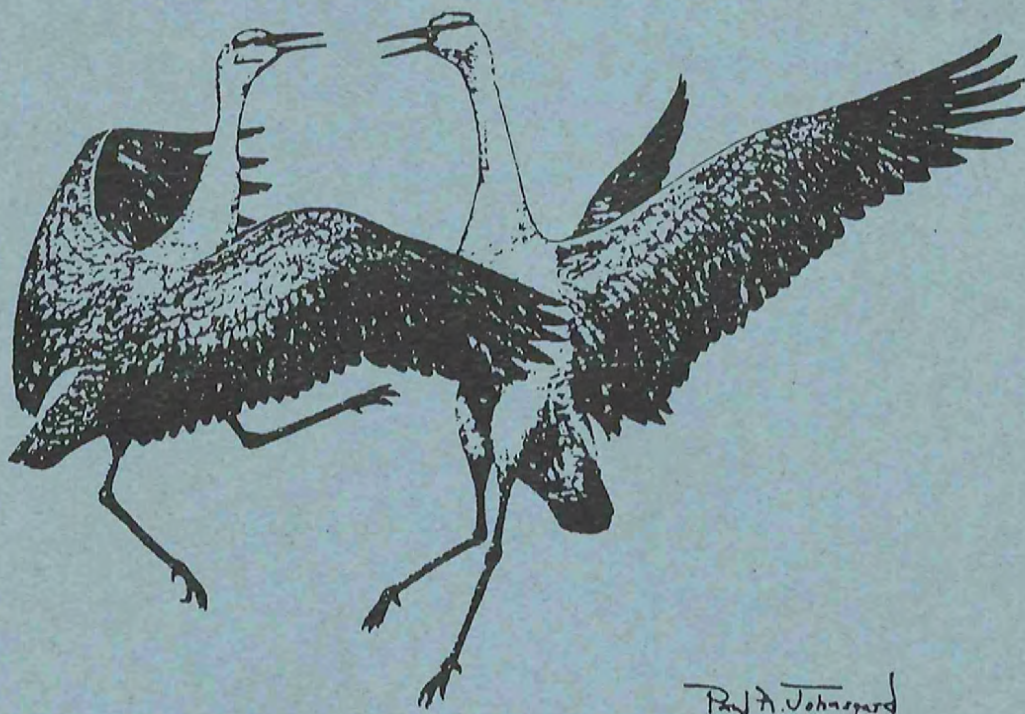


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National Audubon Society

The Proceedings of the Third Annual International Crane Symposium

Kearney, Nebraska March 17-18, 1994



*People, Water and Wildlife:
Human Population Impacts on Cranes*

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**The Proceedings of the Third Annual
International Crane Symposium**

Kearney, Nebraska March 17-18, 1994

***People, Water and Wildlife:
Human Population Impacts on Cranes***

Cathy Schimmel, Editor

Sponsored by the National Audubon Society
and the International Crane Foundation

Cover design by Paul A. Johnsgard

THE NATIONAL AUDUBON SOCIETY

With over 600,000 members and an extensive chapter network in the United States and Latin America, Audubon is one of the world's most effective conservation organizations working to maintain a healthy environment for both people and wildlife. Working from a strong base of scientific research and policy analysis, Audubon employs citizen action, lobbying, litigation, education, habitat acquisition and resource management to effect sound environmental policy and to actively protect wildlife species and their habitats.

AUDUBON'S HUMAN POPULATION AND RESOURCE USE DEPT.

Through public education, legislative advocacy, comparative exchange studies and a grassroots international network, Audubon's Human Population and Resource Use Department works to insure sound population policies are established in the U.S. and overseas, which contribute to the health, well-being and dignity of the individual human citizen, while ensuring the survival of wildlife species and their habitats.

THE SHARING THE EARTH PROJECT

In 1989, Audubon wildlife sanctuaries most affected by human population pressures were matched with eight developing countries with high population growth rates where wildlife and habitat are threatened. A cooperative venture, the Sharing the Earth Project studies threatened ecosystems and looks for sustainable solutions to meet the needs of both people and wildlife. To date, wildlife managers from Pakistan, Nepal, Russia, Mexico, Guatemala, Brazil, Kenya, Zimbabwe, Thailand and Indonesia have worked with Audubon sister sanctuary managers in Nebraska, Louisiana, Texas, North Dakota, Florida and South Carolina.

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People, Water and Wildlife: The Human Resource **by Patricia A. Waak**

Patricia Waak is the Director of the National Audubon Society Human Population and Resource Use Department. Mrs. Waak has twenty-eight years of experience in international development, including work for the Peace Corps and USAID. She has worked in Asia, Africa, and Latin America and is currently a member of IUCN-World Conservation Union's Commission on Environmental Strategy and Planning. Mrs. Waak was also a member of the U.S. Delegation to the International Conference on Population and Development.

The National Audubon Society is sponsoring a third international symposium on people, wildlife, and the water resources all life shares. There is no more notable place to hold these symposia than on the Platte River in Nebraska where the issues come together in stark contrast.

There also is no better organization to host these meetings than the National Audubon Society. Audubon began with birds and their struggle to survive human intrusion into their habitat — living and using the birds for human economic purposes. The egret became a symbol of the organization just as Audubon has become a symbol to the world of sustainability for all life.

Birds are a sign of ecosystem health, a system which developed long before human life appeared on the planet. Even though we understand a little of what the world was like before humans evolved through visits to isolated remnants of tropical forests, we can only imagine the pristine world without cities, roads, airports, houses and farms.

When the first entities we know as our ancestors began to appear, men and women were so few in number that the effects of their presence went unnoticed. People lived in caves and roamed the countryside for food. When a woman traveled with a baby on her back, she only had another child when the first was weaned.

But humankind evolved, discovered agriculture, settled into towns and cities, and ultimately developed new technologies. Today, the earth is experiencing an unprecedented phenomenon in its history — almost total human domination. Our numbers count 5.6 billion, and we grow by 93 million each year.

All of this growth is having an effect on the global environment through resource use and appropriation of natural systems. Too many countries are faced with population growth which outpaces their ability to meet human needs much less cope with ecological change.

The bargain must be made between industrialized countries and developing countries to bring human needs into balance with the earth's bounty. This will mean stabilizing population growth and reducing resource use — consumption.

Leaving aside for a moment the issue of resource consumption by the more fortunate in the world, we first focus on the demands of human population growth. The momentum of population growth and the time at which we reach a stable population will decide what kind of lives we and other species have or whether humans and most of the species of life we know will become extinct.

Two country examples give some perspective on the issue of population size and growth. In 1993, China

had a population of 1.2 billion. Through a system of incentives and disincentives China is attempting to bring population growth down dramatically. Government policy recommends that families keep their offspring to one.

This is not a law but a strong policy of the government. State-supported health and education benefits are provided for one child. These benefits are lost if the family has a second child, and severe monetary penalties are exacted on the husband and wife. While this policy is “voluntary,” continued reports of coercion have been uncovered in provinces where health workers are provided with incentives for keeping the birth rate down.

In addition to the stringent policy related to the “one-child” family, there are also increasing reports of population redistribution used to relieve population pressures. The plans of the Chinese government to “force place” 100 million people to the northern wetlands below the Amur River is an example of massive society restructuring to alleviate population density.

The Chinese today are struggling to accommodate the needs of their people. Massive economic growth is taking place throughout the country. The number of people the government must serve is leading to growth and development, thereby resulting in major environmental problems.

Kenya is another country where population growth is making enormous demands on the government. Until recently, Kenya was growing at 4% per year. With 22 million people, the population size was expected to double every 17 years.

Kenya’s growth rate has dropped to 3.5% after decades of family planning services and education. Women traditionally have preferred a family size of eight children, despite intensive information about the need to reduce population growth. Attitudinal changes have taken place slowly.

Meanwhile, loss of critical habitat has continued at an alarming rate. The use of wildlife for economic purposes has resulted in major conflicts between local people, poachers and wildlife conservationists. This is not surprising given the level of poverty for the majority of Kenyan citizens.

Growth rates like Kenya give us some sense of the nature of the population issue. Demographers use 70 years to calculate doubling times and rate of natural increase. If a country is growing at 2%, we divide 70 by two and get the number of years —35 — that it will take the country to double its population if growth remains constant.

The numbers, however, are less important than what they represent for resources like food supplies. Modern technology has thwarted the Malthusian scenario, at least for now, of massive numbers of people unable to feed themselves. Globally, we are producing more food and meeting the nutritional needs of growing numbers of people.

Over the long term, there still are questions about how many people can be supported, especially if we continue to demand diets that include meat. Fertilizer and water are necessary components for food production along with arable land. Most studies, including those of the U.N. Food and Agriculture Organizations, indicate that many countries of the world will not be able to produce sufficient food for their people as soon as the year 2000.

Alternative future projections of stabilization are based on our ability to deal with population growth. The sooner we reach a two-child family average; the lower the number of people at stabilization.

The continued growth certainly effect survival of endangered species, if not all species. The primary reason for species loss is habitat appropriation by humans. The continued growth will also effect the quality of life for billions of people, if not human survival.

Population growth alone is not the only part of the consideration for life survival. The cyclical nature of wealth, technology, and consumption is creating enormous burdens on the planet. Witness the tons of carbon dioxide and other greenhouse gases being poured into the atmosphere by industrialized nations. Witness the urban takeover of wetlands and often all land. The debate at the Earth Summit in Rio was about the environmental inequity resulting wealthier societies' consumption rates.

We know that ecosystems are resilient, given the opportunity to renew themselves. However, population growth, migration and consumption at the rate they occur today are giving little space for nature to work her magic.

From September 9 to 13, 1994 the United Nations will convene an International Conference on Population and Development in Cairo, Egypt. Many issues will be discussed and debated then brought forth for agreement as to solutions. These issues include access to reproductive health, especially for women, and particularly means to decide their family size in a safe and responsible manner.

One would expect this to be a primary focus for an international conference; however, issues related to coercion will only be part of the discussion. Coercion has to do with sovereignty and human rights.

Issues of environment and sustainable development are part of the negotiations. Population was not on the Earth Summit agenda but the population draft program of action has references and recommendations on environment throughout.

Other issues include population distribution and urbanization, the role and status of women, youth and their special needs, infant survival and the missing girl child, aging as life expectancy extends and what constitutes a family. Private citizens and nongovernmental organizations from around the country are involved in town meetings, special consultations, community discussions and preparatory meetings. They are making their voices heard about what the future should be in the U.S. and around the world.

Our challenge is to link the fate of children in Russia and other countries with the cranes in Nebraska. Sharing the Earth is devoted to that effort and to a vision of a world where there is a place for us all to live in balance.

What if there were 5 billion cranes and 500,000 people?

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Natural Systems and Populations: A Biologist's Perspective

by Dr. Charles J. Bicak

Dr. Charles Bicak is a professor of biology at the University of Nebraska at Kearney with a specialty in plant ecology. He received a B.Sc. degree from Kearney State College, M.S. degree from the University of British Columbia, and Ph.D. degree from Colorado State University. He has pursued a variety of environmental research problems, with particular emphasis on air pollution ecology, plant ecophysiology and grassland dynamics.

Abstract: The recognition of a global connectedness in the past twenty years is unprecedented in human history. A systems approach aids in understanding the interdependence and interaction among urban, rural and wild environments. In particular, overpopulation, reduced biodiversity, waste and global climate change conspire to pose threats to environmental and human well-being. Open agroecological systems are especially susceptible to these stresses. To counter degradation of the environment, a substantive shift in agricultural production from maximization to optimization is emerging. Sustainable agriculture, and therefore society, hinges on practices which more effectively emulate natural ecological processes.

