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DISSERTATION

**IDENTIFICATION OF CRITICAL ORGANIZATIONAL DESIGN PRINCIPLES IN
A COMMON PROPERTY RESOURCE REGIME TO ENHANCE ENDANGERED
SPECIES HABITAT ALONG THE PLATTE RIVER**

Submitted by

Mark Reed Peterson

Department of Natural Resource Recreation and Tourism

In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Spring 2000

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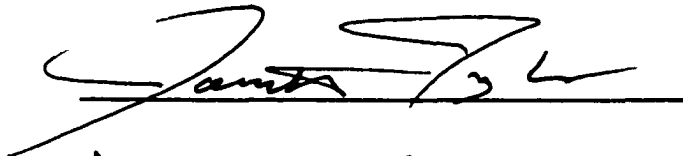
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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR
SUPERVISION BY MARK REED PETERSON ENTITLED IDENTIFICATION OF CRITICAL
ORGANIZTIONAL DESIGN PRINCIPLES IN A COMMON PROPERTY RESOURCE REGIME
TO ENHANCE ENDANGERED SPECIES HABITAT ALONG THE PLATTE RIVER BE
ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF
PHILOSOPHY.

Committee on Graduate Work



Advisor



Department Head

ABSTRACT OF DISSERTATION

IDENTIFICATION OF CRITICAL ORGANIZATIONAL DESIGN PRINCIPLES IN A COMMON PROPERTY RESOURCE REGIME TO ENHANCE ENDANGERED SPECIES HABITAT ALONG THE PLATTE RIVER

This study examined organizational design characteristics present in a newly created institution constructed to enhance wildlife habitat for endangered species in the Big Bend reach of the Platte River in central Nebraska through the re-regulation of river water.

The conceptual foundation for this research was built upon an understanding of the five types of goods available for use by societies and how organizations craft “resource regimes” to obtain the benefits of these different categories of goods. Regimes are a social construct consisting of a tapestry of rights, rules, and responsibilities that vary from regime to regime that define access and use. Understanding these regimes is important as regimes guide human behavior and use of the environment. Successful regime designs, the literature suggests, tend to appropriate goods in a manner that is more equitable, efficient and sustainable than regimes lacking these designs.

The theoretical lens used in this investigation was drawn from case studies of successful, small-scale common property resource regimes. From these studies, researchers have posited specific institutional characteristics, known as design principles, to account for regime success.

This investigation studies a newly created, large-scale common property resource regime designed to re-regulate Platte River water to improve riparian habitat for downstream endangered species. The study hypothesized that seven design principles would be present in this new regime. The hypothesis was supported. In addition, the study also identified four additional design principles critically important to the success of this regime, hypothesizing their importance

to other large-scale, common property resource regimes. The study organizes all the design characteristics into a hypothesized framework for future testing.

It is also suggested that the presence of social capital will contribute to future success. The study examines social capital and documents its presence in this new regime. It found greater familiarity and consulting taking place among the organizations today than when negotiations began in 1994. In addition, there was relatively low polarization among the regime's organizations that will enhance the regime's chances of viability in the years ahead.

Mark Reed Peterson
Department of Natural Resource
Recreation and Tourism
Colorado State University
Fort Collins, CO 80523
Spring 2000

ACKNOWLEDGMENTS

Although words fall so short in matters of the heart, they are the only tool I have available here in which to express my gratitude. Therefore, let these words ring in true sincerity and deep appreciation.

I wish to thank Dr. David Freeman for giving the valuable gift of his time in generous proportions, and the encouragement, ideas and ideals he conveyed along the way. He greatly broadened my horizons about a sociology of social development and justice. Dr. George Wallace helped guide me through the path of this program over an eight-year period. His dedicated efforts to protect lands around the globe for the many values they provide, continues to enlighten and enrich me. Dr. Glenn Haas introduced me to this program, providing me from early on much of the conceptual underpinnings of natural resource recreation, and continues giving me invaluable encouragement and useful perspectives in my professional work. Dr. Jonathan Taylor of the U.S. Fish and Wildlife Service, also served as an important member of this committee, providing a keen eye for detail and insights to the social dynamics in natural resources. The spirit of each committee member will go with me; a spirit that believes in people, committed to social development and resource stewardship.

I also wish to thank those participants in this study. They each provided unique insights, knowledge and interest in this project. With the many dedicated, professional that are involved in the Platte River stewardship, I cannot help but be optimistic about the river and all living beings that depend upon it.

Finally, my deepest gratitude goes to Erica, my wife, who sacrificed time and time again to make this project a reality. Her steadfast support, encouragement, interest and love is the greatest gift of all.

DEDICATION

This work is dedicated to my family – Erica, Cassia, and Chad – who have given me great happiness.

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CHAPTER I

INTRODUCTION

The integrated and interdependent nature of the new challenges and issues contrasts sharply with the nature of institutions that exist today. These institutions tend to be independent, fragmented and working to relatively narrow mandates with closed decision processes.... The real world of interlocked economic and ecological systems will not change; the policies and institutions concerned must.

– World Commission on Environment & Development (1987, p. 310)

A hypothesis-generating case study, supplemented by sociometric analysis, was undertaken to pursue four objectives. These objectives are: 1) to examine and critique theories which assert particular organizational design characteristics will be present when organizations with different goals work together to accomplish a task collectively that cannot be achieved individually, 2) to build upon existing theories of collective action by developing hypotheses for future inquiry, 3) to determine whether social capital was produced in the process of creating a new organization, and 4) to make policy recommendations for the design of institutions seeking to appropriate certain natural resources in a sustainable manner.

To achieve these objectives, this project studied the inter-organizational design characteristics among Platte River water users that contributed to the successful development of an interdisciplinary, multi-agency approach to preserve water-dependent endangered species along that river system. The Platte River System is a classic “common property resource” situation necessitating collective action, rather than individual action, among a variety of interests for its sustainable management.

As the 20th century comes to a close, news stories call our attention daily to the conflicts surrounding demand for all kinds of natural resources among competing interests. This debate over allocation of scarce resources is particularly vigorous for a class of resources known as

"common property resources" (CPRs) which include fisheries, forests, range, water, wilderness and wildlife. These are often simply referred to as the "commons". CPRs are those which cannot be provided by the private marketplace and require collective action (i.e., cooperation among various interests) for sustainable production and allocation.

Collective action is concerned with the formation of groups and their behavior in allocating assets to collective goods in order to provide benefits to a clearly defined set of individuals (Sandler, 1992, p. 193). Collective efforts may fail to form, or, if formed, may not achieve the desired result. While ideally groups may pursue the collective well-being, the pursuit of private gains by some participants can lead to outcomes that bring disaster for collective benefits.

A challenge for the commons is that individual rationality often supercedes collective rationality to the detriment of the resource. For example, people may overexploit a forest because they believe that their self-restraint for the long-term good (i.e., collective rationality) would simply allow others to take more to maximize the benefits they receive (i.e., individual rationality). The result was popularly described by Hardin in his "Tragedy of the Commons" (Hardin, 1968).

Thus the nature of the commons makes them vulnerable to degradation. Indeed, history has repeatedly demonstrated the difficulty societies have had in controlling access to a commons and sustainably exploiting the resource through collective action (Ascher, 1995, p. 3-9; Arnold, 1998; Ciriacy-Wantrup and Bishop, 1975; Fairlie, Hagler, & O'Riordan, 1995; Matsumura, 1994; Ostrom, 1990, p. 143-181; Weber, 1994).

When addressing sustainable resource use today, science has been increasingly successful in understanding the natural systems supporting these resources. This knowledge assists in quantifying sustainable harvest levels of the resource. However, there has been considerably less attention paid to the collective action arrangements among institutions, often with conflicting agendas. These institutions manage CPRs by providing the norms and rules that shape how people use the environment and their behavior toward each other (Hanna, Folke and Maler, 1996). Thus, depending upon the particulars of these arrangements, they can produce

sustainable outputs for the resource, acceptable outcomes as viewed by people involved, and build social capital, or they can result in resource degradation and alienation.

Without properly designed institutional mechanisms, issues surrounding the management of the commons have recently led to increased polarization among competing resource user groups and elevated politicizing natural resource decisions, often triggering lawsuits, administrative appeals, gridlock, or officially sanctioned de jure arrangements not operating as prescribed (Wondolleck, 1988).

Management of CPRs in the United States has suffered because institutions were not designed for the interdisciplinary, multi-valued and ecologically complex nature of natural resource management today. Their design dates back to an era when they had a narrow, single-focus mission and narrow constituencies. Largely as a result, resource policy in the U.S. is dominated by institutions that are fragmented, oriented to the short-term, reactive, conservative and status quo seeking. Such institutions are not particularly creative or good at seeking and dealing honestly with information and involving a diverse set of interests needed to take collective action (Grumbine, 1997; Knight and Bates, 1995; Yaffee, 1997, 1994).

Contributing to institutional ineffectiveness is the "conservation paradigm" incorporated into institutional decision-making. Since the birth of modern natural resource management at the turn of this century, natural resource decision-making has been largely driven by three important postulates regarding: 1) the type of information that is required to make decisions, 2) the values which should prevail, and 3) those who make the decisions (Peterson and Manfredi, 1993). Basic assumptions about the appropriate answers to these questions formed a paradigm for the profession. This agency-driven conservation paradigm has dominated natural resource management in this century throughout the world.

Principally, when an important natural resource decision was required, the paradigm led natural resource institutions to: 1) employ nomothetic knowledge (i.e., generalized, scientific principles) disconnected from idiographic knowledge (i.e., localized, site-specific information), 2) give preference to economic values at the expense of non-economic values, 3) use a governmental regulation "top-down" approach rather than empowering local groups to use self-

governing approaches, in developing a course of action (Hays, 1959; Pinchot, 1947; Rosenbaum, 1991).

Today this institutional paradigm and accompanying institutional designs have proved increasingly ineffective in developing viable solutions to resource problems. In short, these institutions are doing little to promote collective rationality over individual rationality among stakeholders involved in the difficult natural resource issues of our time.

A central thesis of this project is that people, in situations involving common property natural resources, can organize themselves collectively to obtain enduring benefits from these resources that they could not obtain individually or as satisfactorily when compared to either reliance on market or government-engineered solutions. The "tragedy of the commons" can be avoided. This paper hypothesizes that this organization for a collective action approach is most successful when particular institutional design characteristics are adopted. A case study employs an analytical framework to investigate the presence or absence of these organizational characteristics in a common property/collective action resource problem in which participants with competing agendas agreed on a management solution to enhance wildlife habitat.

Theoretical Framework

Over a span of roughly the past two decades, scientists from such disciplines as anthropology, sociology, agricultural economics and political science have begun to investigate CPRs through diverse case studies in natural settings. Their findings have provided rich material from which to analyze CPR management and the institutional arrangements and collective action mechanisms involved.

More recently, learning from these empirical studies, scientists have posited simple analytical frameworks for comparative research to further enhance understanding of the possibilities and pitfalls for individuals to manage commons collectively (Freeman, 1989; Oakerson, 1992; Ostrom, 1990). Analytical frameworks on institutional design from a plethora of case studies on long-enduring, environmentally-sustainable commons have attempted to elucidate the strategic design principles used by these successful organizations (Freeman, 1989;

McCay and Acheson, 1987; Oakerson, 1992; Ostrom, 1990; Tang, 1992.). Several "core" design principles have been identified and some, but limited, empirical work has been undertaken to explore these principles.

By "design principle" is meant a characteristic that helps to account for the success of organizations in sustaining necessary physical works and ecosystem integrity while gaining the compliance of generations of users to the rules in use (Ostrom, 1993). These principles include: 1) clearly defined boundaries, 2) collective-choice arrangements involving a distributional share system, 3) monitoring, 4) graduated sanctions, 5) conflict resolution mechanisms, 6) recognition of rights to organize, 7) nested organizational structure, 8) large degree of local involvement and control subject to standards and review by central agency authority (Freeman, 1989, Ostrom, 1990).

These theorists of CPR problems advance the hypothesis that organizational designs that incorporate these principles into management of the commons can accomplish several critical tasks more effectively than either the individual resource user or central agencies. First, optimal organizational designs can reconcile and synthesize local knowledge of the natural resource with the non-local knowledge supplied by resource professionals and universities, resulting in more efficient use of the resource. Second, optimal designs can reconcile the resource supply with the competing demands for its use, resulting in greater consensus. Third, this reconciliation can be done in a manner that empowers local people, collectively, to police any agreements, lifting that burden from what is usually a single, distant agency representative, resulting in greater compliance.

Study Problem and Purpose

For more than a century, water from the Platte River System has been appropriated for agriculture, industry and urban development along its course spanning Colorado, Wyoming and Nebraska. As a result, both peak and mean annual discharges of the river have been altered significantly over the years (Johnson, 1994; U.S. Fish and Wildlife Service, 1997; Williams, 1978). Correspondingly, the riparian habitat created by the water flows has changed greatly in Nebraska,

much to the detriment of some wildlife species, such as the whooping crane, least tern, piping plover and pallid sturgeon, that require habitats provided by the former river flow regime.

While water is one of the most critical habitat requirements for fish and wildlife (Henning & Mangun, 1989; Leopold, 1933), western water law and policy has not historically recognized fish and wildlife values in allocating and developing water (Wilkinson, 1989). Consequently, fish and wildlife survival have been threatened by the diversion of water for other uses.

Long after the river's waters were fully appropriated, the U.S. Fish and Wildlife (USFWS) declared the whooping crane, least tern and pallid sturgeon "endangered species" and the piping plover was declared "threatened" under the Endangered Species Act. In addition, a 56-mile segment of the Platte River riparian corridor in Nebraska was designated "critical habitat" for the whooping crane.

Under this Act, federal agencies must examine the potential impacts of their actions on threatened and endangered species and their habitats. They are also required to develop mitigation plans to offset any negative impacts their actions may cause.

In 1994, the USFWS concluded that the U.S. Forest Service's re-authorization of six special use permits granting municipal and agricultural users on Colorado's front range the continued right to divert water from the Platte River drainage basin on National Forest lands was likely to jeopardize the continued existence of these species and adversely modify the critical habitat of the whooping crane. Similar concerns were preventing Nebraska's Kingsley Dam from being re-licensed.

Realizing the numerous future federal actions that would occur along the river and could negatively impact these species, and knowing that the USFWS could impose costly mitigation plans on them if they did not develop a plan to benefit these species, the states of Colorado, Wyoming and Nebraska, and the Department of the Interior entered into an agreement in 1994 to collectively attempt crafting a Platte River Recovery Program.

After three years of arduous multi-party negotiations that often bordered on the brink of collapse, a collective plan of action was agreed to in 1997. The agreement is the first step in the

development of a Platte River basin-wide recovery program to benefit these four species and their habitats.

The main objective of this project is to examine the elements that contributed to this successful agreement among competing interests representing local, state, and federal agencies, and the private sector. Using recently formulated analytical frameworks of institutional design for common pool resource management, and a descriptive case study approach, this project will attempt to identify the critical elements that contributed to the success achieved here among competing water interests. It will then: 1) hold what happened up to scrutiny to determine the degree to which the hypothesized design principles were present; and 2) critique CPR theory and advance research questions rooted in these experiences and events for future testing.

Research Method

The following sequence of steps were performed for this field case study:

1. Identify the participants who were actively involved in the process to develop the Platte River Recovery Plan by means of a purposive sampling design;
2. Interview each, using intensive oral interviews and written sociometric instruments, for their perspectives on: a) the sequence of events leading to the agreement with attention to the positions of the several actors; b) what institutional design principles were adopted to protect endangered species in the area of concern; c) river management alternatives; d) whether the negotiation process created social capital among participants through the development of four important variables; and,
3. From the information provided, develop hypotheses for future testing regarding the importance of the design principles identified and determine whether social capital was created.

Significance

We live in an age with telltale signs of severe ecological disruptions all about us and many respected scientists warn us that our use of natural resources today is not sustainable. But

the greatest challenges of conservation may not lie in a greater understanding of the natural sciences, but of the social, economic, and political sciences. The United Nations World Commission on Environment and Development (1987) wrote that human activities on the planet are causing:

...major unintended changes are occurring in the atmosphere, in soils, in waters, among plants and animals, and in the relationships among all of these. The rate of change is outstripping the ability of scientific disciplines and our current capabilities to assess and advise. It is frustrating the attempts of political and economic institutions, which evolved in a different, more fragmented world, to adapt and cope. It deeply worries many people who are seeking ways to place those concerns on the political agenda.

While identification of the problems and consequences are apparent to many, the search for institutional solutions has been, by comparison, largely neglected. This regrettable circumstance is particularly true in the study of the commons which, up until the National Research Council convened the "Common Property Resource Management Conference" in 1985 "to systematically assess differing institutional arrangements for the effective conservation and utilization of jointly managed properties" (National Research Council, 1986, p. vii), scant attention had been paid to these institutions.

There is a recognized need for institutional examination of common property resources. This study will make four specific contributions toward that end. First, after years of high-level discussions and lawsuits regarding water flows for endangered species living along the Platte River in Nebraska, this study will examine a different approach towards solving the collective action dilemma surrounding this issue. What were the collective action decisions involved? Who was involved in helping to craft these decisions and what individual rationality did they possess? What were the events that led to the agreement?

Second, this study will add to the evolving theory of common property resource management. Evidence gathered will address the research question -- i.e., to what degree did theorized organizational design principles have in achieving an agreement which would provide more water to endangered species in Nebraska? What additional factors (if any) were important? Hypotheses will be generated from this study to help direct future theoretical research in this field.

Third, such knowledge has direct, practical implications for natural resource management and policy by investigating an alternative to both "privatization" and bureaucratic management. Such an alternative, based on community empowerment could be expected to craft new institutional designs of self-governance. Indeed, one authority has stated this importance to one area of resource management: "For the next several decades, the most important question related to water resource development is that of institutional design rather than engineering design" (Ostrom, 1993, p. 1907). Similar statements could be made for other areas of natural resource management.

The application of such knowledge can be specifically appreciated in the field of recreation and tourism. For example, in many countries national parks, wildlife reserves, and other types of protected areas are being managed as strict preserves. These efforts have largely followed the Yellowstone National Park model (Foster, 1992). The model prescribes the ideal national park as a wilderness preserve that is not inhabited on a permanent basis. It implies rather strict preservation, with no harvesting or gathering allowed and, up until recently, all wild fires extinguished. This view of parks has become embodied in international criteria which declares that parks are only national parks when the management authority, "...has taken steps to prevent or eliminate as soon as possible exploitation or occupation of the area..." (MacKinnon, MacKinnon, Child, and Thorsell, 1986).

However, many of these areas are in crisis. Under-funded, they are under increasing pressure from local people who look to these resources for sustenance. In response, emphasis is being given to integrated conservation-development projects (Wells and Brandon, 1992). This approach strives to blend land protection in ways that can also satisfy local peoples' social and economic needs. The crafting of common property institutions in some situations may be very appropriate for this reconciliation of resource protection and use.

A better understanding of the commons, to which this study will contribute, will allow governments, environmental organizations and international lending agencies such as the World Bank, to support effective common property organizations, diagnose problems with those operating marginally and prescribe design remedies.

At the local governmental level, new types of common property resources in the form of rural clustering, shared open space, and agricultural land protection districts are becoming more prevalent. These fledgling efforts can benefit from an analysis of organizational design principles.

And finally, in an era when some scholars believe social capital and civic engagement in our society is eroding (Kemmis, 1990; Coleman, 1993; Putnam, 1995, 1996), a better understanding of common property arrangements has the potential to re-build social capital in specific, localized situations through public involvement, local organizational building and collective decision-making.

In an address to the American Sociological Association, Coleman pointed out the challenge:

We fail to recognize that the social capital on which primordial social organization depends is vanishing; we fail to recognize that societies of the future will be constructed, and that we should direct our attention to designing those social structures (Coleman, 1993, p. 10).

Studies such as this will help with the practical design work of entirely new institutions that incorporate society's concerns for participatory decisionmaking, environmental sustainability and economic development and, in doing so, create social capital.

CHAPTER II

REVIEW OF LITERATURE

Your corn is ripe today; mine will be so tomorrow. 'Tis profitable for us both, that I should labour with you today, and that you should aid me tomorrow. I have no kindness for you, and know you have as little for me. I will not, therefore, take any pains upon your account; and should I labour with you upon my own account, in expectation of a return, I know I should be disappointed, and that I should in vain depend upon your gratitude. Here then I leave you to labour alone; You treat me in the same manner. The seasons change; and both of us lose our harvests for want of mutual confidence and security.

—David Hume (1740, p. 590)

To understand the theoretical foundations for this study, this chapter first identifies a typology of goods, providing definitions for each. It then explains, with examples, how societies organize themselves into "resource regimes" to obtain the benefits of these goods, describing property as a social construct and the physical attributes of these goods that limit or expand management options. This chapter concludes by describing the organizational design principles that, when adopted by institutions involved with common property goods, are hypothesized to assist in more effective and efficient allocation of the resource among the stakeholders in that particular resource regime.

A Typology of Goods

The idea of a "good" has come to the social sciences from its original principal use in economics. A good is anything valued, positively or negatively, whether tangible or intangible (Blomquist, 1987). Thus we can conceive of goods as products, services, conditions, benefits, etc.

All goods are not alike. From the classical economic perspective, goods may be classified into five basic types, depending upon the combination of two key variables (Cornes and

Sandler, 1986, pp. 6-7). One variable describes the inherent nature of the good. The other variable characterizes society's ability to exclude this good from all that desire it, as will be described below.

This understanding is important to natural resource management since the type of good strongly influences the management options available for organizing people to overcome inherent obstacles in order to provide the benefits of these goods to society. These five types of goods are identified and described below. They are also graphically summarized in Figure 1. It is

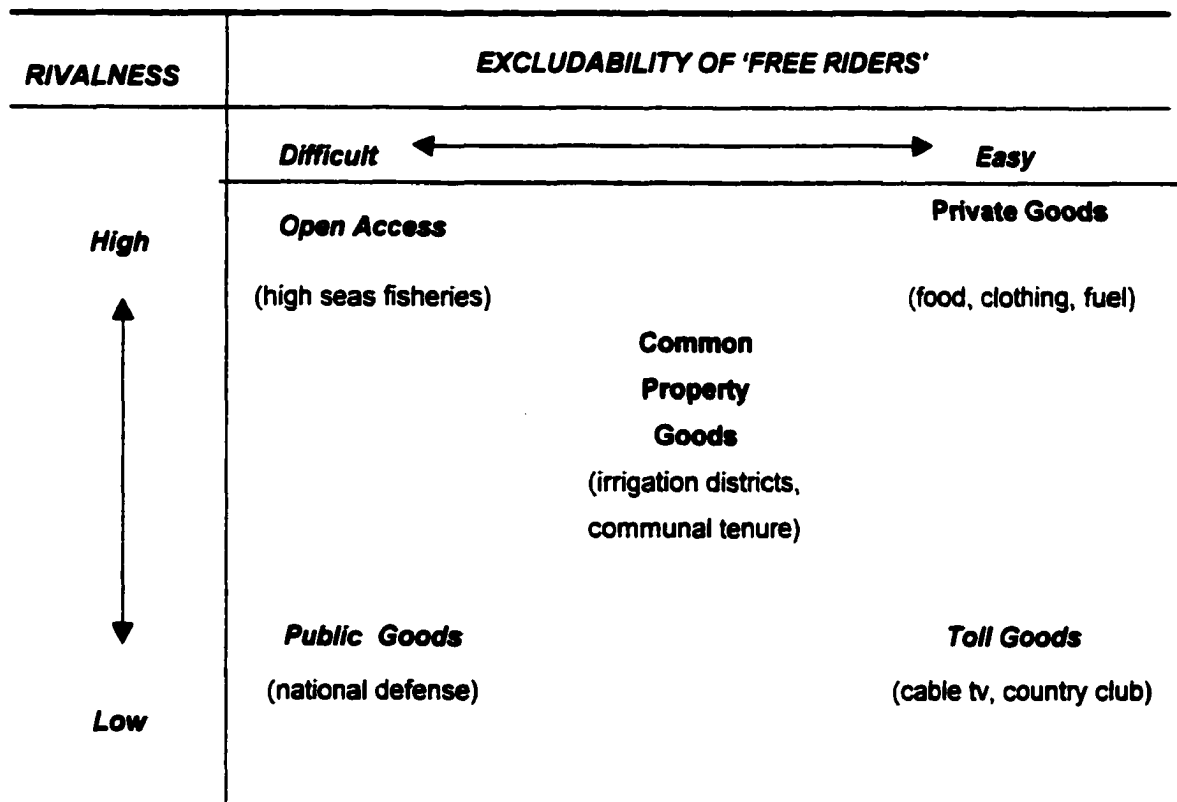


Figure 1

Typology and Attributes of Goods

worth noting that natural resources could come from any of these goods as a natural resource only refers to something that has value when extracted from its natural state (Black, 1990).

Private Goods

Society is very familiar with the first type of good, private goods. These are those goods that are, in the diction of economists, rival and excludable. The first characteristic, rivalness,

refers to those goods that, when consumed, deny others of their use. Some economists refer to this concept as the principle of subtractability. (Miller, 1985, p. 107). It simply means that with this type of good, one's use of it makes it unavailable to others. If I buy and eat an apple, for example, that is one less apple available for consumption by others.

The second characteristic of private goods is that the access to these goods by others can be relatively easily controlled. This quality is called excludability. In manufactured goods, for example, the manufacturer can control who receives the good by a number of different strategies, including pricing. Other examples of private goods include intellectual goods, housing and food.

Because of these two qualities, the benefits of the private good are captured by the buyer/investor who supplies the good and controls access to the resource by excluding all others. Private gains of both parties are enough to induce significant private action to produce and market a private good.

Public Goods

Public goods, in contrast to private goods, have opposite qualities. A public good is one "that has a significant benefit that cannot be denied to those who do not help bear the costs – 'free riders'" (Freeman, 1992, p. 72). Their two defining qualities are, first, they are considered non-rival – one person's use of that good does not reduce another's consumption (Stokey and Zeckhauser, 1978, p. 305-308). National weather forecasts are one example. One citizen's use of this information will not diminish the quantity available for others. Other examples include nuclear deterrents, pollution-control devices, disease-eradication programs, crisis-warning monitors, and information dissemination networks.

The second quality of public goods is that they are non-excludable. The physical nature of these goods is such that controlling access by potential users may be costly or in the extreme, virtually impossible (Feeney, Berkes, McCay, and Acheson, 1990). It is very difficult or expensive to deny access to some while granting it to others. Or, put another way, non-excludability is present when a good consumed by one person can be consumed by another person at no significant additional cost (Freeman, 1992, p. 72). Common examples are lighthouses, national

defense, flood control projects, wilderness areas, traffic regulation, clean air and weather forecasts (Freeman, 1992, p. 73; Vogler, 1995, p. 5).

Because of these two qualities of public goods, the potential investor can capture no greater proportion of the benefits than the non-investor, thus there is no incentive for someone to provide it, as they simply can't capture control of it. In contrast to private goods, the individual gets such a small share of the total benefit from public goods that it is likely that no one will be inclined to purchase the goods on their own (Stokey and Zeckhauser, 1978, p. 305). Thus, in the absence of the private marketplace to provide these goods, they are characteristically provided by government.

Common Property Goods

The third type of good, and the focus of this study, are common property goods. These goods may be relatively small (such as the parking lot for an apartment complex) or very large (such as the high seas).

Goods in this category are characterized by having a high degree of non-excludability and rivalness (Gardner, Ostrom, and Walker, 1990, p. 336). That is, first, it is costly (but not impossible) to exclude potential beneficiaries from gaining access to the resource. Migratory or fugitive resources such as fish and wildlife pose these difficulties, as does groundwater, range and forest lands, and global commons such as the high seas, the atmosphere and the geosynchronous orbit (Berkes, et al., 1989, p. 91).

Secondly, each person's use reduces resource units from those available to others (i.e., rivalness). Thus they share the first attribute with public goods; the second attribute with private goods.

Toll Goods

Toll goods, sometimes referred to as "club goods" are those displaying qualities of excludability and non-rivalness (Tang, 1992). Benefits of these goods are shared simultaneously by more than one individual through a private sector allocation provided by a group or club by some exclusion mechanism, installed at a reasonable cost (Comes and Sandler, 1986, p. 3). Exclusion mechanisms might consist of a toll booth, a guard, a fence, or a ticket office; only those

people who pay the required fee or toll can pass through the exclusion device and reap the benefits of the good. Toll highways and bridges, cable television, in-flight airplane movies (where a fee is assessed for those passengers desiring headphones), country clubs, the internet service, and neighborhood swimming pools charging for membership are all examples of this type of good.

Open Access Goods

The two qualities of open access goods are opposite those of toll goods. With these goods, access is unregulated and is free and open to everyone (i.e., non-excludable). Yet, there is also "rivalry" between consumers since one person's use of this good diminishes its availability for all others (Vogler, 1995, p. 3).

This regime is characterized by its absence of well-defined property rights (Feeney, et al., 1990). Examples include many high-seas fisheries and the global atmosphere. Open access works satisfactorily only when there is little impetus to manage the resource at all, usually when demand is too low to make the effort worthwhile (McKean and Ostrom, 1995).

Societies largely concern themselves with the quest to capture the benefits of these goods, be they public, private, common property, or toll goods. Thus a provision problem must be confronted: how do people organize themselves to extract the potential benefits these goods can provide? To understand how these goods may shape the way in which we organize to obtain their benefits, the second step of this analysis involves a clear understanding of the concept of property and property rights regimes.

The Concept of Property

The Social Nature of Property: Resource Regimes

It is first critical to recognize that the concept of "property", and thus natural resource use and the maintenance of environmental quality, exist in the sphere of social institutions. Property as a social institution differs from other social institutions – such as familial, political, and religious – because in addition to the relations between the individuals involved, there are always relations of some kind to object from a range of various categories (Hallowell, 1943). Hoebel (1964, p. 58)

writes: "There are two essential aspects of property: 1) the object, 2) the web of social relations which establishes a limiting and defined relationship between persons and an object."

From the social psychological perspective, property (the object) stimulates behavior on the part of the nonowner and owner. "The roles," Hoebel continues, "of the property holder and nonholder of the same object of property are culturally determined."

The classic definition of property is offered by Cairns (1935, p. 59): "The property relation is triadic: 'A owns B against C,' where C represents all other individuals." To interpret this in more personal terms, I do not own an object in a practical sense unless society recognizes that I own it and provides me a claim upon it.

This concept becomes clear when one thinks about property as "a claim to a benefit (or income) stream," and a property right as "a claim to a benefit stream that some higher body — usually the state — will agree to protect through the assignment of duty to others who may covet, or somehow interfere with, the benefit stream" (Bromley, 1992, p. 4).

Society constructs various kinds of institutions to manage property rights. As Hollowell (1942, p. 138) writes in a seminal article about property as a social institution:

For human society, by definition, implies the existence of ordered relations and ordered relations mean that individuals [sic] do enjoy the security of sanctioned rights and obligations of various kinds. Among them we inevitably find socially recognized and sanctioned interests in valuable objects. The fact that in all human societies individuals are secured against the necessity of being constantly on the alert to defend such objects from others by physical force alone is one of the prime contributions of the institution of property to a human social order and the security of the individual.

Institutions are defined as:

sets of working rules that are used to determine who is eligible to make decisions in some arena, what actions are allowed or constrained, what aggregation rules will be used, what procedures must be followed, what information must or must not be provided, and what payoffs will be assigned to individuals dependent on their actions." (Ostrom, 1986, p. 4).

Arising from these definitions are four important pre-requisites to consider when analyzing arrangements for natural resource management. The first is a "right" defined as "anything to which an actor is entitled by virtue of occupying a recognized role" (Young, 1982, p.

20). Thus we see private property rights, for example, or common property rights (to air, space or deep-sea minerals). Rights often specify opportunities to receive tangible benefits (e.g., natural resources) or intangible benefits (e.g., the right to participate in making collective decisions).

The property right to a resource is not a single right but rather a bundle of rights the composition of which varies among institutions. Schlager and Ostrom (1992) identify key property rights:

- Access: the right to enter a defined physical property;
- Withdrawal: the right to obtain the benefits of a resource;
- Management: the rights given users to regulate use patterns;
- Exclusion: the right to determine who will have access to the resource;
- Alienation: the rights for individuals to sell, transfer, or lease the above rights.

Each right in this bundle can be conceived of ranging from limited, short term rights to extensive, long-term rights to the benefit streams identified above.

The second pre-requisite to consider when analyzing regimes is, if rights are recognized, the necessary rules to guide the observance of those rights. Rules are:

"well-defined guides to action or standards setting forth actions that members are expected to perform (or to refrain from performing) under appropriate circumstances. Any given rule exhibits the following features: an indication of the relevant subject group, a behavioral prescription, and a specification of the circumstances under which the rule is operative" (Young, 1982, p. 25).

Thus rules can be treaties, laws, regulations or customs.

Third, given that issues surrounding the establishment and maintenance of rights and rules will not always be seen by all actors in exactly the same manner, a procedural mechanism is needed to reconcile differences. Young states a social choice mechanism is required, "whenever it is necessary or desirable to aggregate the (non-identical) preferences of two or more individual actors into a group choice" (Young, 1989, p. 18). These issues arise when claims conflict or scarce resources need to be allocated. Young writes that these mechanisms range widely from the "first-come, first-served" principle to markets, voting, bargaining, administrative pronouncement, coercion and organized violence.

Finally, every regime must have some compliance mechanism to minimize any tendency of participants to violate regime rules. Governmental agencies come quickly to mind for this task,

but less formal mechanisms (social pressure, enforcement by members of the regime) are not uncommon (Young, 1982, p. 39).

Taken together, these four elements – rights, rules, social choice and compliance mechanisms – comprise a conceptual framework Young labels a "resource regime" (Young, 1982, pp. 15-16). Regimes are "social institutions composed of agreed-upon principles, norms, rules, and decision-making procedures that govern the interactions of actors in specific issues areas" (Osherenko and Young, 1993, p. 1). Resource regimes are a special case of these institutions that function to order human behavior in the use of natural resources. Organizations, which are often confused with institutions, then become entities that occur in accordance to an institutional structure (Bromley, 1986, p. 597).

Thus, as we think of property we must think of it not in terms of an object (such as land, wildlife, water, minerals) but as a regime, a relationship between the property holder, other resource users and the relationship of the users to the resource. Because of the resource value to society, society has constructed rules, rights and social choice mechanisms, designed to secure property benefit streams.

Regimes are changeable human creations and many resources can be managed under different regimes. Forests, for example, could be managed as private or public property, or perhaps there is no claim on them and they are not managed by any entity. In the case of salmon, its property status depends upon where it is caught. Caught in a stream surrounded by private lands it is private property, in the high seas it is no one's property (until caught) and in an inshore communally managed fishery it is a common property resource (Vogler, 1995, p. 3).

Therefore, resource regimes are critical institutions as a force in natural resource management. As Hanna, Folke, and Maler (1996, p. 9) write, "They link society to nature and have the potential to coordinate human and natural systems in a complementary way for both ecological and human long-term objectives". The way institutions are designed directly influences the way people relate to each other and to the natural resource, often determining whether a resource is maintained or degraded.

In the development of those social relations, the physical attributes of goods (rivalness and excludability) narrow the options society has available in creating a regime for a given natural resource. The regime type would dictate certain assumptions regarding the rights, rules and social choice and compliance mechanisms that would be employed.

With this insight, several basic property regimes may be identified for natural resources, each consisting of a constellation of rights and duties, privileges and risks (Berkes, Feeny, McCay and Acheson, 1989, p. 91; Bromley, 1986, pp. 597-598). These regimes address the management of goods ranging from open access through centralized state management.

Regime types include: 1) *Open access regimes* are the absence of well-defined property rights. Access is free and open to all. 2) *Private property regimes* are those in which an individual or corporation has the right to exclude others from using the resource and to regulate its use in the marketplace. 3) *State governance regimes* are those situations where the rights to the resource are held exclusively by government that is empowered to manage the resource. State governance creates several situations identified in Figure 2 – it decides what is on the market. 4) The *common property regime* is a set of institutional arrangements whereby the resource benefits accrue to an identifiable community of users who can exclude others and regulate the resource use (see Table 1). It is the institution that turns a common property resource into a common property regime.

Empirical research has shown that the institutional arrangements associated with common property resource regimes are as diverse as the social, cultural and ecological contexts in which they are found (Edwards and Steins, 1996). However, the management practices often share certain characteristics. As one observer writes, "These practices emphasize respect, responsibility and stewardship and are highly participatory" (Jacobs, 1989, p. vii). Throughout our history, natural resource management in the United States has utilized all four of these regime types, each with different assumptions and consequences.

These assumptions, and the consequent advantages and disadvantages of each regime type, will be explained in the following section. The application of each regime in U.S.

conservation history will be briefly explored. As we shall see, one regime type has come to dominate resource management in the twentieth century.

Table 1

Types of Property-Rights Regimes with Owners, Rights, and Duties

REGIME TYPE	OWNER	OWNER RIGHTS	OWNER DUTIES
Private Property	Individual	Socially acceptable uses, control of access	Avoidance of socially unacceptable uses
Common Property	Collective	Exclusion of nonowners	Maintenance; constrain rates of use
State Property	Citizens	Determine rules	Maintain social objectives
Open Access (nonproperty)	None	Capture	None

Note. After Hanna et al. (1996, p. 5)

Types of Resource Regimes

Open Access Regimes

When group size is not controlled and/or any potential user may make unrestricted claims on the resource an open access regime exists. It is not possible for any particular user to have a claim to a benefit stream – all the users have is access. A commonly used legal description is *res nullius* – literally the property of no-one. These regimes are characterized by being completely non-exclusive; their resources are rival. Bromley (1986, p. 597) puts it this way: "The popular phrase 'everybody's property is nobody's property' is thus seen to be nonsense. What should be said is that 'everybody's access is nobody's property'."

Around the world today, we can see instances of open access regimes as a consequence of the severe erosion of social capital as exemplified in Bosnia and Rwanda recently. We see this regime operating as a major factor in the staggering number of extinctions

of 33 genera of large animals that occurred more or less simultaneously with the first solid evidence of human activity in the form of specialized hunting tools in North America 11,000 years ago (Burney, 1993, p. 534).

Or, in the last century, open access regimes were the result of a void when the U.S. was often unable to enforce its property rights, and individuals took freely take from state lands without fear of retribution. In this situation, hunters were able to annihilate the American Bison nearly to extinction. Numbering at least 60 million in North America in the early 1800s, demand for their hide, tongue, bones and meat, as well as the ease and enjoyment hunters found in shooting them, contributed to their speedy demise. With no rules, rights or compliance mechanisms in place, by 1894 there remained roughly 300 bison in the U.S. and a few thousand in Canada (Garretson, 1971; Rorabacher, 1970).

A second example is the nation's first national park, Yellowstone, which was without resources in its early years to enforce laws and regulations. An open access regime was the effect and as a result the park was severely exploited. Poachers slaughtered wildlife and set fires to drive the game in desired directions, vandals desecrated thermal features, robbers accosted tourists, and campers made camp where they pleased instead of designated sites (Ise, 1961, pp. 20-29). It took the cavalry to protect the park resources. Similar situations are also to blame for resource degradation in less developed countries today (Larson and Bromley, 1990, p. 240).

Open access is the regime that was mistakenly described as a commons problem in Garrett Hardin's famous essay, *The Tragedy of the Commons* (1968). He called it "the tragedy of the commons" because of the model's prediction that individual rationality in the use of common property will lead to serious degradation of that resource. To illustrate, Hardin asks the reader to consider a pasture available to any herder. Hardin then asks us to examine the rationale of each herder: Each herder receives direct benefit from each of his cattle fattening itself on the pasture. The penalty caused by each additional animal overgrazing, however, is shared by all herdsmen. So the rational herdsman's incentive is to add more cattle to the pasture. Hardin continues,

But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited. Ruin is

the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all. (Hardin, 1968, p. 1244)

While Hardin's tragedy scenario was used to warn about overpopulation, the impact of this model can be seen in its widespread applications including national forest management (Brown and Harris, 1992), acid rain (Sandler, 1992, p. 176-177), the national park system (Jaffe and Janov, 1989), the radio spectrum (Ciriacy-Wantrup and Bishop, 1975), ozone depletion and global warming (Sandler, 1992, pp. 169-176) and deforestation, declining soil quality, and excessive cattle grazing (Larson and Bromley, 1990). It has become part of the "traditional wisdom" in environmental studies, resource science and policy, economics, ecology and political science (McEvoy, 1988, p. 214).

