are selected for each month from the height anomaly fields for the three-month period centred on that month. The RPCA procedure is based on the entire flow field and not just height anomalies at a few selected locations. The amplitude of each teleconnection pattern is determined by using a least-squares regression analysis. The amplitudes are determined such that the combined sum of their products explains the maximum spatial structure of the observed height anomaly field during the month. For each pattern, the amplitudes are then assembled into a continuous time series and standardized for each month independently.

In addition to the teleconnection values from the current year of harvest for the months of January through July, lag teleconnection values were also entered as possible predictor variables for the crop-district models being developed. These lag values pertain to the year prior to harvest, and are expressed as seasonally averaged anomalies. These lag values were included to test the validity of the hypothesis that teleconnections have both simultaneous and lag influences on the climate of the prairies.

### **Construction of the Long-Range Forecasting Model:**

The utility of the teleconnection indices and the meteorological data in the forecasting of Saskatchewan crop yields was investigated using a stepwise multiple regression technique. In multiple regression, the variation of a single dependent variable is explained by a number of predictor variables. The concept of least-squares is used to obtain the best-fit surface through multi-dimensional space (Shaw and Wheeler 1994). Stepwise regression is an objective method combining the efficiency of the forward inclusion method with the thoroughness of the all-possible regressions.

procedure. In the stepwise regression procedure all predictor variables are re-examined at each stage to identify those that might have become superfluous following the introduction of subsequent predictors, or to allow the use of those predictors previously excluded from the model. At each step, inclusion and exclusion are possible at the selected significance levels (Shaw and Wheeler 1994). Using standard procedure as a guide, the criteria chosen for the stepwise regression models were as follows: probability of F for entry: less than or equal to 0.05, and probability of F for removal: greater than or equal to 0.10.

The stepwise regression method was chosen for this study because it provides an objective automated method to find the bestfit surface. Shaw and Wheeler (1994) recommend this procedure when the goal of the researcher is to produce a predictive model with the highest possible  $R^2$  values. Although this method can be problematic since it relies solely on statistical criteria and is less concerned with theoretical delicacies, it was deemed suitable for this study because one of the principal objectives was to investigate to what degree teleconnection and meteorological information could be used to forecast crop-yields.

A simple three step process was used to develop the crop-yield model. First, all of the meteorological variables (as well as the proxy variable representing technological advances) were used to create a stepwise regression model for Red Spring wheat yield for each crop district. Then all of the teleconnection variables were used to create a second set of models for Red Spring wheat yield for each crop district. The final stage used a simple inclusion method to combine all of the meteorological variables selected in step one with all of the teleconnection variables selected in step two. This resulted in a unique regression model being generated for each of the 20 crop districts in Saskatchewan.

The goodness-of-fit for any given model is measured by the coefficient of multiple determination,  $R^2$ , which is defined as the ratio of variation attributable to the regression relation compared to the total variation in the response variable. Thus,  $R^2$  varies between 0 and 1, where values closer to 1 denote a better fitting model. Increasing the number of predictor variables in a model can only increase the  $R^2$ , or leave it unchanged. Therefore, it is

better to use a modified measure of goodness-of-fit called the adjusted coefficient of multiple determination. The adjusted  $R^2$  introduces a slight penalty for each predictor variable introduced into the model.

The significance of any model can be tested using an F-statistic, which is the ratio between explained variance (regression) to unexplained (residual). The standard error of the estimate, or root mean square error, provides an estimation of the standard deviation of the residuals. The better the model fits, the closer to zero will be the standard error of the estimate (Garnett *et al.* 1998).

# **Model Results**

#### Non-Teleconnection Variables Selected by the Model:

On average, variations in the local meteorological conditions and/or technological innovation (year-of-harvest) were able to explain almost 45% of the variation in Red Spring wheat yield, but the results varied significantly between crop districts. A summary of the correlations is presented in Table 3.

Crop District 6b (hereafter CD6b) produced the best-fitting model, with an adjusted  $R^2$  of 0.754, and CD8a was found to have the lowest degree of explanation with an adjusted  $R^2$  of 0.124. Hence, approximately 75% of the variation in crop yield was explained by the linear combination of meteorological variables selected by the model in CD6b, while only about 12% of the variation in crop yield was explained in CD8a.

All models include between one and six meteorological/year of harvest variables. June and July precipitation were the most frequently selected variables; both were chosen in 16 out of 20 crop districts (Figures 2 and 3). March, April and May precipitation totals were also found to be significant in the model, but were selected less frequently than the summer precipitation variables. From the available temperature variables, July mean temperature was selected in six crop districts (Figure 4). May and June mean temperatures were selected in two and four districts, respectively. Interestingly, the year-of-harvest variable was found to be quite an important variable, providing a significant degree of explanation in eight crop districts (Figure 5). Altogether, non-lag precipitation *Table 3:* Correlations between meteorological/year of harvest variables and crop yield.

Crop Districts	Non-teleconnection variables		
-	R Square	Adj. R Square	RMSE
1a	0 382	0 344	4 04
16	0.002	0.011	3.88
	0.707	0.401	0.00
Za	0.707	0.009	3.00
2b	0.491	0.425	4.04
3an	0.551	0.509	4.43
3as	0.587	0.548	4.09
3bn	0.534	0.490	4.64
3bs	0.506	0.442	5.02
4a	0.633	0.572	4.28
4b	0.520	0.458	5.44
5a	0.350	0.311	4.00
5b	0.309	0.267	4.03
6a	0.284	0.241	4.65
6b	0.797	0.754	3.20
7a	0.693	0.629	3.84
7b	0.718	0.670	3.26
8a	0.150	0.124	6.13
8b	0.481	0.449	4.35
9a	0.633	0.586	3.66
9b	0.431	0.358	3.70

variables were chosen a total of 43 times and non-lag temperature variables were chosen 12 times. Lag variables (conditions in the year prior to harvest) were only selected five times. Table 4 summarizes the frequency that each of the non-teleconnection variables was used in the models.

The results reveal, not surprisingly, that precipitation is the most important weather variable for explaining the variation in crop yields. As was determined by previous research (Babb *et al.* 



Figure 2: Crop districts where June precipitation was included in the model.



Figure 3: Crop districts where July precipitation was included in the model.

*Table 4:* Frequency of meteorological/year-of-harvest variables selected by the model.

VARIABLE	# OF OCCURRENCES
July precipitation	16
June precipitation	16
May precipitation	7
April precipitation	3
March precipitation	1
Total Precipitation Variables	43
July mean temperature	6
June mean temperature	4
May mean temperature	2
Total Temperature Variables	12
Sept-Oct-Nov lag precipitation	1
Jun-Jul-Aug lag precipitation	1
Jun-Jul-Aug lag mean temperature	3
Total Lab Variable	5
Year-of-harvest	8

1997), July precipitation was found to strongly influence Red Spring wheat yield. June precipitation was selected as a significant variable in an equal number of crop districts and therefore should also be considered an important predictor of crop yield.

The spatial distribution of the crop districts in which June and July precipitation was found to be influential is very revealing. The northeast corner of the study area is the only location in Saskatchewan where both June and July precipitation were not found to have a statistically significant effect on crop yield (Figures 2 and 3). This corresponds to the area of maximum precipitation in the study region. An examination of the mean annual precipitation totals for Saskatchewan crop districts reveals that June and July precipitation variables were not important in CD8a and CD8b where both annual precipitation totals exceed 400 mm. In



*Figure 4:* Crop districts where July precipitation was included in the model.

other crop districts that have relatively high annual precipitation totals (e.g., CDs 1a, 5b, and 6a) only one of the summer precipitation variables (either June or July) was selected. Generally, it appears that the more precipitation a crop district receives, the less valuable the June and July precipitation variables are in explaining crop yields.

The pattern of districts in which July mean temperature was chosen is harder to explain.

The crop districts are generally arranged in a linear feature stretching from the southeast corner of Saskatchewan towards the northwest corner (Figure 4), roughly corresponding to those districts defined as part of the semi-arid moisture zone (CDs 1a, 2a, 2b, 6a, 6b, and 7b) (Bullock, *pers. comm.*). It is, perhaps, surprising that the crop districts classified in the sub-arid moisture zone (CDs 3as, 3an, 3bs, 3bn, 4a, and 4b) did not also have July mean temperature (which, in part, determines moisture stress) selected as a significant variable considering that moisture availability is one of the primary limiting factors of crop yield (Bullock 1998). Indeed, July mean temperature tends to be inversely correlated with wheat yield (Babb



*Figure 5:* Crop districts where the year-of-harvest was included in the model.

*et al.* 1997), since higher mean temperatures in July put additional moisture stress on the crop. Thus, even if there is significant rainfall, the higher than normal temperatures will cause much of the precipitation to evaporate before it can be absorbed to be utilized by the crop.

Year-of-harvest was found to be an important predictor of crop yield in eight crop districts. In fact, it was the only nonteleconnection variable that was used to predict yield in some crop districts (CD 8a). The crop districts in which year-of-harvest was selected are primarily in the northern half of the study area, with the exception of CD3bn and CD3bs (Figure 5). The selection of this variable is probably due to the fact that there were significant technological advances in farming during the study period. For example, new varieties of wheat were developed that mature a week or two earlier than previous varieties (Bushuk 1982). This advancement was most important along the northern fringe of the wheat growing area because of its relatively short growing season. Thus, it seems that the benefits of technological advances in farming have been most evident in the more marginal growing areas.

Crop Districts	<b>Teleconnectio</b> R Square	n variables Adj. R Square	RMSE
1a	0.551	0.493	3.55
1b	0.176	0.152	4.74
2a	0.536	0.492	4.46
2b	0.201	0.177	4.84
3an	0.667	0.611	3.95
3as	0.499	0.469	4.44
3bn	0.962	0.942	1.56
3bs	0.462	0.430	5.07
4a	0.981	0.966	1.21
4b	0.579	0.524	5.10
5a	0.325	0.261	4.14
5b	0.451	0.381	3.71
6a	0.209	0.185	4.82
6b	0.376	0.338	5.25
7a	0.542	0.499	4.47
7b	0.821	0.759	2.79
8a	0.844	0.782	3.13
8b	0.930	0.894	1.91
9a	0.815	0.751	2.84
9b	0.976	0.955	0.98

Table 5: Correlations between teleconnection variables and crop yield.

June-July-August mean temperature was the only lag variable to be included in the model more than once. It is difficult to explain why this variable, indicating summer temperature conditions one year before harvest, holds any skill in predicting crop yields. Generally, lag weather variables were not selected very often by the model and therefore do not seem to be especially important for crop yield prediction. In summary, monthly weather variables provided a reasonable amount of predictive power for crop yields, although the results varied greatly between crop districts.

# **Teleconnection Variables Selected by the Model:**

Teleconnection patterns, on average, were able to explain about 50% of the variation in crop yields at the crop district level. The adjusted  $R^2$  values for the teleconnection variables ranged from 0.152 in CD1b to 0.966 in CD4a. A summary of the correlations between the teleconnection patterns and crop yields is presented in Table 5.

The number of teleconnection variables selected by the model varied from one to sixteen. Not surprisingly, those crop districts

**Table 6:** Frequency of North Atlantic teleconnection variables selectedby the model.

WARNAGE .	
EA February	2
EA March	4
EA Dec-Jan-Feb lag	1
NAO February	1
NAO March	4
NAO April	5
NAO May	1
NAO June	2
NAO July	3
NAO Mar-Apr-May lag	2
NAO Sep-Oct-Nov lag	1
EAJET May	1
EAJET June	6
EAJET lag	1
Atlantic Variable Total	34
Simultaneous Total	29
Lag Total	5

### **# OF OCCURRENCES**

VARIARI F

 Table 7: Frequency of North Pacific teleconnection variables selected by the model.

VARIABLE	# OF OCCURRENCES
WP January WP February WP April WP June WP July WP Mar-Apr-May lag WP Jun-Jul-Aug lag WP Sep-Oct-Nov lag WP Dec-Jan-Feb lag	1 1 3 1 2 2 2 1
EP February	1
EP March	2
EP April	1
EP May	4
EP July	1
NP April	2
NP May	1
NP June	1
NP July	4
NP Mar-Apr-May-Jun-Jul lag	2
PNA January	3
PNA February	2
PNA March	1
PNA Mar-Apr-May lag	1
PNA Dec-Jan-Feb lag	1
PT May	1
PT July	11
TNH Nov-Dec-Jan lag	1
Pacific Variable Total	54
Simultaneous Total	42
Lag Total	12

**Table 8:** Frequency of ENSO teleconnection variables selected by themodel.

VARIABLE	# OF OCCURRENCES
Niño-1+2 July	1
Niño-3 April	2
Niño-3 June	1
Niño-3.4 June4	
Niño-4 February	1
Niño-4 June	1
Niño-4 Jun-Jul-Aug lag	1
SOI January	1
SOI May	1
SOI June	1
ENSO Variable Total	14
Simultaneous Total	13
Lag Total	1

for which a greater number of significant teleconnection variables were selected by the model also had higher adjusted  $R^2$  values. The frequency of selection of each variable is summarized in Tables 6 to 9, with the North Atlantic teleconnection variables summarized in Table 6, the North Pacific variables in Table 7, the ENSO-related variables in Table 8, and the Atlantic and tropical SST variables in Table 9.

The results indicate that the July PT teleconnection pattern is the most significant predictor of crop yield as it was chosen in 11 out of 20 crop districts. The PT pattern exists as a prominent mode in the North Pacific between May and August, measuring height anomalies along the 40°N latitude across North America (CPC 1999). The strength and sign of this teleconnection pattern is associated with the strength of the mean ridge over North America. Negative phases of the PT occur when the strength of the mean

<b>Table 9:</b> Frequency of SST teleconnection variables selected by the mo
--

#### VARIABLE

#### **# OF OCCURRENCES**

3
1
1
1
1
1
1
1
1
1
1
1
2
16 15 1

ridge is a substantially reduced, and positive phases occur when the mean ridge is strengthened (CPC 1999).

The study region is divided into two distinct parts by a diagonal line that runs from CD7b in the northwest to CD1a in the southeast. South of this line, the July PT variable was selected by all of the crop districts as a significant predictor of crop yield. North of this line, none of the crop districts found that the July PT variable provided any significant prediction of crop yields (Figure 6). This distinct boundary between those areas where the July PT variable was not selected and where it was selected suggests that this teleconnection exerts influence only over part of the study region. It seems reasonable that the July PT variable would exert the largest influence on the southerly crop districts considering it is a phenomenon that is centred on 40°N latitude. The link between



*Figure 6:* Crop districts where the July PT variable was included in the model.

the PT and crop yields likely arises through its effect on July and August precipitation. The negative phase of the PT is associated with below normal heights in the mean pressure ridge over the northwestern United States (CPC 1999). Therefore, if the negative phase is strong and persistent in July, it will contribute to higher than normal precipitation over the northwestern U.S. and southwestern Canada (including the study region). Conversely, a positive phase is associated with above normal heights in the mean pressure ridge and, therefore, below normal precipitation over the study region (CPC 1999).

The June EAJET variable was selected in six crop districts and is the second most frequently selected teleconnection pattern. There is a great deal of spatial coherence in the location of the crop districts where June EAJET was found to be a significant predictor of yield (Figure 7). Most of the northern part of the study region is affected by the June EAJET (CDs 6b, 7a, 7b, 8a, 8b, and 9b), with the notable exception of CD9a. This pattern is difficult to explain. The EAJET is primarily a measure of the intensity of the westerlies over the North Atlantic (CPC 1999). One possible explanation for the connection between this teleconnection variable and crop yield



*Figure 7:* Crop districts where the June EAJET variable was included in the model.

on the prairies is that the EAJET may influence the location and intensity of storm tracks over North America. However, further study is needed to identify the physical mechanisms through which the EAJET exerts a statistically significant influence on crop yield.

The next most frequently occurring teleconnection chosen by the model was the April NAO. This pattern was found to be significant in CDs 7a, 7b, 8a, 8b, and 9b (Figure 8). These crop districts are essentially the same as those that were found to be significantly influenced by the June EAJET (with the exception of CD6b), which is also a North Atlantic teleconnection pattern. The NAO is similar to the EAJET in that it manifests itself through changes in the jet-stream and storm track patterns over the North Atlantic as well as causing modifications in the mean configuration of zonal and meridional heat transport (CPC 1999). The similarity in the spatial configuration of both the June EAJET and April NAO would seem to indicate that their influence is transmitted to the Canadian prairies via the same physical mechanism.

The March NAO variable was selected for four crop districts (Figure 9). The March NAO teleconnection only partially follows



*Figure 8:* Crop districts where the April NAO variable was included in the model.



Figure 9: Crop districts where the March NAO variable was included in the model.



*Figure 10:* Crop districts where the March EA variable was included in the model.

the pattern of occurrence that exists in the other North Atlantic teleconnections because CD7b and CD9a are both located in northern Saskatchewan, while CD3an and CD3bn are located more towards the centre of the study region. Perhaps this North Atlantic variable influences the prairie climate slightly differently than its later spring and summer counterparts. The March EA teleconnection was selected for CDs 1a, 1b, 2a, and 3as, which are all found in the southeastern corner of the study region (Figure 10). The area of influence of March EA has no similarities with the other North Atlantic teleconnection patterns, suggesting that the EA pattern is not closely related to those teleconnections and is transmitted via a different physical mechanism. The May EP teleconnection was selected for CDs 3an, 3bn, 4a, and 9a. Three of these crop districts are located in the southwestern corner of the study area while the fourth is located along the northern boundary (Figure 11). There does not appear to be a spatially coherent pattern in the location of the crop districts in which the May EP occurs. The EP teleconnection pattern is associated with the strength and location of the westerlies over the eastern North Pacific and western North America (CPC 1999). This suggests that the EP affects the



*Figure 11:* Crop districts where the May EP variable was included in the model.



*Figure 12:* Crop districts where the July NP variable was included in the model.



*Figure 13:* Crop districts where the June Niño-3.4 variable was included in the model.

whole study region, but does not provide a sufficiently strong signal to be statistically significant in most crop districts.

The July NP teleconnection pattern was selected for CDs 4a, 7b, 8a, and 8b. There does not appear to be a spatially coherent pattern in the location of these crop districts (Figure 12), but all four crop districts have adjusted  $R^2$  values of > 0.75.

The June Niño-3.4 variable was selected in CDs 3an, 3bn, 6a, and 6b (Figure 13). These crop districts are all located in the centre of the study region. Interestingly, June Niño-3.4 was the only variable that was chosen by the model for CD6a and was one of only two variables that was chosen in CD6b. ENSO tends to exhibit better predictive skill over Canada during the winter (Shabbar and Barnston 1996), but apparently a significant connection exists between the crop yields in the central part of the study region and the June Niño-3.4 teleconnection pattern.

### **Crop-Yield Model:**

Overall, the crop-yield model produced an average adjusted  $R^2$  value of 0.624 and the mean standard error of the estimate was

Crop Districts	Crop-Yield Model		
-	R Square	Adj. R Square	RMSE
1a	0.647	0.574	3.26
1b	0.587	0.550	4.08
2a	0.740	0.677	3.79
2b	0.534	0.459	4.32
3an	0.711	0.629	4.19
3as	0.605	0.542	4.63
3bn	0.965	0.939	1.61
3bs	0.608	0.530	5.08
4a	0.982	0.959	1.33
4b	0.693	0.602	4.67
5a	0.566	0.493	3.43
5b	0.619	0.540	3.19
6a	0.330	0.269	5.11
6b	0.840	0.794	3.19
7a	0.783	0.708	3.41
7b	0.912	0.853	2.18
8a	0.876	0.819	2.86
8b	0.951	0.918	1.68
9a	0.763	0.628	3.84
9b	0.992	0.981	0.64

Table 10: Summary of crop-yield model results.

3.29. This means that, on average, more than 62% of the variation in crop yields was explained for the 20 crop districts in the province of Saskatchewan. The number of predictors used in the model varied from a minimum of three in CDs 1b and 6a to a maximum of twenty in CDs 4a and 9b. A summary of the results of the model is presented in Table 10.

The model was most effective at explaining the crop yields along the northern and western boundaries of the study region in CDs 3bn, 4a, 7b, 8a, 8b, and 9b (adjusted  $R^2$  values > 0.8), and least effective at explaining the crop yields in the center and southeastern corner of the study region in CD6a (adjusted  $R^2$  value were less than 0.45) and CDs 1a, 1b, 2b, 5a, and 5b (adjusted  $R^2$ values ranged from 0.45 to 0.625) (Figure 14). The fact that there is significant variation in the ability of the model to explain crop yield over the study region suggests that a finer spatial resolution



*Figure 14:* Long-range crop forecasting model: adjusted R<sup>2</sup>values for Saskatchewan crop districts.

provides a better opportunity for the accurate prediction of crop yields.

The model provided a substantial level of explanation of the variations in crop yield. More than 98% of the variation in crop yield was explained in CD9b. More than 80% of the variation in crop yield was explained by a combination of teleconnection and local weather variables in 6 out of 20 crop districts in Saskatchewan. However, only 27% of the variation in crop yield was explained in CD6b. On average, the model explained more than 62% of the variation in crop yield.

# Summary

This study was undertaken to determine to what degree teleconnections and local meteorological conditions are related to Red Spring wheat yields in Saskatchewan. The study also identified, through the development of a statistical model, the particular teleconnection and meteorological variables having the strongest influence on wheat yields. Finally, the spatial distribution of these variables was examined in order to determine the variation in these relationships at the crop-district level.

The frequency with which variables were selected as predictors was used as an indicator of influence on crop yields. Therefore, one can conclude that summer precipitation, North Pacific teleconnections, and North Atlantic teleconnections are the three most influential variable types. More specifically, June and July precipitation, the July PT teleconnection, June EAJET, and the April NAO were the individual variables that exerted the most effect on crop yields. In addition, the proxy year-of-harvest variable also had significant influence on crop yields.

Many of the teleconnection and weather variables with the strongest links to crop yield over the study region occurred in spatially coherent groups. That is, some variables were found to influence crop yield only in certain regions of the study area (e.g., July PT). Other teleconnection and weather variables did not have any readily apparent patterns of occurrence (e.g., July NP). It is quite likely that the coherent spatial grouping evident in the occurrence of these teleconnections indicates that the correlations found between these teleconnection indices and crop yield are due to a specific physical mechanism of transmission. These mechanisms can take the form of modifications in the location and strength of the jet stream, height fields, westerlies, or a variety of other climate features, most of which are probably related to precipitation production.

There were also coherent regions within the study area where the crop-yield model was quite effective at explaining crop yields (northern and western sections) and areas where it was less effective (central and eastern sections). In fact, no two crop districts used the exact same combination of variables to predict crop yield. These variations in the adjusted  $R^2$  values, crop prediction models, and patterns of correlation indicate that the physical mechanisms that link some teleconnections and, to a lesser extent, weather variables with crop yield operate on a relatively small spatial scale. Thus, it can be concluded that it is important to utilize a finer spatial resolution, such as crop districts, in any crop forecasting model.

In conclusion, this study verified the strong effect that weather has on crop yields and it provides a basis for further research into the development of long-range crop forecasting models for the Canadian prairies because it presents evidence to support the use of teleconnection indices as a statistically significant means to produce accurate crop forecasts. Specifically, the study determined which teleconnection and meteorological variables are important for crop-yield prediction at the crop-district level. Coherent spatial patterns were evident in the occurrence of predictors within particular crop districts in the study region. Therefore, the physical mechanisms that link teleconnections to crop yield operate at a finer resolution than has been considered in previous studies (e.g., Babb *et al.* 1997; Garnett *et al.* 1998).

Importantly, the study showed that commonly used ENSO, PNA, and SST indices may be able to contribute to the forecasting of prairie crop yields. Especially noteworthy is that Atlantic-sector teleconnection patterns may have more influence on prairie climate and, therefore, crop prediction than the literature suggests.

