

DESIGNING POLICIES IN A WORLD OF UNCERTAINTY, CHANGE, AND SURPRISE

ADAPTIVE POLICY-MAKING FOR AGRICULTURE AND WATER RESOURCES
IN THE FACE OF CLIMATE CHANGE



PHASE 1 RESEARCH REPORT

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International Institute for Sustainable Development

161 Portage Avenue East, 6th Floor
Winnipeg, Manitoba
Canada R3B 0Y4
Tel.: +1 (204) 958-7700
Fax: +1 (204) 958-7710
Website: <http://www.iisd.org>

The Energy and Resources Institute

Darbari Seth Block
IHC Complex, Lodhi Road
New Delhi – 110 003, India
Tel. (+91 11) 2468 2100 or 4150 4900
Fax (+91 11) 2468 2144 or 2468 2145
Website : www.teriin.org

Designing policies in a world of uncertainty, change, and surprise

*Adaptive policy-making for agriculture and water resources
in the face of climate change*

Contents

Executive summary	vii–xii
--------------------------------	---------

Weathering uncertainty

Adaptive policies

Policy case studies

Conceptual framework and next steps

CHAPTER 1	1–8
------------------------	-----

Introduction

1.1 Background

1.2 Why study adaptive policies and why in the context of climate change?

1.3 Research question, propositions, and approach

1.4 Road map to Phase I research report

CHAPTER 2	9–36
------------------------	------

Initial conceptual framework and literature review for understanding adaptive policies

2.1 Concepts: initial terminology and framework

2.1.1 Background terms and concepts

2.1.2 Our initial conceptual framework for adaptive policies

2.2 Literature review

2.2.1 Insights from the adaptive policy-making literature

2.2.2 Insights from adaptive management literature

2.2.3 Insights from policy pilot studies

2.2.4 Insights from the policy learning and change literature

2.2.5 Insights from the institutional learning literature

2.2.6 Insights from natural systems

2.2.7 Insights from complex adaptive systems theory

CHAPTER 3	37–52
------------------------	-------

Indian agriculture: growth, sustainability, and vulnerability

3.1 Overview of the agriculture sector

3.1.1 The Green Revolution

3.2 Sustainability issues

3.2.1 Groundwater depletion

3.2.2 Soil degradation

3.3 Vulnerability to climate change

CHAPTER 435–68

Adaptive policy case study: weather-indexed insurance for agriculture in India

- 4.1 Introduction
- 4.2 Background
- 4.3 Policy description: evolution of crop insurance in India
 - 4.3.1 Traditional crop insurance schemes
 - 4.3.2 Liberalization of insurance sector
 - 4.3.3 Weather-indexed contracts
 - 4.3.3.1 ICICI Lombard pilot scheme for groundnut in Andhra Pradesh
 - 4.3.3.2 KBS pilot scheme for soya farmers in Ujjain
 - 4.3.3.3 Rajasthan government insurance for orange crop
 - 4.3.3.4 IFFCO-TOKIO monsoon insurance
 - 4.3.3.5 AIC Varsha Bima Yojana (rainfall insurance scheme)
 - 4.3.3.6 AIC Sookha Suraksha Kavach (drought protection shield)
 - 4.3.3.7 AIC coffee rainfall index and area yield insurance
 - 4.3.3.8 ICICI Lombard loan portfolio insurance
 - 4.3.3.9 Results update
- 4.4 Adaptive policy analysis
 - 4.4.1 Ability to adapt to a range of anticipated conditions
 - 4.4.2 Ability to adapt to unanticipated conditions
 - 4.4.2.1 Built-in mechanisms for learning and improvement
 - 4.4.2.2 Learning from pilot schemes
 - 4.4.2.3 Learning from engagement of local institutions
 - 4.4.2.4 Degree of self-adjustment to unanticipated circumstances

CHAPTER 569–78

Adaptive policy case study: agriculture price policy in India

- 5.1 Introduction
 - 5.1.1 MSP and procurement prices
 - 5.1.2 Zonal restriction
- 5.2 Policy description: changes, drivers, and impacts
- 5.3 Adaptive policy analysis
- 5.4 Lessons learned

CHAPTER 679–96

The Canadian Prairies: biophysical and socio-economic context

- 6.1 Overview of agriculture on the Canadian prairies
- 6.2 Prairie hydrology, hydrologic variability, and drought
 - 6.2.1 Palliser's expedition, drought, and historic climate variability
 - 6.2.2 Paleo-climatic research

- 6.2.3 Implications of future climate change
- 6.2.4 Evidence of the current adaptive capacity to climate variability
- 6.2.5 Prairie water and soil quality
- 6.3 Agricultural policy drivers and socio-economic conditions

CHAPTER 7 97–116

Adaptive policy case study: analysis of the Crow Rate in Prairie Canada: a cautionary tale

- 7.1 Introduction
- 7.2 Policy description: changes, drivers, and impacts
- 7.3 Adaptive policy analysis
 - 7.3.1 Period of policy change (1897–1925)
 - 7.3.2 Period of policy stability (1925–84)
 - 7.3.3 Period of policy decline (1984–96)
 - 7.3.4 Period of socio-economic and environmental impact due to termination of the WGTA (1996 onwards)
- 7.4 Lessons learned

CHAPTER 8 117–150

Adaptive policy case study: analysis of Manitoba's conservation district policy

- 8.1 Introduction
- 8.2 Policy description: changes, drivers, and impacts
 - 8.2.1 Historical policy evolution
 - 8.2.2 Initial watershed focus
 - 8.2.3 Conservation Districts Commission
 - 8.2.4 The current legislation
 - 8.2.5 Recent financial history
 - 8.2.6 Emergence of local decision-making
 - 8.2.7 Range of programmes
 - 8.2.8 Drainage, conservation, and performance measurement
- 8.3 Adaptive policy analysis
 - 8.3.1 Surface water management (various CDs: 1972–2006)
 - 8.3.2 Surface water management – first CD is the best existing model
 - 8.3.3 Abandoned well capping – Pembina Valley: 1997–2006
 - 8.3.4 Conservation agreements – Turtle Mountain: 2003–05
 - 8.3.5 Trans-boundary partnerships – West Souris: 2001–05
 - 8.3.6 Alternative Land Use Services pilot project – Little Saskatchewan: 2004–06
 - 8.3.7 Aboriginal participation – Alonsa: 1991–2001
- 8.4 Analysis and results

Appendix: Manitoba conservation districts

CHAPTER 9 151–170

Synthesis and conclusions

- 9.1 Understanding the ability of a policy to adapt to anticipated conditions
- 9.2 Understanding the ability of a policy to adapt to unanticipated conditions
- 9.3 Discussion of results and conceptual issues
 - 9.3.1 Key observations from the case studies
 - 9.3.2 Policy adaptability versus ad hoc policy review
 - 9.3.3 Policy adaptability versus policy change or substitution
 - 9.3.4 Policy rigidity
 - 9.3.5 Addressing policy side effects
 - 9.3.6 Linkages between adaptive policies and community-level coping strategies
- 9.4 Conclusions

Executive summary

Weathering uncertainty

Adaptive policies

Policy case studies

Conceptual framework and next steps

Designing policies in a world of uncertainty, change, and surprise

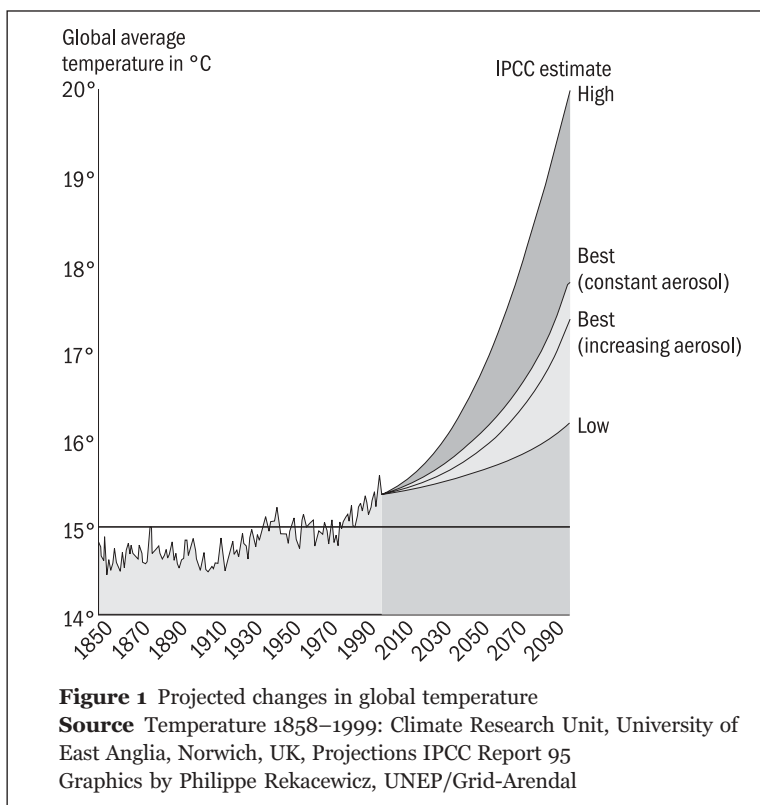
*Adaptive policy-making for agriculture and water resources
in the face of climate change*

Phase 1 research report

Weathering uncertainty

Climate change introduces tremendous uncertainties for policy-making. We know that the globe is warming and that there will be significant changes in average weather. We also know that the nature of global warming signifies that there will be more extreme weather events. Typical precipitation patterns will change, and floods and droughts will become more common and severe. The implications for human well-being around the world will be enormous, but the precise nature of the impacts and their extent remain, and will always remain, impossible to predict. Figure 1 depicts the basic issue: scientists agree that the globe will warm, but the range of estimates is an order of magnitude greater than the variability in the historic record.

Farmers and water resource managers have a long history of adapting to climate shocks and stresses. However, the current climate change phenomenon is projected to exacerbate these



shocks and stresses, and result in long-term changes in precipitation and evaporation. Increasing our capacity to cope is imperative. Public policies can help build this capacity. However, a key challenge is developing policies that are robust enough to be useful in a rapidly changing and uncertain future.

Adaptive policies

Experience demonstrates that policies designed implicitly or explicitly to operate within a certain range of conditions are often faced with challenges outside that range. The result is that many policies have unintended impacts and do not accomplish their goals. Therefore, in order to help policies help people, policy-makers need ways to design policies that can adapt to a range of conditions.

How does one do this? The IISD (International Institute for Sustainable Development) and TERI (The Energy and Resources Institute) argue that one can learn from past policy successes and failures. Using case study analyses of the existing and past policies in the water and agricultural sectors, one can better understand the features that make policies adaptive to changes in underlying conditions.

In the first phase of the four-year research project entitled *Designing policies in a world of uncertainty, change, and surprise: adaptive policy-making for agriculture and water resources in the face of climate change*, review of a very young literature on adaptive policy-making and its connections to adaptive management and complex adaptive systems theory is given. The literature review clarifies that the key policy design challenge is the ability of a policy to adapt to both *anticipated* and *unanticipated* changes in underlying conditions.

Policy case studies

To further understand adaptive policies, we studied four cases drawn from the water and agricultural sectors. Two are from India and two are from Canada, enabling comparison of developing and developed world experience. The case studies reveal adaptive as well as maladaptive policy features.

- 1 We studied index-based weather risk insurance contracts, which are emerging as an alternative to traditional crop insurance in India. Unlike traditional crop insurance, where settling a claim can take up to a year, private weather insurance contracts offer quick payouts triggered by independently-monitored weather indices (rather than farm loss sampling) and can improve recovery times, thereby enhancing coping capacity. The automatic adjustment feature provides a simple mechanism for managing insurer risk and determining farmer eligibility for benefit payments, while also passing along incentives for farmers to adjust to long-term change by providing appropriate signals calculated on the basis of actuarial risk. The case study provides insights into the importance of automatic adjustment triggered by climate information and, more generally, the utility of using pilot approaches to test key assumptions for iteratively refining programme delivery; to better understand risk patterns; and to create awareness among farmers. The delivery of weather insurance through local micro-finance institutions suggests the importance of two-way communication channels in fostering adaptive policy design by building in feedback mechanisms to respond to changing client needs or other conditions.
- 2 The case of agricultural price policy in Punjab, India, provides an interesting example of how price support levels are adjusted through a formal review process to support farm livelihoods. For example, the Commission for Agricultural Costs and Prices takes into account important factors, such as cost of production, changes in input prices, and trends in market prices, in announcing the minimum support price each year. However, other features of this system may be ecologically maladaptive to future climate impacts. For instance, in the state of Punjab, price incentives that did not internalize natural resource costs resulted in cultivators getting locked into a highly irrigation-intensive cropping pattern, which is drastically depleting already limited groundwater supplies.
- 3 In Canada, our analysis of a long-standing transportation subsidy, the Crow Rate, is a cautionary tale of a maladaptive policy. The rigidity of the policy resulted in the slow deterioration of the rail

transportation system as contexts changed over the course of the 20th century. This study highlights the difficulty in modifying subsidy policies, which has implications for adaptation. An overhaul of the policy in response to decades of public scrutiny eventually introduced a number of adaptive features, including adjustment of the freight rate based on variable transportation costs, grain volume forecasts and transport distance; and a four-year costing review and ongoing evaluation of system efficiency by a Grain Transportation Agency. Political support for the policy slowly waned and the policy was terminated. Curiously, the increases in crop diversification and improvements in the livelihoods of farmers anticipated in the wake of the policy's termination have not materialized, and today, the Canadian Prairies are suffering some of the worst ecological and economic conditions since the dust-bowl years of the 1930s.

- 4 Our final case, the Conservation Districts Programme in the Province of Manitoba, Canada, provides an interesting counter-example to the Crow Rate, primarily in terms of adaptability. Whereas the Crow Rate was a federal programme administered homogeneously across Western Canada, the CDs (Conservation Districts) were designed to decentralize responsibilities for environmental management to local organizations that could then access various federal and provincial funding programmes to suit their needs and preferences. Comparative analysis of different CDs reveals that they have consistently adapted to new conservation challenges, in some cases with completely unanticipated stakeholders and around unexpected issues. Furthermore, among the CDs that were examined, the most successful had physical boundaries that conformed to watershed boundaries, and had clear jurisdiction over water resources management—highlighting the significance of policy design oriented towards ecosystem realities, and drawing attention to questions of decentralization as being potentially significant in adaptive policy-making.

Conceptual framework and next steps

The literature and a synthesis of the key learning from all four case studies helped us articulate a general conceptual framework for adaptive policy design (see Figure 2). The framework is sensitive to a subtle distinction between conditions that policy-makers can and cannot anticipate during policy design and implementation. We find that ‘no-regrets’ policies and automatic adjustment based on triggers and actions improve adaptability to anticipated conditions. Perhaps most importantly, principles for intervening in complex adaptive systems yield many insights for improving policy adaptation to unanticipated conditions, as do structured learning processes such as scheduled policy review and re-adjustment.

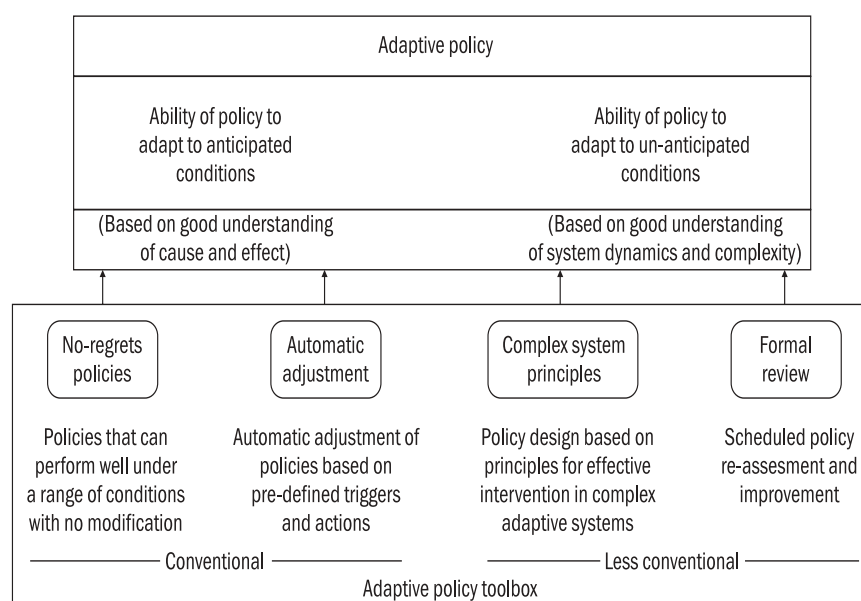
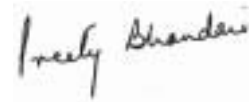


Figure 2 Initial conceptual framework of adaptive policies

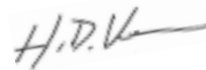
With the continued support of Canada's IDRC (International Development Research Centre), our next phase of research will conduct community-level surveys to test our hypothesis that the key policies which help build the capacity of communities to cope with climate shocks and stresses contain a core set of features that allow these policies to respond successfully to anticipated and unanticipated conditions. We believe this analysis of policy dynamics and community responses will generate further insights and examples to round out an emerging 'toolbox' of adaptive policy approaches for the water and agricultural sectors, and will better enable public policies in helping to build the capacity of agriculture producers, pastoralists, and water resource managers to cope with climate change.



Preeti Bhandari
Director, Policy Analysis Division, TERI



John Drexhage
Director, Climate Change and Energy, IISD



Henry Venema
Director, Sustainable Natural Resource Management, IISD

For more information, please contact

Darren Swanson
Project Manager
International Institute for Sustainable Development, Canada
E-mail dswanson@iisd.ca

Ulka Kelkar
Project Investigator
The Energy and Resources Institute, India
E-mail ulkak@teri.res.in

**Project
website**

http://www.iisd.org/climate/canada/adaptive_policy.asp

CHAPTER

1

Introduction

- 1.1 Background
- 1.2 Why study adaptive policies and why in the context of climate change?
- 1.3 Research question, propositions, and approach
- 1.4 Road map to Phase I research report

Introduction

Stephen Barg¹, Preety Bhandari², John Drexhage¹, Ulka Kelkar², Sudip Mitra², Darren Swanson¹,
Stephen Tyler³, Henry David Venema¹

1.1 Background

This document presents results from the first year of a four-year collaborative research project involving the IISD (International Institute for Sustainable Development) in Canada, TERI (The Energy and Resources Institute) in India, and the IDRC (International Development Research Centre) in Canada. The project is titled *Designing policies that can adapt to a world of uncertainty, change, and surprise: adaptive policy-making for agriculture and water resources*.

The specific objective of the project is to help government agriculture and water resource development policy-makers at the local, provincial, and federal levels to design adaptive policies. These are policies that contain features to facilitate successful performance of the policy under a range of anticipated and unanticipated conditions. The key tenet of the analysis put forth in this report is that our economic, social, and ecological systems are so integrated and complex (whether recognized or not) that society can no longer rely on simple cause–effect understanding to respond to new and unanticipated conditions.

While uncertainty, change, and surprise come in many forms, and are a reality for all sectors, this project focuses on the physical (and associated socio-economic) uncertainties, surprises, and slower changes resulting from climate change—one of today’s most pressing and complex sustainability challenges (Box 1.1).

The capacity of communities to adapt to surprises and longer-term change is a critical aspect of the transition to sustainable development. For example, in the climate change context, adaptive capacity has been described as a function of several factors including economic and physical resources; access to technology, information, and skills; infrastructure; and institutions (Smit, Pilifosova, Burton, *et al.* 2001). Public policies can help contribute to the presence of these factors in communities. But what if these public policies themselves have difficulty adapting to surprises and longer-term change?

Experience demonstrates that public policies are typically not adaptive. Public policies designed implicitly or explicitly to operate within a certain range of conditions are often faced with challenges

¹ International Institute for Sustainable Development, Canada

² The Energy and Resources Institute, India

³ Adaptive Resource Management Ltd, Canada

outside of that range. The result is that many policy impacts are unintended and do not accomplish their goals. With surprise, change, and uncertainty being constant in our world, the ability to respond more effectively to a complex range of anticipated and unanticipated conditions is imperative.

A concept of adaptive management emerged in the late 1970s, which suggested that ecosystems must be managed in an adaptive manner, with experimentation and learning built in, if the management process was to be successful (Holling 1978). This insight – now well acknowledged in natural resources management (Lee 1993; Gunderson and Holling 2003) – also applies to public policy, where integrated socio-economic and ecological systems are even less well understood.

The literature on applying adaptive management concepts to policy design is scant, perhaps because an important goal of public policy is certainty. Fiscal policy, in particular, is often designed to give investors and tax-payers as much certainty as possible, so that they have a clear policy framework within which to make their calculations. The idea of designing into policy instruments the ability to adapt is new (particularly in relation to unanticipated conditions). Nevertheless, there are examples of adaptive policy instruments, and the goal of this project is to search for such examples, analyse them, and try to derive lessons for policy designers.

Box

Climate change as a good example of uncertainty, change, and surprise

1.1

A good example to study adaptive responses, and to examine the characteristics and mechanisms of adaptive policies, is the communities that have experienced high climate variability and stress. It is becoming increasingly evident that climate change, as an issue, has evolved from a narrow interest base in the meteorological sciences to a broad social recognition that both the impacts of and policy response to climate change will have significant implications for human development.

The physical manifestations of climate change include change in temperature or precipitation, sea level rise, changes in the frequency and duration of extreme weather events, and the resulting changes in hydrologic conditions including stream flow rates, and surface and groundwater levels. There is uncertainty about these changes because the natural system is so complex and our understanding of it is incomplete. The global circulation models used to model climate capture global warming in broad terms, but do not have any fine-grained local predictive power. Furthermore, specific impacts will be an artefact of assumptions used to generate the emissions scenario driving the model. Any associated prescriptions for adaptation to climate change will similarly be an artefact of the scenario assumptions. For example, projections of future climate from five different global climate models indicate a range of precipitation and temperature for India (Figure 1).

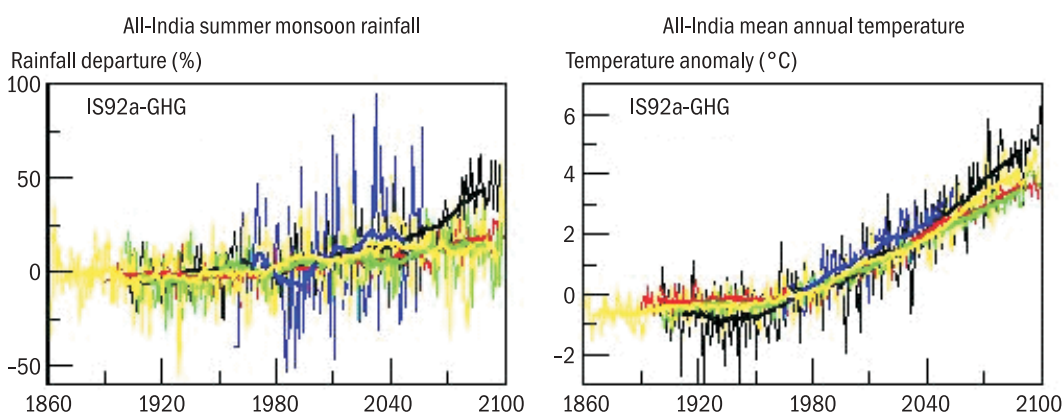


Figure 1 Climate change projections for India based on a range of global climate models (business-as-usual scenario).

Source Kumar (2004)

1.2 Why study adaptive policies and why in the context of climate change?

Agricultural producers and pastoralists have a long history of adapting to uncertainty, change, and surprise. Climatic variability is one example, be it surprise in the form of floods or stresses such as prolonged droughts. The current climate change phenomenon is projected to exacerbate these surprises and stresses, and result in longer-term changes in the average precipitation and evaporation levels. Building the capacity to adapt to such conditions is a critical step in helping those relying on agriculture and water resources to sustain their livelihoods—in other words, to become resilient to surprises and longer-term changes.

Public policies and institutions have been developed in the past to facilitate this ability to adapt to climate variability and change (for example, the Prairie Farm Rehabilitation Administration in Canada). Adaptation priorities in the face of future climate variability and change, and the specific policies required to help facilitate these adaptations, are the focus of a significant and growing body of pragmatic research around the world. But what if the policies themselves cannot adapt to the anticipated and unanticipated conditions, which inevitably emerge over time; conditions which invalidate many of the core assumptions upon which the policy operates? Such policies could become a hindrance or a constraint on the ability of individuals and communities to adapt. Unfortunately, this is a situation which has become all too common in today's increasingly interconnected and rapidly changing world, and a growing body of research is pointing towards the need for adaptive approaches to policy-making.

For example, in India and Nepal, a group of researchers studying water governance in an IDRC-funded project found that 'when situations are characterized by variability, uncertainty, and change, conventional planning scenarios provide little guidance regarding future needs and conditions' (Moench, Dixit, Janakarajan, *et al.* 2003). The research revealed that although it might be possible to identify some emerging issues with conventional approaches, 'changing conditions often render specifically targeted management proposals irrelevant or impossible to implement'. The authors concluded that there is a 'clear need for frameworks that are adaptive—which reflect uncertainties and can respond as contexts change or unforeseen problems emerge'. Specific insights towards better management approaches were gleaned from their water governance research, including the following.

- 'Specific solutions are less important than the existence of processes and frameworks that enable solutions to be identified and implemented as specific constraints and contexts change.
- In most situations, more attention needs to be given to clumsy, resilient institutions and approaches rather than tightly focused (theoretically efficient) but brittle ones. Tightly focused institutions and organizations are essential for specific tasks, but they cannot govern or guide the complex, surprise-laden process of water governance central to long-term management at a regional, basin, aquifer, or even local level.'

Along similar lines, Scoones (2004) points out that much can be learnt from the pastoral rangelands⁴ of the world where uncertainty has always been a part of everyday life and survival. He describes these as regions 'where systems are not at equilibrium, where sometimes chaotic, often stochastic, dynamics prevail, and where predictability and control are false hopes.'

Scoones (2004) recognized that if climatic uncertainty and variability are on the rise due to climate change, 'we must shed our blinkered equilibrium views and solutions, and search for alternatives that allow for living with uncertainty'. Conventional views of institutions as static, rule-based, formal, fixed, and having clear boundaries are giving way to views that institutions must be dynamic, overlapping, heterogeneous, socially defined, emergent from adaptive practice, and flexible. Similarly, Scoones (2004) also noted that development planning, which traditionally has taken a blueprint approach and used linear policy models, is giving way to views of development as characterized by adaptive planning and policies that are flexible, responsive, learning, non-linear, and discretionary.

⁴ These types of regions are described by Ellis (1998) as existing in very large swathes of Africa, where the coefficient of variation of rainfall is more than 30%.

All of these situations start from the recognition that policy systems and policy change are not linear, rational, or deterministic processes. There is typically no clear causal chain to explain how a particular policy either takes shape or fails. Policies are the outcomes of iterative and opportunistic interaction among multiple factors including perception of problems among different groups; communication of new knowledge; and consensus on validity, argument, contestation, power, and political opportunity.

Our current project aims to fill a significant gap in the research regarding public policy design in a world of uncertainty, surprise, and change. How can policies be designed and implemented so as to react well to changing conditions, rather than break down in the face of unforeseen challenges?

1.3 Research question, propositions, and approach

The underlying premise for the project is a general recognition that surprise, change, and uncertainty are inherent characteristics of the world in which we live, and that the capacity of communities to adapt to these surprises and longer-term changes is a critical aspect in the transition to sustainable development. This is particularly evident when considering the global issue of climate change. Public policies can build the capacity of communities to cope with climate variability and change. It is particularly important to better understand what types of policies help build capacity and create opportunity for communities to cope with changing conditions (Box 1.2). But to do that effectively, such policies may need to adapt themselves to surprises and longer-term change.

Following from this premise, our research question guiding this four-year project is two-fold.

- 1 *Do public policies that build the capacity of communities to cope with surprise and longer-term change have adaptive features?*
- 2 *What adaptive features enable policies to remain effective despite changes in external conditions?*

Our initial proposition regarding the first question above is that yes, public policies which build the capacity of communities to cope with climate change do contain adaptive features. Our rationale is that policy effectiveness in this regard is in part a function of the ability of the policy to adapt to new conditions. Regarding the second research question, our initial proposition – formulated based on a review of the literature – is that under conditions of surprise and slower change, effective public policies have the ability to adapt to both anticipated and unanticipated conditions.

Box	Adaptive policy-making in civil aviation
1.2	<p>Changes in climate are one source of uncertainty and surprise, but rapid shifts in trade, investment, competitiveness, environmental degradation, and resource use are also common. Apart from agriculture and water resources, another example of the need for adaptive approaches in policy-making can be seen in the national civil aviation policy of the Netherlands. Specifically, Walker, Rahman, and Cave (2001) identified that a host of uncertainties surrounded the issue of accommodating projected increased volume at the Schiphol Airport, such as other governments subsidizing inefficient carriers giving unfair competitive advantage, other airports increasing their capacity, and airlines changing their hub location. Walker, Rahman, and Cave (2001) proposed adaptive policy-making in this instance noting that if the future could be predicted accurately, preferred policies could be identified simply by examining the future that would follow from the implementation of each possible policy and picking the one that ‘produced the most favourable outcomes’.</p> <p>However, the inherent problem with this approach is fundamentally that ‘for most systems of interest today (particularly social and economic systems), such prediction is not possible, due to increasing complexity, their increasing interrelationships with other systems, and the increasing uncertainty of development external to the system that have important effects on the system’ (Walker and Marchau 2003).</p>

To begin addressing the above two research questions, the project employs the following research methodology.

- **Phase I: Desk-level policy case study research** This phase of research is designed to advance and test our proposition that adaptive policies have features, which facilitate the ability to adapt to both anticipated and unanticipated conditions. Towards this, we compiled insights on adaptive policies from the relevant literature, and developed two policy case studies each in Canada and India.
- **Phase II: Community case study research** This phase of the research is designed to test our first research question: *Do public policies which facilitate the ability of communities to cope with surprise and longer-term change contain adaptive features?* Towards this, we will carry out field research in several communities in India and Canada to study how they have coped with historical climate stresses; the policies, which helped or hindered this coping ability; and the features of key policies that helped the policies perform successfully.
- **Phase III: Action learning research** For this final phase of research we will work directly with policy-makers to apply adaptive policy features to the design of an existing or proposed policy as a test for pragmatism, and functionality of key concepts and tools.

1.4 Road map to Phase I research report

This document reports on the results of the Phase 1 research and is divided into four parts. Part A presents this introductory chapter along with a chapter outlining our initial conceptual framework and literature review in support of adaptive policies.

Part B contains three chapters, the first of which is an overview of the socio-economic and environmental context relevant to agriculture and water resources in India. Chapters 4 and 5 present two policy case studies: weather-indexed insurance contracts and agriculture price policy, respectively. Index-based weather risk insurance contracts have emerged as an alternative to traditional crop insurance in India, and this policy instrument is analysed for its adaptive policy features. The MSP (minimum support price) instrument of India's agriculture price policy is discussed from an adaptive policy perspective.

Part C mirrors the type of information presented in Part B except in relation to Canada. The socio-economic and environmental context of the Canadian Prairies is presented followed by two policy case studies: a historical adaptive policy analysis of a longstanding rate control agreement for grain transport by rail (Chapter 7), and a comparative adaptive policy analysis of the Manitoba provincial government's Conservation District Programme.

Part D takes a look across the four policy case studies and synthesizes key features of adaptive policies observed (Chapter 9).

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CHAPTER

2

Initial conceptual framework and literature review for understanding adaptive policies

- 2.1 Concepts: initial terminology and framework
 - 2.1.1 Background terms and concepts
 - 2.1.2 Our initial conceptual framework for adaptive policies
- 2.2 Literature review
 - 2.2.1 Insights from the adaptive policy-making literature
 - 2.2.2 Insights from adaptive management literature
 - 2.2.3 Insights from policy pilot studies
 - 2.2.4 Insights from the policy learning and change literature
 - 2.2.5 Insights from the institutional learning literature
 - 2.2.6 Insights from natural systems
 - 2.2.7 Insights from complex adaptive systems theory

Initial conceptual framework and literature review for understanding adaptive policies

Darren Swanson¹, Henry David Venema¹, Stephen Barg¹, Stephen Tyler³,
John Drexhage¹, Preety Bhandari², Ulka Kelkar²

What do we mean by adaptive policies? One can imagine, in one case, a policy framework that needs little adjustment to cope with new conditions. Another case would be one in which the core elements of policies may persist under stress, but the ways in which policy is implemented must change in order to meet unexpected conditions. We also want to consider circumstances in which policies are fundamentally untenable due to changing external conditions and must be completely overhauled. Policies in these circumstances will have exceeded their adaptive capacity, but an adaptive policy should quickly learn how to diagnose and respond to the new context.

This section presents our initial conceptual framework for understanding adaptive policies and policy-making based on insights from the relevant literature.

2.1 Concepts: initial terminology and framework

While the literature relating directly to the topic of adaptive policies is limited, there exist other useful sources of information within the fields of societal and policy learning, adaptive management for natural resources, and complex adaptive systems research. The key insights gleaned from this information are discussed below as a framework for an initial understanding of adaptive policies for this project.

2.1.1 Background terms and concepts

Before presenting a conceptual framework for adaptive policies, it is necessary to define a few basic terms and concepts. First, a *policy* can be thought of as a broad statement of purpose and process for addressing a particular social, economic, or environmental issue. The intent of a policy is implemented via *policy instruments* such as regulatory, economic, expenditure, and institutional instruments (Box 2.1).

¹ International Institute for Sustainable Development, Canada

² The Energy and Resources Institute, India

³ Adaptive Resource Management Ltd, Canada

Box

One typology of policy instruments

2.1

Policy instruments can be placed under four broad categories (IISD and TERI 2003).

Economic instruments refer to measures that directly influence the price that a producer or consumer pays for a product or activity. Economic instruments also include market-based instruments or financial incentives. Specific economic instruments include tradable permits, deposit refunds, performance bonds, taxes, user fees, subsidies, tax breaks, earmarked taxes and funds, and administered prices.

Regarding **direct expenditure instruments**, governments influence producer and consumer behaviour through channelling expenditures directly at the behaviour they want to encourage (Barg, Boame, Brown, *et al.* 2003). This category of instruments is characterized by broad programmes of expenditures targeted at a macro level to foster activities such as technological innovation. Specific instruments of direct expenditure include the very wide range of programme, expenditures that governments make as well as some particular cases like green procurement, research and development, and moral suasion.

Regulatory instruments describe efforts to create change via legal avenues. Several different regulatory instruments fall under this category including legislation, liability, enforcement activity, and competition and deregulation policy instruments. Legislative instruments involve the acts and regulations that a government passes to create a legal mandate for change. Enforcement instruments are considered separately in that there could be a legislative requirement and no enforcement—the combination of course, leads to an ineffective legislative instrument. These instruments aim to induce socially responsible behaviour by establishing legal liability for certain activities such as natural resource damage, environmental damage, property damage, damage to human health, non-compliance with environmental laws and regulations, and non-payment of due taxes, fees, or charges (Panayotou 1998, p. 41).

Institutional instruments affect the workings of the government itself in an effort to promote change. Included in this category are internal education efforts, and internal policies and procedures. Efforts such as the National Round Table on the Environment and the Economy in Canada are often initiated to educate government decision-makers and the policy community on issues. Internal policies and procedures act to change the way governments go about making and implementing decisions. For example, Canada's Office of the Auditor General includes a Commissioner of Environment and Sustainable Development with a mandate of overseeing the drafting of sustainable development strategies by all federal governmental departments.

For purposes of this report, any policy instrument could be considered to be made up of two components.

- **Design** defining how the instrument is designed to perform
- **Implementation** actions of the people and organizations which implement the rules of the policy instrument

These two components are illustrated in Figure 2.1, which presents an idealized process of policy design and implementation. Policies are designed with varying degrees of consultation with relevant stakeholders, and it is typically the case that an institution or organization different from the one, which designed the policy, is responsible for implementing the policy.

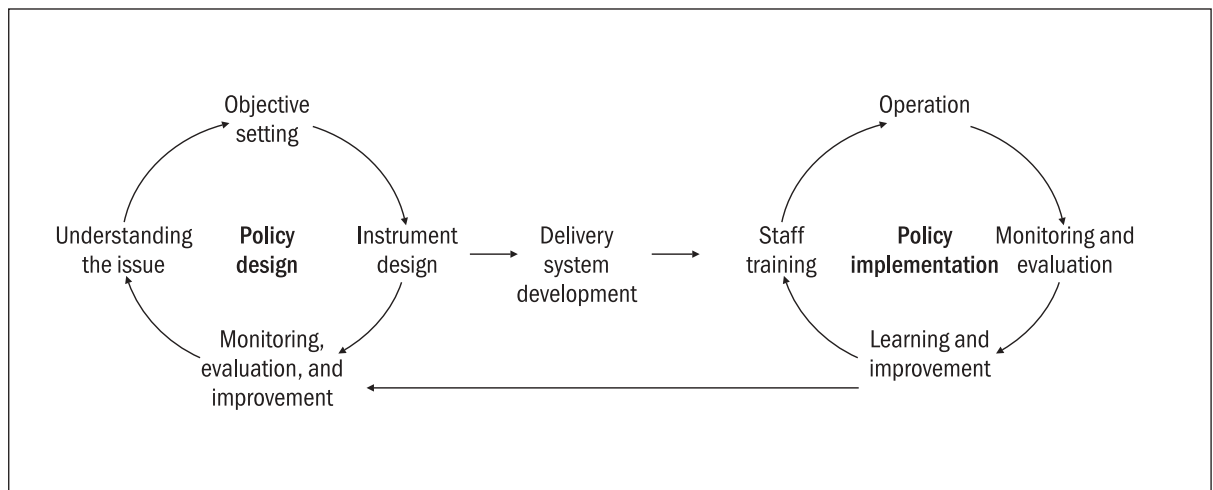


Figure 2.1 Idealized illustration of policy design and implementation

Consider, for example, a law for automobile speed limits. Penalties are defined by government policy- and law-makers for drivers who exceed the speed limit. The policy is implemented by a police officer who stops the speeding driver. The police officer then has discretion on how to implement the policy. Depending on the actual speed of the driver and the road conditions at the time, the officer will decide on a warning or issue a speeding ticket. The police department may decide that speeding is an issue that will be given low enforcement priority.

Thinking of policy and implementation as two distinct yet integrated processes is helpful from a practical perspective. Pritchett and Woolcock (2004) suggest that much more attention has to be paid to the ‘implementation’ cycle. Therefore, in relation to this research project, designing adaptive and shared learning mechanisms among practitioners through that cycle, not just feedback to policy, is important. They argue that design and delivery of key, transaction-intensive public services can be described using two characteristics: the degree of discretion involved in decisions, and the intensity of transactions required. In a western context, policy design, for example, requires high discretion, but limited transactions; whereas, policy implementation requires many transactions, but little discretion. Pritchett and Woolcock (2004) argue that in developing countries, policy implementation has more discretion relative to the western context given a heavy dependence on personal context (context-specific, depending on tribe, caste, and so on), connections, and experience. In such a case, generalized rules and procedures are problematic.

2.1.2 Our initial conceptual framework for adaptive policies

Our conceptual framework of adaptive policies is illustrated in Figure 2.2. Adaptive policies have features that enable them to continue to adapt to both anticipated and unanticipated conditions. In dealing with a range of *anticipated* conditions, adaptive policies make use of no-regrets alternatives and employ mechanistic adjustments triggered by the monitoring of key system indicators. Beyond these more conventional features, adaptive policies incorporate scheduled evaluations to respond to *unanticipated* circumstances. Perhaps most important, the design and implementation of adaptive policies is informed by complex adaptive systems theory. This enables policies to self-adjust, and be better suited to the infinitely complex and dynamic interactions among people, the economy, and environment.

The conceptual framework is based largely on three literature sources, which used the terminology of adaptive policy explicitly⁴ and a host of literature related to effective policy interventions in complex adaptive systems. The specific insights for the conceptual framework gained from this literature are described in the sections that follow.

⁴ One in relation to the transportation sector in the Netherlands (Walker, Rahman, and Cave 2001), one related to adaptive management in the Columbia River Basin in the United States (Lee 1993), and the other dealing with agent-based modelling (Banks 2002).

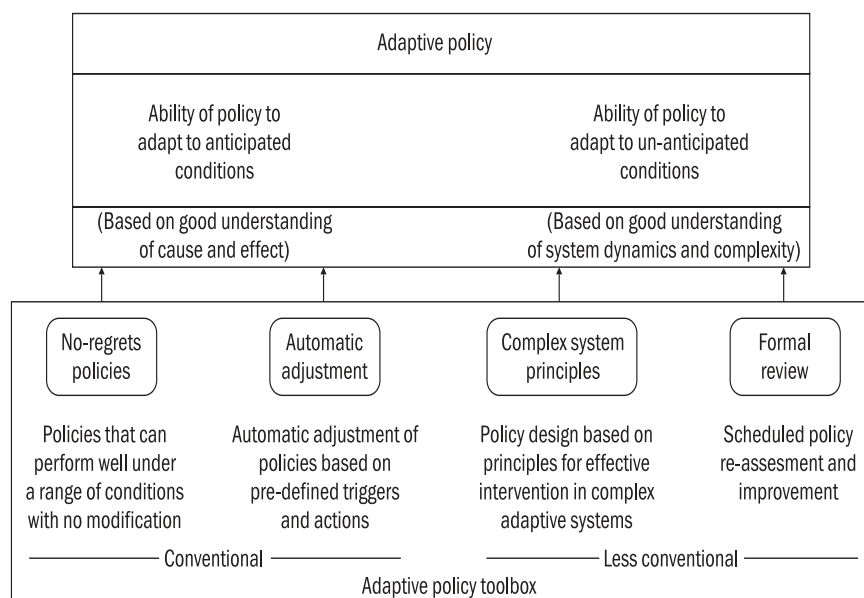


Figure 2.2 Initial conceptual framework for adaptive policies

Box 2.2	The Canadian income tax system as an example of policy robustness
<p>One example of an economic instrument is the income tax system, both personal and corporate. In Canada this system is complex with legislation, regulations, and government policies covering many thousands of pages. The system is administered by two separate departments of the federal government (Finance makes the policy, and the Canadian Revenue Agency operates the assessment and collection system), and even has its own court (the Tax Court of Canada).</p> <p>In Canada, individuals are required to pay a government tax equal to a certain percentage of their yearly income, but not everyone pays the same percentage. Individuals with lower incomes pay a smaller percentage of their total income to tax compared to those with higher incomes. These are called tax brackets. This is to acknowledge that the lower is your total income, the greater the burden of paying a dollar of tax (for example, more difficult to afford subsistence items such as food, shelter, and transportation).</p>	

Box 2.3	International carbon trading market: an example of policy adaptability
<p>Tradable permits are one type of economic instrument, a recent example of which is the international market for carbon credits created by the Kyoto Protocol, which in 2005 traded 397 MT (million tonnes) of CO₂ (carbon dioxide) at an average price of 6.7 euros per tonne of CO₂.</p> <p>Markets have adaptive features in that they provide signals that reflect changing (demand and supply) conditions, while leaving specific decisions up to the individual, company, or government. For instance, the price of carbon reflects the availability of carbon credits from various countries, the relative cost of reducing emissions from different types of projects and mechanisms, and demand determinants as diverse as the weather, oil prices, and risk perceptions. Companies can choose to continue to emit by purchasing credits at the prevailing price, or invest in energy efficiency and carbon abatement technologies.</p> <p>Thus, the decision can be made by taking many policy, technical, and market factors into account, and as those conditions change, the decision-maker can respond flexibly.</p>	

2.4

A set of expenditure instruments that exhibit adaptive characteristics is that of 'automatic stabilizers'. These are expenditure instruments that operate on the opposite cycle to the economy as a whole: when the economy is growing, automatic stabilizers spend less money, and when the economy is shrinking, they spend more. The net result is that the expenditures take place at a time when they will help the economy out of a downturn. One standard example is unemployment insurance, which pays out to people who become unemployed.

In a paper reviewing Canada's UI (Unemployment Insurance) system, Dungan, Peter, and Murphy (1995) found that the UI policy instrument had a clear stabilizing effect on the Canadian economy. In the context of unemployment insurance, Dungan, Peter, and Murphy (1995) describe the automatic stabilization function as

'It takes time before the problem of rising unemployment or a sluggish economy is recognized. Because there is a further lapse of time before policy decisions are made, implemented, and have an effect on the economy, economists and policy-makers look for 'automatic stabilizers' that respond immediately when the economy slips from the level of full employment. Such automatic stabilizers should respond quickly – changing taxes, or increasing or reducing government spending – to even out the economic impacts of cyclical fluctuations.

There are two features of the UI system that make it an automatic stabilizer. First, when unemployment increases, total UI payments increase, with only a short time lag. Secondly, when people lose their jobs, they and their employers immediately stop paying the UI premiums associated with those jobs. When an economic downturn results in fewer jobs, the total tax represented in UI premiums immediately falls. At the same time, increased payments in UI benefits put some purchasing power back into the economy by automatically increasing government spending.'

Dealing with anticipated conditions

- Adaptive policies are 'devised not to be optimal for a best estimate future, but robust across a range of futures (Walker, Rahman, and Cave 2001)'.
- Adaptive policies 'need to be evaluated on their robustness properties, not on their performance on any single case (Bankes 2002)'.
- Adaptive policies 'respond to changes over time and make explicit provision for learning (Walker, Rahman, and Cave 2001)'.
- Adaptive policies make 'adaptation explicit at the outset of policy formulation. Thus, the inevitable policy changes become part of a larger, recognized process and are not forced to be made repeatedly on an ad hoc basis (Walker, Rahman, and Cave 2001)'.

How might policy be designed to perform in a range of anticipated circumstances? This ability depends largely on a good understanding of cause and effect relationships. In practice this can be accomplished either through a no-regrets policy (that is, works well in a range of anticipated conditions without a modification to the original policy design) or through mechanistic adjustment triggered by a monitoring process.

Pertaining to no-regrets policies, Bankes (2002) suggests that computers can be used to 'discover policies that are robust across multiple scenarios or alternative models, and to identify and graphically depict sets of policies with satisfactory robustness'. He concludes that computers can be used to '... find important scenarios by searching through such ensembles, in particular to find cases that break a proposed policy. Such worst cases can stimulate users to modify the range of possible policies to allow for combinations that hedge against these possibilities'.

We saw from the policy instrument examples that in the case of the Income Tax Act of Canada, and for most income tax systems in fact, tax brackets exist to allow the level of tax collected to be fairly distributed according to the level of one's own income. This is a level of adaptability that is built into the policy instrument directly.

But a policy need not be static over time. When monitoring reveals that conditions have changed and design assumptions invalidated, this can trigger an improvement in the policy.

From the definitions of Walker, Rahman, and Cave (2001) it is clear that from a pragmatic perspective, aspects of indicators and assessment play an important role in adaptive policies.

Of particular relevance are their ideas related to the following.

- *Signposts* – information that should be tracked in order to determine whether defensive or corrective actions, or a policy reassessment is needed
- *Triggers* – critical values of the signpost variables that lead to implementation of corrective actions

The literature on policy pilots (Section 2.3.2) informs us that aspects of measurement and assessment need to focus on both impact (to test the likely effects of policies) and process (to explore the practicalities of implementing a policy in a particular way) (UK 2003).

A better understanding of cause–effect relationships can inform both no-regrets policy design, and the design of triggers and corrective actions. Insights from efforts to improve health policies in cities in Canada (Glouberman, Campsie, Gamar, *et al.* 2003) remind us that understanding local conditions is vital to interacting in complex adaptive systems and that not doing so can make conditions worse due to the many inherent interdependencies. Perhaps most importantly, Glouberman, Campsie, Gamar, *et al.* (2003) recommend respecting historical conditions since complex adaptive systems are ‘shaped by their past, and a knowledge of this history may suggest constraints on and opportunities on what can be done in the future’.

Dealing with unanticipated conditions

Adaptive policies are ‘designed from the outset to test clearly formulated hypotheses about the behaviour of an ecosystem being changed by human use’ (Lee 1993).

There appear to exist at least two means by which a policy can be made adaptive in the face of surprises and slower seemingly undetectable change. The first is discussed by Walker, Rahman, and Cave (2001), Lee (1993), and others, and is built on the ideas of explicit review and reassessment of policy. A second means is by adhering to principles for effective intervention in complex adaptive systems.

Walker, Rahman, and Cave (2001) in addition to recommending corrective actions in response to triggers, also describe ‘defensive actions’ which they note are taken after the fact to preserve a policy's benefits, and ‘reassessment’ of the instrument when the policy has lost validity.

As illustrated in Figure 2.1, the learning and improvement could occur in both policy design and implementation. For example, the institution, which designed the policy might have an internal process of checking whether the intended societal change is actually occurring. If this institution has the discretion to change instrument rules, such monitoring, evaluation, and learning might directly result in an improvement in the instrument design, which would then need to be communicated to those responsible for implementing the policy.

Similarly, the people and organizations responsible for implementing a policy instrument might learn of a necessary change required to adequately implement the policy. If they have the discretion to make this change, they can do so, otherwise they would communicate this learning to the policy designers with the hope that this learning results in an improvement to the instrument delivery system. It may also be the case that the implementing institution, being close to the ground, learns that the desired societal change is not occurring, or that something negative and unexpected is occurring as a result of the instrument design. If the implementing institution does not have the discretion to change the design, this learning would need to be communicated to the policy designers in order for the necessary policy improvement to be assessed and carried out.

Another possible means by which policies can become adaptive is by adhering to certain design principles, which make a policy better suited to complex adaptive systems. In the policy and management fields, a substantive body of knowledge has emerged over the last 10 years on the topic of complex adaptive systems. In all cases the study of complex adaptive systems was based on a need to better see the structures underlying complex situations and better identify leverage points for change. The recent study and application of complex adaptive systems can be seen in many fields including business management, health care, information technology, transportation, sustainable development, and international development.

Table 2.1 lists a set of principles for effective policy intervention compiled from the literature sources mentioned in Section 2.2. These principles have been organized according to an idealized policy cycle to help make these principles more pragmatic for policy-makers. The table also lists which aspect of policy flexibility the principle contributes the most to (for example, to adaptability or robustness).

For example, one of the principles that is frequently mentioned is the capacity of systems to self organize. This suggests that one way to make an instrument more adaptive is to decentralize the decision-making as much as is possible, allowing it (at least potentially) to respond to local circumstances. As we proceed with the case studies, we will examine this possibility.

Additionally, the literature on complex adaptive systems was particularly insightful in understanding the rationale for adaptability through learning and improvement. For example, Glouberman, Campsie, Gemar, *et al.* (2003) recognized that in complex adaptive systems policies ‘undergo selection by the system’ and therefore, it is important to include ‘evaluating performance of potential solutions, and selecting the best candidates for further support and development’. Additionally, they also note the importance of fine-tuning policies because ‘in complex adaptive systems, which change over time and respond dynamically to outside forces, it is necessary to constantly refine interventions through a continual process of variation and selection’.

A more detailed description of the literature underpinning Table 2.1 is provided in section 2.2.7.

2.2 Literature review

This section provides a more in depth look at the literature, which informed the initial terminology and framework presented in Section 2.1. A broad literature was conducted to explore concepts of relevance for advancing an initial understanding of adaptive policies in the context of this project. We begin in this section by focusing on literature, which explicitly mentions the terminology of adaptive policies or policy-making. The literature review necessarily engages in some divergent thinking in order to develop some peripheral vision, to look for insights on adaptive policy-making from sources of literature, which we perceived to be related to the concept of adaptive policy-making.

2.2.1 Insights from the adaptive policy-making literature

Some of the first hints towards adaptive policy-making actually came early in the 1900s. Dewey (1927) put forth an argument proposing that ‘policies be treated as experiments, with the aim of promoting continual learning and adaptation in response to experience over time’ (Busenburg 2001). Over 60 years later Kai Lee appears to be one of the first to use the term ‘adaptive policy’ in his account of integrating science and politics in the highly contested issue of salmon fisheries restoration and hydropower development in the pacific northwest of the United States. Lee describes *adaptive policy* as a policy that is ‘designed from the outset to test clearly formulated hypotheses about the behaviour of an ecosystem being changed by human use’ (Lee 1993).