Proposed solutions are to convert the commons to either a private property regime for individual users, or a state governance regime in the form of user fees, subsidies, or imposition of regulations. Indeed, Hardin concludes that if we do not act in one of these two ways, we "acquiesce in the destruction of the commons" (Hardin, 1968, p. 1245).

At the core of this dynamic is the concept of collective action. Sandler explains the concept: "Collective action arises when the efforts of two or more individuals are needed to accomplish an outcome.... Collective action problems are typically characterized by an interdependency among the participants, so that the contributions or efforts of one individual influence the contributions or efforts of other individuals" (Sandler, 1992, p. 1).

Game theory took collective action situations similar to Hardin's model and structured it into a version known as the "Prisoners' Dilemma" (Dawes, 1975). This influential model also is offered to suggest state or market solutions to social dilemmas. Luce and Raiffa (1957, p. 95) sketch out the dilemma:

Two suspects are taken into custody and separated. The district attorney is certain that they are guilty of a specific crime, but he does not have adequate evidence to convict them at a trial. He points out to each prisoner that each has two alternatives: to confess to the crime the police are sure they have done, or not to confess. If they both do not confess, then the district attorney states he will book them on some very minor trumped-up charge such as petty larceny and illegal possession of a weapon, and they will both receive minor punishment; if they both confess they will be prosecuted, but he will recommend less than the

most severe sentence, but if one confesses and the other does not, then the confessor will receive lenient treatment for turning state's evidence whereas the latter will get 'the book' slapped at him.

The game assumes no communication between players. Each player's dominant strategy -- the one they feel is their best option -- is to confess. However, when they each confess, the result is the third best option for each. This result suggests that individual rational decisions can lead to collective irrational consequences. The basis of each actors' decision is a lack of trust in others and a belief that they would exploit his/her restraint by taking the option that best suits their narrow self-interests.

Exploring further this inconsistency between individual and collective interests is the influential work of Mancur Olson in his book, *The Logic of Collective Action*, (1965). Prior to Olson's contribution, groups and political collectives were always seen as advancing their members' and/or constituency's well-being. Olson raises the specter that actions by group members may worsen, rather than enhance, collective or group well-being (Sandler, 1992, p. 1-3).

Olson identifies an element which works against a rational group decision: the "free rider" problem, although he never uses this term per se. This problem exists whenever one person cannot be excluded from the benefits that others provide by their collective efforts. Public goods are vulnerable to such a situation because of their non-rival and non-exclusive properties. Thus, the rationale goes, individuals have no incentive to pay for public goods which they cannot be prevented from enjoying free once provided by others. The rational actor will, therefore, tend to "free ride" (Olson, 1965, p. 35; also see Buchanan, 1968, p. 89).

The nearest Olson comes to using this terminology is in the following:

Once a smaller member has the amount of the collective good he gets free from the largest member, he has more than he would have purchased for himself, and has no incentive to obtain any of the collective good at his own expense. (Olson, 1965, p. 35)

The message from rational theorists in these three models is clear: rational, self-interested individuals will fail to manage and resolve problems of interdependence in a

cooperative and mutually beneficial manner. These theoretical models of interdependent behavior dominated scholars' evolving theory of collective action and the thinking of public officials into the 1980s. Not surprisingly, policy prescriptions for natural resource management responded with continued emphasis on centralized or privatized solutions. Bureaucracies grew larger and more invasive. Perhaps in partial response, calls for privatization or local control – evidenced by the "Sagebrush Rebellion" and "Wise Use Movement" – grew louder.

The Private Property Regime

While common property resource (CPR) regimes were used extensively in New England prior to this country's independence, it was private property rather than public commons – that was to dominate. Land, water and other resources found there were increasingly valued not for the present utility they offered the user, but for "profit". That term's original meaning referred to the benefits one obtained from using something but later the gain one made upon its sale was added.

Initially in the colonies' market development was constrained by municipal regulations, high transportation costs, and medieval ideas about the "just" price (Cronon, 1983, p. 76). But taxes and the desire to acquire market products encouraged colonial production beyond the level of subsistence. Slowly notions of utility gave way to conceptions of treating land as capital, improving it, obtaining a marketable surplus and thereby accumulating wealth. This factor is also cited as important to explain the reduction of the grazing common lands in Great Britain and the common forest lands in Europe (Ciriacy-Watntrup and Bishop, 1975, pp. 719-720).

As the United States' market economy developed beyond early commodities of fur, fish and timber, a more vigorous resource regime began to assert itself: private property and the marketplace. Unlike CPRs, regimes of this sort are able to effectively exclude others from access to the resource. But like CPRs, their resources are rival.

In the developing science of economics, the free market was to be encouraged for its promise to improve the welfare of those exchanging resources and thereby advance the condition of the broader society. Adam Smith was the chief spokesman and booster of the free market

approach through his *Wealth of Nations* (1776). Traditional economic theory is predicated on the proposition that the self-serving actions of each individual contributes, albeit unintended, to the common good. Smith wrote:

It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own interest. We address ourselves, not to their humanity but to their self-love, and never talk to them of our own necessities but of their advantages (1776, p. 18).

No social dilemma problems exist here. The goods in these regimes do not require collective action decisions. However, despite its many virtues, a pure economic resource regime was found to have some key shortcomings.

One source of failure is in the markets generation of externalities. These represent costs and benefits unaccounted for in marketplace exchange. Thus when coal-fired power plants contribute to acidification of downwind lakes, an externality (cost) exists not borne by the marketplace. Similarly, wetlands have a low market value. However, they serve critical ecological functions of flood control, water purification, wildlife habitat, as well as enhancing human welfare by their aesthetics and recreational values. These benefits, like the costs above, are also not normally captured by the market.

A similar type of failure exists as market decisions based on returns to private owners tend to be shortsighted, not reflecting the long-term value of resources (Grima and Berkes, 1989). Natural resources that we may want to sustain decades from now have almost no present monetary value to the rational decision-makers at competitive discount rates. Grima and Berkes (1989) show that a resource worth \$800,000 in 30 years would today have only a value of \$100,000 if one assumes an interest rate of 7%. Higher rates would reduce the present value even more. Thus costs and benefits projected for more than two decades are discounted to nothing. While this practice may be useful for human-made artifacts such as cars and machinery that wears out, its application to resources that are self-renewing, and therefore provide a continual stream of benefits, is not appropriate.

These discount rates were largely responsible, particularly in the 19th century, for the rapid exploitation of this country's natural resources. Timber, wildlife, fishery and habitat

resources were decimated in many parts of the country. Clawson (1979, p. 1170) estimates that between 1800 and 1900, timber inventory volume in the U.S. declined by perhaps two-thirds. Under the privatization marketplace regime, owners had wide latitude on how to use the resources they controlled.

The State Governance Regime

Because public goods have no possibility of excluding some so that others can be charged, nobody has an incentive to provide these goods. Market mechanisms do not secure goods by voluntaristic means. The state must therefore take on the responsibility for their provision.

To check these excesses caused by the marketplace on one hand, and the open access regime on the other, the social institution of government bureaucracy was expanded tremendously in the 20th century. While this regime of bureaucratic management was not new, what had changed was the scope and pervasiveness of this regime's reach, effectively eliminating the open access regime and substantially curbing the free marketplace regime.

Perhaps serving as an early foundation for today's strong governmental involvement in natural resource management was that colonial powers in many parts of Asia and Africa often presumed that supplying natural resources demanded considerable technical expertise, which is unlikely to be found locally, lead to a belief that "scarce technical expertise is best located in a powerful state bureaucracy where it can be effectively dispensed" (Barker et al., 1984, p. 26). Local knowledge was often ignored and state-imposed management systems destroyed long-functioning, sustainable common property regimes.

The state governance regime, which still reigns today, is characterized by three main postulates regarding: 1) the type of information that is required to make decisions, 2) the values which should prevail, and 3) those who make the decisions.

Principally, when an important natural resource decision was required, the paradigm led natural resource professionals to: 1) favor nomothetic knowledge (i.e., generalized, scientific principles) over idiographic knowledge (i.e., localized, site-specific information), 2) give

preference to economic values at the expense of non-economic values, 3) use a bureaucratic regulation "top-down" approach rather than empowering local groups to use self-governing approaches, in developing a course of action (Hays, 1959; Peterson and Manfredo, 1993; Pinchot, 1947; Rosenbaum, 1991).

In a critique of its planning process, the U.S. Forest Service (1990, p. 7) observed that personnel became enamored with technical resource dimensions in developing forest plans:

Early in the planning process, most people in the agency believed planning would essentially be a scientific process. Many felt if we just brought the facts together and ran the FORPLAN model, the 'right' answers would unfold and everyone would be happy. After ten years, to our dismay, we found planning was much less scientific and much more social and political than we first expected.

A penchant for this approach has contributed to public dissatisfaction with natural resource agency decisions resulting in polarization, lawsuits and gridlock. When the U.S. Forest Service, for example, began its forest planning process in 1983, 200 to 300 administrative appeals to the final plans for 156 national forests were expected. By 1992, over 1,300 had been formally filed (Wondolleck, 1988, Timberlake per. comm.). Numerous timber sales were also delayed, as 6,277 appeals were filed from 1988 to 1992, an average of 40 per national forest.

Wildlife Management and the State Governance Regime. Wildlife management is symptomatic of the traditional conservation paradigm enforced by the state governance regime. Largely because of centralized control and the utilitarian values that worked to shape wildlife policy, wildlife management in the past 25 years has been on the forefront of public controversy (Knight and Bates, 1995). Whether it has been spotted owls in the Pacific Northwest, wolf restoration in Yellowstone, snail darters in Tennessee, or bison in Montana, wildlife management has a penchant for generating lawsuits and extensive press coverage as each of these issues has demonstrated.

The state governance regime guiding wildlife decisions that has evolved over the past century began with an almost exclusive emphasis on states' rights to a cooperative approach in which state and federal governments share responsibilities (Mangun and Mangun, 1991).

For more than a century, state governments held certain property rights to wildlife since they had assumed game management responsibilities for wildlife. State wildlife commissions supported sportsmen's utilitarian philosophy toward wildlife and adopted this into policy. After all, it was the license fees paid by sportsmen that funded wildlife programs and the state orientation toward consumptive uses of wildlife fit the social values that dominated this era (Wagner, 1989, p. 335).

As Mangun and Mangun describe (1991), the state-dominated approach began to change in the 1960s and 1970s. As the nation's environmental awareness grew, and increased understandings of ecological systems and their complexities became apparent, a trend toward cooperative federalism developed. This trend was further bolstered by environmental organizations, whose membership ranks were swelling, finding a lack of responsiveness and innovation at the state level and shifting their focus to the federal government.

Through their lobbying efforts, environmentalists achieved legislative victories that greatly expanded the responsibilities of the federal government in wildlife management. These victories included passage of the Endangered Species Act, the Marine Mammal Protection Act, and the Anadromous Fish Conservation Act. The National Environmental Policy Act (NEPA) was originally proposed as an amendment to the Fish and Wildlife Coordination Act (Bean, 1983, p. 185). Thus, when agencies like the U.S. Fish and Wildlife Service (USFWS) produced environmental impact statements, they strongly emphasized biological, not utilitarian, values (Mangun, 1989, p. 57). This trend, however, was briefly interrupted during the Reagan administration's "New Federalism" approach, which reverted wildlife policy to a pattern of dual federalism, with federal agencies' responsibilities more limited to migratory and endangered species (Mangun and Mangun, 1991).

In 1983, formal delineation of wildlife management responsibilities was clarified and later codified into the U.S. Code of Federal Regulations (43 CFR, Part 24). It specifies that the states have primary responsibility for resident species and the USFWS is responsible for migratory species, endangered and threatened species, some marine animals and particular management

areas involving anadromous fish. However, even on federal lands, state jurisdiction is concurrent with federal authority.

Table 2 outlines Mangun and Mangun's (1991) identified phases in governmental relations in wildlife policy.

Table 2
Phases in Intergovernmental Relations in Wildlife Policy

<i>Period</i>	<i>Years</i>	<i>Approach to Federalism</i>
I. Game Management	1800s-1960	Dual Federalism (States dominant)
II. Environmental Awareness	1960-1980	A. Initially Cooperative Federalism B. Reverted to Dual Federalism (Federal government dominant)
III. Comprehensive Management (Nongame Programs Initiated)	1980-1989	A. Reagan "New Federalism" B. Dual Federalism (States resurgent)
IV. Renewed Environmental Awareness	1990-Present	Cooperative Federalism

This changing, dual nature of wildlife management may be a contributing factor to four of the five decisionmaking weaknesses in wildlife policy identified by Yaffee (1991, 1997) in his case study of the spotted owl controversy. These four are summarized below:

- (1) Competitive behavior drives out cooperative behavior: a tendency to promote competitive behaviors at the expense of cooperative actions, yet often cooperation is needed to find good solutions;
- (2) Fragmentation of interests and values: a proclivity to split the different elements of a society, avoiding the integration of interests and values necessary to craft effective courses of action;
- (3) Fragmentation of responsibilities and authorities: a tendency to divide those responsible for resource management, diminishing accountability, and ensuring that management strategies are often piecemeal solutions to crosscutting problems;
- (4) Fragmentation of information and knowledge: a proclivity to fragment what is known about a situation and its context so decisionmakers make bad choices because they are operating with inadequate information.

The fifth problem Yaffee identifies is a variant of the dynamic described earlier in this chapter as the prisoner's dilemma and the tragedy of the commons. Yaffee states it as follows:

- (5) Short-term rationality outcompetes long-term rationality: a tendency to make decisions that are rational and effective in the short term, yet counterproductive and ineffective over the long term.

Table 3 summarizes these biases, the policy problems they create, and required actions towards their resolution.

Table 3
The Behavioral Biases that Generate Environmental Policy Problems and Suggested Solutions

Behavioral Bias	Problem Created	Solutions
Competition supplants cooperation	impasses; inferior solutions	Develop processes that promote sharing/trust/relationships
Fragmentation of interests and values	impasses; inferior solutions	Promote discourse and values ratification. Build political concurrence. Promote public education.
Fragmentation of responsibilities and authorities	slow and inconclusive decisionmaking; diminished accountability; piecemeal solutions	Foster leadership. Create coordinating mechanisms. Stricter incentives. Develop clear measures of success and an ability to monitor performance.
Fragmentation of information and knowledge	inferior solutions	Promote information flows within and between organizations. Invest in better databases. Build center of up-to-date expertise. Use data negotiation.
Short-term rationality outcompetes long-term rationality	poor long-term direction	Learn about the future. Bind ourselves to the future through directives, information, and "fixers." Promote innovation and experimentation. Find creative ways to meet both short-term and long-term objectives.

Other authors have identified many of these same problems with wildlife management.

Grumbine (1991, 1997) and McKinney (1991), for example, have elaborated on the need for greater cooperation. Grumbine (1997) focuses on remedies for this condition, writing:

...there are two critical issues in fostering cooperation. First, all potential partners must share in defining the problem.... The second issue in cooperation is sharing power. Everyone who has experience with the cooperative process has noted that the work is not easy, but few are insightful enough to recognize unequal power distribution as a major problem. Potential partners never come to the table equal in power. The trick is to make power imbalances explicit and to facilitate equitable power sharing as much as possible.... experience shows that, the greater the power imbalance in any group, the less chance there is for success.

In furthering cooperation, Grumbine also suggests smaller group sizes, finding short-term rewards to remain productive and taking time for trust building which is "more important than information processing."

McKinney (1991) looks to promote cooperation through collaborative problem solving processes that promote the sharing of values and interests, encourage joint fact finding and focus on the issues and concerns raised by the parties.

Other needs Grumbine identifies for incorporation into wildlife decisionmaking include: 1) adaptive management in which management is conducted as a "continuous experiment where incorporating the results of previous actions allows managers to remain flexible and adapt to uncertainty", 2) developing new networks for information sharing, noting the gaps between top-level decision makers, mid-level managers and bottom-level field implementors, 3) better social data which is often more important than scientific information in problem solving and 4) learning to accept the role of human values explicitly.

In ending Grumbine relates the three central "laws" of resource management espoused by Yale School of Forestry and Environmental Studies professor, William Burch:

- All resource allocation decisions are matters of political struggle rather than technical facts.
- Resource management decisions are about use; therefore they are decisions about manipulating human behavior rather than physical things.
- Resource managers, when confronted with social value decisions, will seek to convert them into technical decisions.

The Common Property Regime

Common property resource (CPR) regimes exist today in numerous settings, ranging in scale from small inshore fisheries, irrigation systems, pasture lands, to the oceans and the biosphere (Ostrom and Gardner, 1993, p. 93).

Under this regime, "use-rights for the resource are controlled by an identifiable group and are neither privately owned nor managed by governments; there exist rules concerning who may use the resource, who is excluded from using the resource, and how the resource should be used...." (Berkes and Farvar, 1989, p. 10).

Some scientists place emphasis on group size in defining CPR regimes writing that "more than one individual holds property rights in the resource" and restrictions on group size exist (Larson and Bromley, 1990, p. 238). Ciriacy-Wantrup and Bishop (1975, pp. 714-715) stress that the group members "are co-equal in their rights *to use* [their emphasis] the resource" stating that it does not imply that the resource quantity each member receives will necessarily be the same.

CPR regimes may be easily confused with communal ownership, however, they are not the same. The latter has been described as "a right which can be exercised by all members of the community" (Demsetz, 1967, p. 353) and implies "free access by all to the resource" (North and Thomas, 1977, p. 234).

Difficulties to privatize the commons and exclude others occur for different reasons. In some cases the resources are inherently difficult to partition using a property-rights regime, as in the examples of fugitive fisheries and groundwater. Alternatively, partitioning problems may stem from cost of fencing (parceling) the resource and/or cost of enforcing property rights to restrict access (Ostrom and Gardner, 1993, p. 93). Or the resource may be so abundant (e.g., air, solar radiation and wind) that no one needs to be excluded from their use.

In looking at the commonalities among CPR regimes and contrasting these with other types of land tenure, scientists have identified attributes of resources frequently managed as a commons (Arnold, 1998; Jodha, 1992; Netting, 1976, p. 140; Runge, 1984, 1986). These characteristics reduce incentives for privatization. Five attributes have surfaced: 1) the value of production per unit of is low, 2) the frequency or dependability of use or yield is low, 3) the possibility of improvement or intensification is low, 4) a large territory is needed for effective use, and 5) relatively large groups are required for capital-investment activities.

Common Property Regimes in the U.S. Although much detail has regrettably been lost over the centuries, resource regimes often used common property arrangements in the early development of the United States, both with the American Indians and with many of the early Spanish and Anglo settlers. The New England Indian tribes claimed not the land, but the right to harvest the useful resources which could be obtained from that land -- firewood from forested

lands, crops from clearings, edible plants or birchbark from some of those same lands, fish and shellfish from wherever they may be found (Cronon, 1983). It was a conception of property much like many hunter-gatherer and agricultural peoples of the world today.

In the west, Spanish and later Mexican land grants provided title to the "common" or grazing lands to a group of families for pasture and wood collection (Leonard, 1970). Irrigable land was parceled out in tracts to individual families. The "common" lands remained under the ownership of the Crown (under Spanish authority) and to the Republic (after Mexican occupation). The irrigated holdings, on the other hand, could often be sold by the owners after a given period of time had elapsed, as set forth in the settlement contract. Much of these common lands, however, fell under private property regimes just after the turn of the century, through various and sundry methods, often through the payment of delinquent taxes by a company or wealthy landowner.

The Anglo common property regimes in New England were similar. Here the King possessed the land and defined the bundle of rights and obligations that operated on the land (Cronon, 1983). Typically, after receiving a land grant, proprietors of a new town held all land in common as they sought to determine what different types of land were present, much as the Indians had done (grassy areas for grazing, marshes for hay, etc.). After locations were determined for homes and cornfields, common lands were considered. Those settlers who came from areas of England with strong manorial control over lands held in common by peasant farmers sought to recreate this system. Their commons would remain largely intact and rules would regulate who could graze, gather wood, etc. on common lands. Immigrants who lived in regions of England where peasants owned their lands proved more eager to convert common lands into private property, to buy and sell lands and develop a market in real estate.

Water for irrigation meets the two criteria for classification as a common property resource. It is a rival resource -- the flow of water available at any one time in an irrigation system is limited. Use by one irrigator subtracts from the amount available to others. When demand for water exceeds the supply, an allocation method needs to be specified by agreed

upon rules. Water allocation may be based upon the area to be cultivated, the purchase of water shares, or a variety of other criteria.

It is also costly to exclude potential beneficiaries from using an irrigation system once it has been constructed. This cost of exclusion is usually due to the size of the water delivery facilities along with the ever-moving nature of water (Tang, 1992, p. 5).

This classic CPR combination of rivalness and costly exclusion can result in conflicts over consumption of the water resource if no accepted system of rights, rules, social choice and compliance mechanisms are in place. Maass and Anderson (1986) note that it is not uncommon to see irrigation conflicts develop into bloodshed or even murder. Users' relations and constraints are of primary importance in the management of irrigation, as they generally are within CPR regimes (Hilton, 1992).

Some scientists (Gibbs and Bromley, 1989) believe that the most highly developed examples of CPR regimes are found in irrigation, "where effective water management is dependent on the interrelated actions of a unified set of water users" (Bromley, 1989, p. 27).

The interrelated actions of irrigators often form a prisoner's dilemma game (Wade, 1988b, p. 490). The irrigators' alternatives are two: cheat and try to obtain more water than they are allocated, or play by the rules and obtain only the water to which they are entitled. The associated outcomes are as follows, in order of irrigator preference: 1) irrigator cheats, others do not; 2) everybody plays by the rules; 3) everybody cheats; 4) irrigator plays by the rules, everyone else cheats. If the first outcome develops, the irrigator is a "free rider"; if the last outcome occurs, the irrigator is a "sucker". If every irrigator tries to free ride, the collective outcome is 3 (above) and a tragedy of the commons results. This outcome is least preferred to 2 in which everyone plays by the rules.

Tang (1992, p. 6) also notes that irrigators face a prisoner's dilemma in their decision to invest in irrigation infrastructure. An irrigator may prefer to withhold his expenditure, hoping to benefit from others' contributions and "free ride". If everyone acts similarly, there will be an under-investment in the facilities.

The tragedy of the commons is only avoided when all participants are identified and aware of the actions of all others. Organizational arrangements are needed that effectively monitor and impose sanctions on cheaters and reward those who cooperate in water allocation and investment (Ostrom, 1990).

Common Property Regimes and Collective Action

A major challenge for CPR regimes is to deal with a "social dilemma" (sometimes referred to as the "commons dilemma") posed when communities are faced with scarcities of common property resources (Tyler and DeGoey, 1995). Collective action is required. Yet developing rules, rights, social choice and compliance mechanisms require cooperation and social capital. This problem is critical. Until recently it was presumed that individuals using a CPR face a situation in which their individual rationality leads to an outcome that is not rational from the perspective of the group (i.e., inefficient use of the resource and environmental degradation), as predicted by Hardin and Olson.

Despite the pessimistic forecasts by these theorists, CPR regimes are ubiquitous and often thriving. In other parts of the world they have been used to sustainably manage natural resources for centuries. The most frequently cited examples in the literature of such resources are fisheries, irrigation systems, grazing lands and forests, although examples can also be found in recreation, groundwater, cropping and global commons like deep seabed mining, whaling, Antarctica, the atmosphere and outer space (National Research Council, 1986; Fortmann and Bruce, 1988; Bromley et al., 1992; Vogler, 1995).

Such evidence may give pause to those who believe today's CPR regimes are simply a quaint anachronism from another era or doomed to failure. Indeed, in the early-1980s, scientists began re-thinking the potential viability of collective action. If the Hardin and Olson models were accurate predictors of failures to obtain adequate collective action outcomes, why are there so many examples of long-standing common property regimes throughout the world? How do they avoid the social dilemma pitfalls predicted? As McKean writes: "The failure of cooperation is

rather easy to understand...[but] instances of successful cooperation are worthy of intense study" (1992, p. 248).

With closer examination the three Hardin-Prisoners'-Olson models have drawn some criticism. Some charge that the analyses are entirely from the individual and does not include potentially important community variables such as norms, trust and moral concerns (Vogler, 1995). Others criticize the assumptions as culturally biased, influenced by free enterprise capitalism that emphasizes competition rather than cooperation (Berkes, 1989). Feminists ask whether herdswomen would behave in as uncooperative manner as Hardin's herdsman (Vogler, 1995). While these criticisms may be valid, there are two fundamental premises of the models have been most seriously challenged.

First, scientists discovered the models put constraints on collective action situations that need not be assumed in empirical settings (Runge, 1984). Specifically, people do not have to be treated as prisoners with the rules of the game fixed by others, preventing group coordination. Communication and persuasion among members of a community can occur (unlike the prisoners' dilemma model) with the potential to change preferences and reorient values. These models also neglect the role of leaders who may be catalysts in achieving group consent. Through monitoring and sanctioning, the free rider problem may be managed.

Secondly, it has also been pointed out that Hardin's pasture analogy portrays an "open access" resource regime, rather than a common property regime as he assumed (Feeney et al., 1990; Larson and Bromley, 1990, p. 239; McCay and Acheson, 1987). "Picture", he begins, "a pasture open to all" (Hardin, 1968, p. 1244). Resources in open access regimes are non-excludable and thus are freely available to anyone.

Alternatively, common property regimes may be collectively owned and managed by a community, making the resources excludable to those outside the collective, as specified by the rules established. Shares, rents, lotteries, kinships and traditions have all been strategies used to restrict access in CPRs (Freeman, 1989).

Thus part of the reason to explain the apparent contradiction between theorists' sweeping pessimistic appraisal of CPRs and their enduring nature worldwide was mistaken assumptions of

the theorists. The other part of the explanation had to do with the particular institutional design elements of the CPR regimes themselves.

It is at this point that approaches to solving the social dilemma of the commons reach a critical juncture of scientific inquiry that will lead down one of three paths. *Social psychologists* view solutions in the context of influences affecting individual behavior in group settings, such as communications, legitimacy, altruism, trust (Kramer, 1990; Messick and Brewer, 1983; Tyler and Degoe, 1995). In contrast, *market-based institutional researchers* of neoclassical economics view privatization of the commons or development of institutions that create *de facto* private property as solutions (Hess, 1993). Lastly, *non-market institutional approaches* tend to be pursued by political scientists, sociologists and anthropologists (Freeman, 1989; Oakerson, 1992; Ostrom, 1990,). This study uses the latter approach to solve the commons dilemma and it serves as the theoretical lens through which this investigation will be conducted.

Designing Common Property Resource Regimes

Cognizant of the disadvantages of private and state governance resource regimes and aware of continued resource degradation under these regimes worldwide, scientists have recently begun to take a closer look at CPRs. The new interest in communal property arrangements is perhaps related to the resurgence of interest in grassroots democracy, public participation and local-level planning (Feeney, et al., 1990, p. 13).

If CPR regimes offer the possibility of managing some natural resource systems in ways that encourage public participation, self-rule, and sustainable use of the resource as the literature suggests, what are the requirements to make a CPR regime a "success"? Success is defined here as the degree to which the resource regime: 1) generates new choice opportunities (i.e., more options available to consider); 2) fosters genuine participation among local people in making decisions about the choice opportunities available that will affect them; 3) preserves choice opportunities for future generations; and 4) is economically efficient (Freeman, 1992, p. 130).

In order to devise a broader and more sophisticated theory of common property, a systematic empirical examination of the factors underlying successful collective action is needed. While some have studied specific situations (e.g., Tang, 1992; Wade, 1988), two social scientists have developed a comprehensive framework that identifies many of these factors across numerous case studies.

Ostrom (1990) examined a wide variety of enduring, self-governing, and common property resource regimes meeting criterion of resource sustainability. Specific rules varied greatly from regime to regime reflecting the particular attributes of the physical system, culture, and socio-political setting. However, she distilled eight "design principles" that characterized all of these CPR institutions (Ostrom, 1990, p. 88-102). She defines "design principle" as the essential characteristic that helps to account for the success of these organizations in sustaining necessary physical works while gaining the compliance of generations of users to the rules in force (Ostrom, 1990, p. 90). These design principles and a brief definition for each, are summarized in Table 4.

A few of these principles require further elaboration here. First, as principle 2 outlines, rules specifying allocation of resource benefits need to be related to the site-specific conditions of the situation and to the required inputs of individuals' assets (e.g., labor, materials, money) to maintain the system. Thus, in successful systems, those who receive the highest proportion of benefits contribute the highest proportion of assets to sustain the system.

Because rules allocating the costs and benefits need to be tailored to the specific local conditions present, it is the local group of users that are best able to devise these rules. Rules may be fine-tuned over time as difficulties arise or as new knowledge or new technologies evolve.

Using the first three principles, Ostrom claims, individuals should be able to devise effective operating rules. However, because reputation and shared norms may not be enough to elicit favorable behavior over the long-run, monitoring and sanctioning rules are needed.

Table 4

Ostrom's Design Principles of Long-Enduring CPR Regimes

1. Clearly defined boundaries

Individuals or households who have rights to withdraw resource units from the CPR must be clearly defined, as must the boundaries of the CPR itself.

2. Congruence between appropriation/provision rules and local conditions

Appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions and to provision rules requiring labor, material, and/or money.

3. Collective-choice arrangements

Most individuals affected by the operational rules can participate in modifying the operational rules.

4. Monitoring

Monitors, who actively audit CPR conditions and appropriator behavior, are accountable to the appropriators or are the appropriators.

5. Graduated sanctions

Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and context of the offense) by other appropriators, by officials accountable to these appropriators, or by both.

6. Conflict-resolution mechanisms

Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.

7. Minimal recognition of rights to organize

The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.

For CPRs that are parts of larger systems:

8. Nested enterprises

Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.

Note. Adapted from E. Ostrom (1990, p. 90).

Another source of specific design principles, comprehensive in scope, distilled from studies of irrigation CPR regimes around the world are summarized by Freeman (1989). He envisions a middle-level organization with characteristics as summarized in Table 5. With these

independent variables in place, there is a greater propensity by the individual user to place loyalty to the organization, rising above their narrow self-interests, with the result of a more sustainably-managed resource.

Table 5
Freeman's Design Principles for Mid-Level Irrigation CPR Regimes

1. Staff

- a. Recruited locally
- b. Responsible to local authority

2. Establishment of a distributional share system

- a. Water delivery dependent on users' fulfillment of obligations to the organization
- b. Distinctions between irrigators at the head and those at the tail of the system are removed by appropriate rules

3. Maintenance/Control of physical system

- a. Staff paid in cash/kind rather than reliance on users
- b. Users granted high degree of water control

Note. Adapted from Freeman (1989, p. 25).

Of key strategic importance in Freeman's organizational design components is the concept of distributional share system. This element requires that benefits of the system are distributed to each of the benefactors proportionately to costs each incurs. Costs may be in the form of annual fees, shares, and/or may require labor in system operation and maintenance. The significance of this principle is to discourage "free riders" which will lead to organizational decay.

Also of importance to robust irrigation CPR regimes is for the distributional share system to reduce the head-tail distinctions. Without rules, rational, self-interested irrigators who are located in the proximity of the water source (the "head") would help themselves first to all the water they can use, often leaving insufficient amounts for those at the end (the "tail") of the water course. Rules need to overcome this distinction to create solidarity among the irrigators on a given water course. Without this social organization, schisms often develop, pitting headenders interests against tailenders. The common result is to polarize the community and, again, to put the organization at risk.

Freeman, with Ostrom, recognizes the importance of how organizations are stitched together hierarchically. Ostrom calls for nesting smaller organizations in larger ones when the CPR is large and more complex (Ostrom, 1990, pp. 101-102). Thus local irrigation groups would be part of regional groups that would be nested in a national organization.

Freeman has developed this concept further. He first makes clear the rationale for such coordination at various levels. There are two kinds of knowledge, both critical to sustaining resource regimes, he says (Freeman, 1989, pp. 14-15). One type of knowledge is "nomothetic". This understanding comes from the study of theories and scientific proofs. It is generalized knowledge, often passed along from higher education institutions and publications from centralized sources. Extension agents excel in this knowledge, as do graduates of natural resource programs.

The second type of knowledge is idiographic (Freeman, 1992, pp. 18-23). It is that unique knowledge that often comes from personal experience with a site-specific place. This understanding is often not applicable to other places. A life-long farmer may possess this type of knowledge of his place – how to work with his soils, how the local social networks work, etc.

Freeman believes that middle level organizations are important because they are capable of assimilating both kinds of understanding – nomothetic knowledge from the centralized bureaucracies above, and idiographic knowledge from the local organizations below.

Freeman explores three ways in which local, middle-level and upper-tier organizations can be linked together effectively in a resource regime (Freeman, 1989, pp. 45-59). While many regimes have opted for a unitary organizational structure, his preference is to employ the federal model, for three critical reasons.

First, each organizational level has control over its own budgets, activities and priorities. With responsibility clearly linked to a specific task, people know where to go when problems arise. Projected costs for tasks at that level are divided among members receiving these benefits at the lower levels and these revenues are spent within that unit.

Second, decision-makers at each level are kept distinct. A board member of a lower-level organization is not simultaneously a board member of a higher organization. Thus, it is easier to assign responsibility to particular individuals for particular operations.

Three, because each level is distinct, the agendas at a particular level are not crowded by business that is addressed at other levels. The effect of this characteristic is that a level's responsiveness to local needs is greater.

These advantages of the federal model are in contrast to the traditional, pyramidal unitary model of organizational structure. Under this model, organizations are linked together vertically by budgets, leadership and decision-making. Leaders at each higher unit are recruited from the leadership council at the next lower level. Policy developed at each lower unit is reviewed by each higher unit that also holds veto powers over the recommended policy. Revenues are raised from the lower units and flow to the highest level, where spending decisions are made.

Key concerns arise from the unitary design. In general, the regime becomes unresponsive to local users needs. Because so many decisions need approval from the top, the upper layers become bogged down in numerous agendas. Because power and influence is concentrated among a few who have made many political promises to attain their position, responsiveness to problems at the lowest levels is compromised. In addition, the structure is fertile ground for polarization among the lower units as they will need to vie for resources from the top.

"Crafting" Institutions

Ostrom predicts that "over the next several decades, the most important consideration in irrigation development will be that of institutional design -- the process of developing a set of rules that participants in a process understand, agree upon, and are willing to follow" (Ostrom, 1992, p. 13). Too often planners concentrate their efforts on building the physical capital of tools, machines and blueprints necessary to reach an objective.

Crafting institutions involve working with the users and suppliers of a resource to develop the rights, rules and compliance mechanisms to design regimes that enhance the supply and use

of a particular resource system (Ostrom, 1993, p. 1907). Such a process is an on-going experiment in striving for success.

In this crafting of institutions, the design principles offered in the previous section can be used in the crafting process. However, there are two important cautionary notes that must be observed in Ostrom's and Freeman's tentative conclusions. First, as Ostrom observes, her list of design principles are "quite speculative" (Ostrom, 1990). She believes that further theoretical and empirical work is needed before one can conclude that these principles are necessary conditions for achieving success in CPR settings.

Secondly, it is also important to note that both Ostrom and Freeman's work comes from the study of relatively small scale CPR regimes in which just one resource is being appropriated. However, CPR regimes sometimes operate on a much larger physical scale (regional to global). They also may encompass multiple-use appropriations involving users who intend to exercise their property rights to the resource in different, even competing, ways (Buck, 1998). The existing literature has little to say about how these situations may affect the application of organizational design principles.

Social Capital and Collective Action

Developing rights, rules, social choice and compliance mechanisms in a process that participants can help determine (i.e., the process of institutional design) requires collective action over individual rationality. The civic engagement process to achieve these results involves mechanisms that are likely multiple and complex. Nevertheless, social scientists in several fields have recently suggested a conceptual framework for learning about this process termed "social capital."

Coleman (1988, pp. 100-101) defines social capital this way:

If physical capital is wholly tangible, being embodied in observable material form, and human capital is less tangible, being embodied in the skills and knowledge acquired by an individual, social capital is less tangible yet, for it exists in the *relations* among persons. Just as physical capital and human capital facilitate productive activity, social capital does as well. For example, a group within

which there is extensive trustworthiness and extensive trust is able to accomplish much more than a comparable group without that trustworthiness and trust.

Putnam (1995, p. 67) is a bit more specific. He defines social capital as the "...features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit". That capacity – the amount of social capital – is perceived by scholars as independent of the resource base (levels of human capital, natural resource capital, and financial and manufactured capital). But capacity includes awareness of those resources and is constantly working to invest them appropriately to meet desired goals (Flora, Flora, and Wade, 1996).

In a study of "civic communities" in Italy, Putnam found that strong social capital facilitates trust, coordination, communication and future collaboration (Putnam, 1993). Regions exhibiting a high level of social capital developed economically faster and resolved conflicts better than areas where social capital was lacking.

Sociologist Coleman puts it succinctly: "Like other forms of capital, social capital is productive, making the achievement of certain ends that would not be attainable in its absence" (Coleman, 1988, p. 97).

Putnam emphasizes dense networks of civic engagement in helping to build social capital. These networks, he hypothesizes, foster norms of mutual reciprocity and encourage social trust. They facilitate coordination and communication, broaden social identities, broaden the participants' sense of self by developing the "I" into "we" thus allowing dilemmas of collective action to be resolved. He stresses the structure of networks, believing that "horizontal" ties represent more productive social capital than "vertical" ties (Putnam, 1995).

Planners, too, have recognized the importance and benefits of civic engagement in another related way. One planning theory to emphasize civic engagement is transactive planning. While the details of this planning theory are beyond the scope of this study, through face-to-face dialogue between the planner and the client, transactive planning hypothesizes that mutual learning can occur (Friedmann, 1973, p. 187). Mutual learning is the fusion of personal

knowledge that the clients possess, with processed knowledge that planners possess, in the joint exploration of problems and potential solutions.

Through mutual learning, transactive planning holds out the possibility for acceptable societal guidance to emerge in the form of decisions. In so doing, this planning process works to build social capital.

Because of its importance for community sustainability, a measure of social capital is important at the community level. Putnam (1993, 1995) has measured indicators of social capital levels on a provincial and national level. Coleman (1988) has addressed social capital on an individual and household level. Flora (1995) has identified some basic social structures within a community that can be seen as elements of a community level social capital. She points to three important factors: diverse symbolic structures (the presence of practices and ideas within a community), network diversity (sharing these ideas and practices with a diverse groups of the community), and resource mobilization (the ability of a community to mobilize resources).

Social Capital and Organizational Conflict

While communication, civic engagement and mutual learning are certainly qualities of social networks to value, public policy inevitably generates social conflict. If decisions are to be made, some groups will find the values they hold are advanced; others will view their values as being set back.

As long as people hold different values that are important to them, there will exist conflict. So, the question becomes not how to abolish conflicts, but rather, can conflict become a force for developing social capital and, if so, how can we distinguish between conflict that advances social capital and conflict that destroys it?

One approach to answer these questions lies in the study of conflict cleavage patterns. These studies identify the diversity of issues surrounding any topic and then examine the patterns of agreement and disagreement across these issues among the actors involved (Freeman, 1992, pp. 154-157).

There are two basic types of conflict cleavage patterns that can exist among groups involved in any type of social conflict. One pattern hampers the development of social capital; the other pattern promotes it.

The first type is labeled "the polarized cleavage pattern." This pattern is said to exist when the same opponent groups are repeatedly in disagreement on each of the relevant issues. In this pattern there are no areas of agreement, there are no common grounds upon which to create compromise and thus no incentive to negotiate. Polarized cleavages erode perceptions of legitimacy among the groups involved. That is, opponent groups distrust their adversaries as having views that are worth consideration. Perceptions of interdependence are seen as zero-sum in nature – that is, gains made by one opponent group are seen as at the expense of the other group.

Social capital is eroded when these cleavages exist. Negotiability of the issues is reduced, mutual threat levels increase, communication among groups decreases and groups may seek every means to throw all possible roadblocks at their opponents.