# References

- ABAWI, G.Y., SMITH, R.J, and BRADY, D.K. 1995 'Assessment of the value of long range weather forecasts in wheat harvest management' *Journal of Agricultural Engineering Research* 62: 39-48
- BABB, J.C., KHANDEKAR, M.L., and GARNETT, E.R. 1995 'Climatic teleconnections and early prediction of Canadian Red Spring Wheat yields' In: *Proceedings of the Long-Range Weather and Crop Forecasting Work Group Meeting II* March 21-23, 1995 Canadian Wheat Board, 423 Main Street, Winnipeg, MB, Canada, R3B 1B3
- BABB, J.C., KHANDEKAR, M.L., and GARNETT, E.R. 1997 'An analysis of PNA indices for forecasting summer weather over the Canadian prairies with implications for wheat yield and protein' Presented at: The Long-Range Weather and Crop Forecasting Workshop, Dorval, Quebec, October 1997
- BARNETT, T.P., and PREISENDORFER, R. 1987 'Origins and levels of monthly and seasonal forecast skill for United States surface air temperatures determined by Canonical Correlation Analysis' *Monthly Weather Review* 115: 1825-1850

- BARNSTON, A.G., and LIVEZEY, R.E. 1987 'Classification, seasonality and persistence of low-frequency atmospheric circulation patterns' *Monthly Weather Review* 115: 1083-1126
- BJERKNES, J. 1969 'Atmospheric teleconnections from the Equatorial Pacific' *Monthly Weather Review* 97: 163-172
- BONSAL, B.R., CHAKRAVARTI, A.K., and LAWFORD, R.G. 1993 'Teleconnections Between North Pacific SST anomalies and growing season extended dry spells on the Canadian prairies' *International Journal of Climatology* 13: 865-878
- BULLOCK, P. 1998 Personal communication
- CANE, M.A. 1991 'Forecasting El Niño with a geophysical model' in *Teleconnections Linking Worldwide Climate Anomalies* New York: Cambridge University Press
- DUVENAUD, J. 1995 'How long-range weather and crop forecasting matters - a user's perspective' in *Proceedings of the Long-Range Weather and Crop Forecasting Work Group Meeting II* March 21-23, 1995 Canadian Wheat Board, 423 Main Street, Winnipeg, MB, Canada, R3B 1B3
- GARNETT, E.R. 1997 'A cost benefit analysis of investment in research on long-range weather forecasting' *Canadian Wheat Board Internal Report*
- GARNETT, E.R., KHANDEKAR, M.L. and J.C. BABB 1997 'Teleconnections from Asia to the Canadian prairies: implications for long-range weather and crop forecasting' in *Proceedings of the Fourteenth Annual Pacific Climate (PACLIM) Workshop* R. C. Wilson and V. L. Tharp (Eds.) April 6-9, 1997 Interagency Ecological Program Technical Report 57, California Department of Water Resources
- GARNETT, E.R., KHANDEKAR, M.L., and J.C. BABB 1998 'On the utility of ENSO and PNA indices for long-lead forecasting of summer weather over the crop-growing region of the Canadian prairies' *Theoretical and Applied Climatology* 60: 37-45
- GLANTZ, M.H. 1991 'Introduction' Glantz, M. H. (ed) *Teleconnections Linking Worldwide Climate Anomalies* New York: Cambridge University Press
- GRAY, W.M., and SHEAFFER, J.D. 1991 'El Niño and QBO Influences on tropical cyclone activity' Glantz, M. H. (ed) *Teleconnections Linking Worldwide Climate Anomalies* New York: Cambridge University Press

- HURRELL, J. W. 1996 'Influence of variations in extratropical wintertime teleconnections on Northern Hemisphere temperature' *Geophysical Research Letters* 23(6): 665-668
- KNOX, J.L., and LAWFORD, R.G. 1990 'The relationship between Canadian prairie dry and wet months and circulation anomalies in the mid-troposphere' Atmosphere-Ocean 28: 189-215
- LAMB, P.J., and PEPPLER, R.A. 1991 'West Africa' Glantz, M. H. (ed) *Teleconnections Linking Worldwide Climate Anomalies* New York: Cambridge University Press
- LEATHERS, D.J., PALECKI, M.A., and YARNAL, B.M. 1991 'The Pacific/North American teleconnection pattern and United States climate part II: temporal characteristics and index specification' *Journal of Climate* 5: 707-716
- MEINKE, H., STONE, R.C., and HAMMER, G.L. 1996 'SOI phases and climatic risk to peanut production: a case study for Northern Australia' *International Journal of Climatology* 16: 783-789
- MEINKE, H., and HAMMER, G.L. 1997 'Forecasting regional crop production using SOI phases: an example for the Australian peanut industry' *Australian Journal of Agricultural Resources* 48: 789-793
- MO, K.C., and LIVEZEY, R.E. 1986 'Tropical-extratropical geopotential height teleconnections during the Northern Hemisphere winter' *Monthly Weather Review* 114: 2488-2515
- NAMIAS, J. 1969 'Seasonal interactions between the North Pacific Ocean and the atmosphere during the 1960s' *Monthly Weather Review* 97: 173-192
- NAMIAS, J. 1972 'Experiments in objectively predicting some atmospheric and oceanic variables for the winter of 1971-72' *Journal* of Applied Meteorology 71: 1164-1174
- NAMIAS, J. 1978 'Multiple causes of the North American abnormal winter 1976-77' *Monthly Weather Review* 106: 279-295
- NAMIAS, J. 1980 'The art and science of long-range forecasting' *EOS* 61: 449-450
- NAMIAS, J. 1986 'Persistence of flow patterns over North America and adjacent ocean sectors' *Monthly Weather Review* 114: 1368-1383
- NICHOLLS, N., and KATZ, R.W. 1991 'Teleconnections and their implications for long-range forecasts' Glantz, M. H. (ed) *Teleconnections Linking Worldwide Climate Anomalies* New York: Cambridge University Press
- RASMUSSON, E.M., 1991 'Observational Aspects of ENSO Cycle Teleconnections' Glantz, M. H. (ed) *Teleconnections Linking Worldwide Climate Anomalies* New York: Cambridge University Press

- RIMMINGTION, G.M., and NICHOLLS, N. 1993 'Forecasting yields in Australia with the Southern Oscillation Index' *Australian Journal of Agricultural Resources* 44: 625-632
- ROPELEWSKI, C.F., and HALPERT, M.S. 1986 'North American precipitation and temperature patterns associated with the El Niño/ Southern Oscillation (ENSO)' *Monthly Weather Review* 114: 2352-2362
- ROPELEWSKI, C.F., and HALPERT, M.S. 1987 'Global and regional scale precipitation patterns associated with the El Niño/Southern Oscillation' *Monthly Weather Review* 115: 1606-1626
- SCOTT, G.A.J. 1995 *Canada's Vegetation: A World Perspective* Montreal: McGill-Queen's University Press
- SHABBAR, A., and BARNSTON, A.G. 1996 'Skill of seasonal climate forecasts in Canada using Canonical Correlation Analysis' *Monthly Weather Review* 124: 2370-2385
- SHABBAR, A., and KHANDEKAR, M.L. 1996 'The impact of El Niño-Southern Oscillation on the temperature field over Canada' Atmosphere-Ocean 34(2): 401-416
- SHAW, G., and WHEELER, D. 1994 *Statistical techniques in geographical analysis* 2<sup>nd</sup> ed. London: Fulton
- STONE, R.C., HAMMER, G.L., and MARCUSSEN, T. 1996 'Prediction of global rainfall probabilities using phases of the Southern Oscillation Index' Science 384: 252-255
- SUTTON, R.T., and ALLEN, M.R. 1997 'Decadal predictability of North Atlantic sea surface temperature and climate' *Nature* 388: 563-567
- TRIBBIA, J.J., 1991 'The rudimentary theory of atmospheric teleconnections associated with ENSO' Glantz, M. H. (ed) *Teleconnections Linking Worldwide Climate Anomalies* New York: Cambridge University Press
- UPPENBRINK, J. 1997 'Seasonal climate prediction' Science 277: 1952
- WALKER, G.T. 1923 'Correlation in seasonal variations of weather III: a preliminary study of world weather' *Memorandum of the Indian Meteorological Department* 24: 75-131
- WALKER, G.T. 1924 'Correlation in seasonal variations of weather IV: a further study of world weather' *Memorandum of the Indian Meteorological Department* 24: 275-332
- WALLACE, J.M., and GUTZLER, D.S. 1981 'Teleconnections in the 500 mb geopotential height field over the Northern Hemisphere winter' *Monthly Weather Review* 109: 784-812
- WHITE, G.H., KALNAY, E., GARDNER, R., and KANAMITSU, M. 1993 'The skill of precipitation and surface temperature forecasts by

the NMC global model during DERF II' *Monthly Weather Review* 121: 805-814

- YARNAL, B., and DIAZ, H.F. 1986 'Relationships between extremes of the Southern Oscillation and the winter climate of the Anglo-American Pacific Coast' *Journal of Climatology* 6: 197-219
- YIN, Z. 1994 'Moisture condition in the South-Eastern USA and teleconnection patterns' *International Journal of Climatology* 14(9): 947-967

# Airport infrastructure as an instrument for regional economic development

#### Michael A. Crockatt and Jill Ogston University of Manitoba

Abstract: Airport infrastructure is part of the basic underlying foundation of an airport system. The existence of airport infrastructure, and associated ground infrastructure, is an essential factor in regional development. It has been demonstrated that the presence of this infrastructure has a direct relationship on the overall economic functioning of the surrounding area. Historically, industrial and commercial firms have tended to locate in clusters near transportation hubs. With the agglomeration of such firms, economic growth is generated. The role of transport infrastructure in regional development is discussed in this paper through the examination of three case studies of airports that have been successful in effecting regional economic development. The primary case studies are Fort Worth Alliance Airport in Fort Worth, Texas; Dallas-Fort Worth International Airport in Texas; and Huntsville International Airport in Alabama. Some conclusions are drawn on airport infrastructure and the role it can play in regional economic development. Some policy recommendations are made as to how the knowledge gained from this study can be applied to an airport business park near Winnipeg International Airport.

# Introduction

Traditionally, industry tends to locate in areas that are considered to be transportation centres, or hubs. This tendency has been the "primary cause for the rapid growth of cities" (FAA 1965). Past studies relating transportation centres and regional economic development have usually focused on seaports, and the ability of the port to stimulate the economy in its hinterland. The focal point of this study, however, is airports, the new "centres of global commerce" (Infrastructure Technology Institute 1999).

Air transportation impacts economic, environmental, cultural and social ways of life worldwide. More people and more companies depend on air transportation than ever before. How significant is the role played by airports in regional economic development? If a city is equipped with an efficient airport, including extensive passenger and cargo links, how much of a comparative advantage does that provide?

Cities and airports can try to attract economic development through airport business parks. Usually located adjacent to an airport, these parks are attractive to those firms that make frequent use of air transportation, whether passenger or cargo. For instance, executives for companies frequently make multiple business trips per month. For these firms, having an office close to the airport allows for a partial workday before or after a flight. Firms that move goods by air, usually goods with a high value-weight ratio or perishable goods, can reduce total transportation costs by locating near an airport. Business park features such as foreign trade zone (FTZ) status make airport locations even more attractive.

As more firms are attracted to a particular airport business park, the service level rises to meet their demands, thus making the location even more desirable to other firms. At this point, the airport business park is said to have reached its critical mass, whereby it enters a stage of self-sustaining growth. The advantages to the firms are not limited to the passenger and cargo air service. In addition, firms are subject to the positive influences associated with agglomeration economies, including combinations of localization economies, urbanization economies and industrial-complex economies.<sup>1</sup>

In Winnipeg over the past ten years, there have been a number of discussions and proposals to create an airport-related business park on lands to the north and west of Winnipeg International Airport (YWG).<sup>2</sup> Winnport, a consortium of local businesspeople who created an all-cargo airline serving Winnipeg and two cities in China, Shenzhen and Nanjing, made some significant progress. Winnport began flying between Canada and China in the autumn of 1998, but suspended operations in January 1999 and has not resumed as of December 1999.

Winnport was undercapitalized when it began its operations, and was cursed with unfortunate timing. Just as the airline began serving China, the "Asian flu" hit, negatively impacting nearly every economy in Eastern Asia. Winnport, being solely focused on Winnipeg-China routes with no diversification, had no other revenue-generating traffic, and thus suspended operations under mounting losses. Winnport's initial difficulties should not necessarily be taken as a sign that a major air cargo operation is not viable in Winnipeg. Rather, it should be a lesson from which future endeavours can learn. Winnport may resume operations in 2000.

This paper is intended to identify some feasible steps required to develop an airport business park in Winnipeg, without having "all the eggs in one basket," as was the case with Winnport initially. The prime purpose of an airport business park is to promote economic development through the provision of infrastructure. This paper considers how that may be possible in Winnipeg.

This paper explores three airports in the United States that *have* been successful in attracting development, to the benefit of their respective regions. In addition, this study further examines Winnipeg's airport, which may have the potential to undergo similar development. The successful US airports examined in this study are:

- 1. Fort Worth Alliance Airport in Texas (AFW);
- 2. Dallas-Fort Worth International Airport in Texas (DFW); and
- 3. Huntsville International Airport in Alabama (HSV).

Each of the airports in this study differs from the others. AFW is part of a small classification of airports with no passenger traffic and a dedicated focus on air cargo and nearby industrial development. DFW is a major international passenger hub, with tens of millions of passengers annually. HSV is a smaller passenger hub, with a proportionally larger focus on air cargo. The main focus at YWG is on passenger traffic, but with increasing attention being
Table 1: Case Study Airport Classification	ı
--	---

Airport	Location	Classification
Fort Worth Alliance	Fort Worth, Texas	Industrial, cargo-based
Dallas-Fort Worth International	Irving, Coppell, Euless Bedford, Grapevine, TX	Major international hub
Huntsville International	Hunsville, Alabama	Cargo-focus with passenger
Winnipeg International	Winnipeg, Manitoba	Passenger-focus with cargo

given to cargo activity. Table 1 summarizes the classification of the airports in this study.

Initially, the paper outlines exactly what is considered to be infrastructure, with specific reference to airport infrastructure. Next the role of infrastructure in development is examined, followed by an in-depth look at the case-study airports. In determining some of the key attributes of the successful US airports, a set of recommendations is made for Winnipeg.

## Infrastructure

The Infrastructure Technology Institute of Northwestern University defines infrastructure as the sum of the physical facilities that move people, goods, commodities, water, waste, energy and information. The main and most basic purpose of infrastructure is to "provide the basis for people and business to access goods, services and activities." (Department of Transport, Western Australia 1999 p.3)

Infrastructure includes: bridges, canals, railways, wires, cables, pipelines, roads, treatment plants, traffic signals, street lights and most importantly for this paper, airports. According to this definition, airports themselves are considered infrastructure. However, there are a number of smaller components that make up the total that is considered "airport infrastructure." The following is a comprehensive list of airport infrastructure:

- runways,
- taxiways,
- aprons,
- terminal buildings,
- cargo buildings,
- maintenance buildings,
- administrative buildings,
- roadways,
- curb frontages,
- rental car areas,
- transit areas,
- taxi areas,
- limousine areas,
- fuelling systems,
- power systems,
- rescue units,
- air traffic control facilities,
- lighting,
- navigational aids,
- boarding devices,
- communications systems,
- security systems,
- parking lots,
- graphics,
- signage,
- landscaping,
- drainage,
- water supply,
- and sewer disposal.

For the purposes of this paper, of prime concern are the actual airfield facilities and the access facilities. The airfield facilities include runways, aprons, taxiways and main buildings, such as the passenger terminal and cargo buildings. The access facilities are primarily the roadways (and rail lines, where applicable) that lead into the airport terminal and cargo areas. These two components of airport infrastructure are most important in terms of regional economic development. To a lesser extent, this paper also considers municipal infrastructure, such as water and sewer service.

Perhaps the best way to address infrastructure and development is to attempt to answer some key questions.

- Why is infrastructure indispensable to development?
- Could development possibly occur without infrastructure?
- Is transport infrastructure vital to economic functioning?

It is the intention of this paper to demonstrate that development requires infrastructure.

## Infrastructure and Development

If infrastructure can attract development, it will positively impact a region.

Even the earliest forms of economic development needed infrastructure. For trade to occur between towns, it was necessary to have a way of travelling between the settlements. In 1964, Fogel related the growth of the American economy to the construction of railways. Railways reduced transport costs for shipping agricultural products compared with the relatively high costs associated with the combination of wagon and water transport. It is well known that the completion of the transcontinental railway in Canada in the late 1800's was a major factor in enabling Canada to function as a political and economic unit.

Transport infrastructure provides defined channels of movement for the physical interaction of goods and people between places. The flow of goods and people is the crux of economic functioning and it is only possible with transport infrastructure. The functioning of an economy requires the use of transport and, as economies develop, relatively more transport is required (Hurst 1974). However necessary it may be for development, transport infrastructure by itself is useless. Resources are also necessary for any kind of economic functioning, growth or development. Transport infrastructure can have three possible effects on development, positive, neutral, or negative (Gauthier 1970; Hoyle and Knowles 1992; Wilson 1966; Rietveld et al 1993; Hoyle and Smith 1992). There are proponents and historical examples of each.

For transport infrastructure to have a positive effect on development, an improved transport network must directly result in the expansion of productive economic activities. New economic opportunities can be created through improved transport service. Most macro-economic, or industry-wide, studies show that investment in infrastructure has a positive effect on regional economic growth (Kessides 1993). However, it is difficult to attribute economic growth directly to transport infrastructure. There must be complementary growth elsewhere in the economy.

The neutral effect, generally the most accepted, notes the derived demand for transportation alluded to above. The provision of transport infrastructure creates one circumstance of many that are necessary for economic development to occur. Infrastructure is a requisite for development, not a factor in production (Kessides 1993; Hoyle and Knowles 1992; Gauthier 1970). The neutral viewpoint is a more realistic version of the positive viewpoint.

The negative effect can manifest itself in a number of ways. A prime example is the case of misdirected investment, whereby resources allocated to transport may be more useful in promoting development in other areas. This is also true if a region is already well-served by transport infrastructure; further investment could be wasteful (Rietveld et al 1993). The protectionist viewpoint suggests that high transport costs arising from current infrastructure protect a region from lower-cost competition from outside the region. Finally, the best planning intentions can backfire, in which improved transport infrastructure could benefit urban centres at the expense of outlying development centres (Gauthier 1970; Miyoshi 1997).

The next section attempts to decipher the impact an airport has on economic development in its region, and also to determine how the airport affects its region geographically.

## **Regional Economic Development**

Employment and income generation are two key tools used to measure economic development. Apart from the direct employment generated by the airport, there is indirect employment associated with activities that support the airport, airlines or passengers, such as hotels and car-rental companies. There is also induced employment, which is comprised of businesses whose existence depends on people who are directly or indirectly dependent on the airport.

This study is primarily concerned with employment and income that is generated in airport business parks, or commercial and industrial development near the case study airports.

Employment and income are generated by businesses.<sup>3</sup> Therefore, increased business activity resulting from new and expanded businesses increases employment and income, thereby positively impacting regional economic development. When considering businesses that locate near airports, infrastructure surely does play a role. As mentioned in earlier, the airfield and ground access infrastructure are most important for regional economic development. If a firm is considering an airport location and the decision rests upon infrastructure issues, then runway length, apron space and road access are of greater importance than lighting, drainage or boarding devices.

The investment in infrastructure leads to agglomeration economies, which makes the location more appealing to other firms, intensifying the spatial concentration until the critical mass is reached. When this point is reached, public investment is not as vital.

## **Case-Studies**

The airports included as case studies are among North America's most successful at effecting regional economic development. After examining the three U.S. cases, this study revisits YWG and suggests how it might benefit from a similar style of planning.



*Figure 1:* Fort Worth Alliance Airport. (Source; North Central Texas Council of Governments, 1999)

## FORT WORTH ALLIANCE AIRPORT (AFW)

Fort Worth Alliance Airport was constructed in 1989 as a reliever airport for Dallas-Fort Worth International Airport. The metropolitan Dallas-Fort Worth area has a population in excess of 5 million, and is home to approximately 30 airports.

Alliance is the result of tremendous cooperation between private interests and various levels of government, hence the name Alliance. Although it has been 96% privately funded, the City of Fort Worth, Denton and Tarrant Counties, the State of Texas, and the Federal Aviation Administration (FAA) have all contributed to the project since its inception in the late 1980s.

Alliance, which has no passenger activity, is chiefly concerned with cargo operations, pilot training and aircraft maintenance. Alliance is more than just an airport, it has been billed as the "international business development of the future" (Hillwood Development Corporation 1999). Alliance combines airport infrastructure with an inland container terminal, an industrial park, a foreign trade zone, and a residential development, spread out over approximately 4000 hectares (9400 acres), although not all of the land is developed. Between US\$4 and 5 billion have been invested at Alliance, over 20,000 jobs have been created (including construction jobs), and about US\$10 million in taxation is generated annually for the cities, counties, the school district and the state.

Just over a decade ago, the area that is now Alliance was farmland. In fact, there are still cattle roaming the open areas on the airport site. As of now, there are 19 'Fortune 500' companies at Alliance, and over 70 companies in total. The record of development at AFW is unmatched anywhere in North America.

As for the existent infrastructure, the roadways are very wide, designed to handle high volumes of very large trucks, consistent with the concentration of distribution centres. The single runway is 3,000 m (9,840 feet) in length with FAA approval to be extended to 4,000 m (13,120 feet), which would accommodate the largest aircraft in regular use today.

Alliance features direct access to I-35W, which leads north through the Mid-Continent International Trade Corridor to Canada, and south to Mexico. Often referred to as the NAFTA Superhighway, I-35 is the shortest existing route connecting all three nations.

Some of the major companies at Alliance include:

- Federal Express
- American Airlines
- Kraft
- Maytag
- Michaels
- JCPenney
- Galaxy Aerospace
- Nokia
- Nestlé
- Zenith
- Texas Instruments
- United States Immigration and Naturalization Service, and United States Drug Enforcement Agency

Another major tenant is Burlington Northern Santa Fe Railroad (BNSF), which operates one of North America's largest and most technologically advanced intermodal facilities at AFW. Not only does this company add to the Alliance portfolio, but the facility is also one of the strongest drawing forces. Alliance officials have claimed that the BNSF facility has been "as important" as the airport in terms of attracting tenants.

The entire Alliance area is a Foreign Trade Zone (FTZ), making it especially appealing to firms involved in international commerce. FTZ status enables firms to save on duties and taxes on inventory that is in-transit and on parts used in the manufacturing or assembly of other goods<sup>4</sup>

Just north of Alliance is Texas Motor Speedway (TMS). Developers credited the success and drawing power of Alliance for influencing their locational decision. TMS is another economic spin-off benefit from the geographical proximity to the airport, sparking more agglomeration benefits. TMS hosts a number of events each year, the most popular being NASCAR and Indy Racing League events, which can fill the 200,000-seat facility. With events so large, the added economic impact on the region is enormous.

More recently, a number of residential developments are in the planning or construction phases, designed to house the growing work-force at Alliance.

However important Alliance is to the region, it likely will always be less than the region's main airport: Dallas-Fort Worth International, only 15 miles away.

## Dallas-Fort Worth International Airport (DFW)

DFW, located equidistant from downtown Fort Worth and downtown Dallas, is unique in this study because it is primarily a major passenger hub. It was the 5th busiest airport in the world in 1998, approaching 60 million passengers annually.<sup>5</sup> DFW is owned by the cities of Dallas and Fort Worth and is intentionally located equidistant from both downtowns.<sup>6</sup> It has been generally acknowledged as the "key economic engine" in the region since it opened in 1974 (personal communication with Cynthia Weatherby,



*Figure 2:* Dallas-Fort Worth International Airport. (Source: Dallas-Fort Worth International Airport, 1999)

Program Manager, Texas Transportation Institute; personal communication with Ed McLaughlin, Vice President, North Texas Commission).

However, it competes with another major passenger airport in the area. Love Field, located right in Dallas, is the national headquarters for Southwest Airlines. However, flights from Love Field are limited to Texas, the states that border Texas (New Mexico, Oklahoma, Arkansas, Louisiana) as well as Mississippi and Alabama, which were added more recently. Apart from Southwest, Continental Airlines and American Airlines also have limited service at Love Field.

It is estimated that the annual economic impact of DFW is approximately US\$11 billion. This includes over 200,000 jobs and US\$6.1 billion in labour income (Dallas-Fort Worth International Airport 1999).

There is an incredible amount of infrastructure surrounding DFW airport. In total, DFW covers about 7000 hectares (17,000 acres), an area larger than the island of Manhattan. The most obvious

infrastructure components are the four terminals and seven runways, with expansion plans for two more terminals and another runway. In terms of ground infrastructure, major freeways surround the airport with direct links to the central urban areas of Dallas, Fort Worth and most of the smaller cities that make up the metropolitan area. One freeway, International Parkway, runs through the middle of the airport with aircraft taxiways crossing overhead. Finally in terms of infrastructure, six major rail lines serve the airport area.

The cargo areas at DFW are to the north. United Parcel Service (UPS) operates a regional hub in the northwest corner of the airport and most other major cargo companies have substantial operations in the northwest and northeast areas of Figure 2. FedEx, despite its regional sorting hub at AFW, also maintains some operations at DFW to take advantage of the international routes which are available. DFW was the 21<sup>st</sup>-ranked airport in the world in terms of annual cargo volumes in 1998, with just over 800,000 metric tonnes (Airports Council International 1999).

DFW officials claim that the airport has been a factor in the relocation or expansion of over 400 firms (Dallas-Fort Worth International Airport 1999). This study is part of a larger study aimed at determining exactly how important DFW and the other case-study airports are in terms of industrial location, including the relatively large impact of the airport in the smaller city of Huntsville, Alabama.

## Huntsville International Airport (HSV)

Huntsville International Airport was intentionally located about 5 miles outside of Huntsville proper in order to mitigate potential negative impacts. The city of Huntsville has a population of approximately 180,000, less than one-third of Winnipeg's population, and just a fraction of the population of Dallas-Fort Worth. The city of Huntsville has the highest per capita income in the southeastern US, nearly twice that of the state's largest city, Birmingham.

The airport and much of the surrounding infrastructure fall under the jurisdiction of the Huntsville-Madison County Airport Authority. In 1996, the economic impact of the Huntsville airport was assessed at 28,594 jobs generating almost US\$1 billion in labour income. HSV covers 2350 hectares (5800 acres) with potential expansion to 3400 hectares (8400 acres).

HSV has developable land on three of its sides. To the west and south is mainly farmland. Immediately east is the JetPlex Industrial Park, and further east, between the airport and the city of Huntsville is Redstone Arsenal (a US Army installation) and NASA's Marshall Space Flight



**Figure 3:** Huntsville International Airport. (Source: Huntsville-Madison County Airport Authority, 1999)

Center. The city of Madison, just north of the airport, has a population of fewer than 50,000, but represents a major problem for the airport because of aircraft noise.

HSV's two runways are separated by one mile, facilitating simultaneous operations. The terminal is centrally located in the airfield and has a direct ground connection with Interstate-565. The cargo area is to the east, between the airport and the JetPlex Industrial Park. The most important cargo carrier at Huntsville is CargoLux, which currently flies nine 747 freighters per week between Luxembourg, Huntsville and Mexico. Warehouse space at Huntsville is in the process of doubling its capacity. The air cargo center is adjacent to the International Intermodal Center, which is a rail container facility served by the Norfolk Southern. To the east is the JetPlex Industrial Park, home to some major companies, including Chrysler and the Air Defense and Space

Divisions of Boeing. Other electronics and aerospace firms are also in the area, including Futaba, TDK, Raytheon and Goldstar. The concentration of firms can be clearly noted by the numbers – each representing a tenant firm in the business park – in Figure 3.

The Airport Authority operates the airport, the intermodal center, and the industrial park. Together, their impact on regional economic development can be difficult to separate from the federal government's impact. Many firms that locate near the airport are government contractors, either for the US Army or for NASA.

## Winnipeg International Airport (YWG)

Winnipeg International Airport is located in northwest Winnipeg, only fifteen minutes from downtown. Immediately adjacent to the airport is 1200 hectares (3000 acres) of developable land available for a business park. This land is currently being marketed by the Winnipeg Airport Lands Corporation, a subsidiary of the Winnipeg Airports Authority. Winnport was intended to spur development of an airport business park in the exact same area. YWG's advantages include:

- central location
- developable land near the airport
- 24-hour operations
- uncongested air space, and
- excellent flying weather.

Federal Express and Purolator Courier have substantial operations at Winnipeg, among their most important in Canada. Their facilities are crowded into the area south and east of the airport (Figure 4).

The notion of an airport business park is now being promoted and marketed by a consortium of landowners known as the Winnipeg Airport Lands Corporation (WALCO, a subsidiary of WAA). There are hundreds of hectares of land available for immediate development west of YWG, but very little has even the most basic of services. Upgraded truck routes are also a necessity



*Figure 4:* Winnipeg International Airport. (Source: Winnipeg Airports Authority)

for any substantial distribution activity. Currently, distribution activity from YWG's hinterland to the south and east of the airport must travel along one of the city's most congested arteries (Route 90) to get to the main highway to the United States.

The airfield is adequate, as it is currently underutilized. There are three runways (one of which is for light aircraft only) and sufficient taxiways. Apron space, particularly for cargo, is at its capacity, especially during peak overnight hours. If a business park were to be developed with increased utilization of the airport for cargo, as has happened at AFW, DFW and HSV, new cargo aprons and buildings would be required.

A recent Economic Impact Study pegged YWG's impact at 7220 jobs creating C\$220 million in labour income, and C\$300 million in expenditures (Shurvell et al 1998).<sup>7</sup> This is clearly a significant impact on the community of Winnipeg. However, with some careful planning, strategic investment of public and private

money, and a commitment from some major firms, the impact could be much greater.

## Conclusions

There are a number of key features that each of the successful US case-study airports possess, which have undoubtedly contributed to the positive economic development they have had on the surrounding regions.

- 1. They are fully multimodal facilities. They incorporate air, road and rail infrastructure, and Huntsville is contemplating a port on the Tennessee River.
- 2. Much of the development surrounding the airports has taken advantage of tax incentives and abatements. For example, a major tenant at Alliance Airport, the American Airlines maintenance base, may have located in Tulsa, had not the various levels of government agreed to a fifteen-year abatement of taxes.
- 3. Each airport and each business park is designated as a Foreign Trade Zone. This means that firms do not have to pay duty or taxes on components that are imported into the United States and subsequently re-exported, saving companies millions of dollars annually.
- 4. Not all firms that locate near airports are dependent on air operations. Other possible reasons may include incentives, proximity to customers or suppliers, and the agglomeration advantages associated with shared infrastructure.
- 5. The development has followed the provision of infrastructure. In all cases, the initial outlay of capital created excess capacity, but resulted in a powerful ability to attract firms and effect economic development.