Walker and Marchau (2003) in a special issue of the international journal *Integrated Assessment* give direct focus to the terms adaptive policies, policy analysis, and policy-making, and take them to a more pragmatic level. They suggest that policies be ‘adaptive—devised not to be optimal for a best estimate future, but robust across a range of futures’. They go on to describe that such policies ‘should combine actions that are time urgent with those that make important commitments to shape the future and those that preserve the needed flexibility for the future’. Their notion of adaptive policies is

Table 2.1 Policy design and implementation insights from the complex adaptive systems literature

Idealized policy cycle	<i>Principles for policy-making in settings characterized by surprise, long-term change, and uncertainty</i>
Understanding the issue	<ul style="list-style-type: none"> ▪ Understand local conditions, strengths, and assets (Glouberman, Campsie, Gamar, <i>et al.</i> 2003) ▪ Respect history: ‘adaptive systems are shaped by their past and a knowledge of this history may suggest constraints on and opportunities on what can be done in the future.’ (Glouberman, Campsie, Gamar, <i>et al.</i> 2003) ▪ Understand interactions with the natural, built, and social environment (Glouberman, Campsie, Gamar, <i>et al.</i> 2003; Holling 1978)
Policy objective setting	<ul style="list-style-type: none"> ▪ Look for short-term finer-grained criteria of success that can usually stand in for longer-run broader goals (Axelrod and Cohen 2000) ▪ Gather multiple perspectives from a range of stakeholders involved in the issue (Holling 1978)
Policy design and implementation	<ul style="list-style-type: none"> ▪ Create opportunity for self-organization, and build networks of reciprocal interaction that foster trust and cooperation (Berkes, Colding, and Folke 2003; Glouberman, Campsie, Gamar, <i>et al.</i> 2003; Axelrod and Cohen 2000) ▪ Clear identification of the appropriate spatial and temporal scale is vital to integrated management (the ecosystem approach; Shepherd 2004). ▪ Ensure that social capital remains intact (Ruitenbeek and Cartier 2001) ▪ Promote effective neighbourhoods of adaptive cooperation (Axelrod and Cohen 2000) ▪ Promote variation and redundancy (Berkes, Colding, and Folke 2003; Glouberman, Campsie, Gamar, <i>et al.</i> 2003; Holling 1978) ▪ Balance exploitation of existing ideas and strategies, and exploration of new ideas (Axelrod and Cohen 2000) ▪ Facilitate copying of successes (Ruitenbeek and Cartier 2001; Axelrod and Cohen 2000). ▪ Use social criteria to support the growth and spread of valued criteria (Axelrod and Cohen 2000) ▪ Combine experiential and experimental knowledge (Berkes, Colding, and Folke 2003) ▪ Nurture, and enhance social and ecological memory (Berkes, Colding, and Folke 2003) ▪ Build adaptive capacity (Berkes, Colding, and Folke 2003) ▪ Place effort on determining significant connections rather than attempting to measure everything (Holling 1978) ▪ Increase information on unknown or partially unknown social, economic, and environmental effects (Holling 1978)
Policy monitoring and evaluation	<ul style="list-style-type: none"> ▪ Integral to design are the monitoring and remedial mechanisms—should not be post ad hoc additions after implementation (Holling 1978) ▪ Conduct selection: ‘In complex adaptive systems possible solutions undergo selection by the system. It is, therefore, important to include ‘evaluating performance of potential solutions, and selecting the best candidates for further support and development.’ (Glouberman, Campsie, Gamar, <i>et al.</i> 2003) ▪ Assess strategies in light of how consequences spread: look for linkages in unusual places (Axelrod and Cohen 2000)
Policy learning and adaptation	<ul style="list-style-type: none"> ▪ Fine-tune the process: ‘in complex systems, which change over time and respond dynamically to outside forces, it is necessary to constantly refine interventions through a continual process of variation and selection’ (Glouberman, Campsie, Gamar, <i>et al.</i> 2003). ▪ Understand carefully the attribution of credit: ‘A common mistake in complex systems is to assign blame or credit to a small part of the system, when in fact the entire system is responsible; one of the most important elements of any policy discussion is the specific incentives facing individual agents’ (Axelrod and Cohen 2000).

that they are those policies ‘that respond to changes over time and that make explicit provision for learning’. This approach requires that learning and adaptation of the policy be made ‘explicit at the outset and the inevitable policy changes become part of a larger, recognized process, and are not forced to be made repeatedly on an ad hoc basis’ (Walker and Marchau 2003).

The adaptive policy-making process as articulated by Walker, Rahman, and Cave (2001) begins with *stage setting* and *assembling basic policy* steps, while the remaining parts articulate the critical learning loop processes (Figure 2.3). Some of the innovative steps of their adaptive policy-making process include the following.

- *Separate actions now from those that can or should be deferred* until more information becomes available
- Develop indicators such as *signposts for monitoring changes* and identify thresholds or *triggers for contingency plans*
- *Establish limits to the validity of the analysis*, that once violated, should lead to reassessment of the policy

The basic building blocks and tools of their adaptive policy-making approach include the following.

- *Basic policy* – one or more options and plans for implementation
- *Vulnerabilities* – potential adverse consequences associated with the policy or side effects of the policy
- *Mitigating actions and hedging actions* taken in advance to reduce risk of certain and possible adverse effects of a policy
- *Signposts* – information that should be tracked in order to determine whether defensive or corrective actions or a policy reassessment is needed
- *Triggers* – critical values of the signpost variables that lead to implementation of defensive or corrective actions or to a policy reassessment
- *Defensive actions* taken after the fact to preserve a policy’s benefits, *corrective actions* to adjust the basic policy in response to triggers, *or reassessment* when the policy has lost validity

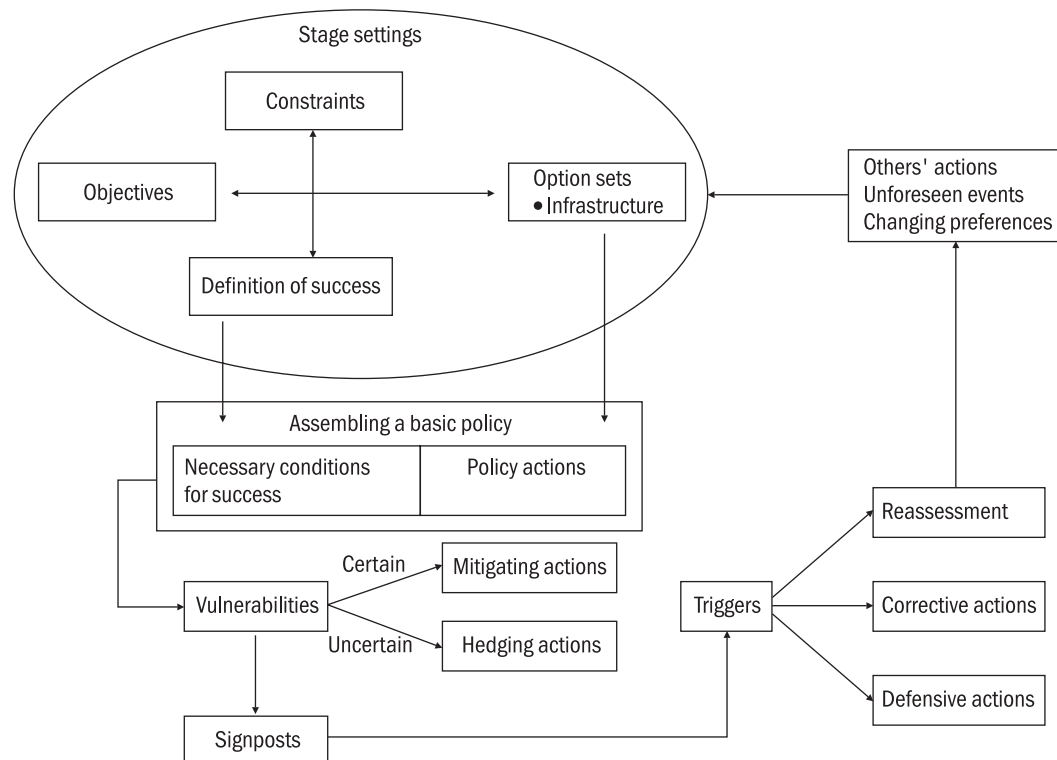


Figure 2.3 Adaptive policy-making framework proposed by Walker, Rahman, and Cave (2001)

The terminology of adaptive policy makes an appearance in the US National Academy of Science literature in 2002 in relation to agent-based modelling. Bankes (2002) proposed refinements in agent-based modelling approaches in recognition that ‘most policy problems involve complex and adaptive systems, and that for those problems the classical approaches of predictive modelling and optimization that have been used in decision-support software are not appropriate’. Bankes contends that for policies to be successful in a complex and adaptive world, they will ‘need to be adaptive themselves’, and warns that relying on optimization techniques to develop policies based on the projections of a single model will produce static policies which make the ‘correct move’ for the best estimate model. Alternatively, he believes ‘adaptive policies’ need to be evaluated on their ‘robustness’ properties, not on their performance on any single case. Used properly, Bankes suggests that computers can be used to ‘discover policies that are robust across multiple scenarios or alternative models, and to identify and graphically depict sets of policies with satisfactory robustness.’ He concludes that computers can be used to

‘... find important scenarios by searching through such ensembles, in particular to find cases that break a proposed policy. Such worst cases can *stimulate users to modify the range of possible policies* to allow for combinations that *hedge* against these possibilities. This strategy can allow users to iterate with the computer to gradually *evolve policy schemas that have particular policy instances with desirable properties*. This approach has been successfully used in several studies to make concrete policy recommendations for deeply uncertain problems by using very non-linear simulations including agent based.’

Ruitenbeek and Cartier (2001) make an indirect connection to adaptive policies in presenting a continuum of policy instruments in terms of flexibility and government involvement, and discussing them in relation to complex adaptive systems. On one end of the continuum are instruments with minimum flexibility, maximum government involvement, and those described as control-oriented. On the other end is maximum flexibility, increased private initiative and litigation-oriented instruments. In between lie the market-oriented instruments. The authors note that virtually any instrument along this continuum could be appropriate in a complex adaptive system, but that this would depend on the nature of the system. For example, ‘if functioning social institutions are in place, decentralized instruments requiring little government involvement may be a good policy choice. Conversely, imposing strong external regulations within such a context could disrupt any positive natural evolution that might occur.’

2.2.2 Insights from adaptive management literature

Insights from the literature on adaptive management are relevant for adaptive policies for two related reasons. First, the two concepts are inherently similar in sharing the term ‘adaptive’ and therefore, insights will be important for defining what adaptive policies are. Second, the two concepts are different as ‘adaptive management’ deals with management of a broader set of policies directed at an issue, while ‘adaptive policies’ deal more with individual policies or instruments.

The notion of adaptive management, as it applies to the process of human intervention in ecological systems, is first attributed to the Canadian ecologist, Holling (1978). Holling describes adaptive management as ‘learning by judicious doing’, and differs fundamentally from traditional anticipatory management by acknowledging that policy is necessarily experimental. Adaptive management is characterized by its flexible policies and the plurality of views that inform it; no particular epistemic community can possess all the necessary knowledge to form policy. Science, models, expert knowledge, and the policies based on them are not interpreted as ultimate answers, but merely as a means to guide a cautious process of intervention in complex ecosystems. The goal of management shifts from achieving a single target to an integrated view of maintaining ecosystem resilience, avoiding for example, catastrophic and irreversible ‘flips’ to other equilibrium states (Holling 2001).

An early analysis of adaptive policy-making in a natural resource management context is provided by Walters (1986). He discusses the problems that people and their institutions encounter in managing things like stocks of fish in the Great Lakes, and the damage caused by acid rain in Europe. Walters first discusses the fact that we do not understand the complex natural systems and thus, are unable to make good predictions as to the results of various policy measures. However, people are very reluctant

to adopt the type of policy response that will work well in such a situation, namely an adaptive response. It is very hard to get people to accept the idea of trying some responses to see how well they work, rather than relying on analysis and prediction.

'It is quite natural for most people to think about other large investment programmes in terms of a careful sequence of tests using such devices as market surveys and pilot studies. Somehow it is viewed as unscientific or threatening to talk about experimentation on large spatial scales, as though experiments were things to be done only in boxes or on benches in university laboratories. Worse, some scientists involved in our discussions were worried about the very notion of publicly admitting uncertainty, and felt that it was important to maintain at least the appearance of consensus within the scientific community.' (Walters 1986, p. 343)

Walters goes on to discuss some approaches that natural resource managers can use to try to get policy-makers to change their attitudes. His suggestions regarding the types of attitudes to promote are listed in Table 1.

Walters' advice on how to get people out of their normal analytical box is to highlight the difficult trade-offs, so that the managers are forced to confront the difficulties rather than defer tough decisions in the hope of improvements next year. Only when a stark reality is accepted, he feels, will creativity and openness to new solutions be available. And in complex resource management situations, creativity is necessary if good solutions are to be found.

Stienemann (2003) sees the current trend towards this concept of adaptive management as exploring three core principles.

- *Experimentalism* Adaptive managers emphasize experimentalism within a dynamic system, recognizing that an ongoing search for knowledge is necessary to set and achieve goals.
- *Multi-scalar analysis* Adaptive managers model and monitor natural systems on multiple scales of space and time
- *Place sensitivity* Adaptive managers adopt local places, understood as humanly occupied geographic places, as the perspective from which multi-scalar management orientates.

It is also her hypothesis, based on decades of experience of systematic weaknesses in environmental impact assessment processes, that if the adaptive management processes being proposed today are to be successful, they will require new ways of involving the public in decision-making.

The differences between adaptive management and adaptive policy-making can perhaps become blurred, particularly if one is dealing with an expenditure policy instrument in the form of a targeted government project or programme. Busenburg (2001) helps somewhat in elucidating the difference between adaptive management and adaptive policy by noting that an 'adaptive management strategy might include a number of parallel policy experiments designed to test different policy measures, as well as procedures for measuring and communicating the results'. This was certainly the way adaptive management was viewed in Kai Lee's experience in the Columbia River Basin on the issue of salmon restoration and hydropower development.

Table 2.2 Conventional vs adaptive attitudes about the objectives of formal policy analysis

Conventional	Adaptive
Seek precise predictions	Uncover range of possibilities
Build prediction from detailed understanding	Predict from experience with aggregate responses
Promote scientific consensus	Embrace alternatives
Minimize conflict among actors	Highlight difficult trade-offs
Emphasize short-term objectives	Promote long-term objectives
Presume certainty in seeking best action	Evaluate future feedback and learning
Define best actions from a set of obvious alternatives	Seek imagination in new options
Seek productive equilibrium	Expect and profit from change

Source Walters (1986, p. 351)

Lee (1993) also introduces the notion of ‘civic science’ in his discussions of adaptive management in the Columbia River Basin, which he describes as ‘being irreducibly public in the way responsibilities are exercised, intrinsically technical, and open to learning from errors and profiting from success’. He goes on to note that ‘the challenge of building and maintaining civic science, and the institutional relations necessary to do civic science is at the individual level. This is because civic science is a political activity; its spirit and value depend upon the players, who make up, modify, implement, and perhaps subvert the rules’. Lee’s insights into adaptive management, adaptive policy, and particularly his ideas on civic science highlight the importance of the human dimension of adaptive policies and that learning from errors is a key aspect of the adaptive policy-making process.

2.2.3 Insights from policy pilot studies

The field of pilot studies can provide helpful insights for adaptive policies because pilot studies are primarily mechanisms for learning and adaptation. A recent review conducted by the Cabinet Office in the United Kingdom (UK 2003) focused on the role of pilot studies in policy-making. The study noted that ‘an important innovation in recent years has been the phased introduction of major government policies or programmes, allowing them to be tested, evaluated, and adjusted where necessary, before being rolled out nationally’ (UK 2003, p. 3). The study noted that the practice of policy pilots has been relatively widespread in the US owing in part to its federal structure, which allows state policy-making to be regarded as large-scale experiments.

Among the recommendations made in the UK study, three, in particular, are relevant to adaptive policies and policy-making in the context of this project. The first is, ‘a pilot should be undertaken in the spirit of experimentation. If it is clear at the outset that a new policy and its delivery mechanisms are effectively already cast in stone, a pilot is redundant and ought not to be undertaken’. The notion of experimentation relates to the notion of adaptive policy as articulated by Lee (1993), and acknowledges that uncertainty and surprise are inherent in the process. However, the policy pilot insights appear to imply that once the experiment has been run, a guiding principle will emerge to ensure its predictability. While this may be the case in many pure sciences, it is not the case in complex socio-ecologic systems, which are adaptive. As Lee points out, it is ongoing policy development and experimentation that is truly adaptive.

A second recommendation from the study deals with extending the notion of piloting beyond just an initial stage to ‘a continuous processes of accumulating policy-relevant evidence’. A third recommendation of the policy pilots study is that ‘appropriate mechanisms should always be in place to adapt (or abandon) a policy or its delivery mechanism in light of a pilot’s findings’. Both of these recommendations speak directly to the primary thrust of the notion of adaptive policy-making presented previously by Walker, Rahman, and Cave (2001), which was for learning and adaptation of the policy to be made ‘explicit at the outset’ and the inevitable ‘policy changes to become part of a larger, recognized process and not forced to be made repeatedly on an ad hoc basis’. So while the policy pilots are an important initial stage in the life of a policy, the study concludes by making a call for the basic premise of testing, learning, and adapting to become part of the ongoing policy life cycle.

The policy pilots study identified two types of pilots, which provide useful examples for our project. These include the following.

- *Impact pilot* – tests of the likely effects of new policies, measuring or assessing their early outcomes. They enable evidence of the effects of a policy change to be tested against a genuine counterfactual, such as is provided by the use of control groups in a medical trial.
- *Process pilots* – designed to explore the practicalities of implementing a policy in a particular way or a particular route, assessing what methods of delivery work best or are most cost-effective (UK 2003).

These two types simply provide an important reminder of incorporating both outcome- and process-based aspects in assessing the performance of policies.

2.2.4 Insights from the policy learning and change literature

A large literature on learning for policy change seems to conclude mostly that this is a complex and indeterminate process, conditioned by the nature of the structures and processes involved, and by the ways in which knowledge permeates these structures through interaction of individuals and groups. There is widespread agreement on the importance of networks, coalitions, or communities of interest, and the ways in which they interact, in the process of policy learning (Lindquist 2001; Sabatier 1999; Stone 2001). But the role of new knowledge in affecting policy is much less clear. The process has been studied in more detail with regard to new scientific knowledge. This is often debated and subject to criticism, from within the framework of its disciplinary and scientific origins, and also by non-scientific sceptics who are threatened by its implications. It takes some time, and occasionally a high-profile public crisis, before scientific evidence attains a degree of 'consensus' in decision-making circles (Haas 1992).

Policy learning comes from a variety of sources: interestingly, academic research is a very limited source of policy learning. It is widely agreed that despite all the resources devoted to social science and policy research in the US during the 1960s and 1970s, there is very little evidence that it contributed directly to measurable improvements in policy (Lindquist 2001). This ought to be particularly sobering for those who emphasize the role of scientific rationality and analysis in policy-making.

How is knowledge used to create policy learning? The policy learning and change literature suggests that new knowledge is always filtered by actors' values and belief systems, prior experience, association, relative power, professional training, and norms. Policy change is normally driven by interactions among groups (or coalitions) of policy actors, where each group may include policy-makers, researchers, business or professional interests, and advocates. These advocacy coalitions compete with each other for power and political authority. Learning within these groups, like Haas's 'adaptation', is normally a shallow process, limited to insights about choice of means and power strategies (Bennett and Howlett 1992). Fundamental challenges to assumptions or core beliefs of such groups are rare, partly because evidence is filtered by the group's own processes of information exchange and validation. And deeply held values, which motivate and give meaning to individual policy actors are highly resistant to learning (changes here are akin to religious conversion). However, political actors who are related to, but not captured by, the coalition group can sometimes learn from the discourse and debate between advocacy coalitions, and change their views on specific policy actions (Sabatier and Jenkins-Smith 1999).

According to Haas, a key role in policy learning is played by 'epistemic communities': groups of professionals who share normative beliefs which provide a value basis for social action; commitment to a common causal model derived from study and analysis of a common set of problems or policy linkages; shared notions of validity in their domain of expertise, and a common set of political values and commitments to translate their perceived truths into policy (Haas 1992). At times of crisis or rapid change, when information is at a premium, epistemic communities can become more important and influential in the policy process. They can shed light on causal relations which had previously been unsuspected, quantify uncertainties for decision-makers, help re-define the interests of the state or of various political interests within it, and directly contribute to policy formulation (for example, through framing alternatives). But most of the time, epistemic communities and technical expertise will play only a limited role in policy formulation (Haas 1992).

Ultimately, the mechanisms by which even scientific consensus by epistemic communities can influence policy are quite murky. The same specialists may provide the same consensual knowledge to several governments, with quite diverse policy responses (for example, Haas points out that similar evidence on environmental toxicity of specific chemicals nevertheless led to different regulatory responses by government in Canada, the US, and Europe). What is clear is that fundamental changes in underlying policy beliefs and assumptions, of the kind, which would probably be needed in the event of policy failure or policy gaps due to external dynamics, are rare. Neither is knowledge neutral. There are few areas of policy importance, which are not subject to scientific and technical debate,

discourses between competing worldviews, and ‘mobilization of bias’ from available evidence (Stone 2001).

There remains concern in the policy learning and change literature about the influence of technical specialists and their instrumentalist rationality on fundamental social and political decision-making. By virtue of their expertise and scientific insights, technical specialists can have privileged access to policy decision-makers. This is not always in the interest of adaptive policies if the key issues in decision-making, and in learning, are issues of value and social change. Public debate and social discourse are important tools to balance this privileged access of technical expertise to power (see Steinemann 2003). Participatory processes also offer opportunities for policy learning, in ways, which differ from the learning models described above driven by expert, elite, or advocacy networks. The outcome of deliberative practice (that is, public decision-making which involves shared discourse, deliberation, and social learning) is not abstract generalization, or discrete policy decisions, but shared meaning by the participants, and engaging narrative accounts of success or failure in their own terms (Forester 1999). Participatory processes are not merely about being heard, or about negotiation, or about sharing evidence and building consensus on facts (although all these are important), but crucially about political identity, about values, about building social cohesion and competence, mutual respect, hope, and capacity to act. Such processes, though time-consuming, have crucial transformative potential in creating new, shared vision, which can motivate learning and policy adaptation.

Policy, whether ‘adaptive’ or not, is almost always modified in its implementation (Majone and Wildavsky 1978). Policy ideals conceived as an analytical interpretation of complex problems, or as negotiated agreement between conflicting power groups, must inevitably take shape through the actions of implementing agents (typically lower-level administrators). This process almost always allows discretion for substantial further political negotiation, interpretation, and modification as the policy is put into practice (Sabatier and Jenkins-Smith 1999). How ought we to conceive of this implementation process in relation to policy adaptation? What aspects of policy implementation are of interest to adaptive policy-making?

At the limits, policy implementers can act to deliberately subvert the original intent of the policy. This kind of ‘adaptation’ is not constructive: it denies the purpose of policy-making and the role of political accountability. Because policy differentially affects the interests of divergent groups, power also comes into play in steering implementation. However, there is an important role for implementing agents to play in smoothing the connection between the necessarily abstract and generalized views of higher-level policy decision-making, and the frequently complex contexts of specific application.

If policy implementation is challenged legally, questions of interpretation can be resolved by the courts (which often leads to policy revision or clarification). Most of the time, it will be public administrators and enforcement agents who are called on to interpret and enact policy. They use information, judgment, precedent, and political power to introduce and sometimes negotiate modifications to policy, which make it more easily implemented (Najam 1995).

Adaptive policy embraces the constructive and judicious interventions of administrative practitioners who share the vision and goals of the policy itself. An important implication of this is that effort needs to be devoted to building shared ownership of the policy vision and goals, best done through consultation prior to policy approval, through the institutional instruments discussed earlier.

Policies intended to enable local responses to national issues often do not recognize the diversity of contexts and conditions in which they will be applied. Through consultation, rapid iterations, or ‘policy trials’ the scope of these contexts can be explored, and policies revised accordingly. Adaptive policies will use such opportunities to increase flexibility and ease of implementation through modification. Adaptive policy-making will build in consultation and learning mechanisms, seeking practical examples and counter-examples of implementation issues in the field, and using evidence from case experiences to modify implementation frameworks. Monitoring and evaluation feedback are elements of such learning systems (Tyler and Mallee 2006) on how participatory action research provides helpful insights for this process.

Modification and adaptation of policies in their implementation may ultimately fail, or new contexts may arise which are completely outside the effective domain of existing policy. Policies may

sometimes need to be completely overhauled in the face of changing external conditions. Therefore, beyond smoothing the implementation of policies, an adaptive policy system must facilitate policy learning or change. This process is unlikely to be smooth and simple, and it will often be time-consuming. But to facilitate adaptive policies, we should want to ensure that policy learning and change eventually generate the desired outcome: effective adaptation to dynamic conditions.

But outcomes of learning in public policy may be difficult to specify. Adoption or non-adoption of particular reforms or instruments are only fragmentary measures of the ways in which ideas, lessons from elsewhere, and experience can contribute to changes in perceived roles, responsibilities, and potential actions by various social and political actors. Over time, learning is coupled to broader social processes, affecting value shifts that may lead to fundamental political changes. Policy learning processes, if they are effective and conducted at least partly in the public eye, may lead to changes in the perceptions of government and private roles (for example, in terms of responsibility for environmental protection). And public learning may lead directly to change in political parties and governments, through the electoral process. Therefore, we can see that policy learning processes that enable the policy system to become more adaptive also link to public and social learning, and to institutional change.

2.2.5 Insights from the institutional learning literature

Berkes and Folke (2001) in their study of ecosystem dynamics and local knowledge define institutions as 'humanly devised constraints that structure human interaction. They are made up of formal constraints (rules, laws, constitutions), informal constraints (norms of behaviour, conventions, and self-imposed codes of conduct), and their enforcement characteristics (North 1994)'. Berkes and Folke also cite institutions as 'the set of rules actually used by a set of individuals to organize repetitive activities that produce outcomes affecting those individuals and potentially affecting others (Ostrom 1992)'.

In citing this definition, Berkes and Folke (2001) highlight that 'institutions are socially constructed; they have normative and cognitive, as well as regulative dimensions' (Scott 1995; Jentoff, Colwell, Dresselhaus, *et al.* 1998). It is the cognitive dimension that Berkes and Folke (2001) focus on in their study of ecosystem dynamics and local knowledge, because it is the cognitive dimension that deals with questions of 'the nature of knowledge and the legitimacy of different kinds of knowledge'.

Important to their work is the notion of institutional learning, which they note takes place at the level of the institution as opposed to an individual level (Lee 1993). In relation to natural resources, they describe institutional memory as memory of experience 'which provides context for modification of resource-use rules, regimes, and typically refers to a decadal scale of time'. It is noted that institutional memory incorporated local or traditional knowledge, and it is this 'knowledge and an understanding of how to respond to environmental change' that are the 'prerequisites for the management and sustainable use of resources, biological diversity, and ecosystems (Berkes and Folke 2001)'.

They describe a conceptual framework for the analysis of linked social-ecological systems (Figure 2.4). On the one side is a nested set of ecosystems while on the other is a nested set of management practices, which are embedded in a nested set of institutions. The linkage between the two is provided by ecological knowledge and understanding, without which the likelihood of sustainable natural resource use is 'severely reduced'.

Haas (1990) identifies 'adaptation' in large international organizations as strategic behaviour, which attempts to preserve the goals, identity, and boundaries of the organization in response to stress, but to adjust its operational practices to ensure political survival. Adaptation is always incremental, and does not involve fundamentally new knowledge or challenges to the organization's assumptions or ends. He distinguishes this from 'learning', which is much less frequent, and involves the application of new consensual knowledge 'to specify causal relations in new ways so the result affects public policy'. Learning challenges individuals and organizations to question their fundamental beliefs about cause and effect, which underlie organizational assumptions and goals. Overcoming and changing behavioural patterns that led to past failure are central to Haas' conception of policy learning. In this paper, we use the word 'adaptation' in different ways, but the concept of organizational learning for policy change which Haas articulates is close to what we intend by the term.

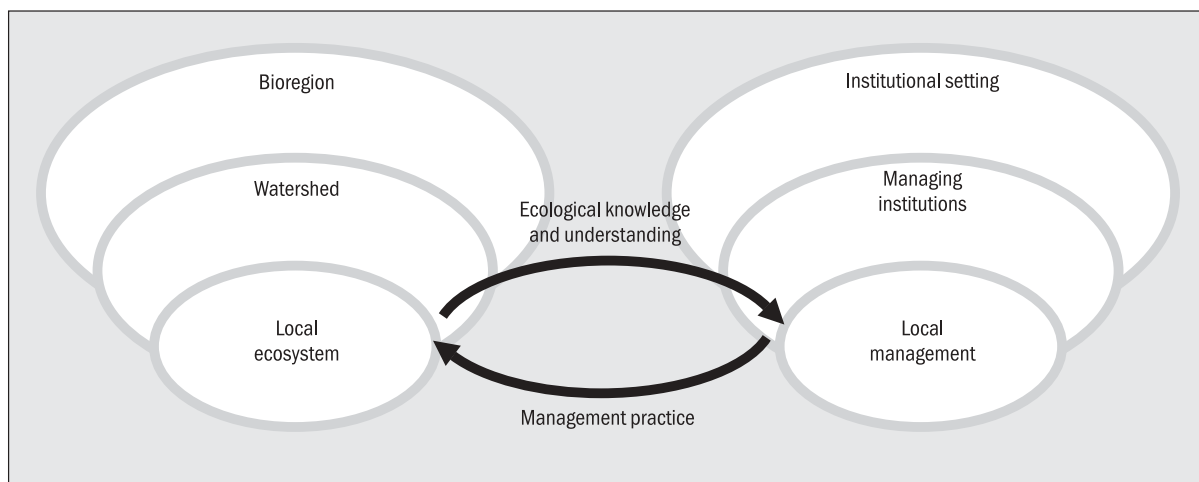


Figure 2.4 Conceptual framework for the analysis of linked social–ecological systems

Source Berkes and Folke (2001)

Organizational learning models developed for the private sector may not be very useful in the public sector, where bureaucratic structure and behaviour undermine many of the precepts of the models (Common 2004). In many government organizations the distance between decision-making and service delivery can be very large (both geographically and organizationally), complicating the ability of central authorities to benefit from the experience of field agents. A special problem in government organizations is the contradiction between learning and control: in conditions of flux and confusion, when learning ought to be prioritized, such organizations are more concerned with politics and control (Coopey 1996). There are some examples in Canada and in the UK of governments setting up high-level groups to facilitate policy learning and external information flow. These groups were charged with looking outside the government itself to lessons from domestic think tanks, research organizations, and other states, consistent with organizational learning prescriptions to strengthen ‘cross-boundary’ information flows. While these have indeed increased access to information, it is difficult to find evidence of systematic impacts on either policy formation or the operation of the bureaucracy (Lindquist 2001; Common 2004).

In their seminal book *Panarchy: understanding transformations in human and natural systems*, Gunderson, Holling, and Peterson (2001) present a theory of adaptive change based on observations of ecosystems. Figure 2.5 presents this adaptive cycle within which four phases are typically seen.

- *Exploitation* – initially a few pioneers exploiting a resource
- *Conservation* – a mature and complex community
- *Release* – a sequence of rapid transformation triggered by disturbance (the beginning of a decrease in potential and adaptive capacity)
- *Reorganization* – a period of recovery leading to a decrease in potential and an increase in connectedness that allows for another cycle of exploitation

Gunderson, Holling, and Peterson (2001) extend this four-phase cycle into the resource management policy realm for purposes of linking ecological and social dynamics, and this provides a useful perspective for adaptive policy-making. In their understanding, the four phases of the adaptive cycle correspond to four phases of policy-making namely

- Exploitation: Policy plan
- Conservation: Policy implementation
- Release: Policy failure
- Reorganization: Policy alternatives

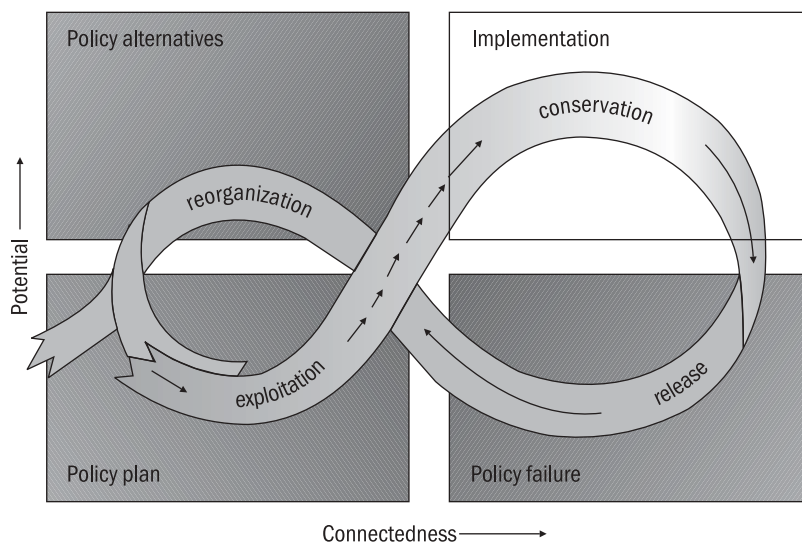


Figure 2.5 The adaptive cycle

Source Gunderson, Holling, and Peterson (2001)

From an institutional perspective, Gunderson, Holling, and Peterson (2001) note that the reorganization phase (for example, policy alternatives) occurs when a ‘rare and unexpected intervention or event can shape new futures as an act of creating opportunity’. In the conservation phase, tight organization and hierarchical control, which precludes alternatives, is broken down due to the combination of maturing brittleness and external events. This ‘loss of control’ releases capital such as money, skills, and experience and dissociation into constitutive elements. The authors note that it is at this point that the system becomes ill defined and loosely coupled providing the conditions for either collapse or innovation. It is at this stage where, particularly in human systems, the potential to influence the future is considered greatest.

Janssen (2001) describes a conceptual understanding of institutions which assumes that agents change their preferred management style ‘if observations about the world are surprising enough—that is, if observations differ enough from what the agents expect based on their worldview’ (Thompson and Wildawsky 1990). They use the adaptive cycle and policy-making context presented previously in Figure 3 to articulate the changes and adaptations of institutions. The description is as follows.

‘The [exploitation] phase is defined as policy formulation. If that policy is successful it leads to increasing bureaucratic processes to formalize and institutionalize policies. The expectations of the institutions are mainly based on insights and information during the time policies were formulated. Since policy was considered to be successful, no new investigation is done on the quality of the expectations. Those groups with other perspectives on reality, leading to other expectations and preferred policies, will challenge ruling institutions. In the event of a surprise, the ruling institution is confronted with evidence that its expectations do not hold anymore, which can result in a crisis. Such surprises can be natural disasters, scientific or technological revolutions, and so on. After the start of such a crisis, a period will begin in which various alternative policies react to surprise. This can lead to continuation of the ruling type of institution with new policy initiatives, or a flip to a new type of institution (Janssen 2001, p. 250).’

Manley, Tracy, Murphy, *et al.* (2000) use the same framework, but develop a more applied cycle of four phases of adaptive management for natural resources (Figure 2.6; p. 692).

- Information needs identification
- Information acquisition and assessment
- Evaluation and decision-making
- Management action

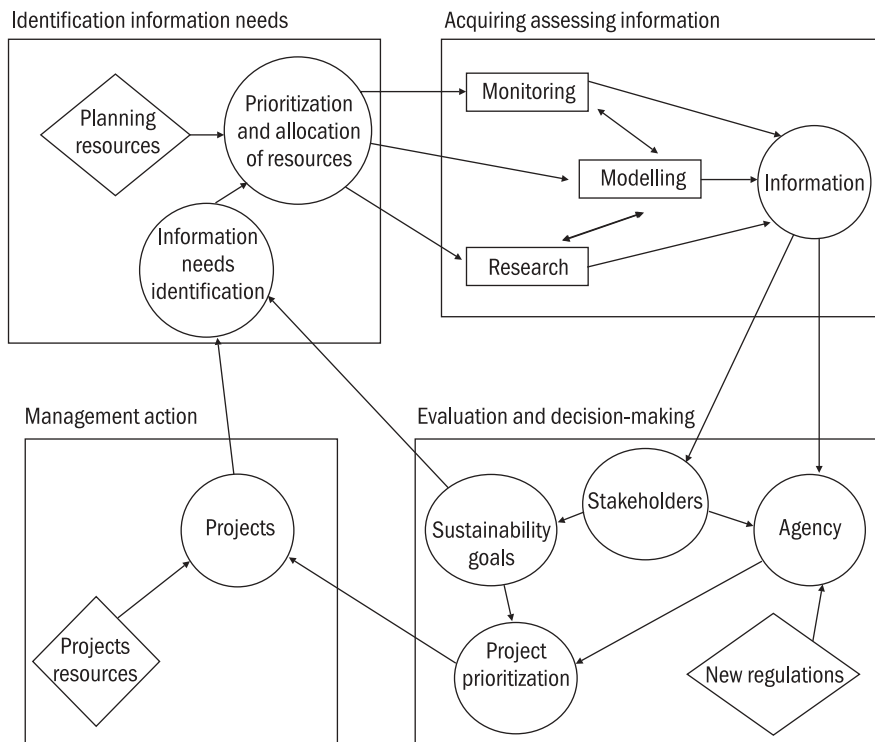


Figure 2.6 Four phases of adaptive management

Source Manley, Tracy, Murphy, *et al.* (2000)

Their diagram of information and decision flow is much more applied compared to the conceptual approach found in Gunderson, Holling, and Peterson (2001).

2.2.6 Insights from natural systems

Natural systems provide insights into what policy adaptation might be. Like policy systems, adaptive natural systems interact with their environments. They respond in non-linear ways to changing conditions. They are purposeful, in the sense that adaptation and transformation serve the perpetuation and function of the whole system, not of individual components.

However, the last few decades have seen advances in physics, mathematics, and life sciences, which have completely transformed scientists' understanding of how nature works. At its roots, the universe appears to be not composed of 'objects' at all, but of events and relationships, ephemeral patterns of interaction which are impossible to predict or define except in probabilistic terms (Zukav 1979). Living organisms appear to interact with many elements of their environments, both material and non-material, in ways, which may be frequently undetectable and unpredictable. Tiny, arbitrarily small changes seem capable, under certain conditions, of spawning large systemic consequences. There is growing recognition that when we try to ensure order, structure, stability, and certainty in our organizations and systems through policy interventions, we are trying to create unnatural conditions. We attempt to plan and control an objective reality which may be illusory, and we treat environmental systems and human organizations as responding predictably to change when science tells us non-linear systems may be well-ordered but are essentially unpredictable (much of the following section from the arguments of Wheatley 1999).

We have learned that highly adaptive natural systems have certain characteristics that reflect this emerging scientific view. They are driven and structured by flows of information and energy and so must remain open and responsive. Negative feedback uses information to provide control functions for system elements and maintains dynamic equilibrium conditions. But adaptive natural systems also swing into disequilibrium under unpredictable conditions, which then leads to rapid degradation of system elements and their re-ordering in a transformed structure to preserve the original function of the system. Particular attention is needed to what in systems terminology are called positive feedback

loops, which signal imminent transformative pressures. Positive feedback is when a change in one direction causes the system to respond in ways, which strengthen that change (for example, melting of Arctic sea ice which reduces surface albedo causing further local temperature increases). Positive feedback signals that systems are about to move beyond incremental change to a chaotic transformation, which results in fundamental restructuring.

Policies also typically use control and regulatory mechanisms to maintain socio-economic systems through negative feedback. However, most information flows in large public or private organizations are designed to provide measures of how well programmes are going and why things are working out as expected. Adaptive policies should recognize limits to control, and seek instead to foster attention to the unexpected, the counter-intuitive, and the changes in elements, which cannot be controlled. They should address qualitative change, and pay more attention to fundamental goals and values, which are long-lived measures, in addition to quantitative indicators, which may mask, rather than clarify, meaning. Policy design and targets should not focus solely on component elements, but also give attention to the broader whole, the big picture.

As science demonstrates that the foundational and persistent elements of our world are not objects or structures but forces and relationships, so adaptive policies need to address dynamic interactions between organizations, people, and the world around them. Just as very complex natural structures can be seen to be built out of simple repeated patterns, which interact at different scales, so adaptive policies might have simple and scalable principles, which respond to complex situations interactively rather than prescriptively.

Adaptive policies will enable and encourage positive action. Adaptive responses in large-scale socio-economic systems come from the creative action and engagement of people with their environment, not from their isolation and control. Policies that foster participation and encourage exchange of information will engage multiple actors in processes of change more quickly than otherwise.

Finally, natural science teaches us that healthy outcomes for adaptive systems come from simple, well-designed, and iterative 'processes', not from strong structures. Adaptive policies should be process-oriented.

2.2.7 Insights from complex adaptive systems theory

In the policy and management fields, a substantive body of knowledge has emerged over the last 10 years on the topic of complex adaptive systems. A complex adaptive system is a conceptual articulation of the real world and has been described as being...

‘...made up of many individual, “self-organizing elements” capable of responding to others and to their environment. The entire system can be seen as a “network of relationships and interactions”, in which the whole is very much more than the sum of the parts. “A change in any part of the system”, even in a single element, “produces reactions and changes in associated elements” and the environment. Therefore, the effects of any one intervention in the “system cannot be predicted with complete accuracy”, because the “system is always responding and adapting” to changes and the actions of individuals, (Glouberman, Campsie, Gemar, *et al.* 2003).

The study of complex adaptive systems has been predicated by a need to better see the structures underlying complex situations and identifying the best leverage points for change. As illustrated in Table 2.3, the recent study and application of complex adaptive systems can be seen in numerous fields including business management, health care, information technology, transportation, sustainable development, and international development.

Some interesting applications of complex systems thinking were seen in the early 1990s in business management. Peter Senge's *The Fifth Discipline* – the fifth discipline being systems thinking – was on the bestseller list in 1993 and delivered pragmatic guidance on how to create and foster a learning organization (Senge 1993). About the same time, Margaret J Wheatley drew on chaos and complexity theory to provide advice for a simpler way to lead organizations (Wheatley 1999). A recent search of the Internet turned up an investment fund management firm which bases its portfolio strategy on an understanding and appreciation of complex adaptive systems (Innovative Portfolio Strategies 2004).

Table 2.3 Scan of theoretical and applied complex adaptive systems research in business and public policy

Sector	Application reference
Business management	
Organizational learning	Senge (1993)
Leadership	Wheatley (1999)
Investment fund management	Innovative Portfolio Strategies (2004)
Health policy	
Health policy in cities	Glouberman, Campsie, Gernar, <i>et al.</i> (2003)
Healthcare and healthcare administration	Mayo Clinic (2003)
Information policy	
Bottom-up management related to information technology	Axelrod and Cohen (2000)
Transportation policy	
Airport design	Walker, Rahman, and Cave (2001)
Sustainable development	
Theory of adaptive change	Gunderson and Holling (2002)
Community-level resilience building	Berkes, Colding, and Folke (2003)
Sustainability assessment	Kay, Regier, and Francis (1999)
Forest management	Ruitenbeek and Cartier (2001)
International development guidance for development assistance	Rihani (2002)
Practitioner networks	
Ecosystem management	The Resilience Alliance is a multidisciplinary research group that explores the dynamics of complex adaptive systems in order to discover foundations for sustainability, and provide novel solutions to managing resilience and coping with change, uncertainty, and surprise in complex social–ecological systems. www.resalliance.org
Network of excellence	EU Complex systems network of excellence. Funded by the European Commission to develop collaboration among European researchers interested in Complex Systems, from fundamental concepts to applications, and involving academia, business, and industry http://www.complexityscience.org/index.php

Complex adaptive systems theory is beginning to influence many facets of public policy and management. Perhaps most active is the research and application in the health care field. The Mayo Clinic in the US has sponsored recent conferences on the topic, and a book has been published synthesizing the outcomes of a symposium held in Florida. More recently, the Caledon Institute for Social Policy in Canada has created a toolbox for improving health in cities based explicitly on the realization that the cities behave as complex adaptive systems (Box 2.5).

The information technology sector published a seminal piece in 2000 called *Harnessing Complexity: organizational implications for a scientific frontier* (Axelrod and Cohen 2000). Funded by the US Department of Defence, this research project constructed a theoretical framework of complex adaptive systems with the purpose of understanding how the theory could be harnessed for policy related to the

Box

A toolbox for improving health in cities

2.5

- *Gather information* – Understand local conditions, strengths, and assets
- *Respect history* – ‘Adaptive systems are shaped by their past and a knowledge of this history may suggest constraints on and opportunities on what can be done in the future.’
- *Consider interaction* – Understand interactions with the natural, built, and social environment
- *Promote variation* – ‘Introducing small-scale interventions for the same problem offers greater hope of finding effective solutions.’ ‘It is critical to understand and accept that many interventions will fail. Such failures should not be viewed as failures of the overall way of understanding the system. This is simply a feature of how one develops successful interventions in complex adaptive systems.’
- *Conduct selection* – In complex adaptive systems possible solutions undergo selection by the system. It is therefore important to include ‘evaluating performance of potential solutions, and selecting the best candidates for further support and development.’
- *Fine-tune process* – ‘In complex systems, which change over time and respond dynamically to outside forces, it is necessary to constantly refine interventions through a continual process of variation and selection.’
- *Encourage self-organization* – ‘Complex adaptive systems often spontaneously generate solutions to problems without external input or formally organized interventions.’ ‘This self-organizing capacity is a free good that can be valuable in producing innovative and novel approaches to problems.’

Source Glouberman, Campsie, Gamar, *et al.* (2003)

Internet information technology wave. This theoretical framework has been cited in many other policy applications including health policy (Glouberman, Campsie, Gamar, *et al.* 2003) and forestry management (Ruitenbeek and Cartier 2001).

About the same time that the BACH framework was being developed, another group of researchers represented by the Resilience Alliance⁵ was doing similar work. This was a three-year project funded by the MacArthur Foundation to advance the theory, policy, and practice involved in resolving issues that emerge from the interaction of people and nature. The pinnacle report from this project was a book entitled *Panarchy* (Gunderson and Holling 2002). *Panarchy* is about a quest for a theory of adaptive change in integrated systems of humans and nature that will integrate across space from local to global, across time from months to millennia, and across disciplines to understand systems of linked ecological, economic, and institutional processes. A research network is active on this topic and has taken on the objective of exploring the dynamics of complex adaptive systems in order to discover foundations for sustainability and provide novel solutions to managing resilience and coping with change, uncertainty, and surprise in complex social–ecological systems.

Advice for development policy-makers and project managers continues to flow out of the Panarchy umbrella of understanding. For example, Berkes, Colding, and Folke (2003) have recently published a book entitled *Navigating social–ecological systems: building resilience for complexity and change*, which identifies a number of critical factors that seem to be required for dealing with nature’s dynamics in social–ecological systems. Like *Panarchy*, the work of James Kay at the University of Waterloo on Self-Organizing, Holarchic Open systems (Kay, Regier, Boyle, *et al.* 1999) has provided much insight into complex adaptive systems.

⁵ <<http://www.resalliance.org/ev.php>>

A recent book on complex adaptive systems and international development articulates a paradigm shift that is based on notions of learning and adaptation (Rihani 2002). This publication describes the following.

'At base, development is what nations do as Complex Adaptive Systems, and what they do can be described as uncertain evolution that has no beginning or end, nor shortcuts, and few signposts on the way...prospects for the future are conditioned by two factors that are difficult to predict and guard against in advance: local opportunities and constraints, and the activities of other co-evolving nations.'

Based on this conceptual understanding of the world, Rihani provides some very relevant policy guidance, guidance that is particularly insightful for understanding adaptive policies. He notes that under the above conditions...

'... rigid plans and policies are inappropriate...The only evolutionary stable strategy open to a nation is to exercise flexibility and pragmatism in order to survive, learn, and adapt over and over again in accordance with its ever-changing fitness landscape. Critically, there is no evolution or progress without interactions; members of the population have to be free and able to interact for anything to happen (Rihani 2002).'

Together, the findings from research focused on complex adaptive systems provide an insightful set of principles for effective policy intervention in complex adaptive systems (for example, the real world). In a 2003 workshop at the IISD, much of this literature was synthesized to create such a list of principles. When organized according to a set of ideal policy-making steps, these principles provide useful guidance to policy-makers towards how to build adaptability into policies (refer to Table 2.1).

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CHAPTER

3

Indian agriculture: growth, sustainability, and vulnerability

- 3.1 Overview of the agriculture sector
 - 3.1.1 The Green Revolution
- 3.2 Sustainability issues
 - 3.2.1 Groundwater depletion
 - 3.2.2 Soil degradation
- 3.3 Vulnerability to climate change

Indian agriculture: growth, sustainability, and vulnerability

Ulka Kelkar¹

Agriculture and allied activities constitute the single largest component of India's GDP (gross domestic product), contributing 24% of the total. The importance of this sector to the Indian economy can be gauged by the fact that it provides employment to two-thirds of the total workforce. The share of agricultural products in exports is also substantial, with agriculture accounting for about 15% of export earnings. With a weight of 57% in the consumer price index, food prices are closely linked with inflation and any adverse shock on agriculture could have cumulative effects on the economy. Agricultural growth also has a direct impact on poverty eradication, and is an important factor in employment generation.

The growth of Indian agriculture post-independence and the country's attainment of self-sufficiency in food grains has been an impressive achievement, but it has come at a high ecological cost. Moreover, the challenge is far from over. The food demands of the present and future generations have yet to be met, while the limits of expansion of cultivated land have been reached. Finally, given that almost two-thirds of the net sown area is rain-fed, Indian agriculture continues to be fundamentally dependent on the weather, and hence, highly vulnerable to climate change.

This chapter sets the context for the policy case studies on Indian agriculture presented in the next two chapters. It discusses key features of the agriculture sector, how it is facing multiple ecological and socio-economic pressures, and the additional stress that is likely to be posed by climate change.

3.1 Overview of the agriculture sector

There are two main cropping seasons in India: the *kharif* season is during the south-west monsoon (July–October), during which agricultural activities are undertaken in both rain-fed and irrigated areas, and the *rabi* season is during the winter months, during which agricultural activities are undertaken only in irrigated areas. About 60% of the net sown area of 142 M ha (million hectares) is rain-fed. Wheat accounts for one-third of the total food-grain production in India, while rice forms about 42% of the total (Table 3.1).

¹ The Energy and Resources Institute, India [Valuable input provided by Suruchi Bhadwal is gratefully acknowledged.]

Table 3.1 Food-grain production (million tonnes)

Crop	1999/2000	2000/01	2001/02	2002/03	2003/04*	2004/05**
Rice	89.7	85.0	93.3	72.7	87.0	87.8
Wheat	76.4	69.7	72.8	65.1	72.1	73.0
Coarse cereals	30.3	31.1	33.4	25.3	37.8	31.9
Pulses	13.4	11.1	13.4	11.1	15.2	13.7
Food-grain production (by season)						
Kharif	105.5	102.1	112.1	87.8	112.0	102.9
Rabi	104.3	94.7	100.8	86.4	100.0	103.5
Total	209.8	196.8	212.9	174.2	212.0	206.4

* 4th advance estimates; ** 2nd advance estimates

Source MoF (2005)

It is worth highlighting that India supports 18% of the world's population and 15 % of its livestock on merely 2.2 % of the world's geographical area. Of India's reporting area of 306.05 M ha, nearly 46 % of the land area is being utilized for agricultural purposes. The remaining land includes area under forests (23 %); buildings, roads, railways, surface water (8 %); barren and unculturable land covered by snow and desert areas (6 %); and other uncultivated land including fallows (17 %).

Table 3.2 compares the pattern of land use between 1950–51 and 1999–2000. There has been a steady increase in the gross cultivated area, from 132 M ha to 192 M ha, in the past 50 years due to the increase in cropping intensity, from 111% to 135% over the same period. However, in per capita terms, agricultural land availability has declined from 0.48 ha in 1951 to 0.15 ha in 2000 (FAI 2004). Indian agriculture is characterized by small landholdings with the majority of farmers practising subsistence agriculture. Only 25% of the farmers produce 60% of the total agricultural output of the country (TERI 2005). Seventy-eight per cent of landholdings are less than 2 ha, 59% are less than 1 ha, and only 1.6% are large holdings of more than 10 ha. A majority of farmers lack direct access to markets and rely on middlemen for marketing their produce in exchange for cash, credit, or agricultural input.

Table 3.2 Land use statistics of India for 1950/51 and 1999/2000 (area in million hectares)

Category	Years	
	1950/51	1999/2000
Geographical area	328.73	328.73
Reporting area	284.32	306.05
Forests	40.48	69.02
Not available for cultivation	47.52	44.35
Area under non-agricultural uses	9.36	22.97
Other uncultivated land excluding fallow land	49.45	28.49
Net cultivated area	118.75	141.23
Gross cultivated area	131.89	189.74
Net irrigated area	20.85	57.24
Gross irrigated area	22.56	76.34

Source Directorate of Economics and Statistics (2003)

It is estimated that the requirement of food stock to feed India's projected population of 1.4 billion in 2030 will be 114 million tonnes of rice, 83 million tonnes of wheat, 13 million tonnes of maize, 106 million tonnes of fruits, and 193 million tonnes of vegetables (TERI 2005). This is an enormous challenge given the limited availability of land and water resources. Most of the area not under forests or cultivation comprises marginal and sub-marginal lands and the extension of agriculture into this area will be costly, as it requires extensive work for soil and water conservation, irrigation, and reclamation (Gundimeda, Sanyal, Sinha *et al.* 2005). Competition from more lucrative cash crops means that there is not much scope for increasing the area under food grains. For instance, a lot of area under rice in Kerala has been lost to coconut and rubber plantations. The yield of food grains in major producing states like Punjab and Haryana has also reached a plateau. Consequently, any growth in food-grain output can be achieved only through rapid increases in productivity (Box 3.1).