The Global Village: Agriculture and the Ecosystem

The recognition of a global connectedness in the past twenty years is unprecedented in human history. Ours truly is a small world dominated by a species *Homo sapien sapien*, which has remarkable powers to alter the landscape. It is that very alteration on a worldwide scale which has heightened our sense of urgency about human interaction with the environment.

The first photos of the earth from space induced a certain welling of emotion. While a casual glance suggests our earth is a composite of different living creatures, these pictures impress on us the truly interdependent nature of the earth's living systems. As Lewis Thomas (1984) describes it, "It is, to put it one way, the only truly closed ecosystem any of us knows about. To put it another way, it is an organism. It came alive, I shall guess, 3.8 billion years ago today, and I wish it a happy birthday and a long life ahead, for our children and their grandchildren and theirs and theirs."

Systems

The notion of the earth as a living organism deserves further inspection, and the analysis ought to begin with the definition of a system. A system is a grouping of regularly interactive and interdependent parts. J.W. Forrester (1968), an electrical engineer, would add that the parts of a system operate together for a common purpose. While the concept of purpose is arguable in biological systems, there is no question that ecologists have borrowed heavily from both engineering and management science in the maturation of systems ecology. The broad definition of a system allows inclusion of an automobile engine, a set of pulleys and levers and an ecosystem in the same arena. What separates biological systems is the living element, notably plants and animals. However, the living element is a very real wild card. Predicting change in ecosystems is difficult enough. Add the human element as in political, economic and social systems and the challenge to reliably predict change becomes awesome. Still, the benefit in terms of improved understanding and wise stewardship warrants the cost of investment in biological systems research.

The classic ecosystem model is made up of four boxes or state variables and arrows or flows which connect them (Figure 1). The model becomes a working tool when we begin to quantify the regulators on flows, which determine changes in state variables (Figure 2). Further, by recognizing the key supplements to crop production, it is possible to structure the similarities and also the differences between natural ecosystems and agroecosystems (Figure 3).

Agroecosystems

Agroecosystems are a part of a larger closed system—the earth itself—but are also open systems integrally and globally connected. What are these connections? Resources, limited resources—both proximal and distal—tie Nebraska to the rest of the U.S., to the Pacific Rim countries, to the rest of the world. Georg Borgstrom (1973) recognized this over 25 years ago when he coined the phrase “ghost acreage” (Figure 4). The reliance of Western Europeans and Japanese on the grasslands and forests of North America, South America and Australia implies a dependence on the regulators influencing these ecosystems: water, light, temperature and nutrients.

Environmental Stresses

Our resource base in 1994 is taxed significantly by four classes of stress caused by humans; overpopulation, reduced biodiversity, waste and global climate change (Figure 5). Perhaps population is the most serious threat since the magnitude of the other three is, in large part, a consequence of our numbers. In our closed-earth system 3 people are born every second, 10,800 every hour, 250,000 every day, and 91 million every year. Our situation is a bit like the classic lily pond model:

Imagine lily pads extending across a pond. Assume that the area covered by lily plants in the pond doubles in size every day. If allowed to grow freely, the plants would cover the entire surface of the pond in 30 days. As an individual, you decide to ignore the problem until the pond is half covered. Then you will take action to reduce plant cover so the pond isn't entirely choked off. On what day will the pond be half covered, and how much time will you have to avert the disaster?

Answer:

The pond will be half covered in 29 days and you have only 1 day to act. There are signals that our earth has entered the 29th day—or the 11th hour.

Water

All four classes of human induced stress influence agroecosystems. In this light, let us briefly examine water, the key limiting resource for most terrestrial plant growth and development west of the Mississippi River. Approximately two-thirds of the United States receives less than 35 inches of precipitation a year. Furthermore, photosynthesis, perhaps the single most important chemical event on earth, depends on water. According to NOAA (1990), long-term water problems, notably prolonged drought in the west, may become a national crisis. Indeed, disruption of local or regional hydrologic cycles has national and global consequences. For example, conversion of Amazon tropical forests to pastureland reduces rainfall in the area because evapotranspiration which helps cool the region is also reduced. Continued deforestation may reduce rainfall by as much as 20 percent. In another alteration of the hydrologic cycle,

the Aral Sea in the former Soviet Central Asian republics has lost nearly 40 percent of its surface area in the last 30 years; 11,000 square miles of now dry, salt-encrusted wasteland. This is equivalent to a volume of water about one and a half times that of Lake Erie. The two key rivers which flow into the Aral have largely been diverted to support cotton production. The canal system, in use since the mid 1950s, is so efficient and comprehensive that if present rates of water use continue, the Aral will simply vanish in the next 30 years. This is an extraordinary environmental problem in magnitude that could become all too ordinary. Thirty-five million people in the region are directly affected. Once thriving fishing villages are 20 miles from the Sea. A nation and an entire continent are indirectly but also very negatively affected.

Alteration of the hydrologic cycle is, in some respects, a dismantling of ecosystems. Stabilizing processes in nature have been decoupled before the connections between the physical and biological components were well understood. Add to the water examples Three Mile Island, Love Canal, Bhopal, Chernobyl and the *Exxon Valdez* and our consciousness of the planetary predicament is heightened. As Wendell Berry (1987) put it, "We have never known what we were doing because we have never known what we were undoing."

This is certainly not to say that all is lost nor that we have not made substantive progress in mitigating environmental impacts. In fact, if attitude and awareness are keys, we have advanced remarkably since the first Earth Day on April 22, 1970. There is an intricate interplay between the environments we inhabit and our attitudes or beliefs about them (Figure 6). This interplay governs human decision-making. For example, we have typically emphasized production in modern agriculture. Human cleverness has been a remarkable force in transforming the earth's landscape to agriculture. Unfortunately, as Wes Jackson and Jon Piper (1989) note, "human cleverness" may stand at the opposite end of the spectrum from the application of "nature's wisdom." The problems of agriculture are central to the human condition. The human condition being a composite of our environments, belief systems and subsequent decisions we make. I think people are rising to the occasion and fashioning a set of decisions which promote a sustainable agriculture; a sustainable society. In fact, the emphasis of agricultural production is shifting perceptibly from maximization to optimization and regeneration (Elliott and Cole, 1989). A symposium of this sort is evidence of heightened awareness about human activity and environmental degradation.

Description and Prescription

Sustainable agroecosystems, those which rely significantly on sunlight and locally derived nutrients, should reflect greater modeling of natural processes and patterns like succession, energy flow and nutrient cycling. Ecology has much to offer agriculture but agriculture has something to offer ecology as well. For too long ecologists have had the luxury of being descriptive, while agriculturists have been pressed at every turn to be prescriptive. The classic growth response curve is an example of a conceptual bridge between theorists and practitioners. The curve has formed the basis for an ecological predictive model (Odum et al. 1979) that fits actual data well (Pimental et al. 1973).

Industrial agriculture is extraordinarily productive and also extraordinarily destructive—in a slow quiet manner which means that the situation could become critical even before it appears serious (Gaia, 1984). A prescription for the future must be one that is conciliatory and compromising with regard to the global commons: particularly the oceans and the combination of weather and climate. Unlike Garret Hardin's (1968) classic "tragedy of the commons"—the pasturelands long since dissolved by "enclosure"—the oceans and the atmosphere are open systems (Cleveland, 1990). This openness is largely due to the fluid

and chameleon-like nature of resources like water and carbon dioxide (they are gases); coincidentally the two key reactants in the summary equation for photosynthesis.

The environment is nearly indestructible. However, an environment *conducive to sustaining the human species as we know it* may very readily be destroyed. The stage is set for a successful, albeit heroic, effort that leads to a relationship between humans, technology and nature which does not harm any of the three.

A Solution

Education is a fundamental and indispensable element in the quest for a sustainable agriculture and society. As our state, nation and world become more urban—75% of us live in cities in the United States, one of the highest proportions in the world (Weber, 1988)—and a rural to urban flight continues, we become ever more dependent on agroecosystems. Less than 3% of the people produce nearly all the food for the remainder of this country. And as our technology seems to distance us from the farm, the grip of the land on us becomes tighter.

This message needs to be conveyed. I see a change in attitude toward degradation of natural resources which is not unlike the present view of drunken driving—disapproval. Furthermore, our economic and ecologic dependence springs from the 3% of the population on the farm to sustain a massive support system which has international dimensions.

Environmental quality and a sustainable agriculture are compatible. The choices are ours, because the potential is ours.

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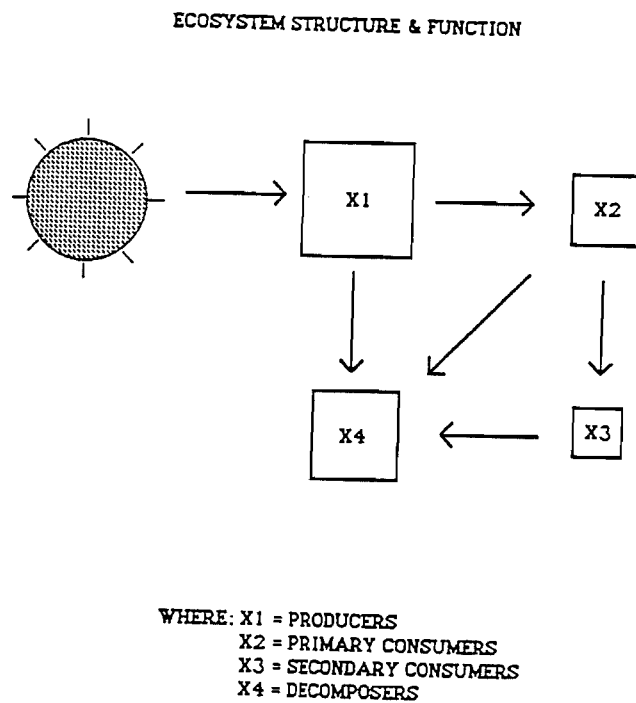
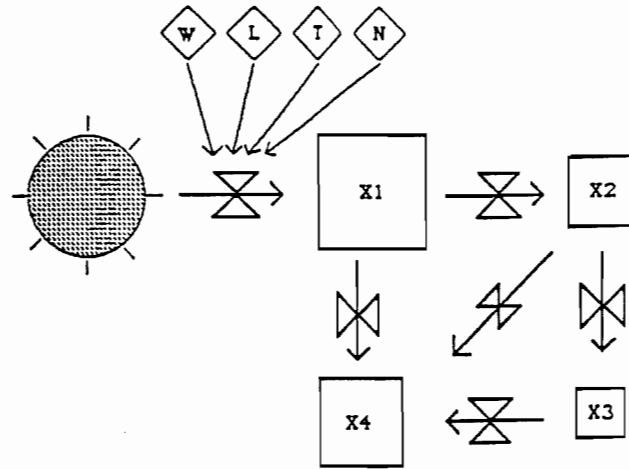


Figure 1. Conceptual model of an ecosystem indicating key compartments and flows.

ECOSYSTEM STRUCTURE & FUNCTION



WHERE: W = WATER
 L = LIGHT
 T = TEMPERATURE
 N = NUTRIENTS

Figure 2. Ecosystem model indicating regulators on flows and key driving variables that influence them.

ECOSYSTEM STRUCTURE & FUNCTION

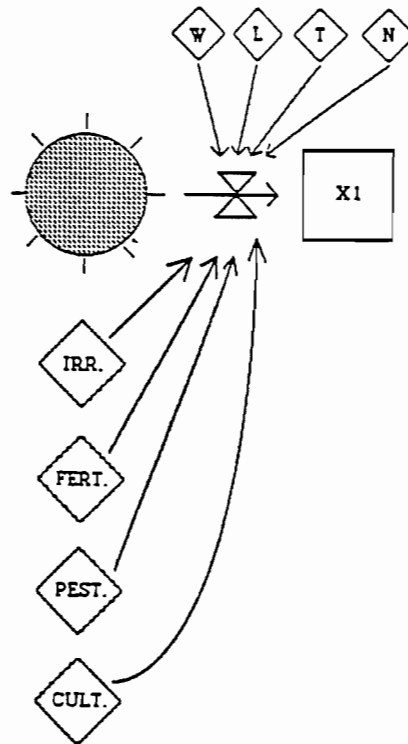


Figure 3. Submodel of an agroecosystem depicting natural and supplemental driving variables; IRR. is irrigation, FERT. is fertilizer, PEST. is pesticides and CULT. is cultivation.