In addition, as development occurs at an airport, other firms note the success of those firms locating near the airport and recognize that similar advantages and benefits could accrue to their own firm from an airport location. Soon, as has been the case at each of the three U.S. airports in this study, a critical mass is reached. At this point, the airport business park is able to undergo selfsustained growth.

## Recommendations

If planners in Winnipeg were to use the three case studies in this paper as models, then some recommendations should be apparent.

- Above all, the parties involved (civic and provincial governments, WAA, and Economic Development Winnipeg, for example) must act together to plan and construct infrastructure that is attractive to firms. Industrial quality water and sewage systems must be complemented by wide, multi-lane divided roadways with grade-separation for rail crossings. The roads should provide quick access to inter-city highways, while avoiding congested urban areas.
- 2. Construct a multi-user intermodal facility. Manitoba would best be served by a container terminal providing access to Canadian National (CN), Canadian Pacific (CP), Burlington Northern Santa Fe (BNSF) and the Hudson Bay Railway (HBR).<sup>8</sup> Without such a facility, YWG would not be on par with AFW, DFW or HSV as a multimodal transportation centre.
- 3. WAA, along with the city, provincial and federal governments should work together to provide an attractive incentive package to urge firms to locate, relocate, or expand in Winnipeg, particularly in a new airport business park.
- 4. Currently FTZs in Canada are very limited in their usefulness. Paperwork is excessive and GST legislation remains a sub-

stantial problem. The federal government is creating a new policy regarding FTZs. Winnipeg needs to be prepared for the impending announcement regarding FTZs in Canada. Local freight forwarders have indicated that an effective FTZ would allow business operations to be carried out more efficiently.

5. There are a number of firms that are good candidates to be the focus of new development. Winnipeg has a core of aerospace firms in Standard Aero, Bristol Aerospace, Boeing and Air Canada's Maintenance Base. High-tech firms are growing quickly in Manitoba and numerous other industries would benefit from an airport location. (For example, local clothing-manufacturer Nygard imports materials for garments from Europe by air. Frequently, there are logistical delays that could, in part, be mitigated by an airport location.)

Following the formulas of the successful US case-study airports will not work everywhere. There are airport business parks in Portland, OR and Kinston, NC that have tried to follow the example of the airports in this study, but have been very slow to develop, despite having large public investments for infrastructure.

Eventually some Canadian airport will take the lead and become the new prototype. Many are trying. Hamilton, Montreal-Mirabel, and Vancouver are definite front-runners. The possibility for such a proposal to work in Winnipeg does exist if it is done effectively. Rather than being strictly concerned with their own interests, individuals and organizations must work together to help Winnipeg's economy diversify and grow, bringing benefits to all local organizations. This is especially true considering that each has the same ultimate goal: economic development. Cooperation is the only way a project of this magnitude will ever be feasible. To date, however, few parties have been willing to work together.

At the risk of being overly optimistic, an Alliance-style development could spur the biggest boom to Winnipeg since the CPR arrived in the 1800s, which was the result of a permanent tax exemption. If an airport business park is going to be successful in Winnipeg, it will undoubtedly be a group effort. No single organization can do it alone.

The cooperative effort has to ensure that adequate infrastructure is available for firms wishing to relocate or expand. This includes: municipal infrastructure such as water and sewer service; rail infrastructure, in the form of an updated intermodal facility; airside infrastructure in the form of runways, taxiways, aprons and warehouses; and ground access in terms of roads and highway connections.

In the US case studies, investment in infrastructure preceded economic development. In Canada, decision-makers wait for the economic development to occur before deciding to invest in infrastructure. Providing the infrastructure will not guarantee development. But providing *no* infrastructure guarantees that *no* development will take place.

## References

AIRPORTS COUNCIL INTERNATIONAL www.airports.org

- CROCKATT, M. 1997 Airport Infrastructure as an Instrument of Regional Development Winnipeg: University of Manitoba
- DALLAS-FORT WORTH INTERNATIONAL AIRPORT www.dfwairport.com
- DEPARTMENT OF TRANSPORT, GOVERNMENT OF WESTERN AUSTRALIA 1999 *Transport Infrastructure Project: A framework* Perth: Department of Transport
- DUNCAN, D. (ed.) 1999 Economic Merits of a Multi-User Intermodal Facility in Manitoba Winnipeg: Transport Institute, University of Manitoba
- FEDERAL AVIATION ADMINISTRATION (FAA) 1965 *Planning the Airport Industrial Park* Washington: U.S. Department of Transportation
- FOGEL, R. 1964 Railroads and American Economic Growth: Essays in Econometric History Baltimore, The John Hopkins Press
- GAUTHIER, H. 1970 'Geography, Transportation and Regional Development' *Economic Geography* 46(4): 612-619
- HILLWOOD DEVELOPMENT CORPORATION <u>www.alliance-</u> worldwide.com
- HOYLE, B. AND KNOWLES, R. 1992 'Transport Geography: An Introduction' Hoyle, B. and Knowles, R. (eds.) *Modern Transport Geography* London Bellhaven Press

- HOYLE, B. AND SMITH, J. 1992 'Transport and Development' Hoyle, B. and Knowles, R. (eds.) *Modern Transport Geography* London Bellhaven Press
- HUNTSVILLE-MADISON COUNTY AIRPORT AUTHORITY www.hsvairport.org
- HURST, M. (ed.) 1974 *Transportation Geography* New York: McGraw Hill
- INFRASTRUCTURE TECHNOLOGY INSTITUTE, NORTHWEST-ERN UNIVERSITY <u>iti.acns.nwu.edu</u>
- KESSIDES, C. 1993 The Contributions of Infrastructure to Economic Development: A Review of Experience and Policy Implications Washington: The World Bank
- MCLAUGHLIN, E. 1998 personal communication Vice President, North Texas Commission
- MIYOSHI, T. 1997 Successes and Failures Associated with Growth Pole Strategies Manchester: University of Manchester
- NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS www.nctcog.dst.tx.us
- PARR, J. 1973 'Growth Poles, Regional Development, and Central Place Theory' *Papers of the Regional Science Association* 31: 173-212
- RIETVELD, P. AND NIJKAMP, P. 1993 'Transport and Regional Development' Polak, J. and Heertje, A. (eds.) *European Transport Economics* Oxford: B. Blackwell
- SHURVELL, S., B. PRENTICE, AND T. HARRISON, T.F. 1998 Economic Impact of Winnipeg International Airport: Prepared for Winnipeg Airports Authority Inc. (WAA) Study Report No. 1. Winnipeg: Transport Institute, University of Manitoba
- SHURVELL, S. AND PRENTICE, B. 1999 'Methodological Issues of Economic Impact Studies' Canadian Transportation Research Forum: Proceedings of the 34<sup>th</sup> Annual Conference, Vol. 2 Montreal: Canadian Transportation Research Forum: 724-738
- WEATHERBY, C. 1999 personal communication Program Manager, Institutional Policy Program, Texas Transportation Institute
- WILSON, G. 1966 *The Impact of Highway Investment on Development* Washington: The Brookings Institution
- WINNIPEG AIRPORTS AUTHORITY www.waa.ca
- YUHN, K. and LEE, Y 1998 Endogenous Growth and Agglomeration Economies in South Korean Manufacturing: A Sign of Declining Competitiveness Seoul: Korea Institute for Industrial Economics and Trade

<sup>1</sup> For more information about agglomeration economies, please see Parr (1973) and Yuhn et al (1998).

<sup>2</sup> Note the open areas to the north and west in Figure 4.

<sup>3</sup> Government agencies, educational institutions and other organizations also generate income and employment. For the purposes of this paper, they can be considered to be businesses if they are indeed airport-related.

<sup>4</sup> For a more detailed examination of FTZs, please see Crockatt (1997), Hillwood Development Corporation (1999), Dallas-Fort Worth International Airport (1999) and Huntsville-Madison County Airport Authority (1999).

<sup>5</sup> By comparison, approximately 3 million passengers use Winnipeg International Airport each year. Even Canada's busiest airport, Lester B. Pearson International in Toronto, handles fewer than 30 million passengers per year.

<sup>6</sup> Dallas owns 7/11 of the airport and Fort Worth owns 4/11 based on their populations at the time of construction.

<sup>7</sup> It is dangerous to compare the results of economic impact studies because each study uses a different methodology, incorporating different elements. The impact figures used in this paper are for rough comparisons only and should not be considered as exact measurements of the economic impact of each airport. For more on this topic see Shurvell et al (1999).

<sup>8</sup> For more information, see Duncan (1999).

# Ice-shoved hills and related glaciotectonic features in the Glacial Lake Proven Basin, Riding Mountain uplands, Manitoba

R.A. McGinn Brandon University

**Abstract:** Five to six ice-shoved hills and a small composite linear ridge represent the suite of glaciotectonic features mapped in the Glacial Lake Proven basin. The ice-shoved hills appear to be associated with small depression lakes located approximately 2.0 - 4.0 km upstream of a N or NE ice flow (5°-50°). The Odanah Shale member of the Pierre formation forms the core of each ice-shoved hill and approximately 1.0 m of Zelena till overlies the shale core. Pebble clast fabric analysis from the till supports the hill-hole hypothesis.

The small composite linear ridge is described as a broken series of hills 8 km long, 2 km wide and 15-30 m high. The ridge is relatively straight and has a NNW-SSE orientation (335°). The gaps appear to be generated by a combination of ice stagnation drainage and Holocene fluvial erosion. About 2.0 m of till overlies a deformation diamict or distorted sands and gravels. The fluvial facies contains dragfolds, overfolds and small thrust faults. Pebble clast fabric analysis from the upper till suggests a northern ice flow vector (5° azimuth). A secondary vector (40° azimuth), however, supports a northeastern ice flow theory. Glacial Lake Proven sediments surround the constructional glaciotectonic landforms suggesting that they were formed during the Falconer Advance of the Lostwood Glaciation.

## Introduction

Constructional glaciotectonic landforms include a variety of hills, ridges and plains which are composed wholly or partly of soft bedrock or drift masses that were deformed or dislocated by glacier-ice movement. (Aber 1985).

The INQUA Commission on the Formation and Properties of Glacial Deposits, formed a Work Group on Glacial Tectonics (WGGT) in 1987. Dr. J. Aber served as the overall coordinator for North America. By 1993 Aber had compiled an extensive bibliography consisting of 575 entries (Aber 1993). In addition, a North American continental wide data base of geographic and glaciotectonic features had been constructed using the ARC/INFO system at the University of Regina. The WGGT (Aber et al. 1993) has classified glaciotectonics into four mappable categories: basement faults, concealed structures, ice-shoved hills and source basins, the later two categories are referred to as "constructional glaciotectonic landforms."

Aber (1989), classified constructional glaciotectonic landforms into five types: hill-hole pairs, large composite ridges, small composite ridges, cupola-hills and flat lying mega blocks. These classes represent the ideal generic types within a continuum of glaciotectonic landforms. Intermediate, transitional and mixed features also can be described (Aber 1989).

Benn and Evans employ Aber's 1989 classification in their text and include descriptive examples of each constructional glaciotectonic landform (Benn et al. 1998). The hill-hole pair is described as a discrete hill of ice thrust material situated a short distance down-glacier from a depression of similar size and shape (Bluemle et al. 1984). Aber et al. (1993) illustrate an example of multiple hill-hole pairs from the Devils Lake area in North Dakota.

Composite ridges are composed of multiple slices of upthrust and contorted bedrock and or unconsolidated sediments which are often interlayered and overlain with glaciogenic material (Benn et al. 1998). Aber (1989) subdivides these constructional glaciotectonic landforms into small composite ridges (< 100 m relative relief) and large composite ridges (> 100 m relative relief and arcuate in form). Large composite thrust ridges in North Dakota are described by Moran et al. (1980). The Brandon Hills in southwestern Manitoba are an example of a small composite linear ridge (Welsted et al. 1980: Aber 1989).



Figure 1: Location of the Lake Proven Basin in southwestern Manitoba.

Benn et al. (1998) describe cupola-hills as glaciotectonic hills lacking a hill- hole relationship and or transverse ridge morphology. Cupola-hills have a dome-like morphology, circular to oval to elongated oval shape and are composed of deformed floes of Quaternary sediments of older bedrock overlain by a thin carapace of till (Bluemle et al. 1984).

Megablocks or rafts are dislocated slabs of rock and unconsolidated material transported from their original position by glacial action (Benn et al. 1998). The Qu'appelle Valley megablock located near Esterhazy, Saskatchewan (Christianson 1971) is a local example and demonstrates the susceptibility of the Cretaceous Pierre Shale Formation to glaciotectonism.

Two, perhaps three, of these types of constructional glaciotectonic landforms have been found in the Glacial Lake Proven Basin, Riding Mountain Uplands, Manitoba. Other concealed structures including bedrock folds, faults and contortions have been recognized in Cretaceous exposures along the Manitoba Escarpment.

## The Glacial Lake Proven Basin

The Proven Lake area is located on the Riding Mountain Uplands south of Riding Mountain National Park, 80 km north of Brandon, Manitoba (Figure 1). The Glacial Lake Proven basin is generally less than 625 m in elevation and includes present day Clear Lake, Bottle Lake, Proven Lake, Jackfish Lake and Otter Lake covering an area of approximately 340 km<sup>2</sup> (Figure 2). Higher elevations, in excess of 670 m, are located to the north and east of the Lake Proven Basin. The Whirlpool and Rolling Rivers drain the southern portion of the basin towards the south; the northern portion drains to the west by way of Clear Creek (Figure 2). Both drainage routes join the Little Saskatchewan River, (Klassen's ancestral Minnedosa River) and eventually drain into the Assiniboine River to the south.

Detailed surficial mapping (Klassen 1966, 1979; McGinn 1991, 1997) have determined that early Glacial Lake Proven deposits occur at elevations above 625 m in the region to the west and southwest of the topographic basin (Figure 3). These rhythmite deposits represent a supraglacial thermokarst lacustrine facies. The deposits of the later phase of Glacial Lake Proven are believed to represent a topographically controlled terminoglacial lacustrine facies, perhaps supraglacial, but with only a thin ice base. To the west are the deposits of the eastern ridge of the Horod Moraine, an ice marginal ridge associated with the general stagnation of Wisconsinan Ice on the Eastern Uplands (McGinn 1997). This



Figure 2: Topography of the Lake Proven Basin.



Figure 3: Surficial deposits in the Glacial Lake Proven Basin.

landform delimits part of the western shoreline of early Glacial Lake Proven (Figure 3).

To the north, a glaciofluvial facies (proglacial outwash) merges with constructional glaciotectonic features in the east. It is these constructional glaciotectonic landforms that are the topic of this paper. The suite of landforms include: two small oval shaped hills in the south (OH), a large elongate oval ridge (EOR), three other smaller elongate oval shaped hills (EOH) and an 8 km long segmented ridge centred on the town of Onanole (Figure 4).

## Ice- Shoved Hills

The two southern ice-shoved hills (OH) are oval in form, approximately 0.75 km in diameter and 10 m - 15 m high. The northern ice shoved hills (EOH) are elongated but do not display arcuate form. These hills are generally larger, 2.0 km - 3.5 km in length, 0.25 km -1.0 km wide, display 10 m -15 m relative relief and are aligned along a north-south vector (350° azimuth).

A large elongated oval ridge (EOR) is situated north of Erickson, east of Provincial Highway 10 and approximately half way between the southern ice-shoved oval hills and the more northern elongated oval hills (Figure 4). This ice-shoved elongated oval ridge is 7.0 km long and 2.3 km wide. The feature is approximately 15 m in relative relief except for a prominent dome shaped hill located near the southern end, which stands 45 m above the Glacial Lake Proven plain.

The two oval shaped hills and the large elongated oval ridge (EOR) north of Erickson appear to be associated with small depression lakes located approximately 2.0 km upstream of ice flow directions ( $40^{\circ}-50^{\circ}$  azimuth) (Figure 5). The other three elongated oval hills may be related to depression lakes 4.0 km upstream (azimuth  $0^{\circ}-20^{\circ}$ ) (Figure 5).

The hill-hole pairs (Figures 4 and 5) are composed of the Odanah Shale member of the Pierre formation. Odanah Shale is described as hard olive-grey siliceous shale with soft interbeds of darker olivegrey shale. The shales are composed of clay sized siliceous particles which show no sign of biogenic origin (McNeil et al. 1981). The



*Figure 4:* Topography of constructional glaciotectonic landforms in the Glacial Lake Proven Basin.



Figure 5: Glacial Lake Proven Basin hill-hole pairs.

mineralogy is described as amorphous silica and illite with traces of quartz and organic carbon (Bannatyne 1959). Roadcut exposures in the small oval hill just north of Erickson indicate that the strike is generally as expected, however, dips appear to be disrupted and plunge opposite the acknowledged trend.

Approximately 1.0 m of Zelena till overlies the shale core. The Zelena formation, on average, is 3.0 m - 5.0 m thick in the region and represents the uppermost tills and intertill sediments on the Riding Mountain Uplands. Klassen (1979) suggests that the Zelena formation was deposited during the final stages of glacial stagnation during the Late Wisconsinan. Oxidized Zelena till is usually yellowish brown or very dark grey brown in colour. Fresh (unoxidized) exposures are dark olive grey or very dark grey (Klassen 1979). The till is shale rich but since Pierre Shale clasts tend to disintegrate when removed from the matrix, it is difficult to determine a percentage composition. Carbonates constitute approximately 26% - 36% of the clasts (Klassen 1979).

Stratigraphic exposures in the Erickson Pit (Figure 5) located adjacent to the southernmost hill-hole pair reveal two tills overlying deformed sands and gravel. The upper diamict, described as a supraglacial meltout complex (Brodzikowski and van Loon, 1991), overlies a slightly more compact supraglacial ablation till. The meltout complex is usually a typical diamict, massive in appearance but with occasional concentrations of relatively coarse or fine material forming vague lenses. The ablation till is massive, and slightly more compact. The prominent clasts are typically Interlake carbonates as the local Odanah Shale clasts quickly achieve terminal grade. Larger shale clasts are evident but difficult to remove without fracture. The underlying fluvial facies (proglacial outwash) contains shearing flexures and small thrust faults, which supports a glaciotectonic modification. Unfortunately, the Erickson Pit was reclaimed before pebble clast fabric analysis was undertaken. Pebble clast fabric analysis from the till exposures towards the north, however, support the hill-hole hypothesis illustrated in Figure 5.

## Small Composite Linear Ridge

Associated with the ice shoved hill-hole pairs is a low relief ridge, centred on Onanole, Manitoba (Figure 4). This small composite linear ridge is described as a broken series of hills 8.0 km long, 2.0 km wide and 15 m -30 m high. The gaps appear to be generated by a combination of ice stagnation drainage and Holocene fluvial erosion.

The ridge may be divided into a NNW-SSE orientation (335°) tri-sectional ridge (CLR) and two distal outlier hills (O) (Figure 4). The tri-sectional ridge is slightly arcuate, suggesting an ice advance from the northeast.

An alternate interpretation employs a natural drainage channel to divide the landform into a northern suite (two sections of the ridge and a northern outlier) and a southern unit composed of a contiguous ridge section and outlier (Figure 4). The northern hills typically exhibit 15 m - 20 m relative relief. The southern unit is higher and broader.

Ice proximal sections in the Beatty Pit (Figure 4) expose about 2.0 m of till overlying a deformation diamict and/or distorted sands and gravels. The fluvial facies contains dragfolds, overfolds and small thrust faults. The deformation diamict, in places, is predominantly reworked coarse glaciofluvial material. When this is the case, dragfolds, overfolds and crenulations are common. When the deformation diamict is reworked till, shear flexures and small thrust faults occur. Pebble clast fabric analysis (Figure 5) from the upper till suggests a northern ice flow vector ( $5^{\circ}$  azimuth). A secondary vector ( $40^{\circ}$  azimuth), however, supports the northeastern ice flow theory.

North of Onanole discordant shale bedrock is exposed in a small borrow pit on the proximal side of the ridge. At this site the strike appears to be as expected, apparent dips seem to be disrupted, plunging opposite the acknowledged trend.

# Conclusions

One might suggest that these hypothesized ice shoved hills are in fact shale bedrock subcrops. Perhaps subsurface drilling could resolve the conflict, but that is unlikely to occur. The stratigraphic evidence (tills over deformed glaciofluvial material) in both the surrounding ice stagnation plain and the Small Composite Linear Ridge support the conclusion that these features are Cupola-Hills and perhaps Hill-Hole Pairs.

All appear to have formed during the Falconer Advance of the Lostwood Glaciation and are surrounded by Glacial Lake Proven sediments. The fluvial facies appears to be outwash suggesting the glacier advanced over its outwash plain. Subglacial shear and folding were probably aided by porewater pressure and frictional drag.

## **References:**

- ABER, J. 1985 "The character of glaciotectonism" *Geologie en Mijnbouw* 64: 389-395
- ABER, J. 1988 "Ice-shoved hills of Saskatchewan compared with Mississippi Delta mudlumps – Implications for glaciotectonic models" Croot, D. (ed) *Glaciotectonics Forms and Processes* Rotterdam: Balkama 1-9
- ABER, J. 1989 "Spectrum of constructional glaciotectonic landforms" Goldthwait, R. and Matsch, C. (eds) *Genetic Classification of Glacigenic Deposits* Rotterdam: Balkema 281-292
- ABER, J. 1993 "Expanded Bibliography of Glaciotectonic References" Aber, J. (ed) *Glaciotectonics and Mapping Glacial Deposits* Regina: Canadian Plains Research Center 99-137
- ABER, J., BLUEMLE, J., DREDGE, L., SAUCHYN, D. and ACKERMAN, D. 1993 "Glaciotectonic Data Base and Mapping of North America" Aber, J. (ed) *Glaciotectonics and Mapping Glacial Deposits* Regina: Canadian Plains Research Center 177-200
- BANNATYNE, B. 1970 "The clays and shales of Manitoba" Manitoba Department of Mines and Natural Resources, Mines Branch, Publication 67(1): 1-104
- BENN, D. and EVANS, D. 1998 Glaciers and Glaciation London: Arnold Bluemle, J. and Clayton, L. 1984 "Large scale glacial thrusting and related processes in North Dakota" *Boreas* 13: 279-299
- CHRISTIANSON, E. 1971 "Geology and groundwater resources of the Melville Area (62 k, 1) Saskatchewan" Saskatchewan Research Council, Geology Division, Map 12

- KLASSEN, R. 1966 "Surficial geology of the Riding Mountain area, Manitoba-Saskatchewan" Unpublished Ph.D. Thesis Saskatoon: University of Saskatchewan
- KLASSEN, R. 1979 "Pleistocene Geology and Geomorphology of the Riding Mountain and Duck Mountain areas, Manitoba-Saskatchewan" Geological Survey of Canada Memoir 396: 1-52
- McGINN, R. 1991 "The formation and draining of late Wisconsinan superglacial lakes on the Riding Mountain Uplands, Manitoba" *Atlantic Geology* 27: 221-227
- McGINN, R. 1997 "The Horod Moraine: The facies and deposits of a supra-terminoglacial subenvironment" Thraves, B., Paul A. and Widdis, R. (eds) *The Estevan Papers. Regina Geographical Studies*, 6. Regina: 100-112
- MORAN, S., CLAYTON, L., HOOKE, R., FENTON. M. and ANDRIASHEK, L. 1980 "Glacier-bed landforms of the Prairie Region of North America" *Journal of Glaciology* 25(93): 457-476
- McNEIL, D. and CALDWELL, W. 1981 "Cretaceous rocks and their foramifera in the Manitoba Escarpment" *Geological Association of Canada Special Paper* 21: 1-439
- WELSTED, J. and YOUNG, H. 1980 "Geology and origin of the Brandon Hills, southwest Manitoba" *Canadian Journal of Earth Sciences* 17: 942-951

# Soil acidity (pH) as influenced by point-source pollution from a base-metal smelter, Flin Flon , Manitoba

Geoffrey A. J. Scott University of Winnipeg

Abstract: This study examines possible spatial variations in soil pH around Flin Flon, Manitoba, that might result from SO<sub>2</sub> deposition coming from the non-ferrous metal smelter located in the town. Ten study sites were selected to reflect decreasing ridge-crest ecosystem pollution damage along a 37.5 km east-southeast transect downwind from Flin Flon to Cranberry Portage. Two control sites were also selected at 33.2 and 47.3 km northeast of Flin Flon to reflect locations where no detectable modifications to ridgetop ecosystems were observed. At each study site eight soil samples were collected at ridge crest, eight at mid-slope, and sixteen at lower slope subsites. In addition, small ridge-top runoff conduits and depressions filled with organic residues were sampled. Linear regression did not confirm any correlation between pH and distance from the pollution source. While SO<sub>2</sub> and base metal fallout are implicated in the death of higher plants and cryptogams (lichen and mosses) on ridge-crest sites near the smelter, it is concluded that base metal/fly ash fallout is sufficient to counteract any SO, induced hydrogen buildup that would lower soil pH. Results support the normal base nutrient/base metal shedding properties of ridges as pH values increase significantly downslope.

## Introduction

Many studies have documented acid fallout impacts on both vegetation and soil across eastern North America and Europe. While results are ambiguous, it is generally concluded that as  $SO_2$  fallout increases, soils that are not well buffered against pH change experience  $SO_4^{2^2}$  adsorption and increased acidity (lowered pH)

over extended periods of time, and impacts to vegetation result (DeHayes *et al.* 1999; Eriksson *et al.* 1992). While such impacts tend to be regional, locally the soils most affected are those which are non-calcareous, coarse textured, have low cation exchange capacities, and low base saturations (Reuss *et al.* 1986).

More dramatic local pollution impacts are associated with increasing SO<sub>2</sub> and base metal particulate fallout as point-source non-ferrous smelters are approached (e.g. Sudbury, Flin Flon and Thompson -- Dudka et al. 1995, 1996; McMartin et al. 1996; Orlandini 1998; Henderson et al. 1995; Hocking et al. 1977). Despite the dramatic impacts on vegetation close to smelters, influences on pH are still ambiguous even though many studies conclude, or imply, that soil pH increases away from these same point sources (Amiro et al. 1981). In fact, it seems that increased acidification close to smelters is a basic assumption in many studies. Hogan et al. (1984), using data from eight lowland forest soils downwind of the Flin Flon smelter, were unable to confirm such a pH trend however, expressing surprise at a result so contradictory to that found for most other non-ferrous smelters. Zoltai (1988) also concluded that SO<sub>2</sub> emissions were not reflected in the surface peats throughout the Flin Flon region, even though within 5 km of the smelter soil sulfur levels were 3 to 12 times higher than background levels. This present study was therefore initiated to determine if any spatial trend in soil pH really exists near Flin Flon. Unlike these last two studies, which only sampled forested soils in run-off receiving lowland mineral and wetland soils, this study selected upland ridges many of which had lost their tree cover due to pollution. Ridges were selected because it was considered runoff shedding sites might better reflect direct fallout, and therefore provide a clearer view of any spatial pH variations resulting from pollution. Field studies were carried out during the summer of 1989, 1995, and 1996, with one winter visit in 1996.