At the other extreme of conflict are "crosscutting cleavage patterns". Here conflict still exists on specific issues across groups, but agreement is held in common on other important issues. Thus actors agree in part and disagree in part across the spectrum of issues involved. In this variable-sum context, there is a mix of concordant and discordant pairs of organizations across all issues.

With these cleavage patterns social capital can be generated. Actors opposed over one issue find agreement on another. Such a dynamic tends to foster perceptions of legitimacy, positive-sum perceptions of interdependence (i.e., groups don't view other groups' advances at their expense), ability to negotiate, and low levels of mutual threat. These cleavages provide a basis for dialogue and openness to reason. Groups' resources are not being expended to thwart another.

An understanding of conflict cleavage is important too for the longer term process affecting social capital that they may set in motion. Coleman (1957, pp.13-14) in his study of community polarization observed how polarization led to emergence of extremist leaders who

swept aside more moderate leaders who had failed in their efforts to contain conflict. As polarization escalated, the issues at stake moved from the specific and negotiable to the general and nonnegotiable and polite disagreement devolved to harsh acrimony. Freeman (1992, pp. 159-164) provides a summary of some of the important literature that describes how conflict polarization, when not kept in bounds by cross-cutting cleavages, can feed upon itself leading to the impoverishment of social capital.

CHAPTER III

BACKGROUND & SETTING

"We the people, who slaughtered the bison and exterminated the passenger pigeon, have had a shift of conscience in the last fifty years and have made the preservation of rare species of wildlife one of our national conservation purposes."

—Stewart Udall (McNulty, 1966)

"GOAL: To remove Grus americana from the endangered category to the threatened category by managing and protecting the populations from present and future threats and ensuring the maintenance of vigorous self-sustaining populations in the species' natural habitat."

—U.S. Fish & Wildlife Service (1986, p. iii)

Introduction

An important public policy issue has arisen over the ecological importance of the Platte River in central Nebraska and the extensive out-of-stream competing demands for the river water. At issue are the shared responsibilities of the Platte River Basin States (Colorado, Nebraska, and Wyoming), the United States, and water user and wildlife organizations to sustain critical habitat for the whooping crane and to protect three other endangered and threatened fish and wildlife species through collective water management along the Platte River.

This issue is a classical example of a Common Property Resource (CPR) problem, possessing all the key attributes described previously (i.e., costly exclusion and rival). As such, the problem can be best addressed by a CPR approach, rather than a strategy relying upon private or public property, a toll arrangement or open access.

The issue was enjoined when the U.S. Fish and Wildlife Service (USFWS), acting under the Endangered Species Act of 1973, concluded that U.S. Forest Service (USFS) actions to issue Special Use Authorizations were likely to jeopardize the continued existence of the endangered

whooping crane, interior least tern, pallid sturgeon, and threatened piping plover. It also would likely adversely modify designated whooping crane critical habitat. The USFS authorizations would have granted long-standing water users the continued right to divert water from the Platte River drainage basin on National Forest lands. With similar USFWS "jeopardy" decisions expected on a variety of other major water management projects in the near future, such as the re-licensing of Kingsley Dam, agencies and river stakeholders jointly began to investigate how to alter institutional arrangements in an effort to address the endangered species problem in central Nebraska.

This issue is particularly problematic as the river's water is fully allocated for agricultural and urban purposes, solely reflecting utilitarian values of an earlier time. Fish and wildlife habitat protection represent new values, not addressed in western water law developed over a century ago (Wilkinson, 1989). In addition, the institutional arrangements affecting river flows are complex, fragmented (involving federal, state and local agencies, and private associations), and suffer from incongruent perspectives of many entities (Poff et al., 1997).

This chapter will examine the details of this CPR issue. In what follows, the Platte River Basin is first described. Since institutional arrangements are key to the provision and allocation problems faced by stakeholders wishing to use the waters of the Platte for any particular purpose among many potential uses of these waters, this chapter will then identify the institutions involved. The focus will then shift to a discussion of a particular element of the basin forcing this issue – the whooping crane and its critical habitat. Next, the Endangered Species Act (ESA), an important element of the basin's legal landscape is examined. Finally, the manner in which the ESA has been applied to recent water management actions affecting the Platte River will be described along with the recent agreement of various elements of the organizational regime to cooperate in a united effort to protect species of concern.

The Physical Setting

The Platte River is formed from the South and North Platte Rivers that both originate in the Rocky Mountains of Colorado (see Figure 2). Together they converge in western Nebraska

and flow across the state to meet the Missouri River south of Omaha covering a total distance of 1,352 miles, gathering waters across 90,000 square miles (Eisel and Aiken, 1997). The river averages 1.3 million acre feet of water per year where the North and South Platte Rivers join. (An acre-foot is the water required to cover one acre with one foot of water, or, 325,851 gallons.)

The North Platte River begins in Colorado's Roosevelt-Arapaho National Forest near North Park. It flows northward into central Wyoming and abruptly turns southeastward into Nebraska. It travels 600 miles before it joins the South Platte River at the town of North Platte, Nebraska to form the Platte River. North Platte River towns include Scottsbluff, Nebraska, Casper, Wyoming and Walden, Colorado.

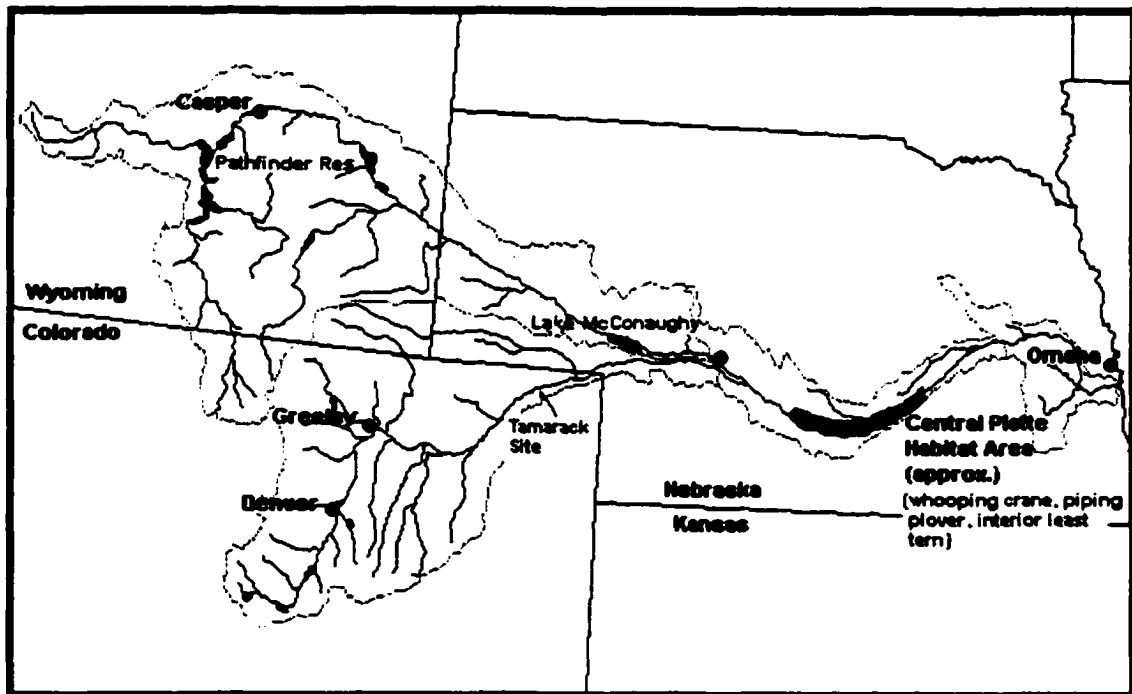


Figure 2
The Platte River Watershed

The South Platte River begins 200 miles south of the North Platte headwaters in the Park Range of central Colorado, near Fairplay. The river joins the North Platte 450 miles downstream, after cascading down narrow canyons in the San Isabel National Forest, flowing through Denver,

picking up additional water along front range creeks including Bear, Clear, Boulder, Cherry, Plum and St. Vrain, and the Big Thompson and Cache la Poudre Rivers.

The Platte River, which means "flat," was named by French fur traders traveling the watercourse, but who perhaps picked up the name by the Indians in the area who called the waters Nibraskier, having a similar meaning. Early settlers said it was, "too shallow to be ferried, too broad to be forded, and the people were too poor to bridge it" (Bartlett, 1984, p. 221). Nevertheless, it served as a major highway for Indians, early explorers and later settlers, and as the route for the first transcontinental telegraph in 1861, the Pony Express, and the Union Pacific Railroad. Today it retains its importance as the nation's premiere east-west transportation corridor containing Interstate 80.

The Platte River flows through a region early American explorers called the Great American Desert. Across this territory lies one of nature's more significant boundaries. In an average year, the 22-inch annual precipitation divide stretches across this area, marking the boundary between the semi-arid region to the west (a scant 14-18 inches of annual precipitation falls along Colorado's front range) and the semi-humid area to the east (about 32 inches of annual precipitation falls near the Platte's confluence with the Missouri River) (Eisel and Aiken, 1997; Jenkins, 1999). Successful high-value crop production requires irrigation when annual precipitation falls below 22 inches. This natural boundary lies about 60 miles east of North Platte, Nebraska near Lexington, roughly parallel to the 100th Meridian.

Because precipitation varies from year to year, the precipitation boundary shifts across the region. Thus, irrigation activities are found east of the 22-inch line to the eastern third of Nebraska. In the irrigation region, irrigated acres will typically produce about one-third more corn than dryland acres. In very dry years, non-irrigated cornfields are devastated (Jenkins, 1999).

With water scare and demands for it high, it is no wonder that the North and South Platte Rivers are arguably some of the most aggressively harnessed rivers in the world. On the North Platte, farmers were using its waters as early as 1889 to irrigate. The first major dam on the North Platte River, Pathfinder Dam in central Wyoming, was completed in 1909. In 1927 a regulatory reservoir was completed at Guernsey, Wyoming and later such reservoirs were

constructed at Lake Alice (1913) and Lake Minnetonka (1915) in Nebraska. Dams began to be constructed for hydroelectric power in the 1930s, with some of the water also used for irrigation. Examples include Kingsley Dam (1941) near Ogallala (the second largest hydraulic fill dam in the world), the Alcova (1938), Seminoe (1939), and Kortes (1951) dams south of Casper, and the Grayrocks Dam (1978) near Wheatland, Wyoming that is located on a major tributary of the North Platte, the Laramie River.

Today, upstream of Lake McConaughy on the North Platte River, there are about 84 storage facilities with the capacity of 4.3 million acre-feet (af), irrigating 721,000 acres (Eisel and Aiken, 1997). In addition, Lake McConaughy, formed by the Kingsley Dam, accounts for about 1.74 million af alone.

In this highly engineered system, water even crosses the continental divide. Transmountain water is imported into the South Platte River Basin from the Colorado River via the Roberts and Moffat tunnels, the Colorado-Big Thompson and Windy Gap projects, and the Grand River Ditch. Water is also imported from the Laramie River Basin and North Park into the Cache la Poudre River and from the Arkansas River through the Homestake Tunnel. Two interstate compacts (The South Platte River Compact and the Republican River Compact) and one U.S. Supreme Court decree (the Laramie River Decree) are part of the South Platte water management landscape.

In all, there are 106 storage facilities holding approximately 2.8 million af of water on the South Platte River (Eisel and Aiken, 1997). These facilities provide water for a population of over two million and for the irrigation of about 1.5 million acres in three states through 10,000 surface water rights and 20,000 groundwater rights (League of Women Voters, 1992, p. 23).

By the time the South Platte River meets the North Platte to form the Platte River, both tributary streams have been put to intensive use. Hydrologists estimate that in some stretches each drop of these waters are used eight times as diverted water returns to the river over and over, via treatment plants, agricultural runoff or through groundwater (Ring, 1999).

The Platte River Basin contains over 15 major dams and is thus considered one of the most highly developed in the world. Over 70% of the flows are diverted for consumptive use.

The Bureau of Reclamation (BOR) constructed the large storage reservoirs in the basin. The storage capacity of the BOR dams is 2.8 million af of the total basin storage capacity of 7.5 million af. This amount is about six times the average annual flow of the Platte River at Grand Island (USFWS, 1977, p. 30). Wyoming accounts for most of the storage (47%), with Colorado and Nebraska splitting the difference (23% each). Despite Wyoming's large capacity, only 25% of that water is used in the state; the remaining flows to irrigators in western Nebraska.

The North, South and Platte Rivers supply municipal and industrial water to about 3.5 million people including the fast-growing Front Range population in Colorado from Fort Collins to Douglas County and to 70% of Nebraska residents.

Agriculturally, these waters supply surface irrigation water to about two million acres in the three states and account for 80% of the consumptive use in the basin east of Grand Island. Cattle and other livestock production are the largest agricultural sector. Most of the corn and other feed grains produced within the basin are utilized for livestock production (Eisel and Aiken, 1997).

For over a century, the increasing human demands drawing upon these life-sustaining waters, have altered river flows, changing the physical properties of the river and its dependent biological components in a myriad of important, but often subtle, ways. Through physical structures and water diversions, humans have altered river flows directly by changing the frequency, magnitude, duration and timing of river stages throughout the year and between natural cycles of wet and dry periods.

For example, under natural conditions there would be two annual high flow events – the February/March pulse as snow melted in the lower elevations of the basin, and the May/June pulse as snow melted in the mountain headwaters. As one can see from the hydrograph in Figure 3, these "spikes" in peak flows have flattened out dramatically since the creation of reservoirs earlier this century.

These large volume water flows would scour the river bottoms of seedlings, preventing shrub and tree growth in the riparian corridor, providing the open roosting habitat preferred by many wildlife species that depend upon this environment such as whooping cranes.

Likewise, the physical blocking of water movement behind large dams and impoundments have greatly decreased the alluvium transported along the river bottom and critical to fishing habitat. The endangered pallid sturgeon, for example, depends upon this loose gravel for spawning.

Thus this was a finely tuned system that had evolved with the unique ebb and flow patterns characteristic of the Platte River. Changes to these water flow patterns have had a profound effect on some of the species most dependent upon this centuries-old riverine system.

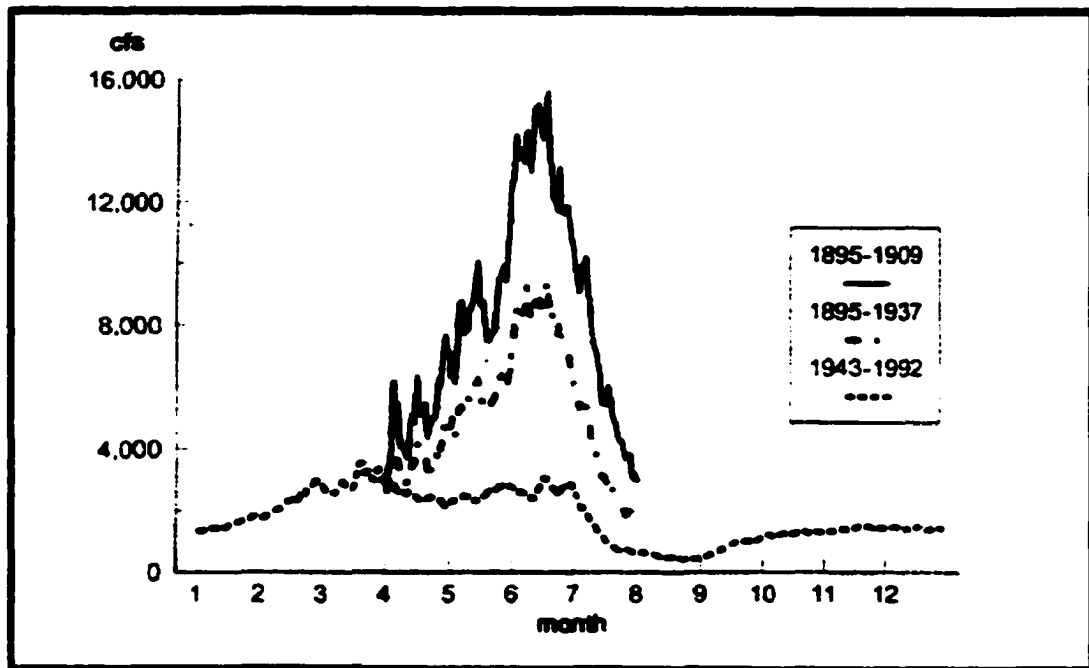


Figure 3
Hydrograph of Late Spring Pulse for the Central Platte River at Duncan, Nebraska

Thus, the alternation of the river caused by the dams and intensive irrigation activities has changed the frequency, magnitude, duration and timing of Platte River water flows over the decades. These actions have set in motion changes in the physical river properties that have changed the roosting, wet meadow, sandbar and fishery habitats of the river. These are summarized in Figure 4. And as the river characteristics changed, so too did the wildlife

dependent upon this riparian habitat. Some wildlife was particularly affected by these changes as will be described in the following section.

INDEPENDENT VARIABLES: Hydrological Changes	<i>Creates</i>	Physical River Properties	<i>Degrades</i>	DEPENDENT VARIABLES: Habitat Response
1. Alteration of Water Flows: a. Frequency b. Magnitude c. Duration d. Timing 2. Physical Blocking of Water Movements	→	<u>DECREASES IN:</u> - channel width - sediment transport - aquifer recharge - backwater flooding - water velocity - wetted surface area - alluvium transport <u>INCREASES IN:</u> - groundwater drainage - water temperature - unnatural depth - depth fluctuations	→	1. Roosting Habitat a. increase of woodlands (willows, cottonwoods) 2. Wet Meadows Habitat a. land leveling b. conversion to agriculture c. drier habitat d. less diverse micro-habitats 3. Sandbar Nesting and Foraging Habitats a. lower sandbars, more easily flooded b. vegetation encroachment c. more vulnerable to predators 4. Fishery Habitat a. warmer temperatures less favorable to native species b. reduction in specialized habitat types (e.g., sloughs, side channels, sandbar edges)

Note. Based on information contained in the Biological Opinion on the Federal Energy Regulatory Commission's Preferred Alternative for the Kingsley Dam Project and North Platte/Keystone Dam Project (USFWS, 1997).

Figure 4

Relationships Between Changes in River Flows and Riparian Habitat Degradation

The Ecological Setting

Besides providing for the physical and economic well being of people who inhabit the Platte River Basin, the river is also the lifeblood of a rich and diverse ecosystem of national and international significance. The river provides a variety of habitat types – forest, prairie, wet meadows, backwaters, sloughs, side channels, shorelines and deep water – creating a diverse

community of plants, invertebrates, shellfish, amphibians, and reptiles, insects, mammals and birds.

Despite this richness, the river is best known for its migratory bird habitat. Over 300 migratory bird species rely on the "Big Bend" stretch of the Platte as an important stopover on the Central Flyway. They depend upon the Big Bend stretch for resting and feeding for several weeks in the spring before migrating to their breeding grounds in the north.

For example, about 80% of the sandhill cranes (*Grus canadensis*) in North America, about 500,000 birds, stop along the river each spring for several weeks on their journey from Texas to Canada, Alaska and northern Siberia (U.S. Fish and Wildlife Service, 1997). At the peak of migration, between March 20 and April 5, over 250,000 cranes may be seen along the river (Lingle, 1994). Nowhere else in the world is there such a concentration of cranes.

Large numbers of waterfowl, estimated between seven to nine million of 38 species, also use this central flyway and stop over to prepare for the breeding season. Here one can find mallard ducks (*Anas platyrhynchos*), Canada geese (*Branta canadensis*) and 90% of the mid-continental population of greater white-fronted geese (*Anser albifrons*).

In recent years this migration has become a significant magnet for bird watchers. In Spring of 1996, between 14,000 and 22,715 birders and general wildlife watchers spent more than a day visiting the Middle Platte River in Nebraska, while another 60,000 single-day tourists traveled to the same area as well. Together it is estimated that these visitors contributed (in direct, indirect, and induced expenditures) between \$25.1 million and \$53 million to the state's economy (Eubanks, Ditton, and Stoll, 1998).

But the small numbers of some bird populations using this habitat is significant too. Bird populations that are few in number, and considered threatened or endangered, find important habitat here. Three species are particularly of interest to this study, the whooping crane, least tern and piping plover.

The Whooping Crane and Designated Critical Habitat

The whooping crane is one of the world's rarest and most adored bird species. Just 340 whooping cranes remain in the world; of these, only 166 birds are in wild, natural flocks (Cannon, 1996). Standing five feet tall, this majestic snow-white bird with a red patch on its head and black-tipped wings stretching seven feet, has captured the public's imagination:

If one had to choose one of the more than 300 species and subspecies of animals currently on the United States endangered species list, to symbolize the endangered species program, it seems probable that the whooping crane (*Grus americana*) would be a prime candidate. Public awareness focuses on this one species, despite the fact that the existence of several others appears more precarious. The whooping cranes' semi-annual travels are newsworthy and its story is dramatic. The whooping crane has become a symbol of international efforts now underway to save endangered wildlife throughout the world (U.S. Fish and Wildlife Service, 1986, p. 1).

Every spring, whooping cranes leave their wintering grounds in the Aransas National Wildlife Refuge on the southeastern Texas coast and begin a 2500-mile northward journey to Wood Buffalo National Park lying astride the border of Alberta and Northwest Territories. En route, they stop along the Platte River to rest, forage and prepare for the remaining journey. Likewise, they depend upon this habitat on the return leg of their migration (see Figure 5).

Unlike many other endangered species, the whooping crane has never been abundant. Allen (1952, p. 83) estimated its numbers in 1860-1870 being between 1300 and 1400 birds. But settlement of the Great Plains and hunting decimated the fragile population. As late as 1955, only 21 individuals existed on the planet, making the species one of the rarest on the planet and the most endangered of the world's 15 crane species (Cannon, 1996; U.S. Fish and Wildlife Service, 1986, p. 5).

In response, this species was listed as "threatened with extinction" by the U.S. Congress in 1967 and as an endangered species in 1970 by the U.S. Fish and Wildlife Service (USFWS). Eight years later the agency designated a 3-mile wide, 56-mile long segment along the Platte River from Lexington to Denman, Nebraska, as "critical habitat" for the species (Cannon, 1996; Federal Register 43[94], pp. 20938-20942) as specified by Section 7 of the Endangered Species Act (see Figure 6). Critical habitat is defined as "...any air, land, or water area...the loss of which

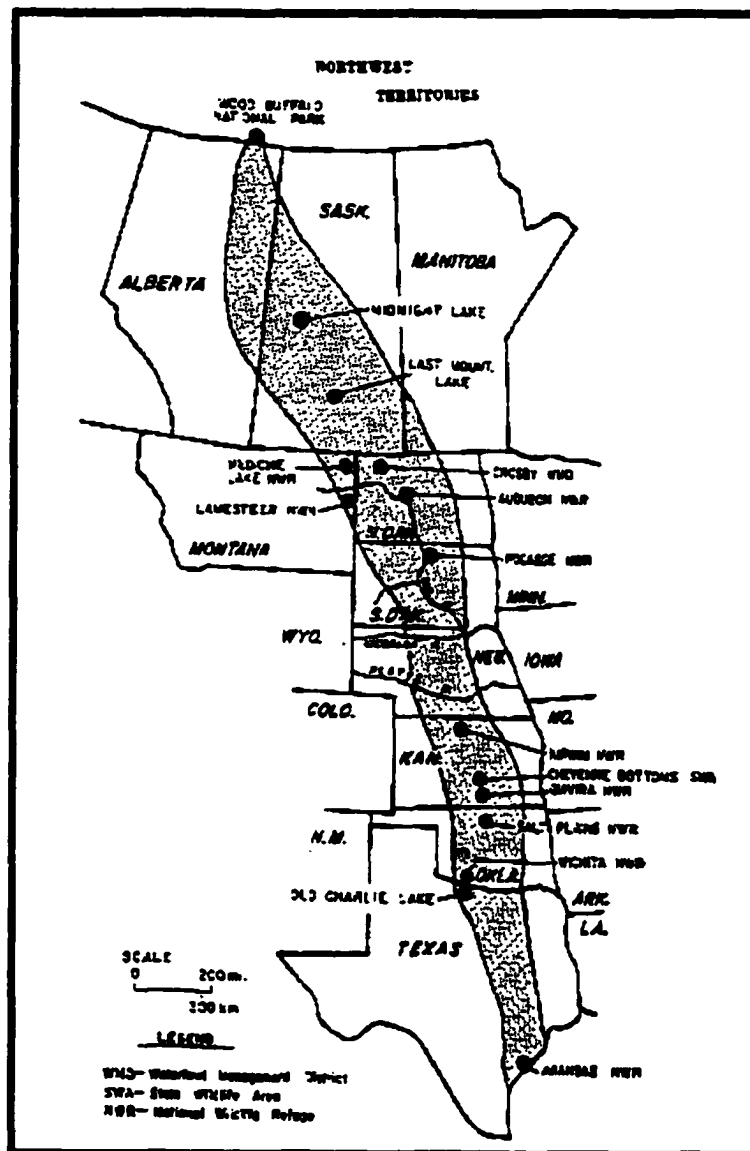


Figure 5

Migration Route of the Whooping Crane

would appreciably decrease the likelihood of the survival and recovery of a listed species...." (Federal Register 43[94], pp. 20938-20942).

The critical habitat portion of the big bend stretch is valuable to whooping cranes for what it supplies these birds: dependable food and water, the required open expanse for nightly roosting and isolation. Whooping cranes are distinctive from many other species in their need to roost in

bodies of water with particular characteristics. An evaluation of 10 known whooping crane riverine roosting sites identified these preferences (U.S. Fish and Wildlife Service, 1981):

- Wide channel (510 to 1200 feet);
- Unvegetated;
- Fine substrate, usually sand;
- Good horizontal visibility unobstructed from riverbank to riverbank at least a few hundred yards upstream and downstream (or to a bend in the river);
- Good overhead visibility, absence of tall trees;
- Shallow water except in the main channel;
- Slow flow, about 1 - 4 miles per hour; and,
- The presence of unvegetated sandbars with very low elevation above water and near the middle of the river.

This favorable habitat combined with a desirable geographical location of the Platte -- about midway between wintering and breeding grounds and in the center of the migration corridor -- makes it a logical place to stop and rest during migration. Many authorities have written about the importance of this stretch of the Platte to the whooping cranes (Allen, 1952; Johnson, 1981; Krapu, 1981; McNulty, 1966; Swenk, 1933).

However, that favorable habitat is changing. Both peak and mean annual discharges of the Platte River have decreased significantly over the years. At the seven locations along the Platte in Nebraska having records indicate that the average peak flow for the period from 1957 - 1970 was about 0.1 to 0.3 of the average yearly peak flows during 1909 - 1927 (see Figure 3).

As a result, the channel characteristics, so critical to whooping cranes, have also changed substantially. From Overton to Grand Island, Nebraska, the channel in 1969 - 1977 was about 0.6 to 0.7 as wide as it was in 1865. Vegetation, including many trees, has become firmly established in the part of the former channel which now is dry (Eschner, Hadley, and Crowley, 1983; Williams, 1978). Woodland expansion along the river corridor began in the South and North Platte rivers around 1900 and spread downstream into the Platte River. By the late 1930s,

vegetation had occupied most of the former channel area of the South and North Platte rivers and by 1986 was pretty uniform throughout the river system (Johnson, 1994).

It is estimated that as much as 97% of optimum crane roosting habitat has been lost in some river segments because of vegetation encroachment (Currier, Lingle, and VanDerwalker, 1985). Scientists attribute these changes to the creation of on-stream reservoirs and the greater consumptive use of river water (Eschner et al., 1983; Williams, 1978).

To improve the status of the whooping crane, the U.S. Fish and Wildlife Service's goal is

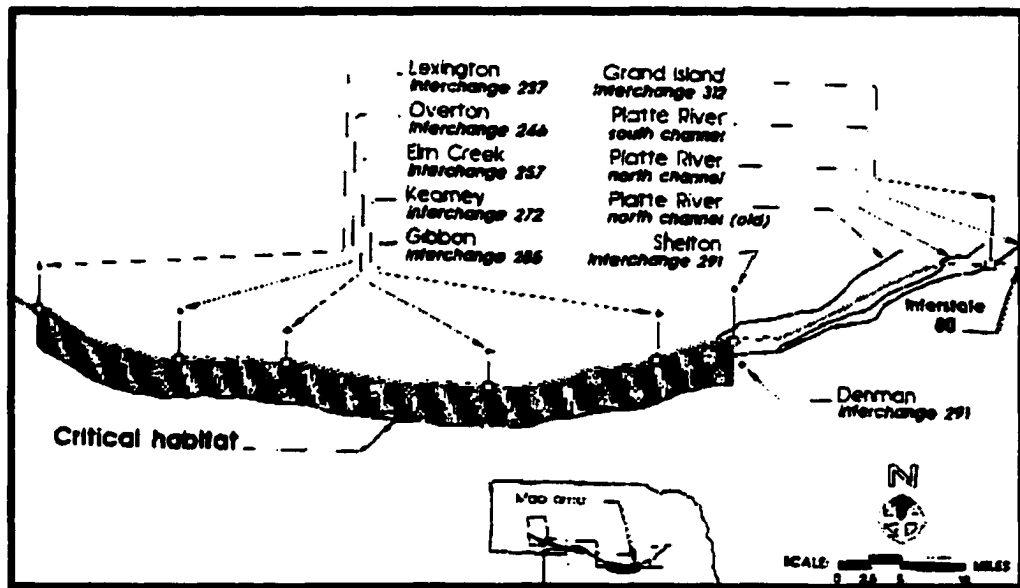


Figure 6

Designated Critical Habitat for the Whooping Crane

to attain a population level of 40 pairs at Wood Buffalo National Park, Canada, and 25 nesting pairs at each of two other sites. If achieved, the crane could be moved from the endangered species list to the threatened list. Criteria for de-listing the species altogether has not been defined (U.S. Fish and Wildlife Service, 1986).

The Interior Least Tern

The second endangered bird species of interest to this study in the Big Bend region is the interior population of the least tern (*Sterna antillarum*). The western explorers, Lewis and Clark, in their expedition up the Missouri River observed that the least terns were observed frequently

and believed them to be a "native of this country and probably a constant resident" (U.S. Fish and Wildlife Service, 1990a, p. 3).

This black-capped, smallish gray and white bird was federally listed as an endangered species on June 27, 1985 (50 Federal Register 21,784-21, 792) in 18 states including Nebraska. Surveys reveal that about 4,800 least terns occur intermittently along interior rivers in only a fraction of their former breeding range that once stretched from Texas to Montana and from eastern Colorado and New Mexico to southern Indiana (see Figure 7). A recovery goal of 7,000 birds has been established (U.S. Fish & Wildlife Service, 1990a).

On the Platte River the interior least tern nests from its mouth at the Missouri River to the North Platte River as far as the shores of lake McConaughy. On the South Platte River it nests as far west as Ogallala, Nebraska. It also breeds on relatively unaltered river systems in Nebraska, including the Loup River, a tributary of the Platte River, and the lower section of the Niobrara River in northern Nebraska. The wintering area of the bird is unknown, however, least terns have been found along the Central America coast and the northern coast of South America to Brazil.

The bird regularly used barren sandbars on the Platte River system as nesting areas. The riverine nesting areas of the least tern are sparsely vegetated sand and gravel bars within a wide, unobstructed river channel. Nesting locations are generally located at higher ports and further from the water's edge because nesting usually begins in May when the river flows are high. The dynamic shifting nature of sandbars kept vegetation at bay. These conditions provided the essential requirements of wide, horizontal visibility, protection from terrestrial predators, isolation from human disturbance, and sufficient protection from natural rises in river levels.

Channelization, irrigation, and the construction of reservoirs have contributed to the elimination of much of the tern's sandbar nesting habitat. River flow regimes differ greatly from historic regimes. High flows may now extend into the normal nesting period. Reduced and stabilized flow has resulted in less shifting of the sandbars, allowing vegetation to encroach along the river. Recreational activities on sandbars cause additional disruption.

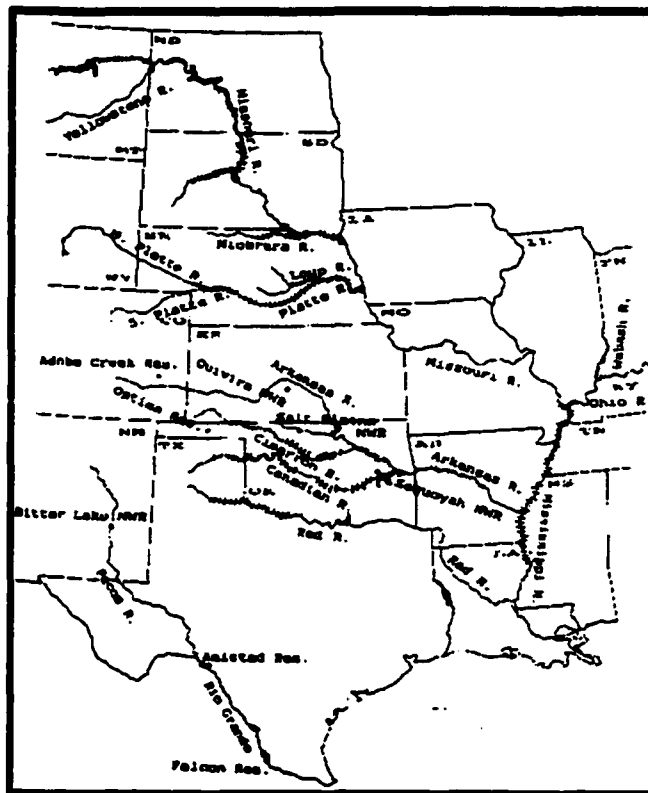


Figure 7
Distribution of the Interior Least Tern

The Piping Plover

The piping plover (*Charadrius melodus*) Great Plains and Atlantic coast populations were federally listed as a threatened species and Great Lakes populations as an endangered species on December 11, 1985 (50 Federal Register 50726-34). A 1991 census estimated 1,616 breeding pairs of the birds in the United States, and another 825 in Canada, for a total of 2,441 breeding pairs. Figure 8 depicts the distribution of plovers from this census. The Great Plains population of this bird extends from southeastern Alberta to northwestern Minnesota and south along the major prairie rivers and reservoirs to southeastern Colorado (U.S. Fish and Wildlife, 1994).

Like the least tern, piping plovers nest on sandbars located mid-stream in wide, open channel beds with less than 25% vegetative cover. Improving reproductive success and protecting and restoring sandbar nesting habitat is the key to the recovery of the bird (U.S. Fish &

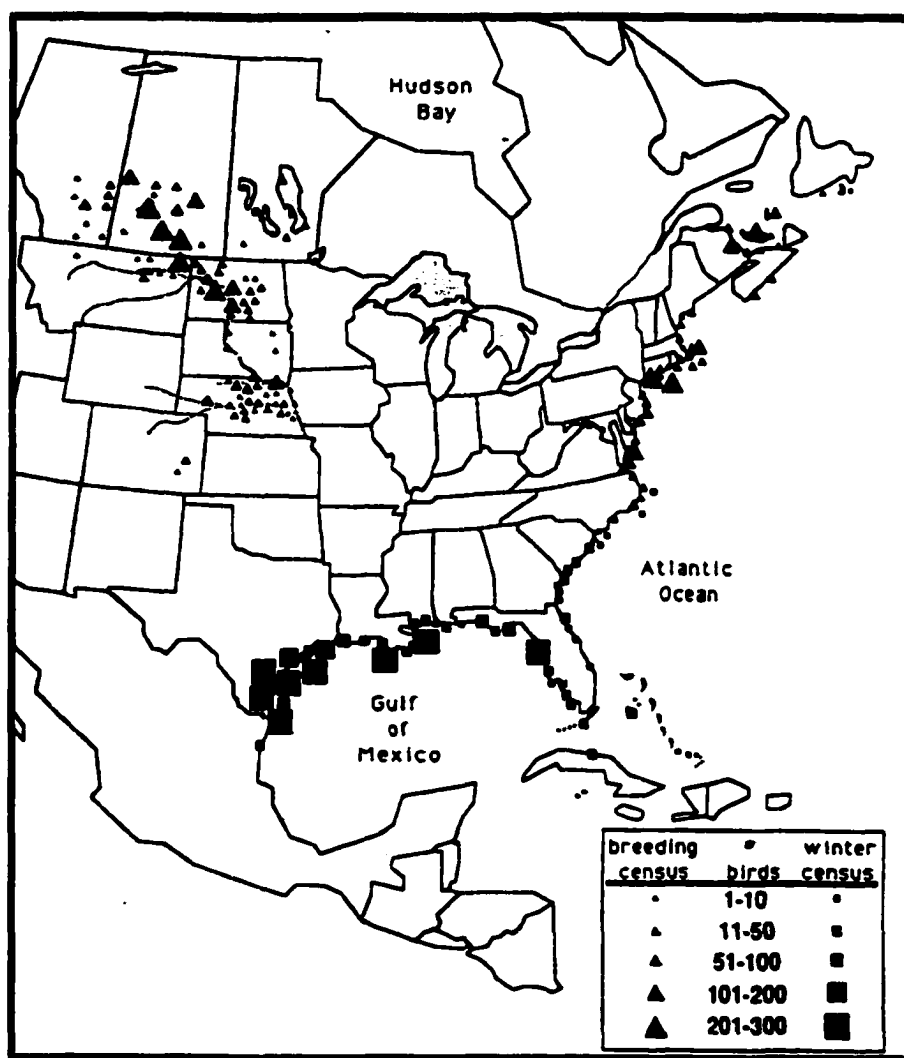


Figure 8
Distribution of Piping Plovers

Wildlife Service, 1997, p. 52). It is believed that this population is declining by 7% annually and it has been recommended for listing as an endangered species.

Similar to the least tern, recovery plans for the piping plover prescribe maintenance of the distribution and range of both species, protection of essential riverine sandbar habitat, and restoration of that nesting habitat (U.S. Fish & Wildlife Service, 1988 and 1990).

The U.S. Fish & Wildlife Service believes that water development on the Platte River system has taken its toll on both these species (U.S. Fish & Wildlife Service, 1997, pp. 55-58).

Reservoir water storage has greatly reduced the high water flows that scoured sandbars reducing vegetation encroachment and widening channels. The reduced water and sediment discharge transformed wide, open channels to multiple narrow channels separated by wooded islands, eliminating much of the sandbar nest habitat. These inadequate flows during the nest incubation and rearing periods from mid to late summer coupled with the extensive vegetation, also allows terrestrial predators access to the nest sites.

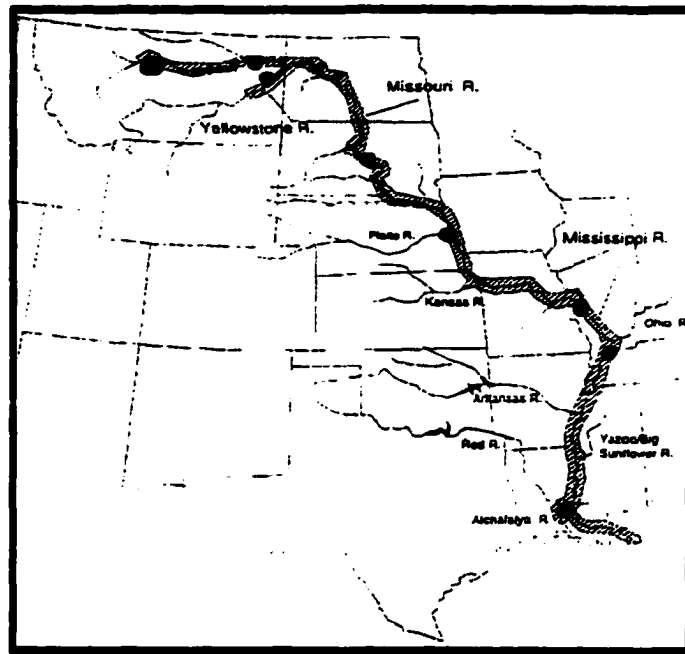
In addition, pulse flows are generally inadequate today to create the higher elevation islands these birds prefer. Low-lying areas are subject to flooding by relatively minor flow surges that frequently occur during the nesting season, drowning nests, eggs or chicks.