THE INTERDEPENDENT GLOBAL SYSTEM:

GHOST ACREAGES*

Acres per person, selected countries

	Tilled Land	Pastures	Ghost Acreage	Ghost Acreage as Percent of Tilled Land
Japan	0.14	0.03	0.84	640
United Kingdom	0.34	0.55	0.98	288
Holland	0.18	0.26	0.78	432
Italy	0.28	0.10	0.25	87

*Coined by Georg Borgstrom (1965)

Figure 4. Examples of ghost acreages for selected countries.

PRESSURES ON THE ENVIRONMENT

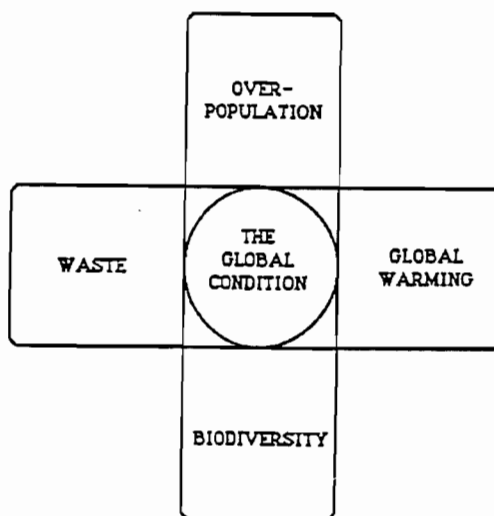


Figure 5. Four classes of stress that pose a threat to ecosystems.

NATURAL WORLD VIEWS

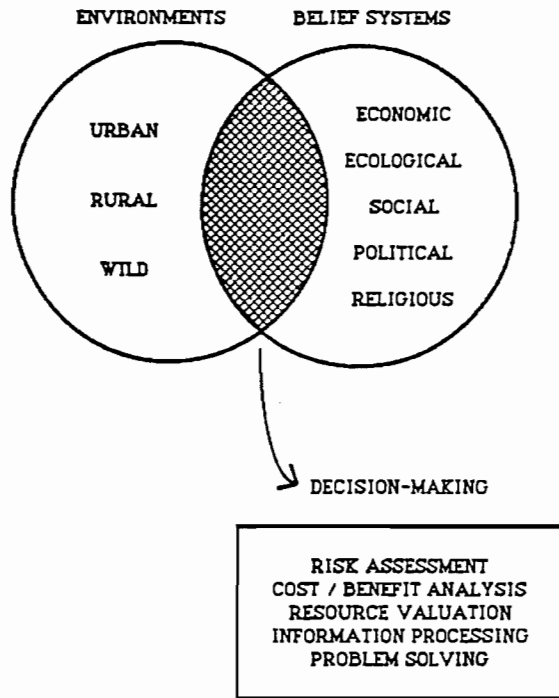


Figure 6. Intersection between human experience with environments and belief systems as it influences decision-making.

Community Based Conservation at Cao Hai Nature Reserve, China

by James Harris and Jeb Barzen

Jim Harris is the Deputy Director of the International Crane Foundation in Baraboo, Wisconsin. Developer of the Foundation's International Training Program, he is especially involved in establishing long-term conservation strategies for natural areas, with an emphasis on the human dimensions to wetland protection. Mr. Harris works primarily in east Asia on crane and wetland issues.

Jeb Barzen is a waterfowl ecologist with the International Crane Foundation. Mr Barzen's work brings natural resource aspects to human resources. Currently, Mr Barzen is focusing his work on watersheds and wetlands, particularly wetland management.

Introduction and Summary

The decline in biological diversity is a growing problem worldwide. Nature reserves are fast becoming islands surrounded by regions of intense human use. Effective conservation must concentrate not only upon creating reserves but also upon wisely managing large tracts of adjacent lands.

The International Crane Foundation (ICF) in collaboration with Trickle Up Program (TUP) has developed a project that emphasizes community participation in conservation planning and economic development, an approach not yet attempted for China's nature reserves. In a period of rapid market reform and uncontrolled free enterprise in China, ICF seeks to promote individual initiative and self-determination within the ecological limits imposed by fragile and already degraded ecosystems.

Among ecosystems threatened worldwide, wetlands are particularly vulnerable to human activities on unprotected lands nearby. Wetland reserves in China typically include the wet areas but not the watershed. Most wetlands, however, live or die by the condition of their watersheds. In addition, most of China's wetland reserves are located in heavily populated areas, and the biologically productive wetlands make important contributions to local incomes. Resource abuse threatens the viability of wetlands as functioning ecosystems with the resultant loss of both human and wildlife values.

China is among the world's most biologically diverse countries. It is also the most populous nation with an economy expanding at more than twelve percent per year. Although China's reserves are surrounded by poor communities with few economic opportunities, wildlife officials have been reluctant to address human needs. Lack of mechanisms for local participation now threaten the viability of the entire reserve system.

Our project attempts to create a process for integration between conservation and economic development through local participation. While holistic in approach, our program closely focuses on twelve villages immediately beside the wetland. Cao Hai Nature Reserve has been chosen because (1) past destruction of both forests and wetlands has sensitized local people to the need for conservation; (2) small scale investments, replicable elsewhere in China, can have significant benefits; (3) Cao Hai's watershed is small enough to facilitate basin-wide planning; and (4) conservation officials have shown a sensitivity to human issues that is unusual for China.

Background

China, located where Palearctic and Oriental realms meet, has moved decisively to protect its extraordinary biodiversity. Since the end of the Cultural Revolution in 1976, the country has expanded the number of nature reserves from nineteen to over seven hundred, covering 56,000,000 hectares (Ministry of Forestry, unpublished data). Such growth in a protected areas system is unique.

Concurrently, China's large human population and its efforts for economic development have placed tremendous strains on natural environments. Where natural resources have been neglected, the results have often been catastrophic. For example, the record damage from the summer 1991 flooding in the Yangtze River Basin was caused by deforestation and wetland destruction throughout the watershed. Losses were in the billions of dollars.

Cranes, revered by the Chinese, serve as an important biological and cultural link within the conflict between growing resource exploitation and environmental protection. Eight species reside in China, more than in any other country. Six of these species, however, are endangered, and their plight has inspired nationwide concern. Twenty-two nature reserves covering 1,685,000 hectares have been established for cranes (Harris 1992).

Wetlands are highly productive ecosystems that provide a home for cranes. At the same time, they provide water, fish and other resources for human use. Large numbers of Chinese people live within and depend upon wetland nature reserves; relocation of people is not an option. The individual activities of large numbers of villagers, acting with little understanding of wetland ecosystems and with little planning or coordination, are causing severe over-exploitation of their natural resources. The results—deforestation, erosion, depletion of fish, flooding and water quality degradation—threaten people as well as wildlife. In recent years, therefore, Chinese authorities have begun to recognize that their nature reserves can not be successful unless economic activities of the people are integrated with conservation objectives.

Before reserve managers can link their conservation work with economic development, they must develop models for nature reserves that integrate environmentally sustainable land use with appropriate management for wildlife. To date, reserve managers have regarded local human needs as a problem obstructing achievement of their mission. Reserve staff have yet to contribute their ecological expertise proactively to aid and encourage community development. Nor have they understood that ecologically sustainable activities within the watershed of protected reserves are critical to the future of their reserves and to biodiversity conservation in China.

Lack of local public involvement in conservation planning has meant that communities have received little or no benefit from nature reserve development, and feel alienated—even hostile—to reserve programs. Another major obstacle to integrating development with conservation has been insufficient capital to improve land uses. Until such initial investments can be made, short term, unsustainable benefits will outweigh long term interests of the people. In local communities this means that people, with minimal financial or technical resources, have been forced into activities in direct conflict with reserve objectives.

China's nature reserve system is at a critical stage. The reserves will have little meaning for the future unless they can solve the issues of resource use and development for the local people.

Brief History of Cao Hai Nature Reserve

Cao Hai Nature Reserve (CNR) protects a wetland that includes 25 km² ha of open water and emergent vegetation (CNR, unpublished data). In recent years, 200-400 black-necked cranes (*Grus nigricollis*) have wintered here (Wu Zhikang et al. 1991) with about 1,000 common cranes (*G. grus*) (CNR, unpublished data), as well as significant populations of bar-headed geese (*Anser indicus*), a large variety of diving and dabbling ducks, herons, shorebirds and birds of prey. Cao Hai is one of the most important wintering areas for waterbirds in southwest China. Several species at CNR, including the black-necked crane, are endangered.

Cao Hai has a dramatic history of destruction and restoration. In 1958, 700 ha of farmland were created by partial drainage of the lake. An attempt to drain the lake entirely was made in 1971, but failed. Most of the lake bottom was unsuitable for farming, and only 100 ha of new farmland was capable of yielding good crops (Li Fengshan and Li Mingjing 1991). During the drainage period, blowing soil and serious outbreaks of crop pests further hampered farmers.

In 1982, Guizhou Province decided to dam the outlet of the basin in order to restore the wetland. As the lake expanded, wetlands formed around the edges. Black-necked cranes, which had dwindled to thirty-five birds during the drainage period (Wu and Li 1985), quickly increased.

Reclamation of farmland from Cao Hai resumed in the 1980s. Farmers developed a technique of hand digging wide, deep ditches and placing the spoil on the land between the ditches, thus raising the surface level of the soil (Hong Shouli, Guizhou Envir. Prot. Bureau [EPB], pers. commun.). Crops could then be grown here during the summer rainy season. As wetland areas were again reduced, cranes, bar-headed geese and ruddy shelducks (*Tadorna ferruginea*) increased their use of croplands for feeding. The conflict between birds and farmers intensified.

In April 1991, CNR gained control over the outlet dam for Cao Hai from the local water bureau and raised water levels during the ensuing growing season. The croplands, created in recent years from wetlands adjacent to the lake, were flooded. By 1993, natural vegetation had returned to these wetlands, providing extensive habitat for cranes, waterfowl and other birds.

High water levels, however, created economic hardship among local people whose croplands had been flooded. The Weining County government provided small amounts of free food, and allowed some families to not pay taxes for the year, but these were temporary remedies. Local families worried about how they could improve their livelihood without farming the wetlands.

As harvestable trees in the watershed have almost all been cut, and remaining wetlands are protected by artificially maintained water levels; CNR is no longer trying to curb ongoing economic activities of the people. At issue is how local people can devise new methods of economic development without further degradation of local ecosystems. Our project is designed to provide the financial and technical support to achieve this goal. In its relations with the local people, CNR does not need to provide instant financial gains. But CNR does need to embark upon a creditable process that promises practical, tangible benefits for the local families. Otherwise, resentment and conflicts over resources will intensify.

Project Description

ICF is working with our Chinese colleagues and the Trickle Up Program to develop alternative economic strategies for local people by creating Community Trust Funds for villages bordering Cao Hai, through which small grants will be provided to local families and groups of farmers. Projects are likely to include livestock management, creation of fish ponds away from the wetland, development of orchards and reforestation of erodible slopes. Trust Fund activities will be compatible with efforts to sustain and restore the resource base of the wetland and its watershed. Following the end of the project, Trust Fund activities will be guided by the Master Plan for Cao Hai. The plan will evaluate wildlife and other resources of the basin, strategies for protection and wise use of these natural resources, and development alternatives that are compatible with nature reserve goals.