Box	Policy goals in agriculture
3.1	<p>India's Tenth Five-year Plan (2002–07) envisages an overall GDP growth rate of 8% per annum. The Tenth Plan has the following focus areas in the agricultural sector.</p> <ul style="list-style-type: none"> ▪ Increase in cropping intensity ▪ Development of minor irrigation and utilization of created irrigation potential ▪ Rainwater harvesting and conservation for the development of rain-fed areas and watershed approach ▪ Utilization of unutilized and under-utilized wastelands and degraded lands ▪ Timely and adequate availability of input, such as seeds, fertilizers, and implements ▪ Improvement of seed production to achieve a desired seed replacement rate ▪ Promotion of organic farming with the use of organic waste and integrated pest management ▪ Strengthening of marketing, processing, and value-addition infrastructure, conservation of threatened breeds of livestock, and improvement of breeds used for draught ▪ Improvement of pasture lands and availability of fodder seeds ▪ Emphasis on biotechnology for the development of high-yielding seeds

3.1.1 The Green Revolution

In the first half of the century, Indian agriculture registered an extremely low growth rate of 0.3% per annum. In the five decades since independence, the annual growth rate was about 2.7%. Food-grain production grew from 50.8 million tonnes in 1950/51 to about 211 million tonnes in 2001/02 (MoF 2005). After being a food deficit country for decades, food imports were virtually eliminated during the 1960s. This growth was driven by massive public investments in public irrigation and rural electrification, development of research and credit networks, and guaranteed support prices for output and subsidized input (Mehra and Datt 2004).

Termed as the Green Revolution, this massive expansion of food-grain production started in 1963/64 when a limited quantity of HYV (high-yielding variety) wheat seed was imported for experimentation, and found adaptable to Indian conditions with the use of fertilizers. The introduction of HYVs was supported through the extension of irrigation facilities, better agricultural techniques, water management, plant protection, and storage and marketing infrastructure. Higher profits meant that both, areas under cultivation and cropping intensity, increased.

3.2 Sustainability issues

While food security was the imperative behind the Green Revolution, it inadvertently created ecological imbalances. The Green Revolution technology required large and assured quantities of water,

Table 3.3 Average annual growth rate of agriculture (%)

Five year plan	Growth rate of agriculture and allied sectors	Overall GDP growth rate
Seventh Plan (1985–90)	3.2	6.0
Annual Plan (1990–92)	1.3	3.5
Eighth Plan (1992–97)	4.7	6.7
Ninth Plan (1997–2002)	2.1	5.5
Tenth Plan (2002–07)		
2002/03+	–7.0	4.0
2003/04++	9.6	8.5
2004/05+++	1.1	6.9

+ Provisional, ++Quick estimates

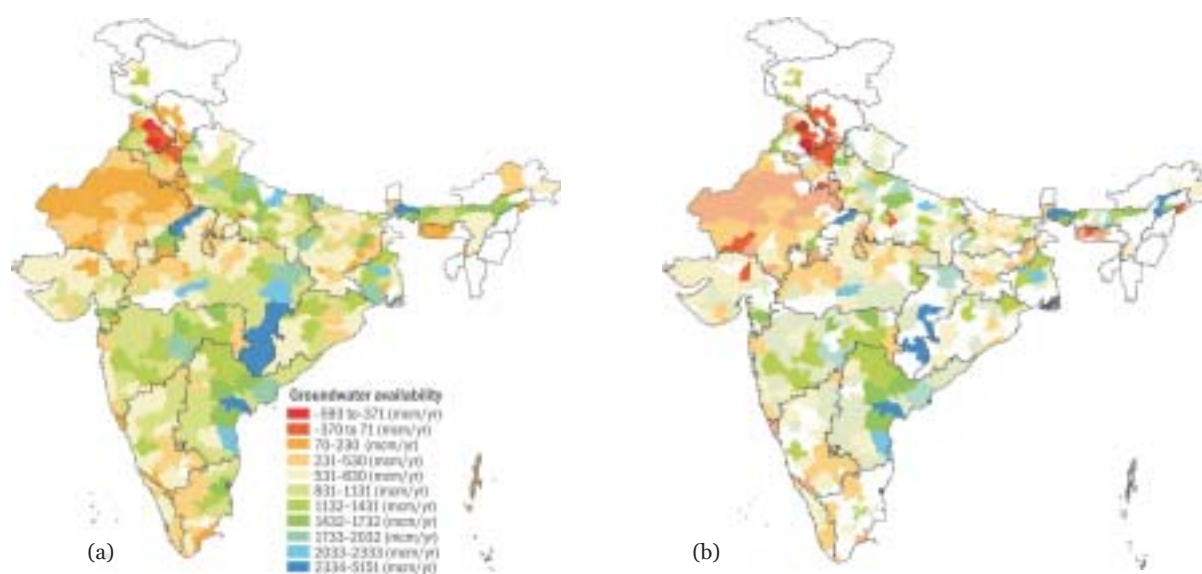
+++ Advance estimates

Source MoF (2005)

fertilizers, and pesticides. However, the longer-term environmental consequences of this intensification of agriculture included soil degradation, pesticide concentration in food chains, decline in crop diversity, depletion of groundwater, water-logging, and salinity problems. This section focuses on groundwater depletion and soil degradation.

3.2.1 Groundwater depletion

The Green Revolution depended on timely irrigation, which was not possible through the state-run canal irrigation system. The percentage of land irrigated increased from 17% of the gross cropped area in the 1950s to 41% in 2000. There was a phenomenal increase in privately-owned shallow tube wells, from about 1000 in 1947 to about 36 000 in 1968/69 to about 20 million presently. The indiscriminate pumping of groundwater has led to a steep decline in the water table in many places. While groundwater exploitation is not presently a major concern at the aggregate level, overexploitation is a serious concern in agriculturally important states. In Punjab, for instance, the level of exploitation is already 94%. Haryana follows suit, at 84%. The situation is also precarious in Rajasthan (51%) and Tamil Nadu (60%) (Figure 3.1).

**Figure 3.1** Groundwater availability in (a) 1991 (b) 2001

Source TERI (2006)

The problem of groundwater depletion has been aggravated by the practice of providing free or subsidized electricity for agriculture. Heavily subsidized flat rates on irrigation pumps, free power policies of certain states, and cross-subsidization of agricultural consumers has meant that the agriculture sector consumes 27% of the total electricity in the country. The electrical energy consumption for irrigation has increased from 17 817 million kWh (Kilowatt-hour) in 1982/83 to 84 729 million kWh in 2000/01 (Table 3.4).

This has also led to inappropriate cropping patterns with water-intensive sugar cane and rice being grown in water-scarce areas. For the country as a whole, about 14% of the blocks is either overexploited or critical, a number, which is expected to reach 60% in just 25 years (World Bank 2005).

TERI's Green India study estimated the incremental costs of groundwater extraction to be around Rs 490 million to Rs 980 million per year. It pointed out the equity effects of falling water tables as they place the resource out of the reach of smaller and marginal farmers who are unable to afford the higher costs of extraction (TERI 1998, forthcoming).

With respect to government policy, water is a state-level subject, but water planning cuts across state boundaries. Unfortunately, the organizational structure for water management at the central level is very fragmented and there is no institutionalized mechanism for securing coordination among the many ministries engaged in water management (such as the Ministry of Water Resources, Ministry of Environment and Forests, Ministry of Rural Development, Ministry of Power, and Ministry of Urban Development and Poverty Alleviation). There is a need for appropriate incentives that encourage efficient water usage and discourage perverse cropping patterns. Recent years have seen a growing interest in participatory irrigation management through the formation of users' groups called water users associations (WUAs) and also a proposal for the interlinking of rivers for inter-basin transfers.

3.2.2 Soil degradation

Of India's total geographical area of 328.73 M ha, it is estimated that an area of about 107.4 M ha has been degraded (Planning Commission 2001) (Figure 3.2). In a study, TERI (1998) identified soil erosion, occurring due to wind and water, as the single largest cause of degradation, followed by water-logging, salinity, and declining fertility. The study also found that soil was becoming polluted with municipal and domestic sewage, pesticides, and fertilizers. Soil degradation leads to loss of productivity, which in turn affects food security and the potential for rural on- and off-farm income generation.

Subsidies to encourage extensive use of fertilizers and pesticides to improve agricultural productivity have led to imbalanced nutrient application and soil degradation. India is the fourth largest producer and user of agro-fertilizers in the world. Consumption and production of fertilizers has increased from a mere 0.5 kg/ha of application in the 1950s to 89.3 kg/ha in 2000–01.

Also, from 1997 to 2000, about 3.43 lakh ha of land were brought under canal irrigation. Though this had a positive effect on productivity, in areas where drainage did not receive adequate attention, this also caused water-logging and secondary problems such as salinization.

Table 3.4 Consumption of electricity by the agricultural sector (million kilowatt-hours)

Year	Consumption by agriculture sector	Total consumption	Share of agriculture sector (%)
1981/82	15 201	90 245	16.84
1985/86	23 422	122 999	19.04
1990/91	50 321	190 357	26.44
1995/96	85 732	277 029	30.95
1997/98	91 277	299 067	30.52
1998/99	97 195	309 734	30.75
1999/2000	90 934	312 841	29.07
2000/01 (provisional)	84 729	316 539	26.77

Source Directorate of Economics and Statistics (2003) cited in TERI (2005)

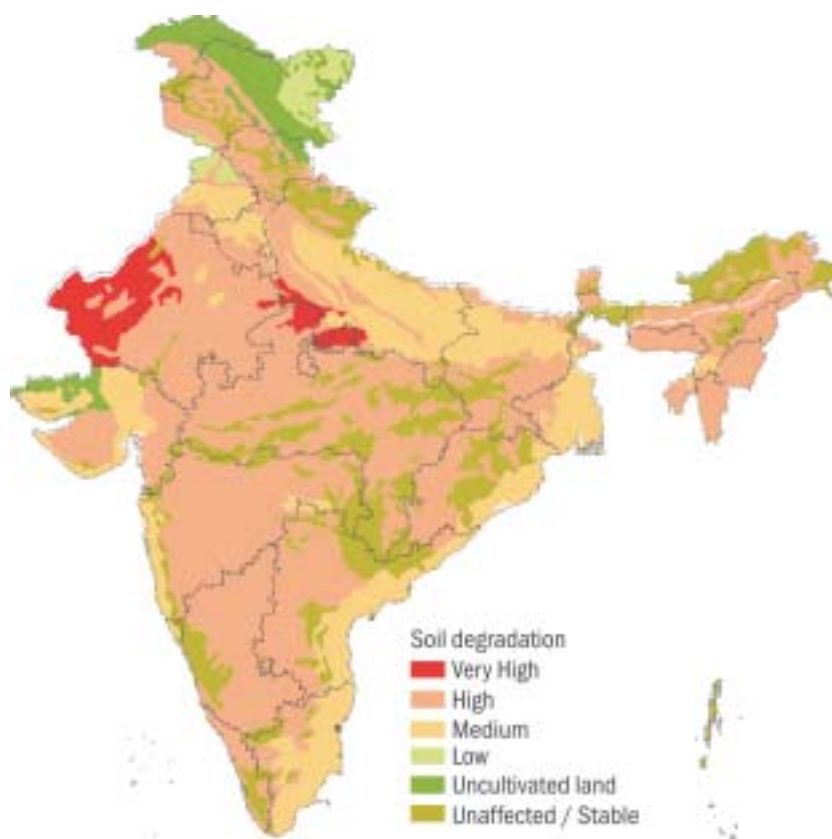


Figure 3.2 Soil degradation

Source TERI (2006)

3.3 Vulnerability to climate change

Climate change is expected to disproportionately impact developing countries, whose economies are closely tied to climate-sensitive sectors like agriculture and which are already facing multiple stresses due to population growth, urbanization, industrialization, and globalization. In the tropics and sub-tropics, where some crops are near their maximum temperature tolerance and where rain-fed agriculture dominates, yields are likely to decrease for even small changes in climate, which could lead to an increased risk of inadequate food supply. Often the poorest in rural areas occupy the most marginal lands, forcing them to rely on highly vulnerable livelihoods in areas prone to drought, flooding, and other hazards. Developing countries also lack the financial and technical resources to effectively defend themselves against natural disasters (IPCC 2001). Thus, regions and communities that are unable to cope with current climate hazards are also likely to be the most poorly equipped to cope with the adverse impacts of climate change (Brooks and Adger 2003).

Of particular relevance to India is the fact that climate change will lead to increased variability in summer monsoon precipitation. As Figure 3.3 shows, the large year-to-year variations in annual rainfall are reflected in substantive variations in yield. The National Commission on Agriculture (1976) had estimated that rainfall variations accounted for 50% of the variability in agricultural yields, being as high as 90% for cotton and groundnut, 47% for wheat, and 45% for barley and *jowar*.

Given that even today rain-dependent agricultural area constitutes about 60% of the net sown area of 142 M ha, Indian agriculture continues to be fundamentally dependent on the weather (Table 3.5).

In particular, it is also observed that the country is facing large and rising economic losses due to natural disasters, amounting to 2% of the GDP (World Bank 2003). Two-thirds of the total sown area of the country is drought-prone, with monsoon rains showing high inter-annual, intra-seasonal, and spatial variability (Table 3.6). 40 M ha of land is prone to floods, with 8 M ha and 30 million people affected each year on an average (NCDM and NDMD 1999). In the pre-monsoon and post-monsoon seasons, the coastline, particularly the east coast, is vulnerable to tropical cyclones.

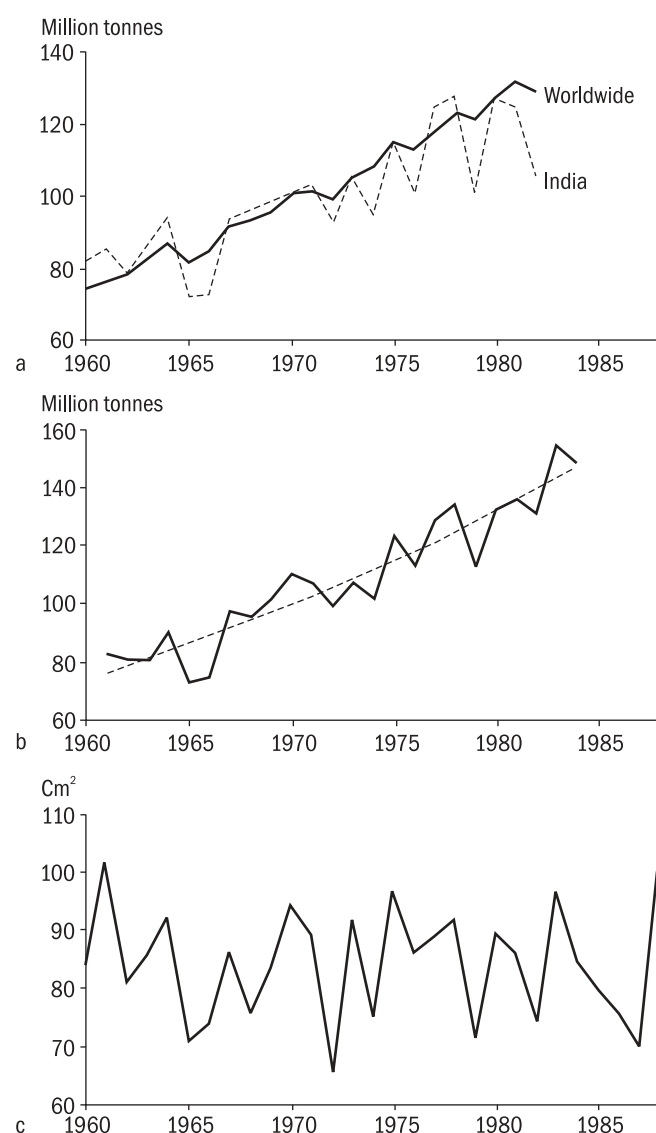


Figure 3.3 Variation during 1960–82 of (a) rice yield throughout the Indian region (b) total food-grain production (c) all-India rainfall

Source Gadgil (1996)

India's first national communication, which was submitted to the UNFCCC (United Nations Framework Convention on Climate Change) in 2004, describes the potential impact of climate change. Climate projections indicate marked increase in seasonal surface air temperature in the 21st century,

Table 3.5 Historical data on rainfall levels and *kharif* crop production in India

Deficient rainfall years	Monsoon rainfall % departure from normal	Rainfall in July (%)	Kharif food grain production % fall
1972/73	–24	–31	–7
1974/75	–12	–4	–13
1979/80	–19	–16	–19
1982/83	–14	–23	–12
1986/87	–13	–14	–6
1987/88	–19	–29	–7
2002/03	–19	–49	–19

Source MoF (2003)

becoming conspicuous after the 2040s. Models predict little change in total monsoon rainfall for India as a whole, but project an overall decrease in the number of rainfall days and increase in rainfall intensity over a major part of the country. Preliminary assessments reveal a general reduction in the quantity of available runoff, and an increase in the severity of droughts and intensity of floods in various parts of India. Wheat yields in central India may drop by two per cent in a pessimistic climate change scenario (GoI 2004).

The results of various studies regarding the impact of climate change on Indian agriculture are presented in Table 3.7.

In addition, climate change is expected reduce water availability by altering the hydrological cycle. Temperature changes will affect evapotranspiration rates, soil moisture, storm intensity, etc. in a major way, while changes in precipitation will affect the timing and magnitude of droughts and floods, shift runoff regimes and alter groundwater recharge characteristics (Gleick 1998). These temperature and precipitation changes will have significant effects on the demand, supply, and quality of water (Lal and Harasawa 2001). The Third Assessment Report of IPCC (Intergovernmental Panel on Climate Change) points out that the impact of climate change is likely to be most serious in unmanaged or unsustainably managed water systems that are currently water stressed. It also states with a high level of confidence that freshwater availability is expected to be highly vulnerable to anticipated climate

Table 3.6 Losses due to droughts (1999–2001)

Year	Districts affected	Villages affected	Population affected	Damage to crops area (ha)	Estimated value of damaged crops (Rs million)	Cattle population affected
1999	125	—	36 988 000	13 422 000	64.4	34 560 000
2000	110	54 883	37 814 000	36 700 000	3 718.7	54 167 000
2001	103	22 255	8 819 000	6 744 000	—	92 155 000

Source Gol (2001)

Table 3.7 Impact of climate change on agriculture in India: results of various studies

Gol (2004)	Decline in yields are offset by increase in carbon dioxide concentrations with the magnitude varying from one crop to the other in different regions, depending mostly on the scenario chosen. Wheat yields in central India may drop by 2% in a pessimistic climate change scenario.
TERI (2003)	Districts in western Rajasthan, southern Gujarat, Madhya Pradesh, Maharashtra, northern Karnataka, northern Andhra Pradesh, and southern Bihar are highly vulnerable to climate change in the context of economic globalization. Numerous physical (e.g. cropping patterns, crop diversification, and shifts to drought-/salt-resistant varieties) and socio-economic (e.g. ownership of assets, access to services, and infrastructural support) factors come into play in enhancing or constraining the current capacity of farmers to cope with adverse changes.
IPCC (2001)	Temperature rise of 1.5 degree centigrade and a 2 mm increase in precipitation could result in a decline in rice yields by 3% to 15 %. Sorghum yields would be affected and yields are predicted to vary from 18% to –22 % depending on a rise of 2 °C to 4 °C (degree centigrade) in temperatures and increase by 20% to 40 % of precipitation.
Kumar and Parikh (1998)	Economic impacts would be significant even after accounting for farm-level adaptation. The loss in net revenue at the farm level is estimated to range between 9% and 25% for a temperature rise of 2 °C to 3.5 °C.
Sanghi, Mendelsohn, and Dinar (1998)	A 2 °C rise in mean temperature and a 7% increase in mean precipitation would reduce net revenues by 12.3% for the country as a whole. Agriculture in coastal regions of Gujarat, Maharashtra, and Karnataka will be the most negatively affected. Possible losses are pointed out for the major food-grain producing regions of Punjab, Haryana, and Western Uttar Pradesh.

change. In particular, surface runoff is expected to decrease drastically in arid and semi-arid India under the projected climate change scenarios. Climate change is likely to change the volume as well as temporal distribution of streamflows (IPCC 2001). The results of various studies on the impact of climate change on water resources in India are presented in Table 3.8.

The vulnerability of agricultural production to climate change depends not only on the physiological response of the affected plant, but also on the ability of the affected socio-economic systems of production to cope with changes in yield, as well as with changes in the frequency of droughts or floods. The adaptability of farmers in India is severely restricted by the heavy reliance on natural factors and the lack of complementary input and institutional support systems. For instance, the New India Assurance Company estimates that insurers in India have been bearing less than five per cent of the total economic cost of disaster claims (Shankar 2003). The low levels of insurance penetration in India are driven home by the fact that after the devastating tsunami of December 2004 with about 10 000 casualties, LIC (Life Insurance Corporation) settled only 268 claims amounting to Rs 2.38 crore in Tamil Nadu, Kerala, and Pondicherry. Without adequate recourse to formal credit and insurance, small and marginal farmers in particular become caught up in a vicious cycle of debt and impoverishment. Therefore, erratic monsoon precipitation due to climate change would adversely affect the farming community in India and its ability to adapt to the impact of climate change. TERI (2003) developed an index of the vulnerability of Indian agriculture to climate change that took into consideration climate sensitivity as well as adaptive capacity, as measured at the district level (Figure 3.4).

Narain (2003) suggests that households engaged in agriculture can employ a range of strategies in responding to water scarcity. This includes the following.

- Improving access to available water (such as makeshift storages, digging deeper tube wells, exchanging irrigation timeshares, buying groundwater, and engaging in water theft)
- Reducing demand for water (such as switching to less water consumptive crops, adopting more efficient irrigation practices, and altering dates for agricultural operations)
- Coping with the adverse impacts of periodic drought (such as credit, sale of valuables and livestock, use of stored seeds and food grains)
- Diversifying sources of livelihood (such as alternative employment opportunities, migration)

The study mentions that many of these response options are to be employed at household level. It concludes that existing responses may not be adequate to cope with prolonged and worsening water stress due to climate change.

Kumar and Parikh (2001) build a case for government policy interventions in light of the potentially severe implications of climate change. Specific recommendations include the need for research

Table 3.8 Impact of climate change on water resources in India: results of various studies

Gol (2004)	Observed a decline in total runoff for all river basins except Narmada and Tapi. A decline in runoff by more than two-thirds the amount in the control scenario has been predicted for the basins of Sabarmati and Luni with severe drought conditions.
Indo-UK programme (2005)	Observed that, except for Godavari, where there are not any significant changes reported in the annual cycle of rainfall, the Ganges and the Krishna basins show major declining trends, which is an interesting observation at a basin scale.
Narula and Bhadwal (2003)	Estimated that decrease of 20% to 30% in total flows in the Lakhwar sub-basin in Uttaranchal on account of climate change alone.
Lal and Harasawa (2001)	Studied the impact of climate change on water resources using output from various GCMs (General Circulation Models).
Tangri and Hasnain (2003)	Examined the impact of climate change on glaciers in the Himalayan region.
Wilk and Hughes (2002)	Studied impact on mean annual runoff and assured water yields for a reservoir in southern India.

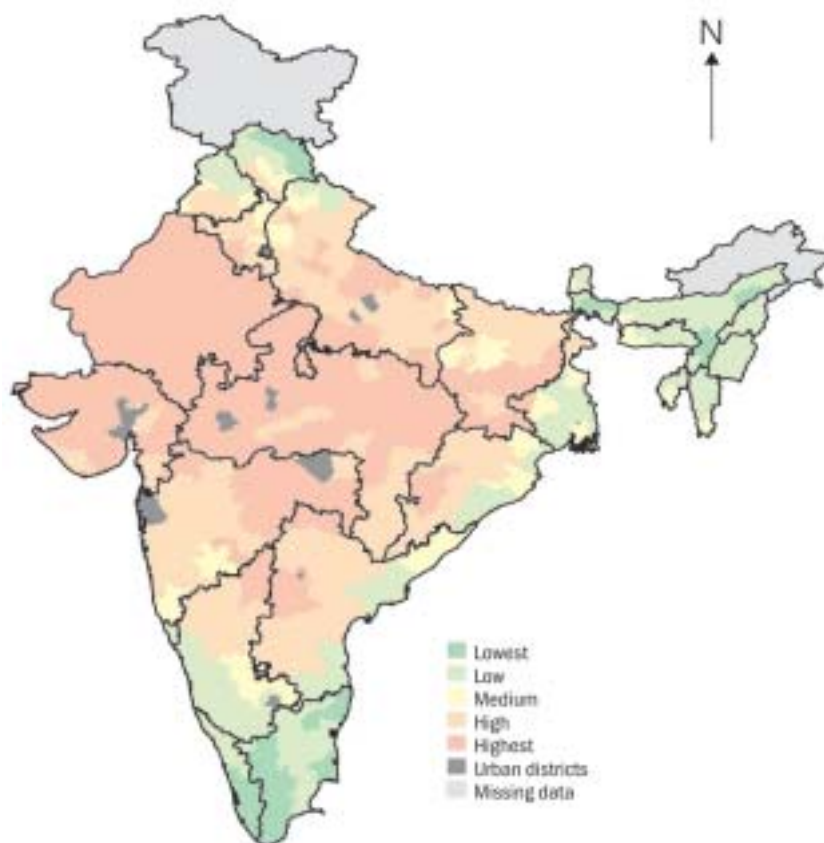


Figure 3.4 Vulnerability of Indian agriculture to climate change

Source TERI (2003)

and development on more heat-resistant crop varieties, development of a database of farmer-level adaptation strategies that can be widely disseminated, and further research on the socio-economic implications of climate-induced changes with emphasis on security of food supply.

It is important to recognize that policy decisions related to agriculture or water resources will influence decisions from the farmer's level to the national level, and have the potential to enhance adaptive capacity to climate change. Alternately, factors that reduce vulnerability to climate risks – irrigation, better infrastructure, electricity, credit, crop insurance, markets, transport, and price information – reduce farmers dependence on climate, and help them to benefit from market opportunities, or switch to alternative crops or employment options. At the other end of the scale are better health facilities, education, and awareness, which are key developmental priorities but are often ineffectively implemented due to conflicts, policy gaps, and the sheer magnitude of the problem. The incorporation of climate change risks in such policies can help farmers tackle current climatic variability as well as extreme events like droughts and floods. As a result, such policies have significant implications for long-term vulnerability reduction and poverty alleviation.

In India, integrated watershed development has emerged as an effective approach in augmenting water supply through conservation of rainwater in rain-fed farming systems. These farmlands account for nearly two-thirds of the country's cultivated land and encompass the arid, semi-arid and drought-prone regions. Interventions in the dry land/ rain-fed regions that are characteristic of poor climate were targeted under IWMP (Integrated Watershed Management Project). This Project suggests that an integrated and coordinated approach be deployed across various ministries to promote soil and water conservation by optimizing land-use production systems and use of sustainable low-cost location-specific technologies (MoEF 2001). The watershed approach basically is a project-based development plan for water harvesting, water conservation, and other related social and economic activities that seek to enhance the production potential of an area on a sustainable basis. There is growing awareness

at the central government level that integrated watershed development can also prove to be a potent instrument of adaptation to climate change. There are special programmes such as DPAP (Drought Prone Areas Programme) for almost one-sixth of the land area in the arid and semi-arid regions of the country, in addition to the special programme of watershed treatment in the catchment of river valley projects and flood prone rivers (Box 3.2).

The role of science and technology has, in the past, also played a crucial role in increasing yields and production across the country. Biotechnology could be used to develop cultivars specific to certain weather conditions. This would include the development of drought-resistant, salt-tolerant, and pest-resistant cultivars of different crops. This would ensure a strong approach to dealing with food security besides addressing climate change (Brenner 1996).

At the same time important insights can be drawn from local knowledge or traditional know-how. Furthermore, local institutions and indigenous arrangements (e.g., micro-credit and land tenure) have an important role in enhancing the resilience of the poor.

Box	Key government programmes
3.2	<p>GoI (Government of India) has several plans and programmes to facilitate the development of degraded lands to improve conditions in rain-fed regions across the country.</p> <ul style="list-style-type: none"> ▪ DPAP (Drought Prone Area Programme) of GoI is aimed at soil and moisture conservation in drought prone areas. The primary objective is promotion of overall economic development mainstreaming marginalized and vulnerable sections. ▪ DDP (Desert Development Programme) was later introduced to restore ecological balance, conservation of soil and water and to arrest the desertification through shelterbelt plantations. ▪ IWDP (Integrated Wasteland Development Programme) was introduced with the aim to develop wastelands for overall economic development besides improving economic conditions of resource poor population. ▪ NWDPRA (National Watershed Development Programme in Rain-fed Areas) initiated in 1990–91 targeted improvement in agricultural production in rain-fed areas, restoring ecological balance. ▪ In order to channelize greater resources for rain-fed areas, NABARD (National Bank for Agriculture and Rural Development) set up a Watershed Development Fund of Rs two billion in the year 2000–2001. ▪ Apart from these, the River Valley Project, Flood Prone River programme, WDPSCA (watershed development project for shifting cultivation Areas) – were introduced to check siltation of reservoirs and enhance the productivity of degraded lands.

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CHAPTER

4

Adaptive policy case study: weather-indexed insurance for agriculture in India

- 4.1 Introduction
- 4.2 Background
- 4.3 Policy description: evolution of crop insurance in India
 - 4.3.1 Traditional crop insurance schemes
 - 4.3.2 Liberalization of insurance sector
 - 4.3.3 Weather-indexed contracts
 - 4.3.3.1 ICICI Lombard pilot scheme for groundnut in Andhra Pradesh
 - 4.3.3.2 KBS pilot scheme for soya farmers in Ujjain
 - 4.3.3.3 Rajasthan government insurance for orange crop
 - 4.3.3.4 IFFCO-TOKIO monsoon insurance
 - 4.3.3.5 AIC Varsha Bima Yojana (rainfall insurance scheme)
 - 4.3.3.6 AIC Sookha Suraksha Kavach (drought protection shield)
 - 4.3.3.7 AIC coffee rainfall index and area yield insurance
 - 4.3.3.8 ICICI Lombard loan portfolio insurance
 - 4.3.3.9 Results update
- 4.4 Adaptive policy analysis
 - 4.4.1 Ability to adapt to a range of anticipated conditions
 - 4.4.2 Ability to adapt to unanticipated conditions
 - 4.4.2.1 Built-in mechanisms for learning and improvement
 - 4.4.2.2 Learning from pilot schemes
 - 4.4.2.3 Learning from engagement of local institutions
 - 4.4.2.4 Degree of self-adjustment to unanticipated circumstances

Adaptive policy case study: weather-indexed insurance for agriculture in India

Ulka Kelkar¹

4.1 Introduction

This case study looks at the specific policy instrument of crop insurance, which addresses Government of India's policy objective of protecting farmers from climatic stress, including droughts, floods, cyclones, etc. Other policy instruments that help address the same objective are promotion of crop diversification, long-range weather forecasting, and early warning systems. In the last two years, index-based weather risk insurance contracts have emerged as an alternative to traditional crop insurance in India. Drawing on some pilot schemes being implemented using different delivery models, we study this instrument as an adaptive policy instrument.

This study draws on consultations with several insurance companies operating in India and IRDA (Infrastructure Regulatory and Development Authority of India), as well as a range of published literature, conference presentations, and news coverage.

4.2 Background

In India, the impact of climate variability has traditionally been tackled through government assistance or informal risk sharing at the community level.² Rural households respond to the lack of formal financial services by turning to moneylenders, selling assets, reducing input in farming, or diversifying their activities. Another strategy is to send family members to work elsewhere and remit payments. However, such traditional risk management strategies, while reducing vulnerability in the short term, can increase vulnerability over the longer term by promoting sub-optimal asset allocation. For instance, small farmers may opt for multiple cropping to reduce income variability rather than risk

¹ The Energy and Resources Institute, India

² Some reasons for the abysmally low insurance penetration in India are

- limited buying capacity,
- insurance is viewed as a means of saving, with risk coverage as a secondary objective,
- consumer perceptions, which tend to be myopic or erroneous,
- Large sections of the Indian economy operate outside the formal economy (e.g. small industries, slums, etc.),
- Non-life insurance penetration stagnated under the nationalized model of the Indian insurance industry. However the situation is improving under competition since 2002/03.

growing the most profitable crops. Traditional risk management strategies also break down in case of disasters affecting an entire community or area (Hess, Richter, and Stoppal 2002; Lilleor, Gine, Townsend *et al.* 2005). World Bank (2003a) indicated that the current approach of risk management through government assistance or informal risk sharing at the community level lacks institutional incentives. It underplays the role of risk financing through *ex ante* mechanisms (such as catastrophe re-insurance and contingent credit facilities) that could provide financial liquidity in the aftermath of a natural disaster, and kick-start economic recovery. Clearly, relief is not enough to restore those most affected to their original economic status. Therefore, risk transfer tools like insurance, in the light of India's disaster vulnerability, are very important.

However, certain conditions must be met before insurers are willing to offer coverage against an unforeseen event (Kovacs and Kunreuther 2001).

- It should be possible to identify and estimate the chances of the event occurring, and the extent of losses likely to be incurred when providing different levels of coverage.
- The insurer should be able to set premiums, which reflect the customer's risk. This has problems of asymmetric information and moral hazard, resulting in excessively high insurance premiums and in insufficient or no coverage being offered.

Climate change compounds these problems by increasing actuarial uncertainty. Past climate and disaster history will no longer be a good benchmark, and future changes could be non-linear and abrupt. The result could be higher premiums and reduced insurance availability (Mills 2004).

Some of the key challenges that the insurance industry faces in addressing the risk of climate change are summarized below (CRM 2005; Linerooth-Bayer, Mace, and Verheyen 2003).

- There is significant uncertainty about incorporating the projections of climate change into risk assessment models, and isolating its influence from that of other factors like increasing population, insufficient capital, and land use changes.
- A major constraint is the dependent nature of risks in a region, particularly for slow-developing catastrophes like drought and rise in sea level. This is exacerbated by the problem of asymmetric information leading to moral hazard and adverse selection associated with traditional insurance.
- When weather trends change, including climatic variability and occurrence of extreme events, payouts will be made more frequently and hence re-insurers will charge premiums that may be too high for end users in developing countries.
- With two billion people living on less than US \$2 a day, making insurance coverage accessible to the poor in developing countries is a mighty challenge. New types of partnerships are needed when up-front premium payment is difficult.

4.3 Policy description: evolution of crop insurance in India

4.3.1 Traditional crop insurance schemes

A beginning in crop insurance was made in 1972 by implementing an experimental scheme for Hybrid-4 cotton in a few districts of Gujarat state. This scheme followed the individual approach and uniform guaranteed yield was offered to selected farmers. This scheme continued till 1979 and was phased out following the assessment that crop insurance schemes based on individual approach are not feasible and economically unviable to implement on a large scale in a large developing country like India.

CCIS (Comprehensive Crop Insurance Scheme) was introduced in 1985. It was based on an area approach, linked to short-term credit, and was implemented only in 19 States and three Union Territories. This scheme linked insurance with credit wherein the amount insured is equal to the crop loan disbursed, subject to a maximum of Rs 10 000 per farmer. The premium was fixed at two per cent of the sum insured for paddy, wheat, millets and one per cent for oilseeds and pulses. 50% of the premiums payable by the small and marginal farmers were subsidized.

Satpathy (2005) suggests that the CCIS failed in its basic objective of underwriting the farmer's losses. The scheme was criticized for

- being financially non-viable,
- predominantly covering rain-fed crops,
- excluding important commercial and horticultural crops,
- covering only loanee farmers, and
- having deficiencies in the system of crop-cutting experiments and assessment of yield.

Another major argument was that of the total all-India cumulative amount claimed, Gujarat alone received 48.8% for a single crop, groundnut. Table 4.1 shows the cross-subsidization across states and crops, which led to pressure from the states to rationalize the structure of premiums. As the premium of the scheme was not based on actuarial rates, low premium to claim ratio (19.3%) threatened the viability of the scheme. During the implementation of CCIS, from 1985/6 through to 1999, the total premiums collected were Rs 4028.3 million and the total claims paid, Rs 23 050 million with a sum insured of Rs 24 9218.7 million. Lastly, the scheme failed to make any significant impact as only a limited number of farmers were covered.

Due to these weaknesses, NAIS (National Agriculture Insurance Scheme) was introduced in the country from the *rabi* season of 1999–2000. This scheme is available to all states/union territories. It covers food crops, horticultural crops, oilseed crops, and commercial crops. All farmers, loanee and non-loanee, are eligible for insurance. All yield losses occurring due to natural, non-preventable risks are covered. Premium rates vary from 1.5% to 3.5% for food-grain crops and oilseed crops on actuarial basis for annual commercial/ horticultural crops. Small and marginal farmers will be entitled for a premium subsidy of 50%, which is to be phased out over five years. Initially implemented by GIC (General Insurance Corporation), a separate agency specializing in agriculture insurance (the Agriculture Insurance Corporation) was set up to take over all the crop insurance functions of GIC.

Table 4.1 Origin and destination of premiums and claims: 1985/86–1999

(a) By crop

Crop	Premium		Claims		Loss ratio
	Rs million	%	Rs million	%	
Paddy	2 175.20	54	5 762.60	25	2.65
Wheat	523.60	13	461.00	2	0.88
Groundnut	604.20	15	12 216.80	53	20.22
Jowar	362.50	9	1 844.00	8	5.08
Bajra	241.60	6	1 844.00	8	7.63
Pulses	4.02	1	23.05	1	5.73
Others	8.04	2	69.15	3	8.60

(b) By state

Crop	Premium		Claims		Loss ratio
	Rs million	%	Rs million	%	
Gujarat	644.5	16	13 369.3	58	20.74
Maharashtra	604.2	15	2 535.5	11	4.19
Andhra Pradesh	1 007.0	25	3 227.0	14	3.20
Others*	1 772.4	44	3 918.6	17	2.21

*Includes 22 states and union territories, excludes Punjab, Haryana, and north-east states

Source Mishra (1996) cited in Parchure (2003)

Table 4.2 Performance of NAIS

Season	Farmers covered	Area (in million hectare)	Sum Insured (Rs million)	Premium (Rs million)	Total claims (Rs in million)
Rabi 1999/20	579 940	0.72	3 564	54	77
Kharif 2000	8 409 374	13.22	69 034	2067	1 2225
Rabi 2000/01	2 091 733	3.11	16 027	278	595
Kharif 2001	8 695 735	12.89	75 025	2616	4933
Rabi 2001/02	1 955 431	3.15	14 975	301	647
Kharif 2002	9 768 711	15.53	94 317	3255	1 8218
Rabi 2002/03	2 326 660	4.04	18 375	385	1885
Kharif 2003	7 970 830	12.35	81 141	2833	6342
Rabi 2003/04	4 410 151	9.20	30 526	644	4901
Kharif 2004*	12 737 279	27.13	124 646	4392	99
Total	58 945 844	101.34	527 630	1 6825	4 9922

* Provisional

Source Gol (2005)

Thus, NAIS provides greater coverage than CCIS in terms of number of farmers (i.e. non-loanee farmers brought under coverage); crops (annual commercial/ horticultural crops included), and risk (i.e. up to the value of threshold yield). The premiums structure in the scheme has been rationalized to achieve some financial viability. The implementing States will now have greater stake in the financial liabilities. In other words, sharing of financial liabilities between the Central and State Government is 1 : 1 instead of 2 : 1. Farmers, under the new scheme, have the option of coverage of higher risk (in terms of sum insured) by paying a higher premium rate.

The main flaws of NAIS include its mandatory nature, its failure to address adverse selection by non-loanee farmers, arbitrary premiums, and the inefficiency of the area approach (Ifft 2001). Although NAIS premiums are higher than CCIS, they are still not enough to cover claims (Box 4.1). In the first year of operations, 2000, NAIS collected Rs 2110 million in premiums and paid Rs 11 000 million in claims. The figures for 2001/02 indicate total premium collections of Rs 2843.5 million and claims of Rs 5552.7 million. AIC (Agriculture Insurance Corporation) collected premiums of Rs 2.5 billion covering an area of 1.3 million hectares—a negligible fraction of cultivated land in India. Total claims were Rs 4.7 billion, resulting in a claims ratio of almost 200% in a normal year. In recent years, the coverage of NAIS in terms of farmers, crops, and risk commitments has been enlarged and premium structure rationalized. But actuarial rates for food and oilseeds crops are yet to be made applicable. In order to operate the scheme on commercial lines, it is necessary that actuarial rates should be charged.

CCIS and NAIS protect a farmer's income partially as they cover only production risks and have no mandate to cover market (price) risks. Therefore, FIIS (Farm Income Insurance Scheme) was launched on a pilot basis in 18 districts of 12 states during the *rabi* 2003/04 season to protect a farmer from both types of risks. The farmer's income would be protected by ensuring minimum guaranteed income. During the season, 180 000 farmers were covered over an area of 1 90 000 hectares. The sum insured was Rs 2390 million, with premium of Rs 141 million generated, and claims of Rs 15 million paid. The scheme was also implemented in selected districts of four States, on pilot project basis, during *kharif*³ 2004 season. During *kharif* 2004, a total of 222 000 farmers were covered over an area

³ There are two main cropping seasons in India: the *kharif* season is during the south-west monsoon (July-October), during which agricultural activities are undertaken in both rain-fed and irrigated areas, and the *rabi* season is during the winter months, during which agricultural activities are undertaken only in irrigated areas.

Box

Financial performance of traditional crop insurance in India

4.1

'Whether it was CCIS or NAIS, the performance of the crop insurance scheme in India can only be judged as disappointing on all counts; financial, economic and administrative. Financially, the scheme has been incurring continuous losses... On the economic front too the performance has been pitiable both in terms of the size of the impact of the scheme and equitability of premium collections and claim payments... On the equitability side too one can witness arbitrary cross subsidization... Some crops and regions pay the premiums, others make the claims... Finally the administrative front. A more complex administrative mechanism for a scheme of so small a financial dimensionality might not have existed in economic history, even in the former Soviet Union.

From 1985/86 through 1999 the total premiums collected were Rs 4020 million (US \$80 million) and the total claims paid Rs 23 050 million (US\$ 461 million) with a sum insured of Rs 249.2 billion (US\$ 5 billion). The loss ratio excluding huge management expenses stands at 5.72. From an economic point of view average per annum claims paid were Rs 2330 million, which if compared to the sum-at-risk, that is the agricultural output of the country worth Rs 6500 billion, is hardly 0.035% and when compared to the total farm loans of Rs 580 billion is only 0.40%.'

Source Parchure (2003)

of 202 000 ha. Premium amounting to Rs 156.8 million was generated against a sum insured of Rs 1775.6 million. Currently, the scheme covers only two crops – wheat and paddy – from which NAIS has been withdrawn. Gradually, the scheme would be expanded to cover all crops by eventually replacing NAIS.

The Task Force on Agriculture, 2001, concluded that all crop insurance schemes in India have failed with payouts being 4–5 times the premium collected. In the last two years, however, the government, through IRDA, has allowed insurance companies to sell index-based weather risk insurance contracts as an alternative to traditional crop insurance⁴. The enabling environment for this was provided by the liberalization of the Indian insurance sector. The evolution of the crop sector in India is depicted in Figure 4.1.

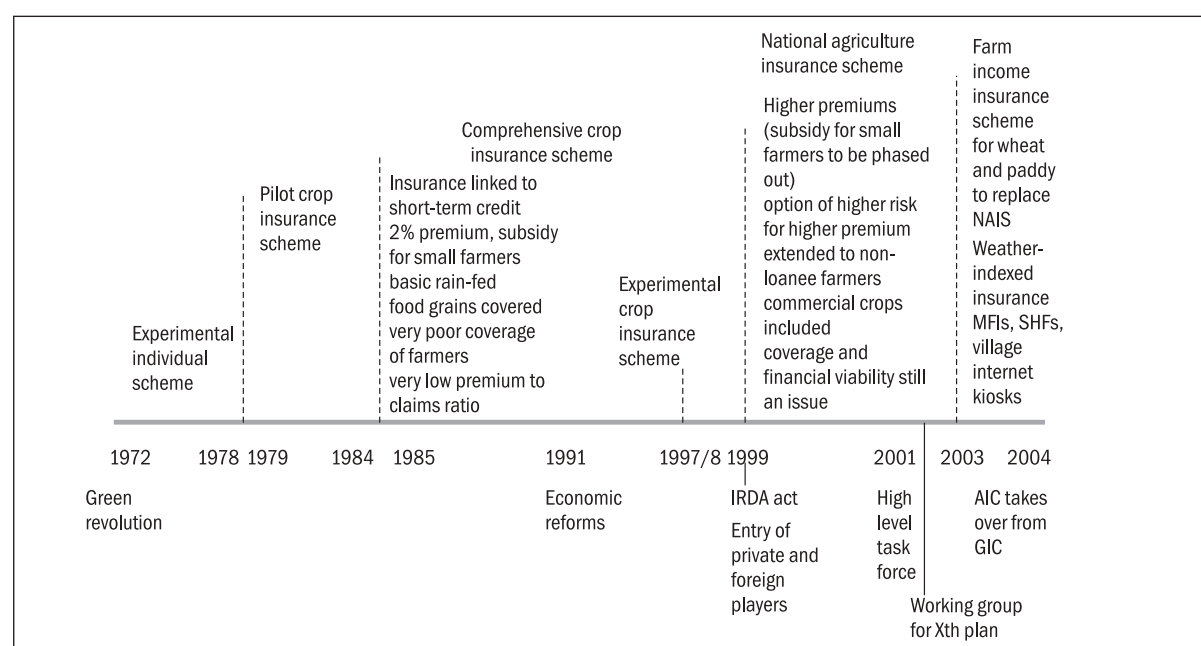


Figure 4.1 Evolution of crop insurance in India

⁴ This has happened with the ongoing trend of liberalization of the insurance sector and the entry of foreign companies.

4.3.2 Liberalization of insurance sector

Before deregulation, the Indian insurance industry was characterized by undifferentiated products, fixed premiums set by the Tariff Advisory Committee, and low coverage rates in nearly all business lines. Public monopolies thrived in the absence of competition. IRDA Act 1999 lifted the ban on private players and opened the industry to foreign players in a limited manner. Key international players have entered into partnerships with Indian counterparts (such as ICICI-Lombard, HDFC-Chubb, IFFCO-Tokio, Bajaj-Allianz, and Birla-Sun Life), and are competing to increase their share of the Indian market at the expense of the government-run monopolies – GIC and Life Insurance Corporation. The entry of the private sector has metamorphosed the way the industry functions and this has been critical in improving the penetration levels of insurance⁵. Today, companies have innovated with their product offerings and how it reaches the end user. Taking cue from the limitations of traditional crop insurance, private insurance companies have modified their offerings considerably by way of weather-indexed contracts. Potentially not just agriculture, but a number of industries like airlines, beverages, refrigeration, and tourism could benefit from such contracts, and this represents a huge market.

Another reason for the focus on agriculture is that as per IRDA regulations, all insurers are required to provide some coverage for the rural sector. In addition, each company is obligated to service the social sector, which includes the unorganized sector, the informal sector, and the economically vulnerable or backward classes in rural and urban areas.

4.3.3 Weather-indexed contracts

In index-based weather insurance, an index based on past weather patterns is created. Internationally, index-based weather risk insurance contracts in agriculture have emerged as an alternative to traditional crop insurance. These are linked to the underlying weather risk defined as an index based on historical data (for example, for rainfall, temperature, snow, etc.) rather than the extent of loss (for example, crop yield loss). As the index is objectively measured and is the same for all farmers, the problem of adverse selection is minimized, the need to draw up and monitor individual contracts is avoided, and the administration costs are reduced. Weather-indexed insurance can help farmers protect their overall income rather than the yield of a specific crop, improve their risk profile enhancing access to bank credit, and hence reduce overall vulnerability to climate variability and change. However the disadvantage is that because of the way the index is defined, there can be a mismatch between payoffs and actual farmer losses (CRM 2005, Hess 2003).

Various types of delivery models can be tried out: directly providing insurance to farmers, linking with finance (banks, cooperatives, MFIs [microfinance institutions]), and linking with others in the marketing chain (for example, input suppliers). Unlike traditional crop insurance where claim settlement can take up to a year, quick payouts in private weather insurance contracts can improve recovery times and thus enhance coping capacity.

Various pilot schemes and delivery models being explored in India are discussed next.

4.3.3.1 ICICI Lombard pilot scheme for groundnut in Andhra Pradesh

ICICI Lombard General Insurance Company, with support from the World Bank and International Finance Corporation, conceptualized and launched a pilot rainfall insurance scheme in Mahabubnagar, Andhra Pradesh in July 2003. The district had previously experienced three consecutive droughts. The scheme was implemented through the KBS (Krishi Bima Samruddhi) local area bank of BASIX, one of India's largest MFIs. KBS Bank bought a bulk insurance policy from ICICI Lombard and sold around 250 individual policies to groundnut and castor farmers. The index capped rainfall per sub-period at 200 mm, and weighted critical periods for plant growth more heavily than others. The premium rates are defined in Table 4.3. KSB decided that only borrowing farmers can buy

⁵ Both insurance penetration (premium as percentage of GDP) and insurance density (premium per capita) in the country has shown an increasing trend. Even though it is low by international standards, it is growing at rates faster than GDP.

weather insurance policies. Eventually KSB planned to lower the interest rate for these farmers due to the reduced default risk (Hess 2002).

ICICI Lombard also launched a pilot scheme for insurance against excess rainfall for rice farmers in Aligarh, Uttar Pradesh.

4.3.3.2 KBS pilot scheme for soya farmers in Ujjain

BASIX/KBS also designed policies for soya farmers in Ujjain, Madhya Pradesh, which linked insurance to bank loans. In normal conditions, soya farmers taking crop loans of Rs 2000, with embedded weather insurance, would be charged an interest rate of 20.5% instead of 17.5%. However, when cumulative weighted rainfall during the critical growing periods falls below 80% of the mean, farmers receive interest payment relief of Rs 10 per mm of rainfall index deficit. Thus farmers pay a higher interest rate in normal years as the weather insurance premium, but receive much-needed relief in drought years (Hess 2003).

4.3.3.3 Rajasthan government insurance for orange crop

ICICI Lombard General Insurance Company entered into a collaboration with the government of Rajasthan in June 2004 to provide rainfall-indexed insurance for orange growers in Jhalawar district and adjoining areas. The scheme covered two types of perils with premiums as defined in Table 4.4.

The policy was made available through branches of the Land Development Bank and Jhalawar Cooperative Bank, rural branches of Commercial Banks in Jhalawar, Jan Mitra kiosks, and direct sales agents of ICICI Lombard. Claim settlement was to be done within 30 days of the expiry of the cover period. The government of Rajasthan has also asked interested insurance companies to send proposals for similar schemes for oranges, cumin, coriander, and other crops (GoR 2005).

4.3.3.4 IFFCO-TOKIO monsoon insurance

In July 2004, IFFCO-TOKIO General Insurance Company Ltd (the Indian insurance arm of the Millea Group) announced its plans to launch an insurance scheme for deficit rainfall during the monsoon months. Named Barish Bima Yojana, the scheme was targeted at four states – Gujarat, Maharashtra, Andhra Pradesh, and Karnataka.

Table 4.3 Premium rates (in Rs) for groundnut farmers in Mahabubnagar pilot scheme

Landholding size	Premium rate	Maximum claim
Small (less than 2 acres)	400	14 000
Medium (2 to 5 acres)	600	20 000
Large (more than 5 acres)	900	30 000

Table 4.4 Premium (in Rs) for units of Rs 5000 insured for two types of perils

Type of peril	Premium	Premium at 50% discount to small and marginal farmers
1 Lack of effective shower to initiate flowering	830	415
2 Dry spell during flowering	630	315

4.3.3.5 AIC Varsha Bima Yojana (rainfall insurance scheme)

This provides for compensation for deficit rainfall. It was launched across 10 states in about 140 rain gauge stations of the India Meteorological Department. Premium rates have been optimized between four per cent and 6 per cent by adjusting the benefits. The sum insured ranges between the cost of production and the value of production. Farmers can buy insurance till the onset of the monsoon for (i) sowing failure and (ii) seasonal rainfall insurance/rainfall distribution index.

4.3.3.6 AIC Sookha Suraksha Kavach (drought protection shield)

This is an exclusive insurance product for the state of Rajasthan and provides compensation for deficit rainfall. It was launched in 23 districts and covers all major crops like sorghum, pearl millet, maize, groundnut, soyabean, and cluster bean. Premium rates have been optimized between five per cent and eight per cent by adjusting the benefits. The sum insured again ranges between the cost of production and the value of production, and farmers can buy insurance till the onset of the monsoon.

4.3.3.7 AIC coffee rainfall index and area yield insurance

This scheme was piloted in three major coffee growing districts of Karnataka state, and blends rainfall index and yield parameters. Nearly two-thirds of the payout is decided on the basis of rainfall during the critical stages of coffee crop growth and the residual risk on the basis of coffee yield at harvest time. Premium rates are flexible, with coffee growers allowed to choose benefits on the basis of their premium affordability. AIC announced that it was likely to introduce short period covers insuring coffee against deficit rainfall during 'blossom showers' and 'backing showers' the following year.

4.3.3.8 ICICI Lombard loan portfolio insurance

The World Bank's Commodity Risk Management group tied up with ICICI Lombard to develop weather-based loan portfolio insurance in India. In July 2004, the first weather insurance policy was offered to BSFL (Bharatiya Samraddhi Finance Ltd), the non-banking finance arm of the BASIX group. ICICI Lombard would compensate BSFL for deviations in rainfall below the threshold level, which is fixed as a percentage of the average rainfall in the area. This is the first instance of an agricultural finance institution transferring the systematic risk of its crop-lending portfolio to the international weather risk market.

4.3.3.9 Results update

Through personal communication with ICICI Lombard, it was learnt that the company made profits in two ventures – insurance of rice crop against excess rainfall in Aligarh and insurance of oranges in Rajasthan. However it did not make a profit in insurance of groundnut crop against deficit rain in Mahabubnagar, which was implemented by BASIX. The basic problem was that of high administration costs of selling the insurance to individual farmers. ICICI Lombard found it uneconomical to seek out each farmer, but would instead prefer to sell insurance cover to state governments.