Despite these challenges, the U.S. Fish and Wildlife Service's plan for recovery of the species has a goal to increase the population of the birds on the U.S. northern Great Plains to 2,300 breeding pairs. In Nebraska, the goal is to increase the breeding pairs from the 1991 census of 139 to 225 breeding pairs, including 150 pairs on the Platte and North Platte Rivers. If reached, the agency will consider de-listing this population from the threatened species list (U.S. Fish and Wildlife Service, 1994).

The Pallid Sturgeon

The river also harbors an endangered fish. The pallid sturgeon (*Scaphirhynchus albus*), one of the largest and rarest fishes in North America, was federally listed as an endangered species on September 6, 1990 (55 Federal Register 4001). The last reported observation of possible spawning was in 1974, and the species may be close to extinction (U.S. Fish & Wildlife Service, 1997, p. 65). The range of the pallid sturgeon comprises the main stem of the Missouri River, the lower reaches of the Platte, Kansas, and Yellowstone rivers, and the Mississippi River below its confluence with the Missouri River (see Figure 9).

Pallid sturgeon were not identified as a separate species until 1905, consequently, historical data are sparse. However, catch records indicate that the fish was somewhat common as late as the 1950s and 1960s (U.S. Fish & Wildlife Service, 1993).



Note. Large dots indicate occurrences of pallid sturgeon. Shaded areas represent its historic range.

Figure 9
Historic and Current Range of the Pallid Sturgeon

Pallid sturgeon require large, turbid, free-flowing riverine habitat with rocky and sandy substrate. River impoundments have eliminated much of the sediment and debris important to maintaining habitat elements such as snags, sand and gravel bars, backwaters, and pools. Flow alterations may also affect timing of reproduction and food sources.

Of the 3,550 river miles that the pallid sturgeon inhabits, all have been significantly affected by human activities. Humans have impounded about 28% of the fish's historic habitat and channelized 51%. The remaining 21% of the habitat is below dams where water has reduced silt loads, different runoff patterns and colder temperatures, all of which scientists believe are detrimental to the fish (U.S. Fish & Wildlife Service, 1995). According to the U.S. Fish & Wildlife Service (1993, p. 10), it is "unlikely that successfully reproducing populations of pallid sturgeon can be recovered without restring the habitat elements (morphology, hydrology, temperature regime, cover, and sediment/organic matter transport) of the Missouri and Mississippi Rivers necessary for the species continued survival."

The Legal Setting

Key Laws Affecting Platte River Management

The Platte River Basin waters are appropriated to innumerable users as the river flows through Colorado, Wyoming and Nebraska. These appropriations are regulated by complex legal and administrative systems in each state that have evolved over many decades. Recently federal law has come in to play a major role in governing these water resources. This section briefly outlines the key state and federal laws and judicial decisions that have shaped the appropriation of Platte River waters and form the stage on which the socio-political issues central to this study became animated.

Appropriation Doctrine. In the western states where water is scarce and seasonal, the property rights attached to water are determined according to state law. The constitutions of each of the Platte River states provide that ownership of state water resides in the public domain and the state determines how that water can best be allocated for the public good. For these three states, domestic uses have highest priorities—municipalities can condemn the water rights of other users. Agricultural uses come second, followed by manufacturing and mining uses.

These states use the Appropriation Doctrine, which uses three criteria to determine the ownership of water rights and the use of water. A property right can be granted when:

1) the claimant establishes use of water, prior to recognition of any claim, in a manner which the state deems beneficial; 2) priority of use lies in the timing of a claim and not in geographical location (during times of drought a senior water rights holder can use their entire share of water even if this leaves nothing for junior water rights holders), and 3) the water claimed must actually be used for the purposes for which it was acquired, unless approval has been granted for a new use.

The Nebraska Legislature adopted prior appropriation as the state's surface water law in 1895 (Kuzelka, 1993).

Nebraska v. Wyoming. The dust bowl years of the 1930s are infamous for the severe drought that occurred in the West. In 1934 the dry spell was particularly harsh and Wyoming

water users held back as much water as possible, leaving little for downstream Nebraska irrigators.

Nebraska demanded their fair share of the river water, arguing that the North Platte River water should be appropriated on the "first-in-time, first-in-right" basis as if state lines did not exist. Therefore, they argued that Nebraska water users with senior rights should get the river's water before rights more junior in Wyoming were honored.

The case went to the U.S. Supreme Court in 1934. In 1945 the Court ruled requiring Wyoming to allow 75% of the river water flow to Nebraska during the irrigation season.

But the issue was not settled. In 1986, Nebraska again filed suit against Wyoming over the latter's plans to construct a dam and reservoir on Deer Creek, a North Platte River tributary. Wyoming claimed the project was exempt from the decree because they planned to use the stored water for municipal, not irrigation, purposes. In addition, Nebraska also contends that it is entitled to 75% of the Laramie River flows, another North Platte tributary, which Wyoming asserts was not regulated by the 1945 decree and therefore Wyoming can legally use as much of its waters as they chose for irrigation. The case is now before the Supreme Court.

The National Environmental Policy Act (NEPA). This 1970 legislation mandates that environmental impact studies be conducted for any federal action likely to have a significant effect on the environment. This study is done through an environmental analysis with full public participation throughout its development. NEPA requires that all environmental impacts be analyzed prior to a decision on the project. Negative impacts associated with the project do not necessarily halt the proposed action, but may set the stage for challenges in court.

The Endangered Species Act (ESA). Recognizing that endangered species of wildlife, fish and plants "...are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people..." (P.L. 93-205, 87 Stat., p. 884), Congress passed this legislation in 1973 with the goal of protecting and recovering all imperiled species in this country (16 U.S.C. 1531 et seq.).

Section 4 of the ESA provides for the identification of species in danger of extinction throughout all or a significant portion of their range ("endangered"), or likely to become endangered within the foreseeable future ("threatened"). This section also provides for the designation of "critical habitat" to protect geographical areas essential to a species conservation and requiring special management or protection.

Of tremendous significance to this study is the ESA's intent to affect institutional behavior. Section 7 is entitled "Interagency Cooperation" which requires federal agencies "to insure that any action authorized, funded, or carried out" by a federal agency does not jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary of Interior to be critical.

To ensure compliance with this mandate, 1978 Amendments to the Act and subsequent regulations formalized the consultation process called for in Section 7. This process requires federal agencies to consult with the Fish and Wildlife Service (FWS) or National Marine Fisheries Service on actions that may affect listed species or critical habitat. If the determination is made that the proposed action is likely to adversely affect a listed species or critical habitat, the FWS must then render a "biological opinion" as to whether the proposed activity is or is not likely to jeopardize either of these. If a "negative" biological opinion is rendered, reasonable and prudent alternatives must be suggested that will avoid the likelihood of jeopardizing listed species and/or their habitat. These alternatives must be economically and technologically feasible and are commonly the product of interagency negotiations.

The 1978 amendments also established an exemption process whereby federal actions of overriding importance could be permitted to go forward in spite of a jeopardy decision. Under specified circumstances, the Endangered Species Committee, a seven member body composed of senior governmental officials and an appointed state representative, may grant an exemption if at least five of its members find that the specified conditions warrant such action. This procedure has been utilized only twice: To approve the proposed Tellico Dam in Tennessee and Graylocks Dam on the North Platte River (MacDonnell, 1985).

In regards to water projects, the USFWS' position is that any water project having federal involvement or control (e.g., a new project in need of authorization or existing project requiring permit renewal) would need to obtain from the USFWS a biological opinion. If that opinion were to conclude that the project would put a species in jeopardy¹ then a "reasonable and prudent alternative" must be devised before the requested agency action may be granted.

The Institutional Setting

Key Organizations Affecting Platte River Water Management

In a water regime as large and complex as the Platte River System, there is a correspondingly large and complex network of institutions. These organizations cover the spectrum from government and quasi-government bodies to privately owned corporations. A summary comparison of key organizations will be useful in better understanding the regime that manages Platte River water and its water related resources.

The Bureau of Reclamation (BOR). As good farmland in the Midwest became scarce at the turn of the century, Congress responded by passing the Reclamation Act of 1902. Its purpose was to reclaim arid lands in the 17 western states to help satisfy the dream of those who hoped to farm their own land. This mission has been accomplished by the development of a system of works for the storage, diversion, and development of water. In the West, the BOR is the principle federal water supply agency where it operates 355 storage reservoirs and 254 diversion dams, and provides water to about 10 million acres of land. It is the nation's largest water wholesaler and second largest producer of hydroelectric energy.

In the region of interest to this study, the Bureau manages projects on both the North and South Platte Rivers, but its operations end just before Lake McConaughy near where the two rivers meet.

¹defined as, "to engage in an activity or program which reasonably would be expected to reduce the reproduction, numbers, or distribution of a listed species to such an extent as to appreciably reduce the likelihood of the survival and recovery of that species in the wild..." (50 CFR 402.02)

On the North Platte River, the BOR has built eight dams that provide over 1.1 million af of storage capacity. Ninety percent of this capacity is in the Pathfinder Reservoir, which when completed in 1909 was the world's largest reservoir. This water is used to irrigate over 100,000 acres of land in eastern Wyoming and the Nebraska Panhandle which produce sugar beets, beans, corn and alfalfa hay (U.S. Bureau of Reclamation, n.d.).

An additional seven other dams on the river provide additional irrigation acreage, hydropower production via six power plants on the North Platte, flood control, recreation, and habitat for fish and wildlife.

Efforts to alter BOR's single-minded mission of supplying low cost irrigation water have spanned half a century (Moore and Willey, 1991). But it was the fiscal conservatism of the Reagan administration, removing financial subsidies and political privileges, which caused the agency to re-evaluate its mission. In 1987, BOR announced its new purpose, one of management and maintenance of existing projects, rather than constructing new ones. Reclamation is now shifting its emphasis from development of structural systems to resource management and more effective use of existing facilities. Nonstructural (organizational, ecological) means of meeting future water and power needs is now being emphasized.

U.S. Fish and Wildlife Service (USFWS) is the lead federal agency in the conservation of the nation's migratory birds, threatened and endangered species, and sport fishes. Their responsibilities include the listing and recovery actions for endangered species, the management of national wildlife refuges and fish hatcheries, management of migratory birds, and conservation of wetlands. They enforce federal wildlife laws such as the Lacey Act, the Migratory Bird Treaty Act and the ESA. Critical to this study, FWS is mandated by the ESA to conduct a biological review of any federal action that could impair threatened or endangered species and require alternatives to the action if these species or their habitat may be negatively impacted.

The FWS has long been interested in protecting habitat along the Platte River. In 1974 the FWS announced its plan to establish a 15,000-acre national wildlife refuge on the Platte River's Shoemaker Island southwest of Grand Island, Nebraska (Farrar, 1991). However, the

proposal caught the public by surprise and local landowner, fearing condemnation of their lands, were vocal in their opposition. The proposal was withdrawn.

U.S. Forest Service administers National Forests and National Grasslands and is responsible for the management of these resources. It is involved in watershed management on lands that it owns. These lands include the headwaters of the South Platte and North Platte Rivers and their tributaries.

Federal Energy Regulatory Commission (FERC). The Congress established the Federal Power Commission (now the Federal Energy Regulatory Commission) in 1920 to allow private development of hydropower facilities to maximize waterpower development (Act of June 10, 1920, ch. 285, 41 Stat. 1063). It required all such proposed facilities to obtain a license from FERC, typically valid for 30- to 50-years, and demonstrate that the proposed project would promote comprehensive development of the river on which it is located (16 U.S.C. 797(e); 16 U.S.C. 803 (a)).

In 1986, Congress directed FERC to not only weigh the development aspects of the project in its licensing decision, but to also give equal consideration to fish, wildlife, recreation and other uses (P.L. 99-495, 16 U.S.C. 803(a)). To accomplish this directive, FERC is required to consult with federal, state, and local resource agencies in its licensing process and to include federal and state fish and wildlife agency recommendations in a license unless it finds such suggestions inconsistent with the purposes of the Federal Power Act.

In addition, under section 10(j) of the Federal Power Act, FERC is required to include conditions that adequately and equitably protect, mitigate damages to, and enhance fish and wildlife, based on the recommendations of the USFWS and state fish and wildlife agencies. FERC is housed in the Department of Energy.

State Engineer Office. In Colorado, water management is administered by the Water Resources Division of the Department of Natural Resources. The State Engineer is the key administrative officer for managing the use and distribution of water. This position is responsible for estimating water supplies, documenting all river flows in the state, regulating all ditch and reservoir diversions, and for overseeing fulfillment of compact requirements. The state engineer

also regulates the 25,000 groundwater wells in the state (Vranesh, 1989: 53). Administrative duties are subdivided over seven geographic regions, one for each major watershed in the state. A division engineer heads each.

Denver Water. As Colorado's oldest and largest water utility, Denver Water serves more than half the people in the Denver metropolitan area, largely relying on water from the South Platte River and its tributaries. The utility was created in 1918 when Denver citizens voted to purchase the Denver Union Water Company for \$14 million. Following the purchase, the Denver City Charter was amended to create a Board of Water Commissioners.

Working to separate the utility from the politics of City Hall, Denver Water is guided by a five member Board of Water Commissioners appointed by the Denver Mayor to staggered six-year terms. Its sole purposed is to ensure a continuous supply of water to Denver's citizens and its suburban customers. The Water Board appoints the Manager of Denver, who is responsible for day-to-day operations.

Today, Denver Water serves everyone in the City and County of Denver and almost 40% of those people living in the suburbs. The utility's watershed covers about 3,100 square miles on the east and west slopes of the Continental Divide. The South Platte River and its tributaries provide 49% of the utility's average annual water supply, with four reservoirs on the main river. Another 23 percent is delivered through the 23-mile long Roberts Tunnel which transports water from Dillon Reservoir under the Continental Divide spilling it into the North Fork of the South Platte River. The remaining 28% of water comes from the Williams Fork and Fraser rivers also on the Western Slope through the Gumlick, Vasquez and Moffat tunnels to Gross and Raiston reservoirs on tributaries to the South Platte near Boulder, Colorado. This water collection system provides a minimum of 315,000 af of water each year.

Northern Colorado Water Conservancy District. Districts are of many different types, but all are chartered under state law to manage specific water resources. Irrigation, water and water conservancy districts are common as are several types of special districts such as those concerned with wastewater treatment, groundwater, or drainage. They can be distinguished by their purpose. Irrigation districts, for example, serve irrigators while water districts might also

serve municipalities and industries. Regardless, districts are formed by local vote and governed by elected boards to serve specified geographic areas. Their purpose, authorities and funding powers, including power to impose taxes, user fees, or access property tax revenues, are defined under their charter.

One of the key districts involved in managing South Platte River water is the Northern Colorado Water Conservancy District (NCWCD) whose boundaries stretch along the Colorado's front range from Boulder to Fort Collins and east along the South Platte River to the Nebraska border. A brief history of NCWCD illustrates their management of South Platte River water.

Irrigators in the 1930s proposed a transmountain diversion to bring surplus water from Colorado's western slope to the water-deficient eastern slope. This project was to become known as the Colorado-Big Thompson project (C-BT project). Short on expertise and funds for the complex project yet wishing to retain local control, irrigation interests got BOR to undertake the project. This agency required formation of a water conservancy district as a project partner.

In 1937 the Colorado legislature passed the Colorado Water Conservancy Act allowing for creation of such quasi-municipal corporations with power to levy taxes, enter into repayment and water delivery contracts and operate and maintain the system. Residents within the district voted to create the NCWCD that, as a governmental body, would distribute the water and reimburse the federal government for half of the project's cost.

Today the NCWCD distributes on average 236,000 af of water to five irrigation companies, nine municipalities, 17 rural domestic water systems and a number of subdivisions and corporations who own units of this water (Maass and Anderson, 1986: 292). It is governed by a 12-member board of directors appointed by the presiding judges of district water courts in the region.

The Central Nebraska Public Power and Irrigation District (CNPPID) and the Nebraska Public Power District (NPPD). Early settlers in Nebraska, particularly those in the far west, learned that raising crops in dry years was not possible without irrigation. Ranchers constructed the state's first irrigation project in the late 1870s on a tributary of Lodgepole Creek

near Sydney (Eckert, 1993). By the late 1880s irrigation canal systems were so numerous in this region that the Platte would dry up in the summer.

In the early 1900s as settlement continued, several people in central Nebraska began to discuss their need for reliable water, recognizing that senior water rights were held by those upriver. Charles McConaughy, mayor of Holdrege realized the opportunity in the spring floodwaters racing down the Platte and proposed in 1913 that a diversion canal be constructed to bring water onto central Nebraska's farmlands. After years of persistence, McConaughy and others including George Kingsley, created the Tri-County Irrigation District, which eventually became CNPPID. After numerous legal battles to gain priority and appropriation rights to water that would be dammed and diverted, 50-year hydropower licenses for Kingsley Dam and its related facilities were issued in 1937 to CNPPID and NPPD.

The two coordinated projects consist of a series of dams, reservoirs, canals and power plants, stretching 170 miles on and adjacent to the North and South Platte Rivers and the Platte River. The major storage facility is Lake McConaughy, averaging 1.7 million af of water storage, created behind Kingsley Dam on the North Platte River. CNPPID holds most of the rights to this water, although NPPD has a right to 125,000 af. Although the projects are licensed for hydropower, the primary purpose of the projects is to satisfy irrigation needs of the farmers on 215,000 acres of highly productive farmland in central Nebraska. The hydropower revenues subsidize the irrigation operations. Project canals are used to transport water to the hydropower facilities on the canals and to 14 irrigation canals for delivery to irrigation users with contracts for storage water. There are several contracts between the two companies dictating power production, irrigation and the sale of hydropower between them.

Nebraska Department of Natural Resources. This state agency has five main functions: 1) to administer/regulate surface water resources in accordance with the prior appropriation doctrine, 2) register groundwater wells and issue certain groundwater permits, 3) review and approve dam designs and inspect dams, 4) measure water flow in streams, canals and reservoirs, and 5) to assist in policy matters, interstate decrees and compacts.

Nebraska Natural Resources Commission. This state agency's responsibilities are to conduct state water plans, manage flood plain programs and a natural resources data bank, administer six water funds, and complete certain survey and photogrammetry tasks. The Commission consists of 16 members, 13 who represent river basins and are elected by the caucuses of Natural Resources District Directors, and three who are appointed by the Governor with legislative approval. The three represent municipal water users, surface water irrigator, and groundwater irrigators. The director is also appointed by the Governor.

Nebraska Natural Resources Districts. For 100 years after Nebraska joined the Union in 1867, its Legislature often responded to natural resource issues by creating a special purpose governmental unit to deal with the issue, but often without sufficient funding or mandate to provide effective solutions. Thus, for example, irrigation districts were created in 1895, drainage districts in 1905, soil conservation districts in 1937, watershed districts in 1959, rural water districts in 1967, along with a host of advisory boards, reclamation districts and sanitary drainage districts. So fragmented was its approach to natural resource management, that by the late 1960s, the state had over 500 such special purpose districts with overlapping authorities and boundaries and duplicative responsibilities.

In 1969, the Legislature approved plans to reorganize these myriad of entities into natural resource districts (NRDs) charged with the responsibility to develop facilities and programs to manage, protect and develop the state's natural resources. In 1972, 24 NRDs began operations.

These local governmental units are unique to Nebraska, and pride themselves with providing local control and local solutions in responding to natural resource challenges. Elected boards of directors govern districts and represent specified sub-districts. The majority of their funding comes from local property taxes. NRDs can regulate how much water a landowner uses, the amount and timing of fertilizer application, conservation measures, the quantity and quality of groundwater. They can also sponsor water development projects, provide wildlife habitat and education programs.

Because NRDs are organized around watershed boundaries, one NRD, the Central Platte based in Grand Island, has responsibilities for the Big Bend segment of the Platte River – the site of the federally-designated critical habitat for whooping cranes and the focus of this study.

Platte River Whooping Crane Habitat Maintenance Trust, Inc. The Platte River Whooping Crane Habitat Maintenance Trust (the “Trust”) is a private, non-profit organization dedicated to the preservation of whooping cranes, sandhill cranes and other migratory birds and their habitat in the 80-mile Big Bend reach of the Platte River in central Nebraska. It is based 20 miles southwest of Grand Island on the Platte River near Wood River, Nebraska.

The mission of the Trust is “...to protect and maintain the physical, hydrological, and biological integrity of the Big Bend area so that it may continue to function as a life-supporting system for the Whooping Crane and other migratory species which utilize it” (Platte River Whooping Crane Habitat Maintenance Trust, n.d.). In order to fulfill this charge the Trust conducts research, acquires land and water rights, manages and protects habitat, conducts litigation to protect these resources and conducts research related to migratory birds and their needs.

The origins of Trust date back to the first endangered species – Platte River development clash in the late 1970s. At that time, the Missouri Basin Power Project proposed construction of Grayrocks Dam on the Laramie River, a Wyoming tributary to the North Platte River for hydropower production. The project was owned jointly by Basin Electric Power Cooperative, Tri-State Generation and Transmission Association, Heartland Consumers Power District, Western Minnesota Municipal Power Agency, the Lincoln (Nebraska) Electric System, and the Wyoming Municipal Power Agency.

The State of Nebraska and the National Wildlife Federation objected to the Grayrocks Dam in federal court. They claimed that diversion of water from the Laramie River would jeopardize irrigation and wildlife habitat in Nebraska. As a result of these claims, the court issued an injunction against the project to prevent dam construction.

Negotiations between the parties resulted in a 1978 court-approved settlement creating the Trust, satisfying requirements of the Endangered Species Act, and allowing the Grayrocks project to proceed. As part of the agreement, the Missouri Basin Power Project funded the Trust

with a one-time payment of \$7.5 million. The Trust is administered by three Trustees – one named by each party to the settlement (i.e., the National Wildlife Federation, State of Nebraska, and the Missouri Basin Power Project.

With these funds, the Trust has acquired 9,198 acres of Platte River habitat, including 20 miles of river channel (Platte River Whooping Crane Maintenance Trust, n.d.). The Trust has protected habitat in eight of the eleven river segments between Overton and Grand Island. It is active in litigation and administrative actions to protect habitat, filing lawsuits in the decade-long controversy over the relicensing of Kingsley Dam by the Federal Energy Regulatory Commission, as well as the dispute between Nebraska and Wyoming over North Platte River flows and water rights issues within the Platte River Basin.

National Audubon Society. The National Audubon Society was officially incorporated in 1905 in New York with the single purpose of stopping the slaughter of birds for the millinery trade. Successful in that campaign, it increasingly grew to become an advocate for wild birds. Today the mission of the 550,000-member National Audubon Society and its 300 employees is to conserve and restore natural ecosystems, focusing on birds and other wildlife for the benefit of humanity and the earth's biological diversity. The Society lobbies for federal and state protection of critical wildlife areas, but has also assembled its own system of 100 sanctuaries.

Audubon's interest in protecting crane habitat along the Platte River began in the 1940s when their director of sanctuaries, Robert Porter Allen, came to the area and some of the early scientific studies on whooping cranes.

This interest became more substantial when, in the early 1970s, the USFWS withdrew their proposal to establish a refuge on a site along the Platte River of importance to cranes after strong public opposition from landowners' fears that federal officials could condemn their properties. In 1973 Audubon followed up on the initiative when it purchased 782 acres of pristine crane habitat along the Platte River east of Kearney, Nebraska and named the property the Lillian Rowe Sanctuary after its benefactor. Additional acreage has been purchased since then and cooperative agreements have been secured with several neighbors to extend protection of a six-mile stretch of river to migratory birds.

With a rash of new water diversion and impoundment projects proposed in the 1970s and 1980s, the Society became increasingly involved in legal action to protect the riparian habitat. Audubon was particularly active, with the Whooping Crane Trust, in the re-licensing of Kingsley Dam throughout the 1980s and became a key environmental force in the three state cooperative agreement that is the focus of this study. Today, restoration of water flows to enhance wildlife of the Platte River system is one of eight major campaigns the Society continues to wage.

Environmental Defense Fund (EDF). EDF was founded in 1967 by volunteer conservationists on Long Island to ban the use of the pesticide DDT. Today it has a staff of 170 people, including more than 75 scientists, economists, and attorneys. It has grown to more than 300,000 members and a \$27.8 million annual budget. EDF has become a leading advocate of economic incentives as an approach to solving environmental problems on the regional, national and international fronts.

Mutual Companies. Mutual companies and irrigation ditch companies have many of the same purposes and characteristics as irrigation districts, but mutuals are private, non-profit entities of more limited scope with no taxing powers. Organized under state laws, their mission is to construct, operate and maintain water supply facilities for the single purpose of delivering water to the local water user, usually a rancher or farmers. As such, they typically have little expertise or interest in dealing with issues beyond local irrigation and are free of bureaucracy.

Mutual companies have their origins in Spain centuries ago in organizations known as huertas. The model was brought to the western states from the Old World by those early pioneers who settled in the arid Spanish-claimed territories. Huertas are intensively irrigated areas adjacent to towns. These resource regimes are managed democratically by those who use the water provided. Typically these institutions enjoy local autonomy to develop their rules, rights, social choice and compliance mechanisms in assemblies that meet periodically to conduct the business at hand (Maass and Anderson, 1986). Many have been in existence for over 700 years.

In Colorado farmers obtain water use rights by owning company stock. Farmers' quantity of water received is based on the number of stock shares they own which are independent of the irrigated land acreage they possess. Operation and maintenance of the system is funded by

assessments proportional to the quantity of stock owned. Likewise, voting for the company directors and major policy decisions is on a one vote per share of stock basis.

The amount of water a mutual company receives is dependent on its earlier claim to water. Colorado follows the prior appropriation doctrine of water rights: Those irrigation organizations that claimed the water first are first in rights to the amount claimed. Later claimants will receive water as availability permits. By early 1900 most of the surface water in eastern Colorado was appropriated.

Local Governmental Organizations. Numerous governmental bodies have interest in local water allocation and management decisions. City and county agencies are engaged in economic development decisions. Besides their share of the C-BT waters many municipalities receive in northeastern Colorado, some also have rights to waters stored in nearby reservoirs.

Other Private Entities. Numerous private organizations exist which may have an influence on water resource management, including land and water trusts, businesses, and environmental and agricultural groups. All are governed by boards of directors selected either by membership vote or by their shareholders. As such, each has its specific water interest to pursue as influenced by their members/shareholders.

The actions of each of these entities have a measurable impact on water flows that leave Colorado or Wyoming and enter Nebraska. This flow, in turn, has an impact on the riparian habitat of Platte River and the species dependent upon this habitat. With so many entities involved in managing the water for their own self-seeking purposes, the social dilemma of the commons arises: How does each entity restrain their water consumption for the benefit of the water-dependent ecosystem? This dilemma is exemplified in a current CPR controversy explained below.

Politics and the Process of Preservation on the Platte

It is against this backdrop of ecology, hydrology, economics, institutions, and law that the socio-political components of this drama came into play. This section will provide a chronological portrait of the events and dynamics that led to the historic signing of the three-state cooperative agreement in 1997, the subject of analysis in this dissertation.

From the Reclamation Act of 1902 continuing with the Public Works Administration projects of the Depression Era, and including passage of the Flood Control Act of 1944, the federal government could be looked to for providing funding for irrigation as a means to boost regional economies which trailed other parts of the nation.

During the same period, wildlife values were quite different than today. Wildlife protection efforts were primarily focused on the harm caused by poaching. That focus began to change in the 1960s to a concern for habitat preservation. Congress, in a reflection of society's values in the 1970s, began to require consideration for habitat protection through the National Environmental Policy Act of 1969 (NEPA), in the Endangered Species Act (ESA) passed in 1973 and in the Federal Power Act.

Participants in this study differed on when this story begins. Their chosen starting points generally coincided with the entry point of their involvement in shaping Platte River management. However, nearly all interviewed chose one of three pivotal events to begin the story – the Grayrocks Dam, the Narrows Dam, or the Two-Forks Dam. Since the Grayrocks Dam project was the earliest of the three, we begin there.

The Grayrocks Dam project began in the 1970s when the Missouri Basin Power Project proposed construction of the Grayrocks Dam on the Laramie River in southeastern Wyoming, a tributary of the North Platte River. Its purpose was to provide cooling water for an electrical plant on the river. The Rural Electrification Administration granted a loan guarantee and the Army Corps of Engineers (COE) issued a construction permit for this power dam. The State of Nebraska and the National Wildlife Federation countered with a lawsuit alleging that the two federal agencies had failed to comply with the ESA and NEPA claiming diversion of Laramie River water would jeopardize irrigation and wildlife habitat in Nebraska. This was the first time the ESA was applied to the Platte River.

The ESA was new and agencies were attempting to determine precisely what it required them to do. The COE argued that they did not have to consult under Section 7 of the ESA because the potential effects of the Grayrocks Dam on endangered species were too far downstream.

The federal court, however, ruled in favor of the plaintiffs, issuing an injunction against dam construction. Negotiations between the parties resulted in an agreement in 1978 whereby the Missouri Basin Power Project agreed to limit their water use, provide water releases at specified times and make a one-time payment of \$7.5 million for a trust fund for whooping crane habitat. The settlement was approved by the "God Squad", a federal committee permitted to exempt projects from the requirements of the ESA. The committee met for the first time to consider this issue and the Tellico Dam in Tennessee, held up by the endangered snail darter. It would not meet again until the early 1990s when the endangered spotted owl issue triggered their involvement.

At the same time the Grayrocks issue was being debated, another shot was fired across the bow of water development interests. The Narrows Dam had been proposed as a multi-purpose project providing irrigation water, flood control and recreation on the South Platte River in northeastern Colorado. It would be constructed by the Bureau of Reclamation, designed as a unit of the Pick-Sloan Missouri Basin program. Once again, concerns with the project centered around reduced stream flows on the Platte River that would further endanger downstream whooping crane habitat (Larsen, 1978).

As a result of those environmental concerns, Interior Secretary Cecil Andrus announced in July of 1978 the Carter Administration's opposition for further funding of the \$162 million project. The Narrows Dam had been included on the original Carter administration "hit" list against continued water project construction in March of 1977, but final decisions were deferred until the project was restudied. With this announcement, the project effectively came to an end.

In the next decade, a number of smaller proposed dam projects in the Platte River Basin were to face similar fates for similar reasons: Wildcat Reservoir in Colorado, Deer Creek in Wyoming, and Nebraska's Catherland project. Clearly, the federal government, as a reflection of society, viewed water development projects quite differently in the second half of this century compared to the first half.

This fact of the changing political landscape surrounding water development and recognition that there needed to be more coordinated management for the Platte River Basin led

to the signing of a Memorandum between the Bureau of Reclamation and the USFWS to establish a Platte River Management Joint Study. In 1984, water users and environmentalists from Colorado, Wyoming and Nebraska joined the study team and together became known as the Platte River Coordinating Committee. Specific recommendations by the Committee proved elusive, but future events would again prove the need.

The last proposed water development project of the century in the Platte River Basin to see its demise was Colorado's Two Forks Dam. For more than 60 years, the Denver Water Department had planned to build a dam at the confluence of the South Platte River and its major tributary, the North Fork, about 25 miles from downtown Denver. The department's water rights for the location dates back to 1902 and the dam construction right-of-way was granted by the U.S. Forest Service in 1931 (Luecke, 1990). By the 1970s the project envisioned would store more than 1.1 million acre-feet of water, much of it diverted from the Colorado River, to deliver 98,000 acre-feet of water per year to 41 cities and utilities in the Denver area.

But, with history repeating itself, the project was not to be. In March of 1989, after more than a decade of legal wrangling over the project, U.S. Environmental Protection Agency administrator William Reilly announced his agency's veto of the project under provisions of the Clean Water Act. Downstream endangered species concerns played a major role in the decision (Hilliard, 1989).

With the termination of Two Forks, possibly the last chapter of the big water development plans and projects in the West came to an end. Yet, even as this last new dam proposal began to falter, existing dams throughout the South Platte River Basin became the focal point over familiar concerns: the whooping cranes and other endangered species downstream along the Platte. This conflict of desires drew widespread media attention (see Figure 10).

The first hint of this new challenge to Platte River water projects was an issue arising over Nebraska's mighty Kingsley Dam, the second largest earthen dam in the world. It holds back two million acre feet of water known as Lake McConaughy, the largest reservoir on the river, providing 250,000 af of water annually to farms and hydropower generators (Kuzelka, 1993; Ring, 1999).

Two original 50-year hydropower licenses for Kingsley Dam, issued to Central Nebraska Public Power and Irrigation District and the Nebraska Public Power District expired June 29 and July 30, 1987. The year before, in 1986, Congress amended the Federal Power Act to require the Federal Energy and Regulatory Commission (FERC) to consider equally in all licensing and re-licensing decisions wildlife habitat enhancement equally with power production and irrigation.

This new law made re-licensing the Kingsley Dam more complicated than before. Disagreements over the interpretation of the law delayed a re-licensing decision. The projects began operating on a year-by-year license renewal after 1987. Due to litigation by the environmental groups and farmers, FERC had ordered interim habitat protection measures including provision for instream flows, but later issued a stay on the flow requirements. When FERC then issued a draft Environmental Impact Statement in 1992 for the project, it met with severe and extensive criticism, including from Interior and the need for major revisions was obvious.

As scientific river studies, lawsuits and arbitration delayed the Kingsley re-licensing process, far up river in Colorado, six reservoirs for front range municipalities came up for renewal. Once again, federal action was required, triggering the ESA.

In 1991 the cities of Boulder, Fort Collins, Greeley and Loveland, and the Public Service Company and the Water Supply and Storage Company were informed by the Arapaho-Roosevelt National Forest that the previously-routine renewal of special use permits for their existing water supply facilities on U.S. Forest Service (USFS) lands would now be required to allow some otherwise-stored water bypass the facilities in order to protect downstream habitat. The USFS claimed that the Federal Land Management and Policy Act of 1976 gave it this authority in order to fulfill the forest's management plan, which included a goal of preserving at least 40% of the forest's potential aquatic habitat.

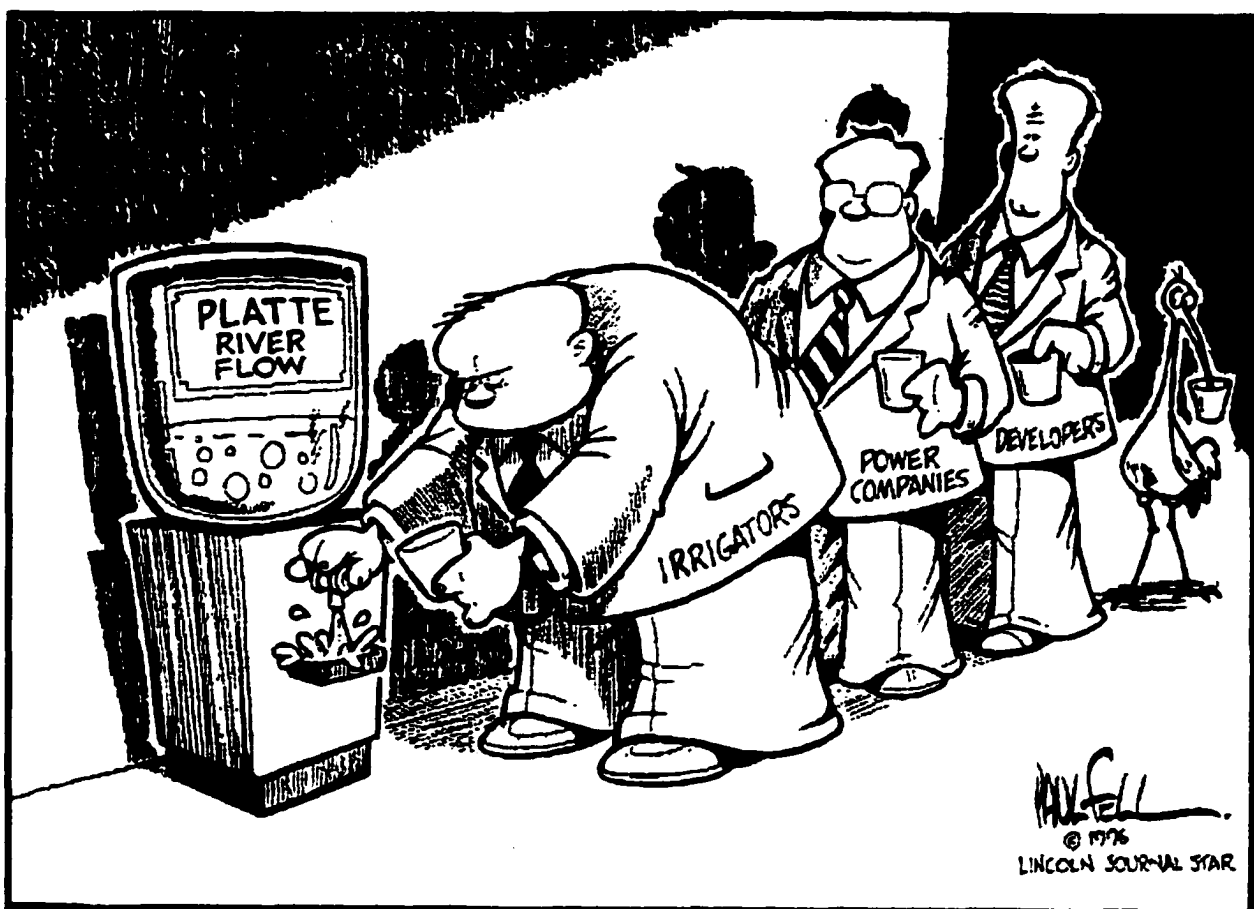
In August of 1992, eleven western congressmen and senators wrote to then-Secretary of Agriculture Edward Madigan, protesting the USFS position to impose bypass flow requirements as a condition of the renewal of the special use permits for water storage facilities located in the forest. They wrote:

If the Forest Service is allowed to proceed in this manner this administration will have taken private property rights, interfered with the development and use of state and interstate water allocations, and replaced state water administration with a federal permit system. (U.S. Senator Malcolm Wallop, et al., personal communication, August 12, 1992).

In October, 1992 Secretary Madigan responded ruling that the USFS should continue its historic policy of not imposing bypass flow requirements on existing water supply facilities (Secretary of Agriculture Edward R. Madigan, personal communication, October 6, 1992). However, the USFS determined that the renewal of these six permits would require an environmental impact statement in accordance with the National Environmental Policy Act.

As part of this process, in December of 1992 the USFS consulted the USFWS under Section 7 of the ESA about the impacts to endangered species by the proposed renewal of these special use permits. In June, 1994 the USFWS issued their biological opinions which concluded that the USFS renewal of these six permits would jeopardize the existence of the endangered whooping crane, least tern, piping plover, pallid sturgeon, and likely would adversely modify designated critical habitat of the whooping crane (U.S. Fish & Wildlife Service, 1994b).

Specifically regarding the whooping crane, the biological opinions stated, "...the key to whooping crane recovery (and by implication survival) is reduction of mortality during migration." It also predicted that, "These depletions would incrementally reduce the suitability of roosting habitat by decreasing aquatic habitat in the channel, decreasing the water width and percent of channel wetted, and reducing suitable water depths" (U.S. Fish & Wildlife Service, 1994b, pp. 24-25). In so doing, it would adversely affect the security, resting and foraging efficiency of the bird and, consequently, the birds would arrive at their breeding grounds in Wood Buffalo National Park in a weakened condition.



Note. From the Lincoln Journal-Star, May 17, 1996.

Figure 10

The Media's Depiction of Competing Platte River Interests

To insure that the proposed actions do not jeopardize these species, the USFWS recommended a "reasonable and prudent alternative". Finding that the average annual shortfall of stream flows needed to meet habitat target flows is 417,000 af out of 3,000,000 af of depletions, it recommended that if water users could not replace a portion of their diversions at the Colorado-Nebraska line, they make an annual payment of \$5.50/af of project diversions for the acquisition of water and habitat and the restoration of riverine habitat. These annual payments were seen as an interim solution until a basin-wide recovery plan is drafted and approved by the federal agencies, Colorado, Wyoming and Nebraska (U.S. Fish & Wildlife Service, 1994b, pp. 30-33).

But the six permits involved here were the tip of the iceberg. It had become clear that the sheer number of permit renewals prohibited a case-by-case approach for development of environmental impact statements and mitigation plans. For example, currently 335 Forest Service special use authorizations occur in the Platte River basin with 118 of these expected to expire prior to the year 2000 (Friedlander, n.d.). Wyoming could foresee many projects in its state needing federal approval, and Nebraska had been trying to obtain a new permit for its Kingsley Dam for several years with no end in sight.