A successful Master Plan process will depend upon two main components. Those components are (1) active participation of local people, a process through which villagers will come to understand the limits and opportunities of their fragile environment (to promote this goal, distribution of Community Trust Funds will maximize control and responsibility at the village level); and (2) development of effective means for collecting and analyzing accurate information that originates over large areas (e.g., the entire watershed) and from a variety of sources. Our project has six components.

Geographic Information Systems (GIS)—GIS will be used to develop the Master Plan for Cao Hai. Geographic information from the watershed and wetland will be used to assign places for each type of land-use to occur, to describe changes in land-use over time, to model hydrological parameters of the Cao Hai wetland and to analyze habitat-use by black-necked cranes. Once tested, this approach can be used for additional studies at Cao Hai and for other nature reserves in China.

GIS will be a powerful tool for communication of land and resource information to local officials and to villagers living within the reserve buffer zone. It will also be used to monitor impacts of the community-development project during and after the three-year period of this project.

Monitoring and Public Involvement Programs—CNR and ICF staff are collecting information on water, vegetation, birds and human activities to measure impacts of community development and management activities, and to allow for re-adjustment of management actions. Public involvement programs at CNR will aim for two-way flow of information, particularly regarding resources and human activities, and will facilitate planning and implementation of management measures.

Forestry Program—The deforested hills contribute greatly to water quality and erosion problems. Afforestation efforts can provide major benefits for both wildlife and people, but past efforts have had limited success because local people have lacked an economic stake in the outcome. ICF involvement will include germination and survival studies for ongoing afforestation efforts, experimentation to determine ecologically and economically feasible methods for restoring forest cover to the barren hills, and development of mechanisms to involve villagers directly in tree care and profits from afforestation.

Small Grants for Business Activities—As a first step for community development, ICF is working with the Trickle Up Program (TUP), a non-profit organization in New York City that has worked in 108 countries to help over 200,000 people start small businesses. The philosophy and design of TUP is based on the belief that self-help is the path to poverty alleviation. The Cao Hai project represents the first time that TUP has participated in a concerted effort to link poverty alleviation with conservation.

Conditional grants from TUP consist of \$100 in two payments of \$50 each, given directly to small groups of at least five people. Three months after the initial \$50 payment, each business fills out a report verifying compliance with the grant conditions and explains their business' progress. The second payment is then given out. While funds provided by TUP are important, the simple business training and self confidence provided by participation in this process are equally significant and tend to have lasting results.

At Cao Hai, TUP plans to provide 400 small grants between 1994-96 in eight of the poorest villages where the impacts of high water levels have been most severe. These eight villages will then be sites for Community Trust Funds.

The TUP process is designed for extremely poor communities, where an individual's labor could be the only resource available. Annual income for five of the villages selected for our project ranges from 100-150 kg of grain per person and 150-200 yuan / person (5.6 yuan = \$1).

Community Trust Funds—As each village gains experience with the small business activities funded by TUP, ICF and Guizhou EPB will deposit money into a Community Trust Fund to be established for that village. Additional contributions will be made by the small business groups from that village. These contributions from the villagers will promote a sense of ownership and responsibility for the Community Trust Funds.

After a village's Community Trust Fund has accumulated at least \$2,000, the village committees will begin to disburse the funds in small loans to individuals or small groups for business activities; or the committee may choose to invest the money in a village enterprise or in projects to benefit the entire village. For the community fund to benefit the entire village, the loans will be repaid. Experience elsewhere with micro-lending projects (e.g., the Grameen project) emphasizes the need for local control over the activities to be funded and over decisions on individual loans.

This project does not attempt to provide financial assistance to all families affected by high water levels at CNR. Instead, we are attempting to encourage a process and model for improving incomes and lives of the villagers. As many small businesses succeed, the general economic situation should improve to the extent that it will become easier for other families to engage in business without outside financial assistance.

Grants from the Community Trust Funds will encourage new types of economic activities or seek to improve current activities. These grants will also support longer term projects such as reforestation. Guizhou EPB and CNR will organize technical assistance from local agencies to assure successful implementation of the funded activities.

Master Plan for Cao Hai Nature Reserve—In 1993, Guizhou EPB and CNR developed a preliminary Master Plan in cooperation with the Weining County Government and local villages surrounding the nature reserve. The preliminary Master Plan will be revised and expanded over the next three years.

The Master Plan process will involve all sectors of local government and the local population. Local guards (employed by CNR from these twelve villages immediately adjacent to the core area of the reserve) will work with other CNR staff to hold village meetings to explain the Master Plan process,

obtain information from villagers regarding Cao Hai's history for the Master Plan, and gain options from the villages about their needs. Following these meetings, representatives of the villages will meet together with reserve staff. The Master Plan will help carry forward approaches developed during this project in the years after 1996.

Local Decision-Making and Participation

The Community Trust Fund project will provide a permanent fund to reside in each of the targeted villages. Use of each village fund will be controlled by a village committee composed of the village leader and three to five village residents. A special emphasis will be made to have gender balance in the village committees. The committee's decisions for lending out the funds will be made after consultation with the villagers. CNR has no direct authority over any village or its leader. CNR will work with the village committee to ensure that activities to be funded are compatible with conservation objectives of the reserve, making modifications to the activities as necessary. As a last resort, CNR will have authority to stop funding of projects incompatible with sustainable land-use objectives as expressed in the reserve management plan.

It is important to understand that the conservation guidelines will serve primarily to steer villagers away from further degradation of their resource base. Given the financial and technical support provided by this project, villagers will have far more options than ever before. Individual families and small groups of villagers will freely choose the directions they wish to follow. We expect a great diversity of choice, especially after the initial villages gain experience with their funds.

Management planning for CNR will be innovative for China in that (1) planning will be an interactive process involving local people so that their perceptions and needs are reflected in the plan; and (2) planning will take a holistic approach that involves all aspects of land and resource use within the core wetland area and the watershed.

While China has decentralized governmental structure, public participation generally means that local people affirm what their leaders suggest. While there is a growing awareness in Chinese rural development circles of the importance of real local control over projects, replacement of a top-down system is slow at best.

Guizhou EPB, CNR and local governmental officials see the strong need for local involvement and control. But fully effective local participation is less a beginning point for our project than a result of its three-year process. We hope that local participation will become more effective as villagers and officials gain experience through the project.

Community based approaches to conservation—where local populations benefit from the resources being protected, and become the guardians for those resources—are now being attempted in many parts of the world (Liz Claiborne and Art Ortenberg Foundation 1994). These approaches involve transforming the complex of relationships among local peoples, governments and outside conservationists. Community based programs are process oriented, rather than aimed at endpoints with human factors minimized. Thus at Cao Hai, all parties are learning as the project unfolds.

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Amur River: Providing Needs for People and Wildlife by Dr. Sergei M. Smirenski

Dr. Sergei Smirenski is a professor of zoology at Moscow State University and an expert on the natural resources of Russia's Amur River Basin. Since 1989, he has led efforts to prevent the construction of numerous dams threatening to destroy the nesting grounds of rare cranes, storks, waterfowl and the nurseries of valuable fish along the Amur River. In 1992, he spearheaded the effort to establish the privately-funded Muraviovka Nature Park.

Abstract: The economical development of the Amur—one of the last free flowing major rivers in the world—has caused the diminishing of biodiversity, as well as the extinction of endangered species, unique communities and tribes of indigenous people. The Socio-Ecological Union, the largest non-governmental environmental organization in Russia, started an alternative program to create a balance of interests between human communities and wildlife and to introduce sustainable ways of development in the area. One of the first results was the establishment of Muraviovka Nature Park, the first private nature reserve in Russia since the early 1900s.

Key Words: Amur River, sustainable development, balance of interests, ecological education, Muraviovka Nature Park, Socio-Ecological Union.

Uniqueness of the Amur River Basin

The Amur River stretches more than 2,700 miles in a west to east direction from Transbaikalia and Mongolia to the Okhotsk Sea. As it winds along the border of Russia and China, the Amur creates flat wetlands ideal for a wide variety of plant and animal species. Six species of cranes nest, stage or visit on the Amur—more than anywhere else in the world. Thousands of other migratory waterfowl of the Arctic-Asian flyways refuel on the Amur during their 3,000 mile migration. The Great Siberian Sturgeon (*Acipenser baeri*), one of the largest freshwater fishes in the world (some reach over 1,000 kg in weight), spawns in the Amur River.

Threats to the Amur River Basin

Until recently, the Amur River Basin remained relatively undisturbed and sparsely populated. The majority of the human inhabitants in the basin were small communities and indigenous groups. These inhabitants practiced traditional land uses including fishing, and hunting and gathering and had a minimal impact on the basin's resources. However, since the beginning of this century, Russian and Chinese efforts to develop this area have increased dramatically.

Today, with the political and economical changes in Russia, local governments are increasingly more powerful and independent. In the Amur region, local governmental officials sign many types of agreements which make them eligible to harvest resources and develop industry in the Far East. International joint ventures are forming in the Far East; many are focused on clearcutting the forests in and around the basin. The majority of the proposed and existing projects, however, do little for the local people. Profits from the harvested resources are exported abroad or to other regions of Russia. With few industries to process these raw materials, the local people are losing their resources and significant profits.

Improved Russian-Chinese relations have contributed greatly to the settlement of the region. As population has increased, so has the growing demand for agricultural land. The woodlands and wetlands of the Amur basin are rapidly being converted into farmlands and are at great risk. Wetland reclamation and deforestation have contributed to decreases in native plant diversity, soil erosion and a decline in water quality, as well as the loss of important wildlife and their habitats in the Amur basin.

The accelerated process of settlement and land conversion in the Amur basin is at an all time high. Economic activities are focused on short term profits and are not concerned with the long term impact of their activities on the health of the basin. In some areas of the basin, logging companies are clearcutting the forest to harvest a specific species of tree and in the process destroying an entire ecosystem. If plans of the Russian-Korean joint venture "Svetlaya" to cover the territory of Bikin River in Primorski Region succeed, the last islets of virgin forests will perish and the ecocide of Udege and other tribes of indigenous people will inevitably take place. Russian-Chinese projects have been drafted to build seven dams on the Amur to supply electricity and create more agriculture land. They are moving ahead without environmental impact studies.

In the span of a few short years, the Amur River Basin—which has remained pristine since the beginning of time—stands to be irreversibly altered. The wildlife and indigenous people that depend on the resources of the basin may also lose their native home and sustenance.

The Amur River Basin Program

Recently, local and international non-governmental organizations (NGOs) have begun to examine economic activities in the Amur basin that threaten wildlife and local communities. At the end of 1991, Russia's largest environmental NGO, the Socio-ecological Union (SEU), founded the "AMUR RIVER" Program (Program) to support the preservation of ecosystems and wildlife and develop sustainable economic activities in the Amur River Basin.

Socio-Ecological Union, together with other NGOs, supported the struggle of indigenous people and local communities against clearcutting in Bikin River Basin. As a result, in late 1992 the Supreme Court of the Russian Federation stopped Russian-Korean logging in this area. In 1993, the Primorski region Council of Deputies gave the indigenous people the right to maintain their territories of traditional land use.

Investigations carried out by Moscow State University show the negative impacts of Khinganski dam on wildlife. The results, distributed through mass media and presented in workshops and conferences, helped to exclude the dam from the Russian-Chinese project "Complex utilization of water resources on the frontier areas of Amur and Argun Rivers."

The Program's mission is not to stop all activities in the Amur Basin. Instead, we propose to examine projects and suggest alternative methods of economic development that are profitable to local regions and do not negatively impact the health of people and wildlife in the basin.