The pilot experience, however, was valuable to better understand risk patterns and the potential for commercial expansion. It was also an opportunity to create awareness among farmers, build trust through timely payouts, and improve the product design in response to customer feedback (Box 4.2). In 2005, the pilot schemes were scaled up by BASIX to reach 6703 farmers in six states, with insured amount of Rs 20 406 000. The premium was not subsidized. As reported in Manuamorn (2005), ICICI Lombard sees a strong profitability potential and expects that 'the weather insurance business, if under-written properly, is at least as attractive a business proposition as other lines of general insurance'.

The BASIX website provided the following data about the performance of its claims service (Table 4.5).

AIC could draw on its established network to sell insurance to more than 125 000 farmers growing crops over 98 000 hectares, covering a risk of approximately Rs 560 million, earning a premium of Rs 32 million (Table 4.6). Claims were processed in a month from the close of indemnity period. Compensation of Rs 1.2 million was paid to nearly 300 farmers in two stations in Uttar Pradesh.

Table 4.5 Rainfall insurance business and claims service performance

	<i>April 2004 – December 2004</i>	<i>April 2003 – March 2004</i>
Customers	427	300
Area insured (acres)	670	450
Premium (Rs)	150 000	100 000
Average sum insured (Rs)	6000	
Claims reported	305	
Claims settled	305	
Settled amount (Rs)	450 000	

Source BASIX (2005), Manuamorn (2005)

Table 4.6 Sale performance of Varsha Bima – 2005

Option	<i>Sowing failure</i>	<i>Seasonal rainfall insurance/ distribution index</i>
Cultivators insured	17 476.00	107 977.00
Area insured (hectares)	19 945.00	77 693.00
Risk value insured (Rs million)	37.53	520.86
Premium (Rs million)	3.41	28.32

Source Manuamorn (2005)

Box

Farmer response to weather indexed insurance

4.2

Informal interviews with farmers who bought the policies revealed that they are very aware of the rainfall-based index nature of the contracts and the associated risks. They also understand the two-step payout structure, that the liability limit is a theoretical number, and that historical maximum payouts are around Rs 3025 and would have occurred in 2002 and 1997. Thus the premium rate at that level is around 15%. Nevertheless, the farmers seem to value the quick payout of the rainfall policy, which distinguishes it from the existing crop insurance policy in India, where claims take at least one year to settle. Farmers also said they understand and appreciate the structure of the insurance policy as it directly reflects their experience that the distribution of rain throughout the season matters a lot for the yield.

Source World Bank (2003b)

In securing access to the large rural population in the country, MFIs consequently have an important role to play by identifying end users, understanding their requirements, and employing appropriate methods to extend the products being designed by insurance companies (Sattiah and Gunaranjan 2005).

4.4 Adaptive policy analysis

In this section we analyse the weather-indexed insurance policy in terms of its ability to adapt to anticipated and unanticipated conditions.

4.4.1 Ability to adapt to a range of anticipated conditions

Insurance can be a powerful tool for reducing vulnerability to climate change by transferring or sharing risk, particularly with recent initiatives like weather derivatives and micro-insurance. By design, crop insurance can help farmers deal with a range of weather conditions. By the same measure, weather-indexed insurance is more effective than traditional crop insurance, as it protects the farmer's overall income rather than the yield of a specific crop. Moreover, traditional crop insurance fails to provide the right incentives to farmers, as crops yields are insured irrespective of efforts, while both moral hazard and claims manipulation are eliminated in objectively-measured weather-indexed contracts.

More important, however, is the difference in the implementation of the two approaches. The way contracts are drawn up and losses are assessed in traditional crop insurance leads to high administrative costs and consequently long delays (of up to a year) in making claim settlements. This tends to benefit large and commercial farmers who can afford to wait, and defeats the purpose of insuring small and marginal farmers who remain indebted. Subsidized premiums, coupled with massive relief transfers demanded by the states from the centre, failed to provide the right signals for risk mitigation to insured farmers. Despite experimenting with different schemes over three decades, public crop insurance policy in India has failed in terms of coverage of farmers and financial sustainability, and is hence not adaptive.

On the other hand, new weather-indexed insurance schemes are able to function effectively under a range of anticipated conditions due to the following two mechanisms.

- Quick payouts in private weather insurance contracts
- Triggering of payouts by independently monitored weather indices and not farm loss sampling

Together, the above two mechanisms can improve recovery times and thus enhance coping capacity. Figure 4.2 shows the results of a pilot scheme implemented in Morocco, where rainfall-indexed insurance protected the revenues of wheat farmers in rainfall deficit years. The difference for the year 1995 stands out, but revenues with insurance do not fall below 3000 in any year, assuring farmers of a basic consumption level. Although the experience informing their implementation is limited, the pilot schemes launched by ICICI Lombard and BASIX were scaled up in 2005 to reach 6703 farmers in six states, with a sum insured of Rs 20 406 000. Premiums were not subsidized, and farmers were reported to be satisfied with the transparent nature of index instruments and timely payouts. ICICI Lombard sees a strong profitability potential in such initiatives and expects that 'the weather insurance business, if underwritten properly, is at least as attractive a business proposition as other lines of general insurance' (Manuamorn 2005).

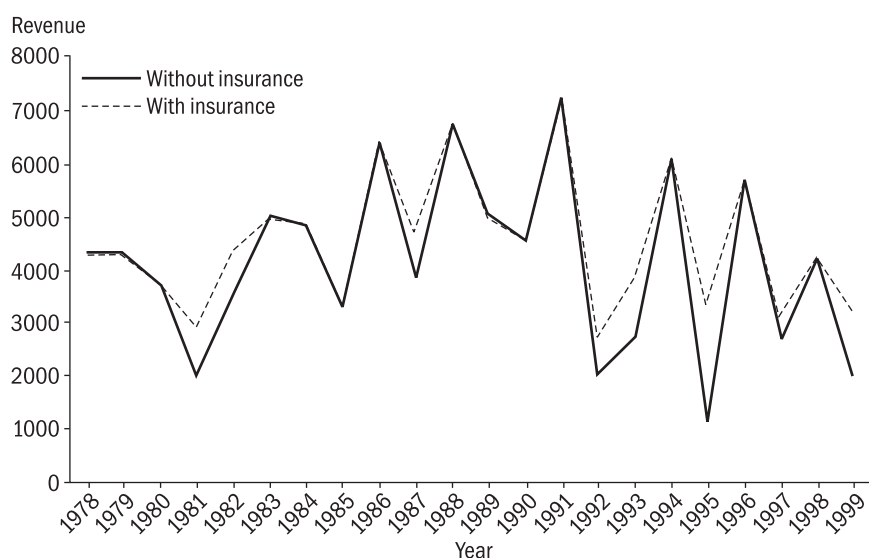


Figure 4.2 Wheat revenues with and without rainfall insurance (index threshold 275 mm)

Source Hess (2003)

4.4.2 Ability to adapt to unanticipated conditions

4.4.2.1 Built-in mechanisms for learning and improvement

One of the features of an adaptive policy is that it is open to review and modification by built-in formal mechanisms. As the previous sections have shown, the crop insurance policy of the Indian government has been constantly evolving and each successive scheme has tried to improve upon the previous one. In 2000, a High Level Task Force on agriculture was set up, whose terms of reference included making recommendations for effective risk management in agriculture including in production systems, insurance, price mechanisms, and future trading. Again the Working Group for the formulation of the Tenth Five Year Plan (2002–2007) on Agricultural Credit, Cooperation, and Crop Insurance was meant to review the present status of the NAIS and suggest measures for making the scheme more cost effective and beneficial to the farming community. However, given the backdrop of policy failure against which these reviews were carried out, this cannot be seen as a measure of adaptability. The broader policy environment fostered learning and change as a result of the liberalization of the insurance industry, which allowed private players to enter and compete with innovative products for untapped markets.

4.4.2.2 Learning from pilot schemes

Weather-indexed insurance was implemented on a pilot basis for various crops and locations by trying out different types of delivery models. The use of pilots has been suggested as a feature of an adaptive, learning-oriented policy system. ICICI Lombard and BASIX have reported that this pilot experience was valuable to better understand risk patterns and the potential for commercial expansion. It was also an opportunity to create awareness among farmers, build trust through timely payouts, and improve the product design in response to customer feedback. Moreover, the early pilot schemes offered by the private sector were followed by the entry of the public sector AIC into this market. In fact, in 2005, AIC with its established country-wide network, was able to offer weather insurance in 125 locations in 10 states. It sold insurance to more than 125 000 farmers growing crops over 98 000 hectares, covering a risk of approximately Rs 560 million, earning a premium of Rs 32 million. Claims were processed in a month from the close of indemnity period. Compensation of Rs 1.2 million was reportedly paid to nearly 300 farmers in two stations in Uttar Pradesh.

4.4.2.3 Learning from engagement of local institutions

Another element of adaptability in the implementation of weather-indexed insurance stems from the engagement of local MFIs that have already established a presence and working relationships with agricultural communities. The experiences of MFIs in delivering insurance to the rural poor have revealed the critical importance of product design, communication, and marketing approach. Self-help groups and e-choupals (village internet kiosks) have been innovatively used to create awareness about and trust in insurance, along with providing information about prices, cropping practices and products, and providing loans or agricultural input.

4.4.2.4 Degree of self-adjustment to unanticipated circumstances

However, if we consider adaptability as the ability to respond to unanticipated circumstances, then there is a question mark on weather-indexed insurance. The use of climatic history as a benchmark will automatically clash with increasing climatic variability and occurrence of extreme events. Payouts will be triggered more frequently and hence re-insurers will charge premiums that may be too high for end users in developing countries. However, the objective indexing of insurance rates to climate trends by using rolling averages is a simple and transparent mechanism that can capture changing risks and allow a farmer to recognize signals (in the form of actuarially determined premiums) and adapt accordingly.⁶

⁶ Anticipatory adaptation rather than recovery.

Table 4.6 summarizes the above discussion by identifying features of adaptive policies in traditional and weather-indexed crop insurance.

Table 4.6 Elements of adaptive policies in traditional crop insurance and weather-indexed insurance

	<i>Ability to adapt to anticipated conditions</i>		<i>Ability to adapt to unanticipated conditions</i>	
	<i>Design</i>	<i>Implementation</i>	<i>Design</i>	<i>Implementation</i>
Traditional crop insurance	<p>Low</p> <ul style="list-style-type: none"> Can help farmers deal with a range of weather conditions but fails to provide the right incentives as yields are insured irrespective of efforts 	<p>Low</p> <ul style="list-style-type: none"> High administrative costs and long delays in claim settlements Failed in terms of coverage of farmers and financial sustainability 	<p>Low</p> <ul style="list-style-type: none"> Poor understanding of interaction with natural, built, or social environments 	<p>Low</p> <ul style="list-style-type: none"> No formal or informal mechanisms for learning and adjustment
Weather-indexed crop insurance	<p>High</p> <ul style="list-style-type: none"> Protects the farmer's overall income rather than the yield of a specific crop Moral hazard and claims manipulation eliminated by use of objectively calculated index 	<p>High</p> <ul style="list-style-type: none"> Quick payouts triggered by independently monitored weather indices can improve recovery times and enhance coping capacity 	<p>High</p> <ul style="list-style-type: none"> Use of rolling means to calculate precipitation thresholds allows for automatic response to unpredictable climate change while maintaining simplicity and transparency 	<p>High</p> <ul style="list-style-type: none"> Implemented on a pilot basis by trying out different types of delivery models - formal process of monitoring, learning and improvement Feedback from engagement of local institutions like MFIs

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CHAPTER

5

Adaptive policy case study: agriculture price policy in India

- 5.1 Introduction
 - 5.1.1 MSP and procurement prices
 - 5.1.2 Zonal restriction
- 5.2 Policy description: changes, drivers, and impacts
- 5.3 Adaptive policy analysis
- 5.4 Lessons learned

Adaptive policy case study: agricultural price policy in India

Sudip Mitra¹ and Jagjeet Singh Sareen¹

5.1 Introduction

Post-Independence, while Indian agriculture has struggled, it achieved a lot as well. Today, the objective of achieving food security has been combined with environment sustainability. With present-day concerns of changing climate, it has become all the more important to have policies, which not only secure the food supply, but also preserve our environment and natural resources.

This paper draws on various secondary information (published either in print or on the Internet, personal communications etc.) as well as informal consultations with agricultural experts in India on the issue of APP (Agricultural Pricing Policy). It analyses some specific policy instruments under APP from an adaptive policy perspective.

The objective of the Government's price policy for agricultural produce is to set remunerative prices with a view to encourage higher investment and production. Theoretically, APP accounts for various economic factors, such as the rate and quality of economic growth, in identifying and promoting the optimal crop mix. This, consequently, ensured appropriate allocation of resources in the agriculture sector, capital formation, and inter-sectoral terms of trade.

APP includes the following instruments.

- MSP (minimum support price)
- Procurement prices
- Public distribution system
- Zonal restrictions

5.1.1 MSP and procurement prices

The price support policy was initiated by the Government to provide protection to agricultural producers against any sharp drop in farm prices. If there is a good harvest and market prices tend to dip, the government guarantees an MSP or floor price to farmers, which covers not only the cost of production, but also ensures a reasonable profit margin for the producers. MSP is announced each year and is fixed after taking into account the recommendations of the CACP (Commission for Agricultural Costs and Prices). Procurement prices are the prices of *kharif* and *rabi* cereals at which the grain is to be domestically procured by public agencies (for example, FCI [Food Corporation of India]) for release

¹ The Energy and Resources Institute, India [Valuable input provided by Suruchi Bhadwal is gratefully acknowledged.]

through PDS (public distribution services). Normally, the procurement price is lower than the open market price and higher than MSP.

In the case of paddy, these two official prices were being announced with small year-to-year variations till 1973/74. However, in case of wheat this system was discontinued in 1969 and then started again in 1974/75 for one year only. Due to lack of demands for increasing the MSP, in 1975/76, the present system was evolved in which only one set of prices was announced for paddy and other *kharif* crops. Wheat was procured for buffer stock operations.

PDS consists of a network of 350 000 fair-price shops that are monitored by state governments. Supplying basic food commodities through PDS not only serves the purpose of reaching the needy, it also acts as a control for general consumer prices. FCI is the sole repository of food grains reserved for PDS. The Corporation has functioned effectively in providing price support to farmers through its procurement scheme and in keeping a check on large price increases by providing food grains through PDS.

FCI was established in 1965 as the public-sector marketing agency responsible for implementing government price policy through procurement and public distribution operations. It was intended to secure for the government a strong position in the food-grain trade. By 1979 the corporation was operating in all states as the sole agent of the central government in food-grain procurement. FCI operates through a countrywide network with its Corporate Office in New Delhi, five Zonal Offices, 23 Regional Offices practically in all the State capitals, 168 District Offices (as on 1 January 2006) and 1452 depots (as on 1 January 2006).

5.1.2 Zonal restriction

In conditions of scarcity, a state can call for restrictions on the inter-state movement of food grains. In case of surpluses and in the presence of an effective buffer stock of food grains, these restrictions may, as and when warranted by the situation, be gradually relaxed. Steps in this direction were taken during 1968 when a bigger northern food zone was constituted and the movement of gram and barley was made free throughout the country. Movement restrictions on maize, *bajra*, and *jowar* were also lifted from Punjab, Haryana, and Rajasthan. Restrictions were further relaxed in 1969 when the Northern Wheat Zone was enlarged so as to cover practically the whole of North India.

In this chapter, the MSP instrument of the APP is discussed from an adaptive policy perspective. As MSP is closely linked with another APP instrument – procurement prices – comparisons between these two are inevitable.

5.2 Policy description: changes, drivers, and impacts

Thomas Malthus (1766–1834) argued that the number of people would increase faster than the food supply. Population would eventually reach a resource limit (overpopulation). Any further increase would result in a population crash, caused by famine, disease, or war.

The arrival of the Green Revolution in India proved otherwise. The area under food grains increased from 101 million ha in 1950/51 to 128 million ha in 1990/91; expansion of irrigated area increased from 20.9 million ha in 1950/51 to 50.2 million ha in 1995; and availability of short duration, high yielding varieties increased as well. Widespread promotion of Green Revolution technologies during the 1960s increased agricultural yields in India for some crops by introducing high-yielding varieties that depended on input such as irrigation, chemical fertilizers, and pesticides (Goldman and Smith 1995).

The Government introduced tremendous agrarian reforms, made institutional changes, and encouraged the development of major irrigation projects. Furthermore, aggressive food-grain marketing in India began in a big way in the mid 1960s (Chand 2003a; Figure 5.1). This was meant to create a favourable, incentive-driven environment for the adoption of this new technology based on HYV (high-yielding varieties) of wheat and rice. India was then facing severe food shortage and mass hunger. The new technology provided a ray of hope to tackle the problem of food shortage and hunger.

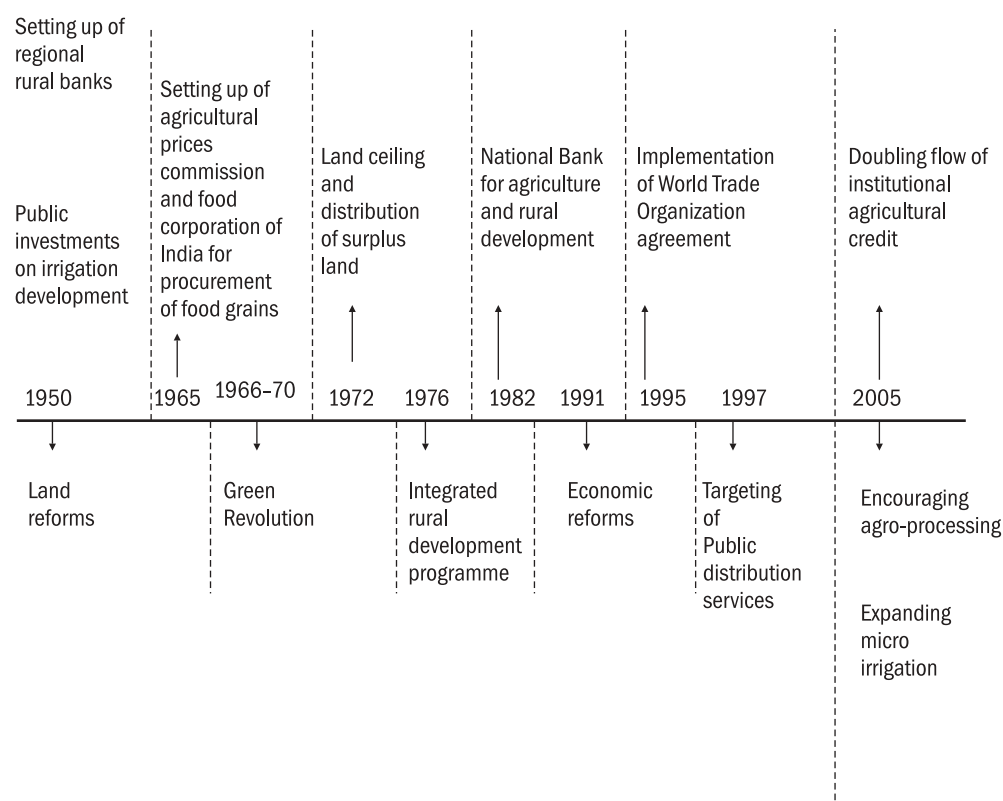


Figure 5.1 Evolution of agricultural pricing policy in India

Adoption of the new technology involved the use of non-conventional input and investments on the part of the farmers. This made it necessary to create a stable and profitable environment for farmers adopting the new seeds. At the same time, it was to be ensured that an increase in production benefited the consumers. The rationale of the twin policy of minimum support and procurement prices is easily understandable. The Green Revolution necessitated a stepping up of per hectare outlay but this was compensated by a much larger output of grain from each hectare of land. Larger output results in the lowering of market price. To protect enterprising farmers from possible loss, MSP was introduced. At the same time, should production be far below than expected, be it due to poor rainfall or any other reasons, market prices are bound to rise. In such an event, procurement price helps consumers access the necessary food grains through a PDS. Government supplies irrigation water, input like fertilizers and HYV seeds at a price lower than the cost of production. Even for the part of the output that would be claimed by the government in the form of procurement, the farmers would be offered a remunerative price which would be higher than its MSP but less than the current market price.

The Agricultural Prices Commission was set up in January 1965 (Figure 5.1) to advise the government on price policy of major agricultural commodities. The objective was to give due regard to the interests of the producer and the consumer, while keeping in perspective the overall needs of the economy. Since March 1985, the Commission has been known as CACP.

The Commission consists of a Chairman, a Member Secretary, two official members, and three non-official members. The non-official members are representatives of the farming community. They are usually persons with considerable field experience and an active association with the farming community.

5.3 Adaptive policy analysis

The MSP instrument of APP exhibited several features reminiscent of adaptive policies and policy-making. One of the most prominent is CACP. MSPs for major agricultural products are announced each year after taking into account the recommendations of CACP. CACP takes into account all important factors (Table 5.1) including cost of production, changes in input prices, input/output price parity,

Table 5.1 Adaptive policy elements in determination of MSP

Factors related to changes in anticipated conditions	<i>Factors related to changes in unanticipated conditions</i>
Cost of production It is the most tangible factor and takes into account all operational and fixed demands.	Demand and supply situation A good analysis of the demand and supply situation allows for adjustments under unanticipated conditions and enables handling uncertainties in the market and production systems.
Changes in input prices It has the ability to address an anticipated change in input price.	
Input/output price parity It considers some anticipated uncertainties in the prices and thus facilitates adjustment.	Effect on industrial cost structure This could address unanticipated conditions and long-term changes.
Trends in market prices, international market price situation, inter-crop price parity, effect on general price level It keeps track on the changes in the market and accordingly influences the delivery decision of the policy.	Effect on cost of living It has a potential to address unanticipated conditions in the future, which might be controlled by a group of factors.
Parity between prices paid and prices received by farmers (terms of trade) This anticipates a potential disparity and organizes this mechanism to address that.	

trends in market prices, inter-crop price parity, demand and supply situation, parity between prices paid and prices received by farmers, etc. Among these factors, the cost of production is the most significant one. A meaningful support price policy should have minimum guaranteed prices, which would cover at least the reasonable cost of production in a normal agricultural season obtained from efficient farming. CACP carries out state-specific analyses for the cost of production in respect of various commodities. This is done through consultations with the state governments. After a meeting of the state Chief Ministers, the MSP/procurement prices are declared. Cost of production for the same crops varies between regions, across farms within the same region, and for different producers. This makes it difficult to have a norm for the level of costs.

In fixing the support prices, CACP relies on the cost concept, which covers all items of expenses of cultivation including the imputed value of input owned by farmers such as rental value of owned land and interest on fixed capital. Some of the important cost concepts used by CACP are the C2 and C3 costs.

C2 cost includes all actual expenses, in cash and kind, incurred during production by the actual owner, plus rent paid for leased land, plus imputed value of family labour plus interest on value of owned capital assets (excluding land), plus rental value of owned land (net of land revenue).

C3 cost is defined as the C2 cost plus 10% of C2 cost, to account for managerial remuneration to the farmer. Costs of production are calculated both, on a per quintal and per hectare basis. Since cost variations are large over states, CACP recommends that MSP should be considered on the basis of C2 cost. However, increases in MSP have been so substantial in case of paddy and wheat that in most of the states MSPs are far greater than not only the C2 cost but the C3 cost as well.

The regional segmentation of the markets resulted in a large gap between the cost of production and the MSP. Market prices were often lower than MSPs, which led to the unabated build-up of food-grain stocks with FCI. The excess stocks, which were much higher than the actual buffer requirement, led to a significant increase in the cost of carrying and also food subsidy. The Government reviewed this situation in considerable detail, ultimately resulting in modest price increases in the past five

years for the *kharif* and *rabi* crops. It is believed that the Government's policy of not hiking the MSP of principal cereals is likely to encourage crop diversification in an indirect way.

Over the last 10 years (Table 5.2) large increases have taken place in the MSPs of paddy and wheat, creating large gaps between the cost of production and MSPs. This has led to the regional segmentation of the markets. Market prices were often lower than MSPs, which led to the unabated build-up of food-grain stocks with the FCI. The excess stocks, which were much higher than the actual buffer requirement, led to the significant increase in the cost of carrying and also food subsidy.

The Government reviewed this situation in considerable detail, ultimately resulting in modest price increases in the past five years for the *kharif* and *rabi* crops. It is believed that the Government's policy of not hiking the MSP of principal cereals is likely to encourage crop diversification in an indirect way.

25 agricultural commodities are currently covered under the mandate given to CACP for advising the government with regard to the price policy. CACP follows a definite process to arrive at recommendations regarding MSPs. The sequence of the process is as below.

- 1 The Commission identifies the main issues of relevance for the ensuing season (short, medium, or long turn).
- 2 The Commission sends a questionnaire to Central Ministries, State Governments, and other organizations related to trade, industry, processors, and farmers, both in the cooperative and the private sector. Furthermore, it seeks their views on certain issues and factual information on related variables.
- 3 The Commission holds separate discussions with the State Governments, Central Ministries/ Departments, and other organizations. The Commission also interacts with research and academic institutions and keeps track of relevant studies and their findings.
- 4 The Commission visits certain areas to make on-the-spot observations and obtain feedback from local-level organizations and farmers.

While India's food-grain policy provided clear benefits to farmers investing in the Green Revolution production package, it also contributed towards the increase of staple grains, thus enhancing the adaptive capacity of poor farmers. On the other hand, it also led to a number of side effects (increased

Table 5.2 Minimum support /procurement price of wheat and paddy

							Rs/quintal
Crop year	Wheat		Paddy		Fine	Super fine	Grade 'A'
	MSP	Per cent change	Common	Per cent change			
1994/95	360	2.9	340	9.7	360	380	—
1995/96	380	5.6	360	5.9	375	395	—
1996/97	475	25.0	380	5.6	395	415	—
1997/98	510	7.4	415	9.2	—	—	455
1998/99	550	7.8	440	6.0	—	—	470
1999/2000	580	5.5	490	11.4	—	—	520
2000/01	610	5.2	510	4.1	—	—	540
2001/02	620	1.6	530	3.9	—	—	560
2002/03	620\$	—	530\$	—	—	—	560\$
2003/04	630	1.6	550	3.8	—	—	580
2004/05	640	1.6	560	1.8	—	—	590
2005/06	—	—	—	—	—	—	600

* Effective 1997–98, MSP is fixed for two varieties of paddy, common and Grade A.

\$ One time special drought relief of Rs 20/- per quintal for rice and Rs 10 per quintal for wheat was given over and above the MSP.

Source MoF (2005)

water and energy demand, environmental degradation, mono cropping, etc.), which, in the long term, posed a threat to Indian agriculture, increasing of the number of uncertainties faced by poor farmers.

There should not be one agricultural produce price policy for the whole country but different policies based on the ecological needs and situation of the area, say experts. Where subsidies are concerned, the pricing policies for fertilizers, water, and power should have a long-term sustainability dimension. It should not be based on immediate socio-economic, technological, and political concerns (Deshpande and Raveendra 2002). A more pertinent problem relates to the effectiveness of the implementation of an MSP policy. The context of price policy has changed substantially over the years, as has its direction and effectiveness as a tool to influence the agricultural economy. In the wake of liberalization, MSP assumes a significant role in the form of state intervention in the agricultural product market as well as a component of a safeguard measure. Therefore, it becomes necessary to see the effectiveness of MSP as a tool to encourage the adoption of technology in the present context, capital formation, as well as to ascertain and document the producers' responses to this scheme of price intervention at the micro level.

5.4 Lessons learned

CACP was set up and it was assigned the task of announcing the minimum support and procurement prices for the main agricultural crops, including food grains. CACP recommendations on MSPs are based on a well-defined process (discussed earlier) considering a variety of important factors. CACP's consultation process with the stakeholders increases the chance of the success of the MSP policy. Thus CACP strengthens the adaptive nature of the MSP policy.

With the advent of the new agricultural strategy, relatively greater outlay of resources was required on the part of the farmers. Farmers with bigger-sized holdings were fortunate enough to reap the advantage of the agricultural strategy. The success of the new agricultural strategy has led to excess food-grain production, which in turn expedites the fall of food-grain price, which in some cases, even fell below the level of the procurement price. It is unfortunate that in such a situation instead of purchasing the grains at MSP, the government opted to buy grains at procurement prices that were higher than the market price as well as the MSP. This led to the subsidized price of the publicly distributed grains.

With the advent of the World Trade Organization, the policy of subsidizing publicly distributed grains took a backseat. As an outcome of that, we have arrived at the present scenario, where the government has a food grains stock of 40 million tonnes. The storage cost of maintaining these stocks is at least Rs 5000 crore per annum, while the off take from the public distribution system is hardly 10% to 15% of the total stocks. Consumers cannot afford the price at which grains are being sold through the PDS and subsidy is out.

MSP has been highly favourable to rice and wheat production and has resulted in the shift of good quality land and resources to these crops, away from pulses, oilseeds, and coarse grains. Lack of crop diversification and heavy dependence on a few major cereal varieties has led to a significant loss in crop biodiversity. Inadequate extension and training, inefficient regulation of water quality and input pricing, and subsidy policies that made modern input too cheap and encouraged excessive application, have, collectively, created negative environmental impacts (Hazell 2003).

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CHAPTER 6

The Canadian Prairies: biophysical and socio-economic context

- 6.1 Overview of agriculture on the Canadian prairies
- 6.2 Prairie hydrology, hydrologic variability, and drought
 - 6.2.1 Palliser's expedition, drought, and historic climate variability
 - 6.2.2 Paleo-climatic research
 - 6.2.3 Implications of future climate change
 - 6.2.4 Evidence of the current adaptive capacity to climate variability
 - 6.2.5 Prairie water and soil quality
- 6.3 Agricultural policy drivers and socio-economic conditions

The Canadian prairies: biophysical and socio-economic context

Henry David Venema¹

The MA (Millennium Ecosystem Assessment) – a four-year study by 1360 scientists from 95 countries – provides a useful lens for examining agriculture and water resource policy and practice in an internationally significant and vulnerable agro-ecosystem—the Canadian prairies.

The key innovation of the MA – as compared to other global environmental assessments – was its framework: human well-being is ultimately dependent on ecosystem services, variously categorized as provisioning, regulatory, and cultural services. The MA identified the acute vulnerability of dryland agro-ecosystems, arising from the loss of ecosystem services, as one of the ‘outstanding’ global environmental problems—particularly in the context of climate change.² This paper contextualizes the general observations of the MA, with a detailed examination as regards the Canadian prairies.

In November 2003, the Canadian Senate Committee on Agriculture and Forestry published a report titled *Climate Change: we are at risk*, which concluded that Canadian agriculture will be affected by climate change, and noted that more frequent and widespread drought on the prairies was expected. The prairies produce well over half of the total value of Canadian agri-food exports, but are frequently affected by climate-related disasters. The prospect of more frequent and larger droughts afflicting the prairies only compounds the multitude of physical and economic shocks and stressors with which prairie socio-ecological systems – including the following – have had to cope.

- Stagnant commodity prices and input price shocks (particularly energy)
- Closure of the American border to beef exports
- Further threats to export markets from the introduction of genetically modified wheat
- Increasing nutrient loads on prairie water bodies

Past adaptations to the cumulative stresses in the dust-bowl years of the 1930s included distress out-migration; they also, however, included federal policy innovations like the PFRA (Prairie Farm Rehabilitation Administration) and the CWB (Canadian Wheat Board). The PFRA was established to assist prairie farmers in recovering ecological resilience that had been lost through poor land

¹ International Institute for Sustainable Development, Canada

² <http://www.millenniumassessment.org//proxy/document.356.aspx>

management practices, which left the prairies extremely vulnerable to wind and water erosion during the droughts of the 1930s. The CWB was established to buffer prairie farmers from the vagary of international commodity prices by aggregating and then marketing all prairie wheat and barley production in global markets.

Our basic hypothesis is that, in the face of recent evidence, the prairies' agriculture is not sustainable and is in need of policy innovation on a similar scale to the advent of the PFRA and the CWB. We believe that existing, nascent market forces that value ecological goods and services, such as organic agriculture and carbon trading, harnessed through focused policy, constitute such innovation. First, we review the climatologic, hydrologic, and economic shocks afflicting prairie agriculture; and, second, we examine federal and provincial agri-water policies that pertain to watershed management and the use of economic instruments to value ecological goods and services—both areas of innovation deemed critical by the MA to reducing agro-ecological vulnerabilities.

6.1 Overview of agriculture on the Canadian prairies

Agricultural exports from the Canadian Prairies are an important source of food and fibre for the global market, and make a significant contribution to the nation's wealth and balance of payments. In 2001, the agriculture and agri-food sector contributed 8.3 % to the GDP (gross domestic product), accounting for CAD (Canadian dollar) 100 billion in annual retail and food service sales, and about CAD 20 billion in exports.³ The three Prairie Provinces – Manitoba, Saskatchewan, and Alberta – generally contribute well over half of these totals. The CWB markets wheat, durum wheat, and barley grown on the prairies. With annual sales revenue between CAD 4 and CAD 6 billion, the CWB is one of Canada's biggest exporters (and foreign exchange earners). The CWB annually markets about 20 million tonnes of wheat and barley to over 70 countries, and controls about 20 per cent of the international wheat trade.⁴

Prairie agriculture takes place in a physiographic region known as the Western Interior Basin that comprises the northern portion of the Great Plains eco-zone, which essentially comprises the north-western extreme of cultivable land in North America (see the box in Figure 6.1).

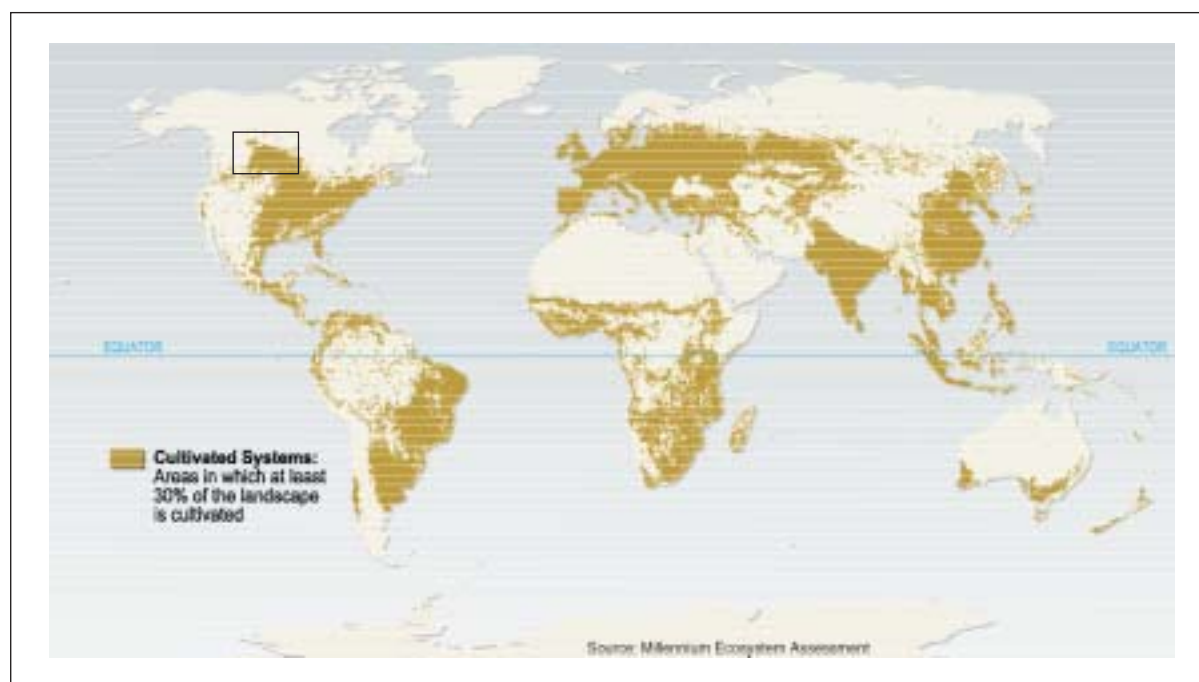


Figure 6.1 Cultivated systems

Source MA (2005)

³ <http://www.cbeglobelink.org/cbcbgloboelink/country/Canada/cr.htm>

⁴ <http://www.cwb.ca/en/about/index.jsp>

The natural vegetation of this region is primarily grassland, extending southward from the Boreal Forest into a transition zone of Aspen Grove to Mixed-grass Prairie and Short-grass Prairie, with the northern tip of the True Prairie grassland extending into south-eastern Manitoba. The soils of the interior plains are quite fertile, made up of Brown Chernozemic, Dark Brown Chernozemic, and Black Chernozemic soils (AAFC–PFRA 2000).

The climatic regimes of the Prairie Provinces are classified as cold temperate and sub-Arctic. They range from dry continental type conditions in the south-west to near-Arctic conditions in the north-east along the Hudson Bay coastline. Most areas of the Prairie Provinces receive their heaviest precipitation from storms fed by moisture flowing northward from the mid-west US. Average yearly temperatures are warmest in the south and coldest in the north-eastern areas of the prairies. The western mountain ranges have a pronounced effect on precipitation patterns across the region and on winter temperatures (Herrington, Johnston, and Hunter 1997).

While the region enjoys predominately sunny skies throughout the year, considerable fall and spring cloudiness occurs due to the oscillation of the migratory storm track across the region. The agricultural regions experience relatively long winters, short summers, and low precipitation. Clear skies and warm temperatures generate sufficient growing degree-days for agriculture during summer. During the period of instrumental record, the available growing degree-days averages about 1700–1800 in Manitoba, with Saskatchewan and Alberta receiving, on average, 100–300 less.

Annual precipitation during the period of instrumental record has ranged from 400 mm to 600 mm for Manitoba, whereas Saskatchewan (300 mm–500 mm) and Alberta (300 mm–500 mm) tend to receive relatively less precipitation. Although this level of precipitation is marginal for agriculture, most of the precipitation falls during the growing season, and typically during the month of June when crops can best use the moisture. Moisture deficits, however, tend to exist in most agricultural regions, ranging from 150 to 400 mm. Extreme weather events such as drought, tornadoes, floods, and hails are also common occurrences throughout the prairies, although the frequency and severity of these events tend to be regionally variable.

The combination of good soils and – on average – adequate precipitation, results in large and diverse agricultural production. The prairies produce well over half of the total value of Canadian agri-food exports (Tyrchniewicz and Chiotti 1997). Although grain production has historically been associated with prairie agriculture and continues to account for the majority of production, in recent years, many farmers have begun to diversify into specialty crops (such as mustard seed, dry peas, and lentils). In areas subject to extreme moisture deficits, extensive irrigation systems have also been developed. According to AAFC–PFRA (2000), 630 000 hectares of agricultural land on the prairies currently rely on irrigation; almost 500 000 hectares of which are in southern Alberta, producing a wide variety of crops including grains, pulse crops, corn, sugar beets, and vegetables.

In summary, the coincidence of favourable soils and a marginal hydro-climatological regime has given rise to large and diverse agricultural economy on the Canadian prairies during the period of European settlement. The appearance of climate change as a major public policy issue motivates a retrospective of the historic prairie climate as a potential proxy for the future climate, as well as a survey of the existing research on the projected impacts of climate change.

6.2 Prairie hydrology, hydrologic variability, and drought

Canada is widely regarded as a water-abundant country—a notion reinforced by maps like the national water poverty index recently published in *Scientific American*.⁵ However, this very coarse generalization belies the relative water stress on prairie agriculture. Global precipitation maps, such as that produced by the International Water Management Institute (Figure 6.2), reveal that although the Canadian prairies are not as arid as central Asia or Australia, they are one of the major agricultural zones with the least precipitation—viable because the relatively cool temperatures reduce potential evapo-transpiration.

⁵ *Scientific American* 293 (3): 87

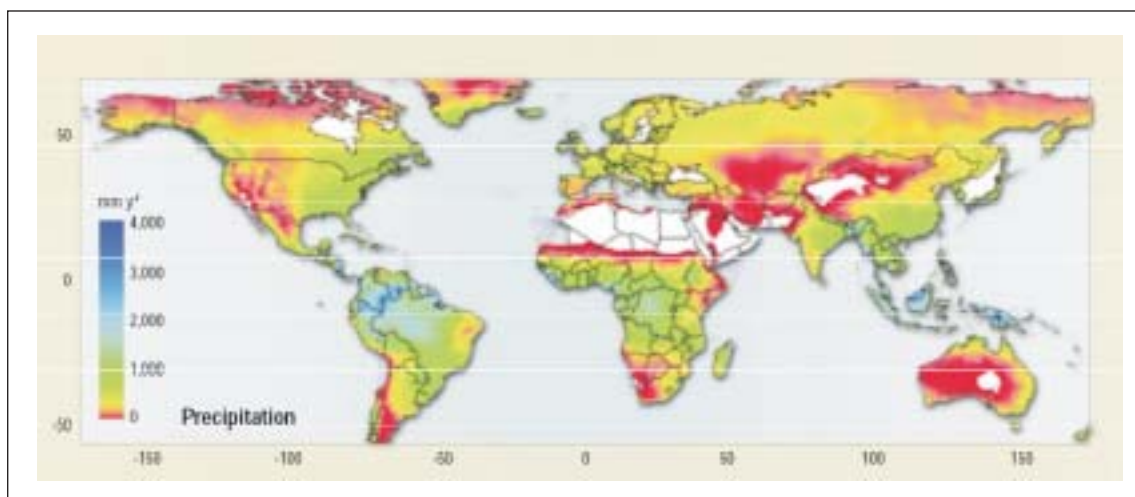


Figure 6.2 Global precipitation map

Source IWMI (2005)

6.2.1 *Palliser's expedition, drought, and historic climate variability*

The earliest scientific assessment of the prairies produced a foreboding assessment of the viability of prairie agriculture. From 1857 to 1860, Captain John Palliser led a group of scientists into what was then the virtually unknown (to European explorers) territory lying west of what is now Manitoba. Palliser's group, known as the British North American Exploring Expedition, was commissioned by the government of the day with exploring, studying, and mapping the plains between the North Saskatchewan River and the current American border. They identified a triangular region bounded by the lines adjoining Cartwright, Manitoba; Lloydminster, Saskatchewan; and Calgary, Alberta (now known as Palliser's Triangle) as arid and unsuitable for settled cultivation. Palliser warned that disaster would befall those who tried to settle in the region. A subsequent expedition by Henry Yule Hind reached different conclusions from Palliser's, probably because of a different geographic focus.

Government policy followed Hind's recommendations, and the early settlement of the prairies coincided with an unusual sustained run of moist years from the late 1890s to the early 1900s, with 12 years of average or above-average precipitation. Increased soil moisture reserves provided for good crop yields and led to bumper harvests in 1905 and 1915. The success of harvests in the early years of settlement encouraged further agricultural expansion and population growth. Despite the early promise, the 20th century has been punctuated by droughts, such as those in 1906, 1936–38, 1961, 1976–77, 1980, 1984–85, 1988, and 2001–2003 (Goodwin 1986; Gan 2000; Wheaton, Wittrock, Kulshreshtha *et al.* 2005).

Precipitation is the major factor controlling the onset and duration of drought. Inter-annual variability of precipitation and temperature, to a lesser extent, determine the frequency and intensity of drought. Precipitation variability can be a useful indicator of the extent to which an area is prone to drought, with the coefficient of variation (the ratio of the standard deviation to the mean) being the most stable measure of precipitation variability (Longley 1953). Figure 6.3 depicts the coefficient of variation of growing season precipitation over the Canadian prairies, and is noteworthy for the following two reasons.

- 1 The regions of highest precipitation variability that coincide quite closely with the extent of Palliser's Triangle
- 2 The magnitude of precipitation variability in this area (30–40 per cent)

6.2.2 *Paleo-climatic research*

Recent paleo-climatic research also indicates that the Canadian prairies have been subject to high historic climate variability. Current research suggests a sequence of long-term, broad-scale climatic trends, roughly synchronous over wide areas, and their associated ecological responses. Much of the knowledge of post-glacial environments in the Prairies Provinces has been derived from the study of pollen records recovered from lakes and wetlands. There are about 100 paleo-environmental records available, with more from Alberta than from the other Prairie Provinces.

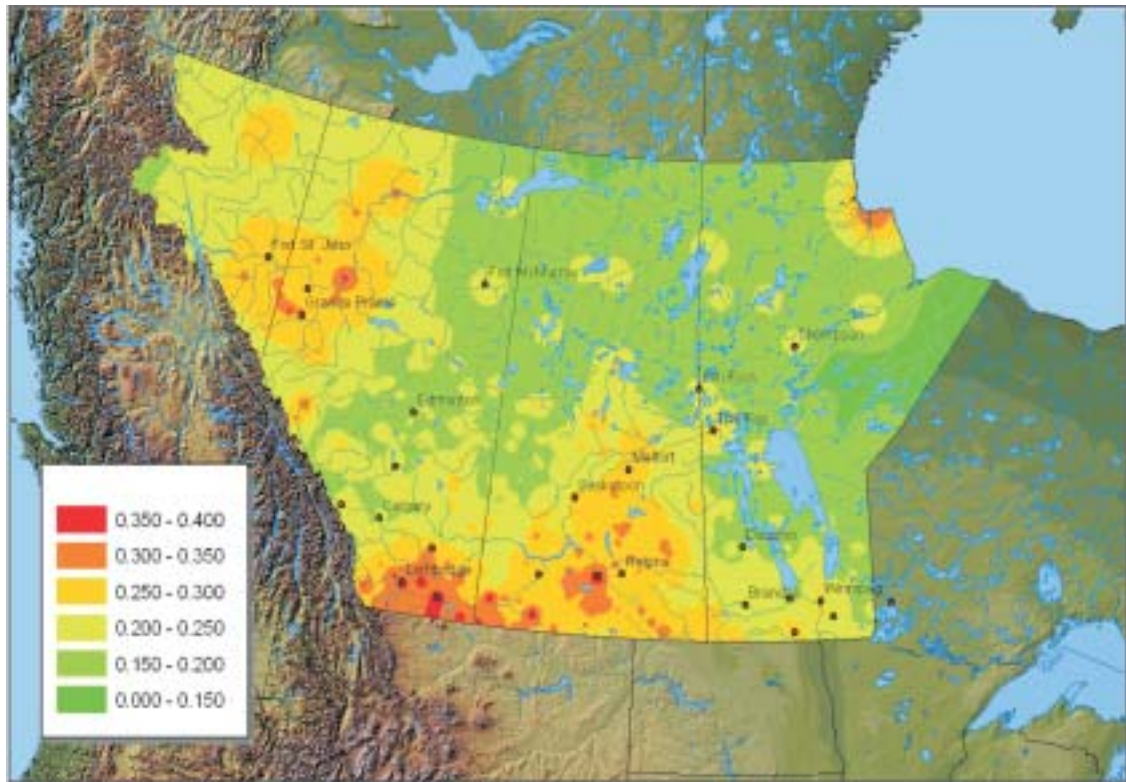


Figure 6.3 Precipitation variability map: coefficients of variability calculated from average precipitation data (1960–2002)

At a very generalized level, paleo-environmental records for the prairies concur in showing a broad three-part division of the post-glacial period. The early part (prior to about 9000 years BP [Before the Present, specifically before 1950]), for which there are comparatively few records, shows a sequence of rapid vegetation changes that reflect post-glacial migration of plants into the region and soil development and landscape response to post-glacial conditions—all of which tend to blur the climate signal. Between around 9000 and about 6000 year BP, most records show evidence of aridity, increased salinity and higher than present temperatures, with the prairie grasslands probably extending up to about 80 km farther north than their present range. After about 6000 year BP, increased moisture and probably cooler temperatures are inferred from rising lake levels, decreased salinity, and southward advance of the boreal forest margin. This cooler, wetter interval resulted in renewed ice accumulation in the Canadian Rockies and led to the first well-marked Neoglacial advance around 4000 year BP. A series of ice advances have occurred in the last 4000 years, although most glaciers show their maximum advances in the last few centuries.

These general climate changes include considerably smaller scale variability. For example, within the last millennium there were two broad climate phases: the Medieval Warm Period, ending around the 12th century, followed by the Little Ice Age.⁶ The paleo-climatic record for the past 1000 years indicates that periodic and severe drought episodes are common, and that drought conditions prior to Euro-Canadian settlement far exceed anything experienced in the last century (Sauchyn and Beaudoin 1998). The most severe drought of the past 500 years is thought to have occurred between approximately 1791 and 1800 (Harrington, Johnston, and Hunter 1997). Historically, drought has been found to occur every 30 to 50 years, a pattern repeated in the 20th century.

⁶ A cold period lasted from about 1550 AD to about 1850 AD in Europe, North America, and Asia. This period was marked by rapid expansion of mountain glaciers, especially in the Alps, Norway, Ireland, and Alaska. There were three maxima, beginning about 1650 AD, 1770 AD, and 1850 AD, each separated by slight warming interval.

6.2.3 Implications of future climate change

The potential for climate change as the result of global warming is now part of the modern scientific canon, and potential threats to agriculture are also widely understood. A study by the IIASA (International Institute for Applied Systems Analysis) – titled *A Global Agro-ecological Assessment for Agriculture in the 21st Century* – suggests that climate change will create significant but highly varied impacts on crop production. Developed countries will gain substantial potential, with developing countries losing potential (Fischer, Shah, van Velthuis *et al.* 2001). This coarse generalization, however, requires region-specific contextualization. Conventional approaches to estimating agriculture vulnerability to climate change generally use a top-down approach starting with scenarios derived from GCMs (global circulation models), which are, in turn, used to estimate changes in agro-climatic properties, crop yield impacts and regional economic impacts, and to suggest possible adaptation responses. To date, two relevant GCM impact studies have been conducted for the prairies. Sauchyn, Barrow, Hopkinson *et al.* (2002) used results from three different GCM modelling scenarios – HadCM3, CGCM2, and CSIROmk2b – to estimate future aridity on the Canadian prairies. The CGCM1 model was used by Nyirfa and Harron (2001) to estimate the impact of climate change on land suitability for agriculture as it had been applied in previous agricultural adaptation studies in Canada (Bootsma, Gameda, and McKenney 2000), and is considered to be performing well in reproducing present baseline climate characteristics (Hengeveld 2000). The two studies produced broadly similar results.

Although precipitation increases in all the GCM scenarios, this gain is offset by higher temperatures, which increase the potential evapo-transpiration, thus increasing moisture deficits. The moisture deficit – defined by Nyirfa and Harron (2001) as precipitation minus potential evapo-transpiration – for the nominal ‘normal’ period (1961–1990) is shown in Figure 6.4. The projected moisture deficit for the 2040–2069 period (Figure 6.5) reveals an increase in the overall extent of regions affected by moisture stress—regions of highest moisture deficit correspond quite closely to that of the Palliser’s Triangle.

Sauchyn, Barrow, Hopkinson *et al.* (2002) investigated a broader range of climate scenarios, but had similar results. The HadCM3 model used by Sauchyn, Barrow, Hopkinson *et al.* (2002) is cooler and wetter than the CGCM1 scenario used by Nyirfa and Harron (2001); the CSIROmk2b is similar to CGCM1; and the CGCM2 hotter and dryer than CGCM1. Sauchyn, Barrow, Hopkinson *et al.* (2002) concluded that the climate projections suggest a general increase in dry conditions; the cooler, wetter scenario (HadCM3) merely delays the onset of increasing aridity, whereas the hotter, dryer scenario (CGCM2) reveals a possible desertification risk.

Even in the absence of climate change, based on the proxy-historical record, the prairies are expected to return to drier conditions in the coming decades. Thus, a natural cyclical drying combined with climate change potentially leaves the prairies extremely vulnerable to transient climatic variability and extreme weather events in the coming century.

The demonstrated adaptive capacity to historic climatic stress is not heartening in light of projected future climate change adaptation requirements.

6.2.4 Evidence of the current adaptive capacity to climate variability

Although the history of prairie agriculture is characterized by adaptations to climate variability, including the development of drought- and frost-tolerant crops and farming practices that conserve soil moisture, there is considerable evidence of more aggressive policies being required to increase adaptive capacity. The drought of the Great Depression provides a classic example of mal-adaptation; drought in the 1930s affected 7.3 million acres and forced distress migration of a quarter of a million people (Goodwin 1986). This mass exodus did catalyse a major institutional response, that being the formation of the PFRA and the CWB. The impacts of subsequent droughts have largely been simply absorbed by a much larger national economy, less dependent on agriculture.⁷ The 1984–85 drought affected most of the southern prairies, and cost Canada at least a billion dollars of GDP (Ripley 1988).