Until a comprehensive solution could be found, the endangered species issue would be reoccurring. The need for a basin-wide solution that could reconcile whooping crane requirements with water development was clear.

Basin-Wide Negotiations

In June 1994, the week following the release of the USFWS' biological opinion, the Governors of Colorado, Wyoming and Nebraska and the U.S. Department of Interior signed a Memorandum of Agreement (MOA) to develop a Central Platte River Basin Endangered Species Recovery Implementation Program. It allowed one year for development of a reasonable and prudent alternative to avoid the likelihood of jeopardy to federally listed species that was acceptable to the three states and the United States. Illustrative of the arduous negotiations that were to come, it had taken six months for the parties to negotiate this MOA that only committed the states and Interior to talk. After the MOA was signed, Interior's Assistant Secretary of Water and Science was appointed to lead Interior's negotiating team and the Governor's each appointed high level staff to represent their state's interests. The sessions were open to the public so that environmental groups and water users had an opportunity for full participation. The number of people attending the sessions ranged from 10 to 70 (Zallen, 1997).

Margot Zallen, Senior Attorney for the Department of Interior's Office of the Rocky Mountain Regional Solicitor, and an observer at these negotiations wrote:

The first sessions were confrontational, with frequent venting of anger at the FWS, and there was a tendency for the host state's negotiators to "grandstand" for the local constituencies. There were a number of times that either the states or DOI presented positions that were untenable to the other parties, and it

appeared that the MOA process was dead. But no entity was willing to be the one to walk away from the negotiations.... Many of the biggest issues were differences among the states and they met many times, without DOI present, to resolve those. The 1996 FERC initiation of consultation inserted a new urgency in the talks and finally, in late 1996, a "small" negotiating team of 17 and a drafting team of 5 were established. Although there were never just 17 at the sessions, this smaller group made real progress, developed innovative solutions, refined solutions and resolved the larger issues (Zallen, 1997, p. 12).

Central to the dispute were difficult questions of individual state compact requirements and institutional legal limitations of each state.

Late in the negotiations it became clear that the USFWS's biological opinion on FERC's preferred alternative for the Kingsley Dam Project would be very critical of the project's effects on wildlife. Indeed, when the opinion document was issued in July 1997, the USFWS found the proposed action was likely to:

...a) jeopardize the continued existence of the endangered whooping crane, least tern, and pallid sturgeon, and the threatened piping plover; and b) result in the destruction or adverse modification of federally designated whooping crane critical habitat along the central Platte River. In addition, the proposed action may adversely affect but is not likely to jeopardize the continued existence of the bald eagle, Eskimo curlew, American burying beetle, and the western prairie fringed orchid.... [and] likely to jeopardize the continued existence of the sturgeon chub which is currently designated as a candidate species, and is expected to soon be proposed for federal listing. (U.S. Fish & Wildlife Service, 1997, pp. 1-2)

The Cooperative Agreement

After these three years of negotiations that up until the very end looked like they could collapse at any moment, Colorado, Nebraska, Wyoming and the U.S. Department of Interior (Interior) reached agreement on a program to protect endangered species in Nebraska's Big Bend region of the Platte River on June 10, 1997 called the "Platte River MOA" (Lockhead and Robotham, 1997).

The agreement is in two phases. The Cooperative Agreement is the first phase. It establishes a three-year period during which the USFWS will review the proposed program in accordance with the National Environmental Policy Act (NEPA) and the ESA. During this review period, activities will be outlined for the states and Interior to undertake to prepare for program

implementation. Water users will have regulatory certainty under the ESA upon the payment of specified mitigation fees.

In addition, the Cooperative Agreement calls for a ten-member Governance Committee, comprised of state, Interior, water user and environmental organization representatives. This committee will oversee activities under the Cooperative Agreement and the Proposed Program, and will serve as a forum for dispute resolution.

After this phase of NEPA and ESA review, the states and Interior will enter into a new agreement to begin the Program. Based on the review, USFWS may determine the Proposed Program to be inadequate and require modification. If so, the states and USFWS will work to renegotiate the program. If negotiations fail, USFWS can reinitiate its original consultation on all permits.

The Proposed Program will be implemented in stages. The first stage will last from ten to about thirteen years. The parties will then negotiate a second stage and associated activities, based on the results of the first stage.

If the Program terminates or expires, or progress is not satisfactory, the USFWS may reinitiate ESA consultation on all permits that have been part of the reasonable and prudent alternative in this Program. If the USFWS reinitiates consultation on any one permit on this basis, it will reinitiate consultation on all such permits.

The first stage must attain two goals. First, the parties are required to protect and restore at least 10,000 acres of land in the critical habitat area. Second, they must deliver 130,000 to 150,000 acre-feet of water to the habitat area. Of this amount, 70,000 acre-feet will be provided by water re-regulation projects in each of the states: the Tamarack Project in Colorado, an environmental storage account in Lake McConaughy in Nebraska, and a storage account in an enlarged Pathfinder Reservoir in Wyoming. The balance of water to meet the target will be provided through as-yet-unspecified water conservation and supply projects in the basin.

In the first stage, the parties will contribute cash and cash equivalents totaling \$75 million to fund program administration and land and water acquisition to meet the goals. Each state will

develop its own program to mitigate the effects of new water development. Contributions are as follows:

- Colorado (\$15 million): \$10.8 million in cash and \$4.2 million in water from the Tamarack Project.
- Nebraska (\$15 million): \$5.3 million in land, \$9 million in water from Lake McConaughy, and \$700,000 in cash.
- Wyoming (\$7.5 million): \$4 million in cash, and \$3.5 million in water from an enlarged Pathfinder Reservoir.
- Federal Government (\$37.5 million): in cash.

In concluding this chapter, it is instructive to look back at the history of the Platte River. This perspective not only tells us where we've been, but one can obtain a sense of the river's future as well. As seen in Table 6, the 110 years following the first water claim in the Platte River Basin was characterized by numerous, ever-larger water development projects. A pronounced shift occurred by 1970 by which time emphasis was given to environmental considerations. After that time, dam proposals were under much scrutiny and, with the one exception of Grayrocks Dam, were defeated. This historical view provides a context for this study. It helps explain the tensions and conflict leading up to the Cooperative Agreement negotiations and the incentive to develop a new water resource regime, the focus of this investigation, as society's perceptions over Platte River water changed.

Table 6**Key Historical Events in the Management of the Platte River**

Year	Event
1859	First water claim in Platte River Basin (Anderson Ditch on Boulder Creek, CO.)
1863	First dam in the Platte River Basin (Clear Creek drainage near Kelley, CO.)
1902	Reclamation Act passed to reclaim arid lands in 17 western states
1909	Pathfinder Dam completed, first large reservoir created on the North Platte River
1923	Colorado and Nebraska sign the South Platte Compact, apportioning flows of the South Platte River in Colorado between the two states
1941	Kingsley Dam, world's largest earth-filled hydraulic dam, dedicated on N. Platte R.
1945	U.S. Supreme Court renders the North Platte Decree, apportioning the flow of the North Platte River between Nebraska and Wyoming with Nebraska receiving 75% of the natural flow in the North Platte River and its tributaries. It also placed limits on the amount of land Wyoming and Colorado irrigators could water.
1947	The Colorado-Big Thompson Project begins delivering water into the Platte from the Colorado River across the Continental Divide
1970	National Environmental Policy Act becomes law
1970	Congress declares whooping crane "endangered"
1973	Endangered Species Act becomes law
1974	FWS announces plan for wildlife refuge on Platte, public opposition defeats proposal
1978	Grayrocks Dam proposal altered due to Endangered Species concerns; last large dam built in basin
1978	Narrows Dam in Colorado falls victim to Carter Administration's "hit list" of dams
1985	Least tern and piping plover added to endangered species list
1986	Electric Consumers Protection Act amends Federal Power Act of 1920, requires FERC to give equal consideration to power generation and fish, wildlife and recreation for dam licensing/re-licensing
1987	Kingsley Dam fails to achieve re-licensing permit on time, series of one-year extensions begins
1989	EPA vetoes Denver Water's Two Forks Dam proposal
1990	Pallid sturgeon added to endangered species list
1994	USFWS issues jeopardy opinion for renewals of six USFS reservoir permits for Colorado cities
1994	Governors of Colorado, Nebraska and Wyoming sign agreement to develop a Central Platte River Basin Endangered Species Recovery Program
1997	Cooperative Agreement signed for re-regulating water use on the Platte River to protect habitat

CHAPTER IV

RESEARCH METHODOLOGY

There are many windows through which we can look out into the world, searching for meaning. There are those opened up by science, their panes polished by a succession of brilliant penetrating minds.... But there are other windows...[M]ost of us...peer through but one of those windows...and even that one is often misted over by the breath of our finite humanity. No wonder we are often confused.... It is...like trying to comprehend the panorama of the desert or the sea through a rolled-up newspaper.

– Jane Goodall (1990, p. 10)

This chapter describes the research methodologies employed in this study. The first section explains the objectives, hypotheses and sampling design. The second section describes the case study approach and data gathering. The chapter then proceeds to explain the data analysis and concludes with observations about this study's limitations.

Research Objectives and Hypotheses

The Platte River System, discussed in Chapter 3, is a classic “common property resource” (CPR) situation. It possesses rival resources from which it is costly to exclude others. It necessitates collective action, rather than individual action, among a variety of interests for its sustainable management and equitable apportionment. In addition, numerous organizations interested in the Platte River have created – after more than a decade of debate, litigation and legislation – a new entity and mechanisms for re-regulating the river's waters to preserve the water-dependent endangered species found along that river system. This new organizational entity is a resource regime, as defined in Chapter 2.

Together, the resource and the regime provided an opportunity to study a new, large-scale CPR regime. This study examined the regime's organizational design principles comparing it with those in the case study literature that hypothesizes that certain organizational design principles are required for regime and resource sustainability. However, a potentially significant difference exists between the Platte River CPR regime and those reported in literature. CPR regimes studied previously are almost exclusively small-scale, local regimes that appropriate a single resource (water, forage, fisheries, etc.) The regime studied here is large-scale (covering portions of three states) and aims to appropriate both water and wildlife. Therefore, this situation presented an opportunity to compare these CPR regimes. The investigation also examined whether this multi-year process of regime formation generated social capital.

This study employs the methods of an instrumental case study that is supplemented by sociometric analysis. It is guided by four objectives:

- 1) to examine and critique theories which assert that particular organizational design characteristics will be present when organizations with different goals work together to accomplish a task collectively that cannot be achieved individually;
- 2) to build upon existing theories of collective action by developing hypotheses for future inquiry;
- 3) to determine whether social capital was produced in the process of creating an organization; and,
- 4) to make policy recommendations for the design of institutions seeking to appropriate certain natural resources in a sustainable manner.

Hypotheses were developed to help direct the study towards its objectives. They are as follows:

- A) The new Platte River Common Property Regime will have adopted the organizational design principles extracted from the literature and identified later in this chapter as necessary organizational components for the sustainable appropriation of common property resources;
- B) Over the three years of negotiations that resulted in agreement to establish a Platte River Common Property Regime, social capital was created as evidenced by these characteristics:
 - 1) the organizations involved are today more familiar with each other and consult each other more often than the time prior to the start of these negotiations; and,

- 2) overall polarization on key Platte River management issues among all organizations will be low.
- C) Pairing of each organization will show that with increasing polarization among pairs of organization:
- 1) ratings of familiarity with each other will decrease;
 - 2) frequency of consulting with each other will decrease;
 - 3) perceptions of legitimacy (i.e., being "fair and worth listening to") will decrease; and,
 - 4) perceptions of interdependence (i.e., gains made by one organization are seen as at the expense of the other organization) will increase.

Population and Sampling Design

Data for this case study was obtained from personal interviews with representatives from those organizations that participated in the development of the Platte River agreement discussed in Chapter III. Thus the unit of analysis employed here is the organization and the element from which the information was collected is the organization's representative to the negotiations that this process of water re-regulation created.

This study relied on the non-probability sampling method often employed in field research known as snowball sampling rather than on the techniques of random sampling usually employed in quantitative studies. Snowball sampling involves asking each person interviewed for a list of additional people to interview based upon some criteria, or qualifications that are stated (Babbie, 1992, p. 292).

In this study, the interviewer identified a few participants likely to have a great deal of knowledge about the new Platte River CPR regime (history, structure, etc.), based upon pre-test interviews conducted. After the main interviews were completed with each participant, the researcher asked for recommendations of other key players involved who were "key players" in the negotiation process, knowledgeable and who might have different views about the regime that was just provided (i.e., key informants). This process was repeated with each interviewee. When a name was volunteered by two or more interviewees, an interview with that person was sought. This selection of interviewees allows the researcher to fill in the gaps and focus on insights until

the time when information becomes redundant, not when a statistical number was reached for the desired confidence level.

According to Lincoln and Guba (1985, p. 210), this approach provides the broadest range of information obtainable. The deviant case is not suppressed, and a full array of multiple realities may be uncovered. This sampling design is emergent rather than an *a priori* design. The goal was to interview the entire population of participating organizations having important information about the CPR regime and its effects as defined by the key participants in the process. When no new names were suggested for interviewing, but rather the same names kept surfacing, that signaled the population had been defined and identified, according to the criteria already mentioned that was seen as critical to the objectives of this study. See Appendix A for the informant list upon which this study draws.

Study Procedures and Instruments

Case Study Approach

Since CPR theory and its associated organizational design principles are relatively new and important variables are not yet well understood, and since events shaping the Platte River regime had already occurred, analysis here does not lend itself to either laboratory or field experimental design. Therefore, a field study using an instrumental case study approach was selected as the primary research method. Through the application of this study method, variables identified in the literature, but not thoroughly tested, were evaluated for their relevance and completeness when applied to this CPR regime. New hypotheses were then constructed that may be tested to advance understanding of common property regimes.

Field studies are nonexperimental scientific inquiries. Kerlinger (1986, p. 348) defines "nonexperimental research" as follows:

Nonexperimental research is systematic empirical inquiry in which the scientist does not have direct control of independent variable because their manifestations have already occurred or because they are inherently not manipulable. Inferences about relations among variables are made, without direct intervention, from concomitant variation of independent and dependent variables.

Exploratory field studies, Kerlinger notes (1986, p. 373) have three objectives: "...to discover significant variables in the field situation, to discover relations among variables, and to lay the groundwork for later, more systematic and rigorous testing of hypotheses." Thus, field studies are activities that precede true hypothesis-testing in scientific research, working to seek what is, and laying the theoretical and methodological foundations for later work that attempts to predict relationships among the variables.

Babbie (1992, p. 286) points to field research as "...especially appropriate to the study of social processes over time," and lists practices, relationships, groups and organizations as very appropriate foci for field research. It is a preferred method for research topics that appear to defy quantification.

One of the most favorable attributes of field studies is their realism. Of all types of scientific research, they are the most free of artificial trappings. They best reflect real life processes or conditions. Field studies are also rich in their discovery potential. They have the advantage over other approaches of being more likely to reveal new information that may not have been the specific target of the research.

However, field studies have their weaknesses. The field situation contains a multitude of variables and variance, and thus final statements about relationships among the variables are weaker. Largely due to this complexity, there is also a lack of precision in the measurement of field variables.

Thus, this research employs a case study approach in a field setting, specifically an instrumental case study, as opposed to an intrinsic or collective case study. In the instrumental case study,

...a particular case is examined to provide insight into an issue or refinement of theory. The case is of secondary interest; it plays a supportive role, facilitating our understanding of something else. The case is often looked at in depth, its contexts scrutinized, its ordinary activities detailed, but because this helps us pursue the external interest.... (Stake, 1994, p. 237; see also Stake, 1995, p. 3).

This approach was selected because it: a) yields the best "real life" results, having neither artificial settings nor manipulation of variables; b) is a preferred method for studying social

processes (Babbie, 1992, p. 286); c) can identify the important variables that will aid in developing common property resource theory and yield hypotheses for further testing in model and theory development.

Three surveys were used in this study. The first survey involved an oral discussion with each informant separately to determine the presence of organizational design principles used in the Platte River CPR regime. The remaining two surveys were written instruments. A sociometric instrument was designed to determine the interactions among organizations involved in the CPR regime creation. Another survey gauged the presence and degree of social capital among the various organizations within the common property regime. The surveys were administered in the order presented here. All three surveys are described below. (See Appendix B for the written instruments and key oral interview questions.)

Intensive Interviews

Information on organizational perspectives were collected using the technique of intensive interviewing, also known as unstructured interviewing (Lofland and Lofland, 1995, pp. 18-19). The goal of this survey technique is to elicit from the informant rich, detailed materials, seeking to discover the informant's experience of a particular topic or situation. This contrasts with structured interviewing where the goal is to elicit choices between alternative answers to preformed questions.

Informants were presented with open-ended questions about the theorized organizational design principles. Analyzing the most important factors to the successful creation and maintenance of CPR regimes summarized from the literature in Chapter II, the researcher consolidated these factors into the following seven variables. These hypothesized variables were incorporated into open-ended questions to determine their degree of presence or absence in the Platte River CPR regime and, if present, how they were defined. Informants were also asked whether there were other institutional characteristics that were critical for its success.

1. **Minimal recognition of rights to organize regimes.** Political authorities and administrative managers must legally recognize and support CPR regimes to develop.
2. **Clearly defined boundaries.** The starting point for developing a CPR regime must be to define two sets of boundaries: a) physical boundaries of the resource domain, and b) to distinguish those who have rights to withdraw the resource from those who do not share that privilege.
3. **Deployment of a “distributional fair-share” system and congruence between this system and local conditions.** This organizational design principle posits that resource benefits obtained by organizational members must be proportional to their costs. These allocation and provision rules must be appropriate for local conditions.
4. **The presence of “collective choice arrangements”.** For CPR regimes to endure, resource users must participate in establishing and maintaining the allocation and provision rules of the fair share system.
5. **The presence of a monitoring system.** The allocation of resource benefits to organizations and organizational payments for these benefits must be monitored in a manner to which all parties agree is fair and accurate.
6. **Graduated sanctions.** When a member violates the operational rules of the regime, sanctions must be employed, commensurate with the severity of the violation, to prevent “free riders” and the tragedy of the commons.
7. **Conflict resolution mechanisms.** When disputes arise over the implementation of operational rules, a method for conflict resolution must be available.

Sociometrics

A second part of the research employed sociometrics in two written survey instruments. Sociometry is a broad term, “indicating a number of methods of gathering and analyzing data on the choice, communication, and interaction patterns of individuals in groups” (Kerlinger, 1986, p. 499). It is a method to study the attractions and antagonisms of group members.

In this research, sociometrics was used to determine which organizations communicate with each other, to what degree they assigned legitimacy to one another, and the conflicts they had over various methods to improve endangered species habitat.

Specifically, the instruments were designed to determine which organizations communicated with each other, how organizations view legitimacy and interdependence of other organizations, and whether cross-cutting or polarizing conflict cleavages existed among organizations. As discussed in Chapter II, these variables have long-term implications for the ability of these organizations to keep conflict within bounds that produce social capital.

The sociometric instrument listed 31 organizations that may have played an important role in the development of this regime over a three-year period from 1994 to 1997. For each organization, the respondent was asked to respond to the following variables:

1. **Familiarity.** Respondents were asked how familiar they were with each of the 31 listed organizations prior to 1994 and how familiar they were with each today. The possible responses were categorized as "not at all", "some" and "much".
2. **Degree of Consultation.** Respondents were then asked whether representatives of their organization consulted with each of the 31 listed organizations on issues of importance prior to 1994 and today. The responses were coded on a four-point scale ranging from 0 "never" to 3 "often".
3. **Perceptions of Legitimacy.** Respondents rated whether representatives of the given organizations could be relied on to be "fair and worth listening to". This variable measures their perception of legitimacy for the other organizations involved in this dispute. Responses were coded on a four-point scale from 0 "never" to 3 "always".
4. **Perceptions of Interdependence.** Lastly, respondents were asked to rate the degree to which the organizations provided tended to make gains at the expense of the respondent's organization. This category measured the perception of interdependence among each organization. Again, responses given ranged from 0 "never" to 3 "always".

Familiarity and consulting among organizations are surrogates to measure social capital. Organizations having high scores here have created considerable social capital, i.e., productive activity that fosters a negotiability of issues, an increased sense of legitimacy among organizations and low levels of mutual threat. One possible dimension of polarization is characterized by inhibited communication and consulting among adversaries who will withhold information from each other in situations of high threat.

Perceptions of legitimacy and interdependence are important measures of polarization. A high degree of legitimacy recognized among group members promotes a willingness to accept leadership authority from other groups' members (Freeman, 1992, p. 162). A low degree of interdependence breeds mistrust, less chance for peaceful and constructive relationships and less potential for concessions in negotiations (Freeman, 1992, p. 163). These concepts will be described in more detail in Chapter V.

Public Policy Assessment Survey

The second written instrument listed river management policy issues. It was constructed to gauge each organization's position on issues critical to the negotiations involved in creating the new resource regime. Such information was analyzed to determine whether polarizing conflict cleavages existed among organizations or whether conflict cleavages were characterized by cross-cutting patterns. As pointed out in Chapter II, polarizing cleavages may result in nonnegotiable, antagonistic, choice-destroying conflict. Cross-cutting cleavages, on the other hand, foster social cohesion and negotiability of issues.

Seven cleavage issues surrounding Platte River endangered species habitat management were selected based on pre-test interviews with key informants. Issues included were: approval of the cooperative agreement for Platte River habitat recovery, placing lands under protected management, water flow goals, funding for the recovery program and management of U.S. Forest Service lands to increase water flows. The responses were coded in a five-point scale ranging from 1 "strongly supports" to 5 "strongly opposes".

Data Analysis

This project used both quantitative and qualitative data. Quantitative data obtained in this study was analyzed using SPSS/PC+ 9.0 for Windows. Descriptive statistics (i.e., sums, percentage frequencies, means) were used to describe characteristics of the variables in the sociometric instrument. Such quantitative information assisted to measure social capital and its change over the course of the negotiations, perceptions of legitimacy and rivalness among organizations.

The information obtained on the second questionnaire, the policy issues instrument, was analyzed for patterns of conflict cleavage. According to Freeman (1992, p. 143), highly polarized conflict cleavage patterns exist when the same opponent groups confront each other over differences on all issues at stake. There exists no common ground to find compromise and thus no incentive to negotiate. Crosscutting conflict exists when groups are opposed on some issues, allies on others. Maximum cross-cutting occurs when two organizations agree on the same number of cleavages on which they disagree. Minimum cross-cutting occurs when two organizations agree on all cleavages or disagree on all cleavages.

The statistical method employed to determine the conflict patterns and degree of polarization among all organizations followed the procedure explained by Freeman (1992, pp. 173-203). For detailed analyses of the procedure, see Hittle (1989). The method computes deviations from cross-cutting as the difference between the observed number of agreements and disagreements between two organizations, and the number of agreements and disagreements that would be expected under maximum cross-cutting.

This approach has been developed to measure polarization for practical policy assessment at the structural level. It consists of the following steps:

1. Compare each organization's position on each identified issue to that of each other organization. This is most easily accomplished by selecting any one organization as a basis for comparison and then determining each organization as either an ally, adversary or neutral to this base organization on each issue. A perfect polarizing pattern is one in which organizations oppose the same organizations on every issue. A perfect cross-

cutting pattern is one in which organizations are allied on half the issues with each other, and are opposed to each other on the other half of the issues.

2. In the next step the researcher determines the difference between the observed conflict pattern for each organization and the ideal needed for a perfect cross-cutting pattern. If, for example, there are ten issues, and organization y sides with the base organization's position on five of these issues, and opposes them on the remaining five issues, the difference is 0, that is, this is what the ideal cross-cutting pattern would produce. However, if organization y never sides with the base organization, but opposes it on every issue, the difference would be 5 (10 times opposed minus five times expected = 5).
3. All organizations' difference scores are added.
4. The sum of the potential differences that could have occurred given the number of organizations and issues calculated and added.
5. A polarization coefficient is obtained by dividing the sum of the actual difference (step 3) by the sum of the potential maximum differences (step 4).
6. The resulting coefficient value will vary from 0 to 1.0. A coefficient value near 0 represents a high degree of cross-cutting cleavages; a value near 1 represents a high degree of polarizing conflict cleavage.

Since all issues selected may not have the same salience for each organization and among organizations, salience scores can be computed in this analysis, however, salience data was not collected in this study.

In the final statistical procedure, every organization was paired with each other to develop a polarization score for the paired organization representing the sum of their differences on each of the seven issues they were asked to rate. Organizations were numerically ranked according to their polarization levels. Kendall's tau-b (see Appendix C for details on this nonparametric ranking statistic) was then used to establish degree of association between two organizations' polarization scores and the four variables measuring social capital contained in the sociometric instrument and previously described.

Our hypotheses here was that as polarization scores increase among pairs of organizations, the degree to which they communicate and consult with each other will decrease, their perceptions of legitimacy of each other will also decrease, and there will be an increased perception of zero-sum interdependency (i.e., a loss for their organization, when the other gains).

In this statistical test, there is no attempt made at calculating levels of significance. The logic of statistical significance rests on differences between the assumed independence of variables in a population and the observed distribution of sample elements in order to explain any discrepancies. However, because this study data captures the entire population of organizations involved in formulating the common property resource regime studied, no sample is represented. Thus, there is no attempt here to reason from a sample to the population as is the basis for statistical significance.

Qualitative data was used to identify the presence or absence of organizational design variables, theorized in the literature. The analysis of qualitative data has been described, "...as a progression, not a stage; an ongoing process, not a one-time event" (Erlandson, Harris, Skipper, Allen, 1993, p. 111). Whereas a traditional study separates data collection from analysis, the naturalistic inquiry involves a close interaction between the two. As the first data are collected, very tentative working hypotheses are made that cause adjustments in subsequent interview questions and data collection procedures. These revisions yield new data that are then subjected to new analysis. The interactive refining process continues until the report is finalized. The result is a set of rich data that generate alternative hypotheses, tested and re-tested, providing the basis for a commonly held construction of reality.

One characteristic process to illustrate this interactive refining process has been described by Guba and Lincoln (1989, p. 149) as the "hermeneutic-dialectic process". "Hermeneutic" because it is interpretive in character and dialectic because it seeks a synthesis through comparing and contrasting divergent points of view. As Guba and Lincoln describe it: "[T]he major purpose of this process is not to justify one's own construction or to attack the weakness of the constructions offered by others, but to form a connection between them that allow their mutual exploration by all parties."

The process starts with one respondent who the researcher selects for any salient reason. The interview is conducted. At the end of the interview, the respondent is requested to identify another respondent who has divergent constructions from his or her own. The second interviewee is initially interviewed as the first respondent until no further new information is forthcoming. At this point the interviewer introduces themes from the first respondent and asks the second respondent to respond. Following that discussion, a nomination for a third respondent is requested.

This iterative process continues until information becomes redundant or construction categories are irreconcilable. This approach in the early stages maximizes divergent constructions. As it continues it ensures that as many stakeholders as possible have contributed to the study.

After this first set of interviews is complete, a second round is conducted with the same set of respondents, termed the "circle" of respondents. The early respondents receive their first chance to respond to the constructions of others in the circle. In this manner, constructions are enriched by confronting divergent ones. In addition, documents can be introduced to the circle by the researcher at the appropriate times. Finally, the researcher's own constructions may be introduced and criticized, integrated, or expanded by circle members.

Study Limitations

To increase the validity and reliability of this study's results, the investigation interviewed the entire organizational population that was the focus of this investigation. It also employed data triangulation (Denzin and Lincoln, 1994, pp. 214-215) in which the same key question was asked of different informants. If all replies point to the same answer, this is evidence of internal validity. And it employed member checking (Erlandson et al., 1993, pp. 142-143; Stake, 1995, pp. 115-116) which also enhances internal validity by allowing members of stakeholder groups to test categories, interpretations, and conclusions of that group. In this manner, the members of the setting being studied indicate the degree to which the inquirer's reconstructions are accurate.

However, there are a number of limitations for which absolute control was not maintained by the researcher. First, in field studies such as this, a multitude of variables may exist, each containing its range of variance, in a qualitative context. Thus, final conclusions about the hierarchy of importance of these variables are not precise. Likewise, the strength of the relationships between the variables, is weaker.

Similarly, reliability of the results may be weaker in field studies when compared to other types of quantitative research. As noted above, steps were taken to improve our confidence in the study's reliability.

Bias may be present in the study results due to the sampling procedure. Purposive sampling was the technique used to identify the key participant in each organization and this should improve external validity. However, others were involved in the issue who were not interviewed. They may have played some role and might have offered additional insights.

Bias may also occur through the length of time over which interviews were conducted. Interviewing took place over approximately 18 months, during which time memories may have faded and intervening events worked to alter perceptions.

Finally, bias may exist as a result of the on-going nature of personal relationships among the participants who continue to negotiate among themselves on implementation of the principles to which they agreed. Particularly among the public agencies interviewed, there may be a bias towards not speaking frankly about the private organizations that are still involved in the issue studied here.

CHAPTER V

FINDINGS

Angry as one may be at what heedless people have done and still do to a noble habitat, one cannot be pessimistic about the West. This is the native home of hope. When it fully learns that cooperation, not rugged individualism, is the quality that most characterizes and preserves it, then it will have achieved itself and outlived its origins. Then it has a chance to create a society to match its scenery.

– Wallace Stegner (1969, p. 38)

Throughout this discourse we have come to learn that irrigation water in the arid west is a common property good having the two prerequisite resource attributes: the difficulty of excluding others from enjoying the resource (i.e., excludability) and the reduction in resource quantity when enjoyed by another user (i.e., rival). Because of this combination of qualities, institutional analytic frameworks posit that the resource can be sustainably managed through a common property resource regime that prescribes certain rights, responsibilities and benefits for those allocating this water in accordance to certain design principles.

This study has applied these hypothesized design principles to a new common property resource regime being crafted for managing the Platte River. The creation of this regime is in response to new demands for water to protect endangered species dependent upon habitat nourished by the river's flows.

Through exploratory research, this study ascertains whether the formation of the new Platte River water rights regime contains the elements hypothesized in the institutional analysis frameworks presented in Chapter II and whether additional factors were significant in this regime's formation beyond those hypothesized from the analytic framework.

Designing institutions includes creating new relationships among individuals. This study also addresses whether, in developing this new regime, social capital was created among the regime designers as measured on several dimensions.

This chapter will present the research findings. It first examines the hypothesized variables for their presence or absence in the construction of this new regime. The study will then proceed to identify new design elements that have emerged outside the scope of the hypothetical framework and explain their importance to this regime. Finally the chapter will conclude with an analysis for the hypothesis that social capital was created in the formation of developing these new institutional arrangements.

Survey Response

The study interviews and administration of the written surveys were conducted between February, 1997 and June 1999 throughout Colorado, Nebraska, Wyoming and Washington, D.C. In all, 31 people were interviewed representing 22 different organizations. On average, initial interviews lasted about 90 minutes. Some people were interviewed multiple times.

In addition to the oral interview, written surveys were administered to 24 individuals, representing 22 organizations plus separate surveys for field and regional offices of two agencies. Two individuals declined to meet with the researcher and one individual declined the written survey only. For the list of organizations participating in the study, see Appendix A.

The researcher also was also an observer at "scoping meetings" for the Platte River Cooperative Agreement required by the National Environmental Policy Act in Scottsbluff, Nebraska and Loveland, Sterling and Denver, Colorado.

Presence or Absence of Hypothesized Design Principles in a Common Property Resource Regime

In Chapter IV of this study, elements (called design principles) were identified that the extant literature posits may be essential for the success of a small scale common property

resource regime to sustainably provide a specific resource from one generation to the next. This section examines each design principle for its presence or absence in the newly formed, large-scale Platte River regime. Findings are based upon the oral interviews conducted with those identified as key participants in the regime's creation.

In these interviews, the investigation finds the hypotheses of Chapter IV supported, that is, each hypothesized design principle is found to exist in this new common property regime. However, three of the design principles are not as fully developed as the literature recommends for regimes that are sustainable, posing a degree of uncertainty for the regime's long-term security.

In addition, this study finds evidence to support four critical design principles not identified in the literature. It is now hypothesized that these additional principles are important in a large scale, rather than small scale, common property resource regimes. Each design principle is examined below.

1. Minimal Recognition of Rights to Organize Regimes

There are many examples of CPR regimes in which external government officials establish appropriation and/or provision rules contrary to the best judgement of local appropriators (Ostrom, 1990). This action makes it very difficult for local appropriators to sustain their CPR over time. Sometimes, for example, powerful interests can have the government intercede on their behalf to change the rules in their favor. Freeman (1989) discusses the critical importance of political authority and administrative managers to legally recognize and support water user organizations.

In this study of the Platte River regime, the issue was driven by the federal government challenging the long-standing regime on how water was appropriated from the Platte River. Nowhere did we see this as clearly as with the U.S. Forest Service initially calling for the release of water from six reservoirs along Colorado's front range. Many Colorado key informants identified this action as a defining moment, an attempt to take away their water rights as they viewed them. At this moment it became clear to many of them that this was an action they needed to strongly oppose. Nebraska and Wyoming respondents, on the other hand, tended to

see the issue beginning either with the Grayrocks decision in 1978 or in the delays with the Kingsley Dam re-authorization in the 1980s.

One informant, vigorously opposed to the cooperative agreement, feels the federal government forced this regime upon them. He believes the federal strategy was one of calculated “divide and conquer” among the three states and that “Nebraska isn’t screaming because the feds have a gun to their head by holding up the Kingsley Dam re-authorization.”

Unfortunately, this design principle of Ostrom’s is not easily measured in this situation because of the qualifier she uses, “minimal recognition”, without supplying a definition for this term. When government challenges some of the rules of a CPR regime, is it challenging the rights of that institution to organize?

What can be said here is that external governmental officials became part of the regime through the Cooperative Agreement and their participation Governance Council created by the Agreement. In effect, these officials had altered the rules of the regime in order to deploy water to new uses (i.e., ecosystem enhancement). In this setting, government officials did not presume that “only they” had the authority to set the rules as Ostrom and Freeman warn about, but they did insist that the regime’s rules had to be altered significantly to meet new federal government mandates.

With this recognition, the government did allow this regime to flourish, supporting its interest to form a Governance Council, committees, and rules in accordance to the basic requirements for any organization to conduct its business.

2. Clearly Defined Boundaries

Institutional analytical frameworks, as examined in Chapter 2, hypothesize that there must be two clearly defined boundaries: 1) of the physical resource domain and, 2) of those having rights to withdraw the resource.

None of the interview respondents questioned the physical resource boundaries. To all it was clear that the physical boundaries surrounding this issue was the Platte River and its tributaries and land within the 53-mile long, 3-mile wide corridor that was designated critical habitat for the whooping crane in Nebraska. Despite the fact that whooping cranes and other

endangered birds species were found in riparian areas beyond this designated habitat, such as the nearby Loup River, and require habitats other than Platte River throughout the year (such as the distant Wood Buffalo National Park in northern Canada), not one participant suggested that the physical boundaries be more expansive.

Agreement over who has rights to appropriate Platte River water was another matter. Such membership clarity was not present prior to the Cooperative Agreement (i.e., appropriator membership). Indeed, the controversy surrounding this issue arose when new rights were asserted for control of water resources through the Endangered Species Act by the U. S. Fish and Wildlife Service (USFWS), supported by environmental organizations that viewed the assertion of these rights as an action in the broad public interest. This disagreement over who could appropriate water created animosity and polarization among the parties and threatened protracted, expensive legal action if not resolved.

However, with the signing of the Cooperative Agreement, the former boundaries of those having rights to withdraw resources were expanded. Now, besides the three states of Colorado, Nebraska and Wyoming as had been the traditional practice throughout this regime in the Twentieth Century, the federal government's USFWS agency was granted, in effect, a senior water right to a portion of the river flows. As one informant put it, "In effect, the feds have just gotten themselves a 1904 water right" (water right date for the Pathfinder Dam, the first dam in the North Platte Basin).

Not surprisingly, no one interviewed felt that additional interests had rights to water usage beyond those already operating in the system under state law. However, some suggested that one groups' use of water was not appropriate. Some Colorado informants expressed concern that groundwater users in Nebraska must not be allowed continued unregulated privileges for groundwater pumping because of its impact upon Platte River flows. However, these informants stated their acceptance for the State of Nebraska to deal with this issue in the near future.

Thus, with the agreement's adoption, clearly defined boundaries do exist for both the physical resource domain and those given rights secure to a portion of the Platte River water, pending Nebraska's future ability to manage groundwater pumping near the river.

3. Congruence Between Operational Rules and Local Conditions and the “Distributional Share System”

The third design principle involves the creation of two types of rules – appropriation rules for resource allocation and provision rules for resource acquisition. Together these rules are called operational rules. Ostrom states that regulations controlling everyday regime activities must fit the local conditions where the activities take place and the benefits received must be related to the costs (Ostrom, 1990, p.92).

Freeman also discusses this concept in more detail through what he terms “distributional share systems” in irrigation regimes (Freeman, 1989, pp. 27-33). Freeman states that two strategic variables must be present for sustainable water development: 1) joint organizational agreements that specify water delivery is dependent upon members paying their share of the cost, and 2) members' water costs should be roughly proportionate to the water service they receive. Distributional shares may be organized by various ways – by volume, by a specified priority system (e.g., by crop), or by demand (using storage). But, like Ostrom, Freeman notes a key determinant to devising the optimal share system lies in understanding local circumstances.

This section will first examine whether the new Platte River Regime operational rules are related to local conditions. The next section investigates how the regime unites costs with benefits. The final section explores the reconciliation of the river's head and tail distinctions.

Reconciling Rules and Local Conditions. In this study, congruence with local conditions is a more complex task for appropriators than in the case studies presented by Ostrom and Freeman. In this Platte River study, participants indicated there are at least three major “local” conditions that each need to be satisfied, rather than just one set. Three different conditions are presented in the form of the three states through which flows Platte River water. Each state has its own laws, policies, politics, and river infrastructure characteristics that separately present opportunities and challenges to provide more land and water for endangered species habitat in Nebraska.

For example, particularly Nebraska informants pointed out that Colorado's South Platte River watershed is marked by a rapidly growing population with implications for future water

supplies. It has no main channel reservoirs in the lower reach of the river, nearest the critical habitat. Wyoming, on the other hand, has a sparse, mainly agricultural population, and the Bureau of Reclamation manages a series of reservoirs along the main stem of the North Platte River into Nebraska. Nebraska has the critical habitat, is downstream of significant Platte River water use, and has notable, largely unregulated groundwater pumping. Each situation provides opportunities and constraints for development of a basin-wide plan to improve downstream habitat.

The distributional share principle rests on an assumption that local conditions of a resource domain are well understood. While this knowledge may more often be the case in small CPR regimes from which the design principles have been developed, adhering to this principle in complex, multi-jurisdictional commons, such as is the case here with the Platte River, becomes more problematic.

To deal with this complexity while developing rules to conform to local conditions, study participants identified the importance of "adaptive management" in reaching agreements. This approach was seen as critical to most of the informants in this situation where historical information regarding baseline flows is absent and there is a rather poor understanding of the natural system's response to increased water flows. Even some of those most adamantly opposed to the agreement favor adaptive management, as it "may help the feds back down from their target flow numbers." Because this element is not discussed in the extant literature, it is defined and explained in detail under "Additional Design Principles" later in this chapter.

Costs and Benefits. The agreement, to be successful, needed to apportion costs among the regime members involved, and capture for its members an adequate share of the benefits they required. Informants identified five major costs and two key benefits that needed to be distributed fairly in order to secure an agreement among the parties. The key costs to participants were water, money, land, authority, and participatory costs (staff time and related costs).

Participants linked these costs to the benefits that might be achieved: habitat improvement for the species of concern, and "regulatory certainty" – the security an organization

finds in advanced knowledge that its obligations to provide a quantity of water, money or other organizational resources will remain unchanged over a given period of time. In this case, regulatory certainty is achieved by compliance with the Endangered Species Act (ESA) and the identification of specific measures to be undertaken by the stakeholders over the next 15 years. These measures serve as the reasonable and prudent alternative for impacts to the target species and their habitats.