## Materials and Methods

**a) Study Area**: Flin Flon is located on the Saskatchewan/ Manitoba boundary at 54° 45' N (Figure 1). This part of the Precambrian shield is dominated by granitic and metavolcanic



*Figure 1:* Location of study sites 1-10 between Flin Flon and Cranberry Portage. The Sherridon road control study sites #11 and 14 are located off the top right corner of the mapped area.

(greenstone) rocks containing sulphide orebodies rich in non-ferrous metals such as zinc, copper and cadmium. In1927 Hudson Bay Mining and Smelting Company (HBMS), began construction of a zinc-copper smelter which became operational in 1930, with atmospheric emissions being released from 30 m tall stacks. These were replaced in 1974 by a single 251 m stack. In addition to  $SO_2$ Zn, Cu and Cd, emissions include arsenic, nickel, iron, lead and mercury, with dry and wet base metals deposition taking the form of metal particulate, metal oxide and metal sulfates (Franzine et al. 1979). Emissions levels for SO, have always been high, but the addition of electrostatic precipitators in 1982 has reduced particulate emissions by approximately seven fold (Schultz et al. 1983). In 1996, 202,032 tonnes of SO, were released into the atmosphere (Krawchuk 1998), reflecting a gradual increase during the last decade in both yearly mean totals, and in the 1-Hr and 24-Hr maximum SO<sub>2</sub> levels.

Shield-bedrock outcrops as low rolling hills with glacially scoured crests that have been scratched relatively clean of any regolith. Intervening depressions are filled with discontinuous Quaternary and Holocene tills, glaciolacustrine sediments, peats, and numerous lakes. South of Cranberry Portage bedrock consists of Ordovician carbonates completely buried by till and outwash, and without outcrops. The dominant winds are towards the southeast and southwest, with strong components towards the north-northwest and south (Henderson et al. 1995). This results in an oval pattern of decreasing base metal contaminated soil centered on Flin Flon, with a northwest to southeast axis (Zoltai 1988). Undisturbed ridge crests include soil-free areas (with crustose lichen cover) and thin Folisol-like organic profiles developed from accumulations of dead cryptogams together with some conifer residues. These Folisols are protected from erosion by the living cryptogam cover and provide a substrate sufficient to support scattered jack pine, and occasionally spruce. Better drained regolith on forested mid- and lower slopes have Degraded Dystric Brunisols often showing signs of gleying, while in lowlands Peaty Gleysols, Fibrisols and Mesisols dominate (Figure 2A).

Undisturbed forests throughout this Subhumid Mid-Boreal Ecoclimatic Region are characteristic of the mixed-woods section of the boreal forest, and are dominated by jack pine, (*Pinus banksiana*), black spruce (*Picea mariana*), white spruce *Picea glauca*), trembling aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*), and white birch (*Betula papyrifera*) (Scott 1995). Ridge crests close to Flin Flon have been devegetated primarily because of pollution with their cryptogam cover killed, thin Folisols eroded, and conifers toppled. These remaining ridge-crest conifers survive only on remnant Folisol patches or on organic-filled depressions, and are aided by developing basal skirts which are protected during the fumigation winter months intranivally. Lower slopes with deep soils retain a forest cover even close to Flin Flon, although closed mixed forest gives way to a more open hardwood cover of birch and aspen within 3 km of the smelter.
### A. Before



*Figure 2:* A. Typical ridge ecosystem conditions in the Flin Flon region before (or without) pollution impacts. B. Typical ridge ecosystem conditions close to Flin Flon after seventy years of smelter pollution.

**b) Study Site Selection**: Following a preliminary reconnaissance between Flin Flon and Cranberry Portage, ten ridge-crest study sites were selected where conditions were considered similar in all respects except for pollution impacts (Figure 1). Site selection was based to five criteria, 1) conformity to the downwind pollution fallout pattern, 2) similar acidic bedrock, 3) were/are dominated by lichen cover and open jack pine, 4) accessibility, 5) lack of disturbance by fire or other non-pollution anthropogenic impacts. Suitable sites could not be selected southeast of Cranberry Portage due to different bedrock/outcrop characteristics. As the control site (# 10) at Cranberry Portage was later considered to exhibit possible minor pollution impacts, two additional control sites, # 11 and 14,

were selected 33.2 and 47.3 km respectively northeast of Flin Flon along the Sherridon road. Here no pollution impacts were noted, and soil base metal contents approach background levels (Zoltai 1988).

c) Soil Sampling and Analysis: To reflect the nutrient/runoff shedding characteristics of ridges at each study site, samples were collected at three subsites (A, B, and C in Figure 2). Figure 2 models the general pre- and post-pollution ecosystem conditions at the more seriously impacted sites within 6 km of Flin Flon. At each of subsites A, B and C, eight 0-5 cm deep soil samples were collected randomly within a 10x10 m area. At subsite C eight additional samples were collected at a depth of 5-10 cm ( $C_2$ ). Additional samples were collected from small ride-top runoff swales and in depressions (1-5 m across) which had been partially filled with eroded organic debris. Ridge-crest samples were mostly organic except at study sites #1-3 where much of the original Folisol had been removed by erosion. Here many samples consisted of mineral regolith found in crevices. Soil samples were immediately air dried, and on return to the laboratory the organic samples were ground and all samples sieved through a 2 mm mesh sieve. The 0.01M CaCl, method was used for pH determination, using a Radiometer Inc., Copenhagen, pH Meter (type PHM 29b).

**d**) **Statistical Analysis:** Linear regression was performed (using the statistical analysis software SPSS) on the data from study sites

Site #	distance from smelter (km)	mean pH for all 3 sub- sites	mean pH for sub- site A	S. D. for sub- site A	mean pH for sub- site B	S. D. for sub- site B	mean pH for sub- site C <sub>1</sub>	S. D. for sub- site C <sub>1</sub>	mean pH for sub- site C <sub>2</sub>	S. D. for sub- site C <sub>2</sub>
1	1.65	5.299	4.589	.305	5.449	.453	5.961	.159	5.198	.621
2	2.45	4.230	3.540	.142	3.508	.370	4.494	.608	5.38	.711
4	3.00	4.260	4.501	.282	4.574	.264	4.126	.344	3.840	.433
3	3.40	4.560	3.624	.190	3.824	.286	5.206	.573	5.610	.347
5	4.70	4.594	4.103	.278	4.326	.316	5.129	.670	4.851	.765
6	6.35	5.414	4.356	.469	5.300	.261	5.811	.522	6.189	.304
7	10.40	4.026	4.836	.351	4.645	.197	5.311	.354	4.511	.087
8	15.70	3.818	3.430	.253	4.139	.454	3.988	.137	3.718	.365
9	23.90	4.552	4.337	.323	4.995	.460	4.890	.438	3.984	.302
10	37.50	4.554	4.265	.287	3.770	.379	4.594	.707	5.591	.891
11	36.8	3.766	3.900	-	3.600	-	3.800	-	-	-
14	47.3	3.912	4.013	-	3.81	-	3.913	-		-

Table 1: Means and standard deviations for pH data at all study sites.

1 - 10 to determine if there is a statistically significant relationship between the soil pH of the ridge-crest samples (subsite A) and their distance from the smelter. The pH data from the mid- (subsite B) and lower slopes (subsite C) were tested in the same manner. Linear regression was also used to see if there is a relationship between soil pH and position on the hillside (i.e. between subsites A, B and C). As the control study sites 11 and 14 did not conform to the site-selection criteria established for these analyses, they were not used in the regression analyses.

### Results

Table 1 summarizes pH data for all study sites sampled. For ridge-crest study sites 1-10 (subsite A, n = 80) the mean pH value is 4.16, while the comparable value for the two control sites # 11 and 14 (n = 16) is 3.96. Individual pH values for subsites A range from a low of 3.08 at site # 8, to a high of 5.29 at site # 1 (Figure 3). While the largest mean pH values were actually found at study sites # 1 and 7, the lowest ridge-crest mean values were at sites 2,



*Figure 3: Ridge-crest (subsite A only) pH values plotted against distance from the smelter.* 



*Figure 4: Mean pH values at subsites A, B and C*<sub>1</sub> *plotted against distance from smelter. See Figure 3 for study-site numbers.* 

**Table 2:** Pearson Product Moment Coefficients (r) and Significance of r at the 0.01 level for linear regression analyses, study sites 1-10 only.

Dependent variable v independent	r	Significant at the 0.01 level?			
pH values for subsites A v distance from smelter	0.05614	no			
pH values for subsites B v distance from smelter	0.16816	no			
pH values for subsites $C_1 v$ distance from smelter	0.23956	no			
pH values for subsites A v pH values for subsites B	0.49809	yes			
pH values for subsites B v pH values for subsites $C_1$	0.46164	yes			
pH values for subsites A v pH values for subsites $C_1$	0.3097	yes			

3 and 8. Linear regression between ridge-crest pH data (which were considered to be the most likely to demonstrate any pH changes attributable to  $SO_2$  adsorption) and distance from the smelter, reveal no linear relationship at the 0.01 level (Table 2). Figure 4 illustrates mean pH values for each of the subsites A, B and C<sub>1</sub> plotted against distance from the pollution source. While these data (n = 239) might suggest greater scatter in mean values between subsites close to the smelter, again linear regression shows no correlation at the 0.01 level between pH for either subsite B or C with distance from the smelter.

When individual subsites from ridge-crest to slope-bottoms at study sites 1-10 are compared with each other (without regard to distance from the smelter), the base nutrient shedding (and most likely the bases metal/fly ash shedding) characteristics of these ridges is evident (Figure 5). Mean pH values for subsites A, B and  $C_1$  are 4.158, 4.453 and 4.956 respectively. Regression analysis reveals that this downslope increase in pH is significant at the 0.01 level (Table 2). The pH data from control sites # 11 and 14, however, show no particular trend (Figure 5). Results obtained from small depressions at A subsites show great variation in pH values depending on the extent each acts as small collecting basins, or runoff swales. While most of the depressions have strongly acid soils (pH 3.5 - 4.2), runoff swales for both sites # 1 and 6 exhibited high values. Just below the ridge-crest at site # 1 one swale contained eroded organic debris through which metal particulate



*Figure 5:* Mean pH values for subsites A, B and  $C_1$  for each of the twelve study sites plotted against topographic position.

and fly ash were washed following rain. Three samples taken at its centre of this swale had pH values of 5.5, 6.0 and 6.1. A similar swale at study site # 6 had a pH of 5.8.

### Discussion

This study confirms the more general findings of Hogan *et al.* (1984) and Zoltai (1988) that despite the trend apparently found close to point-source polluting smelters elsewhere, here around Flin Flon there is no statistically significant spatial variation in pH downwind of the pollution source (Figure 3). The study also confirms the expected situation that ridges shed bases and pollutants downslope, a factor which helps account for both higher and more variable pH values in lowland soils (Figure 5, Table 2).

A number of factors may account for this lack of any downwind pH variation. The first possibility is that the 251 m stack, which was constructed precisely to distribute pollutants more widely, has been effective in creating a more even  $SO_2$  fallout pattern, thereby impacting soils equally. This explanation, however, is considered unlikely for two reasons. First, it would require a regional depression of pH values, not supported when pollution transect values are compared to the Sherridon road control sites, and second it is not supported by the earlier results of Hogan *et al.* (1984) and Zoltai (1988).

A more plausible explanation is that buffering by both fly ash and base metal particulate and cations, which have been documented to decrease exponentially away from the smelter (Zoltai 1988; McMartin et al. 1996; Orlandini 1998), are in sufficient quantities to neutralize induced hydrogen ion buildup in the soil solution (Buchauer 1973). It should be noted that the highest single pH value recorded for any ridge crest was at study site # 1 only 1.65 km from the HBMS stack. It is at this same site that the highest pH values for runoff swales were also recorded. This implication of fly ash is supported by Zoltai's findings that the higher levels of sulfur found in peats within 5 km of the HBMS smelter were associated with ash contents also much above background levels. In addition, Hogan et al. (1984) suggest that for Flin Flon, zinc may be responsible for the ameliorating effects of sulfur deposition. In the USA, Legge et al. (1986) also noted that at least half of the sulfur acids deposited by precipitation are neutralized by base metal pollutants precipitated at the same time, while Jordan et al. (1975) found that the amphoteric properties of zinc oxide may cause pH to actually rise near a base metal smelter!

While this study demonstrates no linear relationship between soil acidity and distance from the smelter, the cocktail of sulfur and base metal particulate has clearly been demonstrated to seriously impact the soil-vegetation complex to the point that close to the smelter almost all ridge-crest vegetation has been killed. Particularly significant is the impact of these pollutants on the thin cryptogam-formed and protected Folisols, on which these ridgecrest ecosystems depend (Scott, 1995). Cryptogam death leads to the 'death' of these Folisols and they are then eroded. This soil loss, combined with impacts of atmospheric sulfur to tree leaves, and the effects of elevated base metal levels on roots, free-living soil microflora (Wright *et* al. 1996; Hocking *et al.* 1977), and root mycorrhizal associations (Klein 1983) , may account for such ecosystem destruction.

It may well be that the contradictory statements about pH trends close to base metal smelters found in the literature may be partly the result of the amount and type of data used in each study. Often these pH data were obtained both from few samples, and samples collected as secondary to studies performed to show plant cover damage differences regardless of topographic position. This current study demonstrates that combining data from a variety of topographic sites is inappropriate as they would include the preand post-pollution nutrient cation and base metal pollutant shedding properties of ridges.

### Acknowledgments

The author wishes to thank Lynn Christenson, Rosa Orlandini, Gregory Scott and David Wright, who greatly assisted with field sampling and lab analyses. Special thanks to Brian McGregor who performed the statistical analysis, and Weldon Hiebert for his excellent cartography.

### References

- Amiro, B., Courtin, G. 1981 'Patterns of vegetation in the vicinity of an industrially disturbed ecosystem, Sudbury, Ontario'. *Canadian Journal of Botany* 59: 1623-1639
- Buchauer, M. 1973 'Contamination of soil and vegetation near a zinc smelter by zinc, cadmium, copper and lead.' *Environmental Science* and Technology 7: 131-136
- DeHayes, D., Schaberg, P., Hawley, G., Strimbeck, G. 1999 'Acid rain impacts on calcium nutrition and forest health'. *BioScience* 49(10): 789-800
- Dudka, S., Ponce-Hernandez, R., Tate, G., Hutchinson, T. 1996 'Forms of Cu, Ni, and Zn in soils of Sudbury, Ontario and the metal concentrations in plants'. *Water, Air and Soil Pollution* 90: 531-542
- Dudka, S., Ponce-Hernandez, R., Hutchinson, T. 1995 'Current level of total element concentrations in the surface layer of Sudbury's soils'. *The Science of the Total Environment* 162: 161-171
- Eriksson, E., Karltun, E., Lundmark, J-E. 1992 'Acidification of forest soils in Sweden'. *Ambio*: 150-152
- Franzine, W., McFarlane, G. Lutz, A. 1979 'Atmospheric fallout in the vicinity of a base metal smelter at Flin Flon, Manitoba, Canada'. *Environmental Science and Technology* 13: 1513-1522
- Henderson, P., McMartin, I. 1995 'Mercury distribution in humus and surficial sediments, Flin Flon, Manitoba, Canada'. Water, Air and Soil Pollution 80: 1043-1046
- Hocking, D., Blauel, R. 1977 Progressive Heavy Metal Accumulation Associated with Forest Decline Near the Nickel Smelter at Thompson, Manitoba Information Report NOR-X-169, Northern Forest Research Centre, Edmonton
- Hogan, G., Wotton, D. 1984 'Pollution Distribution and Effects in Forests Adjacent to Smelters'. *Journal of Environmental Quality* 13(3): 377-382
- Jordan, M., Lechevalier, M. 1975 'Effect of zinc smelter emissions on forest soil microflora.' *Canadian Journal of Microbiology* 21: 1855-1865
- Klein, R. 1984 'Ecosystems approach to the acid rain problem.' Linthurst,
  R. (ed.) *Direct and Indirect Effects of Acid Deposition on Vegetation* Boston: Butterworth 1 12
- Krawchuk, B. 1998 Manitoba Ambient Air Quality Annual Report for 1995 and 1996 Report No. 98-03, Manitoba Environment
- Legge, A., Krupa, S. 1986 Air Pollutants and Their Effects of the Terrestrial Ecosystem John Wiley, New York

- McMartin, I., Henderson, P., Nielson, E., Campbell, J. 1996 Surficial Geology, Till and Humus Composition Across the Shield Margin, North-Central Manitoba and Saskatchewan: Geospatial Analysis of a Glaciated Environment Geological Survey of Canada Open File 3277, Ottawa
- Orlandini, R. 1988 An Analysis of the Deposition of Zinc and Copper in Organic and Mineral Soils Found on Rock Outcrop Ridges Downwind of a Base Metal Smelter Located in Flin Flon, Manitoba. Geography B. Sc. Thesis, University of Winnipeg
- Reuss, J., Johnson, D. 1986 Acid Deposition and the Acidification of Soils and Water Ecological Studies 59, Springer-Verlag, New York
- Schultz, A., Reeve, K., Cowan, B. 1983 'Particulate emissions from the Main Stack, Hudson Bay Mining and Smelting, Flin Flon, Manitoba' Environmental Control Programs, Manitoba Environmental Management Division
- Scott, G. 1995 Canada's Vegetation: A World Perspective McGill-Queen's University Press, Montreal
- Wright, R, Adkins, A, Scott, G. 1996 'Microbial diversity and activity in a Northern Stressed Ecosystem'. *Manitoba Society of Soil Science Proceedings* Winnipeg: Freshwater Institute 159-170
- Zoltai, S. 1988 "Distribution of base metals in peat near a smelter at Flin Flon, Manitoba". *Water, Air and Soil Pollution* 37: 217-228

# Public policy in natural resource management: parks, protected areas and network of special places in Manitoba, Canada

#### C. Emdad Haque, Brandon University Swaroop D. Reddy, University of North Texas Jason Adams, Manitoba Natural Resources

*Abstract:* In the face of global concern and awareness of the need for the protection and preservation of nature and natural lands during the past few decades, special interest groups and organizations have played a key role. Numerous international conventions have led to a global understanding of technical classification and development of programs for creating protected lands at the national and subnational levels. As partners in a global program, Canadian public institutes and special interest groups have played a leadership role in formulating and implementing the World Conservation Strategy.

In order to respond to the international call for establishing 12 percent of land as protected land in each nation, Canadian public policies were geared to achieve this goal by the end of the 20th century. In 1992 Canadian federal and provincial governments signed an agreement to expand the nation's network of protected areas to 12 percent of its land and water. To attain the objectives of the 1992 agreement, Manitoba's provincial parks, wildlife management areas, ecological reserves, heritage sites, municipal parks and reserves and federal parks were recognized as Special Places. With the goal of establishing a network of these Special Places, action plans were prepared which included system plans, representation, classification and criteria, data procurement, cooperation and integration. This research established that provincial public initiatives in general were overambitious and that the goals were unattainable within the given time frame. An evaluation of the nature and status of legislation and policy initiatives concerning the Network of Special Places (NSP) has revealed that important contributions were made in these endeavours to preserve the province's natural lands through accurate classifications, appropriate system plans, and legislation. Public involvement in the decision-making processes has significantly assisted the vertical integration of institutions. However, efforts in making horizontal integration were limited, and lack of an integrative approach hampered the pace of progress in establishing the protected and designated areas.

# Introduction

Major worldwide changes are presently underway in economic, social and biophysical areas; the globalization of our economies, the unprecedented magnitude of natural resource extraction, extensive ecological degradation and rapid climate changes are facts of contemporary life. Not only are public awareness and attitudes toward the environment and governments changing, but also, both public and private institutions are undertaking initiatives to react to such changes. One such critical change has been increased public interest in the protection and preservation of nature and ecological attributes, and in the well-being of parks and associated systems. Although public polls consistently reveal the high level of concern among the general public, it is the organized "communities" and "special interest" groups that have been primarily responsible for articulating this interest (Dearden and Rollins 1993). How the public institutions and their policies are responding to the emerging environmental and resource protection concerns is the central focus of this study. The case study of the Province of Manitoba, Canada is used to analyze the resource management, public policies and programs concerning parks and protected areas.

In 1992 Canada's federal and provincial governments signed an agreement to expand the nation's network of protected areas to 12 percent of its land and water and to complete this task by the year 2000. The United Nations and the World Wildlife Fund set the criterion that the areas of protected lands must also exclude mining, commercial logging and hydroelectric development. The province of Manitoba, Canada, possessing more than one-quarter of a million square kilometers of the Boreal forest, has been a key stakeholder in the process of developing and implementing provincial policies and programs. To attain the objectives of the 1992 agreement, provincial parks, wildlife management areas, ecological reserves, heritage sites, municipal parks and reserves and federal parks were recognized as Special Places. The action plans included system plans, representation, classification and criteria, data procurement, cooperation and integration. A number of research questions are addressed in this paper. They include: how much progress have the public policies and programs made? What has been the structure and effectiveness of Manitoba's Network of Special Places (NSP)? What innovative ideas were tested? What lessons were learnt to formulate future policies? In light of these research questions, the present study examines the nature and status of legislative and policy initiatives with regard to NSP. It also assesses the public policy achievements, failures and problems.

### **Global Concerns and Canadian Responses**

Concerns for biodiversity loss, genetic erosion and stresses on ecosystems and the need for parks and protected areas have been addressed since the mid-1960s by a number of global initiatives, but dealing with these pertinent problems and issues can be performed effectively only at the local and regional levels. The International Union for Conservation of Nature and Natural Resources (IUCN) Commission on National Parks and Protected Areas (CNPPA) has therefore advocated a system of different kinds of protected areas in which varied types and degrees of conservation and land use are appropriate. A primary goal has been to motivate decision makers and citizens to consider protected areas as a complex, mutually reinforcing set, developed for varied types and degrees of both conservation and development, rather than as restrictive, even "single purpose" areas (Nelson 1987: 292).

Globally, IUCN has demonstrated its serious concern about more effectively promoting national parks and protected areas as mechanisms for socioeconomic development. The 1982 National Park Conference in Bali, Indonesia, concentrated on the theme of national parks, conservation and development and, more specifically, on the role of protected areas in sustaining society (McNeely and Miller 1984). In this conference and in other contemporary forums, strong arguments were made "for the human

side of the coin, for historical or acheological features, cultural heritage, and traditional conservation practices as a basis not only for better land management but also for making judgements about rapid technical, economic, social and other changes" (Nelson 1987: 293; also see Scace and Nelson 1986). Attention has also been given to the role of parks and protected areas in regional planning and development, along with comprehensive land use management. The Man and Biosphere (MAB) program of UNESCO has been attempting to promote establishment of these areas as part of a cooperative network of institutions and mechanisms functioning for better scientific understanding of the environment and better protection and use of it. On the one hand, this notion insists that tourism, local subsistence activities and other uses of parks and protected areas could bring about greater benefits to local people if they are involved in the overall decision-making process. On the other hand, it suggests that the parks and protected areas network is an essential component of a larger development and conservation system that includes lands and waters being used exclusively for cultivation, grazing or various types of extractive purposes.

The international convention activities largely provide a legal mechanism for collaboration between nations, as well as the role and programs of international organizations with respect to conservation and protected areas (Eidsvik 1993). One of the principal areas of development of IUCN was the World Conservation Strategy (WCS) which was launched in over 30 countries in 1980. The WCS has three major objectives: i) to preserve genetic diversity; ii) to maintain essential ecological processes; and iii) to ensure that the utilization of species and ecosystems is sustainable. The WCS brought about a major shift involving a movement away from preservation of fauna and flora toward a more integrated management of natural resources through the preparation of national and regional conservation strategies. In order to reflect Canada's commitment to the WCS, an amendment to the National Parks Act was made in 1988, through which maintenance of ecological integrity has become the primary goal of her national parks instead of the human use and enjoyment of nature. McNamee (1993: 40) finds that this amendment is significant for two reasons: i) it solidifies the idea that the priority of national parks is to protect natural resources; and ii) in order to maintain the ecological integrity of the national parks, the government must take action to define and eliminate the range of internal and external threats to park resources.

Through the work of Dasmann and others, the IUCN developed a methodology for classifying protected areas in accordance with their conservation objectives. Although ten different categories were formulated initially, the World Conservation Monitoring Center has reported on only five of these categories in the UN's Directory of National Parks and Protected Areas. These include Category I: Scientific Reserves; Category II: National Parks and Equivalent Reserves; Category III: Natural Monuments; Category IV: Habitat and Wildlife Management Areas; and Category V: Protected Landscapes. It is essentially a general framework that is employed to a varied extent in various parts of the world. Examination of this world data set has revealed that by the mid-1980s Canada had emerged as one of the world's leaders in the establishment of protected areas (Eidsvik1993: 286). The most critical issue concerning protected areas is that the ultimate goal of these actions is to allow maintenance of biological diversity, the variety and variability among living organisms and the ecological complexes within which they take place (McNeely et al. 1990). Canada's biological diversity is limited (World Resources Institute, 1990) compared to that of many tropical countries, and protecting species cannot be achieved only by protecting areas. Eidsvik (1993: 286) argues that, if Canada as a political and ecological entity aims at achieving these goals, "protecting species must extend to our society as a whole".

The World Wildlife Fund Canada and the Canadian Parks and Wilderness Society stimulated public advocacy efforts in 1989 through launching the Endangered Spaces campaign to expand the national parks system. In order to represent each of the nation's approximately 350 natural regions, the campaign's goal was to have all levels of governments complete their systems of parks and protected areas by the year 2000. Through these achievements, the land protected should total about 12 percent of Canada, the target recommended by the 1987 Brundtland Commission report on the world environment and development. By the late 1980s it was apparent that there was an emerging consensus amongst the public, scientists and government officials that more wilderness must be protected, and a campaign was launched to translate this growing level of public support for the protection of natural lands and waters into political action. Recent developments in public awareness of the environment and conservation needs involved three major issues. There has been an emerging consensus, first, to expand the parks and protected areas, especially in relation to the public concern over the unprotected wilderness lands; second, to minimize the degradation of existing parklands and their natural resources; and third, to delineate and augment the role of local-level communities in protecting biodiversity and environmentally sound land-use management through the development of a network and system plan.

### **Conceptual Considerations for Network Development**

Application of the concept of a network system in ecosystem, biodiversity and habitat preservation generally refers to established relationships among various spatial units, representing the needed diverse characteristics. Literature on this usage of networks from a spatial unit perspective is limited; however, it is perhaps relevant here to review the well-developed concepts of network development from a social unit perspective. Although the features and contexts of the spatial unit network may vary from that of the social unit network, it is reasonable to presume that their principles and structures do not differ significantly. Moreover, the spatial units *per se* cannot form a network without their articulation with social units, and therefore, these two are inseparable dimensions of a network system. The model of vertical and horizontal integration in the network system thus can be applied to both spatial and social unit perspectives.

With an emphasis on social units, development planning researchers have long used the Model of Horizontal and Vertical Integration (MHVI). They employ the model to assess local organizational development and the effects of horizontal and vertical integration. Horizontal integration is basically the network of interrelationships among the community's various social units and subunits (Warren 1963). Communities with strong horizontal integration demonstrate closely bound local organizations; they vigorously support and mutually reinforce each other. The community deals with its problems through consensus and is comprised of groups and individuals who take a keen interest in articulating their needs and influence decision making at the local level. Under such a scenario, land-use and planning decisions are tailored to fulfill local capacity and needs (Paul 1988; Berke and Beatley 1992). Communities with a weak horizontal integration of organizations are represented by loosely knit networks, and local interest and social groups who can influence public policy have limited interaction with each other.