⁷ In 1999, about two per cent of Canada’s GDP was derived directly from agriculture.
http://www.wd.gc.ca/rpts/audit/wdp/3_e.asp

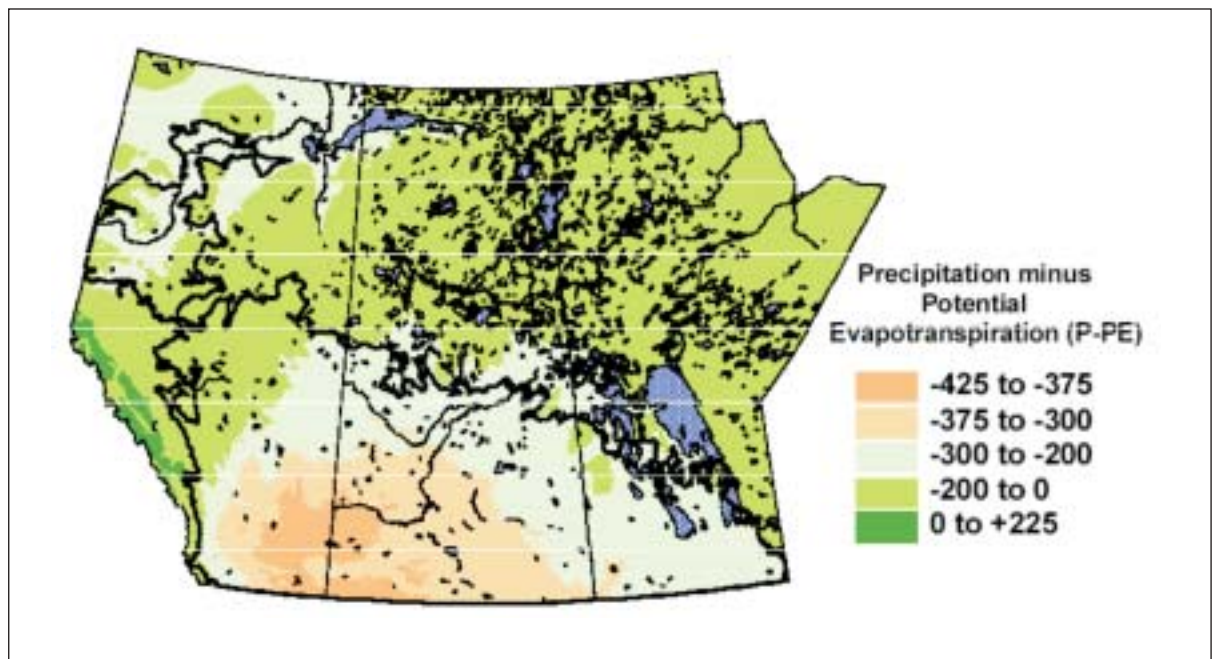


Figure 6.4 Moisture deficit 1961–90

Source Nyirfa and Harron (2001)

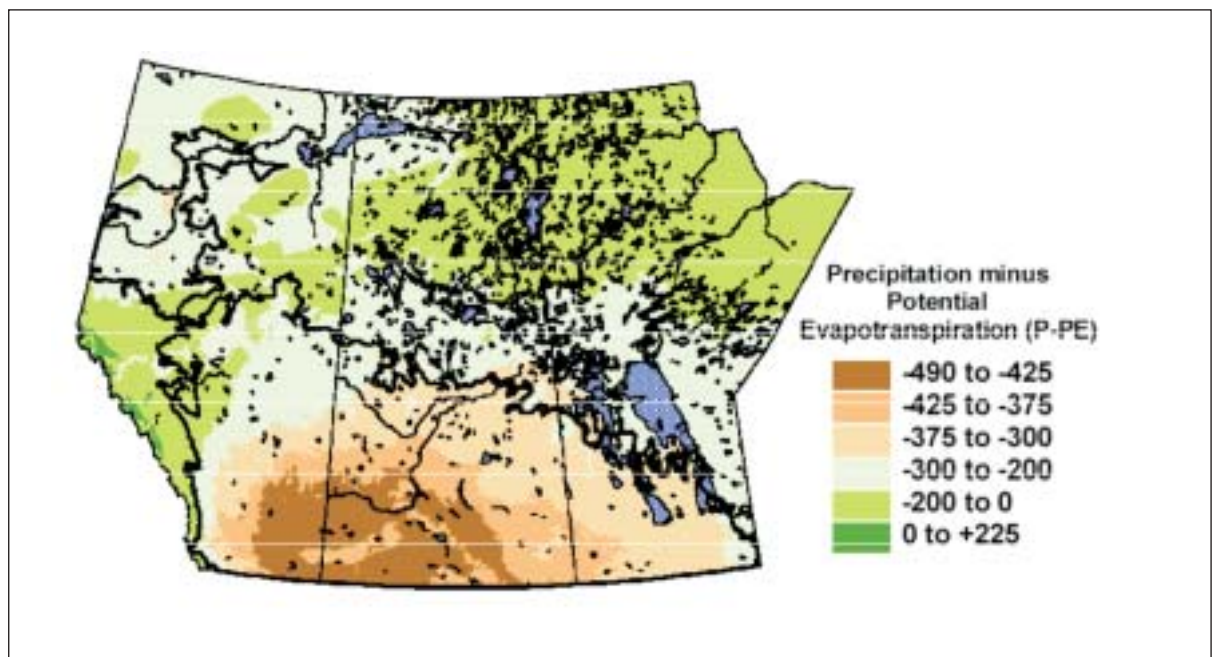


Figure 6.4 Projected moisture deficit 2040–69 (scenario CGCM 1)

Source Nyirfa and Harron (2001)

In the severe drought year of 1988, agricultural export losses topped CAD 4 billion. Despite assistance payments of over CAD 1.3 billion, Manitoba showed net farm income losses of 50 per cent and Saskatchewan 78 per cent, and an estimated 10 per cent of farmers and farm workers left the agricultural sector that year alone (Arthur and Chorney 1989; Herrington, Johnston, and Hunter 1997). Even in 1991 – a year of record-high wheat production – emergency payments (that is, above regular assistance and insurance programmes) were still in excess of CAD 700 million (Sauchyn and Beaudoin 1998). Recent analysis of the 2001–03 drought (Wheaton, Wittrock, Kulshreshtha *et al.* 2005) indicates losses of CAD 3.6 billion and CAD 5.8 billion, in agricultural productivity and GDP respectively, and manifest as the loss of 41 000 jobs in the agricultural sector. Most recently, floods in the late spring of 2005 in Manitoba have devastated yields. Continuous rain through July forced

farmers to abandon seeding on some fields, while losing other newly germinated fields to drowning. About one-third of Manitoba's normally cultivated agricultural land was lost in 2005.⁸

Dave Sauchyn, paleo-climatologist of the University of Regina, makes some rather succinct observations regarding the sustainability of prairie agriculture given probable historic and possible future climate hazards. They include the following.

- The sustainability of prairie agriculture depends on adaptation to the amplitudes of climate change and variability. (Sauchyn and Beaudoin 1998, p.337)
- The prairie eco-zone is the only major region (in Canada) where drought is a landscape hazard... management of prairie ecosystems and soil landscapes requires an understanding of past and future trends and variability. (Sauchyn, Barrow, Hopkinson *et al.* 2002, p.247).
- A policy framework to minimize the adverse impacts of drought and increasing aridity must support adaptation of soil and water management practices to climatic variability. (Sauchyn, Barrow, Hopkinson *et al.* 2003, p.11).

6.2.5 Prairie water and soil quality

In addition to the severe risk to dryland agriculture posed by climate change, the MA also identified nutrient over-enrichment as a critical global environmental issue. Since 1960, flows of biologically available nitrogen in terrestrial ecosystems have doubled, and flows of phosphorus have tripled, primarily due to applications of synthetic fertilizers.

The current eutrophication (oxygen deprivation) of Lake Winnipeg is a useful integrative indicator of nutrient stresses on the prairies. Lake Winnipeg is the 10th largest permanent freshwater lake, in area, in the world, and supports the largest freshwater fishery in North America. Rivers flowing into Lake Winnipeg drain a vast swath of the Great Plains encompassing parts of four Canadian provinces (about 80 per cent of the cultivable land on the prairies), as well as parts of four American states, as shown in Figure 6.6.



Figure 6.6 The Lake Winnipeg Watershed

Source LWSB (2005)

⁸ <http://www.hpj.com/dtnnewstable.cfm?type=story&sid=15105>

Like many lakes in human-dominated ecosystems elsewhere in the world, Lake Winnipeg is currently under increasing ecological stress due to a number of factors including invasive species, erosion, and an inverted discharge regime owing to regulation for hydropower. Nutrient pollution is, however, currently regarded as the most severe threat to Lake Winnipeg water quality. Algal blooms – a typical ecosystem response to excessive nutrient enrichment, usually nitrogen and phosphorus – were significant in the lake’s north basin in 2001 and 2005. Stewart, Stern, Salki *et al.* (2000) suggest that on the basis of inflow phosphorus concentration and water renewal time, Lake Winnipeg is significantly more stressed than Lake Erie prior to remediation efforts.

The cumulative toll on prairie land resources from agricultural stresses is also telling. In 2000, the PFRA released a report, titled *Prairie Agricultural Landscapes: A Land Resource Review* (AAFC–PFRA 2000), which concluded that the following.

- Fifty per cent of lands under annual cropped lands are threatened by erosion and require intensified use of crop residues and permanent cover to maintain soil health.
- Fourteen to forty per cent of soil organic matter (the vital component of the soil fabric, responsible for improving soil structure, fertility, and health) has been lost from prairie soils since cultivation began.

Prominent Canadian ecologist David Schindler (2001) argues that the interaction of climate change and nutrient loadings from intensive agriculture will have multiple negative impacts on prairie water resources, including increased risks to human health from pathogenic bacteria and toxic algal blooms. Schindler (2001, p. 21) argues that ‘only comprehensive approaches to the conservation and management of the catchments, which supply drinking water, can prevent major water problems.’

6.3 Agricultural policy drivers and socio-economic conditions

Heightened concern about soil quality, water quality, and climate change on the prairies is concurrent with, and to some degree a function of, liberalization trends reshaping prairie agriculture. The restructuring of agriculture in Canada by the federal government since the 1980s is similar to that accomplished by the International Monetary Fund / World Bank in the structural adjustment of developing world economies. The key instruments in domestic structural adjustment have been WTO (World Trade Organization) compliance efforts, and the NAFTA (North American Free Trade Agreement). Policies reminiscent of structural adjustment adopted in Canada and applied to the agricultural sector include a focus on production for export; dramatic cuts in government spending; deregulation; measures to attract foreign investment; privatization of government industries and utilities; removal of farm subsidies, price controls, and other supports; and implementation of a freely-floating currency.

Between 1991–92 and 1999–2000, government spending on agriculture dropped by 52 per cent from the peak of over CAD 6.1 billion in 1991–92 to approximately CAD 2.9 billion for 1999–2000.⁹ According to the NFU (National Farmers’ Union), however, no other policy decision has had a greater negative impact on western farmers’ income than the cancellation of the Crow Benefit, which subsidized shipping costs (see Chapter 7).

Some of the diversification anticipated through the elimination of the Crow Rate did take place—not through a return to relatively low input classical mixed farming, but rather through new forms of specialized production as farmers adjusted to new economic realities. Pork and beef production are prominent examples of intensified specialized production. Between 1991 and 2001 Canadian beef exports increased almost fivefold (de Loe 2005), much of it concentrated in southern Alberta. This unfettered growth came to an abrupt end in May 2003, when the US closed its border to Canadian beef following the discovery of a single case of BSE (bovine spongiform encephalopathy) or ‘mad cow’ disease in northern Alberta. Even if the BSE crisis had not dramatically curtailed beef production and

⁹ AAFC, Farm Income, Financial Conditions, and Government Assistance data Book, various releases, Table C.I.

export, climate change and water resource limitations may have placed hard constraints on the industry (de Loe 2005). Sixty per cent of Alberta's beef production takes place in the irrigated areas of Alberta, where moisture deficit is the highest and is projected to increase with climate change (de Loe 2005; Wall, Smit, and Wandel 2004). The economic impacts of the BSE crisis have been exacerbated by the consolidation and closure of slaughtering capacity in Canada throughout the 1980s and 1990s—a trend concurrent with the liberalization forces that reshaped the meat packing industry.

Trends and drivers in the pork industry are broadly similar. For example, in Manitoba, between 1990 and 2000, the number of hog farms has declined by more than 50 per cent from 3150 to 1450, while the average number of hogs per farm has more than tripled—increasing from 388 heads to 1290 heads. Overall hog production has increased rapidly, exceeding 4.8 million in 1999—89 per cent of which is exported. The rapid growth in intensive hog operations is attributed to

- changes in world grain trade resulting in relatively static volumes of grains being sold at ever declining prices (constant dollars) due to technology improvements;
- loss of the Crow Benefit on export grain resulting in farmers facing the full freight bill and lower (at least initially) feed grain prices; and
- growth in world demand for meat due to rising incomes.

This heavy intensification in the hog sector, along with its concentration in certain locations within the province, has heightened public concerns regarding the environment, particularly regarding air and water quality, and public health. A broad-based coalition of environmental NGOs complain that hog ILOs (intensive livestock operations) threaten both water supplies and water quality,¹⁰ and are particularly opposed to the practice of field application of liquid hog manure, which is very high in nitrates and phosphorus. Noted University of Alberta Ecologist David Schindler warns that the combination of declining stream flows due to climate change and the concentration of nitrates, phosphates, and pathogens from ILOs (some of which produce as much waste as medium-sized cities) will seriously imperil freshwater resources on the prairies. Recently a citizens' coalition in Manitoba¹¹ has opposed plans to liberalize regulations governing liquid manure applications, charging that they are in direct conflict with efforts to reduce the volume of pollutants (particularly phosphorus) that enter Lake Winnipeg that are believed to be responsible for the appearance of large oxygen-depleting algae blooms, and the lake's high risk of further eutrophication (LWSB 2005).

How is the family farm on the prairies coping with these agro-ecological stresses and, equally important, with severe concurrent economic stress? In short, the answer is with grim determination to hang on. Ninety-eight per cent of farms in Canada are still family-owned and family-operated (AAFC 2003); however, in 2000, 73 per cent of farm income of the average farm family came from off-the-farm. Low commodity prices are forcing farm families into the stressful existence of combining full-time jobs with farm management; many simply cannot afford to go on. Between 1996 and 2001, the number of farms in Canada declined by 10.7 per cent (Martz 2004). The following story in the *United Church Observer* (June 2004) captures the outcome of these cumulative stresses on the social fabric of prairie communities.

Continuing drought, low grain prices, mad-cow disease, grasshopper infestations, and flu-infected poultry: these are nail-biting times in rural Canada. Some farmers are working two or three jobs to make ends meet. The extra work means they can't volunteer for church positions and activities. And they have less money to put on the offering plate. 'People are cutting back everywhere, including the church,' says Rev. John Lea of the Assiniboia pastoral charge in southern Saskatchewan... Auctions of entire farms are routine now, but the age of the owners is creeping downward to include 40 year-olds, says Lea. The stresses are bursting the entire community and many more families are moving away from small towns to cities. In the last seven years more than 500 people, or about one-sixth of the population have left Assiniboia...for farmers like

¹⁰See for example: <http://www.hogwatchmanitoba.org> and <http://www.beyondfactoryfarming.org>

¹¹<http://www.mbeconetwork.org/news.asp>

Donna Zimmer, there really is no other choice but to keep on going. 'What else can you do?' she says. 'I have worked off the farm all of our married life. I'm looking again for work because we are not making it. We're just hanging on, waiting for something to turn around. (Driver 2004)

The farm income crisis is widely acknowledged in both official policy and farm advocacy circles. A background document to a June 2005 conference organized by the Canadian Agri-food Policy Institute stated, 'an indisputable fact is that at the national level, farm incomes have been decreasing in real terms, whether measured since 1970, 1960, or 1950, and whether measured as net cash income, or as net realized income after accounting for depreciation of assets' (Tyrchniewicz and Tyrchniewicz 2005). The stagnation of commodity prices relative to processed food prices explains much of the farm income crisis. In 1975, the farmer received five cents and the miller and baker 38 cents from the revenue generated from the sale of one loaf of bread. Today, the farmer still receives five cents, while the miller and baker split CAD 1.35.

The NFU goes on to suggest that Canada's export-driven agricultural trade policy¹² has failed the family farm, asserting that if one were to list areas of the agricultural sector that are most heavily focused on export (grains, oilseeds, and hogs), and areas hardest hit by the farm income crisis, one would have the same list. In contrast, the sectors that focus on supplying the Canadian market – dairy, eggs, and poultry – have largely escaped the crisis. The NFU indicates that while Canadian agri-food exports have expanded fivefold since 1979, family farm incomes have declined over the same period (Figure 6.7).

By 1989, the NFU stated that Canada no longer had an agriculture policy as such, but instead had 'a trade policy that masquerades as farm policy'¹³—a very successful trade policy nonetheless. Agri-food exports doubled in seven years from CAD 10 billion in 1989 to over CAD 20 billion in 1996.

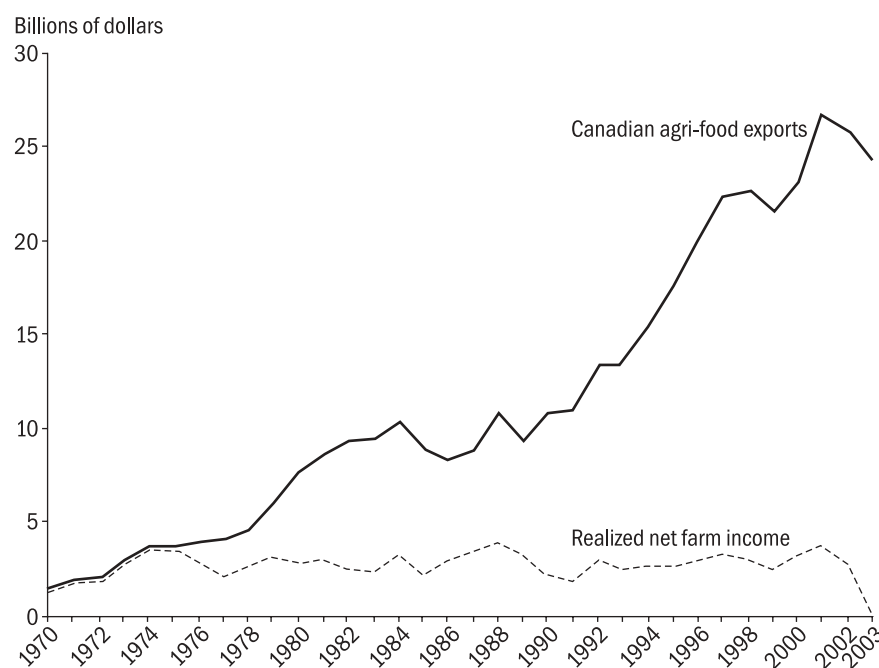


Figure 6.7 Agricultural exports versus farm income

Source Martz (2004)

¹²In 1993, federal and provincial governments set an ambitious target of doubling agri-food exports to CAD 20 billion by 2000. Having accomplished their goal by 1996, well ahead of schedule, federal and provincial ministers pledged to redouble exports to nearly CAD 40 billion (four per cent of world agri-food exports) by 2005. The National Farmers Union claims that the latter goal was actually put forward by the Canadian Agri-Food Marketing Council, a private-sector group that includes representatives of Maple Leaf Foods, Cargill and McCain Foods.

¹³'NFU official wants a farm policy; not a trade policy,' Barbara Duckworth, *Western Producer*, February 2, 1989, p. 60

Inducements to foreign investment have worked rather well also; by 1999, one US trans-national – Archer Daniels Midland – owned almost 50 per cent of the Canadian flour milling capacity.

The stresses associated with these macro-trade policies compound climate-related stresses; we observe that a major underlying hypothesis of the MA—that human well-being is fundamentally a function of ecosystem services—is very well supported on the face of evidence from the Canadian Prairies. The Prairie socio-ecological system no longer possesses the necessary resilience to climate or economic shock, and farmer frustration with the lack of institutional support to increase their resilience is palpable. Writing in the *Winnipeg Free Press* on 29 October 2005, Laura Rance evokes the desperation felt by Prairie farmers after this year’s harvest (Box 6.1). Rance’s article also reveals however, that by sheer exhaustion of conventional options, there is a growing receptivity among farmers to new policy options that expand rural livelihood beyond traditional Prairie agriculture, which includes energy production and environmental stewardship. How those policies should be crafted to improve resilience is the substance and challenge of our ongoing ‘Adaptive Policy’ research.

Box

Farmers struggle to see some light at end of the tunnel

6.1

Discouragement in community is palpable

Laura Rance, *Winnipeg Free Press*, 29 October 2005

It was a solemn bunch of farmers who gathered in Brandon recently for a KAP (Keystone Agricultural Producers) meeting... KAP president David Rolfe could measure the level of stress in the farming community right now by the number of phone calls he is getting. ‘It usually starts with someone pointing a finger at a policy or one particular thing, whether it’s the high fuel prices or the education tax,’ he said. They are angry with KAP for not doing enough. They are angry with governments. They are angry with consumers for wanting cheap food.

But eventually, it comes down to one common theme. In the face of poor crops, low market prices, soaring fuel prices, and taxes due at the end of the month, an unknown number of farmers in this province can no longer make ends meet. ‘They say I’ve expanded, I’ve diversified, I’ve done everything. I possibly can—and I still can’t make it,’ he said.

Farmers once believed that markets would rebound—maybe next year. Even if they didn’t, technology would improve their production to compensate. There have been failed efforts over the years to organize farmers to limit production in an effort to force prices higher. And there are ongoing efforts to disorganize them by getting rid of orderly marketing systems that prevent them from going broke sooner.

Farmers have traditionally believed that governments would help—especially if producers rallied before the television cameras. And they thought that if only we could get improved trade rules—that would make all the difference. Not so any more. ‘All through my youth we had our bad years and the good years; but there was always a light at the end of the tunnel—things will get better. I don’t see that light any more,’ said John Castle, a Miniota farmer who has been going to farm meetings since before some of his fellow KAP delegates were born... There’s no arguing that the production problems faced this year were unusually severe. But likewise, **there’s little argument that farming has been in a perpetual state of crisis for decades because of one reason or another. Apparently, the type of farming we do here has a weak immune system; it catches a cold every time the environment changes.**

Lenders, who a few short years ago were a source of reassurance for their farm clients, are becoming less flexible, Rolfe said. ‘They’ve run out of patience; we’ve run out of time.’ For Castle, who had clearly spent some time pondering this problem, it

Box continues...

comes down to one fundamental shift. This part of the world was settled because governments of the day valued what the region could produce. People in other parts of Canada and in other parts of the world wanted that production badly enough that governments were willing to shoulder part of the export transportation costs. But the world has changed. 'I don't know of any products that we can raise in Western Canada that they can't raise just as well somewhere else in the world,' he said. 'We've got to be producing what is wanted by the world because it doesn't want our current production,' he said.

Some have suggested farmers have more value to society as park wardens or environmental stewards than food producers. Castle said that he, at first, thought such an idea was ridiculous. But now he openly entertains such suggestions. He's not the only one starting to think about farming in a different way. **Starbuck farmer Ed Rempel wondered whether farmers should stop thinking of themselves as food producers and start using their production capacity for things the world wants and needs. He sees high oil prices and the Kyoto accord as potential allies.** 'If I can grow nothing but energy on my farm, I will be very happy indeed. If we reforest Western Canada, you won't see me crying, you'll see me learning about lumber.'

We are in the midst of a very painful and difficult transition that offers potential, yet no promise of better times ahead.

The discouragement within the farming community is palpable. People aren't kidding when they worry about a 'silent exodus' from their rural communities. *But it's not over yet.* (emphasis added)

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CHAPTER 7

Adaptive policy case study: analysis of the Crow Rate in Prairie Canada: a cautionary tale

- 7.1 Introduction
- 7.2 Policy description: changes, drivers, and impacts
- 7.3 Adaptive policy analysis
 - 7.3.1 Period of policy change (1897–1925)
 - 7.3.2 Period of policy stability (1925–84)
 - 7.3.3 Period of policy decline (1984–96)
 - 7.3.4 Period of socio-economic and environmental impact due to termination of the WGTA (1996 onwards)
- 7.4 Lessons learned

Adaptive policy case study: analysis of the Crow Rate in Prairie Canada: a cautionary tale

Darren A Swanson¹ and Henry David Venema¹

7.1 Introduction

This chapter studies the adaptive and mal-adaptive nature of a Canadian agricultural policy known as the ‘Crow Rate’. The Crow Rate was a rate-control agreement for the transportation of grain produced in the prairies. The policy instrument first appeared on the policy landscape in 1897 and went through a series of adaptations until its eventual abandonment in 1996 in the guise of the WGTA (Western Grain Transportation Act).

The Crow Rate was a regulated tariff for transporting grain on the Canadian prairies. The Crow Rate initially supported railway expansion in western Canada at the turn of the last century. After inflation eroded its value to the Railways, the Crow Rate was re-interpreted as a key element of a social contract between the federal government and prairie farmers who benefited from the artificially low transportation rates. The Crow’s permanent enshrinement in legislation was vigorously supported by activist political forces of the time.

In hindsight, an unsurprising outcome of the Crow Rate’s persistence well into the 20th century was serious under-investment in grain handling and rail transportation infrastructure—shortcomings brought into stark relief when major grain sales to Russia and China in the 1960s almost caused the system to collapse.

The near-failure of the grain transportation system catalysed a flurry of investigation and effort to reform the system, often over the vigorous objections of farm advocates. Eventually, the Crow Rate was replaced by the WGTA—a more sophisticated instrument than the flat Crow Rate, but still a subsidy.

Central to critiques of the Crow Rate and the WGTA were that they encouraged reliance on a narrow range of monoculture grains and oilseeds, with negative economic and environmental implications, and that they generally impeded innovation and prosperity. Unfortunately, the hoped-for agricultural diversification has not materialized in the years following the termination of the WGTA in 1996. Farm incomes are now significantly lower than that of a decade ago, and prairie agriculture is in

¹ International Institute for Sustainable Development, Canada

the midst of economic crisis comparable to the depression of the 1930s—a disturbing situation given projections for further economic and environmental stress from climate change.

Although the current state of prairie agriculture is not solely attributable to the loss of this transport subsidy, the inevitable call for progressive agricultural policy clearly motivates retrospective analyses of its rise and fall. Termination of the Crow Rate and the WGTA has also been studied as a proxy for the kind of shock and stress associated with climate change. More generally, the Crow Rate and the WGTA make an excellent case study in the broad context of this study, because their long history has been contentious, intertwined with the political and social history of western Canada, and well-documented.

The history of this policy has been studied extensively including the driving forces and impacts of the policy at the various stages of its implementation. It, therefore, provides a unique opportunity to study the evolution of a policy instrument over the course of an entire century. With the benefit of hindsight and the perspective of a complex system, we study how the impacts of the Crow Rate diverged from the policy goals over its life, and accordingly what policy-relevant lessons can be deduced to inform our understanding of adaptive policies.

The Crow Rate was many things to many people—to its defenders, the *Magna Carta* for Prairie Canada; and to its detractors, a stultifying force impeding innovation in prairie agriculture. It may have been both at different times been both, but as recent history demonstrates, their cessation did not remove the last remaining obstacle to prosperity and sustainable development in the prairies. When the successor to the Crow Rate, the WGTA, was finally terminated in 1996, its detractors heralded a new, more innovative, entrepreneurial, and prosperous future for prairie agriculture, no longer hobbled by this archaic grain transportation subsidy. The reality has been somewhat different.

Producer organizations, farm advocacy groups, and mainstream policy analysts agree that prairie farm incomes have never been lower. A background document to a June 2005 conference organized by the Canadian Agri-food Policy Institute stated, ‘an indisputable fact is that, at the national level, farm incomes have been decreasing in real terms, whether measured since 1970, 1960, or 1950, and whether measured as net cash income, or as net realized income after accounting for depreciation of assets’ (Tyrchniewicz and Tyrchniewicz 2005).

According to the recent *Statistics Canada* data published by the Canadian Federation of Agriculturalists², average net ‘market’ income for farm households (the household income minus government support payments) is now negative. Obviously the demise of the Crow Rate does not solely explain the malaise afflicting prairie farming—stagnant commodity prices for traditional prairie crops, soaring chemical and fuel input costs, and the devastating impacts of multiple droughts have all played roles. The NFU (National Farmer’s Union), however, argues that the direct impacts of the Crow’s termination are significant, citing the closure of no-longer profitable rail branch lines and rural grain elevators and the resultant punitive transportation costs now shouldered by farmers (NFU 2005).

Furthermore, the recent impacts of drought are very troubling. Although European settlement of the prairies coincided with an unusual sustained run of wet years from the late 1890s to the early 1900s, were followed by recurrent and often severe drought throughout the 20th century: 1906, 1936–38, 1961, 1976–77, 1980, 1984–85, 1988 (Godwin 1986; Gan 2000). This millennium has not begun auspiciously either; the Saskatchewan Research Council estimated losses of CAD (Canadian dollar) 3.6 billion and CAD 5.8 billion, in agricultural productivity and gross domestic product, respectively, and the loss of 41 000 jobs in the agricultural sector—all attributed to the 2001–02 drought, arguably the worst drought episode ever (Wheaton, Wittrock, Kulshreshtha *et al.* 2005).

The fragility of the prairie agricultural economy to drought is particularly worrisome given climate change projections. To date, two relevant climate change impact studies have been conducted for the prairies. Sauchyn, Barrow, Hopkinson *et al.* (2002) and Nyirfa and Harron (2001) used GCMs (General Circulation Models) to estimate future aridity, and the impact of climate change on land suitability for agriculture and produced broadly similar results.

² http://www.cfa-fca.ca/upload/nat_sym_fast_facts.pdf

Although precipitation increases in all the GCM scenarios, this gain is offset by higher temperatures, which increase potential evapo-transpiration, thus increasing moisture deficits. The climate projections suggest a general increase in dry conditions—cooler, wetter scenarios delay the onset of increasing aridity whereas the hotter, dryer scenarios reveal possible desertification risks. Even in the absence of climate change, based on the proxy-historical record (Sauchyn and Beaudoin 1998), the prairies are expected to return to drier conditions in the coming decades. Thus, a natural cyclical drying combined with climate change potentially leaves the prairies extremely vulnerable to transient climatic variability and extreme weather events in the coming century and generally increased drought frequency, all of which bodes ill given the low demonstrated capacity for coping with 2001–02 drought.

Bradshaw, Dolan, and Smit (2004) actually used termination of the WGTA as a proxy for understanding adaptive capacity to climate change on the prairies. The WGTA and its predecessor, the Crow Rate, were heavily criticized for their perceived effect of favouring a narrow range of cereal grains and oilseeds over perennial forage crops. The demise of the WGTA was thus anticipated to prompt prairie producers to reverse this imbalance and diversify into non-traditional crops (Kerr, Fox, Hobbs *et al.* 1991; TAEM 1992). In the years immediately following the WGTA's abandonment, the Goss Revenue Insurance Plan, a commodity-based revenue protection programme, was also phased out, which also had the effect of increasing producers' exposure to price and yield risks. According to standard agricultural risk management theory *and* conventional climate change adaptation theory, individual producers should have diversified their crops..

Figure 7.1 depicts a conceptualized 'coping range' superimposed on climatic conditions. This formulation supposes that when the climatic condition exceeds a farmer's coping range, producing an 'extreme event', an adaptive response may be initiated. Bradshaw, Dolan, and Smit (2004) argue that this conceptualization can be extended to any exogenous condition like commodity price or input cost, and that all other things being equal, a mix of crop with minimal yield and price correlation will increase a farmer's coping range, while crop specialization serves to narrow it.

Bradshaw, Dolan, and Smit (2004) then use the WGTA's termination to test this formulation of adaptive capacity, and then calculate that between 1994 and 2002, and found that diversification actually decreased across all farm types, with the smallest size farms becoming relatively more specialized.³

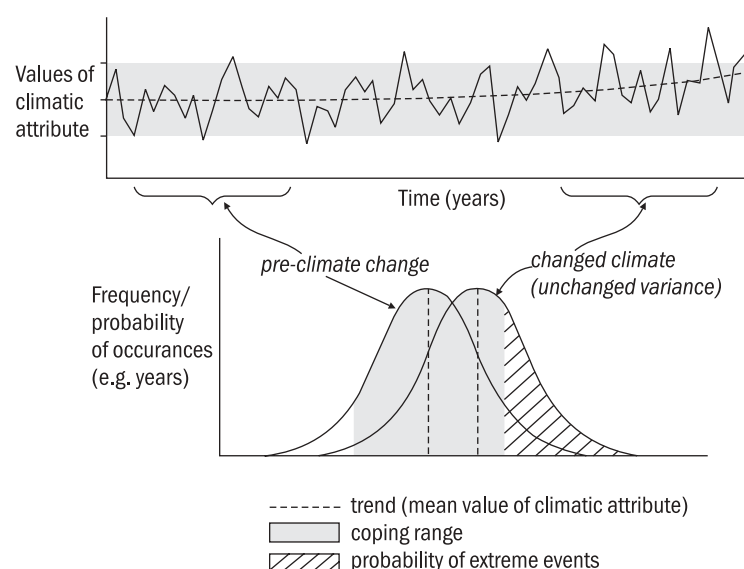


Figure 7.1 Concept of coping range in relation to climate change, variability, and extreme events

Source Smit and Pilifosva (2001)

³ Although on a regional scale, diversification did appear to have taken place.

Bradshaw, Dolan, and Smit (2004) relate this case of apparent non-adaptation as a cautionary tale of sorts for mainstream climate adaptation practitioners—primarily the notion that adaptive strategies can in principle be identified by analysts and extension officers and promoted to farmers for timely adoption. Bradshaw, Dolan, and Smit (2004) infer that diversification may be impeded by its perceived high start-up cost, and negative scale economies, and conclude that the task of identifying and promoting acceptable adaptation strategies may be slow, difficult, and even futile, and that observing actual on-farm behaviour in light of multiple risks and opportunities may be more fruitful.

More broadly, what of the WGTA? Why has diversification not flourished at the farm-level as its detractors expected after its termination (particularly as farm incomes continue to stagnate)? Two general hypotheses emerge, such as the following.

- 1 The demise of the Crow Rate is irrelevant or marginally relevant compared to the other determinants of agricultural practice and outcomes
- 2 The detractors were essentially right, but under-estimated its significance. In this scenario, the Crow Rate has had such a large influence on patterns of settlement and agricultural practice that its detrimental effect on the capacity for prairie agriculture to adapt (to economic or climatic risks) has persisted long after its termination.

Through an interrogation of the adaptive policy characteristics of the Crow Rate policy, the latter hypothesis is explored to a certain degree. Our rationale is simple—prairie agriculture is in crisis and at further risk from climate change, thus a clear retrospective understanding of the dynamics and impacts of policies that defined the region is a pre-requisite to understanding the future role of policy intended to help promote adaptation.

7.2 Policy description: changes, drivers, and impacts

This section presents a time line for the evolution of the Crow Rate and its successor, the WGTA, through its century-long existence (Figure 7.2). Specific attention is paid to changes in the rules and delivery system of the policy instrument, the driving forces for changes that did occur, and the socio-economic and environmental impacts that resulted from policy implementation. This information forms the foundation for an analysis of the adaptability of the policy instrument throughout its life span, presented in section 7.3.

The policy began as part of a broader policy framework, namely the Crow's Nest Pass Act of 1897. The purpose of the Act was to facilitate the development of western Canada in light of a potential threat of American influence and expansion northward and to expand the existing market base of eastern Canada. Central to the Act was a CAD 3.4 million subsidy from the federal government to the CPR (Canadian Pacific Railway) for the construction of a railway through the Crow's Nest Pass of the Alberta Rocky Mountains into the Kootenay region of British Columbia to arrest further American control of the area (Friesen 1984).

As *quid pro quo* for the expansion subsidy, the CPR did agree to reduce freight rates for transporting grain from the prairies by CAD 0.03 per hundred pounds (Rothstien 1989) and establish this as the maximum rate in perpetuity. This rate-control agreement is referred to as the Crow Rate. Historians now regard the rate-control agreement as more of a footnote in the Crow's Nest Pass Act, rather than a central feature of the agreement; the broader purpose of the Act was to reinforce national development and sovereignty and reign in the CPR, which the federal government still regarded as an instrument of national policy (Friesen 1984)⁴. Earl (1996) notes that, of the Act's 17 clauses, only three relate to freight rates, and little, if any, of the parliamentary debate leading up to the Act that dealt with the role of freight rates in western settlement. The actual inclusion of the rate-control agreement may

⁴ CPR President, William Van Horne (an American), described the CPR's role differently when he told a US Senate committee that 'The Canadian Pacific was built for the purpose of making money for the shareholders and for no other reason under the sun.' (Friesen 1984, p.177)

have been more of a desire for market control on the part of the federal government at that time, and a desire for security on the part of agriculture producers.

A 1973 paper of the University of Manitoba concluded that the Crow Rate deal was a means to re-establish a 'unity of purpose' between the railway and the federal government by buying back from the CPR rate-setting freedom, which many felt was not in the national interest (Duncan 1973)

The first change in the rate-control agreement came just seven years after its inception in 1903 when the government of Manitoba requested that the agreement be extended to the CNR (Canadian National Railway). To solidify this change, the government of Manitoba leased several bankrupt railway systems to CNR and guaranteed bonds for rail construction (Rothstein 1989).

The railways did well by the deal in the early years. Earl (1996) also notes that freight rates at the time of the agreement's were dropping and rates lower than the Crow Rates prevailed until World War I. The War ushered in a new inflationary era, resulting in a costly wage settlement for the railway and eroding profitability. The War Measures Act in 1919 suspended the Crow Rate for three years allowing freight rates to rise above the 1897 level, and allowed the railways to cope with their impending insolvency (Earl 1996). Although political efforts were made to permanently suspend the Crow Rate, prices, politics, and values had changed, and the Crow was reinstated—it and its successor, the WGTA, would then last for the next 70 years.

The political forces that held sway to reinstate the Crow in 1922 and retain it in 1925 (when the issue came before Parliament again) differed substantially from those of the original framers of the 1897 agreement in the following two ways.

- 1 The predominant ideology in Parliament and among farmers was *laissez faire* liberalism in 1897, and the essential unity of purpose between the railways and the nation was unchallenged. However, by 1922, sharp conflicts of interest had emerged between the railway and defenders of the Crow Rate. Relatively minor irritants such as liability for damaged livestock and distribution of boxcars foreshadowed more fundamental grievances with capitalist ideology. Grain prices had collapsed in the early 1920s, which was popularly interpreted as collusion by 'powerful interest groups: manufacturers, the railways, and banks' (Earl 1996, p6) to secure special privileges and manipulate markets at the farmer's expense. Earl argues that between the First World War and 1924, farm leaders began to view the market economy 'not as a malfunctioning institution that could be corrected, but as fundamentally corrupt' (Earl 1996, p6). Reinstating the Crow Rate on terms beneficial to the farmer was, in this view, part of this basic fight for justice.
- 2 An emerging view of the Crow's role was as an essential part of the West's socialist *Magna Carta*. Whereas, the goal of the western settlement was scarcely raised in 1897, the Crow's encouragement of settlement featured prominently in the arguments raised by its proponent's—primarily the newly founded 'Progressive Party'. Although a complex, nationwide phenomenon and often badly divided, the *Progressives* were the first political manifestation of this emergent socialist sentiment that ultimately gave rise to farmer-owned wheat pools, consumer cooperatives, and eventually the Canadian Wheat Board, all of which were attempts by farm groups to control their own economic destiny (Friesen 1984, Earl 1996). The *Progressives*⁵ held the balance of power in McKenzie King's 1921 minority Liberal government (including 37 seats from the prairies!), and forced the reinstatement of the Crow Rate in 1922 and its continuance in 1925—political victories for which they received credit from the farm community⁶.

⁵ Thomas Crerar, the Progressive leader in 1922, was, also President of the United Grain Growers, an old *laissez-faire* liberal and former minister of agriculture, but firm proponent of public railway ownership.

⁶ The largely farm-based Progressive Party had continuous representation in Parliament until 1935, when they were routed by the Social Credit Party of Canada. After the party's electoral demise, supporters generally returned to the Liberal party camp where they had been popularly regarded as "Liberals in a hurry". The more radical fringes splintered several ways: the "Ginger Group" joined with the two sitting Labour MPs, eventually forming the CCF (the fore-runner of the modern New Democratic Party). The radical populists, would embrace Social Credit ideology, forming a continuous line of western protest that continues to this day through the Reform Party of Canada, the Canadian Alliance party, and the now-governing (again just) Conservative Party of Canada. Impressively, both ends of the contemporary Canadian political spectrum (and much of the middle), have their roots in this fledgling farm movement founded in Winnipeg eighty five years ago.

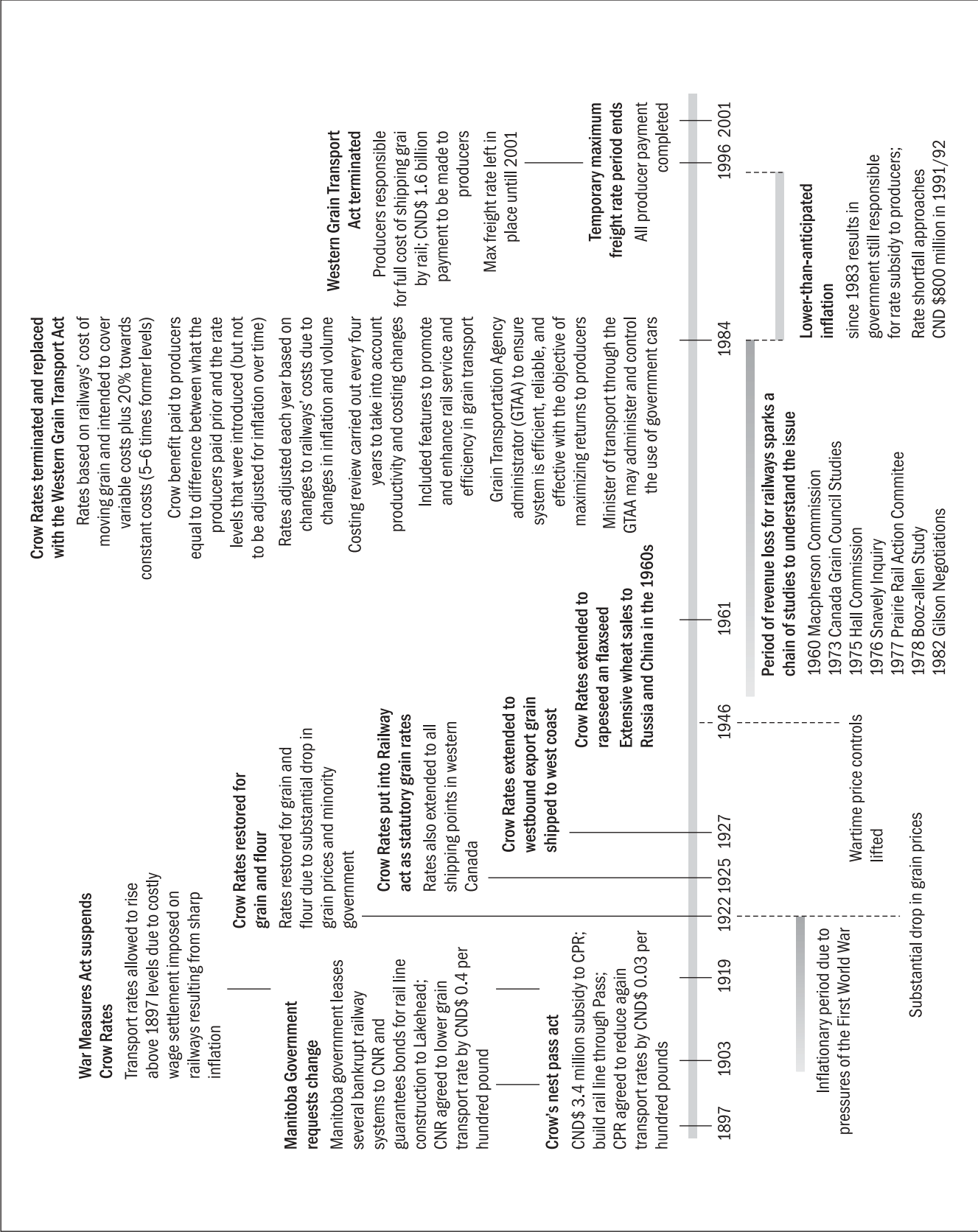


Figure 7.2 Evolution of the Crow Rate

The 1925 legislative change to the Crow Rate, achieved by the *Progressives*, was particularly significant as they forced King's minority government to embed the Crow Rate in the Railway Act as 'statutory grain rates'. Although the previous two decades saw the rate appear and disappear due to inflation, the Crow Rate would now stay in place virtually unchanged for the next six decades. The only exceptions were further *expansions* of the rate-control agreement in 1927 and 1961 to include west-bound transport of grain to the prairies and to include rapeseed and flax in addition to grain and flour (Earl 1996).

Earl (1996, p 10) argues that the vigorous defence of the Crow Rate marked an era of policy dysfunction, 'with all that it implied by way of regulatory control, intervention in the market, antipathy to a free market', and was foundational to a developing a 'grain ideology' that shaped prairie agricultural policy detrimentally and ruled unchallenged until the late 1960s.

A major underlying premise of the Canadian grain policy, concurrent with the rise of the Wheat Pools and the Canadian Wheat Board, was that farmers could be buttressed from international price vagary if Canada withheld wheat from the market. Early commissioners of the Board, J D McFarland and Bill McNamara, firmly adhered to this theory, the net result of which was unfortunately increased stocks, not prices. Earl (1996, p10) relates that, by the 1950s, burgeoning wheat stocks were stored in elevators, on farms, and even in community curling rinks built with government storage payments for the wheat they housed. The other major effect of 'withholding' was a poorly maintained grain transportation system, whose dysfunction was clearly revealed after the federal government decided to abandon the withholding policy and sell large amounts of wheat to Russia and China starting in the late 1960s.

The protracted period of unabated maximum freight rates under the Crow Rate had left a legacy of a network of elevators and rail lines that were quite decrepit (Earl 1996) as the railways did not have the funds or the incentive to invest in the required capacity increases (Rothstein 1989). The transportation system's poor performance in the wake of these Chinese and Russian sales was really the catalyst for major study and a fundamental re-thinking of grain transportation policy. There was significant government intervention during this period to improve the grain transportation system, particularly from 1975 to 1979 via the purchase of close to 20 000 new railcars and an 'upgrading and rehabilitation programme for the lines in the basic branch network' (Rothstein 1989). The excerpt below describes these impacts in more detail.

'Over time, the costs associated with the transportation of grain rose with inflation and the two dominant railway companies that existed in western Canada began to incur losses. By the 1970s, the rate railways were forced to charge for moving grain was far below its costs of doing so. In 1977, only 32% of variable costs were covered by users, 18% by federal branch line subsidies, and the remaining 50% was left to the railroad as loss. As a result, the railway companies had an incentive to slow down maintenance on prairie branch lines. A lack of equipment capacity to move grain to port became severe during the 1970s and led to major delays and a lack of capacity in the grain-handling system. Demand for wheat exceeded the grain transportation capacity and grain sales were lost. As a result of the crisis, the Government of Canada along with Provinces of Saskatchewan and Alberta became involved in the grain transportation industry by providing new hopper-bottomed cars to the railways, in order to improve their grain-handling capacity' (Khakbazan and Gray 1997).

These impacts did not go unnoticed and, in fact, they sparked a chain of studies to get to the bottom of the impacts and the linkages with the Crow Rates. From the first analysis in the 1960 MacPherson Commission, through Snaveley Inquiry in 1976, and ending with the Gilson Negotiations in 1982, a long and drawn-out period of analysis and learning ended with a complete overhaul of the Crow Rates under a new policy – the WGTA – in 1984. It should also be noted that this policy overhaul took place in the wake of a massive inflation problem, which inflicted the economy in the 1970s.

The instrument rules under the WGTA were more sophisticated than the rules of its predecessor instruments—the statutory rates under the Railway Act and the original Crow Rate. Some of the key features under the new act included the following.

Rates

- Rates based on the railways' cost of moving grain and intended to cover variable costs plus 20% toward constant costs (5–6 times former levels)
- Based on forecast grain volumes provided by the Grain Transportation Agency, and the estimated costs to the railways for moving grain calculated by the National Transportation Agency (Producer Payment Panel 1994)
- Distance-based, designed to allow equal rates for equal distances (Producer Payment Panel 1994); shippers (producers) to be responsible for any increase in the volume of grain moved
- Rate divided into the shipper (producer) share and the government share—42.8% and 57.2% in 1993/94, respectively
- Rates adjusted each year based on changes to the railways' costs due to changes in inflation and volume

Crow benefit

- Payment to the railways initially established at CAD 656 million, which represented the losses incurred by the railways in the movement of grain during the 1981/82 crop year (Producer Payment Panel 1994)

Shipper share limitation

- Limits the freight transportation rate producers pay relative to a basket of grains—set at 10% (Producer Payment Panel 1994).

Inflation sharing

- Shippers (or producers) to pay the first 6% of inflation on grain transportation costs each year, with the government paying any remaining annual cost increases related to inflation

Costing review

- Carried out by the National Transportation Agency every four years to take into account productivity and costing changes

Grain Transportation Agency

- Created to ensure system is efficient, reliable, and effective with the objective of maximizing returns to producers
- Responsibilities included rail car allocation, system performance monitoring, port coordination, and the provision of grain volume forecast for WGTA rate determination. The Grain Transport Agency also administers the System Improvement Reserve Fund, which provides trucking and off-track elevator programmes for farmers affected by branch line abandonment (Producer Payment Panel 1994).

Senior Grain Transportation Committee

- A 29-member committee to advise the Minister of Transport on grain transportation issues

Many refer to the WGTA as the beginning of the end of the Crow Rates. For example, Khakbazan and Gray (1997) described, 'Over time, the WGTA was intended to transfer the responsibility of the costs of transportation from the government to the grain producers. However, lower than anticipated inflation since 1983 resulted in the government still being responsible for a significant subsidy to the railways well into the 1990s.' Despite the sophistication of the WGTA rules, changes were sought soon after its implementation in 1984, as the following excerpt illustrates.

'In June 1993, the federal government proposed (but did not pass) legislation to change the current method of payment from that of paying the subsidy to the railroads (in compensation for reduced producer rates) to that of paying the subsidy directly to the producer through the farm safety net system. This would result in transportation rates to producers, increasing to the full compensatory level. The Producer Payment Panel was established to make recommendations on how the WGTA benefit should be delivered to producers. It proposed that payments to producers be made initially on an acreage basis and eventually (after seven years) be part of a national farm safety net programme for all producers in Canada (FAO 1994).'

In 1996, the federal government had come to the point where the tether was to be cut and terminated the short-lived WGTA. The producers would now be responsible for the full costs of transporting grain by rail. To end the century old Crow Rate, the government was to make a CAD 1.6-billion payment to producers. Schmitz, Highmoor, and Schmitz (2002) took note that this was particularly favourable to the livestock industry as 'they argued that the added costs of shipping grain out of the prairies, if the Crow subsidy was changed in this manner, would lower the cost of beef production on the prairies and create much-needed value-added activities.' As a transition period, the maximum freight rate was left in place until 2001. In the 1995/96 crop year, transportation costs for barley in Saskatchewan more than tripled (Schmitz, Highmoor, and Schmitz 2002).

However, with the end of the transitory period for maximum freight rates in 2001, there was little opposition to the demise of the century-old policy instrument, owing to a large degree to the high prices of grain at the time and to the general acceptance of free market mechanisms—an acceptance that was not present 100 years earlier.

Many experts believed that the Crow Rate in the later part of the century led to a lack of diversification in cropping choices and a specialization in grain that would not have been there otherwise. A 2000 issue of the *Statistics Canada* bulletin on the agri-food industry and the farm community highlighted that 'contrary to expectations, the end of subsidized grain transport has not yet led to more diverse cropping patterns in Saskatchewan' (Bradshaw 2000). The bulletin noted that 'the Act was said to promote excessive cultivation of prairie soils by subsidizing and, hence, favouring the production of a limited number of grains and oilseeds over perennial forage crops. The inverse of this contention would suggest that its termination should have altered this favouritism and thereby reduce soil cultivation in the prairies and promote output diversification.' A number of studies assessing the WGTA were noted to have project minor changes in prairie production, including 'decreased wheat and barley production, increased canola, flaxseed and livestock production, and some conversion of arable land to pasture.'

7.3 Adaptive policy analysis

In this section we analyse the evolution of the Crow Rate from an adaptive policy perspective following the conceptual framework described in Chapter 2.

From the timeline presented on Figure 7.2, there appear to be four key periods in the life of the Crow Rate policy, such as the following.

- 1 *Period of policy change:* from inception in 1897 through 1925 when the policy was made statutory
- 2 *Period of policy stability and learning:* from 1925 through to the termination of the Crow Rate and introduction of the WGTA in 1984
- 3 *Period of policy decline:* up till the termination of the WGTA in 1996
- 4 *Period of impact:* from termination of the WGTA

Each of these periods is analysed here in terms of adaptive policy features as they relate to helping policies adapt to both anticipated and unanticipated conditions. We also make reference to the principles for effective intervention in complex adaptive systems, a feature of adaptive policies, which deal with unanticipated issues (see Chapter 2, Table 2.1).

7.3.1 Period of policy change (1897–1925)

The policy changes that occurred during this early period were of two main types. One was expansion of the policy to more rail lines in the west and these changes were made relatively easily since the policy was an agreement, which could be amended without significant formality. The other type of change, and the one most interesting in this analysis was the change in the policy resulting from inflationary pressures. From our current perspective in the year 2005, this would appear to be a lack of ability to adapt to anticipated conditions, but the historical account of the policy notes that inflationary pressures were a new thing of the day, at least to the mainstream policy community⁷. It is highly possible that some experts anticipated this and may have suggested that the rates would need to change in such a case, but no such rule was built into the policy at the outset to allow the policy to perform under changing inflation. Instead, informal process of monitoring and learning resulted in the rates being allowed to rise above the 1897 levels due to a costly wage settlement imposed on the railways to deal with inflation. But since the policy was an agreement, it was easily changed to account for the then unanticipated condition.