Regulatory certainty is also attained by anticipating destabilizing future events in the accord and specifying actions to be taken should they become reality. Thus the agreement addresses what will happen if a state proposes further water depletions, if the program is not meeting its milestones, if a court ruling on *Nebraska v. Wyoming* is developed, and if a state withdraws from the agreement.

For some informants, regulatory certainty was considered an important benefit when viewed with an historical perspective of this issue. One Nebraskan informant, noting the lack of progress over ten years with the federal bureaucracy, called the certainty that the agreement would provide as “welcome”. Some environmental informants likewise saw the agreement as providing some habitat improvement immediately after years of delay. Most informants on both sides of the issue saw the alternative, litigation, in an unfavorable light as perpetuating delay and uncertainty for many years and having an unpredictable eventual outcome.

In arriving at these allocation costs and provisional benefits, informants generally noted that achieving fairness was important to them. Some said they measured fairness by their cost for what it “bought” them, a simple economic calculation. Others said they measured fairness by their cost-benefits compared to the other parties’ cost-benefits, a political determination. The degree to which either of these two measures of fairness was important, varied from informant to informant and was not quantified in this study.

Despite numerous serious disagreements that threatened to imperil the process over the three years of negotiations, the distributional share system of costs for securing benefits sought were spelled out in the Cooperative Agreement signed by all participants in 1997.

In the following narrative, note that in each, the appropriator achieves some benefit for the cost incurred. All appropriators achieved regulatory certainty that all informants held high in importance. However, beyond this shared benefit, additional benefits often accrued to appropriators that were state-specific.

Four elements comprised the costs for the distributional share system in the Cooperative Agreement under study. Each cost and associated benefits are identified and discussed below.

Participatory Costs. Although not directly addressed in the Cooperative Agreement, some informants held concerns over the cost of reaching an agreement, in terms of their time and their organization's travel budget, and in the inequity of these costs that placed a greater burden on smaller organizations. The benefits for such costs can be substantial, allowing the organization a place at the table, literally and figuratively, in helping to shape the final rules and agreements. This topic is discussed further in the section following on "collective choice arrangements".

Sharing Water: The Environmental Accounts. Many informants spoke about the extreme difficulties encountered and frustrations generated over the apportionment of Platte River water for endangered species habitat. The USFWS, they claimed, was unable to ascertain what the fair share distribution should be, preferring to speak of the total species needs, an amount which water interests found entirely unacceptable. Adherence to this total target flow amount nearly caused the negotiations to collapse in February of 1997. However, the continuing question of what constitutes "fair share" among the parties was "most important" in the words of one informant, with another stating that determining the amount current water projects could provide led to "the" debate.

The agreement finally reached pledges each state to contribute a share of water for the critical habitat, with a combined goal of providing 130,000 to 150,000 acre feet (af) at the end of the program's first increment (about 15 years). Approximately 70,000 af will be provided through three projects, one in each state. These projects create "environmental accounts" which, in effect, are new water rights equal in priority to the most senior rights on the river. The USFWS can order releases from these projects according to wildlife needs.

In Nebraska, 10% of the storable flow into Lake McConaughy during the winter is available to USFWS. This amount of water should average 50,000 to 70,000 af per year. In return, Nebraska gets federal re-licensing of Kingsley Dam for 40 more years and the state can continue its *Nebraska v. Wyoming* lawsuit in an effort to obtain more upstream water from Wyoming.

In Wyoming, the environmental account is in the Pathfinder Reservoir. Here an inflatable, 2.4-foot high plastic dam is to be constructed across the top of the existing Pathfinder Dam to increase its storage capacity. This additional water equates to the amount lost to sediment fill over the decades. The USFWS will obtain 60% of the additional stored water, about 34,000 af per year, with the state free to use the remaining 40% or 20,000 af. The environmental account will be assessed its proportionate share of evaporation losses based on the storage water in the account. Thus, Wyoming benefits from regulatory certainty and the ability to recapture 20,000 af of additional water.

For its water share, Colorado will develop a new project along the South Platte River near the Nebraska border to create its environmental account. This project, called the Tamarack Project, will pump water from wells along the river into nearby recharge basins during the winter when river flows are higher. During the summer, when the demands for water are the greatest, the water would seep underground back into the river. This operation should add about 10,000 af to the river each year. In return, Colorado gets: 1) its headwaters projects approved, 2) a project which may also keep minnows there from being listed as federally endangered or threatened, and 3) greater certainty that, in drier years, it will provide Nebraska sufficient water obligated to it under the South Platte River Compact.

An additional 60,000 af of water will be provided by the three states through new water conservation efforts. The details of this allocation will be developed through future studies conducted by the Governance Committee's Water Sub-Committee.

A small minority of informants believed that, to be fair, the agreement should also obligate the federal government to provide water for habitat improvement. They point to the opportunity to generate more water from federal national forest lands located in the Platte River

headwaters. This additional water would be obtained through greater timber harvest levels, allowing for more runoff and less evapotranspiration from trees and plants.

Providing Land: Habitat Acquisition. The agreement also specifies that 10,000 acres of key habitat in the Big Bend region of the Platte River will be acquired in the first 10 to 15 years toward the long-term goal of 29,000 acres. During this first program increment, Nebraska will contribute the 2,600-acre Cottonwood Ranch valued at \$ 5,300,000. Wyoming has agreed to donate fee simple title to the 470 acres of habitat it owns in the critical habitat area to USFWS. Colorado will contribute cash towards purchase of habitat as determined by the Governance Committee.

Cash and Cash Equivalents. Informants spoke of the critical nature in determining the allocation of cash to the project, with one informant calling this discussion, "the big issue."

The eventual agreement took the total financial costs needed and shared them among the four parties as summarized in Table 7. The federal government agreed to pay 50% of the program costs, and the states agreed to pay the remaining 50%. This arrangement will generate \$37.5 million for habitat improvements by the federal government, matched by the three states combined.

The federal government was interested in obtaining its distributional share of benefits at some price. Most respondents felt that the federal government paying for half the cost was a fair apportionment. They argue that expenses to improve habitat for endangered species that are enjoyed by all citizens should not be borne entirely on the backs of the water users.

In the lexicon of this study, this argument can be framed by noting that this newly-evolving river regime is attempting to provide two sets of goods: a common property resource good in the form of re-regulated water of the Platte River, and a public good in the form of improved wildlife habitat. As a public good, the benefits of enhanced habitat can be enjoyed in the form of whooping crane watching, for example, by all who wish to do so, whether at the cranes' wintering grounds in Texas, or en route to their breeding grounds in Canada. Indeed, many more people will enjoy the intrinsic value of these cranes by just knowing that they exist.

Thus, with the wildlife benefits so available to citizens, the rationale that citizens should fund a portion of this effort made sense to most informants.

According to study informants, the states agreed to divide their share of the costs based upon approximate water use. Thus the states using the most water would pay accordingly. There then arose general agreement that, of the states' obligations, Colorado and Nebraska would contribute 40% of the states' share and Wyoming contribute 20%. The Agreement provides for proportionally reducing the amounts if Congress did not appropriate the full amount.

Table 7

**Program Contributions, Cooperative Agreement through First Program Increment
(values in millions of 1997 dollars)**

	CO.	WY.	NE.	States' Total	Federal Total	Total
Term of Cooperative Agreement (3 years anticipated)						
Conservation Study	0.3	0.3	0.3	0.9	0.0	0.9
Habitat Cash Equiv.	0.0	0.0	5.3	5.3	0.0	5.3
Other Cash	0.6	0.3	0.4	1.3	7.5	8.8
Total	0.9	0.6	6.0	7.5	7.5	15.0
First Increment						
Years 4 ~ 6						
Cash	2.475	0.85	0.0	3.325	7.5	10.825
First Increment						
Years 7 ~ 15						
Cash	7.425	2.55	0.0	9.975	22.5	32.475
Totals of Cash and Cash Equivalents Through the First Increment (about 15 years)	10.8	4.0	6.0	20.8	37.5	58.3
Water Projects' Value Through the First Increment (about 15 years)	4.2	3.5	9.0	6.7	0.0	16.7
Program Totals Through the First Increment (about 15 years)	15.0	7.5	15.0	37.5	37.5	75.0

4. Collective Choice Arrangements

This design principle posits that for common property resource regimes to endure, resource users must participate in setting the appropriation and provision rules. This principle is most directly connected to the first principle, establishing clearly defined boundaries, since how we circumscribe the physical resource and identify the legitimate appropriators provides the yardstick for determining the degree to which this collective choice principle was attained.

In a common property resource regime such as the one studied (spanning portions of three states and involving water, land, and wildlife resources), identifying all the resource users can be difficult; obtaining their full participation can be unwieldy; reaching a common understanding of such a complex problem can be formidable.

Respondents reported the difficulties encountered in balancing the twin objectives of keeping the group size small enough so that negotiations could advance at an acceptable rate while assuring that all the key interests had a voice. Participants eventually used small group committees with tasks broken down into component parts as a solution.

Some respondents made a distinction between their officially sanctioned role to represent a class of interests and the inequalities that existed among participants in representing their interests. Some felt that there were great disparities in financial resources and staff size among those in the negotiations that prevented them from negotiating as effectively as interests that were endowed with larger staff and budgets upon which to negotiate.

Beyond the inequality concerns, one respondent strongly felt that all the key interests were not adequately represented resulting in a biased process. Specifically, this respondent views the whooping crane as an international resource, due in part because the wild crane population breeds and nests in Canada. Despite this fact, there was no Canadian representation nor representation from the other states, such as Texas, in which the crane lives. The result of this representation absence, the respondent believes, is a process that favors water development interests of the three states, rather than the wildlife interests of the globe. He believes this bias is

further exacerbated when two of the three states do not have a crane population and, he assumes, have no interest in cranes, but considerable interest in water development.

However, regarding the question of membership, all others interviewed felt that these interests were represented indirectly through the national environmental groups' membership.

Some informants also expressed frustration with the amount of information one needed to digest when the issue was expanded from within a state to a three state region. According to one respondent, this expansion required environmental interests to be active on every front, requiring "massive" amounts of time. A result of the complex nature and time constraints, this informant believes, led negotiators to become non-technical "horse traders", rather than approaching the issues from a more principled and scientific basis.

Despite these challenges, many informants identified two elements that were responsible, in part, for reaching an accord. First, the process was not a federal program constrained by extensive federal guidelines. Rather, it was a cooperative process in which all voices could be heard and seriously considered. As one informant put it, "You had the feeling you had control over your own destiny."

Second, several informants identified the importance of having the key active participants possessing the power to make deals. This dynamic distinguished it, they claim, from the Platte River Management Joint Study which relied on lower level bureaucrats without decision-making authority and which, after years of meetings, was not able to translate talks into concrete actions. A related, positive dynamic also reported was that the prestige of governors and the Secretary of Interior were at stake, making it difficult for their representatives in the talks to disengage from the process.

In the end, the final agreement was reached, but without the acceptance of the environmental representatives. The two environmental groups representing wildlife interests, the Whooping Crane Trust and the National Audubon Society, withdrew from the agreement in February 1997, after nearly three years of negotiations and just four months before the agreement was signed.

According to some respondents, these interests felt that they were not affecting the agreement being reached. Their view is USFWS was under pressure by the Department of Interior to reach an agreement and show that the ESA could balance environmental with economic interests. Some stated that once USFWS agreed with the water interests in the proposal, the agreement would move forward with or without them.

Environmental interests interviewed were generally hopeful that the Agreement will achieve their goals for habitat enhancement. They have agreed to re-engage themselves into developing a program through their participation on the Governance Council. However, they also see that legal action remains a viable alternative in the future if the habitat improvement hoped for does not materialize.

A 10-member Governance Committee was established in the Cooperative Agreement to direct and provide oversight for all the activities specified in the Agreement with the exception of NEPA and ESA Compliance. Specifically, it develops rules of governance, procedure and conflict resolution; establishes technical committees to carry out activities of the Agreement; serves as arbiter of disputed external peer reviews; allocates funds and resources; enters into agreements; assesses progress and implements measures to correct shortfalls; and develops deadlines for program implementation.

The committee is structured to provide for balance among the interest in two ways. First, membership is divided according to interest in the water and wildlife resources being appropriated (see Table 8). The specific member appointed is a decisionmaker delegated to each of those respective entities.

Second, interests are balanced in decision-making by requiring a super-majority of nine out of ten votes to establish a position on policy issues (i.e., affecting the term, scope, allocation of funding, or viability of the Cooperative Agreement). According to informants, this recipe balances twin objectives: No one party can exercise a veto alone, and neither environmental interests nor federal interests can be over-ruled by the other parties.

Table 8
Governance Committee Structure

Constituent	Number	Qualification and Selection Process	Initial Appointment
The States	3	One member per signatory state, selected by each Governor	CO: Dir. DNR NE: Dir. Nat. Resources Commission WY: Dir. Water Dev't. Commission
The Federal Government	2	One member representing FWS, one representing BOR; selected by Secretary of Interior	Ass't. Secretary for Water and Science; FWS Regional Dir.
Environmental Interests	2	Two members representing environmental entities in the 3 states; selected by those entities	National Audubon Soc.; Platte River Trust; Env'l. Defense Fund (share seats)
Water Users	3	One representing each of the following water users: in Nebraska above L. McConaughy, on the S. Platte R. above Western Canal diversion, downstream of L. McConaughy; each selected by those users	Northern CO. Water Cons. District; Nebraska Public Power Dist.; Goshen Irrigation District

5. Monitoring

While respondents stated they clearly recognize the need for monitoring water resources according to agreed upon rules, exactly how water resources should be managed and how this might be done is not yet decided. Of particular difficulty will be monitoring and assigning credit for increased water flows achieved through future conservation efforts. Monitoring decisions are pending further modeling work and recommendations by the Water Sub-Committee of the Governance Committee. Indeed, the very basic measure of what constitutes success for this program has yet to be determined. Thus, while the principle has been identified by the organization as critical, how to accomplish this task remains under study.

6. Graduated Sanctions

When monitoring indicates that a member of the CPR regime has violated the operational rules of regime, sanctions are required. Without them, there is no incentive for members to continue to restrain their behavior for the common good. The regime is then in danger of degenerating to "the tragedy of the commons."

In this study, respondents indicated that there are two sanctions preventing violation of the agreement by any party. First, a violation could trigger lengthy and costly litigation by those parties adhering to the agreement against those who would chose to violate its terms. The basis for this litigation could be the agreement itself or it could be the ESA.

Secondly, a violation or abrogation of responsibilities outlined in the Cooperative Agreement by any one member could result in USFWS reinitiating all consultations under ESA which relied upon the Cooperative Agreement and the proposed Program as a component of their reasonable and prudent alternatives. One informant termed this wording in the agreement as "the mutually assured destruction clause." Such an event would require habitat mitigation strategies be approved on a project-by-project basis, an outcome no one desires.

Most water users interviewed view this prospect with tremendous concern as they feel it would remove one of the key benefits of the agreement – regulatory certainty. Without this predictability, the assurance of adequate water supplies to meet their customers' demands becomes unreliable, with undesirable consequences for agriculture and urban development.

Likewise, most environmental interests regard imposition of this sanction contrary to their interests. Imposition of such a sanction could mean years of delay in full implementation of measures designed to improve endangered species habitat along the Platte River. Such delay, they stated, could be disastrous for the recovery of species that are already in a precarious state.

Ostrom (1990) posits that sanctions should range "...from insignificant fines all the way to banishment" in order to deal more effectively with first offenders. While sanctioning options are available in the Platte River regime, and respondents view these sanctions as a significant incentive to keep all parties from violating the agreement, there is nothing incremental in their structure. No respondent suggested the gradual nature of sanctions will be a significant element in this agreement.

7. Conflict Resolution Mechanisms

Ostrom's (1990) sixth principle is critical should a CPR regime be able to survive the test of time. Inevitably, conflicts will arise of such significance as to threaten the stability of the

regime. Conflict resolution mechanisms anticipate this eventuality and are prescribed to deal with a conflict before it escalates beyond control.

However, in elaborating on this principle, Ostrom seems to apply this mechanism only to established rules that, subject to the interpretation of the arbiter, may have been broken. Indeed, as she points out, rules are often quite vague and situations arise where clarification is needed from an authority.

However, in this study, many of the rules have yet to be developed, particularly in the critical phase after the first increment (i.e., after the first 15 years of the program). In addition, many of the areas to be interpreted are not rules per se as Ostrom envisions them, but agreements on very technical matters dealing with establishing base flows, ecosystem modeling, ecosystem response, etc.

Needing a super-majority to advance policy issues such as these may prove to generate paralyzing polarity, since only two members out of ten can prevent implementation of any proposal. Since the four general interests represented on the committee are in blocks of two or more, any one interest can stymie a recommendation.

Importantly, if difference of opinion cannot be resolved at the Governance Committee level, the Cooperative Agreement establishes an Oversight Committee. It is a four-member committee, consisting of the Secretary of Interior, and the Governors of Colorado, Nebraska and Wyoming.

The Committee does not meet to resolve disputes in general day-to-day matters regarding the Governance Committee or the Agreement. Rather, it is required to meet whenever a request for such a meeting is made by any state or federal member of the Governance Committee because the committee is "...unable to resolve problems relating to (1) a preliminary determination by the U.S. Fish and Wildlife Service ('FWS') that the program is not continuing to serve as a reasonable and prudent alternative, (2) a proposal by the Department of the Interior ('DOI') or any state to withdraw from the Program, or (3) lack of funding by Congress or any state to fulfill its responsibilities set forth in any subsequent agreement implementing the Program" (Cooperative Agreement for Platte River Research, 1997, Appendix C, p. 1). The Committee is

also required to meet before any party of the Program withdraws or if there is a determination that the Program is not continuing to serve as a reasonable and prudent alternative.

Only the Governor of a state or the Secretary of the Interior can decide to withdraw from the program and the reasons for such action must be provided in writing and made public.

Some informants believe that there is a built-in incentive to resolve differences before they escalated into a conflict that would threaten the regime. First, their rationale goes, all parties have invested so much in this public process. Second, it has strong political support coming from above the members of the Governance Committee. And third, for one entity to walk away from the agreement would place all interests in jeopardy and all future water management actions having an effect on the Platte River could be subject to mitigation measures that would need to be negotiated with the USFWS on a project-by-project basis.

Thus, while the regime has incorporated this design principle, other factors could come into play, and many decisions have yet to be made. It remains to be seen whether the implementation of this principle is sufficient to sustain the regime over time.

Table 9 summarizes the status of hypothesized design principles in the Platte River CPR regime. Informants and an analysis of the Cooperative Agreement provide evidence that five of

Table 9
Design Principles of the Platte River Regime

Design Principle	Presence	Comments
Recognized Rights to Organize	Yes	Governance Committee with federal involvement recognized to re-regulate Platte River water
Clear boundaries and Membership	Yes/Yes	110 miles of riparian habitat set boundaries, membership clearly defined
Rules congruent with conditions and obtaining resource	Yes	Several conditions factored in separately in devising rules; costs equated to water delivery
Collective Choice	Yes	Representation through the Governance Committee and its sub-committees
Monitoring	Evolving	Members recognize importance; committee studying potential methods
Graduated Sanctions	Partial	Sanction options limited
Conflict Resolution Mechanisms	Partial	Helpful, but withdrawal by one party can destabilize entire regime

the seven hypothesized design principles have been fully embraced in this CPR regime. However, the two design principles of graduated sanctions and conflict resolution mechanisms are not comprehensively adopted here. This action may leave the regime with few conflict resolution options should a severe conflict crisis erupt within the regime.

Additional Design Principles Required in a Large-scale CPR Regime

In addition to the above design principles, this study found evidence to support four additional design principles that were of critical importance to the creation of this regime. It is surmised that the extant literature has not captured these principles because of past studies' focus on small-scale common property regimes. In a complex, large-scale common property regime, such as the Platte River, where great uncertainty surrounds the operation of the system, these four design principles may be of critical importance. They are described below.

1. Informational Expertise Shared

In a small-scale common property resource regime, the system is well enough understood from first-hand experience of the users and through shared experiences of neighbor with neighbor. In a regime such as the Platte River, however, there are two major informational challenges not faced by small-scale regimes.

First, the Platte River is much larger than the regimes generally investigated in the literature. This regime covers 86,000 square miles across portions of three states. Most regime members are not neighbors. One regime member's experience may not be the same as another regime member's reality. Regime members' actions and thus experience may be different from state to state, depending upon the laws of the jurisdiction under which they live.

Secondly, whereas the goal of most common property resource regimes is to appropriate goods among all members fairly, this regime has an equally important additional goal: to enhance wildlife habitat in the Big Bend stretch of the Platte River. As has been indicated in Chapter III, this is a formidable challenge since there is no certain knowledge of what river base were a century ago and because there is considerable uncertainty over ecological restoration.

These twin challenges necessitate the explicit need for education and informational sharing by regime members. Indeed, many informants of this study identified this element as critical to fostering the required understanding to reach agreements on the construct of a regime. Idiographic knowledge (i.e., "unique, site specific knowledge") needed to be shared along with nomothetic knowledge (i.e., "generalized tendencies, more theorized knowledge"). The different organization and legal structures needed to be understood, as well as the socio-political realities that differed among groups of constituents and jurisdictions. Without the sharing of this breadth and depth of information that no one party possessed, most informants believed there could have been no agreement.

2. Adaptive Management Program Employed

Information sharing was a critical element to success in the construct of this regime, but in many cases there was inadequate information for which to foster agreement. As an important outgrowth the design principle described earlier, "Reconciling Rules and Local Conditions," informants spoke of the importance to deploy adaptive management in reaching agreements for the system that was complex and in some regards, little understood.

Lee (1993, p. 9) describes adaptive management as "... an approach to natural resource policy that embodies a simple imperative: policies are experiments; learn from them.... Adaptive management takes... uncertainty seriously, treating human interventions in natural systems as experimental probes. Its practitioners take special care with information. First, they are explicit about what they expect, so that they can design methods and apparatus to make measurements. Second, they collect and analyze information so that expectations can be compared with actuality. Finally, they transform comparison into learning—they correct errors, improve their imperfect understanding, and change action and plans."

Throughout most interviews in this study, disagreements among the parties to the Cooperative Agreement over some of the most basic facts regarding Platte River flows and habitat requirements for endangered species in the Big Bend reach of the river, were clearly evident.

Since there are no records of river flows along the Platte prior to its extensive development of water impoundments and diversions, one can only postulate what river flows are needed to maintain optimal habitat. Some respondents pointed to increasing whooping crane populations since the early 1940s, and/or steadily increasing river flows every decade since the early 1900s, to bolster their opinion that more river water is not required.

The question of the amount of water wildlife requires is most basic, yet is the most contentious, critical question throughout the negotiations. The USFWS arrived at a definitive number at one point in the negotiations: 417,000 acre-feet per year. This amount would require release of more than 30% of the flows going to the Big Bend region of the when needed by wildlife. Most respondents revealed how the process nearly collapsed at the meeting in which this number was announced.

The interviews also demonstrated a schism exists over an understanding of how the river operates. The example some respondents used was the USFS and USFWS belief that releasing more water from reservoirs in Colorado would improve habitat in the Platte's Big Bend reach. They point out that the Doctrine of Prior Appropriation would allow junior water rights holders downstream of any release to divert this water to their uses. Many also felt that uncontrolled groundwater pumping in western Nebraska would also siphon off any additional upstream releases.

Compounding the problems caused by a lack of data appears to be inconsistent risk assessments with the data. Risk assessment allocates probabilities to possible outcomes as a result of actions taken. In this case, for example, respondents have vastly differing views on the chances of further whooping crane population declines without an agreement.

Despite these differing assessments, value-laden judgements, and competing resource interests, 94% of respondents rated the Cooperative Agreement, with its operational rules, as something they could "strongly" or "somewhat" support (see Tables 14 and 15). From the interviews it appears that this support may be largely due to participants' willingness to embrace an adaptive management strategy towards solving the dilemma of appropriating water in an

arena of uncertainties. This action, in itself, may be a strategy to tailor the operational rules to the local conditions characterized by uncertainty.

This agreement uses adaptive management by establishing specific water, land, research, program development and administrative goals for each of the first three years of the agreement. At the end of each year, "...the Governance Committee will assess accomplishments, implement measures to correct any shortfalls, and evaluate and adjust future year milestones accordingly" (Cooperative Agreement for Platte River Research, 1997, pp. 7, 10, 14).

3. *Involvement of Organizational "Decision-Makers" throughout the Process*

As discussed earlier, many informants believed that the a significant measure of the success achieved to craft this regime was due to the active participation of people in positions of such power in their organization that they could make organizational commitments at these meetings. This was often contrasted to earlier efforts in which lower level bureaucrats represented their organizations and found it difficult to get commitments of their organization. In this case, those who could speak for their organizations were involved in the meetings and the commitment for agreement was personally undertaken by the governors and the Secretary of Interior.

4. *Participation Costs Not a Barrier*

In a large-scale, complex common pool resource, challenges of participation arise not found in small-scale regimes. Some informants identified two significant challenges they encountered regarding participation in crafting a large-scale regime.

First, as described earlier, some informants cited the difficulties to attend monthly meetings that were usually held in Denver, because of the distances involved in this large-scale common pool resource. Both travel expenses and time allocation were sometimes factors prohibiting their full participation. Should these costs prohibit effective participation by some key groups necessary to fully engage in regime creation and maintenance, the sustainability of that regime could be at risk.

In addition, some informants of smaller organizations cited their perceived disadvantage compared with larger organizations for their lack of staff specialists to check facts and conduct independent research. If this disparity grew to such an extent that some organizations felt they could not adequately represent their interests over organizations with more discretionary money, regime creation and maintenance could be placed in jeopardy.

Social Capital

The task of designing institutions, such as the new Platte River water regime, necessitates creating new relationships between those involved in the regime design and implementation if it is likely to succeed. In this case, the process must directly involve the users and suppliers of water to create new personal associations.

This section of the study examines the nature of the relationships among the network of those involved in designing the new Platte River water regime. Two survey instruments were administered to the principle participants in the Platte River Cooperative Agreement (See Appendix B).

The first instrument gathered information related to familiarity with, and communications among, other organizations participating or affected by the Agreement prior to 1994 and "today" (1998-99). Social capital is built upon groups discussing issues together so we prepared scales to assess whether this was occurring and with what relative frequency. Whether social capital was increasing depends upon the changes in familiarity and consulting each other over a period of time, so this was assessed as well. The year 1994 is purposely chosen as it marks the beginning of the negotiations that led to the Cooperative Agreement.

The instrument also sought to quantify perceptions of legitimacy and of interdependence among these organizations involved in three years of negotiations (1994 – 1997). As will be explained, these variables are significant indicators to portend the chances of further social capital development.

The second instrument examines polarization on organizational positions for seven specific management policy issues under discussion that affect wildlife habitat along the Platte

River for endangered species. This information is useful for determining the degree of polarization among the organizations and the nature of that polarization (i.e., cross-cutting cleavages or polarizing cleavages) each with implications for social capital as will be explained.

Through an analysis of the results, support was found for two of the hypotheses stated in Chapter IV, that is, a) organizations involved are more familiar with each other today and consult with each other more often than the time prior to the start of these negotiations; and, b) overall polarization on key Platte River management issues among all organizations will be low.

Four hypotheses were also made regarding the relationship of polarization between organizations and the four variables of social capital (i.e., familiarity, consulting, and perceptions of legitimacy and interdependence). Analysis of the data showed no relationship between the degree of polarization and the level of these four variables.

Inter-Organizational Familiarity and Communications

In Chapter II social capital and its partner, civic engagement, were discussed. We learned that communications and networks among people and the familiarity this engagement breeds are fundamental cornerstones to building social capital among a network of people (Coleman, 1988). Consulting with others and becoming more familiar with each other broadens social identities from the "I" to the "we". Mutual learning, trust, collaboration, and norms of mutual reciprocity can flourish. Indeed, it is hard to comprehend how social capital can be built without communications among people leading to familiarity.

Thus it is that the written survey began with two variables: a measure of familiarity (i.e., diversity of participants), and the degree to which organizations consult with one another (i.e., inclusiveness). For if these qualities do not exist in this Platte River management network, it is likely that little social capital and capacity for collective action is present. Familiarity is first examined, then inter-organizational communications.

As hypothesized, familiarization among organizations increased markedly from "prior to 1994" to the time of their interview between 1997 and 1999. Total familiarity scores among all groups rose from 746 points before 1994, to 956 points "today", an increase of 210 points

(28.15%). In evaluating familiarity "today", 18 organizations rate with 30 points or more – over twice as many as a few years earlier.

Prior to 1994, almost all organizations were already "very" familiar with two federal agencies, the Bureau of Reclamation and the U.S. Fish and Wildlife Service, in that order (see Table 10). With 48 points the maximum score any single organization could receive on familiarity, these two organizations very nearly achieved the maximum possible.

A secondary tier of familiarity was present prior to 1994 for two other federal agencies (the U.S. Forest Service and U.S. Geological Survey-Water Resources Division), two environmental organizations (the Platte River Whooping Crane Maintenance Trust and the National Audubon Society) and two water user organizations (Denver Water and the Northern Colorado Water Conservancy District). Thus, eight organizations scored above an arbitrary 30-point threshold.

It is worthwhile to note that organizations that were best known represent a mix of starkly different missions and values. Of the top eight organizations, four are federal agencies with different missions, two are environmental organizations and two are water development interests. This could be considered a desirable situation from the social capital perspective, in that various positions on the issues at hand are known among the network participants.

These 1994 ratings can be contrasted to those of the "today" period, a few years later. The U.S. Fish and Wildlife Service and U.S. Bureau of Reclamation switch spots for the numbers one and two positions. State based agencies (like the Colorado Division of Wildlife and the Colorado Engineers Office) and water user organizations particularly in Nebraska (e.g., the Nebraska Dept. of Water Resources and Nebraska Natural Resource Districts) become much more familiar to respondents. All three of the major environmental organizations involved in the issue are generally well known. Municipalities, local irrigation districts and associations remain less well known, many of which played a less active role in the negotiations.

In an examination of the organizations experiencing the greatest increase in familiarity ratings during this period, the table shows that private water user organizations appear to have experienced the greatest increase in familiarity (e.g., Goshen Irrigation District, Central Nebraska

Public Power and Irrigation District and Northern Colorado Water Conservancy District). Those organizations showing significant increase in familiarity represent a fairly even mix of the three states involved. Thus no one state fielded organizations that showed a disproportionate increase. According to the interview discussions, many of these organizations were very actively involved in the negotiations.

Table 10

Familiarity of Platte River Organizations with Each Other in 1994 versus 1998 - 99

NAME OF ORGANIZATION	FAMILIARITY PRIOR TO 1994	NAME OF ORGANIZATION	FAMILIARITY TODAY (1998-99)	NAME OF ORGANIZATION	FAMILIARITY INCREASE
Bureau of Reclamation	45	Fish & Wildlife Service	47	Goshen Irrigation Dist.	11
Fish & Wildlife Service	43	Bureau of Reclamation	45	Central NE. Public Power & Irrig. Dist.	11
Platte River Whooping Crane Trust	34	Northern CO. WCD	42	Northern CO. WCD	11
U.S. Forest Service	34	National Audubon	40	WY. Water Dev. Comm.	11
USGS Water Res. Div.	34	Env'l. Defense Fund	39	Env'l. Defense Fund	11
Denver Water	33	Platte River Whooping Crane Trust	39	NE. Public Power Dist.	11
National Audubon	33	USGS Water Res. Div.	39	NE. Water Users Association	10
Northern CO. WCD	31	U.S. Forest Service	38	Pathfinder Irrigation District	10
CO. Div. of Wildlife	29	Central NE. Public Power & Irr. Dist.	37	NE. Dept. of Water Resources	9
CO. State Engineer	28	Denver Water	37	Central CO. WCD	9
Env'l. Defense Fund	28	NE. Public Power Dist.	37	Lower S. Platte WCD	9
NE. Dept. of Water Resources	27	CO. State Engineer	36	NE. Natural Resource Districts	8
NE. Natural Resource Districts	27	NE. Dept. of Water Resources	36	WY. State Engineer	8
NE. Public Power Dist.	26	CO. Div. Of Wildlife	35	CO. State Engineer	8
Central NE. Public Power & Irr. Dist.	26	NE. Natural Resource Districts	35	GASP	7
WY. State Engineer	22	NE. Water Users Association	31	National Audubon	7
City of Greeley	21	Central CO. WCD	30	City of Boulder	6
Central CO. WCD	21	WY. State Engineer	30	CO. Div. Of Wildlife	6
NE. Water Users Association	21	Lower S. Platte WCD	27	City of Ft. Morgan	5
City of Ft. Collins	19	WY. Water Dev. Comm.	27	Platte River Whooping Crane Trust	5
City of Loveland	18	GASP	24	USGS Water Res. Div.	5
Lower S. Platte WCD	18	Goshen Irrig. Dist.	24	Denver Water	4
City of Boulder	17	Pathfinder Irrigation District	24	City of Ft. Collins	4
GASP	17	City of Ft. Collins	23	City of Loveland	4
WY. Water Dev. Comm.	16	City of Greeley	23	City of Sterling	4
City of Ft. Morgan	15	City of Boulder	23	Fish & Wildlife Service	4
City of Sterling	15	City of Loveland	22	U.S. Forest Service	4
Pathfinder Irrigation District	14	City of Ft. Morgan	20	Irrigationists' Association	3
Goshen Irrig. Dist.	13	City of Sterling	19	Water Supply & Storage	3
Water Supply & Storage	12	Water Supply & Storage	15	City of Greeley	2
Irrigationists' Association	9	Irrigationists' Association	12	Bureau of Reclamation	0
TOTAL SCORE/MAXIMUM POSSIBLE	746/1152	TOTAL SCORE/MAXIMUM POSSIBLE	956/1152	TOTAL INCREASE/MAXIMUM POSSIBLE	210/406

Note. Ratings represent totals on a scale of 0 = "not at all familiar", 1 = "somewhat familiar" and 2 = "very familiar". N = 24. Maximum score if all organizations rated a 2 = 48. Familiarity increase scores represent the difference of 1994 ratings compared to ratings "today"

The next variable examined concerns communications: How frequently do organizations voluntarily "consult with each other?" As shown in Table 11, organizations say they consulted with each other on issues of importance more "today" than prior to 1994. This finding supports our hypotheses that consultation would increase from 1994 to "today". The total of consulting scores for prior to 1994 is 797, whereas the total for "today" is 1050, representing a 31.74% increase in about three years. This is approximately the same percentage increase in scores found for familiarity ratings (28.15%).

In an examination of the patterns of those organizations that were consulted, we find that, like familiarity, the U.S. Bureau of Reclamation and the U.S. Fish and Wildlife Service ranked on top, more often consulted than other organizations. The second tier of those organizations being consulted prior to 1994 are primarily Colorado-based agencies and water users.

This second tier of most consulted organizations changes after 1997 to include many more Nebraska-based water user organizations (e.g., Central Nebraska Public Power and Irrigation District, Nebraska Department of Water Resources and Nebraska Public Power District), as well as more consultation conducted with municipalities in a third tier of frequency. It is interesting to note the prominent role the Northern Colorado Water Conservancy District takes after 1997, showing the greatest gain as an organization with which others consulted, perhaps as a response to its very active participation in the cooperative agreement.

The Northern Colorado Water Conservancy District also leads the list of organizations in the greatest increase in consulting among organizations (see Table 11). Many Nebraska-based organizations show sizeable increases, such as the Central Nebraska Public Power and Irrigation District, the Nebraska Public Power District, and Nebraska Water Users, Inc.

Notable as an anomaly in this listing, is the Bureau of Reclamation's change score of -1 at the bottom of the table along with the Central Colorado Water Conservancy District. This number indicates a very minor decrease in organizational consulting with that agency "today" compared with in "prior to 1994". The negative score for the Bureau may represent the agency's changing mission and a feeling on the part of one informant that they feel less familiar with its evolving mission today than several years ago.

Table 11
Degree to which Platte River Organizations Consulted with Each Other Prior to 1994 Versus 1998 - 1999

NAME OF ORGANIZATION	CONSULTED WITH PRIOR TO 1994	NAME OF ORGANIZATION	CONSULT WITH TODAY (1998-99)	NAME OF ORGANIZATION	CONSULTING CHANGE
Bureau of Reclamation	59	Fish & Wildlife Service	62	Northern CO. WCD	17
Fish & Wildlife Service	55	Bureau of Reclamation	58	Central NE. Public Power & Irr. Dist.	16
CO. State Engineer	39	Northern CO. WCD	51	WY. Water Dev. Comm.	16
USGS Water Res. Div.	36	USGS Water Res. Div.	45	NE. Public Power Dist.	15
Northern CO. WCD	34	Central NE. Public Power & Irr. Dist.	44	Env'l. Defense Fund	15
CO. Div. of Wildlife	33	NE. Dept. of Water Resources	43	WY. State Engineer	13
National Audubon	33	NE. Public Power Dist.	43	Goshen Irrig. Dist.	12
NE. Dept. of Water Resources	33	CO. State Engineer	42	NE. Water Users Association	12
U.S. Forest Service	33	National Audubon	41	GASP	11
Denver Water	32	NE. Natural Resource Districts	39	Pathfinder Irrigation District	11
Platte River Whooping Crane Trust	32	NE. Water Users Association	39	City of Loveland	10
NE. Natural Resource Districts	30	Platte River Whooping Crane Trust	39	NE. Dept. of Water Resources	10
Central NE. Public Power & Irr. Dist.	28	U.S. Forest Service	37	City of Boulder	9
NE. Public Power District	28	CO. Div. Of Wildlife	36	NE. Natural Resource Districts	9
Central CO. WCD.	27	Env'l. Defense Fund	36	USGS Water Res. Div.	9
NE. Water Users Association	27	Denver Water	33	City of Greeley	8
Env'l. Defense Fund	21	WY. State Engineer	32	National Audubon	8
GASP	20	WY. Water Dev. Comm.	32	City of Fort Collins	7
City of Greeley	20	GASP	31	Fish & Wildlife Service	7
Lower S. Platte WCD	19	City of Greeley	28	Lower S. Platte WCD	7
WY. State Engineer	19	City of Loveland	27	Platte River Whooping Crane Trust	7
City of Fort Collins	19	City of Fort Collins	26	City of Fort Morgan	6
City of Loveland	17	Central Colorado WCD	26	Water Supply & Storage	5
City of Boulder	16	Lower S. Platte WCD	26	City of Sterling	4
WY. Water Dev. Comm.	16	City of Boulder	25	U.S. Forest Service	4
Pathfinder Irrigation District	14	Pathfinder Irrigation District	25	CO. Div. Of Wildlife	3
Water Supply & Storage	14	Goshen Irrig. Dist.	22	CO. State Engineer	3
City of Fort Morgan	13	City of Fort Morgan	19	Denver Water	1
City of Sterling	11	Water Supply & Storage	19	Irrigationists' Association	0
Goshen Irrig. Dist.	10	City of Sterling	15	Bureau of Reclamation	-1
Irrigationists' Association	9	Irrigationists' Association	9	Central Colorado WCD	-1
TOTAL SCORE/MAXIMUM POSSIBLE	797/1728	TOTAL SCORE/MAXIMUM POSSIBLE	1050/1728	TOTAL INCREASE/MAXIMUM POSSIBLE	253/931

Note. Ratings represent totals on a scale of 0 = "never consult" to 3 = "always consult." N = 24. . Maximum score possible for single organization = 72.

Not surprisingly, there appears to be a great deal of similarity among organizations near the top of increases in familiarity and increases in consulting. Of the top 12 organizations showing the greatest increase in being consulted with, eight of these are in the top 11 organizations showing the greatest increase in familiarity.

Interestingly, one of these organizations, the Central Colorado Water Conservancy District (CCWCD) based in Greeley, ranked highly on the increase in familiarity measurement (among the top nine organizations), but ranked much lower on the frequency of organizations consulting with them (23rd). This finding may be explained by the fact that the organization took a hard line against the negotiations and refused to participate in these discussions. Thus, this apparent incongruence between their two scores may suggest that organizations were familiar with CCWCD because of the controversial stand they took, but because they were outside of the process, organizations did not consult with them. The finding may provide some insight into what can happen to one parameter of social capital when an organization opts out of the community discussions.