The Program has designed many strategies of protection including land protection efforts, sustainable development projects and educational programs that require local as well as international assistance. For coordination of the Program and SEU activities in East Siberia, the Priamurski branch of SEU was established in September 1993. With support from the Institute for previous Soviet-American Relations

(ISAR), Sacred Earth and other NGOs, the centers for communication and information exchange will be established in the Amur River Basin.

Muraviovka Nature Park

In the late 1980s, Russian scientists received word that rare species of cranes banded in the Amur region were sighted in Japan, Korea and China. Inspired by this discovery, and with the help of the International Crane Foundation (ICF), letters to various international conservation groups were sent asking for their assistance in protecting wetlands in the Amur River Basin. Within days, a response from the Wild Bird Society of Japan (WBS) was received informing they were ready to help.

In December 1992, the SEU signed a contract to rent 5,700 hectares of land in the Amur Region for 50 years and established the first private nature preserve in Russia since the early 1900s: Muraviovka Nature Park (MNP). The funds for leasing the land are to be donated by the Pop International Group of Textile Companies through the WBS.

Because of the political and economic instability in Russia, we were hesitant to pay local authorities cash for the rent. Instead of providing capital for the land rent, we offered local authorities the rent value in food production equipment. In essence, the Program would rent the land from local authorities and local authorities would rent the food processing equipment from the Program. In addition, the Program would receive a percentage of the funds from the processing plant for the operation of the nature park. This solution not only ensured the creation of the park, it also gave the local communities needed equipment and provided sources of revenue and food for the local people. Today, the park has been established and the purchase of the equipment is near completion.

Sustainable Development Projects

We believe that protection efforts will be unsuccessful without support from the local community. The Program is focused not only on the protection of habitats and wildlife, but also on programs that benefit the local community without negatively impacting on its resources.

It is hard to convince people to save wetlands and endangered species when they are struggling to obtain food for their table. One of the Program's goals is to demonstrate to the people of the Amur River Basin that conservation and not destruction of resources is much more profitable for the region.

We have already begun a sustainable agriculture program near MNP. American agri-tech specialists visited the area in 1992 and 1993. These specialists have developed proposals to create processing plants for meat, milk and soya beans, which will greatly enhance the economic viability of the rural Tambovka district. Included in these proposals will be information regarding new varieties of crops, management, nutrition, genetic improvement in cattle and economic information regarding joint enterprises. In the summer of 1993 two American farmers visited MNP. The farmers will continue to demonstrate new farming techniques to local people that will yield a larger, healthier crop and not destroy fertile agricultural lands in the spring of 1994.

Our hope is that new farming techniques that are better for the land will be learned and passed on. Yet, equally important is that the local community feel they are directly benefitting from the creation of the MNP. With these feelings, the community will be more likely to protect the area and have an open mind

when conservation issues in their region arise.

In addition to the sustainable agriculture program at Muraviovka, we are also hoping to work with other conservation and for-profit groups on sustainable timber programs. Over the next year we hope to be involved in designing a land use plan for the Amur River Basin. This plan would identify core areas for protection, areas where logging and other economic activities are feasible, areas of indigenous groups and traditional land uses that should have no large scale economic development. In addition, current logging operations would be analyzed and suggestions would be made to improve operations and provide alternatives to clearcutting techniques and current operations that involve incredible destruction and waste.

The last component of the sustainable development project for the Amur River Basin is the development of limited ecotourism in the area. Ecotourism programs will be designed to minimally impact the basin's resources and bring revenues to local industries and people. Ecotourism in the Amur River Basin will also serve to educate local and international people about the uniqueness and importance of the area and the need to protect one of Russia's greatest resources.

SEU, together with the Baikal Watch, organized in August-September 1993 the first workshop on ecotourism in Khabarovsk. Over 50 specialists from Nature State Reserves, National Parks, Academy of Sciences, Universities, Association of Indigenous people, committees on ecology and nature protection, tourist companies and NGOs from East Siberia, USA and Scotland discussed the positive and negative impacts of ecotourism. They decided to develop management plans for certain areas and start training programs for ecotourism specialists.

Education Programs

An ongoing goal of the Program is community outreach and education. The center for environmental and agricultural education that will be established in MNP will not only be active in the Park, but will also coordinate a larger community outreach program for the Amur River Basin. The center will provide education materials for schools and neighborhoods and host community meetings to discuss conservation issues.

National Audubon Society (NAS) and other international NGOs provide technical experts, information, textbooks, video films, slides, and equipment for the educational programs. Utah State University (USU), one of the leaders in the delivery of education technology, is attempting to establishing a video telecommunication education program in the MNP.

In 1994 a group of American school teachers, under the leadership of an ICF educational expert, will visit MNP and Khinganski State Nature Reserve. They will assist in environmental education activities with local children and communities, and will exchange information and materials with Russian school teachers. We believe that these contacts will lead to continuing cooperation.

WBS is going to establish strong cultural and economic connections with the authorities in Amur region. The WBS has arranged for representatives of the Amur regional administration to visit the wintering grounds of the cranes in the Izumi area of Japan. In addition we are going to support the leadership of Izumi city to visit MNP in the summer of 1994 to observe the nesting grounds of their wintering cranes.

The ICF, NAS, WBS and Nature Conservancy have a strong commitment to provide training for the staff of the MNP and other conservationists in East Siberia, including study visits to the USA and Japan. Utah State University will invite farmers and agriculture specialists from Amur region for training in the USA.

In the summer of 1993, an American student was trained at ICF in order to serve MNP in the summer of 1994 as a volunteer assisting with research and conservation activities.

By educating the local people and authorities about the uniqueness and importance of the Amur River Basin, and examining new economic activities in the area, we hope to change attitudes toward wildlife conservation.

International Cooperation

The resources and problems of the Amur River Basin are the shared responsibility of many countries. Because the Amur River winds along the border of Russia, China and Mongolia, these three countries should cooperate to protect the river and its resources. Additionally, many species that depend on the river migrate to other parts of the world including Japan and Korea. The health of the river, as well as of the people and species that use the river, depends on the cooperation of all these countries.

In the summer of 1992, the Program held an international meeting "Cranes and Storks of Amur River" to discuss numerous subjects including the protection of these groups of birds, biodiversity, pristine ecosystems, the problems of deforestation, dam construction and sustainable development of the area. The Workshop resulted in a Russian-Chinese agreement on the Khanka Lake and Transbaikalia Nature Reserves. The list of important sites for cranes and storks was composed and sent to the Russian Federation Ministry of Nature Protection and to international environmental organizations. As a result, some of the areas were included in the list of wetlands of international importance from Ramsar Convention.

The workshop has brought national and international attention to the environmental and economical problems of the Amur River through mass media coverage including internationally known newspapers and magazines, television and radio broadcasting. The attention has generated interest to the region and has created deep concern among federal and public institutions in Russia and across the world. As a result, the funds have been increased to carry out the Program and first-class specialists have been involved in the implementation process.

Today, MNP is not only an individual nature park, but an important link in the growing network of protected habitats for migratory birds. Its importance can not be overstated. MNP, together with Lillian Annette Rowe Sanctuary (NE, USA), WBS and local officials of Izumi (Japan), would like to see continued cooperation with the work involving crane and habitat preservation. We would also like to expand the network of protected territories and sister sanctuaries. We hope that the migration stop-over sites in China, Korea, Mongolia and other countries will also be covered by this network.

The Program works daily to coordinate protection efforts in the Amur Basin, to create models of compatible economic development and nature protection that can be duplicated in other areas of East Siberia.

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The Amur Conservation Project: A Global Partnership for People and Wildlife

by Ken Strom

Ken Strom is the coordinator for Audubon's Sharing the Earth Project and director of Audubon's Camp in the Rockies. For the past 10 years, Ken managed Audubon's Lillian Annette Rowe Wildlife Sanctuary on the Platte River in Nebraska. Ken is an active participant in Audubon's international efforts and is also coordinator of the Amur Conservation Project. Additionally, he is an author and co-editor of Sharing the Earth: Cross-Cultural Experiences in Population, Wildlife and the Environment, and serves on the IUCN-World Conservation Union's Commission on Environmental Strategy and Planning.

In recent decades, there has been growing attention paid to the migratory birds which connect North and South America by means of the flyways which they traverse between nesting grounds in the north and wintering areas in the south. Until very recently, there has been little or no such public attention given to the movement of birds between North America and Asia. Migrating birds, as well as large mammals and marine animals, navigate across the polar regions of these two great continents without regard to political boundaries.

Even more impressive are the long migrations of numerous bird species from the heart of each continent to nesting grounds across the Bering Sea in the Arctic wetlands of the other. In crisscrossing flyways, such birds as arctic warblers (*Phylloscopus borealis*) and bluethroats (*Luscinia svecica*) from Asia fly north and east each spring to nesting areas in Alaska, while snow geese (*Anser caerulescens*) and sandhill cranes (*Grus canadensis*) move from wintering grounds on North American marshes to breeding grounds in Siberia. In Siberia the sandhill cranes occasionally meet up with Siberian cranes (*Grus leucogeranus*) and common cranes (*Grus grus*). Individuals of the latter species have been known to take a wrong turn and end up in the United States for the winter, just as sandhill cranes sometimes join flocks of common cranes in China until spring.

National Audubon Society's Beringia Conservation Program has drawn attention to America's and Asia's shared wildlife resources, which congregate where the two continents nearly touch. Yet saving Beringia will not alone save the migrating species that breed there, since most of their lives are actually spent elsewhere. Just as surely as North American conservationists must involve themselves in environmental protection in Latin America, so must they support similar initiatives in the heart of Asia, if they wish to protect an important portion of the diversity of bird species that they call their own.

A shared resource implies a shared responsibility. A shared responsibility carries greater imperatives for all parties to protect the resource. These are some of the assumptions that have formed the basis for Audubon's Sharing the Earth Project, which has brought Audubon professionals to Asia. In 1987, an international conference of mostly Russians and Chinese, meeting south of the Amur River, passed a resolution calling for greater protection of the Platte River because of its international bird resources. In 1990 Russian conservationists submitted written testimony to the U.S. government requesting greater protection for the Platte River in the relicensing of the Kingsley Dam, in order to protect "Russia's sandhill cranes" and other migratory bird species. In the case of the Platte River, the involvement of the international community has raised the stakes and elevated the issue to one of global significance. This has been of enormous help to the conservation cause and has brought it considerable publicity.

Now some of the same people from Russia and China who supported our efforts here on the Platte are requesting our involvement and assistance in saving one of their great wildlife rivers: the Amur River, on the border between Russia and China. Not only is it appropriate for us to return the favor—both to cement a powerful alliance of global conservationists and in recognition of the Amur's international significance as a habitat for migratory birds—but it is also in our own interest to be involved in the conservation of a region of such great significance to the wildlife resources of the Pacific Rim, including some of "our own."

Father River and His Children

The Amur River (known as the Heilongjiang River to the Chinese) is called "Father River" by the Russians, just as the Volga is called "Mother River." It is 2,700 miles long, making it the eighth longest river in the world, with the ninth largest watershed. It has qualities reminiscent of both the Platte and the Columbia Rivers in this country. Throughout much of its length, it is a braided stream, like the Platte—broad and sandy-bottomed—but elsewhere it runs through high hills and woodlands, with a flow and navigability on par with the Columbia. (The city of Khabarovsk, 600 miles from the sea, can receive ocean-going vessels.)

About 60% of the Amur watershed is mountainous, with 14% of it still unexplored. The diverse plant communities—from broad-leafed forests and taiga to East Asian prairie—support the greatest diversity of animal and plant species to be found in Russia. But of these, 49 vertebrate species, 25 invertebrates and over 30 vascular plants are listed in the Red Data Book of Russia. This region is the last stand of the Siberian tiger (*Panthera tigris altaica*) and the far eastern leopard (*Panthera pardus orientalis*), as well as a reintroduction site for Przewalski's horse (*Equus przewalskii*).