Those in favour of the policy were troubled by how easily the Crow Rate could be changed. This realization resulted in a significant policy change in 1925 when the minority government of the time was pressured to engrave the Crow Rate into the Railway Act.

7.3.2 Period of policy stability (1925–84)

The statutory Crow Rate achieved what many nervous politicians and policy-makers set out to accomplish at the time, because while the rates were expanded to other rail lines, the actual Crow Rate did not change at all for the next sixty years. The history on the policy is relatively quiet during the war time period, but following the end of World War II revenue losses by the railways as transportation costs rose with inflation, were starting to become apparent and this sparked a period of policy learning via a series of at least seven commissions, studies and inquiries to understand the extent of the issue and the range of impacts resulting from the Crow Rates.

The impacts of the statutory Crow Rates identified from this period of policy learning were significant. Among the most serious impact was a complete deterioration in the performance and capacity of the rail system to transport grain, which became painfully apparent when Canada's grain export market expanded to Russia and China. Following the seventh study by Gilson in 1982, the stress that had been building up in the statutory policy finally had to give way to a complete policy overhaul with the introduction of the WGTA.

While this is surely a mal-adaptive period of the statutory Crow Rate, an informal mechanism of monitoring, learning and policy improvement was realized via the seven studies carried out during the period 1960 through 1982. We refer to this as an informal mechanism because these studies were not required as part of the rules and delivery system of the statutory Crow Rate, but rather, were initiated external to the policy. This period of informal policy learning could be analysed in great length here, however, the focus of this research project is on the formal mechanisms of adaptive policy-making—mechanisms that are built into the policy at the outset to require that policy performance be monitored and necessary improvements be incorporated. Such formal mechanisms are evident in the new version of the Crow Rate – the WGTA—and are analysed in more detail later.

Before moving on however, it should be noted that adaptability was again lacking in the Crow Rate during this period. Despite having learned about inflationary pressures prior to 1925 and the stress this put on the Crow Rate, nothing was built into the statutory rate in 1925 that would allow the rate to adjust with inflation. Had this been done, it is quite plausible that the negative impacts on the quality of the rail network might have been averted.

⁷ A system of national accounts in Canada to analyse inflation did not exist until the middle part of the century. Therefore, it is plausible to consider inflation at that time to be an unanticipated condition in mainstream policy.

7.3.3 Period of policy decline (1984–96)

The policy rules and delivery system of the WGTA represented a significant increase in sophistication compared to its predecessors in 1925 and 1897. An analysis of the policy rules and delivery system in section 7.2 revealed that several mechanisms for adaptive policies were incorporated, and these are summarized again in Table 7.1. Most notable for this paper is the adaptability mechanism (monitoring, learning, and improvement) in the form of a *Costing Review* carried out by the National Transportation Agency every four years to take into account productivity and costing changes. This is the first time in the history of this policy that such a review had been formally required on a systematic basis. Another adaptability mechanism was incorporated in the form of the Grain Transportation Agency, which was created to ensure the system, stays efficient, reliable, and effective with the objective of maximizing returns to producers.

A number of mechanisms were built into the rate mechanism of the revised policy to help it perform effectively under a range of anticipated conditions. The most notable being that the rate, once fixed, would now be based on the railways' 'cost of moving grain and its intended cover variable costs, plus 20% towards constant costs'. This cost was based on forecasts of grain volumes by the Grain Transportation Agency and on the railways' costs provided by the National Transportation Agency.

Another notable mechanism was the policy rule requiring that rates be adjusted each year based on changes to the railways' costs due to changes in inflation. These two mechanisms were clearly designed to make the new rate more effective under conditions previously unanticipated—inflation and rising transportation costs.

With the above mechanisms and the others listed in Table 7.1 being incorporated after decades of policy learning, one would think that the policy would stand the further test of time. But, not soon after the WGTA was implemented, there were calls for it to be changed and even terminated.

While the policy's rate mechanism had been made robust to rising inflation, the policy overall was still vulnerable to uncertainty in the form of a lower than anticipated inflation rate; because the Crow benefit mechanism was not robust. Because of these lower-than-anticipated inflation rates, the federal government was still responsible for a significant subsidy on the order of CAD 800 million by 1994.

The list of principles for effective policy intervention provided in Chapter 2 (Table 2.1) does alert us to another possible explanation for the demise of the WGTA. Creating opportunities for self-organization is a critical aspect of effective intervention in complex and adaptive systems. The ability of the free market to adjust to numerous circumstances in all corners of the market is a positive trait with respect to adaptability. In this instance the stifling of innovation in the railway transportation network was a clear consequence of a policy, which hindered the market from providing the signals to allow actors to self-organize appropriately.

In the end, there was a growing public acceptance that such an administered rate in a free market system did not make economic sense. Combined with the high price of grain at the time the WGTA was terminated, this led to the Crow Rate and its predecessor, the WGTA, to go 'not with a bang, but with a whimper' (Earl 1996).

7.3.4 Period of socio-economic and environmental impact due to termination of the WGTA (1996 onwards)

In a study on farm-level adaptation to climate variability and change, Bradshaw, Dolan, and Smit (2004) reported that, in the years following the termination of the WGTA, GRIP (Gross Revenue Insurance Programme) was also phased out 'thereby increasing prairie farmers' exposure to both price and yield risks.' These researchers provide a particularly insightful and lucid account of the economic and environmental conditions during this phasing out of multiple farm assistance packages. Their account included the following.

- With respect to economic conditions, prices for traditional cereal crops, and especially spring wheat, declined significantly after the 1995 peak year to levels comparable to the early 1990s but well below those of the prior decade in real dollar terms. In the prairie region in particular, this downturn, coupled with steadily increasing input costs, put a significant strain on farm profitability through the latter years of the 1990s; in Saskatchewan, for example, realized net

Table 7.1 Adaptive policy mechanisms of the Western Grain Transportation Act for addressing anticipated and unanticipated conditions

Policy rule or delivery system component	<i>Mechanism to deal with anticipated or unanticipated conditions</i>
Rates	
<ul style="list-style-type: none"> ▪ Rates based on the railways' cost of moving grain and its intended cover variable costs, plus 20% towards constant costs (5–6 times former levels) 	For anticipated conditions
<ul style="list-style-type: none"> ▪ Based on forecast grain volumes provided by the Grain Transportation Agency, and the estimated costs to the railways for moving grain calculated by the National Transportation Agency (Producer Payment Panel 1994) 	For anticipated conditions
<ul style="list-style-type: none"> ▪ Distance-based, designed to allow equal rates for equal distances (Producer Payment Panel 1994); shippers (producers) are to be responsible for any increase in the volume of grain moved 	For anticipated conditions
<ul style="list-style-type: none"> ▪ Rate divided into the shipper (producer) share and the government share—42.8% and 57.2% in 1993/94, respectively 	For anticipated conditions
<ul style="list-style-type: none"> ▪ Rates adjusted each year based on changes to the railways' costs due to changes in inflation and volume 	
Crow benefit	
<ul style="list-style-type: none"> ▪ Payment to the railways initially established at CAD 656 million, which represented the losses incurred by the railways in the movement of grain during the 1981/82 crop year (Producer Payment Panel 1994). 	
Shipper share limitation	
<ul style="list-style-type: none"> ▪ Limits the freight transportation rate producers pay relative to a basket of grains, such that the producer freight rate cannot exceed 10% of the basket price of grains. 	For anticipated conditions
Inflation sharing	
<ul style="list-style-type: none"> ▪ Shippers (or producers) to pay the first 6% of inflation on grain transportation costs each year, with the government paying any remaining annual cost increases related to inflation 	
Costing review	
<ul style="list-style-type: none"> ▪ Carried out by the National Transportation Agency every four years to take into account productivity and costing changes 	For unanticipated conditions
Grain Transportation Agency	
<ul style="list-style-type: none"> ▪ Created to ensure the system is efficient, reliable, and effective with the objective of maximizing returns to producers 	For unanticipated conditions
<ul style="list-style-type: none"> ▪ Responsibilities included rail car allocation, system performance monitoring, port coordination, and the provision of grain volume forecast for WGTA rate determination. The Grain Transport Agency also administers the System Improvement Reserve Fund, which provides trucking and off-track elevator programmes for farmers affected by branch line abandonment (Producer Payment Panel 1994). 	For anticipated conditions
Senior Grain Transportation Committee	
<ul style="list-style-type: none"> ▪ A 29-member committee to advise the Minister of Transport on grain transportation issues 	For unanticipated conditions

incomes in 1999 were down by 87% relative to the average baseline during 1994–98 (Agriculture and Agri-Food Canada 2000). Wheat prices rebounded in 2002, but many farmers were unable to capitalize on them owing to drought-induced production declines.

- Record dry conditions were experienced in many parts of the prairies in both 2001 and 2002 following two decades of generally warmer and drier conditions. Indeed, for the period 1948–2003, nine of the 10 warmest springs and five of the 10 driest springs in the prairies have occurred since 1980 (Environment Canada 2003). While events such as the 2001 and 2002 droughts were within climatic norms, they and the general conditions of the past two decades have increasingly been viewed in the context of anticipated climate change (Agriculture and Agri-Food Canada 2003).
- Lastly, on the technology front, increased use of irrigation has enabled the production of novel crops (such as potatoes) in traditionally semi-arid zones, while effective and relatively inexpensive herbicides have facilitated a shift towards conservation tillage. Zero- and minimum-tillage systems not only save time for producers and contribute to long-term soil quality, but also serve to limit greenhouse gas emissions and soil erosion, two environmental issues of particular concern to the region. Indeed, conservation tillage – as with irrigation, crop diversification, and other favoured innovations – has been actively promoted, of late, through a well-funded extension effort; this is to promote adaptation of Canadian prairie agriculture in case of a less subsidized and more risky environment.
- While the termination of the WGTA provided the specific justification and impetus for the provision of over CAD 2 billion to prairie farmers and regional “adaptation councils” in the four-year period following 1995, its broader aim was to foster greater self-sufficiency among producers in anticipation of market threats and recurring weather events such as drought. Given this concerted effort, recent evidence of crop diversification and other shifts in practice has been well received by federal and provincial officials; however, it is not clear that crop diversification has occurred at the individual farm scale.⁸

In 2005, the NFU submitted a 16-point plan to the Parliamentary Secretary of Agriculture and Agri-food Canada to help solve the farm crisis. In this plan, they re-address the transportation cost issue and cite that ‘no other policy decision has had a greater negative impact on western farmers’ income than the ending of the Crow benefit and the legislative changes made to transportation. The results have been devastating, with grain farmers’ gross incomes reduced by as much as 40% through increased rail costs’ (NFU 2005).

The NFU describes an interesting shift in transportation, which has impacted the agriculture producers. This was a shift from bulk hauling on railway branch lines to the ‘increased use of semi-trailer trucks on rural roads’. This, the NFU notes, has not only increased energy costs and usage, but it has also shifted those increased costs on to farmers. The following citation highlights the impact of ending the Crow Rate on the grain transportation system as put forth by the NFU in their 16-point plan.

Since the beginning of the 1999–2000 crop year, the number of licences for primary and process elevators located in western Canada has fallen from 1004 to 416—a reduction of 59%. The trend towards high-throughput elevators and the abandonment of transfer of thousands of kilometres of branch lines has allowed the railways to capture significant efficiency gains. Farmers meanwhile have been forced to pay the increased cost for trucking, and rural communities have shouldered rising tax burdens associated with increased road maintenance’ (NFU 2005).

⁸ The data analysed by Bradshaw, Dolan, and Smit (2004) indicates that crop diversification is not occurring at the farm level in the prairies; however, there would appear to be some modest level of crop diversification at the sector level on the prairies. Therefore, while this might help reduce the vulnerability of the sector (for example, given a greater variety of crops being grown), the vulnerability of the individual farmer is not being reduced.

The deleterious impacts to railway hopper cars observed in the 1970s were again observed by the NFU at the turn of the century. In their 16-point plan of 2005, they highlight that ‘the hopper car fleet in general has deteriorated, and substantial refitting must be done to reclaim this important asset.’ Additionally, the NFU notes that ‘farmers who try to utilize the producer cars are given low priority by the railways, often facing long waiting periods and unreliable spotting of cars.’ All of these impacts have led the NFU to call for a ‘renewed emphasis on the use of railway branch lines to lower farmers’ costs, and thereby contributing to higher net income.’

7.4 Lessons learned

Analysis of the Crow Rate over the course of the 20th century from the perspective of adaptive policies has provided some useful insights into the policy itself and into the conceptual framework from Chapter 2 as a diagnostic heuristics for our analysis.

Essentially, the ‘reformed’ Crow Rate – the WGTA – illustrates mechanisms for responding to anticipated conditions. Arguably the single biggest failing of the Crow Rate was the absence of inflation indexing in the 1925 legislation. Inflation, though a relatively new phenomenon, was not unprecedented and policy-makers could have reasonably anticipated its re-occurrence, but the emergent anti-market ideology of the day probably precluded such a concession to the market forces.

Although the WGTA was a vastly more sophisticated policy instrument; it was likely doomed from the outset; its appearance was too late—popular ideology had shifted too profoundly. Earl (1996, p16) remarks, ‘In the end, it was not the rational arguments, which prevailed, but the shift in public philosophy that saw markets, not centralized control as the appropriate way to run an economy.’ Earl further remarks, ‘Perhaps, (future policy-makers) will point out just how foolish we were to place such faith in the market, and to forget the abuse of market power, which led farmers to be so interventionist in the first place. And perhaps, as we repeat history, we will come to find out why farmers and shippers portrayed the system of the 1920s in the way they did as depicted in Figure 7.2.’

Ten years later, Earl’s comments seem prescient; given the current economic crisis the prairie agriculture is now going through. One certainly wonders if the ‘adaptive capacity’ of prairie farmers to cope with market vagary was greatly over-estimated in the zeal to embrace market principles. Furthermore, we can only speculate the extent to which a fundamentally mal-adaptive instrument like the Crow Rate ‘hard-wired’ economic and environmental inefficiency. This is perhaps the most humbling learning from this case study—policy persistence. Rigid, mal-adaptive policies foreclose for a long time in the future other policy options. Decades of ‘grain ideology’ left a legacy that could not simply be undone by terminating the subsidy. In fairness, the necessity of facilitating adjustment was recognized and three provincial rural adaptation councils were formed to conduct and disseminate research that would enhance farmers’ adaptive capacity. However, in their analysis of observed post-WGTA diversification, Bradshaw, Dolan, and Smit (2004) contend that there are probably real limits to the extent that adaptation measures can be identified *a priori* and extended, which they interpret as a cautionary tale with regard to climate change impacts.

With the benefit hindsight, how might policy-makers have developed a policy framework that could cope with the fundamental surprises, longer-term changes, and uncertainties inherent in complex socio-ecological systems—the uncertainty of future climate change an excellent example thereof? To help address this question we look for guidance from our adaptive policy heuristics (that is, for anticipated and unanticipated conditions). We also look for voices from the farm and community to understand the practical dynamics of adaptation and adaptability—a research priority also identified by Bradshaw, Dolan, and Smit (2004).

Table 7.2 summarizes our adaptive policy analysis over the life span of the Crow Rate policy and its predecessor, the WGTA (Figure 7.3). The summary purports that the Crow Rate never achieved a high level of adaptability, owing in large measure to an inability to respond to unanticipated conditions throughout its life. Looking deeper, we see that informal mechanisms for policy learning were

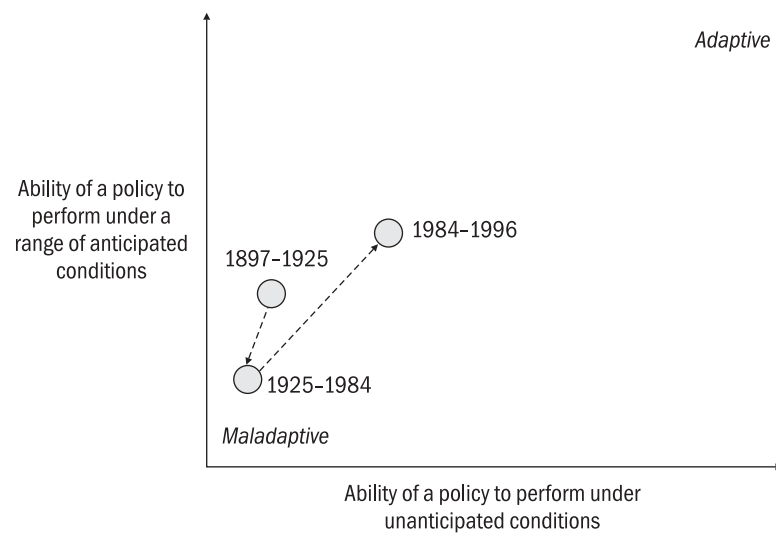


Figure 7.3 Adaptive policy diagnostic of the Crow Rate policy over its life span.

Table 7.2 Adaptive policy analysis of the Crow Rate during its life

	<i>Period of policy change (1897–1925)</i>	<i>Period of policy stability (1925–1984)</i>	<i>Period of policy demise (1984–1996)</i>
Ability to perform in a range of anticipated conditions: Understanding interaction with the natural, built, and socio-economic environment	Low: could not account for inflation	Low: still did not account for changes in inflation, which could have been anticipated	High: policy rules account for inflation and changes in transportation costs
Ability to perform in unanticipated conditions: Monitoring, learning, and improvement	Medium: while formal process did not exist, informal processes resulted in change, owing in large measure to the relative simplicity of making amendments to the rate-control agreement	Low: informal process at work, but statutory nature of the policy made it difficult for informal learning processes to result in change	High: formal processes in place (4-year Costing Review; GTA administrator's ongoing evaluation of system efficiency)
Creating opportunities for self-organizing behaviour	Low	Low	Low: the eventual demise of the policy in this period makes it clear that despite mechanisms of monitoring and learning, the policy did not allow for sufficient self-organization (for example, the rate was still an administered rate in a free-market system) and this was ultimately its downfall.

operating throughout the policy's life span, but it was the rigidity of the statutory nature of the policy starting in 1925 that led to a reduction in adaptability to unanticipated conditions.⁹

Ultimately, it can be argued that it was the non self-organizing nature of the administered rate in a free-market system that kept the adaptability of the policy at a low level and, consequently, kept the policy inflexible over its life span and leading to its demise.

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CHAPTER

8

Adaptive policy case study: analysis of Manitoba's conservation district policy

- 8.1 Introduction
- 8.2 Policy description: changes, drivers, and impacts
 - 8.2.1 Historical policy evolution
 - 8.2.2 Initial watershed focus
 - 8.2.3 Conservation Districts Commission
 - 8.2.4 The current legislation
 - 8.2.5 Recent financial history
 - 8.2.6 Emergence of local decision-making
 - 8.2.7 Range of programmes
 - 8.2.8 Drainage, conservation, and performance measurement
- 8.3 Adaptive policy analysis
 - 8.3.1 Surface water management (various CDs: 1972–2006)
 - 8.3.2 Surface water management – first CD is the best existing model
 - 8.3.3 Abandoned well capping – Pembina Valley: 1997–2006
 - 8.3.4 Conservation agreements – Turtle Mountain: 2003–05
 - 8.3.5 Trans-boundary partnerships – West Souris: 2001–05
 - 8.3.6 Alternative Land Use Services pilot project – Little Saskatchewan: 2004–06
 - 8.3.7 Aboriginal participation – Alonsa: 1991–2001
- 8.4 Analysis and results

Appendix: Manitoba conservation districts

Adaptive policy case study: analysis of Manitoba's Conservation District policy

Stephan Barg¹ and Bryan Osborne²

8.1 Introduction

This case study was designed to explore several aspects of adaptive policy design. Chapters 1 and 2 have laid out a framework derived from the experience of the authors and from the literature. This particular case study examines a situation wherein the policy instrument – the conservation district policy of the government of Manitoba – devolves decision-making down from the provincial government to the locally-based boards of directors. It, therefore, allows us to explore the implications of such a decision-making policy on policy adaptability. Obviously, the local board can be closer to changing conditions in its own territory, and, therefore, presumably, better able to recognize and respond to unforeseen circumstances than the more distant officials in Winnipeg would be. Figure 8.1 is the map of the CDs (conservation districts).

The CDs have operated over a number of years, and there are now 17 of them. This allows us to compare the experiences across various CDs.

8.2 Policy description: changes, drivers, and impacts

8.2.1 Historical policy evolution

This section presents a chronology of key issues and events influencing the creation of Manitoba's CDs, their range of programmes over time, and their apparent future direction. Specific attention is paid to changes in the rules and delivery system of the policy instrument, the driving forces for changes that did occur, and the socio-economic and environmental impacts that resulted from policy implementation. This information forms the foundation for an adaptive policy analysis, presented in Section 3, of the policy. Manitoba's Conservation Districts Act received royal assent in 1976, making the provincial policy instrument itself relatively recent at only 30 years. However, the historical evolution of this policy is germane to the analysis of unanticipated conditions.

Much of Manitoba's landscape is inherently wet, including its productive southern agricultural soils. Consequently, water management challenges have existed in Manitoba since the province's

¹ International Institute for Sustainable Development

² Panterra Management Ltd

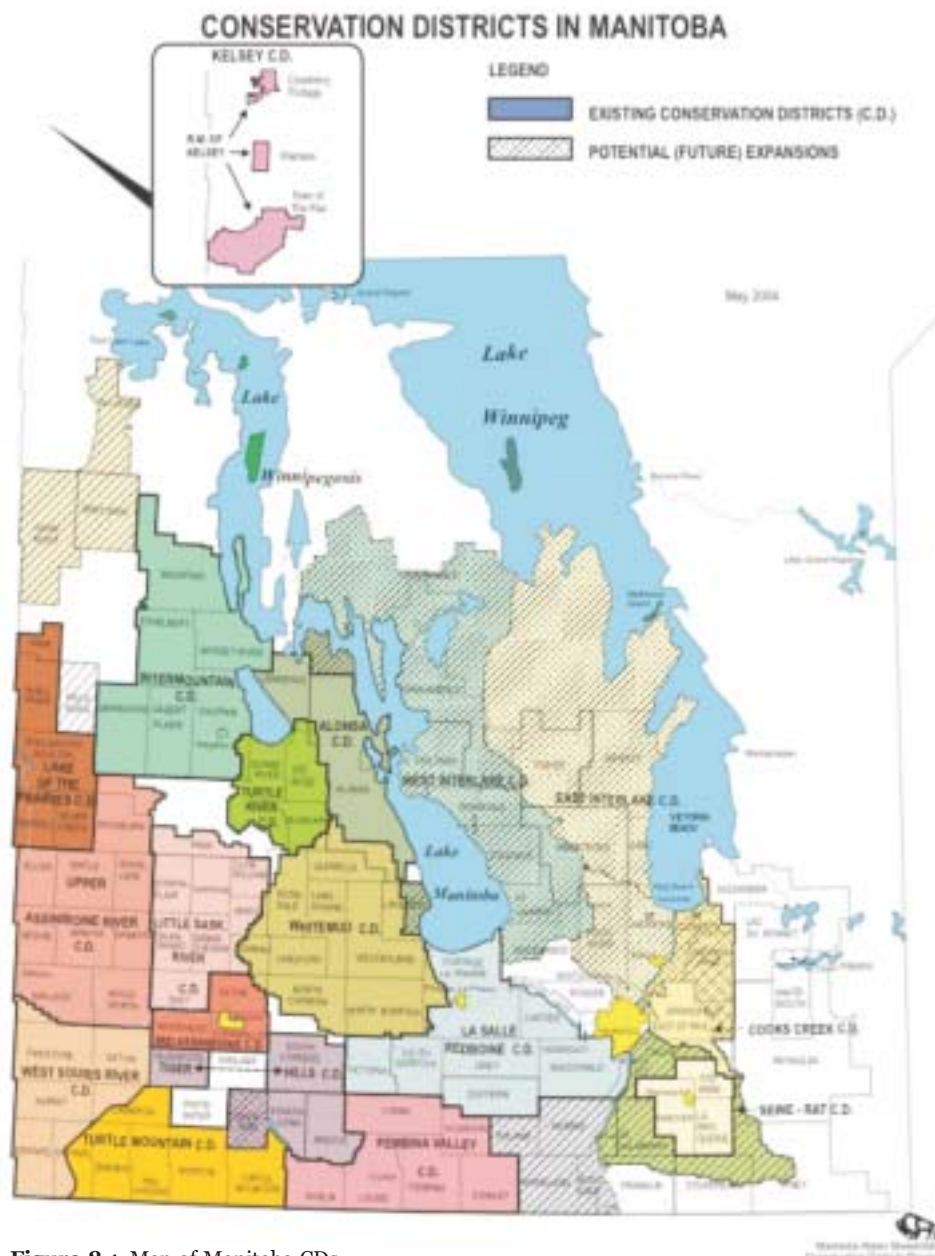


Figure 8.1 Map of Manitoba CDs
Source Manitoba Water Stewardship

agricultural settlement period. In response to the needs and demands of Manitoba's rapidly increasing population of rural agricultural families, provincial and municipal agricultural drainage schemes were a major focus from 1895 to 1935, during which two million acres of prime agricultural land were serviced with drainage infrastructure. Subsequent periods of drainage activity occurred in the 1970s, largely with the support of the federal government. While increased agricultural drainage made more land viable for annual crop production, according to Ogrodnik (1984), a number of long-standing and recurring drainage-related concerns routinely influenced local politics and provincial policy. These remain relevant even today and include the following.

- 'Foreign water' (water flowing into other areas from upstream) has regularly plagued the owners of the lowland agricultural areas and the downstream rural municipalities governing these lands.
- Strong perceptions exist that problems related to foreign water occur, and have become worse, because of upland drainage, land-use changes (including clearing of forested lands), and road construction.
- Suggestions are regularly made that owners of the upstream land (and rural municipalities) pay a portion of lowland water management costs.

Predictably, these concerns are more prevalent during and following periods of relatively wet growing seasons. They are highlighted in current public policy debates, particularly following record rains in Manitoba, and across the Canadian Prairies, during the peak growing period of 2005. Increased technological efficiency has also made it easier to undertake new on-farm drainage, often at a lower cost as compared to earlier methods.

In an attempt to understand and address the emerging 'foreign water' problems associated with increased agricultural drainage, the Province of Manitoba conducted several inquiries, beginning in 1918. As reported by Ogrodnik (1984), these commissions of inquiry gradually assisted in defining and clarifying Manitoba's surface water management challenge—eventually leading to the formulation of Manitoba's Conservation District Policy in 1976. The findings and recommendations of various commissions are described briefly in the following paragraphs.

The Sullivan Commission (1918–21) addressed the physical design of the agricultural drainage system; it was determined that a watershed-based drainage system should have been used by the provincial government, rather than the gridiron approach that was employed. The Commission also suggested that upland contributors of foreign water should be making a payment for the opportunity to drain water from their land to those living downstream.

The Finlayson Commission (1935–36) determined that downstream run-off flows were accelerated because of the associated upstream land clearing, roads, and ditch construction—all of which were elements of the upland drainage process. These factors resulted in rapid and high-volume run-off, causing erosion and silt deposition in the lowland areas downstream. Due to this extra water, downstream maintenance districts were forced to construct more drains, with costs borne by rural municipalities (and ultimately local taxpayers). As the costs of drainage increased, the proportion of provincial contributions to drain maintenance decreased—again increasing the local tax burden.

The Lyons Commission (1947–49) determined that upstream land-use changes and road/ditch work had affected water flow in two ways: by increasing the total run-off volumes and by increasing the rate of flow. These two factors resulted in increased peak flow during the run-off events. However, specific liability for the foreign water problems could not be proven, and it was recommended that the province become responsible for two-thirds of all future maintenance and construction of downstream drains that intercept, collect, and convey foreign water together with local water to points further downstream.

Ogrodnik (1984) also notes that two dominant policy results emerged over time, as the province attempted to address Manitoba's surface water management problems.

- 1 The transfer of most responsibilities for drainage from the local rural municipalities to the provincial government.
- 2 The enactment of legislation that permitted a more holistic approach to land and water management, embodied within the (ultimately repealed) Watershed Conservation Districts Act of 1959, and the current Conservation Districts Act, which received royal assent in 1976.

8.2.2 Initial watershed focus

The Manitoba Watershed Conservation Districts Act of 1959 is particularly interesting and relevant. It appears that this act may have represented the vanguard of public water management policy at the time (recognizing the importance of watershed-based solutions). However, it was repealed in 1976.

In fact, Manitoba's watershed focus for resource management began to dissipate as early as 1970, with the passing of the Resource Conservation Districts Act. Early CDs were formed under both forms of legislation. Whitemud and Turtle River were formed under the 1959 watershed-based legislation, while Turtle Mountain was formed under the 1970 resource legislation. Both early Acts were repealed and merged into the current version, initially passed in 1976.

Ontario's conservation authority legislation (which is watershed-based) was enacted in 1946, enabling the eventual formation of 36 local corporations that today spend CAD (Canadian dollar) 158 million annually on watershed management solutions through a local-provincial cost-shared partnership (Conservation Ontario 2006). Their responsibilities and financial capacity have increased dramatically in response to the Walkerton Inquiry recommendations, as key policy instrument delivery agents for the province.

A decade earlier, the US Flood Control Act was passed by Congress in 1936, signalling clear federal responsibility for water resources management (Allee 1987). Based on the apparent multi-purpose success of the Tennessee Valley Authority, federal support would be provided for the watershed-based projects for which 'the benefits to whomsoever they accrue are in excess of estimated costs', marking the beginning of watershed project evaluation (Galloway 1988).

Allee (1987) points to the early management concepts advanced by White (1957) as the first 'pure doctrine' of integrated watershed planning, management, and development-citing three ideas (multi-purpose storage projects, basin-wide programming, and comprehensive regional development) and two concepts (articulated land and water programmes, and unified administration), which characterize an effective watershed approach.

By the early 1960s, scientists recognized 'the watershed' as a sensible framework within which to address interrelated problems such as water quality and contamination. The approach of 'taking the whole watershed into account' emerged as an efficient and practical means of tackling these issues with the support of science. In tracing this evolution, Heindl (1972) notes two pervasive concepts founding the discipline.

- 1 The watershed is a closed system, which integrates the physical forces that act upon it.
- 2 The knowledge and experience gained through the study of one watershed are transferable and, thus, may be applied extensively elsewhere (and concentrated, small basin study is applicable to the larger ones).

Manitoba's 1959 watershed-based CD legislation was drafted following earlier legislative experiences in Ontario and the United States, at the dawn of the emergence of a new scientific discipline focused on watershed planning and management solutions. Manitoba had a timely opportunity to learn from these leading policy and scientific trends, and lead with new innovations.

8.2.3 Conservation Districts Commission³

It is critical to recognize the central and historical role played by the CDC (Conservation Districts Commission), an inter-departmental advisory body to the minister. The CDC has been in place since the earliest CD-related legislation established it.

The CDC provides guidance on policy and financial matters, including recommending annual provincial budget contributions for each district and the programme as a whole. The key policy-setting/recommending role played by the CDC is very important, as it represents the only real source of long-term planning (as well as documented historical reference regarding many policy decisions) for the CD programme.

The importance of these functions was recognized as early as 1959. The CDC has been strengthened over time and remains in place to this day. In its initial form, the CDC comprised director-level representatives from rural provincial departments such as natural resources, agriculture, and highways. It was initially chaired by the director of water resources.

Today, the CDC is chaired by the deputy minister of Manitoba Water Stewardship and comprises deputy ministers from four additional departments (responsible for agriculture, conservation, inter-governmental affairs, and transportation). It includes representatives from the Association of Manitoba Municipalities, the Manitoba Conservation Districts Association, and a public appointee. Recent legislation has also been enacted to increase this public representation by an additional person.

8.2.4 The current legislation

The CDs programme in Manitoba was originally mandated in the Watershed Conservation District Act of 1959. The rationale behind the Resource Conservation Districts Act of 1970, and the ultimate repealing of both Acts in 1976, is unclear. It may well have been associated with the turbulent nature of Manitoba's legislative assembly during this period. Seven general elections occurred between 1958 and 1977, representing the scope of potential political influence on the two (watershed- and resource-

³ The authors express their gratitude for contributions to this section by W Hildebrand.

focused Acts). General elections occurred in 1958 (June 16), 1959 (May 14), 1962 (December 14), 1966 (June 23), 1969 (June 25), 1973 (June 23), and 1977 (October 11).

The current Manitoba Conservation Districts Act was passed in 1976, and is designed to create partnerships between the provincial government and rural municipalities. The districts are to implement programmes that meet both local and provincial needs - with a focus on soil conservation and water management. The districts receive funding from both provincial and municipal sources, as discussed further along in the chapter.

Under the 1976 Act, the provincial cabinet can create CDs through an Order-in-Council. This may be done following an application from a municipality or municipalities, or it may be initiated by the provincial government. According to Section 7(7) of the current Act (Manitoba Statutes), the Order-in-Council establishing the district must state

- (a) *the boundaries of the district;*
- (b) *where applicable, the boundaries of the sub-districts into which the district may be divided;*
- (c) *the name of the district, which shall be substantially in the words 'The ...Conservation District';*
- (d) *the works to be excluded from the jurisdiction, authority, or control of the board;*
- (e) *the coordinator;*
- (f) *the schedule;*
- (g) *the effective date of the formation of the district; and*
- (h) *such other matters relating to the district as may be appropriate.*

In the legislation, the coordinator is defined as 'a civil servant designated by the minister for the purpose of coordinating all services and administrative assistance to CDs.' This is normally the manager of the province's Conservation Districts Programme.

The legislation defines the schedule as an Order-in-Council, which stipulates

- (i) *the upper and lower limits of the amount of money that a board may annually assess an included municipality and*
- (ii) *the limitations of the borrowing powers of the board.*

By this means, and through the advisory role played by the CDC, the government controls the financial and administrative capacity of the CDs. The CDC also provides policy guidance to all CDs through a series of policy directives approved by the minister of Manitoba Water Stewardship and coordinated by the CD programme secretariat with staff support.

While some of the earliest CDs were established along watershed boundaries, the majority of those existing today are based upon municipal boundaries, and as noted by the Conservation Districts Mandate Study (FT-Ecologistics 1998): 'Comprehensive watershed management planning is not being widely employed as a means of dealing with land and water interrelationships'.

Internally, each CD is divided into various 'sub-districts' that are intended to be as watershed-based as possible, so that planning and programme delivery tends towards implementation at the watershed level. The effectiveness of this approach is debatable.

On the one hand, municipal boundaries make CD formation easier, which is important. However, a lack of watershed focus (even when conscious planning and delivery attempts are made at the sub-district level) raises the question of effectiveness of CDs in their attempts to address water-related challenges.

The formation of the earliest CDs (Whitemud, 1972; Turtle Mountain, 1973; Turtle River, 1974; Alonsa, 1978; and Cooks Creek, 1979) represents a mix of watershed- and municipal-boundary-based corporations that have experienced the greatest range of policy instrument rules and instrument delivery mechanisms associated with Manitoba's Conservation District Policy. In doing so, these five CDs have also forged the path for successive CDs to follow.

In the initial years following the 1976 Act, provincial CD responsibilities were coordinated by the Water Resources Branch of the Provincial Department of Mines and Natural Resources. The Branch was a powerful, well-staffed organization focused on water planning and management, and charged with the delivery of several major federal/provincial projects at any one time. A small annual budget

was allocated by the Branch on behalf of the CDs and their partner municipalities. Drain maintenance and improvement projects were the major focus, while local input and governance were fairly limited. The CD programme budget was increased in 1984, which resulted in significant funding improvements for the initial five districts.

8.2.5 Recent financial history

Over the past 10 years, provincial spending on the CD programme has gradually increased, as shown in Table 8.1. However, the budgets for individual CDs have not increased appreciably, as increases in total programme spending are largely attributed to the formation of new CDs. Municipal grants went up as well, based on the general 3:1 funding arrangement, although these too were due to the addition of new municipalities joining the CD programme in the formation of new districts. Additionally, the CDs were able to access other funding sources, mostly from other federal and provincial programmes. These sources have been somewhat erratic. Most districts have had fairly steady levels of expenditure, with a few major deviations. Figure 8.2 shows the breakdown of expenditure by CDs over the past 10 years.

8.2.6 Emergence of local decision-making⁴

In 1981, a seven-member CDA (Conservation Districts Authority) was established within the Department of Natural Resources, with strong political support and direct reporting authority to the assistant deputy minister. The CDA focused on providing a full range of planning support to the existing CDs, coordinating required government technical expertise, assisting with budget planning and purchasing, and establishing new CDs.

A central element of this new programme delivery system involved the recognition by the key personnel that local control was critical to ultimate CD success, and that this local governance capacity should be fostered with strong support and encouragement.

From 1985 to 1990, the active presence of an assistant deputy minister (Derek Doyle), who strongly supported the potential role of CDs as local solution providers, with decision-making capacity and adequate resources to address local soil and water management problems, was a major evolutionary factor in the programme. Doyle began to instil the concept that CDs should have the latitude and autonomy to focus on local priorities (as determined by the community residents and the local CD boards). Each CD should be free to determine which topics/projects to focus on-targeting CD resources as they see fit. Doyle's vision was to remove CDs from the control of the government planners and engineers-under which it was felt their full potential had been previously limited.

Table 8.1 CD revenue sources

Year	<i>Provincial grant (in CAD)</i>	<i>Municipal grant (in CAD)</i>	<i>Other (in CAD)</i>
1995	1 853 617	894 466	434 762
1996	1 762 301	993 234	577 679
1997	2 426 951	653 039	1 159 260
1998	2 316 355	690 201	1 053 313
1999	2 560 475	1 015 719	2 033 273
2000	2 659 302	830 249	1 837 015
2001	2 893 144	915 833	1 245 984
2002	3 226 186	1 105 096	2 060 977
2003	3 296 786	1 282 895	1 711 467
2004	3 729 085	1 240 945	1 505 009
2005	4 031 482	1 910 221	1 204 480
Total	30 755 684	11 531 898	14 823 219

Source Conservation Districts of Manitoba, Annual Reports

⁴ The authors express their gratitude for contributions to this section by I Dickson and D Doyle.

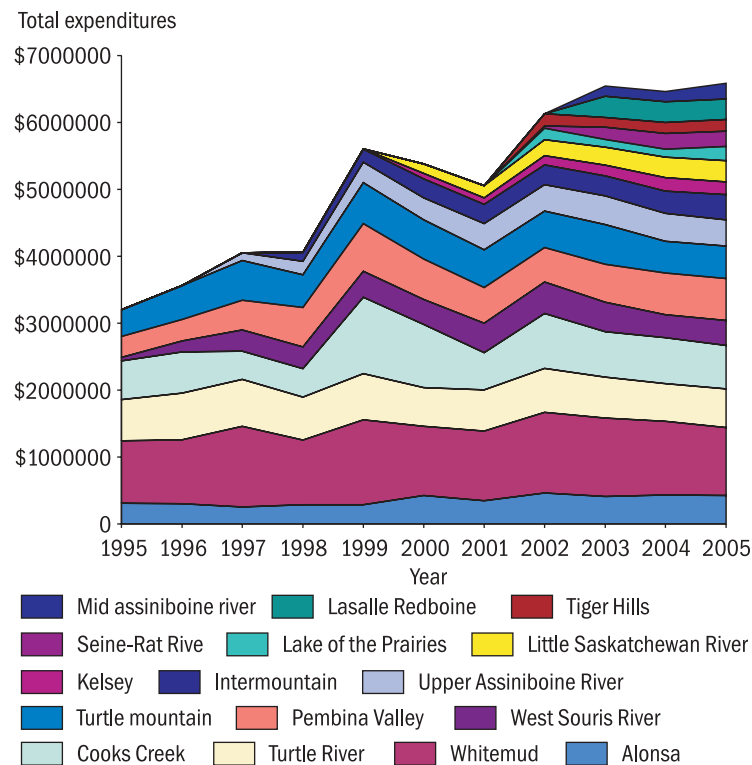


Figure 8.2 District expenditures

Source Conservation Districts of Manitoba, Annual Reports

As a result, local CD boards (who had largely come to view 'planning' as a bureaucratically-imposed barrier to actually completing management solutions on the landscape) began to embrace the opportunity of undertaking community-level CD management planning. Most initial plans were fairly general, although they were very holistic in considering the inter-related importance of conservation issues.

Later iterations became increasingly focused on key local issues such as flooding, subsequently integrating related issues such as soil conservation, water quality, and wildlife habitat. However, these later plans appeared to be less technically rigorous, owing to decreased levels of federal and provincial staff participation in their development. Also, a possible lack of municipal commitment to some later plans has been identified as a problem, perhaps due to a lack of education, awareness, and capacity building.

Despite these important and valuable new policy instrument delivery principles, only one new CD (Pembina Valley, 1989) joined the programme during the 1980s. This limited programme expansion progress is attributed largely to the fact that only limited additional funding was available for new CD activities.

8.2.7 Range of programmes

By 1990, a flexible suite of CD programmes had developed, with each CD engaged in several activities in common with other districts in the programme, and, typically, one or two unique programmes. All CD budgets and a detailed list of planned programme activities were reviewed annually - for ministerial recommendation - by the CDC. The review committee comprised deputy ministers representing several government departments with obvious CD linkages.

The older, watershed-based CDs have always devoted a significant portion of their annual budgets to drain maintenance and road-crossing activities, notably those of Whitemud and Turtle River. Low-lying landscape and dominance of agriculture in the area led to the formation of Cooks Creek. Alonsa assumed a degree of drain maintenance and crossing responsibilities through several agreements with the provincial water resources branch. Turtle Mountain does not have provincial drainage responsibilities, given its formation as a resource CD.

Pembina Valley and all subsequent CDs were established without any responsibility or authority associated with the provincial drainage system.

Beyond the complexities of drainage and water management, the range of CD programming by 1990 included the following (not all programmes offered by all CDs).

■ **Soil and water conservation**

- Creek/Gully stabilization
- Creek maintenance
- Grassed waterway seeding
- Road allowance seeding
- Rotational grazing management
- Stone crossing installation
- Water quality testing
- Tree planting/shelterbelts

■ **Wildlife and habitat**

- Conservation corridor
- Fisheries enhancement
- Habitat acquisition
- Land donations

■ **Education**

- Conservation in the classroom
- Conservation family award
- Youth speaking competition
- Agro-forestry

In 1989, Derek Doyle was replaced as assistant deputy minister of The Department of Natural Resources responsible for the CD programme. In 1990, the executive director of the CDC (Dr Ian Dixon) assumed another position in another agency; this leadership position was never filled, and the CDA staff group was gradually dismantled.

Two remaining staff members were transferred to the Department of Municipal Affairs, and in 1998, the budgetary authority for the CD programme was transferred to the re-named Department of Rural Development (later known as Intergovernmental Affairs), under the auspices of the Manitoba Water Services Board—a coordinating body for the federal/provincial funding for water-related municipal projects.

At this point, significant programme funding for the CD programme was provided by the provincial government to the individual district. However, very limited provincial programme staff (two) was in place to support the needs – related to policy, technical support, and capacity building – of the individual districts. The ramifications of this decision are still being felt, although the situation has improved somewhat with the establishment of a dedicated programme support office.

With the availability of additional programme funding for the formation of new districts, several new CDs were created during the 1990s (West Souris River, 1995; Upper Assiniboine, 1996; Intermountain, 1997; Little Saskatchewan, 1999; and Kelsey, 1999). Several of these new CDs were formed at the same time as the termination of a major federal/provincial agreement on agricultural sustainability—which saw ongoing programmes being extended and technical staffing support being provided to local farming associations wishing to demonstrate innovative sustainability options.

During the 1990s, the Manitoba CDA became more formalized, better funded, and more professional-towards playing an increasingly credible role in representing all CDs in a unified manner in discussions with government and other stakeholders. Major improvements in annual conference attendance, sponsorship funding, communications, and policy/initiative negotiations occurred, evidenced by the drafting of favourable conservation agreement legislation and the negotiation of a GIS (geographical information system) programme royalty arrangement with a private software firm and the provincial government.

None of these newer CDs were interested in assuming any significant drainage or road-crossing responsibilities, opting for an agricultural sustainability focus-stemming largely from their origin as

local farm associations. By 2001, various new CD programmes included the following initiatives (many of these were gradually adopted by all other CDs in the programme).

- **Soil and water conservation**
 - Small-scale water storage (small dams)
 - Abandoned well sealing
 - Remote cattle watering systems
- **Salinity seed programme**
 - Wildlife and habitat
 - Conservation agreement
 - Riparian stewardship
 - Ecotourism
- **Education**
 - Interpretive sites
 - Adult education workshops
 - Holistic pasture management
 - Check strip crop demonstrations

Continued strong provincial promotion and support for the CD programme – combined with a lack of substantial funding alternatives for both local farm associations and municipal councils - saw its continued expansion into the new millennium (Lake of the Prairies, 2001; Tiger Hills, 2001; Seine-Rat River, 2001; Mid-Assiniboine, 2002; La Salle Redboine, 2002; and East Interlake, 2005).

However, some of these latest additions to the CD programme (and indeed some CDs created during the late 1990s) appear to be having difficulty focusing on an ideal mix of local programmes of interest to local landowners and municipalities. Some have experienced high staff turnover and few have developed management plans to guide their long-term operations. Also, several of these later generation CDs were established by a relatively small group of rural municipalities (and in two cases, without the participation of logical adjacent municipalities). Merger discussions are being considered in at least one case.

Most of the later generation CDs include many towns and villages among their partners—building important urban/community connections and raising valuable additional operations revenue. An overview of all CDs can be found in the Appendix to this chapter.

Beginning in 2001, provincial policy discussions focused on the need for 'large area and watershed planning'. This was in response to a major consultative effort called the COSDI- consultation on sustainable development implementation. From this process evolved the Manitoba Water Strategy (advanced jointly by Manitoba Conservation and Manitoba Intergovernmental Affairs), which identified CDs as the most logical delivery agent for a renewed focus on watershed planning and management, for a range of water-related sustainability solutions. In 2003, the Department of Manitoba Water Stewardship was created, and the CD programme was transferred to it, under the auspices of the Planning and Coordination Branch, reporting to the assistant deputy minister.

In 2005, a new Water Protection Act identified CDs as logical lead entities to coordinate the functioning of 'local water planning authorities' and development of watershed plans and management implementation priorities.

8.2.8 Drainage, conservation, and performance measurement

In several cases, the Manitoba CD programme is designed to facilitate land drainage in response to local agricultural needs, and/or in place of municipal/provincial drainage responsibility. From a sustainable development viewpoint, drainage can be problematic—allowing rapid run-off rather than a slower pace, which allows for more infiltration of surface water into the ground. In more steeply sloped areas, this can result in a higher risk of flooding and infrastructure losses downstream. It may also lead to increased streambank erosion and sedimentation, increasing downstream drain maintenance costs.

However, agricultural drainage is a fundamental economic reality in much of the province, particularly in its relatively flat Red River Valley, as well as in many other southern areas where highly productive soils are inherently wet.

Unfortunately, substantial wetland drainage and loss have also occurred in Manitoba, and Manitoba CDs have been relatively powerless to stop it – a dichotomous and difficult challenge to reconcile when CDs may have both drainage and conservation responsibilities. In addition to associated wildlife habitat and biodiversity losses, wetland drainage reduces natural water retention/flood control capabilities and eliminates an impressive range of water quality services provided by these ecosystems. Increased rates of drainage (while desirable from an agricultural production perspective) also tend to increase the flow of pollutants and nutrients – mainly from agricultural run-off – into downstream rivers and lakes. This is especially a problem for Lake Winnipeg, which is heavily stressed from agricultural run-off, among other sources.

A slower run-off regime would see many contaminants retained in upstream wetlands and/or retained on the landscape. However, as was described in Section 8.2.1, from the earliest days, drainage was a major goal of farmers and governments in Manitoba. This case study accepts those goals, rather than overlaying a different set.

A second important observation regarding the CD programme is that it does not contain provisions for monitoring and evaluation. This step could occur both at the provincial level (is the programme fulfilling its goals?), and at the individual CD level (is the CD implementing its plans and fulfilling its goals?).

Annual reporting for the overall programme is largely a factual outline of activities occurring within each CD, accompanied by its audited financial statement. While CD boards report both formally (at an annual general meeting) and informally (through regular contact with the local stakeholders, often through the publication of meeting minutes in local newspapers), there is no specific performance measurement framework for the Manitoba CD programme.

Budget-based financial reporting and annual programme review do occur though the CDC and additional pre-budget consultations with several CD programme partners, while the entire programme is subject to annual review by the provincial legislature.

However, there are gaps in linking annual CD programmes to long-term management plan goals based on locally identified needs combined with provincial policy objectives. Using indicators to monitor annual progress would provide an important feedback mechanism for adapting to changing conditions over time.

8.3 Adaptive policy analysis

This section reviews several policy issues that have been addressed by the districts, and then analyses their adaptive characteristics using the conceptual framework described in Chapter 2. Section 2 of the current Manitoba Conservation Districts legislation (Manitoba Statutes), reads

The purposes of the Act are

- (a) *to provide for the conservation, control, and prudent use of resources through the establishment of conservation districts; and*
- (b) *to protect the correlative rights of owners.*

As outlined in Section 21 of the Act

A board may

- (a) *study and investigate, or cause to be studied and investigated such resources of the district as may be necessary to prepare a scheme;*
- (b) *implement a scheme;*
- (c) *transfer, for the purposes of maintenance and operation, to an included municipality or other person, jurisdiction, authority, or control, over any works in the district;*
- (d) *enter into an agreement with the owner of any land for the carrying out of works considered necessary for the implementation and operation of a scheme;*
- (e) *issue, subject to provisions of The Forest Act, permits for cutting of forest from protected areas;*
- (f) *issue, subject to provisions of The Water Rights Act, permits to alter surface water courses;*

- (g) *recommend the acquisition by the Crown, of any real or personal property necessary for a scheme;*
- (g) *sell, subject to the provisions of The Water Rights Act, water from reservoirs constructed or operated by the board; and*
- (h) *require the municipality to furnish to the board information pertinent to a scheme.*

In the legislation, a 'scheme' is defined as 'a programme developed by or for a district in accordance with the purposes of the Act. Also, works include any structure or physical undertaking developed for the purposes of maintaining, conserving, developing, controlling, protecting, rehabilitating, or using the resources available to the district'.

In terms of the Act's purpose, protecting the 'correlative rights' of landowners is significant because it recognizes the reality of private property ownership, a characteristic of agricultural landscapes such as the Canadian Prairies, including Manitoba.

Property owners have many rights regarding the use and management of their land, which are enshrined in the provincial and municipal legislation. In many ways, they are also protected in law from the actions of others, which can be interpreted as a form of responsibility among all landowners in the case of a watershed, where deleterious effects of upstream activities such as wetland drainage, forest clearing, or inappropriate agricultural drainage could result in damages downstream.

It is also important to note that the CD Act does not bestow substantial enforcement powers (or penalties for non-compliance) on individual districts or the provincial governments. The CD programme is specifically designed to be an incentive-based, partnership-building programme instead of a regulatory one.

In terms of policy instrument rules and instrument delivery mechanisms, the Manitoba Conservation District Programme has demonstrated a variety of characteristics, discussed in the following sections.

8.3.1 Surface water management (various CDs: 1972–2006)⁵

The reasons informing the formation and the early evolution of Manitoba's CD programme were largely an attempt to address chronic water management issues, within and between the province's rural municipalities. However, given that the 1959 watershed-based version of the CD Act was never used – in favour of a municipal boundary-based framework – the stage was set for a continued struggle towards a workable provincial-municipal surface water management solution, a struggle that continues even today.

With a few exceptions, many CDs are frustrated that progress has not occurred towards effective surface water management in Manitoba. Even with fairly clear provincial policy regarding on-farm drainage, it has been estimated by several CD managers that approximately 90% of all the new drainage work within many CDs, being undertaken by private landowners, is occurring without required provincial reviews or licenses. As such, rapidly occurring on-farm agricultural drainage in Manitoba (including wetland drainage) is illegal.

This trend has been particularly strong in recent years due to the recurring heavy precipitation events, increased technological efficiency, and the widely-held perception among many farmers that the ability to remove excess water rapidly is the fundamental right of private agricultural landowners—who should not have to wait up to six months for provincial review of their projects. In the estimated 10% of the actual drains being reviewed and approved by the provincial inspectors (within many CDs), it seems that many conditions imposed by the provincial legislation are being ignored by many landowners who are not worried about provincial enforcement.

Many local CD boards and their partner municipalities have repeatedly called on the Province of Manitoba to address this situation—typically through greater provincial enforcement of penalties for illegal drainage. However, a lack of provincial resources, the assignment of clear decision-making authority regarding drainage licensing, in particular, and the absence of a watershed-based planning

⁵ The authors express their gratitude for contributions to this section by J Buhler, D Donachuk, D Nicklin, L Thompson, and P Weiss.

framework to deal with this problem suggest that this situation will continue for some time. In the absence of this framework, several CDs have recently embarked on watershed-planning exercises, the results of which are helping to suggest what a provincial surface water management framework should look like – involving central concepts such as watershed-based planning, drain licensing, enforcement, and the promotion of BMPs (beneficial management practices).

Additionally, there is a high degree of frustration among several CDs and a good many more rural municipalities (within CDs or not) regarding a lack of provincial maintenance on provincial (larger capacity) agricultural drains, many of which are channelized former natural waterways. In most cases, rural municipalities are responsible for local municipal drains (which, in terms of size and drainage capacity, lie between on-farm and provincial drains). This creates an uneven patchwork of responsibilities and authorities for water management across the province, both within CDs and beyond them.