Perceptions of Legitimacy

The reader will recall from Chapter II that the quality of perceived legitimacy across organizations is critical if divergent groups are to support leaders that rise from the ranks of other factions involved in the issue. When cross-cutting conflict cleavages exist, legitimacy creates a climate wherein leaders can effectively formulate compromises perceived as worthy of consideration by antagonistic organizations (Freeman, 1992, p. 162). Through the groups' mutual process of listening, questioning, and reacting, social capital is advanced.

For the purposes of this study, organizational legitimacy was defined to informants as whether an organization was "fair and worth listening to." Informants were not asked their opinion of whether an organization had a legitimate claim to be involved in the negotiations (i.e., "standing") which is another way to view legitimacy.

Table 12 depicts the perception of legitimacy of Platte River organizations by all key informants interviewed. The large Nebraskan power and irrigation districts that were focused on renewing the federal license for the Kingsley Dam were viewed overall as having the highest

legitimacy (2.39 and 2.37). Also rating high were the Wyoming State Water Engineers' Office (2.33) and the Northern Colorado Water Conservancy District (2.32). Both of these organizations played an important role in the negotiations at critical times to advance the discussion, according to study informants.

Garnering generally low perceptions of legitimacy (1.75) was the Central Colorado Water Conservancy District based in Greeley, which refused to participate in the negotiations. This organization ranked third lowest. The U.S. Forest Service was rated second lowest (1.52) perhaps due to their earlier involvement in the mountain reservoir dams relicensing issue. Ranked lowest (1.50) was the Platte River Maintenance Whooping Crane Trust which has litigated numerous issues to protect Platte River flows and with the National Audubon Society walked away from further negotiations towards the cooperative agreement in February of 1997.

To put these ratings in proper perspective it must be noted that 42% (n = 10) of the organizations interviewed were private organizations dedicated to intensive water uses. Only 17% (n=4) of those classified as environmental organizations were interviewed. Thus the overall percentages reflect disproportionately a water use organization bias. Nevertheless, these overall mean ratings do reflect the views of the population which was interviewed.

Within groups, it is interesting to note the rather high (2.00) legitimacy rating for the U.S. Bureau of Reclamation by environmental organizations as being nearly always "fair and worth listening to." This rating would hardly have been anticipated even a decade ago, when the agency had a zeal for water development projects that usually put it at odds with environmental interests. As pointed out in Chapter III, the agency changed its focus in the 1990s and now has a greater emphasis on ecological restoration and water conservation. These results may be reflective of that shift in agency emphasis.

Likewise, environmental organizations tended to rate many of the water development organizations as highly legitimate, such as Nebraska Water Users and Nebraska Public Power District (2.67) and Central Nebraska public Power and Irrigation District (2.50). This contrasted with the water development organizations that viewed environmental groups such as the Whooping Crane Trust (.89) and National Audubon (1.33) as having very low legitimacy.

Table 12
Perceptions of the Degree to which Other Organizations are "Fair and Worth Listening to"

NAME OF ORGANIZATION	ENVIRO	FEDERAL	STATE	WATER DEV	MEAN
Central NE Public Power & Irr.	2.50	2.00	2.40	2.50	2.39
NE Public Power District	2.67	2.00	2.40	2.38	2.37
WY State Engineers' Office	2.00	2.33	2.50	2.38	2.33
Northern CO WCD	2.33	2.00	2.00	2.67	2.32
USGS – Water Resources Div.	2.25	2.67	2.29	2.25	2.32
GASP	3.00	1.67	1.67	2.62	2.27
Pathfinder Irrigation District	2.00	1.67	2.20	2.67	2.25
CO State Engineers' Office	2.33	2.33	1.80	2.40	2.24
US Bureau of Reclamation	2.00	2.67	2.14	2.20	2.21
WY Water Development Comm.	2.00	2.00	2.33	2.25	2.19
NE Dept. of Water Resources	2.25	2.33	2.17	2.13	2.19
Lower South Platte WCD	3.00	1.67	2.00	2.30	2.18
Nebraska Water Users	2.67	2.00	1.80	2.25	2.16
NE Natural Resource Districts	2.00	2.33	2.00	2.25	2.14
City of Fort Morgan	2.00	2.00	1.50	2.33	2.08
Denver Water	2.00	2.00	1.60	2.30	2.05
City of Greeley	2.50	2.00	1.33	2.11	2.00
City of Sterling	2.00	2.00	1.50	2.17	2.00
CO Division of Wildlife	2.00	1.67	2.00	2.11	2.00
City of Fort Collins	3.00	2.00	1.67	1.89	1.94
Goshen Irrigation District	1.50	1.67	2.25	2.00	1.93
Environmental Defense Fund	2.00	2.67	1.83	1.70	1.91
City of Boulder	1.50	2.00	1.67	2.00	1.89
US Fish & Wildlife Service	2.25	2.33	1.57	1.80	1.88
Irrigationists' Association	2.00	1.67	1.67	2.00	1.83
National Audubon Society	2.00	2.33	2.00	1.33	1.77
Water Supply & Storage	2.00	2.00	1.50	1.67	1.75
Central Colorado WCD	2.00	1.00	2.00	1.80	1.74
US Forest Service	1.33	2.00	1.33	1.56	1.52
Whooping Crane Trust	1.75	2.33	1.83	.89	1.50

Note. Ratings of "representatives of this organization can be relied on to be fair and worth listening to" ranged from 0, "never", to 3, "always".

Perceptions of Interdependence

Organizational destinies are often viewed by its members as intertwined, or interdependent, often in ways that are competing, to a greater or lesser degree. One extreme possible view that might be held of this condition among organizational members is referred to as a zero-sum situation. In this situation members perceive that a gain for an opposing organization on some issue means an equal loss for their organization. The perception becomes that there are no common causes in which both sides can simultaneously benefit, and the interests of adversarial groups are diametrically opposed (see Chapter II), similar to a game of chess. In this situation, actors are more rigid in their positions and seek to exploit any opportunity to their exclusive benefit. Under these conditions, social capital is weakened.

Perceptions could also be held which view another organization in a variable-sum, or non-zero sum position. For example, I may believe that a large gain for your organization means a slight loss, or benefit, for mine. In this case, interests partly diverge as well as converge. Actors perceive a given opponent may gain more than others, but all are capable of advancing their values to some degree simultaneously. These situations promote risk-taking, compromise and accommodation, thus furthering social capital.

In an examination of perceptions of interdependence among Platte River regime organizations presented in Table 13, organizations viewed as least threatening to the interests of the organizations interviewed were the U.S. Geological Survey (.90) and the Lower South Platte Water Conservancy District (.94). This perception was held fairly uniformly across all organizational groups. Participants were not asked why these organizations were seen in this light and the possible explanations are numerous and may be different from organization to organization.

Organizations perceived with the greatest interdependence, i.e., gaining at the expense of other organizations, were the Nebraska Public Power District (1.53) and the Nebraska Water Users. This view was most strongly held among environmental organizations that rated both of these organizations 2.0, compared to water user groups which viewed these organizations in a less threatening light rating them 1.33 and 1.29 respectively.

Within groups, water development organizations viewed the Platte River Maintenance Whooping Crane Trust as the organization whose gains were most likely at the water organizations' expense (2.00). The U.S. Forest Service (1.78) and National Audubon Society (1.70) rank second and third as gaining at the water organizations' expense.

Environmental organizations saw the City of Boulder (2.50) as benefiting most at their expense for reasons that are not clear. Following that organization, ten water development organizations and municipalities rate 2.0, much higher overall ratings than were viewed by the other organizational groups. Apparently, environmental organizations view many more organizations as more likely to advance at their expense.

Conflict Patterns Among Organizations

The analysis now turns to the second survey instrument designed to help assess proposed policy options for the enhancement of endangered species habitat along the Platte River and to examine conflict cleavage patterns among the organizations involved in implementing Platte River water flow re-regulations.

There is always some degree of conflict when organizations take positions of support and opposition on a range of collective management decisions. The literature suggests that there is a continuum of conflict cleavages ranging from overlapping to cross-cutting that can promote development of social capital or reduce it (Freeman, 1992). Thus, an examination of conflict cleavage provides insight into the potential for agreement or deadlock in negotiations around a series of management decisions.

In this instrument seven policy alternatives are presented and respondents expressed their degree of support or opposition to each alternative. These policy statements are presented below.

The task here was to identify what type of conflict cleavage pattern the organizations involved with this Platte River issue would have on the seven management alternatives before them. An overlapping conflict cleavage pattern reflects the situation where the same configuration of groups are opponents across all management alternatives, creating a state of high polarization.

Table 13
Perceptions of Effects of Gains Made by Other Organizations on One's Organization

NAME OF ORGANIZATION	ENVIRO	FEDERAL	STATE	WATER DEV	MEAN
USGS – Water Resources Div.	.75	.67	1.00	1.00	.90
Lower South Platte WCD	1.00	1.33	1.00	.80	.94
GASP	1.00	1.33	1.00	.88	1.00
CO Division of Wildlife	1.00	1.67	1.25	.80	1.05
Water Supply & Storage	1.50	1.33	1.00	1.00	1.14
Irrigationists' Association	2.00	1.33	1.00	.80	1.15
US Bureau of Reclamation	1.00	.67	1.43	1.20	1.17
Northern CO WCD	1.33	1.00	1.71	.80	1.17
Pathfinder Irrigation District	1.67	1.33	1.25	.86	1.18
City of Sterling	2.00	1.33	1.00	1.00	1.23
City of Fort Morgan	2.00	1.33	1.00	1.00	1.23
City of Fort Collins	2.00	1.33	1.33	1.11	1.29
WY Water Development Comm.	1.75	1.00	1.40	1.13	1.30
WY State Engineers' Office	1.75	1.00	1.40	1.13	1.30
National Audubon Society	1.25	.67	1.00	1.70	1.30
Central Colorado WCD	2.00	1.67	1.00	1.20	1.32
Goshen Irrigation District	2.00	1.33	1.50	1.00	1.33
Environmental Defense Fund	1.75	.33	1.33	1.50	1.35
City of Greeley	2.00	1.33	1.67	1.11	1.35
Central NE Public Power & Irr.	1.50	1.33	1.60	1.14	1.37
CO State Engineers' Office	1.00	1.33	1.80	1.33	1.40
NE Dept. of Water Resources	1.25	1.33	1.20	1.63	1.40
City of Boulder	2.50	1.33	1.00	1.33	1.41
Denver Water	2.00	1.33	2.00	1.10	1.42
US Forest Service	.33	1.33	1.50	1.78	1.43
Whooping Crane Trust	1.25	1.00	1.00	2.00	1.45
US Fish & Wildlife Service	1.75	1.00	1.57	1.50	1.50
NE Natural Resource Districts	1.25	1.33	2.00	1.50	1.53
NE Public Power District	2.00	1.33	1.60	1.33	1.53
Nebraska Water Users	2.00	1.67	1.60	1.29	1.58

Note. "Gains made by this organization are at the expense of my organization" ranged from 0 "never" to 3 "always." As the rating approaches 3, members of other organizations increasingly perceive the organization in a zero-sum interdependence situation with their own organization.

A cross-cutting conflict cleavage pattern, on the other extreme, signals that each group is opposed on some issues, but find common agreement on others, making for low polarization.

Social capital is reduced when overlapping conflict cleavages exist. Groups with this pattern of opposition on issue after issue work to block and undercut opponents' choices. Social capital grows when there is a variety of crosscutting cleavages across which sincere negotiations can take place towards agreement, thereby building mutual understanding and social cohesion.

A summary of the positions on the seven management issues is presented in Table 14 for environmental organizations while Table 15 depicts the results among water user organizations. All organizations were asked to respond as "strongly support" to "strongly disagree" with the summary statements of management issues surrounding enhancement options for Platte River endangered species habitat. For purposes of brevity, the seven management issues are coded on the table as follows:

C.A. = Cooperative Agreement. "Approval, as currently written, of the Cooperative Agreement for the Platte River Recovery Implementation Program."

Land = Land Management. "Placing under management, as a long-term objective, approximately 29,000 acres of land located between Lexington and Chapman, Nebraska for habitat restoration and protection for endangered and threatened species found there."

Phase 1 = Phase 1 of the Recovery Program. "The goal of the first increment of the proposed recovery program – to provide 130,000 – 150,000 acre feet/year of the Platte River's water – is appropriate for protecting wildlife habitat in central Nebraska for endangered species."

Flows = Target River Flows. "U.S. Fish and Wildlife's long-term estimated target flows of Colorado's Platte River water are appropriate for protecting wildlife habitat in central Nebraska (i.e., 425,000 acre feet/year)."

State Pay = State Payments for Program. "State funds should pay to achieve the goals of the Cooperative Agreement."

User Pay = Water Users Pay for Program. "Water user organizations (e.g., irrigation districts, mutual companies, etc.) should pay to achieve the goals of the Cooperative Agreement."

USFS = U.S. Forest Service Land Management. "U.S. Forest Service lands in the headwaters of the Platte River system should be managed to increase timber production targets in order to generate more water for the Platte River and downstream endangered species."

A quick examination of Tables 14 and 15 indicate that only one environmental group (The Whooping Crane Habitat Maintenance Trust) and one water user organization (the Central Colorado Water Conservancy District) of the organizations surveyed oppose the cooperative agreement [C.A.]. Interestingly, these were also the two organizations ranked lowest and third lowest respectively as being "fair and worth listening to" in Table 12.

Table 14
Positions of Wildlife Organizations on Seven River Management Issues

ORGANIZATION	C.A.	Land	Phase 1	Flows	State Pay	User Pay	USFS
CO. Div. Of Wildlife -Field Office	2	1	0	0	2	2	0
CO. Div. Of Wildlife -Region Office	1	1	1	1	1	1	0
Environmental Defense Fund	1	2	2	2	1	1	0
National Audubon Society	2	2	2	2	2	-1	-2
Platte River Whooping Crane Trust	-1	2	1	2	0	-1	-2
Rowe Sanctuary	2	2	1	1	2	2	-2
U.S. Fish & Wildlife Service – Field Office	2	2	2	2	2	2	-2
U.S. Fish & Wildlife Service – Regional Office	2	2	2	2	1	1	0

Note. Judgments were made on a 5-point scale (2=strongly agree, 1=somewhat agree, 0=neither agree nor disagree, -1=somewhat disagree, and -2=strongly disagree).

On the question of protecting 29,000 acres of land in central Nebraska [Land] for endangered species, all environmental organizations and all but three water user organizations were supportive. Two of the three opposing organizations are based in Nebraska.

The next two policy issues dealing with water flows needed to maintain endangered species habitat show the most divergence between environmental groups which, with the exception of one organization that was neutral, all favor the stated increased water flows, while for water user organizations, most were opposed. Water user organizations were particularly unified against the long-term target flows of 425,000-acre feet/year of increased river flow [Flows], with only the Bureau of Reclamation supportive of this target.

On the two issues regarding who should pay for this program, the organizations were close to unanimous in their opinion that the state should pay (with only Denver Water dissenting),

Table 15
Positions of Platte River Water User Organizations on Seven River Management Issues

ORGANIZATION	C.A.	Land	Phase 1	Flows	State Pay	User Pay	USFS
Cache La Poudre Water Users Association	1	0	-1	-1	2	1	0
Central CO. Water Cons. District	-1	-2	-2	-2	1	-2	1
Central NE. Public Power & Irrigation District	2	1	2	-2	2	2	0
Central Platte Natural Resource District (NE.)	2	2	1	-2	2	2	0
Colorado Dept. of Natural Resources	2	1	2	-2	1	1	1
Colorado Division of Water Resources (Div. 1)	1	0	-1	-2	1	1	0
Denver Water	1	2	0	-2	-1	1	0
Groundwater Appropriators of the South Platte	2	0	-1	-1	2	0	0
Lower South Platte Water Conservation District	1	1	0	-2	2	1	0
Nebraska Natural Resources Committee	2	1	1	0	1	1	-2
Nebraska Public Power District	2	1	-1	-2	2	-1	0
Nebraska Water Users, Inc.	1	-1	-2	-2	2	-2	2
Northern Colorado Water Conservancy District	1	1	1	-1	2	-2	1
Pathfinder Irrigation District	2	-1	1	-2	1	0	1
U.S. Bureau of Reclamation	2	2	2	2	2	2	0
Wyoming Water Development Commission	1	1	1	-2	1	0	0

Note. Judgments were made on a 5-point scale (2=strongly agree, 1=somewhat agree, 0=neither agree nor disagree, -1=somewhat disagree, and -2=strongly disagree).

but the organizations were less unified on whether water user organizations should pay to fund the cooperative agreement [User Pay].

The last issue was one raised at the public scoping meetings and suggests that U.S. National Forest lands in the Platte River watershed should encourage more logging to decrease water retention thereby increasing river flows [USFS]. This issue garnered the most "neither agree nor disagree" opinions, with 11 of the 24 organizations selecting this "0" option. Apparently, this is not an issue of concern to many of these organizations.

From the positions taken by each organization on seven issues, conflict cleavage patterns are derived in Table 16 (for procedure, see Freeman, 1992, pp. 154-203 and Chapter IV of this study). The U.S. Fish and Wildlife Service's Nebraska field office was used as the required base organization for comparisons with all other organizations upon which calculations were derived.

Table 16
Comparison of Conflict Cleavages among Platte River Organizations

Organization	Frequency			Deviations From Ideally Expected
	Allied with Base Org.*	Opposed to Base Org.	Neutral Position	
Cache La Poudre Water Users Association	3	2	2	1
Central CO. Water Cons. District	2	5	0	3
Central NE. Public Power & Irrigation District	5	1	1	4
Central Platte Natural Resource District (NE.)	3	2	2	1
Colorado Dept. of Natural Resources	5	1	1	4
Colorado Division of Water Resources (Div. 1)	6	1	0	5
CO. Div. of Wildlife - Field Office	4	0	3	4
CO. Div. of Wildlife - Region Office	6	0	1	6
Denver Water	3	2	2	1
Environmental Defense Fund	6	0	1	6
Groundwater Appropriators of the South Platte	2	2	3	0
Lower South Platte Water Conservation District	4	1	2	3
National Audubon Society	5	2	0	3
Nebraska Natural Resources Committee	5	1	1	4
Nebraska Public Power District	3	3	1	0
Nebraska Water Users, Inc.	3	4	0	1
Northern Colorado Water Conservancy District	5	2	0	3
Pathfinder Irrigation District	4	2	1	2
Platte River Whooping Crane Trust	3	3	1	0
Rowe Sanctuary	6	1	0	5
U.S. Bureau of Reclamation	6	0	1	6
U.S. Fish & Wildlife Service - Regional Office	6	0	1	6
Wyoming Water Development Commission	4	1	2	3
Deviation Sum				71
Deviation Potential (7 x 23 orgs.)				231
Polarization Quotient (71/231)				0.31

*Note. U.S. Fish & Wildlife Service Nebraska Field Office served as the base organization for comparisons.

A glance of the table reveals that the organizations do not exhibit highly polarized conflict cleavage patterns. There appears to be no clear cleavages among the groups and there are several neutral positions taken across organizations.

Indeed, the necessary calculations bear out this observation and provide support for our hypotheses that polarization among the organizations would be relatively low, due to the

numerous, lengthy negotiations that have occurred between organizations over the past several years.

With polarization scores potentially varying from 0 (no polarization) to 1.0 (maximum polarization), the calculation of 0.31 on these key issues for Platte River organizations indicates a cross-cutting conflict cleavage pattern, thus a mildly non-polarizing situation. This score signals that there is a significant mix of groups that are allied on some issues, opposed on others. Such circumstances bode well for sincere negotiations to occur by opponents on each issue and thereby increase social capital.

The analysis then examined the different ratings for each possible pair of organizations. The rating difference for each of the seven issues was calculated among all organizational pairs.

Then, these seven difference scores were summed for every combination of organizations. Thus the highest scores are indicative of large differences of opinion on a large number of issues. These polarization scores for each pair are presented in Table 17.

Tables 18 and 19 present the pairs of organizations having the highest and lowest polarization scores, respectively. Note that in Table 18, depicting organizations with the highest polarization scores, just a few organizations were represented in the bulk of the listings. The Central Colorado Water Conservancy District was listed 12 times, the Whooping Crane Trust, 8 times, and the Nebraska Water Users, 7 times. Largely absent from this list is the USFWS, the agency enforcing the Endangered Species Act.

In Table 19, organizations with the lowest polarization scores, there was considerably more of a mix of organizations represented with the Colorado Division of Water Resources mentioned most (5 times), followed by the Colorado Division of Wildlife – field office (4 times).

Table 17

Polarization Scores among Platte River Organizations on Seven River Management Issues

	CDOW-fld	CDOW-reg	EDF	NAS	WCT	ROWE	USFWS-fld	USFWS-reg	CLP WUA	CC WCD	LSP WCD	NC WCD	DW	PID	GASP	NWU	CNPPID	NPPD	WWDC	CP NRD	C DNR	C DWR	N NRC	BuRec
CDOW-fld		5	8	10	14	5	7	7	5	16	4	8	6	9	5	13	4	6	7	4	7	7	5	5
CDOW-reg			3	9	9	6	8	6	6	15	5	7	7	8	8	14	7	9	4	7	6	6	4	6
EDF				6	8	7	5	1	9	18	9	10	8	11	11	17	8	12	7	8	7	9	7	3
NAS					6	5	3	5	13	20	12	8	14	13	11	17	10	10	11	10	11	15	7	5
WCT						9	9	9	15	16	14	12	12	15	15	19	16	14	11	14	15	15	9	11
ROWE							2	6	9	21	9	11	11	13	10	18	7	11	10	5	10	10	4	4
USFWS-fld								4	12	25	11	13	13	14	12	20	7	13	12	7	14	10	6	2
USFWS-reg									10	19	9	11	10	10	10	18	7	11	8	7	10	6	6	2
CLP WCD										11	3	7	7	8	2	8	7	5	6	9	8	8	8	10
CC WCD											12	10	14	9	11	5	16	10	11	16	13	13	17	21
LSP WCD												6	4	7	5	7	4	4	3	4	5	3	7	9
NC WCD													10	7	7	7	8	6	5	8	7	9	9	11
DW														9	9	13	8	8	5	6	9	5	9	11
PID															6	7	7	7	4	7	4	4	8	12
GASP																8	7	3	6	7	8	4	8	10
NWU																	13	7	10	13	12	6		18
CNP-PID																		6	5	2	3	3	7	5
NPPD																			5	6	7	5	9	11
WWDC																				5	4	4	6	10
CPNRD																					5	5	7	5
CNDR																						6	6	8
N NRC																								8
BuRec																								

Note. Highest scores represent greater opinion differences on a greater number of issues across seven Platte River management issues.

Table 18**Pairs of Platte River Organizations with the Highest Polarization Scores**

ORGANIZATIONAL PAIRING	POLARIZATION SCORE
Central Colorado WCD/ USFWS-field office	25
Central Colorado WCD/ Bureau of Reclamation	21
Central Colorado WCD/ Rowe Sanctuary	21
Central Colorado WCD/ National Audubon Society	20
Central Colorado WCD/ USFWS-regional office	19
Nebraska Water Users/ Whooping Crane Trust	19
Central Colorado WCD/ Environmental Defense Fund	18
Nebraska Water Users/ Bureau of Reclamation	18
Nebraska Water Users/ Rowe Sanctuary	18
Nebraska Water Users/ USFWS-regional office	18
Central Colorado WCD/ NE. Natural Res. Committee	17
Nebraska Water Users/ Environmental Defense Fund	17
Nebraska Water Users/ National Audubon Society	17
Central Colorado WCD/ CNPPID	16
Central Colorado WCD/ CO. Div. Of Wildlife-field	16
Central Colorado WCD/ Whooping Crane Trust	16
Central Colorado WCD/ Central Platte NRD	16
CNPPID/ Whooping Crane Trust	16
Nebraska Water Users/ NE. Natural Res. Committee	16
Central Colorado WCD/ CO. Div. Of Wildlife-reg.	15
Cache La Poudre WUA/ Whooping Crane Trust	15
CO. Dept. Nat. Res./ Whooping Crane Trust	15
CO. Div. Water Res./ Whooping Crane Trust	15
CO. Div. Water Res./ National Audubon Society	15
GASP/ Whooping Crane Trust	15
CO. Div. Water Res./ National Audubon Society	15
Pathfinder Irr. Dist./ Whooping Crane Trust	15

Note. Possible polarization scores range from 28 = maximum disagreement to 0 = complete agreement on the seven issues presented.

Table 19

Pairs of Platte River Organizations with the Lowest Polarization Scores

ORGANIZATION PAIRING	POLARIZATION SCORE
USFWS-regional office/Environmental Defense Fund	1
USFWS-regional office/ Bureau of Reclamation	2
USFWS-field office/ Bureau of Reclamation	2
USFWS-field office/ Rowe Sanctuary	2
Cache La Poudre WUA/ CO. Div. Water Resources	2
Cache La Poudre WUA/ GASP	2
CNPPID/ Central Platte NRD	2
Bureau of Reclamation/Environmental Defense Fund	3
Cache La Poudre WUA/ Lower South Platte WCD	3
CO. Div. Wildlife-reg/Environmental Defense Fund	3
CNPPID/ CO. Dept. of Natural Resources	3
CO. Div. Water Resources/ Lower South Platte WCD	3
GASP/ Nebraska Public Power District	3
USFWS-field office/ National Audubon Society	3
WY. Water Dev. Comm./ Lower South Platte WCD	3
Bureau of Reclamation/ National Audubon Society	4
CO. Dept. Nat. Res./ Pathfinder Irr. District	4
CO. Dept. Nat. Res./ WY. Water Dev. Comm.	4
CO. Div. Wildlife-field/ CNPPID	4
CO. Div. Wildlife-field/ Central Platte NRD	4
CO. Div. Wildlife-field/ Lower South Platte WCD	4
CO. Div. Wildlife-reg/ NE. Nat. Res. Comm.	4
CO. Div. Wildlife-field/ WY. Water Dev. Comm.	4
CO. Div. Water Resources/ GASP	4
CO. Div. Water Resources/ Pathfinder Irr. Dist.	4
CO. Div. Water Resources/ WY. Water Dev. Comm.	4
CNPPID/ Lower South Platte WCD	4
Central Platte NRD/ Lower South Platte WCD	4
Denver Water/ Lower South Platte WCD	4
NE. Public Power Dist./ Lower South Platte WCD	4
Rowe Sanctuary/ NE. Nat. Res. Comm.	4
Pathfinder Irr. Dist./ WY. Water Dev. Comm.	4
USFWS-field office/ USFWS-regional office	4

Note. Possible polarization scores range from 28 = most disagreement to 0 = complete agreement on the seven issues presented.

The Relationships of Polarization and Social Capital Variables

Polarization scores from every pair of organizations were then analyzed for their relationship to social capital variables already reported (i.e., familiarity, consulting, perceptions of legitimacy and interdependence).

Statistical analysis using Kendall's tau-b (see Appendix C for explanation) was employed in the data analysis.

Polarization and Familiarity

For the first variable, familiarity, the polarization scores from the data above were analyzed for their relationship with how familiar these two organizations were with each other, prior to 1994 (when the Platte River negotiations began) and for "today" (i.e., after the cooperative agreement was signed).

Not supporting our hypothesis, we found no relationship between polarization scores and familiarity, with little difference between dates as depicted in Table 20 below. There is a slight positive relationship between the two variables that would suggest that as familiarization between two organizations increased, polarization also increased. Our hypotheses had predicted an inverse relationship. However, the value is so small it can be interpreted as no relationship.

Table 20
Relationship of Organization Polarization with Organization Familiarity Prior to 1994 and "Today"

	Prior to 1994	"Today"	N
Kendall's tau – b	0.079	0.044	169

Note. No significance values reported since data represent the population of key organizations involved in Platte River regime creation, not a probability sample.

Polarization and Communications

Each pair of organization's polarization scores was then matched with the degree to which "Representatives of my organization consulted with this organization on issues of importance." Responses were obtained on this variable for both "prior to 1994" and "today". Using Kendall's tau-b for statistical analysis, once again no relationship was found.

Table 21

Relationship of Organization Polarization with the Degree to which Organizations Consulted with Each Other Prior to 1994 and "Today"

	Prior to 1994	"Today"
Kendall's tau – b	-0.058	-0.096
N of Valid Cases	168	166

Note. No significance values reported since data represent the population of key organizations involved in Platte River regime creation, not a probability sample.

Polarization and Perceptions of Legitimacy

The relationship between polarization scores among organizations and the degree to which each organization viewed the other as being "fair and worth listening to" was examined next. The hypothesis was for an inverse relationship between the two variables, the data show no defense for this supposition in Table 22. No relationship was found between the variables.

Table 22

Relationship of Organization Polarization with Perceptions of "Being Fair and Worth Listening to" Among Organizations

	Value	N
Kendall's tau – b	-0.186	120

Note. No significance values reported since data represent the population of key organizations involved in Platte River regime creation, not a probability sample.

Polarization and Perceptions of Interdependence

Similarly, organizations' polarization scores were then matched with each organization's assessment of the other that, "Gains made by this organization tend to be at the expense of the interests of my organization." This assessment may be called a "rivalry score" as it represents the degree to which organizations view each other's achievements as a zero-sum game.

The study had hypothesized that there would be a positive relationship between these variables. As Table 23 demonstrates, there was no relationship found.

Table 23
Relationship of Organization Polarization with Perceptions of Interdependence Among Organizations

	Value	N
Kendall's tau – b	0.264	119

Note. No significance values reported since data represent the population of key organizations involved in Platte River regime creation, not a probability sample.

Thus, for each of the matched rankings between polarization and variables indicating creation of social capital, no meaningful relationships were found. This may be due to the fact that polarization, in general, was fairly low. Thus strong differences among the organizations do not exist, except in a small number of cases. Nearly all organizations are supporting the Cooperative Agreement, perhaps the most important near-term issue.

Summary

In summary, this chapter has presented its findings that organizational design principles hypothesized were present in the newly formed Platte River Common Property Regime. The study found that all design principles are present in this new regime as was hypothesized, although the two principles dealing with conflict resolution and sanctions were not fully developed in this regime and the monitoring principle is only in the development stages. Four additional design principles, not hypothesized, were also present in this regime. It was suggested that these four principles may be more important to large-scale CPR regimes such as this one, and not a factor in small-scale regimes from which the literature and this study's hypotheses draw upon.

In examining social capital, support was found for the hypotheses that organizations helping to design the regime are more familiar with each other and consult more often with each

other today than prior to the start of these negotiations. This finding provides evidence that this process created social capital. Also, as hypothesized, overall polarization on critical river management issues was low and cross-cutting, further aiding support for creation of social capital.

Regarding the relationship between social capital variables and polarization, there was not sufficient evidence to support hypotheses predicting that as polarization among pairs of organizations increased, communications, perceptions of legitimacy and interdependence would decrease. Likewise, there was no evidence to support the hypothesis that as polarization increased the degree of familiarity among pairs of organizations would decrease.

CHAPTER VI

DISCUSSION AND CONCLUSIONS

Large ecosystems present some of the most difficult problems of environmental science and policy. They are complex, often badly damaged, driven by deep-rooted rivalries among several jurisdictions, and essential to the well-being of large populations.... Their governance presents challenges of science, management, and politics, often entangled in ways that resist simple approaches. But without some degree of simplification there can be no learning and no transfer from one case to others. Rather than pursuing conceptual neatness, we should study how human institutions deal with the interdependence created when human boundaries cut across ecological continuities. In the case of large ecosystems, pragmatism is a prime virtue: to learn what we can, and to recognize its limits.

– Kai N. Lee

Compass and Gyroscope (1993, p. 11)

The Platte River, like rivers everywhere in the Western United States, faces rapidly growing, and often competing, demands on its waters. Agricultural producers wish to expand irrigation opportunities. Municipalities seek to increase water allocations for domestic and industrial needs. Electric utilities want to manage reservoir levels and river flows to maximize the growing electrical demands of the region. Environmental interests aspire to increase stream flows to improve wildlife habitat and recreational opportunities. Multiple governmental jurisdictions, obligated to protect the rights of one or more of these interests, have been drawn into this public policy debate. Federal agencies, state agencies in Colorado, Nebraska and Wyoming, natural resource districts, irrigation districts, cities and towns and other governmental entities have claimed competing stakes in the waters of the Platte River watershed.

The geographical “ground zero” for this debate centers on the Big Bend stretch of the river which was declared “critical habitat” under the Endangered Species Act for the endangered whooping crane and also serves the threatened piping plover and the endangered interior least tern and pallid sturgeon. How to balance these river demands with the requirements of this

powerful law was the catalyst for the creation of a multi-stakeholder committee to alter water flows in order to improve the river's critical habitat.

This study demonstrated that the Platte River is a common property resource (CPR) governed by a newly created institution, or regime. Of significance to this study is that this regime is composed of particular organizational characteristics, called design principles, which set it apart from many other institutions. These design principles, the case study literature informs us, has a great deal to do with the success of a CPR. Failure to adequately address CPR challenges has been endemic in large-scale public irrigation projects in many nations (Freeman and Angin, 1999) and with the appropriation of many other natural resources. This problem is commonly referred to as the "tragedy of the commons" (Hardin, 1968). But more recently CPR frameworks have been theorized to avoid this tragedy. They postulate that particular social organizational designs of institutions are critical in appropriating common property resources sustainably, efficiently and equitably (Bromley, 1992; Freeman, 1989; Ostrom, 1990) in a manner that builds social capital.

This investigation builds upon this body of literature by examining the design of the Platte River regime. The conceptual foundation for this research was built upon an understanding of a typology of goods and how societies organize themselves into "resource regimes" in certain ways to obtain the benefits of specific types of goods. Regimes are seen as a social construct consisting of a tapestry of rights, rules, and responsibilities varying from regime to regime. The case study literature shows that these regimes, in turn, can guide human behavior and use of the environment, for better or for worse, depending upon their construction. Successful regime designs, therefore, will appropriate natural resources in a manner that is equitable, efficient, and sustainable.

The theoretical lens used in this investigation was drawn from case studies of enduring small-scale CPR regimes. From these studies, researchers have posited specific institutional characteristics, known as design principles, to account for regime success.

This study has four objectives, the results of which are summarized in the four sections presented in this last chapter. The first section, summary of findings, describes the design

principles present in the Platte River regime, comparing these to those suggested in the literature. It also summarizes the changes in social capital that may have occurred as a result of this regime-building exercise. The second section critiques the principles presented in the literature in light of this study's findings, offering proposed hypotheses and implications for future research. The third section explores the study's implications for policy development. A final fourth section offers key conclusions drawn from this investigation.

Summary of Findings

The study hypothesized that the same design principles identified in the literature for small-scale CPR regimes would be present in the new institutional arrangement created to manage the large-scale CPR regime of the Platte River. The hypothesis was supported. The new Platte River regime is found to contain: 1) recognized rights to organize, 2) clearly defined boundaries both of the physical domain and of those having rights to withdraw the resource; 3) a distributional share system; 4) collective choice arrangements; 5) resource monitoring (now in the developmental stages); 6) graduated sanctions for those not in compliance with the stated rules; and, 7) a conflict resolution mechanism for disagreements between the members of the domain.

Additionally, this investigation sought to identify other design principles operative, not reported in the literature. This study finds support for four additional design principles as described below.

First, many informants attributed some of the success to the regime's formation as due to the active involvement of organizational representatives that had the power to deliver their organization's backing for the commitments they made. Earlier negotiations in the 1980s and early 1990s involved middle to lower management level staff and failed to reach an agreement. Beginning with the successful evolution of this regime, high level officials from the federal and state agencies, water development organizations and environmental groups were present. For example, negotiations began with the active involvement of Secretary of the Interior Bruce Babbitt, and continued for three years with the Assistant Secretary. The regional director for the

U.S. Fish and Wildlife Service was present and engaged in each meeting as was the director of the Colorado Department of Natural Resources.

The second new principle was the concern expressed by several informants that the cost of participation in the building of the organization could have prohibited their active participation. Particularly among the non-profit organizations, both the time commitment involved (three years) and travel costs (meetings were initially held in Denver and then alternated sites in Colorado, Nebraska and Wyoming) put a severe strain on their abilities to represent their interests. Had much more been required, some organizational representatives feel their interests would have been compromised.

Two additional principles stem from the perceived inadequacies in all groups' understanding of the natural systems required to improve endangered species habitat. Because the water and ecological systems were so large and complex, there was no shared reality. Yet decisions were needed that would be based upon resource realities.

Two design principles regarding information management were seen as very important by informants: the need for complete, unbiased, information leading to a shared understanding of the resources involved and the willingness of all partners to consider regime rule changes if their resource monitoring efforts and future research studies alter the assumptions upon which the rules were based (i.e., adaptive management). Without a common understanding of resource response to management re-allocation decisions, and a willingness to re-evaluate assumptions when more data is collected, the chances for agreement among diverse interests may be greatly reduced.

This study also investigated the dynamics of social capital among the organizations involved in three years of intensive negotiations to design this new regime. Results show that during this period, these organizations became more familiar with each organization and consult with each other more frequently today than prior to 1994. Organizations becoming much better known through this process tended to be private water user organizations such as irrigation districts. The Northern Colorado Water Conservancy District experienced the greatest increase

among organizations consulting with them, followed by many Nebraska-based water user organizations.

In examining perceptions of legitimacy, not surprisingly the water user organizations ranked the environmental organizations, the U.S. Forest Service and the U.S. Fish and Wildlife Service lowest among organizations that were "fair and worth listening to." Environmental organizations, however, tended to rank the municipalities involved with the lowest scores and identified the Central Colorado Water Conservancy District as least "fair". This organization refused to participate in the negotiations.

Results of the perceptions of interdependence (i.e., perceived opponents) show that water users view the Whooping Crane Maintenance Trust and the U.S. Forest Service as most negatively impacting their organization when these organizations advance their missions. Environmental organizations viewed gains made by the Central Colorado Water Conservancy District and the Nebraska Water Users, Inc. as the most detrimental to their cause.

The building of social capital noted previously may be an important factor in explaining the mildly non-polarized score among these organizations on seven important river resource management issues. It may portend relative success in their ability to mutually develop solutions to the difficult river management issues that lie ahead.

Indeed, on the issue of the cooperative agreement, most organizations interviewed, whether environmental or water user groups, viewed the agreement positively and polarization cleavage patterns were cross-cutting so that opponents on some issues are allies on most others. However, on the question of providing much larger Platte River target flows in the future, a majority of environmental organizations and conservation agencies strongly supported these flows; a majority of all water user groups and agencies strongly opposed the targets. This finding signals, like a flashing red light, the challenge ahead of these organizations to find a permanent solution for improving endangered wildlife habitat.

Implications for Research

The case study literature from which the CPR design principles used in this study evolved from analyses of local, small scale CPR regimes that appropriate a single resource (e.g., wildlife, water, forests, fisheries) between a single type of user from a system that is well-understood by the regime members (Edwards & Stein, 1996). In this study, however, the CPR dilemma being studied has at least three characteristics that make it unique to the cases examined in the classic CPR literature and may account for the additional design elements present in this regime.

First, the newly formed Platte River regime spans three states and numerous political jurisdictions. Thus, this is not a small-scale regime as presented in the research literature. There is no one set of "local conditions" (design principle 2), and no one body of law and policy upon which appropriators may draw.

The second notable difference in this case study is that this case involves the appropriation of two sets of goods simultaneously, a "multiple use" commons. The first good is the re-appropriation of Platte River water, which analysis identifies as a CPR. The second good involved is creation of more suitable habitat for the needs of endangered species found in the Big Bend reach of the Platte River. This latter good is, in the typology of goods presented in Chapter II, a public good, whether the good be public land for crane habitat (created from individual landowners involving a private good) or the bird itself.

Ostrom (1990) distinguishes the "resource system" from the flow of "resource units" it provides. A single resource system may be capable of producing a wide variety of resource units. Thus, applying this concept, there are "extractive users", who appropriate resource units (measurable water quantities) from the resource system, and "non-extractive users", who derive amenity benefits from the resource system itself. In today's world it is not surprising that CPR regimes that began with a single use evolve into multiple goods appropriators as resource use for recreation, aesthetic and intrinsic values come to the fore. Institutions devised to govern the single use of a CPR must be flexible enough to cope with the demands of the new, competing uses or they may face drastic change (Edwards and Stein, 1996).