The river itself is home to the Great Siberian sturgeon (*Acipenser baeri*), the largest freshwater fish in Russia, often weighing over a ton. It is also home to the calico salmon, which has the longest river migration in the world (over 900 miles).

Like the Platte, the mainstem Amur is in the heart of a vast wetland complex, with the broad marshes of China's Three Rivers Plain to the south and the wet prairies of Russia's Zeisko-Bureinskaya Plain to the north. This complex supports the greatest diversity of cranes (6 species) in the world, including 4 that are endangered—the red-crowned (*Grus japonensis*), Siberian, white-naped (*Grus vipio*), and hooded cranes (*Grus monacha*). The Amur Basin contains most of the breeding habitat of the red-crowned crane (c. 60 pairs) on mainland Asia.

The black stork (*Ciconia nigra*) and the endangered Oriental white stork (*Ciconia boyciana*) also nest here. The lower Amur is home to the white-tailed sea eagle (*Haliaeetus albicilla*) and Steller's sea-eagle (*Haliaeetus pelagicus*); while Barun-Toray Lake, in the upper basin, contains the world's largest colony (c. 300 nests) of the very rare relict gull (*Larus relictus*).

Although the Amur River is still free-flowing, human population growth in the basin is already having major impacts on the health of the ecosystem. At least 19 large cities are located in the basin and are the source of considerable industrial air and water pollution. Much of the land adjacent to the river channel has been converted to agriculture, which pollutes the river with fertilizer run-off. Clearcutting of forests on tributaries, with no reforestation programs, is causing heavy siltation. In addition, there are at least 53 types of mines in 177 areas in the basin. Gold mining alone causes significant siltation from the

Russian side and mercury run-off into the river from the Chinese side. Yet in spite of all these environmental changes, the greatest threats of all to the survival of the Amur ecosystem are coming from a series of proposed dams on the mainstem Amur and its tributaries. As of today the Amur is the largest undammed river on Earth, but that may soon change.

The Power of Partnerships

In the spring of 1990 Dr. Sergei Smirenski, an outstanding ornithologist from Moscow State University who has been studying Siberia's cranes and other migratory birds for over 25 years, led a delegation of 5 Russians whom Audubon hosted at its Rowe Sanctuary on the Platte. At that time, Sergei was struck by the similarities of the Platte to his beloved Amur River; and we proposed a joint Amur-Platte Project: (1) to draw attention to the human population impacts on both rivers, (2) to elevate them both into the international arena, and (3) to provide mutual technical assistance in the development of our respective sanctuaries and their education programs. Sergei was looking for a way to protect critical wildlife habitats on the Amur River, at a time when the Soviet Union was undergoing tremendous political and economic upheaval.

With the support of the Amur-Platte Project, Sergei became a catalyst for the establishment by Russia's largest environmental NGO, the Socio-Ecological Union (SEU), of the Amur River Program for the long term conservation of the Amur River Basin's natural resources to benefit both people and wildlife. For SEU, the Amur-Platte Project became an international piece of its overall program for the Amur. For Audubon, Amur-Platte developed as one piece of the overall Sharing the Earth Project, which now includes a quadrilateral exchange between Rowe Sanctuary's management staff and protected area managers in Russia, Pakistan and Nepal. All four areas share similar habitat types (braided rivers, wetlands, grasslands) and wildlife resources (cranes, waterfowl, wading birds), with a variety of human population impacts (especially related to agriculture) that create conservation and management challenges that are also often quite similar.

All the partners in Sharing the Earth have come to realize that we have a great deal to learn from each other. We also gain a great deal of inspiration and encouragement from one another, which can be of critical importance to environmental advocates who often find themselves working alone on intensely difficult and contentious issues. During a series of international conferences over the past two years, our partners in Asia have prevailed upon Audubon to take the lead in coordinating these partnerships as an ongoing network for the sharing of information and ideas on issues of mutual concern. These partnerships create a synergy that has produced many unforeseen benefits. The Amur-Platte Project itself grew out of a serendipitous meeting with Dr. Sergei Smirenski in 1989 in India, during the first exchange visit to southern Asia for the new Sharing the Earth Project.

This year, the Amur-Platte partnership is entering a dramatically expanded phase. Audubon and SEU have joined forces to create the Amur Conservation Project (ACP). Working together to secure funding from ISAR and USAID, we have provided the first funding ever for a fully staffed Amur Conservation office in Moscow, along with environmental educators to work with communities in the Amur River Basin. With a professional staff to support him, Dr. Sergei Smirenski is finally able to institutionalize the conservation program he has been pursuing on the Amur. With this solid base to build on, we will soon see the establishment of an SEU program office in Blagoveshchensk on the Amur.

The Amur Conservation Project is a true joint project of the Socio-Ecological Union and the National

Audubon Society. It is aimed at protecting the biodiversity and maintaining the ecological integrity of Russia's Amur River while promoting sustainable economic livelihoods for the resident human population. The ACP is the first organized phase of a long term program planned for the Amur, which will ultimately lead to the establishment of a corridor of protected natural areas and enhanced wildlife habitats. Wildlife will share the watershed with human communities that are making sustainable use of the region's natural resources, agricultural riches and ecotourism potential. During this first year of funding the ACP will undertake a program of information gathering, environmental education and community outreach. The program will serve as a catalyst for empowering people in river communities and local NGO's to become actively involved in the process of improving the river environment to maintain its biodiversity and to achieve a sustainable economic lifestyle. This is a vital first step towards preserving this and other valuable ecosystems.

In addition to community outreach activities and environmental education programs, the critical elements of ACP's long term conservation strategy for the Amur include (1) the establishment of protected areas for wildlife along the river, (2) the sharing of information on evaluating the impacts of development on the river environment, and (3) gathering information on the resources of the Amur Basin to understand both its natural values and the threats they face.

Sister Sanctuaries

Just a few years ago, Sergei Smirenski's investigations of Amur habitats uncovered a previously unknown concentration of nesting cranes and storks on an expanse of wet meadows and prairie in the Amur floodplain. The area, called Muraviovka, was unprotected from conversion to cultivated agricultural fields.

Muraviovka is a critical breeding area for endangered red-crowned and white-naped cranes and Oriental white storks (several breeding pairs of each), as well as a critical migrational area for endangered Siberian and hooded cranes. Also seen are flocks of common cranes, occasional demoiselle cranes (*Anthropoides virgo*) and little terns (*Sterna albifrons*). It is one of the most important stopover areas for waterfowl, shore-birds and songbirds on the central Amur. Muraviovka also has the highest documented densities in the Amur Basin of roe deer (*Capreolus capreolus*) and East Asian pheasant (an endemic subspecies of the common pheasant, *Phasianus colchicus*).

Sergei was convinced that this area had to receive the highest level of protection. With the prevailing conditions in Russia, it was unlikely that it could become a state nature reserve or national park. If anything, existing state protected areas have become more tenuous than ever. Sergei's visit to Rowe Sanctuary in 1990 helped inspire him to pursue the establishment of a private sanctuary. Because of the changes that have occurred in the past three years, it is now possible to purchase land (or at least lease it) with private money. With funding arranged by the Wild Bird Society of Japan, Sergei has now leased nearly 15,000 acres of wetlands to create the Muraviovka Nature Park. It is to be dedicated as a sister sanctuary to Audubon's Rowe Sanctuary on the Platte.

Assessing the Impacts

The greatest single new threat to the Amur is the proposed Khinganski Dam (Mid-Amur Dam Project) and the population issues that are driving it. This dam, to be built in the gap through the Little Khingan Mountains, is a hydroelectric project that is the first of as many as 12 such dams proposed for the Amur

and its tributaries. This obviously can only come to pass as a joint Russian-Chinese initiative, but the Chinese are by far the most enthusiastic proponents of the project.

The Chinese are running out of room for their ever-growing population and are particularly looking to expand their agricultural base. The relatively unpopulated marshlands of northeastern China form the last great wetland area left to reclaim. The Chinese government says it plans to move 100 million people onto the Three Rivers Plain and turn it into the future breadbasket of China. But to make this feasible, they need hydroelectric power.

It is generally agreed that the proposed dam will devastate the Amur fisheries, essentially eliminating the sturgeon and calico salmon. It will also threaten critical nesting habitat for a number of rare bird species, including red-crowned and white-naped cranes, the Oriental white stork, Blakiston's Fish-Owl (*Ketupa blakistoni*), the Chinese merganser (*Mergus Squamatus*), and the long-billed plover (*Charadrius placidus*). The Russians have seen the Volga destroyed by hydro development, and they are gravely concerned that a similar situation is developing on the Amur. For now, the Russian powers-that-be oppose the dam's construction. But the strong desire on their part to cooperate with China after many years of confrontation could tip the scales the other way. And Russia's economic desperation could make them easily tempted by an offer of a World Bank loan, which would be needed to carry out the project. ACP will continue to monitor the dam proposals and to inform the public about the likely impacts of such a project on their living environment.

Undiscovered Riches

Even as ancient forests are being clear-cut in the Russian Far East and pristine wetlands are being drained for agriculture, much of the wildlife wealth of the Amur Basin has yet to be inventoried. To a great extent, the Russian people truly do not know what they are losing. In some cases, someone knows but the word has not yet gotten out.

While making some quick assessments of the ecological importance of different stretches of the Amur in 1992, we met in Khabarovsk with biologists of the All-Russia Research Institute of Hunting & Fur Farming. This is a non-governmental wildlife institute which formerly got most of its money from government contracts to study game populations, make habitat management recommendations and promote improved harvesting techniques. Today, with government funding almost non-existent, they are trying to survive in the brave new world of private contracts and commercial enterprises, by seeking private funds for their research, while selling wildlife products (skins, skulls, etc.) and art, as well as guide services for ecotours and hunting trips.

The biologists were eager to share some information with us and to make a plea to us for help in preserving some critical habitats for cranes and waterfowl which they were studying. Their research indicates that two large lakes near Khabarovsk and the Amur are far more important for East Asia's water birds than has been previously recognized. Lake Evoron has a surface area of 190 sq km, with wetlands of twice that size. Its nesting populations include 35 pairs of hooded cranes, 40 pairs of Oriental white storks, 10-12 pairs of white-tailed sea eagles, a few black storks, and some swans; a nearby reach of the Evor River is a migrational stopover for some 200,000 waterfowl. About 100 miles away, Bolon Lake has a surface area of 330 sq km, with four times as much wetland area. According to the Institute's biologists, this is the largest migrational stopover on the flyway for waterfowl, with a total of 800,000 birds, including 30-40,000 geese and 5-7,000 swans. It is also the main nesting habitat for Oriental white storks (75-85 pairs),

with 12-14 breeding pairs of red-crowned cranes, many nesting mandarin ducks (*Aix galericulata*), and one of the biggest colonies of nesting gray herons (*Ardea cinerea*) and great cormorants (*Phalacrocorax carbo*). On migration they have also counted great egrets (*Casmerodius albus*), Eurasian spoonbills (*Platalea leucorodia*), ibis (F. *Threskiornithidae*), eastern curlews (*Numenius madagascariensis*), 3-5 accidental Australian black swans (*Cygnus atratus*), and Aleutian terns (*Sterna aleutica*) which nest on the nearby Sea of Okhotsk. Both lakes are severely threatened by human disturbance from the nearby city of Komsomolsk, by wetland drainage, and by a proposed nuclear power plant to meet the energy needs of this growing region.