Three inter-related issues have thwarted the progress towards effective surface water management since agricultural settlement began in Manitoba.

The first is the absence of a clear decision-making process. As outlined above, the approach taken has varied significantly over time. Early responsibility for drainage was transferred from the province to rural municipalities and back, as the search for an effective model continued. The passing of the Watershed Conservation Districts Act (1959), the Resource Conservation Districts Act (1972), and ultimately the Conservation Districts Act (1976) reflect these approaches.

While the current CD Act enables and encourages local decision-making in support of soil and water conservation, the ultimate authority for surface water drainage largely lies with the Province of Manitoba. The two CDs (Whitemud, Turtle River) created under the 1959 watershed-based legislation are responsible for maintaining both municipal and provincial drains and stream crossings. Cooks Creek is responsible for all drainage works within its boundaries (there are no provincial drains); Alonsa is responsible for some municipal and some provincial drains. No other CDs have direct responsibilities for provincial drainage works.

While the CD Act (Section 21) articulates an implied responsibility and authority to CDs for many aspects of resource management, their ability to coordinate surface water management is limited in most cases.

Throughout the province, responsibility for most waterways lies with the Province of Manitoba (including most provincial drains). However, municipalities that have constructed their own drains are generally responsible for these drains.

Manitoba's waterways are classified according to a 'drain order' system, represented by numerous 'designation of drain' maps that define the scale of each waterway according to the area of land it drains and the relative size of its contributing watershed (Table 8.2). Generally, municipal drains operate within Order 1 and Order 2, while provincial drains are level 3 and above. On-farm drainage generally occurs on land contributing to an Order 1 drain.

CDs respond to local drainage issues by consulting with the provincial government, their partner municipalities, and landowners within the CD. However, without the clear assignment of drainage authority or resources in many cases, the success of these consultations depends entirely on the quality of these inter-organizational and inter-personal relationships.

Table 8.2 Manitoba drain order

Drain order	Description
Order 1	Drains an area less than 1 mile ²
Order 2	Drains an area greater than 1 mile ²
Order 3	Confluence of two Order 2 drains
Order 4	Confluence of two Order 3 drains
Order 5	Confluence of two Order 4 drains
Order 6	Confluence of two Order 5 drains
Order 7	Confluence of two Order 6 drains

Source Manitoba Water Stewardship

The province has limited financial and staffing resources available to undertake this programme. However, the debate between Manitoba's farmers, rural municipalities, and the provincial government is still raging. Annual policy conventions organized by KAP (Keystone Agricultural Producers) and AMM (Association of Manitoba Municipalities) routinely call for better and permanent solutions to addressing the challenge of agricultural drainage, as noted below.

In a letter to the provincial government, dated 2 September 2005, the Keystone Agricultural Producers said, 'As the impacts of flooding and moisture damage continue to mount in fields, on the farm, and in rural communities, we believe it is now the time for the province to take a leadership role to implement programmes that will assist in recovery. To that end, we recommend instituting a drainage maintenance programme to clean up drains and remove silt deposited by overland flooding. Though much of the affected fields and pastures have dried this fall, the subsoil remains saturated. We are concerned that even normal spring melts and rainfall could create a second year of flooding across the province, particularly if the drainage system is left in its current conditions.' (KAP 2005)

The CD programme has provided yet another forum for this debate – one that the programme itself had originally intended to address. The ongoing debate over agricultural drainage (both on-farm and in provincial drains) is indicative of serious problems with the decision-making framework for surface water management.

As a result, many Manitoba's CDs are caught in the drainage struggle among farmers, rural municipalities, and the province. In responding to the surface water management dilemma, some CDs are attempting to find workable approaches to managing surface water by outlining clear plans and relative responsibilities for all drainage stakeholders. However, due to the lack of resources and clear decision-making responsibilities (among all stakeholders), a viable solution still does not seem to be in sight.



Figure 8.3 Manitoba CDs and watersheds (2006)

In addition, the fact that most CDs are not defined on watershed boundaries leads to other management problems (Figure 8.3). The 'functional area' on which most CDs are administratively designed is not consistent with the natural systems the CDs are trying to manage effectively. Most CDs do not have authority over all the contributing headwater areas – or all the collecting waterways downstream – of their existing administrative boundaries. As a result, many more stakeholders than necessary, must be engaged for any effective surface water management plan to be effective.

The inter-related issues of illegal on-farm drainage and a perceived lack of provincial maintenance on larger downstream drains suggest that Manitoba's CD policy has not dealt well with the anticipated conditions with respect to its instrument design. The problem of inter-municipal surface water management was identified as early as 1918, and it may be argued that Manitoba CDs based on municipal boundaries (rather than watersheds) have merely created an additional layer of administration, but have failed to deal effectively with the challenge of surface water management.

By creating another forum for debate, and indeed another layer of local decision-making and assessment-based funding requirements (albeit with limited authority, enforcement power, or technical capacity), it could be argued that, indeed, the policy has been mal-adaptive in terms of surface water management. Manitoba is no closer to addressing its surface water management challenge today, after 30 years of the existence of the CD programme. In fact, problem resolution may now be more difficult, given this growing and additional institutional layer covering the Manitoba landscape.

Manitoba's CDs are expected to play a central role in addressing the challenge of declining water quality in Lake Winnipeg. This challenge was not foreseen as a CD responsibility during initial programme design. At this point, Manitoba's CDs are not prepared to meet this challenge. They have not been adaptive in terms of instrument rules or instrument delivery.

While dealing with Lake Winnipeg's water quality, stakeholders will have to face the same challenges as surface water management: a lack of clear decision-making authority among several stakeholders; a lack of resources at all levels; and the fact that most CDs do not function within complete watershed boundaries. In terms of the challenges of Lake Winnipeg, a lack of coordinated planning and management throughout its huge watershed is also recognized as a critical influencing and limiting factor.

8.3.2 Surface water management – first CD is the best existing model⁶

Whitemud Watershed CD, the first district established in Manitoba (1972), was formed on actual watershed boundaries, involving parts or all of 15 rural municipalities. Its formation was based on the 1959 watershed version of the CD Act. Additional information on Whitemud is available in the Appendix to this chapter.

Whitemud is responsible for the management of all large-order provincial drains and is now coordinating the review of all on-farm drainage proposals (for those private landowners who choose to develop drains in a legal manner) on behalf of the province.

The Whitemud River Watershed has a complex drainage pattern—due to significant and rapid elevation changes (east to west). In the west, a major landform (Manitoba Escarpment) contains many natural headwater areas, which combine to create very substantial flows downstream—where productive agricultural lands are located. Intensive drainage in the lower elevation lands supports agricultural production in the east (through channelization of natural streams and the construction of additional engineered drains - visible as straight drainage lines in Figure 8.4). Light soils in the west are very sensitive to erosion, particularly when natural vegetation is removed. High spring run-off and summer stormwater combined with erosive soils can lead to major and costly downstream flooding, sedimentation, and water quality problems.

Due largely to its original formation in 1972 on watershed boundaries, combined with its responsibility for provincial drains (and solid relationships with its member municipalities which manage their own drains) - the Whitemud Drain Licensing Pilot Project offers real hope for clues in developing a workable surface water management framework - which many CDs and their member municipalities would like to see.

⁶ The authors express their gratitude for contributions to this section by R Baker.

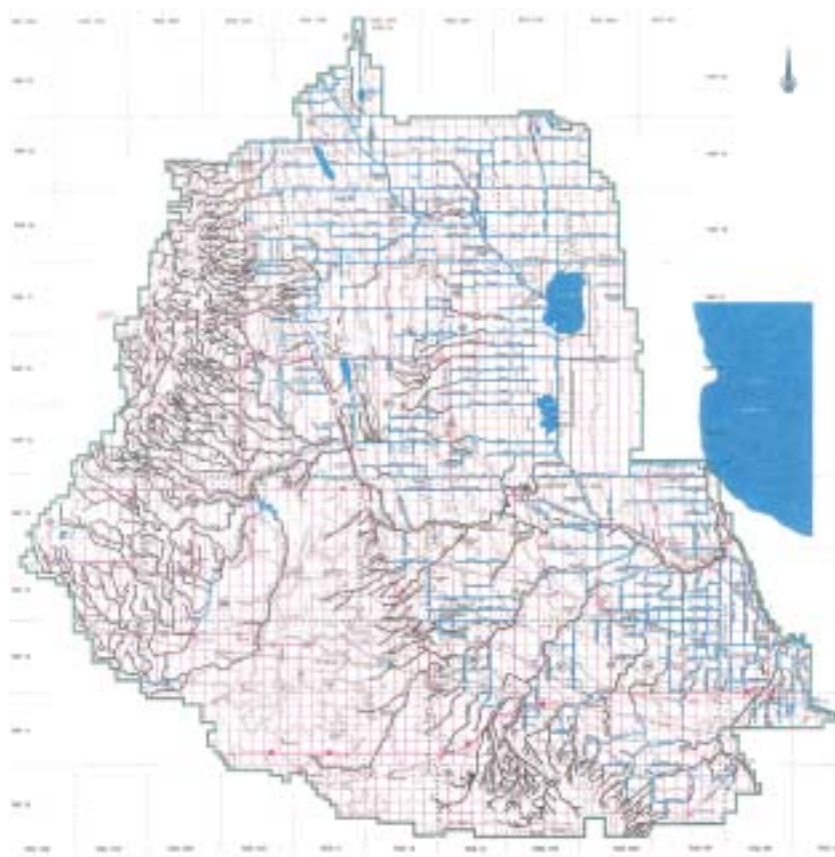


Figure 8.4 Whitemud CD drainage

Source Whitemud Conservation District

The Drain Licensing Pilot Project developed by Whitemud and the Manitoba Water Stewardship Department in 2001 has resulted in a marked increase in the percentage of on-farm drains actually being reviewed by Whitemud, and licensed by the Province.

Now called the Drain Management Programme, the Whitemud review process centres on the concept of building and maintaining solid local partnerships between neighbouring farmers, rural municipalities, provincial regulators, and other community stakeholders. Only one project review meeting occurs – in the field, at the actual site of the proposed drain work. The proponent explains the rationale for the project and demonstrates exactly what drainage work is planned. Questions and concerns from all stakeholders present are considered. Whitemud staff invites any participant (including stakeholders who may not have attended the review meeting) to provide additional comments within two weeks, after which a draft licence is drawn up with conditions (if required) for final approval by provincial staff.

The result has been a dramatic reduction in the time required for licence review (from six months to six weeks) (Table 8.3) This progress has been combined with a general reduction in process complaints,

Table 8.3 Drainage licences processed by Whitemud CD

Year	<i>Applications processed</i>
All 14 years prior to 2001	24 licenses issued
2001	100
2002	90
2003	50
2004	66
2005	50

Source Whitemud Conservation District

better consideration of stakeholder concerns, and improved drainage coordination throughout the CD. Individual rural municipalities are responsible for their own drains, which must go through the review process – as does Whitemud itself (being responsible for the larger order provincial drains).

However, most CDs were not initially established on watershed boundaries and most do not have responsibility for provincial drains. It would appear that innovations such as Whitemud's Drain Management Programme (and the inter-related trend toward improved surface water management coordination) will only happen when the conditions of watershed-based management and responsibility for provincial drains are in place. Another key element involves the full and coordinated participation of a CD's partner municipalities (which may or may not manage their own drains) - a condition, which could alternatively be fulfilled where a CD is also responsible for municipal drains.

The Whitemud case has responded well to anticipated conditions in that this CD is actually coordinating most drainage activity within its entire watershed-based boundaries. Whitemud is demonstrating an ability to legally fulfil the on-farm drainage needs of many farmers, while its member municipalities work cooperatively with the CD in planning municipal-level drainage works. Whitemud's original mandate included responsibility for provincial drainage works and stream crossings, necessitating its preparation of a detailed surface water management plan, the only such plan that currently exists for any CD (Figure 8.5).

Whitemud also demonstrates adaptability, evidenced by the Drain Management Programme. It was never foreseen that a CD would manage the drain licensing process, and Whitemud is now doing this effectively. In most other CDs, drain licensing is managed by the province and remains the focus of many complaints and much frustration. A key innovation is the 'open consultation' involving all stakeholders at one meeting, at the actual proposed drainage project site - with a reasonable comment period, before the proposal proceeds to the provincial government for final approval.

Whitemud's surface water management progress could most easily be replicated in Turtle River Watershed (watershed-based with full drainage responsibilities except for portions of two natural waterways); Cooks Creek (full drainage responsibilities); and Alonsa (significant municipal and provincial drainage responsibilities). Cooks Creek has also been developing a drain licence pilot project based on the Whitemud experience.

Spending any effort in finding solutions to Manitoba's surface water management challenge only make sense within the context of watersheds, where decision-making authority and capacity to assist are in place. Most CDs do not have either and only one has both of these criteria in place – Whitemud.



Figure 8.5 Map of Whitemud CD, showing municipal boundaries

8.3.3 Abandoned well capping – Pembina Valley: 1997–2006⁷

Concerns regarding the protection of groundwater supplies were raised during the late 1990s by local residents in PVCD (Pembina Valley CD). Historically, groundwater had not been a major focus of attention within Manitoba CDs.

At that time, CMASS (Canada-Manitoba Agreement on Agricultural Sustainability) was in operation, one of a series of five-year federal-provincial agriculture funding agreements, which have been in place (in one form or another) since the 1960s, continuing to this day in the form of the Agricultural Policy Framework Agreement and the joint funding of Environmental Farm Plans.

CMASS offered flexible funding for local agri-environment projects, including those focused on groundwater protection. Problems were arising as a result of the sale by individual farm families of their holdings, which resulted in the smaller farms being merged into larger operations. Yard sites and other water well locations were being lost, as these lands were integrated into larger farm operations across the landscape. Abandoned wells represent a substantial risk to groundwater quality, as they can act as a direct conduit for the introduction of contaminants such as nutrients and pesticides. Abandoned wellheads may also pose safety hazards for farm operators. These wells can be easily capped by filling them with bentonite clay, which is impervious.

In 1995, PVCD applied for and received funding to cap four abandoned wells in the district. In addition, four independent, local soil conservation committees of farmers created under the previous five-year federal-provincial agricultural sustainability agreement (Farming for Tomorrow) also capped a similar number of wells that year. In 1997, PVCD began cooperating with LOs (local organizations) to identify and cap many more abandoned wells, the beginning of an effective working relationship with these groups (representing farming districts known as Deerwood, Stanley, Pembina, and St Alphonse-Bruxelles).

A total of CAD 224 000 has been spent on the programme to date (Table 8.4). This includes substantial external funding through 2005, which is no longer available. These sources included general agricultural sustainability programmes from both the federal and provincial governments. Private landowners also provided significant contributions. As of 2006, the number of wells requiring capping has trailed off, although Pembina Valley is prepared to fund any project with its own budget.

The provincial CD programme readily supported Pembina Valley's well capping programme, and a significant amount of external programme funding was also accessed. Based on Pembina Valley's example, all CDs have now incorporated this valuable programme into their range of activities, which had not been envisioned in their original mandates.

Table 8.4 Well filling in the PVCD

PVCD well filling statistics	Number of wells	Costs	CD Funds	External	Landowner
			CAD	CAD	CAD
1995/96	4	1 003	0	1 003	
1997/96	12	3 266	0	3 266	–
1998/97	20	10 216	7 051	–	3 165
1998/99	66	32 346	22 211	4 611	5 524
1999/2000	60	31 575	1 400	21 139	9 036
2000/01	50	26 375	13 344	5 881	7 150
2001/02	50	31 752	14 127	10 950	6 675
2002/03	35	18 387	3 637	10 200	4 550
2003/04	62	25 882	7 915	9 867	8 100
2004/05	43	24 390	7 105	11 285	6 000
2005/06	39	18 370	12 370	–	6 000
	441	223 562	89 160	78 202	56 200

Source Pembina Valley Conservation District

⁷ The authors express their gratitude for contributions to this section by C. Greenfield.

Water quality protection was always identified as an important goal for the CD programme, although the means by which to encourage it were not fully outlined. Groundwater, while an important water supply resource, did not tend to attract the same level of attention as surface water. This reflected the fact that natural groundwater processes were not well understood, and contamination issues were isolated.

As a result, surface water management needs, historically, tended to dominate CD programme activities. With the growth of public concern and scientific knowledge regarding groundwater, the CD programme adapted to emerging needs – redirecting required resources to focus on a specific groundwater issues. Local CD boards were responding to growing public awareness of groundwater contamination issues. While not a comprehensive solution, the CD programme's abandoned well capping efforts were a logical first step to address an obvious problem, one which was the result of direct human impact on the environment. Furthermore, groundwater contamination risks are well documented, while the solutions are both proven and straightforward.

The availability of applicable federal and provincial funding programmes, which could provide funding to address the issue of groundwater contamination, was timely. Local initiative, combined with federal-provincial funding has resulted in the widespread adoption of a proven technique - which is now largely funded through the CD programme alone.

The combination of increasing knowledge of groundwater contamination issues, increasing community concern, sources providing timely funding, and the availability of a low-cost and straightforward solution presented Manitoba's CD boards with an opportunity. The fact that they were able to recognize the emerging importance of groundwater quality – and take advantage of it – is indicative of the programme's adaptability in terms of instrument delivery.

This initiative also illustrates the ability to deal with a range of anticipated conditions in policy in terms of policy implementation. Virtually every other CD in the province developed its own abandoned well programmes based on this model, and most continue to offer the programme today, even as external funding sources have declined.

It is however, important to note that due to a lack of CD programme evaluation, the true impact of this widely adopted (and seemingly successful) initiative cannot be measured. Also, its implementation has not been targeted according to a prioritized plan, so the full effect of its possible contribution to protecting groundwater quality is not known.

8.3.4 Conservation agreements – Turtle Mountain: 2003–05⁸

The Turtle Mountain region centres on a large escarpmental landform located largely within Southwest Manitoba, and situated on the Canada–US border. Both provincial and state parks protect large tracts of natural tree cover, and thus shield the region's sensitive soils from erosion. At lower elevations, agricultural development and associated tree clearing has been a historical concern, in terms of downstream flooding/water quality.

Also, logging of private lands has been a growing concern in recent years, as new markets for aspen wood products developed in Ontario and the United States. Burgeoning aspen markets in central Manitoba have created increased logging infrastructure and capacity, with new contractors looking for new opportunities.

In response to local concerns related to an apparent increase in aspen, logging of private lands below Turtle Mountain Provincial Park, the CD formed an advisory committee. The mandate of this committee is to explore the situation and raise awareness regarding the loss of sensitive woodlands—with potentially negative downstream impacts.

Discussions with MHHC (Manitoba Habitat Heritage Corporation) – a provincial Crown corporation with the mandate to facilitate the preservation of private natural lands – led in 2004 to the first CA (Conservation Agreement) in TMCAPTA (Turtle Mountain CA Programme Target Area)

CAs are voluntary legal agreements facilitated by provincial legislation, which enable private landowners and eligible conservation organizations like CDs, MHHC, and others to work together in

⁸ The authors express their gratitude for contributions to this section by S Kowalchuk.

preserving important natural lands. Landowners continue to own and use their land for agricultural purposes, while a CA is filed with the land title. The conservation organization, which signs the CA with the landowner, does not purchase the land, but negotiates an agreement that maintains the natural values of the land resulting in either the sale or donation of the rights to clear or drain natural landscapes.

While other eligible conservation organizations had negotiated CAs with agricultural landowners further downstream to protect important wetlands, prior to the joint TMCD (Turtle Mountain CD) effort with MHHC, no CAs had been developed to protect forested areas with little or no wetlands present near the park (TMCAPTA).

In total, 8.8% of forest and wetlands on private land identified by TMCD in TMCAPTA has now been permanently protected through CAs held by MHHC. Additional protected areas also exist in the form of municipal and CD reserves, provincial wildlife management areas and parks, and a federal community pasture (Figure 8.6).

The provincial CD programme responded to locally identified needs regarding the loss of upland forests – first by exploring the concerns of local residents, and then by working with another Provincial agency in search of an effective solution. The result is permanent protection of wetlands and forest cover on sensitive lands. At the same time, some payment is being made to farmers for their participation, while they maintain land ownership.

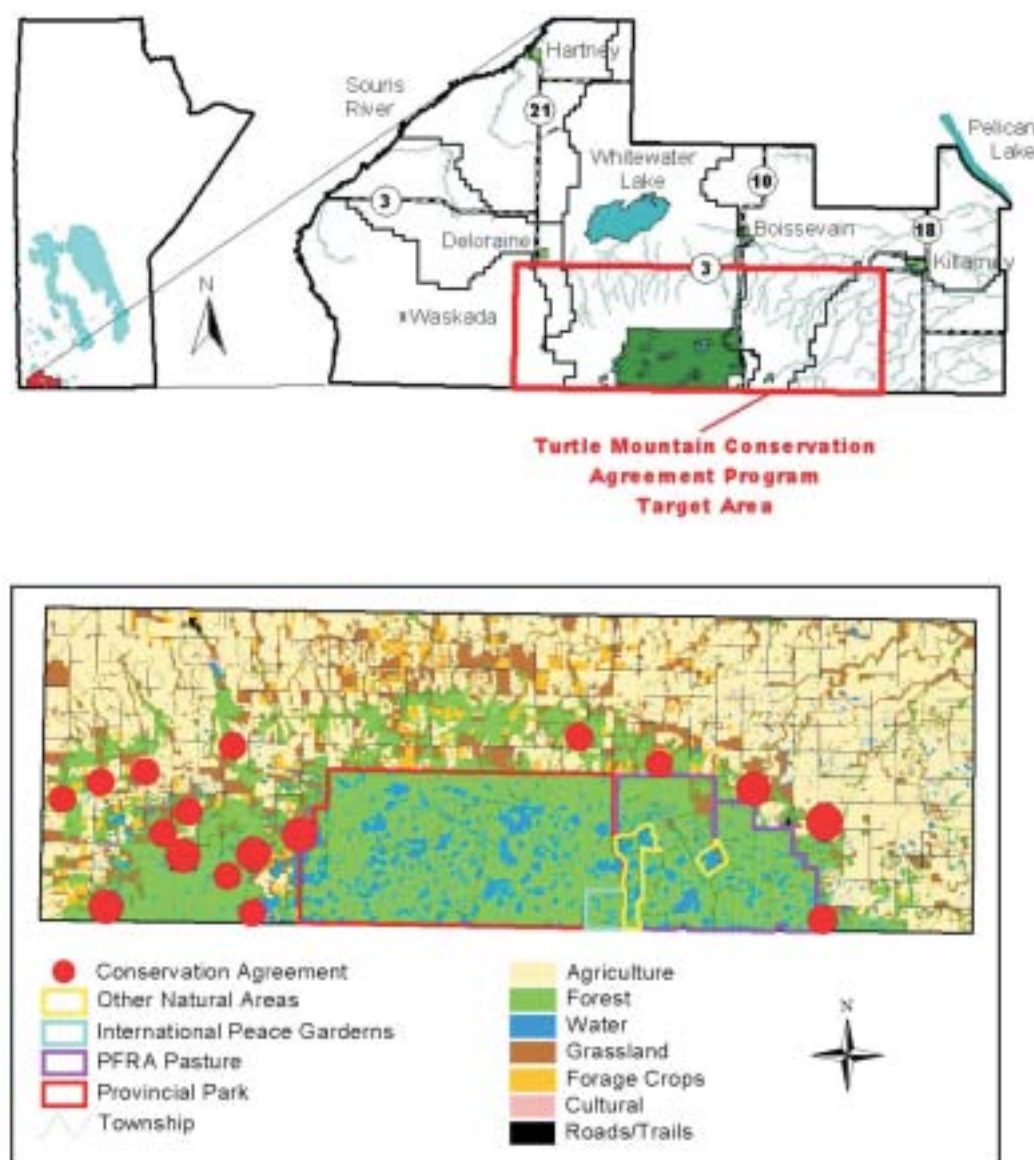


Figure 8.6 Protected lands in TMCD

Source Turtle Mountain Conservation District

This initiative represents the adaptive nature of the Manitoba CD policy in terms of instrument delivery. Landscape protection was always identified as an important goal for the CD programme, although the concept of working with many partners, beyond the CD itself has evolved over time and most CDs today work with other landscape preservation partners. The Turtle Mountain example is representative of how these relationships evolve, toward significant results.

8.3.5 Trans-boundary partnerships – West Souris: 2001–05⁹

Since 1976, the CD programme has not mandated watershed-based administrative boundaries. By 2001, it became clear to many local ratepayers that two separate rural municipalities in two separate CDs, Cameron (in the WSRCD [West Souris River CD]), and Arthur (in the TMCD), were each partially located within a CD, which was not ideal. Separately, the two CDs were unable to implement good soil and water management solutions to the same extent as when they were together.

After reviewing the situation, and recognizing that the Provincial programme objectives would (likely), one day, return to being watershed-focused, the boards for both, West Souris River and Turtle Mountain, decided to proceed with an innovative boundary re-alignment. The process began with initial meetings between both the affected rural municipalities.

In 2003, the re-alignment occurred based on river boundaries – with each affected municipality being bisected by the Souris River – and half of each municipality joining the CD in operation on each side of the river (Figure 8.7). Some minor administrative adjustments were required, specifically in relation to slight differences in terms of relative taxation rates. However, local ratepayers were pleased with the result.

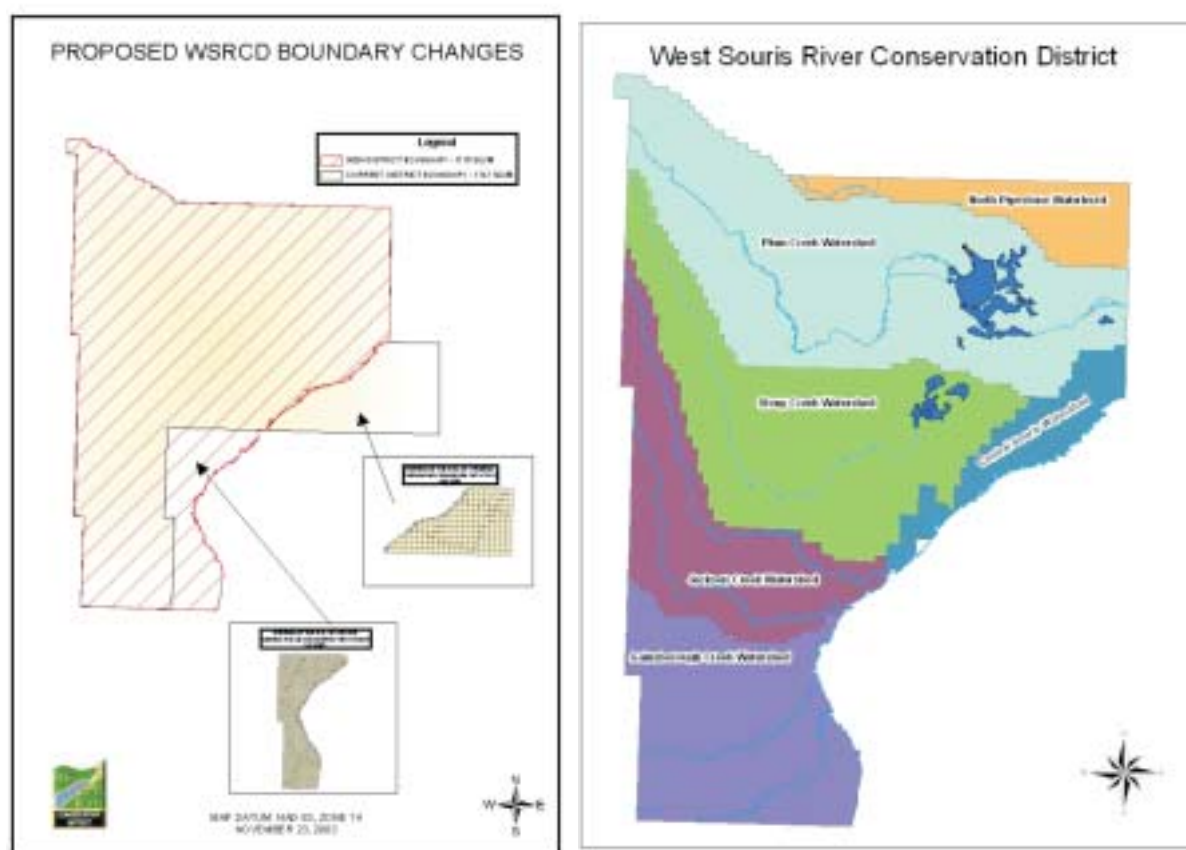


Figure 8.7 WSRCD boundaries

Source West Souris River Conservation District

⁹ The authors express their gratitude for contributions to this section by G Campbell.

In a related development, the following year (2004), WSRCD initiated a watershed planning process within three sub-watersheds in its district, and invited upstream residents and other stakeholders in Saskatchewan to participate. In 2005, as watershed planning efforts began in Saskatchewan, those same upstream partners invited WSRCD stakeholders to participate in the process. This evolving trans-boundary watershed partnership is now going to include the sharing of water quality test results and other data.

While not truly watershed-based (in that it uses the river as the boundary), the boundary re-alignment efforts of the WSRCD are indicative of the Manitoba CD programme's ability to adapt to anticipated conditions in terms of instrument design. The CD Act specifically provides for boundary amendment. Two neighbouring CDs recognized the logic of redrawing their boundaries and requested that the provincial government make the change.

The trans-boundary partnerships between West Souris and Saskatchewan stakeholders are an example of adaptability in terms of instrument delivery. The CD Act did not envision inter-provincial planning partnerships. However, the reality of watershed function suggests that all areas of a watershed be included within the planning framework. The fact that this watershed-based relationship has been built across a provincial boundary is significant, particularly when such partnerships across municipal boundaries are often quite difficult in Manitoba.

8.3.6 Alternative Land Use Services pilot project – Little Saskatchewan: 2004-06¹⁰

Of growing interest in public policy is the use of economic incentives and instruments as a complement or substitute for regulatory and voluntary instruments. This innovation involves measures such as environmental taxes, tax incentives, and tax shifting; and non-tax measures such as tradable permits, subsidies, user charges, and resource pricing. Incentives have proven to be more flexible than 'command and control' approaches. They can promote technological innovation and reduce costs of pollution control, as compared to certain regulations (Environment Canada 2006).



Figure 8.8 Alternative Land Use Services pilot project location

Source Little Saskatchewan Conservation District

¹⁰ The authors express their gratitude for contributions to this section by M Kopytko.

This concept of using tax or income incentives presents significant opportunity and framework for expanding conservation programming with a focus on sustainable land management. This approach is particularly relevant within the agriculture sector, where new income (and cost reduction) opportunities are constantly desired.

In 2004, the Little Saskatchewan River CD was approached by the Delta Waterfowl Foundation (Delta, a charitable wildlife conservation organization) and KAP (Keystone Agricultural Producers, Manitoba's general farm lobby organization), to participate in a pilot project. They wished to test the potential for applying EGS (Ecological Goods and Service) incentive payments to private agricultural landowners, as a means of promoting sustainable land management decisions (Figure 8.8).

The CD appointed a committee to explore the concept and assist with the development of a proposal to the federal and provincial departments of agriculture. The pilot project has now evolved into a significant federal-provincial initiative, with substantial private sector support via Delta, in addition to funding of CAD 120 000 from one of the CD's municipal partners - the rural municipality of Blanshard, where the actual project is taking place.

The CD is also providing valuable GIS and local project management support. It is also likely that it will play a key role in administering the programme, in partnership with a Provincial crown corporation, the Manitoba Agricultural Services Corporation.

This initiative represents the adaptive nature of the Manitoba CD policy in terms of instrument delivery. The concept of using economic incentives was never considered as one of the means by which CD programmes would be implemented. Little Saskatchewan played a key role in developing the ALUS (Alternative Land Use Services) concept and establishing a pilot project. The CD also helped convince one of its municipal partners to make a substantial financial contribution to the initiative.

The adaptive capacity of Manitoba's CD programme was apparent to the two external organizations, which saw the potential for using its flexible delivery structure to provide local conservation programming using economic incentives. This is an innovative approach among all CDs, which may become a model for future application throughout the CD programme. This may contribute to federal and provincial policy changes.

8.3.7 Aboriginal participation – Alonsa: 1991–2001⁹

Given Manitoba's CD policy focus on municipal partnerships, the participation of Aboriginal communities has historically not been a major priority. There are very few examples of CDs working in close partnership with First Nations or Métis Settlements, even when these are located within or adjacent to an existing CD. Growing recognition of the importance of Aboriginal communities in terms of resource management, co-management, and self-determination suggests that CD partnerships with First Nations and Métis Settlements are a logical and appropriate development.

In 1991, a board member of the Alonsa CD identified what he thought might be an ancient Aboriginal rock formation on his farm near the Lake Manitoba Narrows. This rock formation was later determined to represent a ceremonial Thunder Bird Nest, a mythical creature of Ojibwe culture. The Alonsa CD then developed interpretive signage and a walking trail at the site, funded through the CD's education budget.

Initially, provincial programme reviewers were surprised by Alonsa's attention on communicating Aboriginal culture. Also, a nearby First Nation community (Ebb and Flow) soon expressed their gratitude for the project, but noted several factual errors in Alonsa's interpretation signage at the site.

Despite some initial communication problems, this experience represents the first meaningful contact, toward the establishment of a collaborative relationship, between a CD and an Aboriginal community in Manitoba. This relationship continues to flourish (Figure 8.9).

In 1995, Alonsa worked in partnership with Ebb and Flow First Nation on another interpretive site known as Medicine Rock, for which Ebb and Flow did the interpretation and Alonsa developed a walking trail and picnic tables.

In 2001, this partnership grew to include another First Nation (Sandy Bay), Manitoba Hydro, Agriculture and Agri-Food Canada, and the Province of Manitoba for the development of a ceremonial site, based largely on Aboriginal oral traditions and various interpretations of life, land, and resources in the area.

⁹ The authors express their gratitude for contributions to this section by H Harris.



Figure 8.9 Alonsa CD boundaries, First Nations

Discussions regarding future expansion of Alonsa CD are now being explored, with the hope for formalized relationships with the aforementioned First Nations and one more, Crane River. Inclusion of these Aboriginal communities as formal CD partners would greatly contribute to Alonsa's boundaries being representative of several area watersheds.

Other CDs have now also begun to build similar relationships with First Nations within or adjacent to their districts, notably Whitemud, Lake of the Prairies, Little Saskatchewan, Upper Assiniboine, and Pembina Valley. The move by some CDs toward building long-term relationships with Aboriginal communities was initiated by one district and was supported by the provincial CD programme/policy.

Alonsa's experience is an example of the Manitoba CD programme's *ability to deal with anticipated conditions in terms of instrument implementation*. The programme, as designed, certainly anticipated various forms of education programmes, although interpretation of Aboriginal culture was probably not envisioned. This is well beyond conventional perceptions of soil and water conservation.

More importantly, Alonsa is clearly demonstrating the potential for *adaptability*, in terms of *instrument rules*. Any discussions regarding the inclusion of First Nation communities within the Manitoba CD programme would be revolutionary. Implementation of this step would require a change in the CD Act.

Today, in at least one CD, the possibility now exists that three First Nations may eventually join the existing Alonsa partners in an expanded, watershed-based CD. The Aboriginal partnership possibility was never envisioned by the programme. The fact that these Aboriginal communities would help complete Alonsa's watershed boundaries is also significant and once again demonstrates the logic of watershed-based administration, planning, and management. There is additional potential to formalize partnerships with other jurisdictions—toward more complete watershed boundary CD administration in the Turtle River Watershed CD, where Riding Mountain National Park (federal control) comprises much of this area.

8.4 Analysis and results

A summary of the results of the examples from section 8.3, in terms of the adaptive policy framework described in Chapter 2 is presented in Table 8.5. This section outlines some broader implications based on these findings.

Table 8.5 Case study results

Case Study	<i>Ability to perform under a range of anticipated conditions</i>		<i>Ability to perform under unanticipated conditions</i>		<i>Findings</i>
	<i>Design</i>	<i>Implementation</i>	<i>Design</i>	<i>Implementation</i>	
Surface water management - various CDs	–	–	–	–	Lacking financial capacity, lacking decision-making structure, and inappropriate boundaries
Surface water management - Whitemud	Yes	Yes	Yes	Yes	Reasonable financial capacity, clear decision-making structure, and watershed-based boundaries
Abandoned wells- Pembina Valley	–	Yes	–	Yes	Boards took advantage of existing conditions to adapt to new issues. Programme evaluation inadequate.
Conservation agreements - Turtle Mountain	–	–	–	Yes	Demonstrated the value of external partners in meeting CD goals over a diverse landscape
Boundary alignment - West Souris	Yes	–	–	Yes	The CD Act allowed boundary changes; local boards took initiative. Trans-boundary partnerships formed based on logic of watershed function
ALUS pilot project- Little Saskatchewan River	–	–	–	Yes	The CD Act allowed for substantial investment in a new concept of importance to agricultural producers
Aboriginal participation - Alonsa	–	Yes	Yes	–	Education programme includes significant interpretation of the Aboriginal culture. Potential for future changes to the CD Act to recognize First Nations as full CD partners, toward complete watershed boundaries

The CD programme in Manitoba is an example of what might be called devolved decision-making. The provincial government has created a set of institutions – the CD Boards – and given them well-regulated structures. However, they do have fairly wide decision-making latitude, as our seven examples show. So, the instrument itself is inherently adaptive, in that the CD Boards, made up of local stakeholders, are able to make spending decisions based on their locally grounded view of the needs and changing circumstances. Obviously, this is the goal of the instrument, a goal that is captured by

the term *subsidiarity*. An earlier IISD (International Institute for Sustainable Development) finding was: *Subsidiarity recognizes that action will occur at different levels of jurisdiction, depending on the nature of the issue. It assigns priority to the lowest jurisdictional level of action consistent with effectiveness* (IISD 1994). This also connects to Holling's concept of nested hierarchies, or holarchy (Holling and Gunderson 2002). There are many examples of such instruments, so it is useful to analyse the Manitoba CDs for their adaptability.

The inclusion of seven examples of the implementation of the CD policy instrument in this case study allows us to compare various aspects of the implementation of the instrument. We see, for example, that in many CDs, the basic goals of the programme are not being met adequately. On the other hand, there are many examples of the creative use of latitude that the CD programme offers.

The first example, surface water management, shows that the rules that create the policy instrument must be considered in detail. In this case, the legislation defining the CD is quite permissive. However, in the case of most CDs, the boundary is defined in the governing Order-in-Council and this can hamper decision-making. At the same time, the various decision-makers involved in overseeing drainage (which is governed by different legislation), must coordinate, and if they do not, the entire system operates sub-optimally. The contrast between the surface water management example and the Whitemud example is clear – where the boundaries are aligned with the natural water management unit of the watershed, and where all drainage decisions are integrated, the instrument is much more effective.

The abandoned wells example raises another insight with respect to the adaptive policy discussion. PVCD led the way in filling abandoned wells. This was definitely an example of adaptive behaviour. Once they had highlighted the problem and its solution, other CDs followed suit. However, the later CDs' activities were less innovative and, as time went on, may be said to take on the ability to deal with a range of anticipated conditions, as discussed in Chapter 2.

With respect to the rest of the examples, they all show adaptive characteristics. The CD board used its capacity, to a certain degree, to spend money or make decisions to address issues that were not dealt with in the legislation or the Orders-in-Council. In this sense, it is clear that the devolution of authority model works well.

Figure 8.10 provides an overview of how the examples relate to adaptive policies. The first example, on surface water management, seems incapable of responding to conditions, anticipated or unanticipated. The policy design, as applied through various pieces of legislation did not allow the CDs to meet their basic goals of water management.

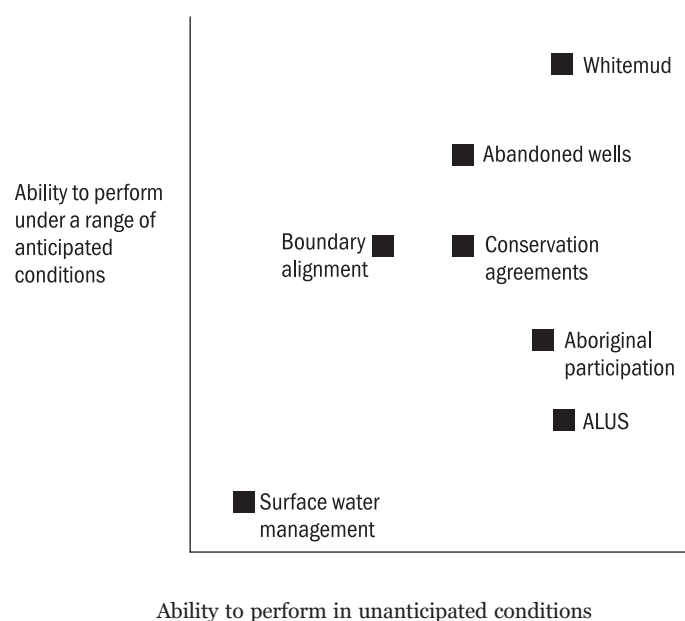


Figure 8.10 Illustrating the adaptability of the CD programme case studies

From Table 2.1 in Chapter 2, we obtain a list of some of the characteristics that various authors have suggested as being important for adaptive policy design. Many of the specific points are also observed in our seven examples. For instance, the set of points on understanding the issue are as follows.

- Understand local conditions, strengths, and assets
- Respect history
- Understand interactions with the natural, built, and social environment

All of these are inherent in the devolved decision making approach that CDs exemplify. We also see examples of self-organization, variation, and redundancy and copying. On the other hand, the principle of effective neighbourhoods might be said to be demonstrated in examples where the CD boards, the municipal governments, and the provincial decision makers are unable to work closely enough together to maintain an effective drainage system.

Our examples also suggest the addition of another principle to our list – that of place-based management. This is commonly mentioned as an attribute of good natural resource management, but was not included in our earlier list.

From the analysis of the CD policy history, current implementation, and the seven specific examples of how it is working, we can identify some issues that future case studies should clarify.

The surface water management example demonstrates that it may be the conjunction of several policy instruments that lead to a poor result. Conversely, in the well capping example; it was, in part, the availability of other funding programmes that facilitated the adaptive response. Future case studies will be based on an analysis of actual community experience, and thus will have the opportunity to try to sort out the impacts of various instruments. In a world where there are almost always several public policies, often based on decisions from several levels of government, impacting any particular activity, such analysis will be very important.

In this case study, the adaptive capacity largely was rooted in the initiative of the individual CD boards. They were given some money and a fairly broad decision-making mandate, within a specified institutional structure. Thus they were able to develop new ideas or make use of good ideas developed by others, in meeting what they felt to be the local priorities. On the other hand, the adaptive capacity was not based on formal monitoring and feedback mechanisms, which literature suggests will be important (Walker, Rahman, and Cave 2001). Future case studies should explore this.

This case study does confirm that devolved decision-making (or subsidiarity) does have significant adaptive qualities. Future case studies should investigate this further. We saw three major characteristics that seem to be important, if not critical, in the success of devolved decision making in adapting to unforeseen circumstances.

- Decision-making capacity that includes most or all of the major variables. Where this did not exist, as in the surface water management example above, the local process did not work.
- In this case, one major variable was the use of watershed as the relevant area, which was available in some examples and not others. For a locally based decision-making process to work, the definition of relevant territory is important.
- Availability of ongoing financial and human resources in amounts relevant to the mandate.

Future case studies should explore whether these findings are duplicated elsewhere.

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Appendix

Manitoba conservation districts

This section is adapted from the websites of the various CDs (conservation districts) listed below.

Alonsa conservation district

Alonsa CD was formed in 1978 and covers approximately 4450 km² of land. The district is located along the west shore of Lake Manitoba and consists of the RMs (regional municipalities) of Alonsa and Lawrence. The beef cattle industry dominates the local economy along with a considerable involvement in commercial fishing in the winter months. The district has been involved in soil and water management since its inception. Some of the major projects include channel construction, improvements, and maintenance; water level and flood control; land drainage/waterfowl habitat enhancement, forage seed assistance; and school conservation education programmes.

Cooks Creek conservation district

Cooks Creek CD was incorporated in 1979 and covers approximately 862 km². It is situated east of Winnipeg and includes most of the Cooks Creek Watershed and parts of the Cooks Creek and lower Seine River basins. The RMs of Springfield, Tache, Ste. Anne, Brokenhead, and Reynolds are included in the district. Water management is the most important issue in the district. However, another significant concern is poor soil drainage. As a result, the district places emphasis on the maintenance and upgrading of agricultural drainage channels. Other initiatives include sealing abandoned wells, crossing replacements and repairs, and public education.

East Interlake conservation district

EICD (East Interlake conservation district) is Manitoba's 17th CD, formed on 24 August 2005. EICD is located on the west side of Lake Winnipeg's south basin and includes the RMs of Fisher, Bifrost, Armstrong, Gimli, Rockwood, and Rosser; as well as the towns and villages of Arborg, Stonewall, Winnipeg Beach, Teulon, Riverton, and Dunnottar. EICD is working towards extending its boundaries to include all members of the watershed over the next few years.

In EICD, water flows into Lake Winnipeg directly through six drainage networks and indirectly, by way of the Red River, through two drainage networks. Much of the land area comprising this District is agricultural, with cottage communities boarding the shores of Lake Winnipeg.

One of the first tasks for EICD is to begin the IWMP (Integrated Watershed Management Planning) process. The IWMP process will provide valuable information about EICD's natural resources and the issues of concern for residents of the district. Results of this process will help guide the CD board when setting priorities and creating programmes for the District. EICD currently operates an abandoned well sealing programme, and through the IWMP process, will develop a broader suite of relevant and effective programmes for residents of the district.

Intermountain conservation district

Intermountain CD was formed in 1997 and covers approximately 7200 km² (720 000 ha), making it the largest CD in Manitoba. Riding Mountain National Park, Duck Mountain Provincial Forest, Crown Territory, and Lakes Dauphin and Winnipegosis surround the district. RMs included in this district are Dauphin, Ethelbert, Gilbert Plains, Grandview, Mossey River, and Mountain South. The villages of Winnipegosis and Ethelbert, the towns of Grandview and Gilbert Plains, and the city of Dauphin are also included. Water management is the highest priority with soil conservation and public education as ongoing priorities. Some programmes include stream bank stabilization, abandoned well capping and sealing, forage seed assistance, grassed waterway development, fish and wildlife habitat enhancement, riparian pasture management, and recreation and education initiatives.

Kelsey conservation district

Kelsey CD was established in 1999 and covers approximately 900 km² (90 000 ha). It is located in the west-central portion of Manitoba. The RM of Kelsey, which includes the Pasquia and Carrot River drainage basins, encompasses the District. Priorities for the District include developing programmes that educate the public about prudent resource management, soil and water conservation practices, and local decision-making, as a means to maintain a healthy rural landscape. Some projects include off-site watering, exclusion fencing, forage assistance, abandoned well capping, well disinfecting, tree planting, and wildlife habitat enhancement.

La Salle Redboine conservation district

The District covers over 7003.4 km² of central Manitoba. It is home to over 37 000 residents making it the most populated CD in Manitoba. It is also home to several major river systems including the Assiniboine, Boyne, Cypress, and La Salle, all of which empty into the Red River at the District's eastern extent. The District consists of 68% agricultural lands, 12.5% grasslands, 9% deciduous forests, 1.5% water, and 1.5% marshland.

Lake of the Prairies conservation district

Lake of the Prairies CD was established as Manitoba's 12th CD 1 January 2001. The District includes approximately 2050 km², extending from the Saskatchewan border west to Riding Mountain National Park and from the Lake of the Prairies south to the village of Binscarth. This CD has a diverse landscape, ranging from rolling topography in the north to low-lying wetland areas in the south. Its principal landscape feature is the Assiniboine River, which runs along the western border of the district.

The area serves approximately 4262 residents and consists of the municipalities of Russell, Shellmouth-Boulton, and Silver Creek; the town of Russell; and the village of Binscarth. The District is divided into four sub-districts based on the drainage basins of the major rivers and creeks within the area. 22 sub-district members act in an advisory capacity to the main Board with each sub-district committee chairperson sitting on the Board. In addition, the Board has invited representation from those member councils not represented at the board-level to attend meetings as non-voting members. The Board and representatives meet on a monthly basis to discuss district business.

Little Saskatchewan River conservation district

Little Saskatchewan River CD was established in 1999. The District covers approximately 6080 km² and is located in south-western Manitoba. Although currently expanding, the district occupies the RMs of Daly, Blanchard, Saskatchewan; and parts of Minto, Odanah, and Clanwilliam. It also includes the towns of Minnedosa and Rivers. Holistic resource management is the overall objective of the District with the primary focus being soil and water conservation. There is also significant emphasis placed on educational initiatives in schools and throughout the district. Some programmes include

constructing headwater dams, abandoned well capping, grassed runways construction, forage seed assistance, riparian pasture management, tree planting projects, and sustainable beaver management.

Mid Assiniboine River conservation district

One of 17 municipal provincial CD partnerships in Manitoba, the Mid Assiniboine River CD was formed in 2002, as a way for all parties to work together in managing natural resources on a sustainable long term, integrated basis. Located in south-western Manitoba, the district was formed by three local municipal governments in response to a need for local practical watershed-based management solutions. The RMs of Cornwallis, Whitehead, and part of Elton, which cover an area of over 600 square miles, define the political boundaries of the MARCD (Mid Assiniboine River conservation district). MARCD was formed by an Order-in-Council of the provincial legislature and is governed by the Manitoba Conservation Districts Act and Regulations.

Pembina Valley conservation district

PVCD (Pembina Valley conservation district) was formed in October 1989. It covers an area of approximately 4270 km² and is situated along the international boundary. This area includes the Pembina Valley, the Tiger Hills, the Red River Valley, and the Pembina Escarpment. RMs included in the district are Lorne, Thompson, Roblin, Louise, and Pembina. Towns included in the district are Pilot Mound and Manitou, in addition to the village of Crystal City. The district's focus is on conservation farming, and water management. Some projects include small water retention structure development, forage seed assistance, grassed runway construction, bank stabilization, public education, and wildlife habitat preservation.

Seine-Rat River conservation district

SRRCD (Seine-Rat River conservation district) was established in January 2002. Each year since it was established, SRRCD has expanded to include more partners. As of April 2006, SRRCD includes the RMs of La Broquerie, Ste. Anne, Hanover, De Salaberry, Ritchot, City of Steinbach, Town of Ste. Anne, and the Village of St. Pierre-Jolys. The District is located south-east of Winnipeg and is home to over 39 000 people. SRRCD offers a full line of soil and water management programmes with a particular focus on surface and groundwater management initiatives.

SRRCD has started an IWMP for the Seine River Watershed with plans to complete work by March 2008. SRRCD has also recently completed Aquatic Inventory and Riparian Assessment studies for the Seine and the Rat Rivers.

Tiger Hills conservation district

On 1 January 2001 the THCD (Tiger Hills conservation district) became Manitoba's 13th CD. Formed as the southern shore of glacial Lake Agassiz during the retreat of the last ice age, the Tiger Hills are underlain by erodible sand and sandy loam soils and covered with mixed forest and grasslands. The distinct characteristics of the area's topography present unique challenges for local landowners and producers in terms of protecting the fragile nature of the Tiger Hills, while maintaining a sustainable and diverse rural economy.

Divided into five sub-districts, each responsible for a distinctive watershed drainage area, THCD was formed through partnership among the RMs of Argyle, Glenwood, Strathcona, and South Cypress; the village of Glenboro; and the province of Manitoba. THCD, along with its many external partners, is committed to natural resource management and sustainable rural development.

Turtle Mountain conservation district

The District was established in the 1970s to support local resource conservation efforts in the Turtle Mountain area of south-western Manitoba. Today, the District's support is demonstrated in a number of ways such as: implementing the East Souris River Watershed Management Plan, improving land

use practices, implementing water conservation projects, offering conservation education, and implementing programmes such as 'Abandoned well sealing' and 'Riparian management'.

Turtle River Watershed conservation district

TRWCD (Turtle River Watershed conservation district) consists of all or parts of seven rural municipalities (Alonsa, Dauphin, Lawrence, McCreary, Ochre River, Rosedale, and Ste. Rose). The district encompasses 2330.40 km².

To facilitate local input and address resource issues on a smaller scale the district is divided into three sub-districts. Approximately 25% of TRWCD exists within Riding Mountain National Park boundaries.

Upper Assiniboine River conservation district

UARCD (Upper Assiniboine River conservation district) is characterized by a diverse landscape. From the Newdale Plain to the border of Riding Mountain National Park the undulating topography can vary over 200 metres. The dominant feature of the landscape is the Assiniboine River meandering gently through the area. The Assiniboine River has carved an impressive valley. At times the valley is over 75 metres deep with steep slopes. The Assiniboine River Valley represents one of the most scenic aspects of this CD, but also represents a major resource management issue.

The surface drainage flows generally to the south-east through a number of minor rivers and streams. Potholes are abundant in the prairie grassland region of UARCD. UARCD consists of the municipalities of Archie, Ellice, Rossburn, Birtle, Hamiota, Miniota, Shoal Lake, Wallace, and Woodworth covering over 2200 square miles. To put size into perspective, this CD is larger than the Province of Prince Edward Island. UARCD can be divided into three distinct landscapes: uplands, plains, and river valleys.