Vertical integration denotes the relationship between a community's units and subunits and systems outside the community (Warren 1963; Berke et al. 1993). Since communities with strong vertical integration usually have an extensive network within the wider political, economic and social entities, they enhance a community's influence on outside affairs. In addition, local concerns are likely to be considered seriously by higher levels of authority at the provincial or federal level. However, inequalities are also evident in this form of integration.

An integrative approach to accommodate both horizontal and vertical relationships is needed to attain optimum results. The benefits of strong vertical integration cannot be fully reaped if the horizontal relationships are weak. The absence of strong horizontal relationships makes communities susceptible and subordinate and often excessively reliant on external forces, whereas strong horizontal resources empower communities to influence interventions from outside (Berke et al. 1993). Programs from outside are tailored to suit local requirements if there is a forceful vertical integration, and lack of it leads to loss of locals' influence on external programs. On the basis of a matrix of both strong and weak characteristics of vertical and horizontal integration, Berke et al. (1993) categorized four types of communities. In this spectrum, type 1 communities can provide effective leadership, disseminate innovation and play a function of role model in both policy formulation and in implementation of the accepted plan. Type 2 and 3 communities are intermediary entities, and they lack relative power and influence due to structural weaknesses. Many communities have no means to acquire external resources, and even if they do receive resources, they have no local networks for making pragmatic decisions and channeling the resources effectively.

Berke and Beatley (1992), Berke et al. (1993), Paul (1988) have described several complex processes that facilitate horizontal and vertical integration. They have adopted the MHVI to the context of development planning and crisis recovery processes. In the context of natural resource management, it is asserted that the same principles, as postulated in MHVI, would apply. Such assertion is more appropriate when the question of a network development for implementing policy decisions arises. In the following, considering the features of MHVI, the approaches and processes of the development of a network of special entities (which embodies both spatial and social dimensions) concerning biodiversity and species protection in the province of Manitoba are examined.

# Parks, Protected Lands and Special Places in Manitoba

The province of Manitoba is endowed with vast natural forests; a total of 263,000 sq. km. is covered by forests. Although the provincial initiative towards establishing forest reserves began in the 1930s, when control of the province's natural resources was transferred to the provincial government, Manitoba's first Provincial Parks Act was passed in 1960. The focus of this legislation was to preserve parks and recreational areas for recreational purposes, but extractive activities and agriculture could continue, provided that they respected the former goals. This approach was becoming obsolete rapidly as the provincial park systems continued to grow throughout the 1970s and 1980s. In recognizing the fact that "there was imbalance between preservation and consumption in the park system" and that there was a "need for parks to represent the province's natural regions", a System Plan for Manitoba's provincial parks was released in 1985. In the 1980s, although persistent and stronger environmental movements and public support for conservation began to emerge than ever before in the province,

allocation of public funds faced a continuous decrease. The words of a natural resources manager in Manitoba echo such concerns:

At the basic level, it was becoming evident that the parks legislation which governed infrastructure management had to be updated to deal with the reality of ever decreasing budgets. Issues like taxation in parks, fees, maintenance of a half a billion dollars of park infrastructure that supported existing developments and cottages had to be addressed to give park managers new tools to manage the developed portions of parks into the next century (Schroeder 1997: 2).

In addition, the provincial public policy domains faced a challenge from an unexpected research finding, as reported by the Federal/Provincial Park Council of Canada. A survey of resource extraction policies and practices of all park systems in Canada in 1990 revealed that Manitoba allowed the greatest range of resource extraction in its provincial parks relative to any jurisdiction in Canada (Watkins 1990). At this time, none of the province's 14,150 sq. km. of park land qualified as protected lands as defined by current standards. The findings delighted those who favored multiple land use in parks, whereas they disappointed others who felt that parks were to be protected. The most conspicuous result of the survey was that it revealed the urgent need for a thorough evaluation of the existing parks and natural resource management system in Manitoba.

The provincial government immediately tried to overcome Manitoba's lagging conditions.

In 1992, Manitoba's Minister of Natural Resources, as co-chair of the Canadian Council of Ministers of the Environment, the Canadian Parks Ministers' Council and the Wildlife Ministers' Council of Canada, was a signatory of the document "A Commitment to Establish a National Network of Protected Areas." Manitoba became the first government in Canada to make a formal commitment to the Endangered Spaces campaign of the World Wildlife Fund. This campaign is a cooperative effort, based on sound ecological criteria, to establish protected areas representing all of Canada's natural regions by the year 2000. It also aims at establishing a network of protected areas that would make up at least 12 percent of the province's land base. While the commitment was not a clear promise that all parks would be protected, it indicated that portions of parks would be protected and other land designations such as Ecological Reserves, Wildlife Management Areas and even Provincial Forests would be employed to create the network of protected lands. In general, in protected areas, logging, mining, hydroelectric development, oil and gas exploration and development and other activities that considerably and adversely affect habitat would be prohibited; these areas may include national and provincial parks as well as other land designations.

In order to stimulate broad public discussion, the Natural Lands and Special Places Strategy was launched in 1992 by the Manitoba Round Table on Environment and Economy. The document proposed policies concerning the protection, use and development of natural lands (Crown and private lands in an undeveloped state) and Special Places (designated lands such as parks, wildlife management areas, heritage sites and ecological reserves). Manitoba's Special Places are classified in seven different categories. They include Provincial Forests, Provincial Parks, Wildlife Management Areas, Ecological Reserves, Heritage Sites, Municipal Parks and Reserves and Federal Parks. Each classification defines a Special Place's use, or reason for existing, as well as defining the types of activities permitted in a Special Place (Figure 1).

Although the policy initiative addressed numerous issues, two are specifically noteworthy. First, a vigorous effort was made to review and seek comment from the public, environmental and business communities concerning protected areas policies; second, an effort was made to formulate a revised park act and guidance regarding the ongoing management of parks. The first initiative fits well with the vertical integration process, according to the MHVI. Public meetings across Manitoba were held; they revealed that widespread public support exists for a network of protected areas. Implementation of this strategy began in two areas: i)



Figure 1: Natural regions of Manitoba.

developing a methodology and approach to select representative lands that might be considered for protected status; and ii) developing legislation to facilitate the establishment of protected areas. Attempts were made to protect a representative portion of each of 12 natural regions delineated within the province (Figure 2). These representative areas are intended to encompass the biological and landscape diversity of natural regions, which are broad geographical entities that share similarities in relief, climate

					s	nent	n	ng	-	R2					ي الأحد	ingev
		arch	atio	Acces	evelop.	merci	al Fish	unting etter/C	ntcan ning	istenc	e	ing .	.ng	Rice	darve	riche
	Res	ea. Re	ere. Co	tas Spr	or Co	ni Lice	u. Out	II. Tra	Pr Sup	Su Far	n. Gra	Hay	Will	BA0	1 Los	eg. Min
vational Parks	$\checkmark$	$\checkmark$	$\mathbf{X}^{1}$	$\checkmark$	Х	Х	Χ	Χ	Х	Х	X	X	Х	X	X	X
rovincial Parks - Natural	$\checkmark$	$\checkmark$	0	$\checkmark$	0	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	0	0	Ο	0	Х	0	0
rovincial Parks - Wilderness	$\checkmark$	$\checkmark$	O	$\checkmark$	0	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	X	Х	Х	$\checkmark$	Х	Х	$\checkmark$
rovincial Parks - Recreation	$\checkmark$	$\checkmark$	0	$\checkmark$	0	$\checkmark$	0	$\checkmark$	$\checkmark$	0	0	0	Х	Х	0	0
rovincial Parks - Heritage	$\checkmark$	$\checkmark$	X	$\checkmark$	0	Ο	Ο	0	$\checkmark$	0	Х	0	Х	х	Х	0
rovincial Parks - Wayside	$\checkmark$	$\checkmark$	х	$\checkmark$	х	$\checkmark$	х	$\checkmark$	0	X	Х	0	Х	х	Х	X
cological Reserves	0	0	X	X	Х	Х	Х	Х	0	Х	Х	X	Х	х	Х	X
oluntarily Protected	0	0	Х	0	0	0	Х	0	0	X	Х	X	Х	Х	Х	X
cological Significant Areas <sup>2</sup>																
nadian Heritage Rivers	$\checkmark$	$\checkmark$	O	$\checkmark$	0	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	X	Х	Х	$\checkmark$	х	Х	0
ritage Sites	0	0	0	N/A	N/A	0	0	0	0	0	0	0	N/A	Х	Х	X
ovincial Forests	$\checkmark$	$\checkmark$	0	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	Х	0	0	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
ildlife Management Areas	0	$\checkmark$	Х	$\checkmark$	$\checkmark$	0	0	0	Ο	0	$\mathbf{X}^{3}$	0	Х	Ο	Ο	0
fuges <sup>4</sup>	$\checkmark$	$\checkmark$	Х	$\checkmark$	$\checkmark$	0	$\checkmark$	0	Ο	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
pecial Conservation Areas	$\checkmark$	0	Х	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	Х	Х	X	Х	Х	Х	X
eritage Marshes	$\checkmark$	$\checkmark$	O	0	0	0	0	0	0	O <sup>5</sup>	Х	$O^6$	$\checkmark$	х	$\checkmark$	0
ilitary Reserves <sup>7</sup>	$O^{8}$	0	Х	Х	Χ	0	Х	X	<b>√</b> <sup>9</sup>	0	0	0	Х	Х	Ο	0
Allowed in all O Allowed in some, Notes: 1. No new cottages allowed. 2. Depends on the discretion of ow Or in zoned areas. Not renewed. 4. Refuges address only hunting and discharge of firearms					of owr arms.											
X Not allowed Or by permit 6. Allowed where traditionally hayed. 7. Limited access because 8. Only essential research allowed. 9. Not allowed during training trainin						ise of ning	safet									
VA Not applicable Source : Manito					toba	Natur	al Re	source	es. Ca	nadia	an Ari	ned I	orce	s, 199	2	

Figure 2: Activities allowed in special areas.

and vegetation. The province has adopted an "enduring features" or landscape unit approach to evaluate representation. Each natural region has been divided into smaller landscape units that are characterized by unique combinations of climate, physiography, surficial geology and soil types.

In terms of legislation that would allow the government to meet its objectives, it proclaimed the Provincial Parks Act in 1996, following the required public consultation. Participants in the public discussion emphasized the need for certainty of tenure and land use and for ongoing public consultation on land use issues in parks (Schroeder 1997). On the one side, individuals and/or groups with a resource interest asked for certainty of tenure and land use to have access to wood supplies for harvest or to mineralized or oil-bearing areas for exploration and development. For cottagers and people involved in the tourism industry, it meant assurances that leases would be honored well into the future. On the other side, for environmentalists, it implied certainty that areas of high ecological value would be protected from harvest and development for future generations. During the development process of the act, the necessity of public consultation concerning land use and management issues was reinforced.

The year 1996 marked the halfway point between the adaptation of the goals laid out by the Statement of Commitment and the proposed date of completion of the network of protected areas, the year 2000. The new Provincial Parks Act intended to deal with the problem of informal classifications of natural areas. This problem could have led to misinterpretation and the improper use of some natural lands. The act clearly defines classification criteria, boundaries, uses and protection of provincial parks.

The public consultation outcomes strongly favored the existence and linkages of the protected lands and "working landscapes". The following is specified in the 1996 act:

- A park system plan be developed with public consultation that employs the park Classification system and a series of Land Use categories (a form of zoning).
- Certain Classifications of parks (Wilderness and Heritage) and certain Land Use Categories (Wilderness, Backcountry, Heritage) preclude logging, mining or the development of oil, petroleum, natural gas or hydro-electric power or any other activity specified in the regulation.
- Certain Land Use Categories (Resource Management and Recreational Development) provide for resource use in parks that are consistent with the park classification.
- Prior to the creation, deletion or change of a park boundary, Classification or Land Use Category, public consultation must take place.
- Development of park management plans for provincial parks became a legislated requirement providing for another level of detailed planning (Schroeder 1997:5).

### Manitoba's Provincial Policy Framework

Having identified the provincial classifications of Special Places, the government developed a framework to fulfil its commitments according to the Statement of Commitment it signed to expand Canada's NSP. Under this agreement, the province of Manitoba had to expand its protection of natural lands to a minimum of 12 percent of its total land base. These areas of protected lands must also exclude mining, commercial logging and hydroelectric development from their borders. This criterion, which is a guiding principle of the Statement of Commitment, is outlined in the Endangered Species Program put forth by the United Nations and the World Wildlife Fund.

The provincial action plan for a network of Special Places determined six key elements; these are discussed in the following text.

#### Integration:

The government's adoption of sustainable development as its guideline for the formation of public policy concerning natural resources requires a new approach to the decision-making process. Achieving the goals set forth by this new approach requires an integrated decision-making and planning process. An integrated mechanism "encourages and supports decision making and planning processes that are open, cross-sectional, incorporate time horizons relevant to long term implications and are efficient and timely". Thus, integrated (vertically) decision making is one of the best means to ensure sustainable development and the preservation of natural areas.

The process involves all stakeholders affected by the decision, which includes provincial government, municipal government, agencies, communities, interest groups and the individual. If it functions properly, this process could lead to a consensus on how best to use a resource or whether the resource should be protected for future generations. Lessons from past occurrences suggest that, when market forces or economic priorities determine resource policies, concerns of sustainable development are often less emphasised. Marty (1997) in this context points to the case of Banff National Park in Alberta. The Banff-Bow Valley area contains montane habitat (Page et al. 1996; CPAWS 1997). Only three percent of Banff National Park's 6641 km<sup>2</sup> is montane habitat, and half of that portion lies in the Bow Valley where wildlife compete for the most productive habitat with development activities. Between 1971-1995, 73 grizzlies are known to have died in the park, and 90 percent of them died close to developed areas. The newly developed infrastructure within the valleys has obstructed the traditional north-south and east-west links or corridors that wild species have used for centuries to move north and south within their range between Yukon and Yellowstone ecosystems. The ongoing development processes are thus endangering the sustainability of the park's ecosystem.

### **Cooperation:**

Approximately 85 percent of Manitoba's land is Crown owned. It may therefore appear that the network of Special Places could easily be achieved using public lands. The remaining 15 percent, which are mostly in private hands and not owned by the government, are located largely in the southern part of the province. Crown land there is sparse and scattered. Without public collaboration and cooperation, the goals of the network of Special Places in the southern regions of the province cannot be attained.

In addition to upward integration in the management and decision-making process, several provincial initiatives were designed to establish downward as well as horizontal linkages in the integration process. The provincial government made plans to reach agreements with municipal governments, private owners and other programs that may protect land and associated resources. Agreements are underway with some of these stakeholders (e.g., governments, non-government agencies and individuals), and they will be included in the network of Special Places. These include: the ecologically significant areas program; national parks; municipal parks; the North America waterfowl plan; Prairie care; the nature conservancy; municipal heritage sites; and federal heritage sites, canals and structures. It is expected that the provincial efforts in concert with other parties will allow for the completion of the network in regions where Crown land is limited.

#### System Plans:

Since 1930 the province has had control over its natural resources, and it began to allocate Crown lands for use as Special Places. The intent of the provincial system plans is to build upon the existing Special Place allocations by enhancing them and addressing special needs where required. System plans are to be compiled for all of the twelve natural regions of Manitoba (Figure 2) so that they each meet the goal of having 12 percent of their land base protected. System plans for each region will include provisions that: i) allow for the completion of the provincial NSP by the year 2000; ii) provide for the designation of lands under appropriate legislation; iii) provide the definition of representation; iv) provide for the preparation of management plans for each designated area; and v) address other relevant issues and objectives.

#### **Representation:**

Representation of Manitoba's NSP should adequately represent the habitats, landforms, rare or endangered sites, unique features, heritage sites and reserves found within each natural region of the province. The representation of Manitoba's natural lands will occur following several guidelines: 1) areas will exclude commercial logging, mining and hydroelectric development; 2) these areas will include waterways, wetlands, shoreland, significant, rare or endangered habitats, as well as landforms and heritage resources characteristic of the region; and 3) each region will allocate 12 percent of its land for the previous purposes. By the year 2000, Manitoba's network of Special Places will include 20 to 25 percent of its land. Twelve percent, as outlined previously, will preserve endangered species; 8 to 13 percent will be multiple uses areas, including the activities of hydroelectric development, mining and commercial logging.

### **Classification and Criteria:**

In the past, both informal and formal classifications were used for Special Places. Classification criteria and methods were to be reviewed and notified where required; this was completed in 1994. This was accomplished using up-to-date data regarding Manitoba's natural areas.

## **Data Collection:**

Methods of data collection have been enhanced so that they will continue to provide information for the identification and evaluation of areas being considered for Manitoba's network of special places. Data collection, which is needed to support the network, includes: 1) provincial forest inventories; 2) geological surveys and inventories; 3) inventory of endangered species; 4) annual and periodic wildlife specific inventories and surveys; and 5) heritage site inventories. The gathering of these data was expected to contribute to the completion of the network of special places by the year 2000, especially in the classification of special areas.

# Expansion of the Network of Special Places: An Assessment

The government initiative for a plan to expand Manitoba's size of protected areas has been courageous and goal-specific. In this plan the problems with the existing system as well as the goals were identified. The government introduced legislation and policies that it felt would allow the plan to meet its goals. It is well-known that legislation and policies are means to an end; these policies and legislation must be put into action in order to realize to their ultimate objectives.

It takes more than legislation to protect our special areas. Conservation and management programs, volunteer programs, and educational programs help shield special areas from environmental stress. Volunteers programs involving liaison committees, cooperating associations, and citizen advisory groups are lending a hand with resource management (Gerrard et al. 1991: 92).

The report prepared by Gerrard et al. (1991) for Manitoba Environment recognizes the need for vertical and horizontal integration in the above manner. The actual progress in the implementation of legislation and the development of the network can be visualized by examining the phases of progress in protecting natural areas.

Special areas or places are designated by legislation to protect and preserve the unique physical, cultural and natural features. Under this term are included arks, heritage resources, ecologically significant areas and heritage rivers. Special Places share a common objective: to conserve delicate ecosystems, representative parts of flora and fauna and significant aspects of regional heritage (Gerrard et al. 1991). Activities allowed in Special areas (Figure 1) depend, considering their environmental impact and socioeconomic needs, on the type of economic, recreational and agricultural function and the category of natural areas (Figure 2). Previous to the provincial government's signing of the Statement of Commitment in 1991 to expand the province's network of Special Places, a total of 11.6 percent of its natural areas was protected. However, of this 11.6 percent, only 0.6 percent met the criteria put forth by the United Nations and the World Wildlife Fund. This meant that to meet the goal of preserving 12 percent of Manitoba's natural land in this fashion, the government was required to increase the protected land base by 11.4 percent by the year 2000.

The process of a kind of vertical integration was attempted in the fall of 1992, when the Manitoba Round Table on Environment and Economy was pursued. It conducted a public review of draft policies for the protection, use and development of the province's natural, cultural and heritage resources. The review included 19 workshops, 13 public hearings, a questionnaire survey covering 1,270 responses and an evaluation of 8 written submissions (Gerrard et al. 1993). In 1993 the amount of park land that met the criteria of the Statement of Commitment was still only 0.6 percent. The area from parks and ecological reserves had grown from 1,795,929 hectares to 1,801,714 hectares, an increase of 0.3 percent. There was the addition of an ecological reserve, 27 ecologically significant areas and a provincial park. The number of provincial parks dropped from 151 to 127 in 1993. Several small wayside parks were transferred from Manitoba Natural Resources to the Department of Highways. As these parks are used mainly as rest stops for travellers, it was felt they could be better serviced by the Department of Highways, while at the same time saving the financial resources of the Department of Natural Resources, which could better be used elsewhere.

The criteria set forth by the United Nations and the World Wildlife Fund were met in 1995 by 5.5 percent of the province's land (Gibson et al. 1995) This was a significant addition of 4.9 percent since 1993, which was mainly accomplished by the introduction of four large provincial parks in northern Manitoba. These parks increased the province's park land to 2.1 million hectares, an approximate 300,000 hectare increase from that of 1993. These new parks include Caribou River Provincial Park, Sand Lakes Provincial Park, Numavkoos Lake Provincial Park and Amisk Provincial Park. By the end of 1997, the amount of protected land base that meets agreement requirements grew to 6.5 percent. This is an addition of only 1 percent in the protected land base since 1995, reflecting a much slower progression during 1995-1997 relative to the 1993-1995 period. In 1996 the provincial and federal governments announced the establishment of Wapusk National Park, located in the Hudson Bay lowlands.

From 1991 to 1995, there has been an increase of 5.9 percent in the total protected land area, which meets the Statement of Commitment's criteria. This has been achieved largely through the introduction of several parks, both provincial and federal, into Manitoba's network of protected areas. In spite of these impressive gains, a significant drop in the rate of progression at which new Special Areas are formed has been noticed. This made it questionable as to whether or not the government could meet its timetable for completing Manitoba's network of Special Places by the year 2000.

In undertaking a project or in making an agreement, several variables must be considered simultaneously. First, prior to undertaking the task, the decision-makers should have a thorough background knowledge so that they can envision the scope of the task. Adequate specific knowledge is also required. Second, prior to the signing of any agreement, an assessment should be made of the existing human and capital resources. Third, the concerned agencies need to seriously consider and evaluate the duration



Figure 3: Manitoba's protected areas.

required to complete the task. It is for these reasons that planning, including detailed research of the *de facto* situation, is essential before agreeing to any collaborative task. The government initiatives throughout the 1990s to expand Manitoba's network of Special Places have been commendable, but it appears that the complexities and potential difficulties of the task of implementation were not adequately assessed before the government signed the Statement of Agreement.

A number of problems were identified in meeting the goals of the agreement within the stated time period. The inadequate timetable that the provincial government set for itself to complete the task generated a major difficulty; the government signed the agreement in 1992, giving itself only eight years to complete the ambitious network. As noted above, through ongoing legislation and policy initiatives, the concerned public agencies have made noticeable progress in terms of establishing the framework necessary to complete the desired task. However, some of the necessary legislation has been only recently implemented: for example, the new Provincial Parks Act. Other essential legislation and policies are not yet fully enacted: for example, the system plans for ecological reserves and wildlife management areas. Another problem identified relating to the timetable was that the length of time needed to identify, approve and establish a protected natural area was considerable. This was affected by a number of factors: long distance, isolation and remoteness of the proposed areas. The proposed areas must be thoroughly researched and assessed, both in terms of classification criteria and feasibility before any steps could be taken towards establishing a protected area.

Between 1993 and 1995, there was a sharp increase in the establishment of protected areas meeting the United Nations and World Wildlife Fund criteria (Gibson et al. 1995). From 1995 to 1997, the amount of additional land base that met these criteria was only nominal (Gibson et al. 1997). Assuming that the rate of progression did not drop, the amount of Manitoba's land base meeting the previous criteria would perhaps reach up to 9.5 percent, 2.5 percent short of the province's goal.

Realization of a proportional representation of the province's 12 natural regions by the established protected areas has been another major critical problem. Underrepresentation in some regions was detected (Figure 4). Approximately 15 percent of Manitoba's land is privately owned. As is evident in Figure 4, the north, south, east and portions of the southwest of the province are adequately represented, while the central and south-central portions are grossly underrepresented. There could be two plausible reasons for this underrepresentation of some natural regions: i) that much of these lands may be privately owned, and due to weak vertical



Figure 4: Natural region representation, 1995 and 1997.

integration the public institutions were having difficulty soliciting help from these communities; and ii) that these regions are so intensely disturbed by human activities that there is little or no natural land worth preserving. In any case, for the previous reasons it may not have been possible to preserve 12 percent of each natural region's land.

As a whole, public policy concerning the expansion of the province's protected areas in Manitoba can only be described as an attempt to react too ambitiously to popular public demand. A longer timetable for completion of the tasks associated with the agreement could allow for an accurate analysis of proposed areas with feedback and an undertaking of reformulated programs stepby-step. It could allow for the identification of flaws in policies, legislation and classification criteria before the system was complete, avoiding the potential cost involved in making changes to these factors at a later stage. This might also have allowed timeduration for the successful adaptation of integrated decision making into the policy process, perhaps avoiding future land use conflicts in these areas. Finally, the public agencies should have accepted the fact that it may not be possible to adequately represent all natural regions, and therefore, should have concentrated on those that could function as a catalyst.

# Conclusion

This study has examined the innovative approaches of public institutions, interest groups and organizations in the province of Manitoba, Canada, in meeting goals concerning the conservation and protection of biodiversity, ecological resources and natural heritage set by the World Conservation Strategy. In the face of global concern and awareness of the need for the protection and preservation of nature and natural lands during the past few decades, the organizational entities have played a key role. In order to respond to the international call for establishing 12 percent of land as protected land in each nation, Canadian public policies were geared to achieve this goal by the end of the 20<sup>th</sup> century. In 1992 Canada's federal and provincial governments signed an agreement to expand the nation's network of protected areas to 12 percent of its land and water.

Because the government of Manitoba has ignored the aspects of preservation of ecological and cultural resources for decades, it was forced to react vigorously when faced with public embarrassment in the early 1990s. The goals set forth in the public initiatives attempted to recover quickly, and consequently they were overambitious and unattainable within the given time frame. Questions may here arise with regard to the cost-effectiveness of such reactive, expeditious policies and programs; further research on these issues should be pursued. Proactive policies, with adoption of sustainable development as a guiding principle for protection and preservation of natural and cultural resources, would demonstrate strong institutional commitment to the preservation of natural heritage and the meeting of long-term social goals. Underestimation of land-use conflicts and their associated complexities has been common in public policy formulations. An established dialogue between stakeholders and an understanding of trade-off and mutual benefits could help resolve many emerging conflicts; however, the process could require a prolonged time period. Institutional and organizational integration would be an essential means for establishing such a dialogue.

In this study, the public policies and activities of the special interest groups were examined in light of the concept of vertical and horizontal integration of social and spatial entities. In order to prepare the framework for a NSP, public involvement was sought. Participants involved in the public hearing processes have revealed that they prefer direct engagement of communities and lower-level units in decision-making concerning formulation of conservation and protection programs, determination of access to natural resources and delineation of Special Places. A vertical integration of community level organizations and groups was strongly recommended. They also demanded that policy framework should aim at protecting, as much as possible, the interests of the stakeholders in natural resource management decisions. This research has further registered that efforts in establishing a horizontal integration in the NSP appear to have been limited. Also, the lack of an integrative approach between the vertical and horizontal entities has hampered the pace of progress in implementing the protected and designated areas. Overall, although overambitious, the government's intentions and efforts have been positive, making important contributions to the preservation of Manitoba's natural lands with accurate classifications, appropriate system plans, policies and legislation.

### Acknowedgment

The authors wish to express their deep gratitude and thanks to the Brandon University Research Committee for providing a research grant to carry out this research. Also, special thanks to Mr. W. Watkins, Manitoba Conservation who provided valuable data and insights to facilitate interpretation of research findings.