The threats facing the Amur River Basin and its wildlife from human population growth and development are enormous. Yet there is much that we still do not know. A long range goal of the Amur Conservation Project is to conduct surveys of the wildlife and habitats throughout the watershed. One of Sergei Smirenski's goals in the next few years is to lead a research and survey expedition by boat down the entire length of the Amur River. With adequate funding, there is no doubt that he will achieve this objective as well. And with it will come greater visibility for the Amur Conservation effort, a greater understanding of what is at stake if we mismanage this magnificent ecosystem, and greater hope for the cranes and other migratory birds which fly north and south from the Amur valley to human communities in numerous countries on several continents.

Symposium Banquet Keynote Address by Peter Matthiessen

Peter Matthiessen, author and naturalist, graduated from Yale University in 1950. He has written numerous works of nonfiction, including The Wind Birds and The Snow Leopard, which won the National Book Award. His novels include At Play in the Fields of the Lord, and Killing Mr. Watson. In recent years he has studied and written numerous articles about cranes of the world.

Thank you for that very kind introduction and I really will try to keep this brief because I know that we are all tired, and I'm tired too. This is kind of, in a way, going home week. Not only because of the Amur River trip, a trip of a ship of fools, but because I also have connections that go back a long way with the Audubon Society. My father was a director of the Society for many years and I used to write a great deal for *Audubon Magazine*. Now I'm happy to say that I've come back to Audubon with a piece this month on the black-necked crane in Bhutan.

Readings from upcoming book on the world's cranes...

On a rare clear day—the first day of summer—flying the Bering Straight from the Yukon Delta to the Diomed Islands and the Chukotia Peninsula, it excites me to imagine this gray sun-silvered sea from the view on high of the great cranes, more particularly the golden eye of the Crane from the East, as the Canadian or sandhill crane of North America is known in its western breeding territory in Siberia. Even the airplane's altitude at 30,000 feet might prove no obstacle to the sandhill, which commonly migrates a mile above the earth; its smaller relative the demoiselle crane has been seen passing the snow peaks of the Himalayas at 26,000 feet.

The Arctic air numbs the bright red skin on the sandhill's crown, the long stiff wings creak in the wind. As a family the first cranes appeared some 50 million years ago, and the sandhill crane, whose bones have turned up among Wyoming fossils 10 million years old, is the most ancient bird species on earth. The world's great cranes stir the imagination not only because they are the oldest and the largest of the earth's flying creatures not because the horn notes of their voices summon man's attention to his own swift passage, but because they symbolize like no other living things the disappearing expanses of clean water, earth, and air upon which their species—and ours too, though we learn it very late—must ultimately depend for their survival.

The brown coast of Alaska falls away in the bright mists, there is only the rotted pack ice and gray shallow seas of the vanished land bridge between continents. Like wild geese, cranes often fly in V formation, having had long ages and many millions of miles of buffeting by the great winds to learn the aerodynamic limitations of—let's say—the letter H. Soon the Diomed Islands—one in the New World and one in the Old—drift off in the northern mists and are replaced by Siberian barrens of the Chukovski Peninsula, home of the Chukot or Chukchi aborigines, who share an ancient ancestry with the Inuit. Even in late June, the mountain tundra of Chukotia looks wintry, with hard wind—worn snow in the ravines. Following old migration instincts, the sandhill will descend each spring to this peninsula, and some may continue west along the Arctic coast some 1500 miles to the Yana River.

In the clear weather, one can see Kamchatka, that primordial peninsula of volcanoes and great bears, of lakes and meadows, swift cold streams and hard bright coast, like a last stronghold of the Ice Age. From Kamchatka, great Sakhalin Island and the Kuriles bend away in a long arc, all the way to Hokkaido, the northernmost island of Japan. The plane heads south over the Okhotsk Sea, crossing the Siberian coastline once again where the delta of the great Amur River, spreading away forever between sea and mountains, glitters in the sun of eastern Asia.

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Crane Ecology and Bird Conservation in Lumbini (1992-93)

by Rajendra N. Suwal

Mr. Rajendra N. Suwal, biologist at Gaida Wildlife Camp and master's student in zoology, Tribhuvan University, Nepal, has travelled extensively in-country in search of cranes and other birds. He has received formal training on captive breeding of cranes and public education at the International Crane Foundation (Wisconsin, USA).

Abstract: Home range, habitat utilization, nesting location and habitat preference of three pairs of Sarus cranes (*Grus antigone antigone*) were studied in Lumbini Development Project. The bird diversity in the project area was also studied.

The annual home range of these cranes was found to be 963 ha, 488 ha and 1725 ha. Mean annual habitat utilization by these birds was 42.77% in the different types of wetlands, 24.37% in fallow lands and 8.4% in wheat fields. The population density was 0.6 birds per square kilometer. Paddy fields (37.5%), ponds (33.3%) and flooded grasslands (25%) were the favorite nesting habitats.

Altogether, 238 species of birds belonging to 17 orders and 55 families were recorded. Of the bird species observed, 47.5% were arboreal, 20% shore and wading birds, 13% birds of prey, 5% terrestrial and 2.1% aerial. Non-migratory birds constituted 47.1% of the survey species, migratory 30.3%, partial migrants 21.9% and birds of uncertain status 0.8%.

Overview of Study Site

Location

The study was conducted in Lumbini Development Project (LDP) in the Rupandehi District of Nepal, an area famous for being the birthplace of Prince Sidhartha (Buddha). The LDP lies in Nepal's southern lowlands in an area known as the Tarai, approximately 200 km southwest of Kathmandu. Lumbini is situated at a latitude of 27°28'N and a longitude of 83°29'E, approximately 100 meters above mean sea level. Climatological information for this area is listed in Figure 1.

Area & Land Tenure

The Lumbini Development Project covers an area of three square miles (one mi. E-W, three mi. N-S). The land is owned and managed by the Lumbini Development Trust, a non-governmental organization. The Project area is surrounded by five Village Development Committees, which are local administrative bodies. The land adjacent to the Lumbini Development Project is privately owned and consists of farmland and villages.

Before its purchase by the Trust, Lumbini was inhabited by people and was farmed. An ambitious conservation project launched in the 1970s changed this by restoring Lumbini's tropical habitat and by building monasteries in homage to Lord Buddha. Under this conservation project, each square mile was placed in one of three categories: Sacred Gardens, the Monastic Zone or the New Lumbini Village. Currently, the Monastic Zone and some parts of the new village are still under construction.

With the end of farming, tall grasses such as *Imperata spp.* and *Saccharum spp.* rapidly recolonized

Lumbini Development Project land. People, responding to the Green Revolution's call for increased forestry output, further changed the landscape by planting nearly 300,000 sisoo (*Cedrela sinensis*) and other tree saplings in the LDP. The Project's habitat now comprises 400 ha grassland (58.8%), 270 ha secondary forest (39.7%) and 100 ha open water (1.5%). The cultivated land surrounding Lumbini supports rice crops during the monsoon season, mustard and wheat in the winter, and corn in the pre-monsoon season. Most of the land under cultivation is left fallow in the dry season.

Biogeography

Two major rivers, the Tinau and Danob, flow east of the LDP. Four smaller rivers are also associated with the Lumbini Development Project: the Telar and Harhawa, which flow east from the LDP, and the Kothi and Bethi Rivers, which flow west from the LDP. All of these rivers flow north to south and are minor tributaries of River Ganges. Additionally, there are many ponds and lakes scattered around the villages.

Aquatic vegetation in the wetlands of Lumbini includes: *Vallisneria spp.*, *Hydrilla spp.*, *Potamogeton spp.* (sub-merged), *Nymphaea spp.*, *Eichhornia spp.* (floating), *Scirpus spp.*, *Eleocharis spp.*, *Zizania spp.*, *Typha spp.*, *Polygonum spp.*, *Carex spp.*, *Leersia spp.*, *Ipomea spp.* (emergent), *Imperata spp.*, used for thatching, and *Sachharum spp.* (grassland).

The major tree species planted in Lumbini Development Project are sisoo and sal (*Salix babylonica*). Following in prevalence are kadam (*Anthocephalus chinensis*), eucalyptus, bottle brush, mango and laurel (*Terminalia spp.*). The peripheral boundary (approx. 200 m in width) of the LDP is densely covered by sisoo. Native trees such as cotton tree (*Bombax cieba*), figs (*Ficus religiosa*) and bamboo are not common in the LDP. The nearest natural sal forest lies 8 km north of the LDP; this forest is degraded as a result of over use.

Lumbini Past and Present

Buddhist text mentions that, while giving birth to Sidhartha, Queen Maya Devi held on to a branch of a sal tree, indicating that sal forest once covered this holy land. Lotus flowers mentioned also denote the former presence of wetlands in Lumbini. Former characteristics are reappearing in Lumbini due to current habitat protection efforts. Biologically diverse, it is increasingly evocative of the natural gardens of the Shakyas Dynasty, much like the one in which Prince Sidhartha was born.

Animals responded quickly to Lumbini's tall grass and forest restoration. Many different species of fish, frogs and snakes now inhabit the area. The LDP is now an important nesting site for herons, egrets, sarus cranes and other bird species. More than 500 harriers (chiefly pied followed by hen and marsh harriers) have been recorded roosting in the grasslands of the LDP during migration. A flock of more than 500 open-billed storks (*Balarniceps rex*) have been sighted flying around Lumbini; several hundred of these birds roost regularly at Lumbini.

Among the mammals, the five striped squirrel (*Fienambulus pennanti*), rufous tailed hare (*Lepus oiostolus*), flying fox (*Pteropus personatus*) and the largest of Nepal's antelope species, the blue bull (*Boselaphus tragocamelus*), have colonized this area. Currently, 15-40 of these animals live within the compound. There has also been an unconfirmed report of a spotted deer (*Axis axis*) residing in the LDP. Among the omnivores, yellow-throated martens (*Pseudochelidon sirintarae*) frequent the forests of the

Lumbini Development Project. Carnivores include the rare striped hyena (*Hyaena hyaena*), as well as the more commonly found Asian jackal (*Canis simensis*), Indian fox (*Vulpes bengalensis*), jungle cat (*Felis chaus*) and probably smooth-coated otter (*Lutra perspicillata*). The response of the biodiversity to protection has been overwhelming.

Lumbini Wildlife Protection Efforts

Building on the success of the restoration project and with the help of Jim Harris, Deputy Director of the International Crane Foundation/USA, a seven point plan was submitted to the Lumbini Development Trust. The plan, designed to promote wildlife conservation, is as follows:

1. Recognize Lumbini's beauty and biodiversity as symbolic of world peace and harmony.
2. Promote natural diversity at Lumbini.
3. Protect birds and mammals from hunting and other disturbances.
4. Create wetlands of different sizes.
5. Plant trees for wildlife and in relation to Buddha's life.
6. Teach Buddha's love for nature.
7. Establish a natural garden at the north end of Lumbini.

Studies of large waders and wetlands of the Tarai (Suwal and Shrestha 1992) helped identify the Rupandehi district as the last stronghold for sarus cranes. This study was sponsored by the King Mahendra Trust for Nature Conservation (KMTNC) and the U.S. Fish and Wildlife Service. Upon learning about the plight of the sarus cranes, KMTNC/Netherlands chapter provided assistance for hiring guards to protect the sarus cranes in the LDP.