Once again, UARCD expanded. When the district was originally established in 1996, it was made up of the RMs of Birtle, Ellice, Hamiota, Miniota, and Rossburn; joined by Shoal Lake (1998), Woodworth (2000), Archie (2001), and part of Wallace (2002). On top of this rapid expansion, this CD has also undertaken its first management plan with much assistance from the Gladstone office. The District learned a lot from the information provided during public consultations; feedback, which has gone a long way towards forming district policy for the future.

West Souris River conservation district

WSRCD (West Souris River conservation district) was officially incorporated as Manitoba's seventh CD on 1 January 1995, upon request to the provincial government from the municipalities of Sifton, Pipestone, Albert, and Edward. The RMs of Cameron and a portion of Wallace joined the District on 1 April 1999 and 2002, respectively. Effective 1 April 2004, the Souris River became the new boundary between West Souris River and TMCD. The RMs of Arthur and Cameron will have land in both CDs.

WSRCD lies on the second prairie steppe in the Saskatchewan Plain Division of the Great Plains region. The underlying geology and the overlay of soil materials strongly influence the land use patterns that have developed over time. Natural drainage is generally from west to east. The major streams in the district, listed from north to south are: Pipestone, Gopher, Stony Jackson, Graham, Gainsborough, Souris, and Antler Creeks. Oak and Plums Lakes are the major water bodies in the District.

Whitemud Watershed conservation district

The first CD formed in Manitoba was WWCD (Whitemud Watershed conservation district) in 1972. The district covers approximately 7115 km² of land. WWCD includes the complete area of some municipalities and portions of others. In total 15 rural municipalities and three towns are involved. The CD is situated in south-central Manitoba from Minnedosa to Portage la Prairie and Carberry to Kelwood. The headwaters originate from the Riding Mountain Escarpment and Assiniboine Delta

Aquifer and drain via the Whitemud River into Lake Manitoba. The District's goal is to promote soil and water stewardship and facilitate agricultural land drainage on a watershed basis. It provides conservation programming and infrastructure management within its watershed. The District is responsible for over 1760 km of drainage infrastructure and 1265 crossings. Major activities include maintenance and replacement of infrastructure as well as proactive soil and water conservation projects such as forage assistance, shelterbelts, grassed runways, water retention, shale traps, wild lands and habitat preservation, conservation corridors stream bank stabilization, and riparian management. The District has also been facilitating drainage licensing within the Watershed in association with Manitoba Conservation for the past two years. This partnership has dramatically increased the effectiveness and efficiency of water management in the District and is being considered by numerous other CDs.

CHAPTER 9

Synthesis and conclusions

- 9.1 Understanding the ability of a policy to adapt to anticipated conditions
- 9.2 Understanding the ability of a policy to adapt to unanticipated conditions
- 9.3 Discussion of results and conceptual issues
 - 9.3.1 Key observations from the case studies
 - 9.3.2 Policy adaptability versus ad hoc policy review
 - 9.3.3 Policy adaptability versus policy change or substitution
 - 9.3.4 Policy rigidity
 - 9.3.5 Addressing policy side effects
 - 9.3.6 Linkages between adaptive policies and community-level coping strategies
- 9.4 Conclusions

Synthesis and conclusions

Stephen Tyler¹, Ulka Kelkar², Stephan Barg³, Henry Venema³, Darren Swanson³,
Preety Bhandari², John Drexhage³, Sudip Mitra²

This chapter provides a synthesis of the four policy case studies from an adaptive policy perspective. The policies considered in these cases were designed to support farm livelihoods and natural resource management in Prairie Canada and in India. The case studies were presented in detail in previous chapters and are summarized in Table 9.1.

Table 9.1 Overview of policy case studies

Case study	<i>Policy description</i>
Chapter 4 Weather-indexed insurance, in India	In the last two years, index-based weather risk insurance contracts have emerged as an alternative to traditional crop insurance in India. Unlike traditional crop insurance where claim settlement can take up to a year, quick payouts in private weather insurance contracts are triggered by independently-monitored weather indices (rather than farm loss sampling) and can improve recovery times and thus enhance coping capacity.
Chapter 5 Agriculture price policy in India	In the northern state of Punjab, the Government of India provides protection to agricultural producers against any sharp drop in farm prices. If there is a good harvest and grain prices weaken, the government guarantees farmers a minimum support price. This price is announced each year after taking into account the recommendations of the CACP (Commission for Agricultural Costs and Prices).
Chapter 7 The Crow Rate in Prairie Canada	A railway freight rate-control agreement known as the Crow Rate was implemented in 1897 for the transportation of grain produced in Prairie Canada. Designed initially to help spur development in

(Continued)

¹Adaptive Resource Management Ltd, Canada

²The Energy and Resources Institute, India

³International Institute for Sustainable Development, Canada

Table 9.1 Overview of policy... (Continued)

	western Canada, the Crow Rate became a cornerstone of western agricultural policy, but eventually came to be seen as subsidizing producers at the expense of the railways. It endured close to 100 years before being terminated in 1996.
Chapter 8 The Conservation District Programme in Manitoba, Canada	Passed in 1976, the policy was designed to create partnerships between the provincial government and rural municipalities for soil conservation and water management. Seventeen conservation districts are given a mandate to implement programmes that meet both local and provincial needs, and have been given substantial freedom to act on local priorities.

In an era of more rapid climatic change and more frequent extreme climate events, policy support to agricultural livelihoods and to natural resource management will become even more important. This chapter draws insights from the four case studies into the attributes of policies that are responsive or unresponsive to changing conditions. We describe policies in terms of their ability to perform successfully under a range of anticipated conditions and also, perhaps more importantly, to perform successfully in unanticipated conditions. While many kinds of policies could be adaptive, we focus here on policies that have helped, or are helping build the capacity of farmers and rural resource users to cope with the increasing pressure from climatic variability and change.

Our conceptual framework of adaptive policies is illustrated in Figure 9.1 (and previously in Figure 2.2). Adaptive policies have features that enable them to respond constructively to both anticipated and unanticipated conditions. In dealing with a range of conditions that can be anticipated through prudent analysis, adaptive policies make use of no-regrets alternatives and automatic adjustments triggered by the monitoring of key system indicators. Formalized and scheduled evaluation allows adaptive policies to recognize unanticipated conditions and make adjustments based on a revised understanding of the socio-economic and ecological conditions within which the policy is being implemented. Adaptive policies also employ principles for effective intervention in complex adaptive systems—the inherent backdrop for all policy implementation in settings involving human interaction with the environment.

Policies can always be changed, of course, if they no longer function as intended or have outlived their usefulness. *Ad-hoc* policy revision, however, is often a time-consuming process, and may create a high degree of uncertainty. In a world of rapid and complex change, adaptive policies reduce the need for costly and uncertain *ad-hoc* review precisely at a time when resource users need flexibility in developing their own responses to climatic variability.

9.1 Understanding the ability of a policy to adapt to anticipated conditions

According to our research proposition, an adaptive policy can perform successfully in a range of conditions that were anticipated in its design. This is a measure of the ability of policy analysts and decision-makers to correctly diagnose the problem they are responding to, understand the relevant cause–effect relations extant at the time the policy was designed, and predict the possible range of socio-economic and/or ecologic conditions under which the policy will function during its life. Socio-economic phenomena that are known to be inherently chaotic, stochastic, or otherwise erratic in their behaviour are not generally targets for policy intervention because of their low predictability of success. Similarly, policy decision-makers typically avoid instruments whose outcomes are difficult to predict or are unknown. For these reasons, we should expect to see policies with adaptive features, relating to anticipated conditions, from competent policy-making.

This study does not consider policies that are effective mainly because their key elements address relatively static parameters. It is important to recognize that many policies are intended precisely to

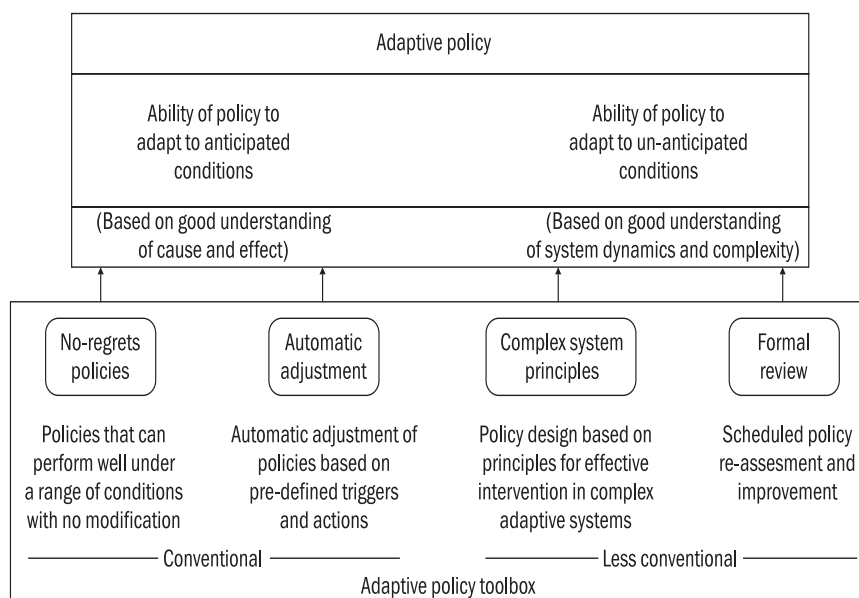


Figure 9.1 Initial conceptual framework for adaptive policies

foster continuity and persistence—important features for a healthy social, business, and financial climate. The policy problem is that continuity can become rigidity, which, in the face of ongoing systemic change, can lead to instability, generally the opposite of the intended result. This analysis, by focusing on policies that must be sensitive to changing agro-ecological conditions, is intended to learn from how they respond to such changes. All four case studies illustrate features of responsiveness to external change. We first explore ways in which the cases demonstrate policy features that facilitate the ability to perform in a range of anticipated conditions.

The original Crow Rate (1897–1919), for example, was suspended after twenty years because sharp inflation raised the wages of rail workers outside the range in which the policy could operate effectively. The policy did not anticipate an important condition, namely, inflationary wage rates. Despite this learning, the 1925 legislation locked in a new rate without provisions for adjustment once again. Regardless of the gradual changes in underlying conditions over the decades, the Crow Rate proved relatively effective at achieving its main policy objectives without being adjusted. These objectives were, initially, to provide some certainty to the railways for commodity transport, and then later to support the development of staple grain production on the prairies for export. Our first insight is thus that some policies can be effective for relatively long periods of time before they reach a critical state of dysfunction in the face of contextual changes.

In the case of the Crow Rate, the eventual policy redesign in the form of the WGTA (Western Grain Transportation Act) in 1984 did account for changes in railway costs and grain production volumes, and that allowed the rate to adjust each year. With these features, we observe that policy designers understood better the important contextual variables. However, events in the decade following the implementation of the WGTA revealed that only a narrow range of inflation had been anticipated. Lower inflation rates resulted in higher than expected government payouts to producers, which, at a time of fiscal restraint, contributed to the eventual demise of the policy in 1996.

The Indian agricultural price policy and its key instrument, the MSP (minimum support price), was effective in achieving its principle objectives—that is, increasing production of staple grains and ensuring stable incomes for farmers through guaranteed purchase prices. In this respect, its designers predicted well the behavioural responses of producers, and chose simple and powerful market instruments to implement the policy. The policy was a significant contributor in India to the grain output increases following the advent of the Green Revolution. While the MSP did anticipate and account for a range of input factors, it was perhaps not revised frequently enough to allow it to decrease in the face of changing relative prices of agricultural inputs and outputs as influenced by

increased trade liberalization. Like the Crow Rate, it was weakened by the debilitating impacts of its own success, but has proven very difficult to modify, despite repeated efforts at adaptive measures.

Public crop insurance policies in India have almost completely failed to achieve the impacts they were intended to have, or to achieve even modest levels of administrative effectiveness and fiscal sustainability. New privately offered weather-indexed insurance schemes have greater ability to function effectively under a range of conditions. They have a higher likelihood of addressing the basic objectives of affordable risk reduction for farmers through administrative simplicity and prompt payouts, while remaining commercially sustainable and profitable.

The Manitoba provincial policies governing CDs (conservation districts) represent a somewhat more nuanced situation. In many respects, the policies have had only limited success in managing surface water flows and drainage. Instead, the initial emphasis on physical infrastructure led to structuring the CDs in relation to existing RMs (rural municipalities) in order to assure fiscal accountability for the construction expenditures and management. The provincial government took a leading role in the technical and financial responsibilities at various times in the history of the CDs. It is only as functional decision-making and fiscal capacity have been decentralized to the CDs, that they have been able to respond to local priority issues and begin to address new (local) policy objectives. This has not been a particularly effective policy experience, because of the spotty successes of various CDs in addressing fundamental surface water management issues. Interestingly, however, the case illustrates a number of features of adaptability, as local districts using the enabling features of the policy seem to address issues that had not been anticipated in its design (discussed further in section 9.2).

There are exceptions to the generally low effectiveness of the policy, as noted in the case study in Chapter 8. For the original CD, Whitemud, which was constituted on a watershed basis, the programme has been quite effective—it has responded to the main issues of surface drainage. In addition, the Souris case illustrates the effectiveness of the original policy in providing for boundary changes and enhanced collaboration across these boundaries. In many cases, with increased devolution, this responsiveness to local opportunities and priorities has been enhanced. It is noteworthy that in the Manitoba CD case, as more control over CD policy priorities passed to the local level, initiatives to increase effectiveness spread to other CDs as well. This is consistent with the complex adaptive systems principles represented in the literature (Table 2.1), where greater understanding of local conditions, strengths, and assets should facilitate the ability to deal with a range of anticipated conditions. This is an argument for devolution of policy priority-setting to the lowest feasible level. The policy design question, then, is to establish a framework that will allow local decision-makers to make adaptive decisions. This means that the policy goals set for local decision-makers, within which they must carry out their responsibilities, need to be specific enough to be meaningful, but general enough to withstand the test of time. In the Manitoba CD case, devolution of authority and initiative led to successful adaptation, but in most cases, the mismatch between CD boundaries and watersheds prevented effective surface water management. The challenge of getting this mix of constitution and devolution right is a fruitful area for further inquiry as this research project proceeds through more case studies.

An interesting feature of the more effective examples for dealing with anticipated conditions in this study is that they are typically high-profile policies that attracted intense public attention. In the case of the Indian food grain procurement policy, the policy responded to strong political pressures from both farmers and from urban food consumers to ensure predictable supplies of staple food grains. Similarly, for the Crow Rate, this was a policy that attracted high public attention and strong advocacy efforts. This political importance provides an incentive for policy designers to get the essential features right for important political audiences. We should expect that such policies be designed to respond effectively to anticipated conditions due to their political prominence. In this respect, the Indian food grains policy proved more adaptable than the Crow Rate.

9.2 Understanding the ability of a policy to adapt to unanticipated conditions

In addition to having the ability to adapt to anticipated conditions, an adaptive policy achieves its intent by adjusting to unexpected and unpredictable changes. This is not a question of cause–effect relationships (because responses are not necessarily predictable), but of formal review, defensive actions (see Chapter 2, section 2.1.2), self-correcting features, and policy reassessment. Adaptive policy designers are comfortable with higher levels of uncertainty and recognize that our capacity to analyse and predict the behaviour of natural or social systems is limited. The point is that policy provisions are designed, not just to be static no-regrets policies or to respond to pre-defined triggers, but to be purposively responsive to their contextual environment. The responsiveness may come from after-the-fact defensive actions, or formal and systematic policy reassessment (Walker, Rahman, and Cave 2001; as in Chapter 2). Adaptive policies have built-in mechanisms for responding to circumstances beyond the ranges anticipated when they were designed.

The ability of a policy to adapt to unanticipated conditions is a relatively new concept. There are thus few examples of this feature explicitly included in policy design at this time. Policy design is based on political priorities and adaptability has mostly not been a political priority. Only when adaptability becomes an important policy criterion and a recognized asset to policy design will some of these mechanisms be systematically explored and implemented at the policy level. However, we can begin to describe this ability by looking at some of the features observed in the four policy case studies.

The case studies mostly provide examples of policies that are not adaptive with respect to unanticipated conditions. The policies, even if they accomplish their design objectives, do not adjust well to changes in complex ecological, natural resource, and social parameters. In fact, not only do the policies not adapt well to contextual change, but this lack of adaptability specifically constrains the capacity of farmers to cope with change. This is particularly true for the cases of the Crow Rate and the Indian food grain procurement policy, both of which persisted for long periods of time, and conditioned the behaviour of farmers in ways that have hindered their ability to cope with change.

These examples also demonstrate ways in which policies can undermine the coping capacity of farmers by constraining farmer adaptation. For policy mechanisms to be considered adaptive, they should reinforce the coping capacity of farmers themselves. Policies which respond to change by undermining farmers' coping capacity – by, for example, reducing information flow, restricting choices, or increasing the costs of adjustment – are not of interest in identifying policy features for adaptation to climate change, which is the fundamental purpose of this work.

Some policies include rules for their own review or modification of their implementation procedures. These indicate inherent attention to issues of policy adaptability. These may fall along a performance spectrum. On one end are mechanisms for anticipated conditions—fully pre-specified mechanical rules of the type, 'if X happens, adjust policy parameter Y to value Z'. For example, the WGTA offered rules for adjusting grain freight rates based on the rate of inflation in railway costs within a certain range (a similar feature is found in the minimum support price instrument for the Indian agriculture price policy). This kind of adjustment mechanism is based on anticipated conditions and predictable cause–effect relationships, as discussed in section 9.1. It indicates how policy designers expected the policy framework to respond to contextual changes they anticipated at the outset.

On the other end of the continuum are policies and policy implementation systems that are autonomously self-organizing. These are designed around processes of deliberate information sharing, learning, and feedback, which may take policy content or implementation instruments in directions not anticipated at the design stage. For example, in the case of CDs in Manitoba, the structure of the policy eventually came to allow a high degree of local devolution in setting priorities and developing implementation processes. This allowed CDs with geographic boundaries consistent with a watershed to undertake more effective local actions in support of surface water management and related NRM (natural resource management) issues. Examples of this include, payment for ecosystem

services, or engagement of First Nations in joint planning and management. The focus of policy implementation moved in directions not originally anticipated, but was locally effective in responding to policy objectives such as soil and water conservation. This example falls much further along the continuum towards self-organization and continuous learning or adjustment than the inflationary rate adjustment in the WGTA example.

However, in addition to this feature introduced in the WGTA for addressing a range of anticipated conditions (for example, accounting for variable transportation costs), a relatively open-ended mechanism for unanticipated conditions was also built into the WGTA in the form of a costing review carried out by the National Transportation Agency every four years to take into account productivity and market changes. Additionally, the Grain Transportation Agency was created to ensure the system was efficient, reliable, and effective with the objective of maximizing returns to producers. A Senior Grain Transportation Committee was also formed to advise the Minister of Transport on grain transportation issues.

Weather-indexed crop insurance also provides an example somewhere in the middle of the spectrum. While the mechanism for adjusting premiums is mechanical, the specific values for premiums or payment triggers could be derived automatically, and could reach levels well beyond what was originally anticipated in the design of the programme, depending on climatic change, risks, and levels of subscription. Policies that display greater degrees of autonomous self-adjustment can be described as having higher levels of adaptability to unanticipated conditions.

In the case of the WGTA, adjustments to the transportation subsidy were intended to respond to changes in the railways' cost structure and grain production volumes, but not to the international price of grains or to farmers' input cost structure. While part of the intent of the policy was to maximize returns to producers through assuring efficient grain transportation, there was no protection to farmers from exposure to market or ecological changes, which gave an incentive for longer term adaptation to these external changes.

In the case of weather-indexed crop insurance, the automatic adjustment feature provides a simple mechanism for managing insurer risk and determining farmer eligibility for benefit payments, while also responding to unusual weather conditions. This instrument, because of its administrative simplicity, offers a practical and cost-effective way to reduce farmer risks from climatic extremes. Yet, it also passes along incentives for farmers to adjust to long-term change by providing appropriate signals calculated on the basis of actuarial risk. And if, for example, a payment threshold is set as a fixed percentage of a 10-year rolling mean precipitation, it will trend lower as long-term mean precipitation declines.

By contrast, much of the experience with the Crow Rate was of continuity and rigidity. In 1925, the Crow Rate was embedded in the Railway Act as a statutory grain rate. By the 1960s, the problems with the Crow Rate policy were acute enough to spark the undertaking of at least seven different commissions and studies to better understand the problems of the Crow Rate and recommend solutions. While this demonstrates the maladaptive nature of the Crow Rate policy at the time, this period of review (1960–1982) also generated policy learning and change.

We differentiate 'policy learning' from 'adaptive policies'. Policy learning is an important process that will always play a role in policy change and adjustment. But we are most concerned with processes that can be designed into policies at the outset to require that policy performance be monitored, lessons identified, and essential revisions undertaken. Such formal mechanisms were only evident in the new version of the Crow Rate—the WGTA after 1984.

The crop insurance example demonstrates the benefits of pilot implementation to test instrument design and implementation options. This is suggested in the literature as one of the features of an adaptive, learning-oriented policy system (Chapter 2, section 2.2.3 on policy pilots). The evolution of trials with different public crop insurance schemes certainly suggests regular evaluation of experience and the willingness to try new approaches. So far, this learning has not yielded significant public policy successes, but a similar approach to market-based pilots was reported by the insurance industry leaders in this field as highly beneficial to better understand risk patterns and commercial potential, and to build consumer awareness of the insurance product. While these features were introduced by private sector companies for whom adaptation to market realities is imperative, they illustrate

features that could also be used in the public sector. Policy pilots are designed to deliver information and analysis on crucial functional parameters, and specifically intended to foster learning.

In the Indian agricultural price policy case, a type of formal review process was observed for the MSP policy. Market prices were often lower than the MSPs and, therefore, there was an unabated build up of food grain stocks with the Food Corporation of India. Often, the stocks were higher than the buffer requirements, resulting in extremely high carrying costs and swollen food subsidies. The situation was reviewed and crop price subsidies reduced over the last five years.

The Manitoba CD programme case study in Canada is a classic example of the ability to adapt to unanticipated conditions in relation to the incorporation of principles for effective intervention in complex adaptive systems (Table 2.1). In this case, there have been changes to instruments and implementation mechanisms through the life of the policy, but remarkably few changes to the fundamental policy design despite a substantially different ecological, agricultural, social, and political context now. This is a sign of an adaptive policy. Interestingly, one of the few changes to the legislation (moving away from watershed basis to municipal government basis for constituting CDs) likely reduced the effectiveness of the policy.

The central element of the CD policy, that upstream drainage should compensate downstream recipients of excess water, is directly tied to the ecological functioning of watersheds. While it is a simple principle, it is difficult to implement effectively in the absence of clear decision-making rules and a strong provincial role in the compensation and maintenance of higher-order infrastructure. Implementation in the case of the CDs has been hampered by greater attention to the principles of fiscal accountability for infrastructure investment through local governments than to the principles of ecological accountability through the management of watersheds as administrative units. Hence, the selection of contiguous political units (such as RMs in this case) to constitute a CD, rather than of coherent ecological units (such as watersheds in this case), proved to be a crucial stumbling block in policy implementation. These observations are consistent with those in Table 2.1 in that understanding ecological functionality and structuring policies to reinforce ecosystem function are helpful tools for adaptive policies.

The CDs have been able to overcome the drawback of their non-ecological structure in several ways to increase their ability to adapt to unanticipated conditions. Key among these has been the *de facto* devolution of programming and priority-setting to the local level. While it has probably limited the effectiveness of the core objectives of the policy (namely, drainage) by obscuring the appropriate responsibilities of the province, this devolution has led to a number of innovations at the initiative of specific CDs to respond to local priorities. These innovations have subsequently been taken up by other CDs. An obvious example is the well-capping programme in Pembina Valley, which was a response to a local priority consistent with the intent of the policy, but well beyond its original design parameters.

The combination of devolution of instrument implementation and ecological definition of CD boundaries in the case of the Whitemud CD provides the best example of adaptation in policy implementation. Through development of new administrative procedures, and through maintenance of watershed drainage infrastructure, this CD has managed to most successfully deliver on the original policy objectives of surface water management. It has done so by adapting the original instrument design and implementation mechanisms to suit its priorities and ecological conditions.

In this respect, the example reinforces many of the principles summarized in Chapter 2 (Table 2.1). As expected, this policy evolved in its implementation, to focus both on the existing areas of activity and on innovative new areas of engagement. It builds on ecosystem functionality and responds to local priorities.

Another key aspect of the CD case study in terms of consistency with the principles listed in Table 2.1 is the way in which it illustrates the value of interactive processes of social learning. One of the important elements of how CDs function is that they engage a wide range of stakeholders in joint problem assessment, diagnosis, learning, and action planning. Regardless of the outcome, these processes for broad social engagement and learning appear to be linked to higher levels of adaptation. They build social capital, create trust, and combine the experiential knowledge of farmers with the technical expertise of professionals. They build capacity in shared learning and decision-making,

enhancing ability to adapt. They enable better feedback and monitoring close to the decision-making level, and facilitate interpretation of a wide range of different kinds of knowledge through deliberative processes.

Relating to the Manitoba CD case study, incorporation of conservation agreements, and special arrangements with First Nations offer further examples of how local initiative has contributed to the adaptation of CDs to respond to a broader range of conditions than initially anticipated.

Three factors seem particularly important in adapting to unanticipated conditions in the Manitoba CD case. One is that decision-making capacity and geographic jurisdiction should capture most or all of the major variables. The successes of Whitemud CD compared to the others demonstrate that without clear, internally controllable instrument rules on drainage management within a single watershed, it is difficult to accomplish much on surface water management. But with consistency between the locus of instrument implementation and the locus of problem intervention, there is considerable scope for adaptation.

Second, ecological units for decision-making and management seem particularly important to adaptation in natural resource management. As it is inherently challenging to predict the evolution of natural systems, all management must be adaptive. Without local monitoring and feedback at the ecosystem level, and good systems to integrate information and decision-making at that scale, it is very difficult to take advantage of adaptation opportunities.

Finally, there is the question of matching resources to the scope of the mandate. In the Whitemud CD, where full management and maintenance responsibility for drainage rests locally and the resources are provided to accomplish that task, effectiveness is high and adaptation is possible. Without the resources to undertake essential operating functions, other CDs have much more limited scope for adapting these practices to suit local priorities.

Another example of adaptive policy features can be seen in the weather-indexed insurance case study. The use of a simple and transparent benefit calculation mechanism which adapts to changing climate patterns, to reduce costs and speed claims payments, is an adaptive innovation that has been copied from private commercial firms by the public sector. Provisions for learning and copying successful innovation are signs of adaptive mechanisms.

In terms of programme delivery as well, insurance firms, driven by the discipline of the marketplace, have recognized the need for client satisfaction to improve effectiveness. Public policies are less responsive to client needs as accountability mechanisms have to work their way through politicians whose calculation of the public interest is inevitably more complex than a corporate bottom line. Nevertheless, the example of the insurance industry's successful delivery of weather insurance through local MFIs (microfinance institutions) points to the adaptive value of communications and feedback in sharing information and improving programme effectiveness. These local organizations have already established working relationships with agricultural communities. MFIs strengthened the delivery of weather-indexed insurance to the rural poor because they were organizations that already had built the trust and knowledge of the target group, and could serve as conduits of information both to the insurance provider (on rural terms and conditions which would suit poor farmers) and to farmers themselves (on the nature of the product and the commercial reputation of the provider). Self-help groups and *e-choupals* (or village internet kiosks) have also been used to create awareness about insurance products, as well as providing information about prices, cropping practices and products, along with loans or other agricultural inputs. This experience suggests the importance of two-way communication channels in fostering adaptive policy design by building in feedback mechanisms to respond to changing client needs or other conditions.

9.3 Discussion of results and conceptual issues

In this section, we summarize the key observations from the case studies and list conceptual issues which arose during the analysis and require further discussion and elaboration.

9.3.1 Key observations from the case studies

Table 9.2 provides a summary of the key observations from the four policy case studies regarding the presence of features that facilitate the ability to perform in a range of anticipated and unanticipated conditions. The two Canadian cases provided insights on adaptive policy features from both a temporal perspective (that is, the 100-year history of the Crow Rate), and a spatial or issue perspective (that is, the various CDs in Manitoba and the issues they have recently faced).

Given the long historical perspective of the Crow Rate case study, it is possible to plot the adaptive features of the policy over time with respect to anticipated and unanticipated conditions. Pictured on a two-dimensional axis, it is possible to get a sense of the overall adaptive nature of the policy. The policy, as originally conceived and implemented, did not perform well under either anticipated or unanticipated conditions. It had no mechanism for responding to predictable external changes such as inflation and no formal monitoring and review process to deal with unanticipated conditions. The result was a serious deterioration of the freight transport system. The policy was enshrined in legislation as a statutory rate under the Railway Act in 1925, so any adjustments required legislative change, making revisions much more difficult. The ability to deal with both anticipated and unanticipated conditions increased under a revised Crow Rate in the WGTA with inflationary and review mechanisms built in. But over its entire life, the policy exhibited a low level of adaptability, and changes to the policy, which did occur, were the result of public pressure, which initiated a number of public commissions and reviews.

Of the Canadian cases, the Manitoba CD case provided the best example of policy design and implementation features aligned with principles for effective intervention in complex adaptive systems (in the form of benefits of place-based watershed management). This observation would not have been possible without a comparative analysis of policy implementation in several different CDs. The range of CDs studied allows for an analysis of the adaptive nature of the programme under different forms of implementation. In the case of surface water management for most of the CDs, the legislation did not help them effectively address the basic goals of water management. On the other hand, some of the CDs were able to use the devolution of management authority to adopt innovations both within and outside the parameters originally envisioned for the policy. The Whitemud CD managed to achieve greater adaptability because of the coincidence of its administrative and ecological boundaries.

In the Indian weather-indexed insurance case study, the use of pilot testing and community organizations provided opportunities to commercial insurers to better understand risk patterns and

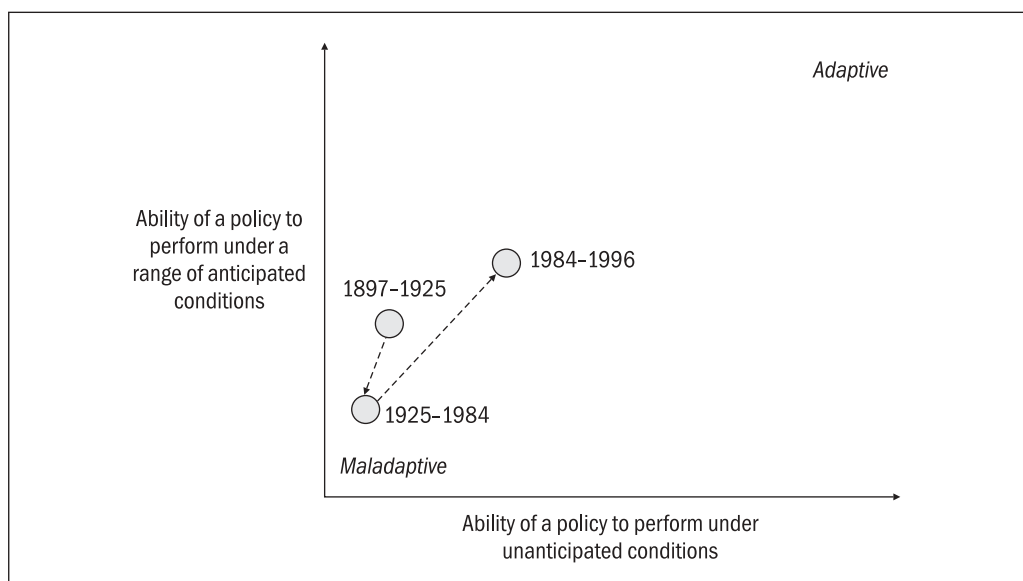


Figure 9.2 Adaptive nature of the Crow Rate policy

the potential for commercial expansion, as well as the opportunity to create awareness among farmers, build trust through established relationships and timely payouts, and improve the programme design in response to client feedback. A study conducted by the Cabinet Office in the United Kingdom (see Chapter 2, section 2.2.3, UK 2003) reporting on the use of policy pilots cited them as ‘the phased introduction of major government policies or programmes, allowing them to be tested, evaluated, and adjusted where necessary, before being rolled out nationally.’ The study found that such practices were prevalent in the United States owing to the devolved policy-making responsibility of individual states. In the weather-indexed case study, we see some evidence of both types of policy pilots noted in the UK study, namely, ‘Impact pilots—tests of the likely effects of new policies, measuring or assessing their early outcomes; and process pilots—designed to explore the practicalities of implementing a policy in a particular way or by a particular route, assessing what methods of delivery work best or are most cost-effective (UK 2003, as mentioned in Chapter 2).

The Indian agriculture price policy case study illustrated periodic adjustments to the MSP. The adjustment process, which considers various factors (Table 4, Chapter 5), was built in at policy design to deal with variations that were anticipated at the time. This is an illustration of the signposts and triggers mechanisms described by Walker, Rahman, and Cave (2001) (as in Chapter 2) in their review of adaptive policy-making in the transportation sector.

Next, we turn to a discussion of key conceptual issues, which emerged in the synthesis of the case studies. These conceptual issues related to the following.

- Formal review (for unanticipated conditions) versus *ad-hoc* policy review
- Policy adaptability versus policy change or substitution
- Policy rigidity
- Addressing policy side effects from a conceptual perspective
- Linkages between adaptive policies and community-level adaptation

9.3.2 Policy adaptability versus ad hoc policy review

The case studies alerted us to an important, yet subtle difference between the process of formal policy review (for unanticipated conditions) and *ad-hoc* policy review. Under our conceptual framework, a policy is not adaptive if it is simply subject to *ad-hoc* review and adjustment.

In such a situation, no formal mechanism requires that a review take place at certain time intervals, but public or political pressure reaches such a level that something must be done to change the policy. Sometimes, despite considerable pressure, the political interests aligned with status quo policies prevent policy changes for a long time. This was the case with the Crow Rate in which it required at least seven separate commissions and studies over a 20-year period to fully understand and build political commitment for the necessary policy revisions to mitigate the deterioration of the railway system.

In the Indian weather-indexed crop insurance example, the overall policy goal of protecting poor farmers’ incomes through risk reduction was approached through a series of different public insurance schemes, none of which was adaptive in itself. Their modification was not the result of an adaptive policy or policy instrument, but rather the result of an *ad-hoc* and not very systematic process of policy learning, which explored a series of different instruments. The most promising results have come not through public policy towards crop insurance and farmer income protection, but rather in public policy directed at liberalization of the insurance industry. This policy reform cleared the way for greater innovation on the part of private insurers that has yielded some examples of more inherently adaptable insurance schemes such as weather-indexed crop insurance. Finally, in 2005, the public sector Agriculture Insurance Company also introduced weather insurance, modelled on this private sector experience, in 125 locations in 10 states.

Within our current conceptual understanding of adaptive policies, we would describe this situation as ‘*ad-hoc* policy review.’ If part of a policy’s design and implementation includes a systematic effort to test a variety of instruments or approaches prior to implementation, this is an adaptive feature of the policy. If ongoing systematic review and testing is part of policy implementation, this is an even more adaptive feature of the policy design. Aside from this, *ad-hoc* processes of policy review

Table 9.2 Key observations from the policy case study synthesis

Case study	<i>Ability of policy to adapt to anticipated conditions</i>	<i>Ability of policy to adapt to unanticipated conditions</i>
Crow Rate	<i>Mechanistic adjustment:</i> policy redesigned under the WGTA to adjust the rate based on variable transportation costs, grain volume forecasts, and transport distance.	<i>Formal review:</i> policy redesigned under the WGTA to put in place a 4-year costing review and ongoing evaluation of system efficiency by the Grain Transportation Agency.
Manitoba CD programme	<i>Aligned with principles for intervention in complex adaptive systems:</i> relating to surface-water management in the Whitemud CD, district boundaries are aligned with the watershed boundaries and this has helped to integrate drainage decisions across the basin.	<p>Aligned with principles for intervention in complex adaptive systems</p> <ul style="list-style-type: none"> ▪ <i>Abandoned wells, Pembina Valley:</i> because of devolved decision-making power (for example, to encourage potential for self-organization) to the CD level, the CD was able to identify an emerging issue in groundwater pollution and subsequently, was able to leverage resources to cap abandoned wells and reduce potential for pollution. This successful programme was copied by other CDs. ▪ <i>Diverse local initiatives for sustainable resource management:</i> First Nations participation and conservation agreements introduced by various CDs demonstrate self-organizing and responsiveness features well beyond the original intentions of the policy. These were enabled by the devolution of the management authority to the local level and a flexible provincial approach to policy implementation.
Weather-indexed insurance in India	<i>Mechanistic adjustment:</i> the use of rolling means to calculate precipitation thresholds allows for automatic response to unpredictable climate change while maintaining simplicity and transparency.	<i>Formal review:</i> weather insurance was introduced through pilot tests for various crops and locations. ICICI Lombard General Insurance Company and BASIX have reported that this experience was valuable to better understand risk patterns and the potential for commercial expansion. It was also an opportunity to create awareness among farmers, build trust through timely payouts, and improve the product design in response to customer feedback.
Agricultural price policy in Punjab, India	<i>Mechanistic adjustment:</i> the CACP takes into account important factors in announcing the MSP. These factors, which address a range of anticipated conditions, include cost of production, changes in input prices, input/output price parity, trends in market prices, inter-crop price parity, parity between prices paid, and prices received by farmers.	<i>Formal review:</i> the MSPs for major agricultural products are announced each year after taking into account the recommendations of the CACP. The factors considered that address unanticipated conditions include the demand and supply situation, the effect on industrial cost structure, and the effect on cost of living.

CD – Conservation District; CAPC – Commission for Agricultural Costs and Prices; MSP – minimum support price

on the part of the public and policy-makers should not be seen as an adaptive policy process. Any policy is subject to *ad-hoc* review, so if this were a criterion for adaptability, all policies would be adaptive.

It may also be inferred that unless specific monitoring and adjustment procedures are built into policy instruments when they are designed, policies would tend only to change when underlying politics change. For example, in the case of the Crow Rate, the original policy purpose was to support the railroad. This purpose was changed to that of providing support to farmers over time. But when it became clear that the policy had led to a disastrous decline in infrastructure investment that threatened the entire grain transportation system, it became evident that even farmers' interests were not being well-served. And, to the extent that the political power of those grain farmers and provincial governments that supported the Crow Rate declined in federal politics, their views in an environment of insupportable government deficits became marginal anyway.

A policy that is ineffective, administratively complex, and financially costly is very likely to be reviewed and modified (at least, this is what a taxpayer would hope). While learning and modification are elements of adaptation, the *ad-hoc* review of failed policies is not an adaptive policy feature.

9.3.3 Policy adaptability versus policy change or substitution

Another reason why deliberate policy modification is not an adaptive policy feature is that policies are frequently (but not always) changed to meet new political objectives, rather than to deliver the original policy objectives under new external circumstances. Responding to new external conditions is adaptive; responding to new political priorities is more a situation of policy substitution or change than adaptation.

For example, in the case of the Crow Rate, the objectives shifted over time from supporting the railways to supporting farmers to liberalized markets (favouring the railways again). The changes to the policy were an attempt to substitute new policies with new objectives (it is still true that policy designers, even with new objectives, finally learned in the WGTA to include adaptive mechanisms). In the Manitoba CD case, the local objectives of CD activity shifted over time from drainage to conservation to sustainable development and integrated resource management. Comparing these two examples, the Crow Rate policy changed partly because of the changing external conditions (described in the previous section) and partly because its design did not correspond to new social and political values. On the other hand, CDs have been able to accommodate shifting social and political values through adjustments to instruments for policy implementation, and only recently have they begun to push the envelope of what the legislative framework can accommodate.

Policy instruments are designed to achieve political objectives. Changing political objectives clearly create a special kind of external condition to which policies are most likely to respond. We can see in these cases how political objectives have changed or not, and how this has affected the evolution of the policies. In the Canadian cases, policy objectives for the Crow Rate changed substantially over the century of its existence. But without changing provincial policy objectives for CDs, their activities have been able to respond to shifting local social and environmental priorities through decentralization, allowing the instrument to respond to a broader range of local policy interests.

In both the India cases, policy objectives have remained consistent. The MSP policy remains in place despite having outlived its original utility. This is a policy that is difficult to modify substantially, because it remains popular and sensitive. The objectives of crop insurance policy persist in part because, over several decades of attempts, no public programmes have yet come close to achieving them. Only in the past year or two have public programmes based on successful private-sector pilots begun to adopt potentially more effective approaches such as weather-indexed insurance. This change has not been due to inherently adaptive policies, but rather to changes in policy, which have broadened the opportunities for private insurance schemes more generally, and then have copied lessons from their experience with weather-indexed insurance. These changes in policy have been helpful to farmers coping with climatic variability, but they demonstrate only the value of changing insurance policies, not their adaptability.

9.3.4 Policy rigidity

Both the cases of the Crow Rate and India's MSP policies illustrate the difficulty of modifying or removing a subsidy policy once it is entrenched for whatever reason. Both policies persisted long after they ceased to be useful from a policy standpoint. This is a generalized feature, of subsidy policies in particular, which is inherently not adaptive. External conditions change, but once engaged, subsidies or social payments become 'entitlements' and can only be modified at a high political cost, unless their duration is clearly limited from the outset. This is a warning to climate change adaptation policy-making—subsidies become quickly entrenched and difficult to dismantle.

9.3.5 Addressing policy side effects

Another analytical issue from comparison of the case studies was that of how to address the impacts (both intended and unintended) of policies within our current conceptual framework. The cases revealed examples of policies, which, while effective in achieving their original goals, also had impacts that constrained farmers' adapting capacity. The premises of this research project are that the capacity of communities to cope with change is a pre-requisite for sustainability, and all policy impacts are inherently local. Therefore, policies that constrain local capacity to cope with change or otherwise impede sustainable development options, whether by intent or by oversight, are not helpful to the objectives that this study seeks to promote. For our purposes, even if a policy exhibits adaptive features in relation to its original intent, if it has numerous debilitating impacts on local coping capacity it cannot be termed adaptive.

It is important to note that none of these policies have displayed much understanding of their interaction with natural, built, or social environments. Economic factors tend to feature much more heavily in policy-making. In the case of the Crow Rate and the Indian MSP policies, as well as the case of crop insurance, the lack of understanding of the way the policies interacted with biophysical and natural resource factors has been one of the chief concerns of critics. In Punjab, price incentives that did not internalize natural resource costs resulted in cultivators getting locked into environmentally unsustainable practices. Similarly, subsidized crop insurance, coupled with massive relief transfers demanded by the states from the centre, failed to provide the right signals for risk mitigation to insured farmers. The policies simply were not designed to recognize or adjust to their impacts on the natural environment, or the way that farmers used the environment in response to the policy incentives.

In the case of Manitoba CDs, this linkage to natural resource factors has been highlighted through the experience of implementing the policy. As the policy objectives and mechanisms have simply shifted from investment in drainage infrastructure to addressing a broader range of resource sustainability issues, and as initiative has been passed to the rural municipalities, it has become more and more evident that the geographical structure of the CDs (based on political boundaries) is inappropriate to their resource management objectives. Only those CD's whose boundaries more closely match watersheds have been able to deliver on these natural resource management objectives (and, indeed, on the original drainage management objectives).

This example illustrates better how incorporating ecological functionality in policy design, as suggested in complex adaptive systems theory (see Chapter 2, Table 2.1), can help policies aim at resource management and induce sustainability more effectively in a range of anticipated and unanticipated conditions. Another way of framing this is to suggest that policies whose intended or unintended impacts support ecological sustainability are also likely to be adaptive. This is probably because effective local resource management and ecological rehabilitation is an inherently iterative learning process: practitioners' knowledge of complex local systems is invariably limited and informed mostly by experience. This iterative learning about dynamic interactions between ecological and social systems, which underlies sustainable resource management, is the core of adaptation.

9.3.6 Linkages between adaptive policies and community-level coping strategies

It is important to recognize how limited our understanding is of the relationship between policy design and farmers' adaptive capacity. This is illustrated by the experience of the elimination of the Crow

Rate transportation subsidies in Western Canada. Part of the rationale for eliminating the subsidy was that this would lead to diversification of crop production and a reduction in environmentally damaging grain cultivation techniques. Both of these outcomes were intended to help farmers cope with the changing market and climate conditions, but there is no evidence of either taking place. The links between policy provisions and the ability of farmers to cope with change need to be explored further. With increased trade and market liberalization everywhere, the scope for direct policy influence on farmer behaviour is reduced, and the importance of market factors in decision-making proportionately greater.

This phase of research was designed to test a schema of policy features on some real policy cases. The next phase of the project will examine community-level coping behaviours and explore policies that help communities to cope with sudden surprises and longer-term change, as it elaborates on these features of adaptive policies. It will ask whether public policies that facilitate the ability of communities to cope with change have adaptive policy features such as those described in this chapter.

9.4 Conclusions

Research questions

- 1 Do public policies that build the capacity of communities to cope with surprise and longer-term change have adaptive features?
- 2 What adaptive features enable policies to remain effective despite changes in external conditions?

Looking back to these two research questions (presented in Chapter 1), this report focuses on providing an initial answer to the second question. Through a comprehensive literature review (Chapter 2), we were able to propose that adaptive policies have the ability to respond to both anticipated and unanticipated conditions and that there are a number of policy mechanisms and processes that facilitate these abilities.

The four policy case studies in India and Canada tested the utility of this proposition. The synthesis presented in this chapter illustrates that the analytical framework presented in Figure 9.1 is a useful heuristic for the analysis of adaptive policies. We conclude this based on evidence of a number of policy mechanisms and processes identified from the case studies, which facilitate the ability of policies to adapt to anticipated and unanticipated conditions. The analytical framework was also helpful in understanding why the four policy instruments studied had difficulty in successfully performing at various points in their implementation.

One conceptual challenge encountered was in using the analytical framework to classify a particular policy as adaptive or not. This was difficult to do because it required a comprehensive assessment of whether the policy was performing successfully, which, in turn, required a clear articulation of the objective of the policy. Sometimes policy objectives are only loosely framed and fluid over time, and many policies lack rigorous assessment of performance in relation to these objectives even if they are clearly articulated.

Therefore, our conclusion is that while the analytical framework may not be a policy assessment tool in its current form, it is a useful heuristic for identifying specific processes and features that facilitate the ability of policies to successfully perform in a range of anticipated and unanticipated conditions. We propose to build on this working conclusion through community case study research in the second year.

Table 9.3 summarizes the different adaptive policy mechanisms and processes identified in the four policy case studies. It serves as an initial illustration of a toolbox for adaptive policies and policy-making.

Other working conclusions from the research include the following.

- Policy adaptability under anticipated and unanticipated conditions are characteristics that may be applied to a greater or lesser extent to policies that deliver effective outcomes even when conditions change (that is, achieve their intent and do not have negative side effects). The categories of adaptability under 'anticipated' versus 'unanticipated' conditions should not be seen mutually exclusive.

Table 9.3 Approaches and tools for adaptive policies

Approach	Tool/principle	Sector and literature reference	Related examples from case studies
Ability to adapt to anticipated conditions			
Mechanistic adjustment	Signposts and triggers; corrective actions; policy reassessment (see Chapter 2, section 2.2.1)	Transportation sector (Walker, Rahman, and Cave 2001)	Crow Rate (WGTA)
	Scenario analysis and planning (see Chapter 2, section 2.2.1)	Corporate planning (Wilson and Ralston 2006)	
	Policy pilots (see Chapter 2, section 2.2.3)	Various sectors (UK 2003)	Weather-indexed insurance
Complex adaptive systems principles	a. Understand local conditions, strengths and assets	Health (Glouberman, Campsie, Gemar <i>et al.</i> 2003)	Crow Rate (WGTA): d, e
	b. Respect history—‘adaptive systems are shaped by their past and a knowledge of this history may suggest constraints on and opportunities on what can be done in the future.’	Health (Glouberman, Campsie, Gemar <i>et al.</i> 2003; Holling, 1978)	CDs
	c. Understand interactions with the natural, built, and social environment		
	d. Gather multiple perspectives from a range of stakeholders involved in the issue	Ecosystem management (Holling 1978)	
	e. Increase information on unknown or partially unknown social, economic, and environmental effects		
Ability to adapt to unanticipated conditions			
Policy review	Signposts and triggers; defensive actions (see chapter 2, section 2.2.1)	Transportation sector (Walker, Rahman, and Cave 2001)	
	Scheduled review process (such as annual, semi-annual, etc.)	All sectors	Crow Rate (WGTA) Agriculture Price Policy (Minimum Support Price)
	Policy pilots (see chapter 2, section 2.2.3)	Various sectors (UK 2003)	Weather-indexed insurance

Continued

Table 9.3 Approaches and tools ... (Continued)

Approach	Tool/principle	Sector and Literature reference	Related examples from case studies
Complex adaptive systems principles	a. Look for short-term, finer-grained criteria of success that can usually stand in for longer-run broader goals	Internet development – (Axelrod and Cohen 2000)	CDs: b, c, i
	b. Create opportunity for self-organization and build networks of reciprocal interaction that foster trust and cooperation	Various (Berkes, Colding, and Folke 2003); Glouberman, Campsie, Gemar <i>et al.</i> 2003; Axelrod and Cohen 2000; Forester 1999)	Crow Rate: (WGTA) n, q
	c. Clear identification of the appropriate spatial and temporal scale is vital to integrated management	Ecosystem management (Shepherd 2004).	Weather-indexed insurance: n, q
	d. Ensure that social capital remains intact	Forest management (Ruitenbeek and Cartier 2001)	Punjab grain pricing: n, q
	e. Promote effective neighbourhoods of adaptive cooperation	Internet development (Axelrod and Cohen 2000)	
	f. Promote variation and redundancy	Various (Berkes, Colding, and Folke 2003); Glouberman, Campsie, Gemar <i>et al.</i> 2003; Holling 1978)	Manitoba CDs
	g. Use deliberative processes to build mutual awareness and shared knowledge, identify common values, and plan interventions.	Forester 1999	Manitoba CDs
	h. Balance exploitation of existing ideas and strategies and exploration of new ideas	Various (Ruitenbeek and Cartier 2001; Axelrod and Cohen 2000	
	i. Facilitate copying of successes	Internet (Axelrod and Cohen 2000)	
	j. Use social criteria to support the growth and spread of innovations		
	k. Combine experiential and experimental knowledge	Ecosystems (Berkes Colding, and Folke 2003)	
	l. Nurture and enhance social and ecological memory		
	m. Build adaptive capacity		
	n. Place effort on determining significant connections rather than attempting to measure everything	Ecosystems (Holling 1978) Health (Glouberman, Campsie, Gemar <i>et al.</i> 2003)	

Continued

Table 9.3 Approaches and tools ... (Continued)

Approach	Tool/principle	Sector and Literature reference	Related examples from case studies
	o. Monitoring and remedial mechanisms – should not be post <i>ad-hoc</i> additions after implementation	Internet (Axelrod and Cohen 2000)	
	p. Conduct selection - 'In complex adaptive systems possible solutions undergo selection by the system. It is, therefore, important to include 'evaluating performance of potential solutions, and selecting the best candidates for further support and development.'	Health (Glouberman, Campsie, Gemar <i>et al.</i> 2003)	
	q. Assess strategies in light of how consequences spread - look for linkages in unusual places	Internet (Axelrod and Cohen 2000)	
	r. Fine-tune the process	Health (Glouberman, Campsie, Gemar <i>et al.</i> 2003)	
	s. Understand carefully the attribution of credit - 'A common mistake in complex systems is to assign blame or credit to a small part of the system, when in fact the entire system is responsible.'	Internet (Axelrod and Cohen 2000)	

CD – Conservation Districts; WGTA – Western Grain Transportation Act;
MSP – minimum support price

- Public insurance policies can learn from adaptive features of analogous commercial plans.
- Subsidies are very difficult to remove even when maladaptive.
- Policies that undermine adaptive capacity are not of interest to this project (whether adaptive or not).
- There is a distinction between adaptive policy processes, which use mechanistic review/revision versus indeterminate, open-ended learning and review processes. We find the latter to be more adaptive under conditions of uncertainty.
- Policy pilots can be useful adaptive tools for policy design.
- Devolution and matching of administrative and ecological boundaries are features of adaptive policies. This idea can be reframed as: the jurisdiction with decision-making authority and resources should match the geographic scale and ecological unit at which key interventions are needed.
- We have found evidence of copying of policy innovations and learning between different jurisdictions, an indicator of adaptability (CDs and weather insurance).
- *Ad-hoc* policy review and revision does not constitute policy adaptability.
- Changes in policy objectives do not relate to adaptive policies, but rather, constitute policy change.
- The ability to adapt to anticipated as well as unanticipated conditions are both important characteristics of how policies respond to change and both are needed to create optimal policy adaptation.
- Policies aimed at improving natural resources management ought to adopt ecosystem-based management principles to be more adaptive.

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Climate change introduces huge unknowns for policy-making. A key challenge to mainstreaming climate adaptation is developing policies that are robust to this highly uncertain future. In this Phase I Research Report, the International Institute for Sustainable Development and The Energy and Resources Institute analyse existing and past policies in the water and agricultural sectors to better understand the features that make policies adaptive to changes in underlying conditions. The study found that 'no-regrets' policies and automatic adjustment based on triggers and actions improve adaptability to anticipated conditions. Principles for intervening in complex systems yield many insights for improving policy adaptation to unanticipated conditions, as do structured learning processes such as scheduled policy review and re-adjustment.

Project website http://www.iisd.org/climate/canada/adaptive_policy.asp