### References

- BERKE, P. R. 1992 *Planning Earthquakes: Risks, Politics and Policy Baltimore* Maryland: John Hopkins University Press
- BERKE, P.R., KARTEZ, J. AND WENGER, D. 1993 'Recovery After a Disaster: Achieving Sustainable Development, Mitigation and Equity' *Disasters* 17 (2): 93-109
- CPAWS (Canadian Parks and Wilderness Society) 1997 *The Bow Valley: A Very Special Place* Calgary: CPAWS
- DEARDEN, P. AND ROLLINS, R. 1993 'The Time They Are A-Changin' Dearden, P. and Rollins, R. (eds) Parks and Protected Areas in Canada Toronto: Oxford University Press 1-16
- EIDSVIK, H. 1993 'Canada, Conservation and Protected Areas: The International Context' Dearden, P. and Rollins, R. (eds) *Parks and Protected Areas in Canada* Toronto: Oxford University Press 273-290
- GERRARD, M. et al. (eds) 1991 State of the Environment- Report for Manitoba 1991 Winnipeg: Manitoba Environment, Minister of the Environment
- GERRARD, M. et al. (eds) 1993 State of the Environment- Report for Manitoba 1993 Winnipeg: Manitoba Environment, Minister of the Environment.
- GIBSON, T. et al. (eds) 1991 State of the Environment Report for Manitoba 1995 Focus on Agriculture Winnipeg: Manitoba Environment, Minister of the Environment
- GIBSON, T., NICOL, S. AND STREICH, L. 1997 Moving Toward Sustainable Development Reporting State of the Environment- Report for Manitoba 1997 Winnipeg: Manitoba Environment, Minister of the Environment
- MARTY, S. 1997 'Homeless on the Range: Grizzlies Struggle for Elbow Room and Survival in Banff National Park' *Canadian Geographic* 117 (1): 35-36
- McNAMEE, K. 1993 'From Wild Places to Endangered Spaces: A History of Canada's National Park' Dearden, P. and Rollins, R. (eds) Parks and Protected Areas in Canada Toronto: Oxford University Press 17-44
- McNEELY, J.A. AND MILLER, K.R. (eds) 1984 'National Parks, Conservation, and Development: The Role of Protected Areas in Sustaining Society' Proceedings of the World Congress on National Parks, Bali, Indonesia, 11-22 October 1982, Washington, D.C.: Smithsonian Institute Press

- McNEELY, J. et al. 1990 *Conserving the World's Biological Diversity* Washington, D.C., U.S.A. and Gland, Switzerland: The World Bank,WRI, CI, WWF, and IUCN
- NELSON, J.G. 1987 'National Parks and Protected Areas, national Conservation Strategies and Sustainable Development' *Geoforum* 18: 291-319
- PAGE, R. et al. 1996 *Banff-Bow Valley: At the Cross Roads* Technical Report of the Banff-Bow Valley Task Force Ottawa: Banff-Bow Valley Study.
- PAUL, S. 1988 Community Participation in Development Projects: The World Bank Experience Washington, D.C.: The World Bank
- SCACE, R.C. AND NELSON, J.G. (eds) 1986 *Heritage for Tomorrow* Canadian Assembly on National Parks and Protected Areas, Ottawa: Supply and Services Canada
- SCHROEDER, R. 1997 'Manitoba's Provincial Park System: A Case Study in Linking Protected Areas and Working Landscapes' Paper presented at SAMPA III: Linking Protected Areas with Working Landscapes Conserving Biodiversity, The 3<sup>rd</sup> International Conference of Science and the management of Protected Areas, 12-16 May, Calgary, Alberta, Canada
- WARREN, R. 1963 The Community in America Chicago: Rand McNalley
- WATKINS W.G. 1990 A Survey of Resource Extraction and Land Use Policies in Canada's Park Systems Ottawa: Federal Provincial Parks Council
- WORLD RESOURCES INSTITUTE 1990 World Resources, 1990-91 Oxford and New York: Oxford University Press.
# Gated communities: coming soon to a neighbourhood near you!

Jillian L. Golby

*Abstract:* For many centuries, gated communities have housed the rich and famous in countries around the world. However, in recent decades, they have become a way of life for millions of Americans. On a much smaller scale, some neighbourhoods in Canada are mimicking the functional and symbolic gating and walling of neighbourhoods in the United States. In smaller cities like Winnipeg embryonic versions already exist. Yet despite the trend to "fort-up," the implications for cities and their citizens have gone largely unnoticed.

## Introduction

Since 300 B.C. gated communities have been built in towns and cities worldwide (Blakely and Snyder, 1997). While their popularity has varied significantly, their evolution and emergence have been until recently slow. Although there have been minor design changes, their raison-d'etre has stayed the same. The desire for prestige, increased safety and community organization remains responsible for the existence and growth of these developments.

In fact, fortification by homeowners is currently one of the fastest and widespread trends altering the city and countryside. More than eight million people live in gated communities in the United States, a statistic that continues to accelerate at an astounding pace (Blakely and Snyder 1997). The trend to fort-up has long been a part of American planning but is relatively new in Canada. However, gated and semi-walled enclaves have already crept into Canadian cities like Winnipeg. While they may be embryonic versions of their American counterparts, their repercussions are still far-reaching, spilling into the political, economic and social arenas of cities. In political terms, gated communities illustrate the blurring of lines between public and private designation on an individual and governmental basis. In social terms, they represent the fragmentation of communities nationwide.

# **Classifying Gated Communities**

For the purpose of discussion, gated communities must be defined and classified. . Edward Blakely and Mary Gail Snyder, authors of Fortress America: Gated Communities in the United States (1997), have developed a classification system for gated communities. First are the **lifestyle communities**, where the gates provide security and separation from the leisure activities within. They include *retirement communities*, *golf and country club leisure developments*, and *suburban new towns*. Residents are attracted to the organization, recreation and built-in social life that these communities offer within their boundaries.

Second are the **prestige communities**, which lack the amenities of the lifestyle communities, but where the gates still symbolize distinction and status. These include *enclaves of the rich and famous*, *developments for high-level professionals*, and *executive home developments for the middle-class*. These two main categories are primarily suburban in location and developer-built.

Third are the **security zone communities**, which include the *city perch*, the *suburban perch* and the *barricade perch*. The term perch refers to the erection of the gates or barricades by residents, thereby restricting access to their neighbourhoods. Such closures occur in the inner city and suburbs, in neighbourhoods of great wealth and in areas of great poverty. In all security zone communities, the perceived or real fear of crime and outsiders is the underlying motive for fortification. While the location, prosperity, demographics and other variables may vary from one development to the next, there are basic elements that set gated communities such as ghettos, panopticon malls, prisons, mental health institutions and high-rise, high-density constructs like

apartment buildings are not included in this discussion on gated communities as described in this article.)

## **Characterizing Gated Communities**

Two elements can be used to characterize and define gated communities. First is the Homeowners' Association (HOA). Basically, a homeowners' association is a political body with legal clout that attempts to relocalize governance and prevent public access to local resources by privatizing its grounds, facilities and services. The association's job is to collect assessment fees, to provide community services, to determine and pursue the best interests of the community and, most important, to enforce the rules as stated in the association's declaration. The monies collected by the association help to finance and maintain the privatized community services such as garbage collection, recreation, lighting, beautification and security.

Overall, homeowners' associations are usually "non-profit" organizations, made up of board members, officers and volunteers. These board and committee members, and at times lawyers and accountants too, meet regularly to discuss appropriate details concerning the operation of their community. When necessary, the association will hold a vote but not all votes are equal. The voting power can vary from house to house, from one association to another, and may even vary according to the market value of a house. Often, the voting turn-out is minuscule. Therefore, to call these developments democratic is misleading.

Just as important as their organization is their significant power. Like in a state legislature, their rules are part of a constitution enforceable by law. These rules are known as covenants, conditions and restrictions (CC&Rs). Dating back to fourteenth century England, the CC&Rs are tools that permit the seller of land to retain control over how the land is used after its sale. They are also meant to protect property values by ensuring uniformity in the development. (While the credibility of this point is often debated, a study by Blakely and Snyder found no evidence to suggest they maintain or increase property values (Blakely and Snyder, 1997).) Any deviation from the *thousands* of rules in each gated community (which can range from architectural controls, to indoor window treatments, to the weight of pets) can result in a fine, a lien against his house or jail time. Such measures are warranted because the sale of a house is conditional on the buyer's agreement to comply with the rules. While an overwhelming number of HOAs have been or are in litigation with residents, the outcome is unequivocally skewed in favour of the associations. With so many disputes between associations and their residents, this shows that many gated communities may seem like a utopia in the beginning but are not as attractive after one becomes a resident.

A second attribute of gated communities is the security mechanisms. Depending upon the location and prosperity of an area, a gated community is likely to have one or more security features. All three types of gated communities and their subtypes share some kind of defense mechanism but the security features within each can very significantly. At the poorer end of the scale, neighbourhoods may have street barricades or iron-rod fences that help reduce the number of entrance ways into the community. In wealthier neighbourhoods, electronic gates with coded entrance panels and security cameras may help deter unwanted visitors. Lastly, in neighbourhoods of the rich and famous, the entrance may have multiple security mechanisms such as 24 hour armed guards and dual gates. As demonstrated in Table 1, the more numerous and more sophisticated the security devices, the less accessible the neighbourhood becomes. Furthermore, as the level of security increases, the wealthier the residents, the larger the housing and the more homogeneous the community.

Whether sophisticated or simple, the security features are meant to enhance the *perception* of safety rather than guarantee security. By having symbolic gates or walls, this lets the public know that the community is a united neighbourhood, one that will protect the integrity of its area against undesirable visitors and activity.

FEATURES	ACCESSIBILITY	COMMUNITIES
•concrete barriers •semi-walled •street barricades •iron rod fences •non-gated	•easy public access •not all entrances gated •not completely walled •1 or 2 entrances/exits	<ul> <li>mixed demographics and family size, house types</li> <li>lower income</li> <li>e. city perch, barricade perch</li> </ul>
<ul> <li>•unguarded electronic gate</li> <li>•mechanical arms</li> <li>•completely walled</li> <li>•security cameras</li> </ul>	•access by security pass /card (with or without entrance code) •tailgating •accessible to pedestrians and cyclists	<ul> <li>less income and housing variety</li> <li>middle, upper-middle incomes</li> <li>ie. lifestyle communities</li> </ul>
•electric gate •part/full-time guard •guardhouse •security cameras	•not accessible to pedestrians and cyclists •restricted access •tailgating possible (no guard)	<ul> <li>large houses, multiple garages</li> <li>upper-income</li> <li>ie. security zone communities</li> </ul>
<ul> <li>elaborate gatehouse</li> <li>monumental entrance</li> <li>24 hour armed guard</li> <li>security patrols</li> <li>high fences and gates</li> <li>security cameras</li> <li>electric gate and mechanical arm</li> </ul>	•access extremely limited •heavily defended •no tailgating	•celebrity mansions •rich and prestigious residents •ie. prestige communities

Table 1: Security features and accessibility in gated communities.

This chart shows the variety of security features, accessibility and type of community in terms of family make-up, income level and house type.

# Winnipeg's Embryonic Gated Communities

While gated communities are a relatively new phenomenon to creep into Canadian cities, the groundwork has already been laid. For example, many of Winnipeg's newer residential developments are embryonic-like versions of gated communities in the United States. In numerous middle to high-income areas of the city, and more recently in peripheral areas, semi-walled and gated subdivisions are quickly becoming the neighbourhood of choice (Figure 1). Winnipeg has three gated communities that stand apart from the semi-walled communities scattered throughout the city: Armstrong Point, Hampton Park and the Country Villas.



*Figure 1:* Location of semi-walled and gated subdivisions in the Winnipeg area.

Armstrong Point was the first gated community to appear in Winnipeg. Originally, it was an exclusive neighbourhood that housed the wealthy and prestigious in grand residences. Today, the value of the houses has remained relatively high-priced but the prestigiousness of the residents and the community has decreased. Generally, the houses range from the average two-storey house with a dual-port garage to the monumental estates built long ago. Furthermore, the make-up of its residents includes high-class



Figure 2: Middle gate at Armstrong Point.

professionals and middle-upper class families with dependent children.

As in the past, the gates remain the most important feature of the neighbourhood. Three Classical Revival style gateways were built in 1911 and remain unchanged to this day, with the exception of restorative work. Their form consists of simplified pillars with wrought-iron grillwork (Figure 2). Fortified at the will of the residents, the gates were constructed to separate the enclave from the neighbouring streets that fell into the grid-iron pattern and to keep out wandering livestock. To this day, Armstrong Point's symbolic gates remain a "psychological barrier" to the people that make up the lower strata of Winnipeg's population (Rostecki 1994).

Hampton Park is Winnipeg's second gated community. Built in 1983, it is located across the Assiniboine River from Armstrong Point. It is a ten-unit, gated condominium that caters to wealthy professionals and retirees. Each unit is currently priced at approximately \$250,000 and is 2,400 square feet (Lipson 1997). Residents are singles and couples, aged forty and older. Fortified on the street-side by a wall and by an electronic gate at the entrance and exit, entry is gained to the grounds and the underground parking by remote control or by key. Like many other gated or walled



Figure 3: Gatehouse at the Country Villas.

developments, Hampton Park is well camouflaged and is usually unnoticed by the common passerby.

The most recent gated community, the Country Villas, is Manitoba's first resort inspired adult community. Located in the rural municipality of East St. Paul, and built in 1998, this upscale residential area is an exclusively low-density community where 163 detached, single-family homes are nestled on private landscaped sites. However, because it is an age-restricted development, persons younger than 55 need not apply. Residents include singles and couples who are looking for a safe, close-knit community setting where social organization is built-in. As for the houses, residents have a choice of eight different styles of villa homes, starting at \$145,900 (Viklund 1999).

The site planning highlights include a number of features: a professionally landscaped feature entrance with a gate house and electronic security system, a grand entrance boulevard, perimeter landscape and fencing, a central park with a distinctive clubhouse and English-style gardens, and recreational vehicle parking. As shown in Figure 3, the picturesque gatehouse is the most distinctive security feature in the entire community. The mechanical arms are activated by a coded-panel and can be controlled from each site. Other security features provided include the theme privacy walls surrounding the development, remote camera surveillance for the

entrance, an optional security bungalow package and extensive lighting.

As in many other cases, despite being an ineffective barrier to criminals, pedestrians or cyclists, the gate's purpose is to create the illusion of safety and to restrict all but its own vehicles. Residents belonging to the Country Villas have also confirmed statements made by residents of gated communities in the United States: the presence of a gate *did* have an impact on their decision to move into the development and residents do *feel* safer.

## To Gate or Not To Gate: The Debate

As more citizens are made aware of or are affected by community fortification, the controversy increases. Proponents and opponents of gated communities have strong opinions and real concerns. Yet despite the lack of attention given to fortification, the initial discussion has produced more shortcomings than advantages. Two of the most commonly debated issues are crime/ safety and community. The third issue, the effect on the city, is one seldom mentioned in the literature but is increasingly important to recognize and discuss.

Safety is perhaps the most controversial of all debates. It is true, in some instances, that street closures and gates reduce crime that is likely to arrive by automobile (Whoriskey 1999). The most persuasive statistical evidence of success comes from gated communities in which every vehicular entrance is safeguarded around-the-clock. Although less compelling, the same may apply to areas with street closures. Therefore, by gating and walling communities, some crimes are pushed off private streets and into more public streets.

However, this does not mean that gated communities do not experience crimes, nor does it solve the problem. Rapes, domestic disputes, thefts and other crimes are as likely to occur in gated communities as in non-gated communities. The reality is that crimes like thefts are committed by residents of the same community. While mechanical security devices are in place, security checks are not performed on potential or existing residents of gated communities, nor are searches done to visitors and their vehicles, even in the presence of a guard. As David Gutterson points out, George Hennard (killer of twenty-three people in a Killeen, Texas cafeteria) was a resident of the gated community of Green Valley just months before his rampage (Guterson 1992). This example and many others prove that crime does not discriminate. Furthermore, there is no evidence to suggest that "fortress-building responses" deal adequately with the problem of increasing public violence or crime (Wekerle et. al 1996).

Another highly controversial topic of discussion is the notion of community. Many residents of gated and non-gated communities across the country are searching for a sense of community as it was in the fifties. Neotraditionalism (a philosophy that believes ideals of the past, especially those of the 1950s, should be adhered to in the 1990s) is alive and well (Dowling 1998). While no definitive concept can be given to describe "community" most scholars can agree that it encompasses a geographical entity and a sense of social responsibility. However the real debate is whether gated communities create more community participation and are more neighbourly than a non-gated community.

Proponents of gated communities argue that by allowing neighbourhoods to build and maintain their boundaries and to control access to their tract, they develop a sense of identity and security. The physical borders can help govern interaction, reduce conflict, and stimulate feelings of territoriality and ownership that bond people together and create grounds for interdependence and mutual action (Lang et. al 1979). Because the community is homogeneous, in terms of its lifestyle or life stage, its residents feel as though they belong to one large family, albeit headed by Big Brother (HOAs). Arlene Fishbein, supporter of gated communities, summarizes the feelings of proponents in general:

We cannot go back to earlier years. Gated communities have been successful. Residents like them; future homeowners want them. It is not an ethical issue or a moral issue. People want to feel secure and have that right (Debating Urban Barricades 1999). On the other hand, Blakely and Snyder, along with many other scholars, argue the opinion that gated communities create a coerced sense of community, where formal social controls have been substituted for informal social controls. In their study, most members of gated communities were content to have a limited sense of neighbouring (Blakely and Snyder 1997). They may not know each other but assume that each person is a resident within the same development. (This may be why a burglar's disguise could consist only of a business suit, to give the appearance of belonging.) Clearly, "the mere fact that a group of individuals lives in a single street is no guarantee of common action, mutual sentiment or eye contact" (Cater and Jones 1989). If this is the case, perhaps these developments should be called gated neighbourhoods rather than gated communities.

Lastly, one area that has been absent from discussion is the effect privatizing and fortifying neighbourhoods has on the city. One of the most favourable arguments is made by Gary Pivo. He states that gated communities may actually slow the pace of exurban growth. If people are given the alternative to gain control over their locality using fortification, rather than to relocate in an attempt to escape the "urban" illnesses, it may lead to a decreased spatial distance between the rich and the poor. If this were to occur, gated communities would increase the heterogeneity of the municipality while they increase the homogeneity of their own population. The result would be interspersed pockets of concentrated wealth amongst poorer areas (Lang et. al 1997).

While the theory offered by Pivo is plausible, the negative effects of residential fortification seem to dominate most discussions. Perhaps the most significant problem identified by planners and scholars is the detrimental effect on the city. The privatization of more and more government services and public spaces caused by gating and walling neighbourhoods has created an island-like environment where the rich get organized and the poor get left behind. As the wealthy flee the city to live in isolated, fortified communities, the not-so-fortunate people are left in the city with little political representation and a limited ability to meet their needs. With a decreased tax base, vital physical and social infrastructures cannot be maintained. The effect snowballs until the city becomes a place of decay and despair. Little by little, the price of exclusivity is the price at which cities are decaying. But, it is only a short time before all gated communities must deal with the problems they have paid to avoid.

## Conclusion

Observations from Winnipeg's embryonic gated and walled communities can be extended to the rest of Canada. With the exception of a few rich enclaves, the gated communities in Canada that most resemble their American counterparts are the retirement or golf and country club communities in British Columbia. Yet in cities like Vancouver and Victoria, where there are increasingly more gated retirement communities than any place in the country, the subject of gated communities is rarely discussed. While the phenomenon has yet to catch on in Canadian cities as it has in the U.S., the potential for gated communities to spread and mature is a reality that planners and governments must face in the years to come. Citizens need to recognize the fortress mentality begins in our own yards.

From a social and planning perspective, gated communities are not models of good planning. From a human geographer's perspective, their biggest flaw is the inability of an elite, homogeneous population, able to buy security and privacy, to relate to the "outside" world in social terms. When such a group focuses their money and attention inward and disregards the life beyond their wall or gate, the result is social fragmentation and alienation.

From a planning perspective, fortification of neighbourhoods is also detrimental to the prosperity and growth of a city. When the wealthiest portion of the population privatizes its own services that were once public, the middle-to-lower strata are left to support a greater portion of public infrastructures and services. Such fortification of residences and neighbourhoods is not a solution to "urban" problems. Rather than attacking the root causes of the forting-up phenomenon, gated communities are attempting to remove themselves from the problems felt in all cities. It is this cloning and mass-production of gated communities that is killing creativity and destroying cities. By adding to the literature on gated communities in Canada, the topic can be better introduced into planning and political circles so that we can ensure the same kind of large-scale fortification will not occur in Canadian neighbourhoods. By learning from the American example, it is hoped that planners and citizens can develop better solutions to the ills that push residents into these types of developments. Although it will be a significant task, involving participation from people from all arenas, Canada has a huge advantage in the race.

## References

- BLAKELY, E. and SNYDER, M. 1997 Fortress America: Gated Communities in the United States Washington, D.C.: Brookings Institution and Press and Lincoln Institute of Land Policy
- CATER, J. and JONES, T. 1989 Social Geography: An Introduction to Contemporary Issues Great Britain: Edward Arnold 'Debating Urban Barricades: Selected Responses from Readers about Gated Communities' http://www.herald.com/opinion/archive/docs/ 022503.htm
- DOWLING, R. 1998 'Neotraditionalism in the Suburban Landscape: Cultural Geographies of Exclusion in Vancouver, Canada' Urban Geography 2(19): 105-122
- GUTERSON, D. 1992 'No Place Like Home: On the Manicured Streets of a Masterplanned Community' *Harper's Magazine* Nov. 1992: 55-64
- LANG, R. and DANIELSEN, K. 1997 'Walling Out the World' Housing Policy Debate 8(4): 867-899
- LIPSON, E. Personal Communication Property Manager, Akman Management Ltd.
- McKENZIE, E. 1994 Privatopia: Homeowner Associations and the Rise of Residential Private Government New Haven, Connecticut: Yale University Press
- ROSTECKI, R. 1994 'A History of Armstrong's Point Gates' City of Winnipeg Planning Department: 1-11
- VIKLUND, M. Real Estate Agent, Home Life Properties.
- WEKERLE, G. and WHITZMAN, C. 1996 'Controlling Urban Crime: What Can Cities Do?' *Plan Canada* 2(36): 7-11
- WHORISKEY, P. 'Urban Barricades' http://www.herald.com/opinion/ archive/docs/047870.htm

# From Christianity to Communism: a Russian colony on the banks of the Rio Uruguay

#### Serge Cipko, Lakehead University John C. Lehr, University of Winnipeg

Abstract: Like western Canada, Uruguay was settled by a diverse array of peoples, many of whom established distinctive settlements, of which many still endure. One of the most unusual, from a socio-cultural perspective, is the community of San Javier, located on the eastern bank of the Uruguay River. This settlement was founded in 1913 by members of the Novey Izrail [New Israel] sect. This sect, originally from the Kuban region of eastern Ukraine in Tzarist Russia, has a faith based on the premise that Christ is not the son of God. It rejected the Tzar's dual role as head of state and church and chose its own supreme leader from within its ranks. In Uruguay it built a theocratic colony which was described as a true community with all the advantages for agricultural labour. The economic depression of the 1930s saw the decline of religious cohesion and the growth of Soviet communistic sympathies. During the anti-communist hysteria of the Cold War the colony suffered from state repression and lost a significant proportion of its population who emigrated back to the "workers' paradise" of the Soviet Union. The settlement continues to wrestle with the issue of its national and ideological identity.

A journey eastwards across El Puente Internacional, a bridge over the wide expanse of the Uruguay river that separates Argentina and its smaller neighbouring republic of some three million or so, will lead the traveller past Uruguayan customs and into the border town of Fray Bentos (Figure 1). This Uruguayan centre of the once mighty Anglo-owned meat packing industry canned the famous *Fray Bentos* corned beef that was stocked in supermarkets around the world.

Moving beyond the town, one discovers a different landscape on the roads that wind alongside the eastern banks of the Rio



Figure 1: Location of San Javier, Uruguay.

Uruguay. A drive along Highway 24 (ruta 24) will evoke familiar sights: rolling prairies, cattle ranches, silos and farming communities of disparate ethnic origins. A stop in the community of Nuevo Berlin would betray its German origins, not only in the very name of New Berlin but also in the fragment of the Berlin Wall that residents obtained upon its collapse and have preserved in a glass case for public view in a local square. The accompanying inscription hails it as a link between the old Berlin and the new, thousands of miles across the ocean.



Figure 2: Sabraña Novay Izrail, San Javier. (Photo: J. Lehr)

Further on, still on Highway 24, is the Mennonite colony of Gartenthal, founded by immigrants who had fled westwards from Ukraine to western Germany in 1944, later re-migrating to Uruguay some six years later. In the cemetery headstones bear names familiar to most Manitobans: Enns, Epp, Heide, Reimer, Warkentin and so forth; one of the parallels, perhaps, that may be drawn between this side of the pampas and the Canadian prairies.

Not many miles north of Gartenthal is the Russian colony of San Javier, the closest equivalent to a Canadian Doukhobour settlement that may be found (Figure 1). Like some Doukhobours in Canada the members of this colony, adherents of an obscure sect called the New Israel Community (*Novaia Izraelskaya Obshchina*), fled Tsarist persecution of their religion only to be later reconciled with successors of the Romanovs in a durable relationship with the pro-atheist Soviet state. Vernacular architecture stands to project the mutually reinforcing experience: on one side of the village is the church building of the New Israel sect (Figure 2), and on another, within easy walking distance, the edifice of the Maxim Gorky Cultural Centre, inaugurated on 2 March 1957 but founded as an organization earlier on 25 August 1943 by sympathizers of the Soviet Union. In contrast to the Doukhobours in Canada, literature on the much smaller New Israel sect in Uruguay is difficult to locate. Nonetheless, what little has been detected, provides some loose contours of the colony's history.

The sect originated in the Kuban, a region north of the Caucasus to which the Doukhobours had been relocated in the 1840s (La Colonia San Javier 1986, 72). It is not clear when the sect was founded but, like for the Doukhobours, Russian novelist Leo Tolstoy is said to have paid attention to it. The sect's Christian philosophy, it has been said, "was not alien to his own" (La Colonia San Javier 1986, 70). It is known that the sect was founded by Parphentii P. Katasnov, and that when Tsar Nicholas II began to exile members to Siberia, one of its leaders, Vasilii Simeonovich Lubkov, applied to emigrate to Uruguay with a group of 1,200 adherents (La Colonia San Javier 1986, 71).<sup>1</sup> Uruguay at the time, dubbed the "Switzerland of South America" for its model social and political reforms, was under a government headed by the popular President Jose Batlle y Ordonez, then serving the end of his second term in office. Giving his consent to Lubkov, the first group of 28 landed in Uruguay on 24 January 1913, with others following over the course of several months (La Colonia San Javier 1986, 66). The new settlers were eventually directed to San Javier, and furnished state support in the form of oxen, horses and ploughs.(La Colonia San Javier 1986, 67).