Taken together, these two characteristics present new implications for the design principles identified in the literature. In this study, where the resource domain spanned three states and multiple user types, membership for the new regime needed to be correspondingly larger than a watershed or community forest often cited in literature, comprised of people with different interests in the resource. In the Platte River basin, there is an exceptional number of jurisdictions from local to federal, each entity possessing legal rights for management of the resource. Sometimes these rights among jurisdictions are contradictory, often they are fragmented. The multi-jurisdictional nature of this commons requires institutional arrangements to be constructed for co-management of the resource, rather than management by a single entity as is presented in the bulk of CPR literature.

Thus there exists several challenges: ensuring that all the key representatives are usefully engaged in developing the regime, dividing power and responsibilities among the entities within the constraints of their organization's mission, and overcoming the communication problems that arise in large groups which often do not share the same resource understanding, vocabulary, and culture.

In addition, a multi-jurisdictional commons presents a challenge for participants from outside one area to understand the laws, policies and operations in each jurisdictional area. The Platte River basin is quite a different animal in Colorado than it is in Wyoming, and Wyoming's situation is markedly distinct from Nebraska, as pointed out in Chapters III and V. Since each member's understanding of the commons is critical in the construction of a regime, the quality and quantity of information may be a key determinant in garnering acceptance of any agreement.

The complexity and greater geographic scale has implications for membership, as this study demonstrated. Some informants expressed concern over the time and financial burdens this process has imposed upon them. Whether these constraints do have an impact on effective participation, which groups are most affected, and the perceived limits to participation would be a worthwhile area of research. In the meantime, models for crafting CPR regimes should include this factor in the design principle of membership as has the model developed in this study as presented in Table 24.

A final critical difference in this case compared to those presented in the literature is the great deal of uncertainty surrounding scientific information, due to the large-scale, complex system involved. Information may have a substantial impact on regime decisions. What data is collected, how it is obtained and interpreted is a central issue for study respondents. Participants on all sides worried that scientists have their own agenda or are biased towards a particular viewpoint. Seeing scientific inquiry as a tool for potential mischief, many strongly endorsed peer review of the methodologies employed and the interpretation of results as very important. Frequently, scientists are not involved until this late stage in the process. Their role then is as *post hoc* judge and jury that has very little effect other than to increase the public controversy over the final plan (Noss, O'Connell, and Murphy, 1997). In this case, however, participants are deciding how to weave both science and scientists into the planning process early in order to provide essential guidance for planning, monitoring and evaluation.

Informants identified key areas of uncertainty, including: historic river flows, historic population levels of key species, species needs (particularly for the pallid sturgeon), impact of groundwater development, potential increase to river flows from water conservation efforts, impact of continued urbanization on river flows, habitat response to proposed management schemes and measures defining success. Answers to these unknowns will require both idiographic and nomothetic knowledge, requiring information transfer from the "bottom up" as well as from the "top down." Solutions will also require adaptive management. Such an integration of knowledge, science and planning, guided from the beginning by stakeholders, should build social capital within the group and help to avoid suspicion of science in the final recommendations for river management.

Recent case studies in international common property resources, dealing with outer space, deep seabeds, Antarctica, and the atmosphere, have identified the scientific challenge of appropriation of a resource when it is not adequately understood (Buck, 1998). Buck's research also points out that beyond scientific uncertainty, other related scientific hurdles may await appropriators. These include achieving agreement on risk assessment, reaching common scientific conclusions over data, and agreeing upon policy direction (Buck, 1998, p. 7).

Overcoming these challenges may await this new regime as their monitoring and research efforts generate more scientific information.

In addition to the suggested new design principles, this study also found that all design principles may not be held in equal importance by regime members. While the literature is silent on the relative importance of each design principle, and represents an area of research opportunities, one conclusion derived from this study is the importance of the distributional share system. Each party seemed most interested in the implications this process and regime would have in determining how much they would receive (whether in terms of water, regulatory certainty or habitat enhancement) and at what cost. All other considerations seemed secondary.

As indicated in this section, sustainable management of a regional commons requires institutional design principles that may be different in emphasis and/or substance than those put forward in the literature for small scale CPR regimes. Table 24 offers a framework of design principles based upon the results of this study.

The proposed framework builds upon Freeman (1989) and Ostrom (1990). In this framework, the distributional share system is central. Most of the design principles suggested by Freeman and Ostrom are presented as critical components of the share system, rather than as discrete elements. Ostrom's design principle of monitoring for compliance purposes has been expanded to include research purposes as well. The additional design principles suggested by this study are incorporated into the framework. Finally, the principles articulated here reflect slight modifications from the literature in order to be more explicit.

Only one design principle is considered outside of the share system. Minimal recognition of rights to organize is a necessary pre-condition for the share system to develop (more important in the third world, and non-democratic countries). In this study, those rights were recognized by federal and state authorities.

These appear to be the key operative elements in this study of a sustainable, multi-jurisdictional, multiple use commons. Empirical testing is needed to support these proposed elements and to determine the relative importance of each. In addition, it may be hypothesized

that the four new design principles are only required in large-scale CPR regimes, and will not be found in small-scale CPR regimes.

Table 24

Design Principles Present in the Platte River Common Property Resource Property Regime

1. Rights to Organize are Recognized by a Central Authority
2. Distributional Share System. In this system, participant costs are proportional to the benefits they receive and proportional to other users. The system contains the following elements:
 - A. Geographic Boundaries
 - Clearly defined
 - Ability of resource to meet appropriators' needs
 - B. Membership
 - Clearly defined with manageable number
 - Organizational "decision-makers"; with mandate from highest leadership levels in organization
 - Collective choice arrangements
 - Participation costs not a barrier to participation
 - C. Information Management
 - Informational expertise shared: socio-political, legal, natural resource, idiographic/nomothetic
 - Adaptive management program
 - Monitoring program for compliance and research
 - D. Governance
 - Shared
 - Sanctions
 - Conflict resolution mechanisms

Before leaving the internal organizational design features, two additional characteristics are worth raising as potential areas of study. First, many informants in this study spoke about the critical importance personalities played in reaching an agreement. What was striking to this researcher was the consistency in which the same very few names were repeatedly singled out as extremely helpful, or hurtful, in the process. Of the over two dozen key participants involved in the process, only about four people were repeatedly mentioned as playing a vital role at critical moments in this agreement's evolution. Similarly, only two people were singled out as very

counter-productive to reaching an agreement. One fascinating area of further research is to examine the qualities of leadership involved in common property resource regimes. Is this characteristic of a few individuals inordinately responsible for a regimes success or struggle typical in CPR situations? Across case studies, can these individuals be identified, and if so, what essential qualities and capabilities do they share?

A second internal organizational issue raised by this research deals with the question of whether regime organizations need to engage in public education and outreach in a large-scale, multiple use CPR regime if it is to achieve its mission over the long haul. Every organization in this study was asked whether they are involved in educating their membership about the issues surrounding the cooperative agreement, and each answered in the affirmative. As part of the agreement, some large power/irrigation entities agreed to develop brochures to educate visitors recreating at their site about behavior to protect endangered species nesting nearby. However, how important do they feel it is to conduct broad public outreach beyond their membership? How tied is public understanding to the long-term sustainability of large-scale regimes? How might such an effort be accomplished and how effective are those efforts?

While this study and the bulk of CPR research focused on the internal organizational features that make common property arrangements successful, such as these design principles and social capital, there is a need for investigation outside of the CPR regimes as well for they are affected by external forces, much as the first principle (minimal rights to organize) implies.

First, little research has examined under what conditions CPR regimes are created. In this study, it was a new powerful law, the Endangered Species Act, which threatened the status quo of river flow regulation that brought the parties to the negotiating table. Without this law, all informants believe no agreement would have been reached. But do CPR origins always lie in the midst of a crisis? Does it more often come from a problem between resource users? Can it be sparked by opportunity? Therefore, is it top-down or bottom-up in origin?

And once the crisis was precipitated, what other elements created a climate in which an agreement could be reached, i.e., the basis of cooperation? In this study, nearly all informants pointed to the legal requirements of the Endangered Species Act as responsible for getting the

key players to the table and keeping them there. Even though there were many times when the negotiations were on the brink of collapse, the specter of having to develop remedial management plans for each and every action in the basin that could affect downstream endangered species as required by the Act, was perhaps the key motivator in driving the process forward.

Another factor that some informants identified as a basis for cooperation was timing. They pointed to negotiations occurring at a time when the states involved were enjoying healthy economic conditions and plentiful water supplies. The political climate was identified as well. As negotiations began in 1994, two of the three state governors were running for re-election and the Department of Interior was eager to show that the Endangered Species Act was working. And, the hopes of resource extractors for weakening the Endangered Species Act which were so high with the 1994 national elections vanished with the elections two years later. It became clear that the Act would remain intact.

A study of the beginnings of historically long functioning CPR regimes may shed light on these questions and laboratory experiments that manipulate possible variables involved in the creation of these regimes may also provide insight.

The second area of research needed is to better understand the relationships between government and CPR regimes. Is there a typology for government recognition or involvement with common property rights? What roles can government play in contributing to the success of a CPR regime?

Related to these questions is the research needed to understand conditions for successful co-management of common property resources (CPR). Any one of several areas could be investigated.

First, there is need for analysis of the process. When is co-management feasible? How are these arrangements negotiated? What are the important factors? How are those involved held accountable to the communities they represent?

Second, there is a need for analysis of the agreements. What commonality do they share and can a generic model be developed? Is there an agreement typology that can be identified and how do these types correlate with the ecological or political setting?

Lastly, regimes may be in part cognitive, part normative and part regulative. How operative are these various elements in regimes and what is their relative importance?

Apart from common property resource regimes, the study raises many questions about social capital, considered so important for the success of CPR regimes. Students of CPR management have hardly begun to address questions of social capital and its relationship to CPR management. For example, how is social capital affected by CPR regimes that do not embrace all the institutional design principles described in this study or in these regimes that fail? Do all successful CPR regimes possess high levels of social capital? Do different types of CPR regimes differ in their stocks of social capital? Thinking more broadly, what kinds of civic engagement (i.e., what types of organizations and networks) are most likely to foster social capital and community effectiveness? How is social capital destroyed?

CPR regimes certainly provide a rich area of future research study. There is much to learn about the necessary ingredients for regime development and sustenance. Field case studies, such as the approach taken here, will help inform this area of study. The approach allows exploration and description of elements important to this understanding, derived from hypotheses extracted from the literature. The CPR regimes studies can serve as demonstration projects or prototypes for similar future resource issues. The results of these projects may help persuade people of the usefulness and application of CPRs in a more compelling manner than plans or proposals.

Implications for Policy

There are several implications for natural resource policy that may be derived from this study, some already alluded to in the previous section.

The first set of policy implications clearly revolve around the Endangered Species Act (ESA), one of the strongest and most influential environmental statutes worldwide. Despite its

being much maligned in some quarters, the ESA can work to bring people together across an ecosystem to negotiate new ways to manage a resource. In this study, the “crisis” of water re-appropriation, created by the Act, injected great regulatory uncertainty into water management. The desire to achieve regulatory certainty – guarantees of streamlined regulations (“one-stop shopping”) and a clear understanding of future obligations (“no surprises”) – brought water interests to the collaboration table and kept them there. The chance to improve wildlife habitat as required by the Act brought the environmental interests and federal agencies to the table.

Without this incentive in place, and the shared perception that it would remain in effect in the foreseeable future, it is extremely doubtful that sufficient action to enhance habitat would have been taken. There is a bit of irony in these findings. CPR regimes are put forth in the literature as an alternative resource management approach to the much more common reliance on big government to accomplish the same thing. In this case, it took the federal government to enforce a law (the ESA) which fomented the crisis that gave birth to the CPR regime.

Also regarding the substance of ESA itself, the theme of saving species through the ecosystem or habitat conservation was not well developed in the law. As evidence, the term “ecosystem” does not appear in the Act after its first stated goal (“...to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved”). As a result, a focus on single species recovery has been the dominant approach taken to protect endangered and threatened species in the designations of critical habitat, preparation of recovery plans and development of habitat conservation plans (Noss et al., 1997). Focusing on a single species often has proved to be indefensible biologically, and has not solved the problem of additional species related to the habitat needing attention at a later date. Reminiscent of the Northern Spotted Owl debate is the increasing awareness that ecosystem integrity may be the more important goal in order to protect multiple species of interest.

The conservation of many species joined by their common dependence on or association with a well-defined natural community or process across a landscape, and treated as one functional system, seems the most logical way to enhance species recovery. That was the case here. In this study, endangered and threatened species recovery planning was tied together by

their overlapping habitat needs and the riparian processes that maintain those habitats across a vast landscape. Because the critical habitat was relatively far downstream, and the key riparian processes are affected by activities across hundreds of miles along the ribbon of the Platte, the issue naturally took on a landscape-scale approach, joining far-flung river stakeholders in a common pursuit.

Planning at this scale is difficult. The science behind the conservation of communities and ecosystems is in its infancy. Biologists seldom agree on the details and ecosystem planning is poorly understood by the public. Thus, meager attention has been paid to ecosystems and habitats across landscapes in conservation law and policy. Yet, by taking both a landscape perspective (i.e., connecting actions being taken far distant from the source with the problem) and examining ecological processes (hydrological changes on riparian habitat), it is more likely that the goals of habitat and species conservation will succeed in this case.

The challenges to cooperative land-use and conservation planning to incorporate local, regional, state and federal jurisdictions is a daunting, but critical, task. As has been our history, regional coordination of disparate planning efforts does not develop from good intentions. A good example is the lack of cross-boundary, interdisciplinary efforts in regional land use planning or ecosystem management. We see this quite visibly and commonly across the landscape, particularly in the West, where low intensity agricultural land use is rapidly being converted to high density suburban settings with little connection to the limits of natural resources to sustain this pace.

This study suggests that there needs to be incentives to participate, disincentives for not participating, and a formal organization to direct that participation.

While ESA brought together a diverse set of river stakeholders, did it achieve the more ambitious task of joining stakeholders who do not view themselves as being as directly affected by these decisions? A study by Beatley (1994) of more than 50 habitat conservation plans found similar stakeholders involved in and concern with the outcome. Among these were land developers and the development community, the environmental community, landowners, local government and state and federal wildlife and land management agencies. How can processes

go beyond these regulars so that a wider spectrum of individuals in many more walks of life begin making the connection between their activities and the implications on the ecosystem?

While in this study it appears that the regular suspects were the ones most engaged in the process, this issue does have the potential to bring in a wider public because of the nature of the resource and ESA. ESA is holding all activities that require federal action to address Platte River species loss. The Cooperative Agreement provides that umbrella of compliance. Thus, any citizen in the basin that relies on Platte River water, is affected by these decisions. This situation has the potential to affect many more people than, for example, the degradation of land habitat. While the potential is present, and may make itself felt in the later phases of Platte River management, the process has not yet influenced the every day decisions being made by people throughout the basin that affects habitat far downstream.

But the implications for wildlife management policy from this study goes beyond ESA. The analytical framework tested in this study has very useful implications for regional irrigation re-regulation and wildlife management. It is suggested that there are 11 principles of key importance, working to support the development of a "distributional share system", which should be designed into the development of any common property natural resource regime to achieve the desired outcomes of equity among users, efficiency in distribution and sustainability of the resource (see Table 24).

The study raises implications for the broader field of natural resource management in general. Chapter I of this text discussed the "conservation paradigm" of the 20th Century in which natural resource institutions employ nomothetic knowledge (theorized and generalized), and give preference to economic values using a "top-down" approach to decision-making. The CPR approach studied here turns this paradigm on its head. The CPR approach, in contrast, blends nomothetic (generalized, theoretical) knowledge with idiographic (local, site-specific) knowledge, taking into consideration both economic and non-economic values, using an approach that empowers a "bottom up" philosophy as policy is formulated.

An integration of this knowledge, as well as the differing broader perspectives and experiences that accompany large-scale regime building, necessitates trust building among those

participants who have different constituencies with diverse priorities and perspectives for action. In this study, the trust building – which still continues – was a slow process despite the fact the parties were often meeting monthly for three years. Often, one group of interests would have to back off, while another group caucused and coordinated their plans, before incremental progress could be made. This process took great amounts of time and patience, and is often short-circuited in natural resource policy when pressing problems seem to demand near immediate action. Time frames are compressed, and social capital does not have time to germinate and grow.

Further weaknesses of natural resource management were surveyed in Chapter II. This chapter cited literature critical of wildlife management policy as practiced in the United States. While wildlife management is the focus, the same criticisms could be made of most fields of natural resource management. Wildlife management, the section noted, is practiced largely in the tradition of a state governance regime, rather than in other possible regimes (open access, private sector, or common property resource).

Figure 11 summarizes these weaknesses in wildlife policy as identified by Grumbine (1991, 1997), McKinney (1991), and Yaffee (1994, 1997) in Chapter II. It then identifies whether these weaknesses are present in the Platte River CPR regime as indicated by informants in interviews or by researcher observation (informants were not explicitly questioned about these variables, however, such a survey would make for an interesting study).

As the following figure depicts, the Platte River CPR regime that has evolved significantly improves upon each major criticism of wildlife policy development process as it is commonly practiced in the United States today. Many of these characteristics are minimized or cease to exist under the design elements of the typical CPR regime.

Other implications from this study have to do with the negotiation processes that eventually resulted in an agreement. Respondents identified the struggle to find both the right number of people and the right people engaged in the discussions creating the regime. Allowing only the state and federal agencies to be involved was too restrictive; opening the discussions to all who wished to participate proved too inefficient. In the end a compromise was found by

<i>Weaknesses of Current Wildlife Policy</i>	<i>Weakness Presence in Platte River CPR Regime</i>
Competition supplants cooperation	Minimized
Fragmentation of interests and values	Minimized
Fragmentation of responsibilities & authorities	Not present
Fragmentation of information & knowledge	Not present
Short-term rather than long-term rationality	Not present
Partners do not share in problem definition	Not present
Partners do not share power	Not present
Lack of time for trust building	Not present
Finding short-term rewards to remain productive	Minimized
Lack of adaptive management decisionmaking	Not present
Lack of new networks for information sharing	Minimized
Lack of social data in problem-solving	Provided indirectly
Gaps between top level decisionmakers, mid-level managers and bottom-level field implementors	Not present
Not learning to accept the role of human values	Not present

Figure 11.

Traditional Wildlife Policy Weaknesses Contrasted with the Platte River Common Property Resource Regime

having each agency with clear responsibilities to be present and representatives of the key stakeholder groups. In addition, it proved critical to have negotiators being able to commit their organization to the decisions they arrived at in the meetings. This sped up an already long and complicated process and was crucial for getting the organizations behind the commitments that were made.

Having the decisionmakers present at the meetings was important, and having the right personalities present was also important. Informants were able to point to the same few individuals, representing different constituents, who early in the process substantially impeded and frustrated the discussions. Once these few people resigned from the negotiations, agreements were reached more easily and faster.

Getting the right representatives to fully engage in the process may require financial assistance for smaller organizations with limited budget and personnel. The demands of assimilating large amounts of complex information, negotiations, and numerous all-day meetings may prohibit key stakeholders from participation, unless some compensation can be provided.

Discussed in the previous section, but worth emphasizing here, was the importance of embracing adaptive management by the participants. Because the system was so large and complex, there was scientific uncertainty over a number of key questions. In the absence of certainty, parties to the agreement constructed their realities based on their biases, backgrounds, assumptions and values. The result was broad differences of opinion on the most fundamental matters dealing with water flows, habitat change and endangered species' response.

By not employing an adaptive management strategy to the agreement, the parties were destined for gridlock, with too much at stake for either side to demonstrate accommodation. Adaptive management allowed diverse interests to agree to preliminary actions that all hope will lead to permanent, wiser decisions as an understanding of the system becomes clearer.

It would be interesting to ask participants in common property regimes what criticisms they would have of policy development under these regimes. Based on the respondents in this study, one criticism might be the amounts of time it takes to construct many of these large-scale regimes. However, that criticism would need to be balanced by the time we find often required of state governance regimes in lawsuits and policy revisions due to lack of political agreement.

With the promise of common property institutional design so promising in this investigation and in the extant literature, why isn't there more application of resource management using these designs? Effective conservation requires above all else institutional strength and durability, which is often lacking in many developing countries. In developed countries, the fragmented nature of institutions and their inability to generate social capital significantly contributes to the continual degradation of these nations' natural wealth.

Part of the answer to the question raised above is certainly the lack of study and understanding the role common property regimes can play in guiding management of common property resources. This is an area of study a student would be hard pressed to find taught in any natural resource curriculum at any college or university; invisible in the pages of resource management texts; absent from class and seminar discussions, or among resource managers in the field or office.

While more study of common property resource management is needed, a Center for the Study of Common Property Resource Management needs to be founded in a college of natural resources at one of our leading universities. There, an interdisciplinary team of scholars would work together to better understand the role CPR regimes can play in conserving these resources and teach students these lessons and techniques for application around the world.

Conclusion

This study began in Chapter I with a short quote from the much acclaimed 1987 Brundtland report, the World Commission on Environment and Development's Our Common Future (1987). Among other environmental challenges, the report anticipates a worldwide doubling of population and a quintupling of economic activity: Five times the energy consumption; five times the demands on natural resources, generating, perhaps five times the pollution and waste.

Against this dire prediction, the report singles out the imperative need for institutions to change: to become more dependent, less fragmented, broader of mandate, with decision processes more open. This study examines the nature of common property institutions. This study examines institutional design in a manner that captures most of the qualities the World Commission suggests are needed if our natural resources are to be appropriated sustainably, equitably and efficiently.

The literature review of common property resource management suggests that successful organizations managing small scale, common property resources have adopted particular organizational design characteristics that leads to their stability and resource sustainability. This study found those same design characteristics are present or beginning to take shape in the newly formed, large-scale common property resource regime structured to improve wildlife habitat along the central Platte River.

This study also identified additional design characteristics that may be necessary in large-scale common property resource regimes, particularly when an understanding of a natural system is not well understood by participants in that regime.

In addition, this study suggests that a crisis may be necessary for disparate interests to work together to form a new resource regime. This was the case here, where the threat of sanctions under the Endangered Species Act brought water development interests to the negotiating table with environmental interests to design a new regime responsible for re-regulating Platte River water in the interests of downstream endangered species.

In the process of negotiations to design this new regime, this study found that social capital was created. In a comparison of the time before negotiations and after these talks three years later, the organizations involved were generally more familiar with each other, perceived more of the organizations as fair and worth listening to, and very modest polarization on seven key issues. These facts may bode well for these organizations as they struggle to find agreement on future management decisions.

While the study is optimistic about the chances for success of this new Platte River water regime based upon its incorporation of organizational design principles extracted from examples of successful common property resource regimes around the world, a cautionary reminder is needed. Because this regime has chosen to employ adaptive management to inform future key decisions that will be made after 15 years (in phase two), it is not possible to predict at this time whether this regime will endure across generational boundaries. Many major and difficult decisions will be made 15 years hence regarding the rules governing its distributional share system. Perhaps the social capital being developed in the regime today will serve the regime with the vexing dilemmas and challenges that may lie ahead.

Thus, this resource regime is a work in progress. The findings suggest that the regime has employed design principles, and created social capital, that will greatly improve its chances for initial success. Its long-term outlook will depend upon the collective choices the regime makes in the coming years. Nevertheless, there is reason to hope that a regime born in crisis may circumvent future crises.

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APPENDIX A

Organizations Interviewed and Organizational Abbreviations Used

Cache La Poudre Water Users Association
Central Colorado Water Conservancy District (Central CO. WCD)
Central Nebraska Public Power & Irrigation District (CNPPID)
Central Platte Natural Resource District (NRD)
Colorado Department of Natural Resources (CDNR)
Colorado Division of Water Resources, District 1
Colorado Division of Wildlife, Field Office (CDOW-Field)
Colorado Division of Wildlife, Regional Office (CDOW-Reg.)
Denver Water
Environmental Defense Fund (EDF)
Groundwater Appropriators of the South Platte (GASP)
Lower South Platte Water Conservancy District (Lower So. Platte WCD)
National Audubon Society (NAS)
Nebraska Natural Resource Commission
Nebraska Public Power District (NPPD)
Nebraska Water Users, Inc. (NWU)
Northern Colorado Water Conservancy District (N. CO. WCD)
Pathfinder Irrigation District (PID)
Platte River Whooping Crane Maintenance Trust, Inc. (WCT)
Rowe Audubon Sanctuary (Rowe)
U.S. Bureau of Reclamation (BOR)

U.S. Department of the Interior

U.S. Fish and Wildlife Service – Field Office (USFWS-Field)

U.S. Fish and Wildlife Service – Regional Office (USFWS-Reg.)

U.S. Forest Service (USFS)

Water Supply & Storage

Wyoming Water Development Commission

APPENDIX B

SURVEY INSTRUMENTS AND INTERVIEW QUESTIONS

PLATTE RIVER ORGANIZATION STUDY

Organization _____ Date _____

Name of Organization	Prior to 1994: I was generally familiar with who this organization represents and what it stands for.			Today: I am generally familiar with who this organization represents and what it stands for.		
	NOT AT ALL	SOME	MUCH	NOT AT ALL	SOME	MUCH
U.S. Fish & Wildlife Service	N	S	M	N	S	M
U.S. Forest Service	N	S	M	N	S	M
Bureau of Reclamation	N	S	M	N	S	M
US Geological Survey – Water Resources Division	N	S	M	N	S	M
Colorado Division of Wildlife	N	S	M	N	S	M
Colorado State Engineer, Div. 1	N	S	M	N	S	M
Nebraska Department of Water Resources	N	S	M	N	S	M
Nebraska Natural Resource Districts	N	S	M	N	S	M
Wyoming State Engineers' Office	N	S	M	N	S	M
Wyoming Water Development Commission	N	S	M	N	S	M
National Audubon Society	N	S	M	N	S	M
Environmental Defense Fund	N	S	M	N	S	M
Platte River Whooping Crane Habitat Maintenance Trust	N	S	M	N	S	M
Northern Colorado WCD	N	S	M	N	S	M
Central Colorado WCD	N	S	M	N	S	M
Lower South Platte WCD	N	S	M	N	S	M
Irrigationists' Association	N	S	M	N	S	M
GASP	N	S	M	N	S	M
Nebraska Public Power District	N	S	M	N	S	M
Central Nebraska Public Power & Irrigation District	N	S	M	N	S	M
Nebraska Water Users, Inc.	N	S	M	N	S	M
Goshen Irrigation District (WY)	N	S	M	N	S	M
Pathfinder Irrigation District	N	S	M	N	S	M
Denver Water	N	S	M	N	S	M
City of Greeley	N	S	M	N	S	M
City of Fort Collins	N	S	M	N	S	M
City of Loveland	N	S	M	N	S	M
City of Boulder	N	S	M	N	S	M
City of Sterling	N	S	M	N	S	M
City of Fort Morgan	N	S	M	N	S	M
Water Supply & Storage	N	S	M	N	S	M

Name of Organization	Prior to 1994: Representatives of my organization consulted this organization on issues of importance.				Today: Representatives of my organization consulted this organization on issues of importance.			
	NEVER >>>>> OFTEN				NEVER >>>>> OFTEN			
U.S. Fish & Wildlife Service	0	1	2	3	0	1	2	3
U.S. Forest Service	0	1	2	3	0	1	2	3
Bureau of Reclamation	0	1	2	3	0	1	2	3
US Geological Survey – Water Resources Division	0	1	2	3	0	1	2	3
Colorado Division of Wildlife	0	1	2	3	0	1	2	3
Colorado State Engineer, Div. 1	0	1	2	3	0	1	2	3
Nebraska Department of Water Resources	0	1	2	3	0	1	2	3
Nebraska Natural Resource Districts	0	1	2	3	0	1	2	3
Wyoming State Engineers' Office	0	1	2	3	0	1	2	3
Wyoming Water Development Commission	0	1	2	3	0	1	2	3
National Audubon Society	0	1	2	3	0	1	2	3
Environmental Defense Fund	0	1	2	3	0	1	2	3
Platte River Whooping Crane Habitat Maintenance Trust	0	1	2	3	0	1	2	3
Northern Colorado WCD	0	1	2	3	0	1	2	3
Central Colorado WCD	0	1	2	3	0	1	2	3
Lower South Platte WCD	0	1	2	3	0	1	2	3
Irrigationists' Association	0	1	2	3	0	1	2	3
GASP	0	1	2	3	0	1	2	3
Nebraska Public Power District	0	1	2	3	0	1	2	3
Central Nebraska Public Power & Irrigation District	0	1	2	3	0	1	2	3
Nebraska Water Users, Inc.	0	1	2	3	0	1	2	3
Goshen Irrigation District (WY)	0	1	2	3	0	1	2	3
Pathfinder Irrigation District	0	1	2	3	0	1	2	3
Denver Water	0	1	2	3	0	1	2	3
City of Greeley	0	1	2	3	0	1	2	3
City of Fort Collins	0	1	2	3	0	1	2	3
City of Loveland	0	1	2	3	0	1	2	3
City of Boulder	0	1	2	3	0	1	2	3
City of Sterling	0	1	2	3	0	1	2	3
City of Fort Morgan	0	1	2	3	0	1	2	3
Water Supply & Storage	0	1	2	3	0	1	2	3

Name of Organization	Representatives of this organization can be relied on to be fair and worth listening to.				Gains made by this organization tend to be at the expense of the interests of my organization.			
	NOT AT ALL	SOME	ALWAYS		NOT AT ALL	SOME	ALWAYS	
U.S. Fish & Wildlife Service	0	1	2	3	0	1	2	3
U.S. Forest Service	0	1	2	3	0	1	2	3
Bureau of Reclamation	0	1	2	3	0	1	2	3
US Geological Survey – Water Resources Division	0	1	2	3	0	1	2	3
Colorado Division of Wildlife	0	1	2	3	0	1	2	3
Colorado State Engineer, Div. I	0	1	2	3	0	1	2	3
Nebraska Department of Water Resources	0	1	2	3	0	1	2	3
Nebraska Natural Resource Districts	0	1	2	3	0	1	2	3
Wyoming State Engineers' Office	0	1	2	3	0	1	2	3
Wyoming Water Development Commission	0	1	2	3	0	1	2	3
National Audubon Society	0	1	2	3	0	1	2	3
Environmental Defense Fund	0	1	2	3	0	1	2	3
Platte River Whooping Crane Habitat Maintenance Trust	0	1	2	3	0	1	2	3
Northern Colorado WCD	0	1	2	3	0	1	2	3
Central Colorado WCD	0	1	2	3	0	1	2	3
Lower South Platte WCD	0	1	2	3	0	1	2	3
Irrigationists' Association	0	1	2	3	0	1	2	3
GASP	0	1	2	3	0	1	2	3
Nebraska Public Power District	0	1	2	3	0	1	2	3
Central Nebraska Public Power & Irrigation District	0	1	2	3	0	1	2	3
Nebraska Water Users, Inc.	0	1	2	3	0	1	2	3
Goshen Irrigation District (WY)	0	1	2	3	0	1	2	3
Pathfinder Irrigation District	0	1	2	3	0	1	2	3
Denver Water	0	1	2	3	0	1	2	3
City of Greeley	0	1	2	3	0	1	2	3
City of Fort Collins	0	1	2	3	0	1	2	3
City of Loveland	0	1	2	3	0	1	2	3
City of Boulder	0	1	2	3	0	1	2	3
City of Sterling	0	1	2	3	0	1	2	3
City of Fort Morgan	0	1	2	3	0	1	2	3
Water Supply & Storage	0	1	2	3	0	1	2	3

PLATTE RIVER COOPERATIVE AGREEMENT STUDY

Organization _____ Date _____

For each of the following issues, please indicate whether YOUR ORGANIZATION supports or opposes the action indicated, whether formally or informally. *All information provided will be held in strictest confidence.*

ISSUE 1: Approval, as currently written, of the Cooperative Agreement for the Platte River Recovery Implementation Program.

MY ORGANIZATION:

Strongly Supports	Somewhat Supports	Takes No Position	Somewhat Opposes	Strongly Opposes
1	2	3	4	5

In the past 3 years, my organization... (____ has been) (____ has not been) ...active in informing and involving our membership with respect to this issue.

* * * * *

ISSUE 2: Placing under management, as a long-term objective, approximately 29,000 acres of land located between Lexington and Chapman, Nebraska, for habitat restoration and protection for endangered and threatened species found there.

MY ORGANIZATION:

Strongly Supports	Somewhat Supports	Takes No Position	Somewhat Opposes	Strongly Opposes
1	2	3	4	5

In the past 3 years, my organization... (____ has been) (____ has not been) ...active in informing and involving our membership with respect to this issue.

* * * * *

ISSUE 3: The goal of the first increment of the proposed recovery program – to provide 130,000 – 150,000 acre feet of Colorado's Platte River water – is appropriate for protecting wildlife habitat in central Nebraska for endangered species.

MY ORGANIZATION:

Strongly Supports	Somewhat Supports	Takes No Position	Somewhat Opposes	Strongly Opposes
1	2	3	4	5

In the past 3 years, my organization... (____ has been) (____ has not been) ...active in informing and involving our membership with respect to this issue.

* * * * *

ISSUE 4: U.S. and Fish and Wildlife's long-term estimated target flows of Colorado's Platte River water are appropriate for protecting wildlife habitat in central Nebraska (i.e., 417,000 acre feet/year).

MY ORGANIZATION:

Strongly Supports	Somewhat Supports	Takes No Position	Somewhat Opposes	Strongly Opposes
1	2	3	4	5

In the past 3 years, my organization... (____ has been) (____ has not been) ...active in informing and involving our membership with respect to this issue.

* * * * *

ISSUE 5: State funds should pay to achieve the goals of the Cooperative Agreement.

MY ORGANIZATION:

Strongly Supports	Somewhat Supports	Takes No Position	Somewhat Opposes	Strongly Opposes
1	2	3	4	5

In the past 3 years, my organization... (____ has been) (____ has not been) ...active in informing and involving our membership with respect to this issue.

* * * * *

ISSUE 6: Water User organizations (e.g., irrigation districts, mutual companies, etc.) should pay to achieve the goals of the Cooperative Agreement.

MY ORGANIZATION:

Strongly Supports	Somewhat Supports	Takes No Position	Somewhat Opposes	Strongly Opposes
1	2	3	4	5

In the past 3 years, my organization... (____ has been) (____ has not been) ...active in informing and involving our membership with respect to this issue.

* * * * *

ISSUE 7: U.S. Forest Service lands in the headwaters of the Platte River system should be managed to increase timber production targets in order to generate more water for the Platte River and downstream endangered species.

MY ORGANIZATION:

Strongly Supports	Somewhat Supports	Takes No Position	Somewhat Opposes	Strongly Opposes
1	2	3	4	5

In the past 3 years, my organization... (☐ has been) (☐ has not been) ...active in informing and involving our membership with respect to this issue.

* * * * *

Are there any other key issues surrounding habitat protection in central Nebraska for your organization?

NO

YES → If so, what is the most important key issue to your organization not mentioned above?

THANK YOU FOR YOUR ASSISTANCE !

INTENSIVE INTERVIEW QUESTIONS (presented orally)

As described in Chapter IV, the intensive interviews were unstructured, with no formal written instrument. However, certain key questions were asked of every participant during the approximately two hour interview. Each question inevitably led to several follow up questions. In all questioning, it was emphasized that the informant was to reflect their organization's viewpoint. Often this would need to be clarified, and the informant would be asked whether they were speaking for the organization or whether this was a personal viewpoint different than the organizational view. The initial questions were:

What event marks the beginning of the process that would culminate in the Platte River Cooperative Agreement?

As negotiations began, did the federal agencies involved fully understand the workings of the river? How were various interests helpful or hurtful in this process?

Has the geographic scope of these efforts to protect endangered species along the Platte River been about right, or should the process have defined a larger area? Should some people have been involved in these discussions who did not participate? Was there expertise or important viewpoints missing?

Are the arrangements spelled out in the cooperative agreement basically fair to all interests? Why or why not? How are the costs shared? What benefits does your organization receive for these costs?

What do you think about the structure of the governance committee? Is it fair as currently structured?

How will the parties to the agreement commitments be monitored? Discuss the range of monitoring efforts and needs with me.

What would happen if one of the interests in this agreement decided they no longer wish to abide by the rules? What steps could be taken to prevent this from happening? What if a party decides to withdraw from the agreement?

What sort of conflict resolution methods do you see are available to the governance committee should there be strong disagreement on an important issue?

What were the critical elements in reaching an agreement? How important was the Endangered Species Act in reaching an agreement?

What lessons have been learned in this process? What would you have done differently? Will these efforts lead to improving habitat in the big bend region of the Platte River?

APPENDIX C

The Measurement of Rank Correlation (Kendall's Tau-b)

This study employed the measurement of rank correlation to determine the strength of association between perceptions of legitimacy and interdependence with polarization scores between pairs of organizations involved in this study. This statistical approach is briefly described here based on work by Kendall (1962) and represents a nonparametric test of association, similar to the Spearman rank correlation coefficient (Neter, Kutner, Nachtsheim, and Wasserman, 1996, pp. 651-654).

Individuals are said to be ranked when they are arranged in order according to some quality which they all possess to a varying degree. In this study, individuals were ranked according to scores on polarization, perceptions of legitimacy and perceptions of interdependence. Polarization scores could range from 0 to 1, and perceptions of legitimacy and interdependence ranged from -2 to +2.

Ordinal numbers are used to denote rank, e.g., 1, 2, ... n where n is the number of objects. Thus an individual that comes ninth in ranking has the rank 9. Oftentimes, individuals will possess the same quality that is being assessed. When no meaningful difference exists between them, members are said to be tied. In this case an average of the ranks they would possess if they were distinguishable is used. For instance, if the ties the fourth and fifth members, each is assigned the number 4.5. This is known as the "mid-rank method."

It is important to note that ranks are counts, not measurement. Thus, we cannot subtract "sixth" place on quality A from "ninth" place on quality B. But we can say that a rank of 6 according to quality A is such that five members are given priority over that particular individual, or are preferred to it, while eight members are preferred to quality B. Consequently, the number of preferences in the B-ranking exceeds the number in the A-ranking by 3.

The method employed in this study measures the degree of correspondence between rankings, or the measure of rank correlation intensity. In essence, it measures how far the rankings of X1 and Y1 agree with each other with respect to order and constructs a coefficient denoted by the Greek letter tau, called the Kendall tau coefficient as a measure of concordance between the two rankings. Thus it is similar to the ordinary Pearson product-moment correlation coefficient, but rather than based on actual measurements, it is based on rankings. Such a coefficient has three properties:

- (a) if the agreement between the rankings is perfect, i.e., every individual has the same rank in both, tau should be +1, indicating perfect positive correlation;
- (b) if the disagreement is perfect, i.e., one ranking is the inverse of the other, tau should be -1, indicating perfect negative correlation;
- (c) for other situations, tau should lie between these values whereby increasing values from -1 to 1 corresponds to increasing agreement between the ranks, with 0 representing no association between the paired rankings.

Thus, consider from this study, two organizations, A and B. Their polarization scores were converted into ranks, upon which they ranked 7 and 4 respectively from a list of 45 organizations surveyed. Because their rankings 7, 4 are in descending order, we score this pair a value of -1.

Now we wish to compare organizations A and B on perceptions of legitimacy. In this second ranking, pair AB has ranks of 5 and 7 respectively, which is ascending order and therefore is scored +1.

We now multiply the scores for this pair on both rankings and arrive at the score -1. Thus, for any pair, the score is +1 if their ranks are in the same order, -1 if they are in different orders. We may say that the score reflects whether the pair agree or disagree in the two rankings.

The same procedure is followed for each of the 45 organizational pairs, with each pair having a score of +1 or -1. Let's say the total of positive scores is 21 and the negative scores is -24. Adding these two we arrive at a grand sum score of -3. The maximum possible grand sum score is +45. We therefore calculate Kendall's tau, t , as:

$$\text{tau} = \frac{\text{Actual Score}}{\text{Max. Possible Score}} = \frac{-3}{45} = -0.07$$

This value is nearly zero and indicates very little correlation between the two rankings. A zero value may be regarded as indicative of independence, halfway between complete positive and complete negative dependence.

For a detailed discussion of the construction and theory of Kendall's tau, see Kendall (1962).