Altogether there were at least 120 families established in San Javier by July 1913 (La Colonia San Javier 1986, 67). A contemporary journalist observed rapid progress in the colony. Some 120 houses with enclosed gardens had been built, the soil had been broken and plans for mixed farming were in place. The settlers were extolled as "excellent farmers," having pulled in a harvest worth 100,000 gold Uruguayan pesos within a year (La Colonia San Javier 1986, 69 and 72) (Figure 3). Among the crops planted was one introduced for the first time in Uruguay: the sunflower, which today is the emblem of the colony (*San Javier*, 4). <sup>2</sup>

The colony, visited by President Jose Batlle y Ordonez in 1915, continued to prosper; upon Lubkov's departure to the USSR in 1924 some 10,000 more hectares were added to the original 3,000,



*Figure 3: Settlers in San Javier ca 1925. (Courtesy San Javier Pioneer Museum)* 



*Figure 4: Central administrative building of San Javier Colony. (Photo: J. Lehr)* 



Figure 5: Former mill building, San Javier (1930). (Photo: J. Lehr)

and barely twenty years later, in 1953, another 30,000 from a local private estate (Vidart-Renzo and Hugarte, 1969, 46). The colony continued to expand to the degree that it became necessary to found a new one called Ofir, in which arriving families were allotted 40 hectares of land each (Vidart-Renzo and Hugarte 1969, 46). A central administrative building (Figure 4) and a number of agriculturally based industries in San Javier were initiated early, a processing plant for sunflower oil dating back to 1915 (Figure 5) (Vidart-Renzo and Hugarte 1969, 46).<sup>3</sup> Skilled artisans among the settlers, including carpenters, tailors, cobblers, and blacksmiths, opened workshops. Particularly distinctive were the horse-drawn carts, colloquially called carros rusos, that these artisans assembled, the sheepskins manufactured, or, in the case of Gabriel Velychko, the fabrics he turned out from his weaving looms. Also noteworthy were the three professional fishermen of the colony who would catch 150-180 kilos of fish daily from the Uruguay river (La Colonia San Javier 1986, 67, 73).

The early success of the colony is attributed to the settlers'religion. The colony was organized theocratically. Cooperative labour formed an extension of the members' religious doctrine. One contemporary observer wrote on this relationship

between work and religion: "It is more than just a cooperative, but a true community with all the advantages for agricultural labour when, as is obvious in this case, there is perfect harmony and blind obedience to the leader of the colony" (La Colonia San Javier 1986, 72). Indeed, it has been suggested that it was partly Peter Stolypin's reforms in Russia, which undermined the principle of cooperative labour for the sect, that precipitated the exodus of 1913 (La Colonia San Javier 1986, 67). Another factor in the creed which did not endear the sect to the authorities was its rejection of Tsar Nicholas II's dual role as head of State and Church. Indeed, the sect recognized no pontiff and no ecclesiastical hierarchies. In their stead the New Israel Community acknowledged a supreme leader from their ranks, which at the founding of the San Javier colony was Lubkov, and a council of "12 apostles" and "70 archangels." The principle of private property was also considered alien to their beliefs. In Uruguay, in an effort to stem the circulation of money in the colony, "Those who had any, turned the money over to Mr. Lubkov, who bought a parcel of land and all that was necessary for the initiation of agricultural pursuits and subsistence in the early stages of settlement"(La Colonia San Javier 1986, 72).

Farm labour in the colony was coordinated by a cooperative council which divided the settlers into teams of 5-10 families who performed their tasks together. The labour was considered to be for the benefit of the colony as a whole and all output was to be collectively owned (Vidart-Renzo and Hugarte 1969, 46). This was an exercise in self-management, which excluded even the presence of a police force in the colony.<sup>4</sup>

The Christian faith of the sect was based on the premise that Christ is not the son of God. God's presence, it was affirmed, is to be found elsewhere - "in the relations between people and the good that come from these relations" (Lodovin 1999). Affirmation of faith centred on the so-called "Sobranie," assemblies of the faithful in their church. The sect's house of worship is a simple building, not characterized by the cupolas and crosses of the Orthodox Church from which the adherents had split, nor by the steeples or spires of the Roman Catholic Church, Uruguay's chief denomination. The interior, conforming to the tenets of the sect, is bare of any religious ornaments, icons, paintings and the like. Nor are there any altars and chalices. Chairs can be observed, but otherwise there is scarcely any other furniture. Gracing the walls of the interior, however, are the enlarged and framed photographs of the founders of the sect and of the sobranie gatherings of the faithful.<sup>5</sup> The most important dates on the calendar marked by the sobranie are 31 May and 25 December (Daniel Vidart-Renzo and Hugarte 1969, 46).

The San Javier colony remained prosperous until the years of the Great Depression. A steady decline in river trade and in cereal production resulted in a corresponding downturn in the local economy (Daniel Vidart-Renzo and Hugarte, 1969, 46). A drought blazing through the district in 1932 prompted appeals for government intervention to study local problems. That year, disputes with local private landowners and the authorities led to a bloody confrontation, resulting in many injuries and one fatality (Strelko 1980, 100).

It is clear from this incident that members of the colony were shifting towards a more radical orientation. Certainly, there is a direct correlation between the economic recession and the undermining of the religious cohesion of the colony. The cooperative system, for example, gave way to individual farming and the ideal was now restricted to a single consumer cooperative in the colony (Daniel Vidart-Renzo and Hugarte 1969, 46). Interest in the religious foundations of the colony waned, especially by and during the World War II years.

Until then, there was little evidence of attachment to Communist ideology in the colony. A journalist might call the colony "Communist" but it would be in reference to the utopianreligious experiment in motion rather than the embracement and enforcement of Marxist-Leninist dogma. There is a reference to one staunch Communist, a professional agitator who fled a life sentence in Siberia, joining the colony, but such cases appear to have been the exception rather than the rule in the early years of settlement (La Colonia San Javier 1986, 69).

Conversely, his very admission to the colony and Lubkov's own departure for the Soviet Union in 1924, reminiscent of the Doukhobours who applied to leave Canada for the Soviet Union in the same period, suggests that even if the colony did not accept secular Communist ideology, it may have been open-minded about the new Soviet order without having to compromise their religious convictions. Contact with Communist ideology may have been reinforced in the 1920s and 1930s by ties with new Slavic immigrants in Uruguay, many of whom were Soviet sympathizers: the protester killed in the 1932 confrontation in San Javier, for example, was a Belarusian immigrant (Strelko 1980, 100).

The 1932 event was, in fact, a prelude to a new, stridently anti-Communist regime in Uruguay. During the dictatorship of Gabriel Terra of 1933-38, for example, diplomatic relations with the Soviet Union were severed (specifically, in 1935), not to be renewed till January 1943.

While all of these trends - whether the communal origins of the colony, the ties with Communist sympathizers, the social consequences of the Great Depression, and the new regime in Uruguay, - may have been latent elements conducive to the Sovietophile direction the colony would adopt, it was not until World War II and the restoration of a Soviet embassy in Montevideo that the transition was complete. Until then, the Soviet embassy in Montevideo did not report any active communication with the San Javier settlers (Lapteva 1995, 39). But during the war years, when their ancestral homeland had been invaded by the Nazis, the San Javier group turned out to be among the most enthusiastic supporters of the Soviet Embassy, occupying a forefront position in the collection of aid in Uruguay for the Soviet wartime cause (Vronska and Lysenko 1997, 49).<sup>6</sup> It was in 1943 that the Maxim Gorky Cultural Centre had been founded, mirroring the names of other pro-Soviet organizations in Uruguay.

The enthusiasm did not dissipate in the postwar years, but appears to have been sustained by inclusion into a broader network of pro-Soviet activities in Uruguay. The Maxim Gorky Cultural Centre, and others bearing the same name elsewhere in Uruguay, organized such joint projects as the convening of local and international All-Slavic Congresses. Thus, the San Javier settlers were drawn into a Pan-Slavic movement which included immigrants and their descendants of other ethnic backgrounds, most notably Bulgarians, Yugoslavs, Ukrainians and Belarusians.

The All-Slavic Congresses that convened in Montevideo and abroad accepted Russian hegemony in the common war against Nazism, and the concept fitted well with the orientation of the San Javier settlers. Although there is reason to believe that not all the settlers were of ethnic Russian origin, it was Russian identity that prevailed in the colony and a "national question" does not appear to have entered into any discourse on ideology.

Nonetheless, in spite of this absence of an asserted ethnic division in the colony, it is clear that it contained a significant proportion of members of Ukrainian ancestry. Current residents, when asked to identify the regions of provenance of the settlers, replied that they came from "all over," some "from the Kavkaz [Caucasus]" others "from the Dnieper," etc. When probed about the Ukrainian participation, they responded again that they were "mainly Russian, but some [were] Ukrainians" qualifying this with the statement that "some spoke in the 'dialects' from where they came in Russia."7 Others were more specific. Miguel Roslik, who had been an Uruguayan delegate to the All-Slavic Congress in Toronto in 1952, traced his origins to the city of Mariupol in Ukraine (Roslik 1999). He, like the other residents, however, perceived no contradiction between birthplace and Russian identity. It is curious to note that the San Javier and district telephone directories, namely the Agenda Servitel Telefonica and the Guia Telefonica Interior: Clasificada y Alfabetica 1998-1999, show Ukrainian surnames, especially those ending in -enko, appearing about as frequently as Russian. Indeed, on a hill overlooking the Uruguay river where a tree had been planted in honour of the leaders of the San Javier colony, are tomb replicas, by the tree, representing the two persons singled out as the pre-eminent leaders: one bears the name Vasyl Lubkov and the other the name Maxim Scheuchenko (Maksym Shevchenko), symbolic, perhaps, of the colony's binary ancestral composition (Figure 6).

After World War II the Soviet embassy in Montevideo processed the applications of Uruguayans wishing to adopt Soviet citizenship. Those who were granted citizenship were considered by the embassy as dual citizens, since they resided in Uruguay (Lapteva 1995, 39). But in the mid-1950s permission was given to these new Soviet citizens to emigrate to the Soviet Union, and residents of San Javier were among those who resettled to experience Nikita Khrushchev's post-Stalinist order. With their



*Figure 6:* Maxim and Anna Shevchenko, Ukrainian pioneers of San Javier. (Courtesy Sabraña Novay Izrail, San Javier)

departure, the size of the Russian zone of colonization shrunk to about 1,500 inhabitants, including 299 in Ofir by the mid-1960s (Daniel Vidart-Renzo and Hugarte 1969, 46).<sup>8</sup>

Many of those who remained in the colony retained their sympathy for the Soviet Union and their Soviet citizenship. On at least one occasion, descendants of the settlers undertook their studies in the Soviet Union. This was the case of Vladimir Roslik, the brother of the aforementioned Miguel Roslik, who trained to be a doctor in Moscow in the 1960s and returned to practice medicine in Uruguay. His return coincided with the reversion to turbulent politics in Uruguay. From 1967 the country was once again ruled by single-presidency governments, and then military dictatorship till elections were held in late 1984. A campaign was waged against dissidents and the guerrilla movement known as the Tupamaros. Residents of the San Javier colony, whose predecessors were persecuted decades earlier for the incompatibility of their ideology with that of the Tsarist regime, found themselves again with an incongruous political order and their loyalties questioned.

The first major wave of arrests in San Javier came in 1980, Vladimir Roslik among the detainees. His publicized death, by

torture, stemmed from his second arrest with 10 others from San Javier on the night of 15 April. Roslik was accused of being a member of the Tupamarus, but the only evidence presented of any "subversive" activity in the colony, according to Human Rights activists, were photographs of clubs and swords used in local heritage festivals. While the military junta insisted that the San Javier arrests were justified because of the "revival of a subversive organization tied to the clandestine Communist Party," the leader of Uruguay's National Party attributed them to the community's Russian origins: "In San Javier," he remarked, "there reigns a climate of ethnic persecution"(Vladimir Roslik 1984-1989, 13). It was a view that Roslik's wife shared: Roslik's "only sin," she asserted at a press conference, "is that we are all descendants of Russians. I don't know what is wrong with this country that regards Russian ancestry to be a crime. It is because we are descendants of Russians and he studied in Moscow. That was his only offence" (Vladimir Roslik 1984-1989, 21).9

Democracy returned to Uruguay only months after national and international interest mounted in the inquiry into Roslik's death. Residents in San Javier now freely maintained ties with the Soviet embassy, and observed closely the new developments that were unfolding in their ancestral homeland. Those who still held Soviet citizenship did not welcome the collapse of the Soviet Union. Indeed, while 80% of the Uruguayan Soviet citizens voted yes in the 1991 embassy-administered referendum on the preservation of the Soviet Union, "there was not a single person in San Javier who voted no" (Lapteva 1995, 110).

A Ministry of Tourism brochure on San Javier reads: "Villa San Javier: We are not disposed to forgetting our origins. Remembering and valuing our cultural heritage is to renew hope." The negotiation of identity has been an ongoing process in the history of the San Javier community at its different junctures. What its content will be in a new phase of its history and from which models it will continue to select, remains to be seen.

# Aknowledgements

The authors wish to thank the Pioneer Museum of San Javier, and the Sabraña Novay Izrail, San Javier, Uruguay, for their permission to copy archival photographs. The field research in Uruguay upon which this paper is based was supported by a SSHRC Targeted Research Grant.

# Notes

1. An estimated 100,000 adherents remained behind in Russia. Whether members also emigrated to Australia, California, and Canada, as has been suggested, cannot be confirmed. Certainly, there is no evidence of any ties between the San Javier residents and New Israel Community congregations either in Russia or abroad.

2. The sources conflict on the number settling in San Javier. While *La Colonia San Javier*, 71 suggests that 1,200 adherents had actually settled in Uruguay, another (*San Javier, Rio Negro* (n.d.), 3) refers to 300 families "constructing around 100 houses beside a long road which they named for Jose Batlle y Ordonez, in honour of the visit of the President in 1915." Vidart-Renzo and Hugarte (1969), 45 give 750 as the number of settlers in 1913.

- 3. A large mill built in 1930 still stands today.
- 4. Related to us by residents of San Javier, 14 May 1999.
- 5. Observations based on our 14 May 1999 visit.

6. Altogether some 40,000 pesos were raised in San Javier and turned over for the Soviet war effort. (Strelko 1975), 37.

7. Based on our conversations with Ana and Maria Lodovin in San Javier, 14 May 1999. A second sublimal strand of identity within the larger Russian can be discerned. Settlers dressed in Kuban Cossack attire were captured by press photographers, who used the terms Cossacks and Russians interchangeably on referring to the new settlers. ("La Colonia San Javier" 1986, 66-74). The Kuban Cossacks were descendants of Ukrainian Zaporozhian Cossacks who resettled in Russia in the late eighteenth century and formed a line of defence for the Imperial government on the Russian frontier. To add to the confusion regarding the national origins of the San Javier settlers, an Uruguayan journalist described the colony as exclusively Ukrainian. See Laureiro (1952), 47-49. It is noteworthy that San Javier residents drew our attention to a Russian settlement different from their own, one founded some 10 kilometers away by Russians from Mongolia.

8. There was also migration to other centres in the Department of Rio Negro. For example, to Young, 50 kilometers east of San Javier, and to the border town of Fray Bentos.

9. On the Roslik case, see also Lapteva (1995), 39, and *Noticias: Organo oficial del Sindicato Medico del Uruguay* 1999.

# References

- "LA COLONIA SAN JAVIER: BREVE HISTORIA GRAFICA DE SU PROCESO FUNDACIONAL," 1986 *Hoy es Historia* (Montevideo) 3, no. 15: 66-74
- LAPTEVA, K. 1995 Russkie na vostochnom beregu reki Urugvai (iz zapisok zhenyi posla) (Moscow: I.K. Laptev)
- LAUREIRO, A. 1952 "Za mir, za zemliu, za svobodu," *Slaviane* (Moscow) no. 1 (January), 47-49
- LODOVIN, A and M. 1999 Personal communication, San Javier, Uruguay, 14 May. Ana and Maria Lodovin are members of the New Israel Sect in San Javier
- NOTICIAS: ORGANO OFICIAL DEL SINDICATO MEDICO DEL URUGUAY 1999 no. 98, May
- ROSLIK, M. 1999 Personal communication, San Javier, Uruguay, 14 May 1999. Miguel Roslik is a resident of San Javier, and brother of Vladimir Roslik
- SAN JAVIER, RIO NEGRO n.d. (Uruguay: Ministerio de Turismo)
- STRELKO, A.A.. 1975 "Antifashistskoe dvizhenie imigrantovslavian," in Sovetskii Soiuz-Latinskaia Amerika v gody vtoroi mirovoi voiny k 30 letiiu pobedy (Moscow: AN SSSR)

- STRELKO, A.A.. 1980 Slavianskoe naselenie v stranakh Latinskoi Ameriki (Kyiv: Naukova dumka)
- VIDART-RENZO, D., AND HUGARTE, P. 1969 *El Legado de los inmigrantes. Segunda parte.* (Montevideo: Nuestra Tierra)
- VRONSKA, T.V. AND LYSENKO, O.E.. 1997 Ukrainski hromady zarubizhzhia v roky Druhoi Svitovoi Viiny: Aktsii dopomohy narodu Ukrainy (Kyiv: NAN Ukrainy)
- VLADIMIR ROSLIK: EL PUEBLO URUGUAYO RECLAMA JUSTICIA 1984-1989 (Uruguay:La Comision Intergremial Medica (C.I.M.) y la Federacion Medica del Interior (F.M.I.)

# Contested identities: competing articulations of the national heritage of pioneer settlers in Misiones, Argentina

#### John C. Lehr, University of Winnipeg Serge Cipko, Lakehead University

Abstract: From the early 1890s until 1914, thousands of Ukrainians migrated to North America seeking free land on the agricultural frontier of western Canada or work in the mines and factories of the United States. At the same time a smaller number, about 50,000, migrated to Brazil and some 10,000 immigrated into Argentina where they settled mostly in the northern Territory of Misiones. Intermixed and often confused with Poles, Ukrainian settlers in Misiones established a distinctively Ukrainian cultural landscape. This paper outlines the creation of this landscape, describes its various components and reviews and explains the significance of recent efforts to establish a distinct national identity for Argentineans of Ukrainian origin in Misiones. It argues that the commemoration of the centenary of Ukrainian settlement in the territory by the placement of monuments in public places has meaning at different levels. Monuments marking the Ukrainian settlement of Misiones both celebrate the pioneer past and affirm national origin of the pioneers. Physically they mark territory while conceptually they delineate Ukrainian national consciousness.

### Introduction

The close of the nineteenth century marked the beginning of one of the world's great migrations as hundreds of thousands of Ukrainian peasants from the Austrian Crown Lands of eastern Galicia and Bukovyna left their homeland and sought new lives and opportunities in the Americas. Mixed with thousands of other Slavs — Russians, Belarusians, Poles, Czechs, and Slovaks — they headed to the mines and factories of the United States' eastern seaboard and to the agricultural frontiers of Canada, Brazil and Argentina. Although most Ukrainians who sought agricultural land went to western Canada or Brazil, a significant number, some several thousand, settled in Argentina, particularly in the frontier zone of Misiones, before the outbreak of war in Europe halted emigration in 1914.

The Ukrainian experience in Misiones parallelled that of Ukrainian agricultural communities established in Canada and Brazil. Each was characterized by three major waves of immigration, and in each case the Ukrainian community had to overcome economic adversity, assimilative pressures, and had to strive to assert its national identity within the cultural mix of immigrant society. This paper examines the process whereby the Ukrainian community in Argentina's Misiones province has attempted to establish its identity and position itself within the immigration mythology and settlement history of the area. It also considers how it has sought to mark its presence in the cultural landscape through employment of both religious and secular iconography.

# The Ukrainians

The nineteenth century was the era of European nationalism but for the people who spoke the Ukrainian language a sense of national identity was only beginning to emerge at the time of their first transatlantic migration. In the past Kievan Rus had been one of Europe richest civilizations but the invasions by the Huns, Tatars and Turks beginning in the 13th century had destroyed the kingdom and led to the subjugation of its people and fragmentation of its territory. At the end of the nineteenth century the greater part of Ukraine —central and eastern Ukraine — lay under Russian Czarist control, while the westernmost fringe of Ukrainian ethnographic territory constituted the Austrian Crown Lands of Galicia and Bukovyna and the Hungarian administered region of Carpathian-Rus (Transcarpathia).

In the early 1890s most Ukrainian peasants identified with their family, kin group and village rather than with any larger national concept. The term Ukrainian was being promoted by the nationalistic intelligentsia but the appellation *malorosy* [Little Russians] was more popularly used. Ukrainians in the Austrian territories were Austrian by nationality though ethnically Ukrainian. Within the group they would distinguish themselves ethnographically as *lemky*, *boiky*, or *hutsuly* but would also identify themselves regionally as *halychyny* or *bukovyntsy*—Galicians and Bukovynians. A further geographical term, Ruthenian, a Latinized variation of *Rusin*, was also used to describe all Ukrainians in the Austrian territory of western Ukraine (Simpson 1951).

Although a sense of national identity was only beginning to emerge among the Ukrainian peasantry in the early 1890s there was no doubt in the minds of the people as to their religious affiliation. In Bukovvna the Ukrainian population was almost entirely Greek Orthodox. In Galicia, in contrast the Ukrainian population belonged almost entirely to the Greek Catholic or Uniate Church. This church had been established in 1596 at the Church Union of Berestia with the hope of weaning the Ukrainian peasantry away from Orthodoxy and leading them in to the Polish dominated Roman Catholic church in Galicia. The Uniate Church acknowledged the Pope in Rome as its spiritual leader but maintained the Orthodox tradition of a secular married clergy and the Slavonic rite. The transition towards Catholicism became arrested and by the middle of the nineteenth century the Uniate church became the national church of Ukrainians in Galicia, defending their national identity and a focus for emerging nationalist feelings among the population.

Though Eastern Galicia was predominantly Ukrainian and Ukrainian-Catholic, Bukovyna was Greek Orthodox, while Western Galicia was Polish and Roman Catholic. Religious and linguistic boundaries were often ill-defined. Konfessions-natioalität — a confessional - nationalism (Turczynski 1975, 415), prevailed as the root of self-identity among the vast majority of Ukrainian peasants who emigrated from western Ukraine before 1914. Language alone was not a sufficiently restrictive determiner of nationality in a region of mixed population which had for long been subjected to campaigns of Polonization when under Polish administration. This confusion about ethnic identity was exacerbated because almost all Ukrainians who emigrated to the New World before 1914 were Austrian citizens and carried Austrian passports. Immigration officials in Argentina and, for that matter, immigration officials elsewhere in the Americas, recorded Ukrainian arrivals by generic appellations — as Russians, Austrians or Poles, rather than by their correct ethnic designation as Ukrainians. After 1918 the situation became further confused as the former Austrian Galicia became part of the newly created Poland and its Ukrainian population, formerly Austrian by nationality, became Polish nationals.

### Ukrainian Settlement in Argentina

Although a number of small groups and individual Ukrainians immigrated into Argentina as early as the 1880s it was not until 1897 that significant numbers of Ukrainians entered the country. Those who did not remain in the Buenos Aires region settled mostly in the Mendoza area or in the northern Territory of Misiones (Figure 1). In that year a mixed Ukrainian-Polish contingent of 29 people in 14 families (8 Ukrainian and 4 Polish, one mixed Italian-Ukrainian, and one of undetermined origin, but probably Ukrainian), established a farming colony near to the site of the old Jesuit mission of Apostoles (Snihur 113-115). The peak years of Ukrainian immigration were 1896-1914. It is impossible to extrapolate hard data from the available statistics on Russian and Austrian immigration but it is believed that as many as 15,000 Ukrainians may have arrived in Argentina during that period, though it is unclear how many remained in the country. The years 1896-1902 were the most important for immigrants from Austria, especially Galicia, whereas the period 1905-14 was the most important for Ukrainians from the Russian Empire. By 1914 the Ukrainian community in Argentina may have reached 15,500 with 7,500 in Misiones, 4,000 in Buenos Aires and another 4,000 in Mendoza and other regions (Wlodek 1923, 368; Strelko 1975, 94-95). Ukrainian settlement was frequently associated with Polish settlement. By 1914 the National Territory of Misiones emerged as the centre of Ukrainian population and institutional life. Some 7,536 in 905 families were enumerated there in 1913-14 and were



Figure 1: Location of Misiones, Argentina.

distributed as follows: 400 families in Apostoles; 225 families in Azara and Tres Capones; 200 families in Bonpland; and 40 families each in San Jose and Cerro Cora (Karmansky 1923, 168). Often Ukrainian and Polish families, especially those who came from Galicia, were intermixed and settled in close proximity.

The town of Apostoles became the centre of settlement by Ukrainians, most of whom, if not all, came from Galicia and were Ukrainian-Catholic by faith. Some distance away in the Obera area, small colonies of settlers from Volyn were established in places such as Los Helechos in the 1920s and 1930s, but remained somewhat disconnected from the Ukrainian-Catholic mainstream by their physical isolation and their Orthodox and Evangelical religious beliefs. They were among the 80,000 Ukrainians immigrated into Argentina in 1920-1939, of whom about 70,000 remained. The vast majority of these came from Galicia and Volyn, then controlled by Poland, and hence carried Polish passports. This inter-war immigration was widely distributed across the country though Buenos Aires was the favoured province of settlement with Misiones and Chaco two alternative primary centres. There is no hard data on the distribution of Ukrainians in Argentina by 1939 but one estimate which suggests 120,000 immigrant and Argentineborn Ukrainians by the late 1930s has 25,000 Ukrainians in Misiones, about 55,000 in and around Buenos Aires, some 6,000 each in Rosario and in Chaco and sizable communities in Mendoza, Santiago del Estero, Cordoba, Rio Negro, and Chubut (Kalendar Svitlo 1939, 41-42).

There was a third phase of Ukrainian immigration into Argentina after the end of the Second World War. From 1946-1950 approximately 6,000 Ukrainians arrived, although it is thought that up to two thirds of these may have re-emigrated. Most of these immigrants who remained in Argentina settled in Buenos Aires and environs (Vasylyk 1972, 32). Since the independence of Ukraine in 1991 there has been a trickle of Ukrainian immigration to Argentina. Again, most of these new immigrants have settled in Buenos Aires and environs though some have moved in to other areas where Ukrainian community life is present (Vasylyk 1999; Jachno 1999; Kruk 1999).

# Contested Identities and the Commemoration of the Past

Societies lay claim to the past just as they lay claim to the present. In the latter case they may express their sense of identity through political claims on territory. Perhaps the most emotive way to lay claim to territory is by the simple act of naming places. Control of toponomy may not grant political control of territory but it accords a certain status to the group which bestowed the name, if nothing else, affording it a place in the history of the landscape. More ephemeral but no less emotive is the parade (Visser 1996). Its significance as an overt vehicle to "claim" territory or to affirm past territorial rights as has occurred with sectarian marches through contested areas has been well documented by geographers (Goheen 1993) Often the process is more subtle though no less significant. Institutional buildings which overtly express national identity; secular and religious memorials and buildings; toponyms; the

völkische in secular architecture; and the secular landscape can all serve to affirm a society's claim on territory and to root its place in the past. In many cases, particularly with architecture, these elements affect the public's perceptions at a subliminal level. This is not to deny the force of their impact which may be extremely powerful but the act of creating or dedicating a monument, like the holding of a sectarian march, is seen as a more immediate and political act, which is why the dedication of created monuments, crosses, plinths and the like, is often wrapped in religious and military pageantry so as to legitimize the object and sanctify the events which it commemorates. Parades reify space but monuments canonize the past and claim the future:

A monument can... be a work of art or a public facility; it can even give pleasure. But those are secondary characteristics. A monument can be nothing more than a rough stone, a fragment of a ruined wall as at Jerusalem, a tree or a rough cross. Its sanctity is not a matter of beauty or of use or of age; it is venerated not as a work of art or as an antique, but as an echo from the remote past suddenly become present and actual. (Jackson 1980, 91)

The critical attribute of the monument is the power to remind, to recall something specific and, perhaps more importantly, to suggest a way of thinking and a way of acting in the present. Monuments are a vital element in the construction of landscapes of power (Osborne 1998).

## Identity and Landscape in Misiones

Long before the arrival of the Slavic settlers in Latin America, Misiones was a European colonial frontier region first penetrated by Jesuit missionaries whose missions gave the province its name. Most places were named by Spanish-speaking adherents and servants of the Roman Catholic Church well before the arrival of the Ukrainians and Poles. Consequently, most places were named



*Figure 2:* The Russian Orthodox Church at Tres Capones, Misiones, serves a Ukrainian congregation and the church building itself constitutes an emblem of Ukrainian identity within the district. (Photo: J. Lehr)

for Saints (San Isidro), after landscape features (Tres Capones), or Argentine figures (San Martine), with some Guarani names surviving from colonial times (Iguasu). Place names were rarely bestowed by Ukrainian or Polish settlers since names generally already existed for most sites. The naming of streets or the erection of monuments was a more common practice: hence in centres where Ukrainians have a presence -- whether in Misiones or in the industrial suburbs of Buenos Aires -- a *Calle Ucrania* (Ukraine Street) can often be found.

Religion continues to play a central role in Misiones' Ukrainian society. The Ukrainian churches have a dual function as guardians of both spiritual welfare and national identity. Often the most imposing buildings in a settlement, their physical appearance symbolizes the Ukrainian presence through incorporation of styles and architectural features associated with Ukrainian national identity (Figure 2). Although much of the architectural symbolism found in Ukrainian sacred architecture is spiritual in origin much of it either has or may be given a secular nationalistic interpretation.
Architecturally at least, secular and religious motifs become intertwined. As an example, the tryzub or trident, which is the Ukrainian national symbol, sometimes appears on grave headstones and in mausoleum designs. This symbol also recalls the three banias or domes that adorn many Ukrainian churches, which in a religious sense represent the Holy Trinity. In the Russian Orthodox cemetery at Tres Capones, for example, many of the mausoleums have their facade resembling the tryzub (Figure 3). In all Orthodox cemeteries the cross of St Andrew is ubiquitous and imparts а distinctive appearance to the landscape.



Figure 3: Mausoleum in the Orthodox cemetery at Tres Capones in the tryzub form also carries the cross of St. Andrew, the Orthodox cross. (Photo: J. Lehr)

Although linguistically related, Polish and Ukrainian are quite separate languages. Polish is written in the Latin script — a legacy of the dominance of Roman Catholicism in Poland— while Ukrainian uses the Cyrillic alphabet — a legacy of the influence of the Greek Church in Byzantium.

Use of Ukrainian inscriptions, indecipherable to virtually all outsiders, carries more than the written message. It proclaims identity, separates and distances from other groups which the host society might otherwise regard as cultural affiliates (Figure 4). The Ukrainian Catholic, Russian and Ukrainian Orthodox churches, their cemeteries and associated religious institutions thus came to serve as visible reminders of the distinct identity of the groups which founded them and continue to support them.

Apart from religious buildings and sacred sites there is a secular cultural landscape associated with areas settled by Ukrainians. However, this landscape is becoming eroded as modernity eliminates



Figure 4: Bilingual grave marker in the Ukrainian-Catholic cemetery at Las Tunas, Misiones. Babusia (Ukrainian for Granny) is in Cyrillic but the majority of the inscription is in Portuguese. (Photo: J. Lehr)

traditional agricultural practices and building styles become homogenized.

Prefabrication and employment of materials manufactured outside the region impart a modern look to many *chacras* or homesteads, disguising or eliminating any obvious ethnic character. Despite this, it is still possible to identify chacras developed by Ukrainian pioneers even though they may now be owned by farmers of non-Ukrainian background. House styles, the design of some ancillary farm buildings and the presence of a *pich* (the distinctive Ukrainian outdoor oven) are clear indicators of Ukrainian origins (Figure 5).

The centenary of the first Slavic settlement in Misiones occurred in 1997 and was accompanied by a rash of monument unveilings, dedications, and associated ceremonies and celebrations. Although the Ukrainians in Misiones had constituted the majority in many areas of settlement they found themselves cast in the role of just one of the many groups which had settled in the area. The Poles, generally outnumbered by Ukrainians, received equal billing partly because of the Argentinean practice of labelling all Slavic



*Figure 5: Traditional style Ukrainian outdoor oven (pich) survives in a Ukrainian pioneer's chacra now owned by an Italian farmer.* (*Photo: J. Lehr*)

immigrants as *polacos*, a term which eventually became applied to any fair-haired blue-eyed European in the region (Balanda 1999). This situation was exacerbated by the fact that during the interwar immigration all Ukrainian immigrants from Galicia were Polish nationals since Galicia was under Polish control and they travelled under Polish passports. To most Argentineans the niceties of Slavic ethnic nomenclature were either mysterious or of little concern.

The distinctive Ukrainian and Polish farm wagon, some of which had been brought in "knocked down" form to Argentina by Ukrainian immigrants during the first wave of settlement became universally described, outside of the Ukrainian community, as a *carro polaco* — literally "a Polish wagon." Today, Ukrainian community leaders avoid this designation, preferring the simple term *carro* though *carro ucraino* would be a better designation. This type of wagon proved to be well suited to the hilly topography of southern Misiones and the design was adopted by other non-Slavic immigrants (Berecke 1999). Universally used throughout southern Misiones until the onset of mechanisation in the mid-1970s, the carro polaco is still used on the chacras in the more remote areas and even in the more prosperous areas, where mechanization came earlier, many stand



*Figure 6:* A carro polaco still employed on the chacra of José Berusuki, San Isidro, Misiones, in May 1999. This type of wagon is still commonly seen in western Ukraine. (Photo: J. Lehr)

discarded in farm yards or dismantled in implement sheds (Figure 6).

To the Ukrainian community the carro polaco has become something of a secular icon of identity. In the town of Apostoles a carro polaco has been used as the centrepiece of a monument commemorating the centenary of the first European settlement of the area in 1897 (Figure 7). Adjacent memorials of recent and earlier commemorations, placed on a "wall of the immigrants," demonstrate the struggle by the Poles and Ukrainians to assert their place in the history of the region as numerous plaques dedicated by various Ukrainian organizations and institutions at various times in the past have been duplicated by Polish agencies.

The quest to establish an identity separate from the Poles has led the Ukrainian communities in Misiones not only to erect their own memorials but to commemorate their own national heroes through public monuments placed in public places; in public parks and places, on streets and boulevards. The Ukrainian poet Taras Shevchenko, always an evocative figure for the Ukrainian national movement, embodies Ukrainian aspirations for an identity separate



Figure 7: The carro polaco as an icon. Monument in Apostoles commemorates the centenary of Ukrainian settlement in Misiones. (Photo: J. Lehr)

from Russians and Poles, the two peoples who have historically attempted to absorb the Ukrainians and suppress Ukrainian desires for their own national territory. Today, in Misiones, there is scarcely a community of any substance which has a Ukrainian population sufficiently large to organize itself that does not have a statue of Shevchenko prominently placed in a public place. There are three such monuments in Argentina: one in the Federal Capital, Buenos Aires, one in Apostoles, Misiones, and another in the town of Obera, Misiones. It is possible that Argentina has more monuments to Shevchenko than any other non-Spanish-speaking poet in a public square. With the current attainment of the independence of Ukraine it is highly likely that such projects will no longer be undertaken, but, as the evidence suggests, the contest over the national origins of the Slavic settlers in Misiones continues. A Ukrainian consulate has been opened in Apostoles and both Poland and Russia likewise have honorary consuls in Misiones (Kruk 1990).

## Conclusion

Territoriality has been identified as a basic human trait, one which is intrinsically linked to concepts of self identity, expressed at the national, regional, local or individual level. In Misiones, ethnic territoriality is expressed through the iconography of the landscape, but what makes the situation in Misiones unusual is not that the iconography is contested but that identity attached to that iconography is disputed. The struggle is not so much over what is represented but who controls the meaning attached to the representation. What is at stake in the struggle for control over the objects which constitute the iconography of immigration history in Misiones, the manner of their exhibition, and the terminology associated with them, is the articulation of identity. As Ivan Karp (1991, 15) has pointed out, when cultural 'others' are implicated, exhibitions or monuments tell us who we are and, perhaps more significantly, who we are not. Exhibition of cultural icons in the landscape present images of self and of 'other,' or, in the symbolic landscapes of parts of rural Misiones, self-images of the Ukrainians and Poles. Few members of the Ukrainian community are aware of, or attach much significance to, the cultural landscape of Ukrainian settled areas. The symbols of the sacred landscape speak primarily to the group which created them but the conscious placement of memorials in public places speaks to the wider community. It also speaks volumes about the self awareness and social positioning of the immigrant communities, their visions of the past, and their view of their path towards the future.

# Acknowledgments

The authors wish to thank the Social Sciences and Humanities Research Council for their support of field research in Argentina.

### References

- BALANDA, S. 1999. Personal communication, May 1999, Posadas, Misiones. Sergio Balanda is an engineer and son of a former Argentine M.P. and Provincial Health Minister from Misiones
- BERUSUKI, J. 1999. San Isidro, Misiones, May 1999. José Berusuki is a farmer of Ukrainian origin whose chacra is near San Isidro, on the Brazilian border in Misiones
- GOHEEN, P. 1993. "Parades and Processions," in *The Land Transformed*, 1800-1981, Vol. 2 of the *Historical Atlas of Canada*, ed. R.L. Gentlecore, et. al. (Toronto: University of Toronto Press)
- *ILIUSTROVANYI KALENDAR SVITLO NA 1939 RIK* (Buenos Aires: Svitlo, 1938). pp. 40-48
- JACHNO, O. 1999. Personal communication., May 1999. Oleh Jachno is a businessman and former leader of a community organization of Ukrainian professionals in Buenos Aires
- JACKSON, J. 1980 The Necessity for Ruins (Amherst: The University of Massachusetts Press)
- KARMANSKY, P. 1923 Mizh ridnymy v Pivdennii Amerytsi (Kyiv-Vienna-Lviv: Chaika)
- KARP, I. 1991. "Culture and Representation," in Ivan Karp and Steven D. Levine (eds.), *Exhibiting Cultures: The Poetics and Politics of Museum Display* (Washington, DC.: Smithsonian Institute Press), pp. 11-24
- KRUK, P. 1999. Personal communication, Apostoles, Misiones, Argentina, May 1999. Pedro Kruk is the Secretary to the Honorary Consul of Ukraine in the province of Misiones
- OSBORNE, B. 1998. "Constructing Landscapes of Power: The George Etienne Cartier Monument, Montreal," *Journal of Historical Geography*, 24 (4). pp. 431-458
- SIMPSON, G. 1951. "The Names 'Rus,' 'Russia,' 'Ukraine,' and their Historical Background," *Slavistica: Proceedings of the Institute of Slavistics of the Ukrainian Free Academy of Sciences* 10. (Winnipeg: Trident Press)
- SNIHUR, E. 1997. De Ucrania a Misiones. Una experiencia de transformacion y crecimiento (Apostoles, Argentina: Colectividad ucrania de Misiones)
- STRELKO, A. 1975. "Primeros inmigrantes ucranianos en Latinoamerica," America Latina (Moscow) no. 1 pp.89-98
- TURCZYNSKI, E. 1975. "The Role of the Orthodox Church in Adapting and Transforming the Western Enlightenment in Southeastern Europe," *East European Quarterly* 9: 415-440.

- VASYLYK, M. 1971. "Ukraintsi v Argentini z hospodarskoho pohliadu." Kalendar Almanakh Vidrodzhennia perestupny rik 1972 (Buenos Aires: Vidrodzhennia). pp. 18-35
- VASYLYK, M. 1999. Personal communication, Buenos Aires, May 1999. Professor Miguel Vasylyk [Wasylyk] is an economist and historian, and former President of the Ukrainian Central Representation, an umbrella organization for Ukrainian community associations in Argentina
- VISSER, M. 1996. The Way We Are (Toronto: HarperCollins)
- WLODEK, J. 1923 Argentyna I emigracja, ze szczegolnym uwzglednieniem emigracji polskiej (Warsaw: Wydaw. M. Arcta)

# The Tatra Mountains and Zakopane through the eyes of two artists: Witkacy and Tetmajer

#### Ania Holub and Paul Simpson-Housley York University

*Abstract:* An author's and an artist's treatment of landscape reflects the categories of perception of the culture and what Thomas Hardy called the "idiosyncratic mode of regard." Thus, there are both culturally conditioned and personal (or idiosyncratic) aspects of an artist's mode of perception. We consider how two Polish artists/writers evaluate the Tatra-Podhale region through their perceptual filters. Kazimierz Przerwa-Tetmajer and Stanislaw Ignacy Witkiewicz (Witkacy) provide colourful insights into their regional domain, an area which contrasts dramatically with the lowlands that cover most of the rest of Poland.

A writer's treatment of landscape reflects the categories of perception of the culture and what Thomas Hardy called 'the idiosyncratic mode of regard' (Hardy 1928). Thus, there are both culturally conditioned and personal (or idiosyncratic) aspects of an author's/artist's mode of perception. Geography has traditionally emphasized the former in its assessment of human/environment relationships. However, the artist's personal perception conditions his/her geographic evaluation. In the case of D. H. Lawrence, the general values and categories of English Romanticism are reflected in, for example, his rather conventional contrasts between agrarian and industrial landscapes. His most successful descriptions, however, reflect primarily his intensely personal mode of perception. Lawrence was a writer of extraordinarily diverse works, yet a coherent and very quirky personal view colours everything. In other words, his pseudo philosophy provided a filter through which all is seen, and his sheer descriptive power derives to a great extent from the metaphorical energy provided by his personal view.

Central to Lawrence's mode of regard is a dualistic vision; that is to him everything that exists has two sides to its nature. Since our major focus is mountains we cite Lawrence's description of Etna to illustrate this:

She seems rather low, under heaven. But as one knows her better, oh, awe and wizardry.Remote, under heaven, aloof, so near, yet never with us. The painters try to paint her and the photographers to photograph her, in vain. Because why? Because the near ridges with their olives and white houses, these are with us. Because the riverbed and Naxos under the lemon groves – Etna's skirts and skirt-bottoms, these are still our world, our own world. Even the high villages among the oaks, on Etna... But Etna herself. Etna of the snow and secret changing winds, she is beyond a crystal wall. But when I look at her, low, white, witch-like under heaven, slowly rolling her orange smoke and giving sometimes a breath of rose-red flame, then I must look away from the earth into the ether, into the low empyrean. And there, in that remote region Etna is alone (Lawrence 1921).

John Moss, an English Literature professor, provides a delightful albeit idiosyncratic view of geography in this context:

Trying to define geography: the imposition of knowledge on experience in a specified landscape. That's what I mean to say, but it's so terse it seems evasive. Geography is essentially propriocentric; it does not exist outside our awareness, but is entirely separable both from us and our presence within it. The mind opens like an eye on the landscape, and defines what it sees in terms of itself. The eye measures light; distance and direction – geography articulates our solipsistic vision of the world as knowable, as what we mean it to be...(Moss 1994, 1-2)

Our paper assesses how two Polish artists evaluate the Tatra-Podhale region through their perceptual filters. Kazimierz Przerwa-Tetmajer and Stanislaw Ignacy Witkiewicz (Witkacy) provide colourful insights into their regional domain, a region that contrasts dramatically with the lowlands that cover the area of most of the rest of Poland.

Tetmajer was a poet and short story writer born on February 12, 1865, in Ludzmierz (a town in the Podhale region, which is next to the Tatra Mountains), and died on January 18, 1940, in Warsaw. He was one of the most popular members of the Young Poland movement, which was dominated by a desire to return to the expression of feeling and imagination in literature. Amongst his works are the nostalgic and pessimistic Poezje ("Poetry"), published in eight series between 1891 and 1924, his Legenda Tatr ("Legend of the Tatras"), the first attempt in Poland at historic setting as seen through the eyes of the working classes, and what is considered his best work, Na Skalnym Podhalu ("On the Rocky Podhale"), a story that depicts the landscape and people of the Tatra Mountains, where Tetmajer was born. Na Skalnym Podhalu is based, in part, on an ancient legend of the area, these colourful stories describe the mountaineers, their violent lives and intense love of freedom.

Witkacy, as he called himself, a combination of his first name Ignacy and last name Witkiewicz, was born February 24, 1885, in Warsaw, where he lived until 1890, when his parents moved to Zakopane in the hopes of curing his father's tuberculosis with the fresh mountain air. He was a prolific painter, writer, art critic, and dramatist, despite his rather turbulent life, owing to his experimentation with the effects of narcotics, such as cocaine, on creativity, which ultimately culminated in his suicide on September 18, 1939, in the Dabrowice Lakes area, in the Polesie region. He painted many portraits using the Polish Formist style, a style about which he wrote a theoretical tract, *New Forms in Painting*. He describes the process of painting as an abstract vision in the artist's imagination with more or less precise directional tensions of particular masses, which at the moment of their objectification are determined by the psyche of the artist (Kirkland 1996, 16-18). Amongst his novels written in his most productive era, 1918 to 1927, are *662 Upadków Bunga* ("662 Falls of Bung"), *Nienasycenia* ("Insatiations") and *Pożegnanie Jesieni* ("Good-bye to Fall"), and two examples of plays are *Pragmatyści* ("Pragmatists") and *Maciej Korobowa i Bellatrix* ("Mathew Korobowa and Bellatrix"), amongst many others.

Tetmajer and Witkacy led very different lives but the one thing that they had in common was their love and awe of the mountains that inspired them, the Tatra Mountains. Living in the region left an indelible stamp on their work. Mountains seem to inspire contemplative, spiritual and religious feelings in people, thereby stimulating both religious and secular literature. It can be claimed they symbolize the characteristics of God, which include awesomeness, mystery, transcendence, inaccessibility, eternality and immovability, (Kissoon, and Simpson-Housley, 1999, 90). This metaphor is rendered explicitly in the Psalms:

Those who trust in the Lord are like Mount Zion which cannot be moved, but abides forever. As the mountains are round about Jerusalem, so the Lord is round about his people, from this time forth and forever more. (Psalm 125, 1-2)

There are many other references in the Bible to God appearing on mountains, or in fact God living on a mountain:

God is well known in Judah, and famous in Israel. He has his home in Jerusalem; he lives on Mount Zion. (Psalm 76, 1-2)

Other religions also see mountains as dwelling places of the gods. For example, the Greek gods lived on Mount Olympus. Secular writers also celebrated mountains. One such episode in the English Lake poet, William Wordsworth's autobiographical epic, *The Prelude*, revolves around a sacred or mystical experience on Mount Snowdon in north-west Wales:

A meditation rose in me that night Upon the lonely mountain when the scene Has pass'd away, and it appear'd to me The perfect image of a mighty Mind, Of one that feeds upon infinity, That is exalted by an underpresence, The sense of God, or whatso-er is dim Or vast in its own being, above all One function of such mind had Nature there Exhibited by putting forth, and that With circumstances most awful and sublime, That domination which she oftentimes Exerts upon the outward face of things...

Similarly, the pagan religion of the local inhabitants of the Tatra-Podhale region considered mountains to be sacred. They, in fact, worshipped the mountains themselves as one of the gods (prior to the coming of Christianity).

The Polish Tatra Mountains stretch for 64 kilometres along the Slovak-Polish frontier, in the southernmost region of the country (Figure 1). The average elevation of the Tatras is 700 metres above sea level, with the highest peak, Rysy, reaching an elevation 2500 metres. This contrasts starkly with the rest of Poland, which is largely composed of lowlands, with an average elevation of 200 metres above sea level. This fact gives the region an even greater aura of uniqueness. Some, in fact, venture that the Tatras are the spiritual capital of Poland (Pinkwart, 1998, 3-35). All of these factors contribute to the popularity of the Tatras as a theme, as an inspirational force, for Polish artists.

Tetmajer, in his book *Legend of the Tatras*, shows how Maryna, a young Goral woman (that is what the mountain people of the region are called), falls back on worshipping the mountain gods when she tries to exorcise the love that she feels for a nobleman, whom she would rather hate because he is fighting against her



Figure 1: Location of Zakopane and the Tatra Mountains.

people. She turns to the pagan gods since to her the Christian faith is the faith of the nobility. After sacrificing a bull and throwing it into the fire, she prays:

Mountain pasture, you who freezes in the winter and melts each spring, almighty God, light of creation, the word of the father of gods and people, you who heralds manifestations. I am here! Mountain pasture, almighty God, you who destroys and creates again the world, in you is time, in you is eternity!

Halu, ty, co w zimie marźnies, a odtajes na kazdom wiesne, boze wsehmogoncy, światło stworzenia, słówo ojca bogów i ludzi, ty, co zwiestujes objawienie. Jestem! Halu, boze wsechmogoncy, ty, co wniwec obracas i zaś odnawias świat, w tobie cas, w tobie wiecność! (Tetmajer 1997, 119).

This anthropomorphic treatment of the mountains is seen reflected, albeit more subtly, elsewhere in Tetmajer's description of the Tatras. He does not go as far as to call the mountains gods, but he describes them in such glowing terms, that they would be worthy of being gods or their dwelling place:

Up high, glittering in the sun and bathed in a translucent glow, still covered in snow, hanging in the distance high above ethereal emerald green mists and dark forests, the mountains glowed like sapphires, cut into the joyous expanse of the heavens, so light and airy as if they were carried by the wind.

A wysoko lśniły sie w słoncu obfite w óar przezroczysty, śniegiem jeszcze osypane, zawisłe w przestrzeni wysoko na zwiewnych mgłach seledynowych nad ciemnymi lasami, szafirowopromienne skały, tak lekkie i lotne, jakby wiatrem niesione, w radosny niezmiar nieba wcięte (Tetmajer ibid., 26-27).

The painter/dramatist/writer Witkacy depicted the mountains in a spiritual or mystical manner in some of his portraits. In one portrait of Nena Stachurska (Oct. 12, 1929), he paints her head floating above the mountains and above a crescent moon. He repeats this motif in a painting of Eugeniusz Lorek (May 1937), this time replacing the moon with a bright star. The large size of the heads in comparison to the landscape and their placement in the composition gives the impression that the landscape is an internalized, spiritual landscape, rather than an actual setting (Kirkland, op. cit., plates 88 and 217). The people whom he depicted in this manner were people, who, much like himself, lived in Zakopane, the main town in the Polish Tatras. Witkacy describes the infatuation that people get with Zakopane, after they have stayed for a while, as a drug:

In the atmosphere of Zakopane, so deadly for the tuberculosis bacteria, so full of forceful encouragement to the sleepy phagocytes, there exists a subtle drug, a hundred times worse than the smoke of opium or the hashish paste, a drug that causes artists to fall into total omphalopsychism, in other words, into an unbridled contemplation of their metaphysical navels... They used to call Zakopane 'a spiritual capital of Poland'. We would call it something else: a producer of a specific, a purely Polish drug, 'zakopianiny', its psycho-chemical composition we are trying, it seems for the first time, to analyze.

W atmosferze Zakopanego, tak zabójczej dla tuberkulicznych bakcyli, tak peźnej wsciekłego dopingu dla ospałých fagocytów, unosi sié subtelny narkotyk, stokroć gorszy od dymów opium i haszyszowej marmelady, narkotyk, którym omamieni twórcy wszelkich dziedzin pogrąźają się w zupelny omphalopsychizm, czyli nieokiezónaną kontemplacj" swych metafizycznych pépków... Nazywano niegdyś Zakopane 'duchową stolicą Polski'. My nazwalibyśmy je inaczej: generalną specvficznego. zreszt czysto polskiego wvtwórni narkotyku, zakopianiny, której skĺad psycho-chemiczny staramy sie tu, zdaje sie po raz pierwszy w ogóle zanalizować. (Pinkwart op. cit., 214-215)

Thus, Zakopane is seen as a special town, unlike any other Polish town, owing to its location in the Tatra Mountains. It survived, practically unscathed, the devastating effects of the socialist regime, which plunged so many of the other Polish cities into poverty, grimy with the pollution spewed out by monstrous industrial factories. It will not need any 'place promotion', like some of the other Polish cities, such as Łodi:

Place promotion involves the re-evaluation and rerepresentation of place to create and market a new image for localities to enhance their competitive position in attracting and retaining resources (Young and Kaczmarek 1999, 183-191).

In fact, Zakopane has to figure out how to deal with the millions of tourists who are crowding its streets in increasing numbers every year and how to solve the chronic traffic problem on the one road leading into town (Pinkwart op. cit., 5) Therefore, the mountains, with their magnetic force to artists and tourists alike have ensured the economic survival of this city... but can the city and the Tatras handle the price, the environmental stress, of their success? It seems that for now they are still coping and inspiring, because away from the crowded trails...

... it is possible to see the real Tatras and to come into contact with their indescribable beauty, exotic scenery and still untamed nature, to get choked up by metaphysical experiences and to allow ourselves – as the great composer and mountaineer, Miczyslaw Karlowicz, wrote – to be filled with the *eternal breath of existence*, which manifests itself in this way only in high mountains and large oceans.

... można zobaczyć prawdziwe Tatry i wejść w bezpośredni kontakt z ich niepowtarzalnym pięknem, egzotyczną scenerią i ciagle jeszcze dzik pzýrodą, można zachłýsnąż sie metafizycznymi przeżyciami i pozwolić by – jak pisał wielki kompozytor i taternik, Mieczyslaw Karlowicz – ogarnął nas wiekuisty oddech wszechbytu, tak właśnie manifestujacy się tylko w wielkich górach i na wielkich oceanach (Pinkwart op. cit., 5-6).

### References

- HARDY, F.E. 1928 The Life of Thomas Hardy: 1840-1928 London, MacMillan, 1969 edition
- KIRKLAND III, R. (Translator) 1996 Witkacy: Stanisláw Ignacy Witkiewicz in the Museum of Central Pomeránia in Slúpsk (Wydawnictwa Artystyczne i Filmowe, Warszawa) 16-18
- KISSOON P., and SIMPSON-HOUSLEY, P. 1999 'The Evaluative and Spiritual Dimensions of Mountains in Manfred *The Byron Journal* 27: 90
- LAWRENCE, D.H. 1921 Sea and Sardinia London: Heinemann, 1956 edition
- MOSS, J. 1994 Enduring Dreams: An Explanation of the Arctic Landscape Concord: Anansi 1-2
- PINKWART, M. 1998 Tatry i Podhale Zakopane: Interfart
- TETMAJER (Przerwa), KAZIMIERZ 1999 *Legenda Tatr* Warszawa: Unia Wydawnicza "Verum"
- YOUNG, C. and KACZMAREK, S. 1999 'Changing the Perception of the Post-Socialist City: Place Promotion and Imagery in ód , Poland' *The Geographical Journal* 165 (2)

Note: Translation from Polish provided by Ania Holub