In 1993 Rich Beilfuss, a wetland ecologist at the International Crane Foundation, carried out a brief study on the hydrology and wetland ecology around Lumbini. Beilfuss assessed three types of wetlands at Lumbini: seasonal rainwater depressions, floodplain depressions and groundwater fed wetlands (both permanent and seasonal). His findings indicated that wetlands could be easily restored at Lumbini. According to Beilfuss, native wetland plants would naturally fill gradually sloping depressions, excavated 2.5 m to 3.5 m below ground surface. Wetland creation would improve Lumbini's habitat, as the native vegetation in Lumbini and the surrounding area, i.e. the seedbank for the man-made wetlands, has a high wildlife value. Some of the particularly important wetland species in the area are *Eleocharis spp.*, *Polygonum spp.*, *Typha spp.*, *Leersia spp.*, *Potamogeton spp.*, *Vallisneria spp.*, *Zizania spp.*, and *Scirpus spp.*

To hasten the restoration process at Lumbini, the author and the International Crane Foundation have asked to lease the north end of the LDP from the Trust. Proposal objectives of the restoration project include:

1. Wetland creation to ensure safe breeding habitat for sarus cranes.
2. Restoration of nature in Lumbini in relation to Buddha's life.
3. Development of Lumbini as a small bird refuge with facilities for the captive breeding of sarus cranes (using orphan birds).
4. Planting fodder trees along roadsides and stocking fish in public ponds to demonstrate the wise-use of wetlands.

Study of Crane Ecology and Bird Conservation at Lumbini

Sarus cranes belong to the family *Gruidae*, a family of birds characterized by their long legs and necks. Members of the genus *Grus*, they also exhibit partially feathered heads and necks. Sarus crane's head and upper neck is red and without feathers. Below a white collar, the adult cranes are grey, while the immature are brownish grey. Young chicks are entirely covered with brown feathers. Sarus cranes are the tallest flying bird in the world. The adults stand nearly 5.5 feet tall and weigh about 8 kg.

Sarus cranes, while commonly found in parts of India, are probably extinct in Bangladesh and Pakistan. In Nepal, they are fairly common in the Rupandehi and Kapilvastu districts, sparse in the western part of the country, and probably extinct from the eastern half of the Tarai. A sedentary species, sarus cranes move locally in response to conditions of drought and flood throughout the Gangetic Plain (Ali & Ripley 1989). Sarus cranes favor open, cultivated fields, shallow wetlands and riverbanks. Their diet consists of the roots and young shoots of aquatic plants, reptiles, insects, molluscs, crustaceans, grains and standing rice crops (Soothill et. al. 1989).

Generally, cranes are seen in pairs or with their chicks. In the winter of 1991, sarus cranes were observed in flocks of six or seven. During the months of April to June, 1993, flocks up to 66 cranes (including 3 juveniles) were recorded on the banks of Danob River and the adjacent fallow lands. The territorial pairs from the area roosted there, leaving to forage at dawn. This is important social behavior in the pre-nesting season (H.S. Baral per. comm.).

Local Beliefs about Sarus Cranes

The indigenous inhabitants of Tarai regard the sarus crane as a symbol of love and happiness. People of the Tarai believe that cranes nesting in a farmer's paddy field indicate a good harvest. They also consider the sarus crane as the King of the Locale because of the cranes' habit of acting like a watchdog at night. They believe that killing sarus cranes spells family misfortune. There is also a belief that cranes die of grief or commit suicide when their partners are killed. For all of these beliefs, sarus cranes enjoy protection from the villagers. However, children and new settlers do not always respect these traditional values, and occasionally they steal eggs, capture chicks and kill cranes.

Sarus Crane Research at Lumbini—Methods and Findings

The object of this study was to determine the home range, habitat utilization, nest site selection and population of the sarus cranes. Additionally, site bird diversity and habitat requirements according to homogeneous eco-groups or beak type were also studied.

Methodology

A. Home Range & Habitat Utilization

Three pairs of cranes were selected and identified according to roost site and the whiteness of their lower neck, which differs considerably from individual to individual. Each pair of cranes was monitored by bicycle from sunrise to sunset. Cranes were chosen randomly. Each pair was tracked 2-4 times per month. Generally, observations were made on clear days.

The location of the cranes was noted on an hourly basis. Locations were plotted on a 1 cm grid aerial photo (scale 1:14250), and home ranges were calculated with the AUTOCAD, USA computer program. Each location was plotted with the help of landmarks visible in the aerial photo or by the triangulation method. The outer location was taken for plotting the home range; it was computed linearly. The distance travelled per day was also determined.

Three seasons were defined according to their activity: pre-nesting (March till June), nesting (July till October) and post-nesting (November till February) .

B. Nest Site Selection

Nest sites were studied in 1992 and 1993. Once the nest was located, the following observations were made: location, distance to nearest upland, shrub, tree, and house/settlement, water depth around nest, nest size (length x breadth x height), clutch size and egg casualty.

C. Bird diversity

Checklists prepared by various bird watchers were referred to and classified into assemblages of birds occurring in different habitat types. Bird samples included sightings within 30 km radius of Lumbini.

Results

A. Home Range

Two pairs of sarus cranes (identified as "Kedar" and "Chatra") were selected for the study based on their nesting; one pair was selected based on its roost site (the "Nagina" pair). The Nagina pair had a sub-adult with them, but after a few weeks they chased it away (Figure 2).

B. Daily Movement of Sarus Cranes

The daily area covered by the cranes varied from 22.58 ha to 214 ha, with a mean coverage of 71.55 ha a day. The average distance traversed by the three pairs while foraging was 3.11 km (St. Dev. 2.28). The pairs travelled fairly long distances for communal roosting in the Danob river.

C. Seasonal and Annual Home Range

The average annual home range for the sarus cranes was slightly over 1000 ha. Seasonal home ranges were determined by crane activities and climate. During the nesting period they covered less area (mean 40 ha.) compared to the pre-nesting period when they on average covered 763.4 ha. During incubation and the monsoon season, when food was readily available, cranes covered the least amount of ground. In the pre-nesting period, they were observed going to Danob River for communal roosting (Figure 3). Seasonal home ranges were affected by the climate which, in turn, determined food availability. The drier the climate, the scarcer the food supply, and the greater the home range. Overlapping of home ranges was observed in the Chatra and Kedar pairs; the overlapped area was approximately 500 ha. The home range of the Nagina and Chatra pairs only slightly overlapped.

Two pairs (Nagina and Chatra) roosted, nested and fed inside the LDP. For four consecutive years, the Chatra pair nested in the same location in Lumbini. In contrast, the Kedar pair, nesting outside the LDP, constantly changed nest sites. This suggests that if a habitat is protected the cranes will reside and nest in the same place year after year.

D. Habitat Utilization

The Kedar pair spent all of its time in the paddy field during October 1992, where it nested and foraged. During the post-nesting period, the pair spent most of its time (40%) in the paddy field, but started to use fallow land, ponds and wheat fields, as well. This pair also foraged along the river and streams and in mustard fields. In the pre-nesting season the Kedar cranes foraged in wheat fields followed by wetlands and fallow fields. In the nesting season of 1993, they foraged in the paddy fields and on fallow land. Paddy fields, wetlands, wheat fields and fallow land were the most favored habitat for their foraging activities.

Seasonal Habitat Utilization by crane code: Kedar

Habitat	Oct 1992 Sum (n = 26)	%	STDS	Nov/Feb 1992/93 (n = 125)	%	STDS
Paddy	26	100	0	50	40.00	0.49
Wheat				13	10.4	0.31
Mustard				5	4.00	0.2
Lentil				0	0.00	0.00
Pond				0	0.00	0.00
Wetland				17	13.60	0.34
Grassland				0	0.00	0.00
Mud pool				0	0.00	0.00
Fallow				27	21.60	0.41
Stream				8	6.40	0.24
River				5	4.00	0.20
Canal				0	0.00	0.00
Total	26	100		125	100	

Seasonal Habitat Utilization by crane code: Kedar

Habitat	Mar/June 1993 Sum (n = 126)	%	STDS	Jul/Aug 1993 Sum (n = 84)	%	STDS
Paddy	9	7.14	0.26	62	73.81	0.44
Wheat	56	44.44	0.50	0	0.00	0.00
Mustard	5	3.97	0.20	0	0.00	0.00
Lentil	0	0.00	0.00	2	2.38	0.15
Pond	0	0.00	0.00	1	1.90	0.11
Wetland	18	14.29	0.35	0	0.00	0.00
Grassland	0	0.00	0.00	11	13.10	0.34
Mud pool	0	0.00	0.00	0	0.00	0.00
Fallow	14	11.11	0.31	0	0.00	0.00
Stream	15	11.90	0.32	3	3.57	0.19
River	7	5.56	0.23	5	5.95	0.24
Canal	2	1.59	0.12	0	0.00	0.00
Total	126	100		84	100	

During the post-nesting season (1992), the Kedar pair was observed most often in paddy fields and frequently in wetlands and fallow land. In the post-nesting season, fallow land was the most available habitat, followed by wetlands. Grasslands, and then wetlands, were the primary foraging areas during the pre-nesting season. In the nesting season of 1993, the Kedar pair spent most of their time in wetlands.

The Nagina cranes showed an annual habitat preference for wetlands of different types and fallow fields (38.74%). The excavated pond of LDP was their favorite roosting place. This pair built its nest on the flooded forest near the Hokke Hotel surrounded by young sisoo trees inside the LDP.

Seasonal Habitat Utilization by crane code: Nagina

Habitat	Oct 1992 Sum (n = 25)	%	STDS	Nov-Feb 1992/93 Sum (n = 126)	%	STDS
Paddy	13	52.00	0.51	3	2.38	0.15
Wheat	0	0.00	0.00	4	3.17	0.18
Mustard	0	0.00	0.0	6	4.76	0.21
Lentil	0	0.00	0.00	0	0.00	0.00
Pond	6	24.00	0.44	20	15.87	0.37
Wetland	0	0.00	0.00	5	3.97	0.20
Grassland	0	0.00	0.00	4	3.17	0.18
Mud pool	0	0.00	0.00	0	0.00	0.00
Fallow	3	12.00	0.33	50	39.68	0.49
Stream	3	12.00	0.33	25	19.84	0.4
River	0	0.00	0.00	0	0.00	0.00
Canal	0	0.00	0.00	9	7.14	0.26
Total	25	100		126	100	

Seasonal Habitat Utilization by crane code: Nagina

Habitat	Mar/Jun 1993 Sum (n = 171)	%	STDS	Jul/Aug 1993 Sum (n = 60)	%	STDS
Paddy	0	0.00	0.00	9	15.00	.36
Wheat	0	0.00	0.00	0	0.00	0
Mustard	0	0.00	0.00	0	0.00	0
Lentil	0	0.00	0.00	0	0.00	0
Pond	30	17.54	0.38	8	13.33	0.34
Wetland	1	0.58	0.08	27	45.00	0.50
Grassland	9	5.26	0.22	4	6.67	0.25
Mud pool	0.00	0.00	0.00	0	0.00	0.00
Fallow	92	53.80	0.50	3	5	0.22
Stream	27	15.79	0.37	1	1.67	0.13
River	0	0	0	0	0.0	0.00
Canal	12	7.02	.26	8	13.33	0.34
Total	171	100		60	100	

The Chatra pair divided its time between paddy fields and wetlands during the nesting season. In the post-nesting period, they most often foraged in wetlands, fallow fields and ripened as well as harvested paddy fields. During the pre-nesting season, they predominantly foraged in fallow fields and wetlands.

In the nesting season of 1993, the Chatra pair was most often observed in the wetlands of Lumbini. During the nesting period, they confined their activity near their nest. Occasionally, they flew away to paddy fields for foraging. On an annual basis, wetlands followed by fallow and paddy fields constituted the most important habitat for these cranes.

Seasonal Habitat Utilization by crane code: Chatra.

Habitat	Sep/Oct 1992 Sum (n = 78)	%	STDS	Nov/Feb 1992/93 Sum (n = 155)	%	STDS
Paddy	51	65.38	0.48	24	15.48	0.36
Wheat	0	0.00	0.00	12	7.74	0.27
Mustard	0	0.00	0.00	3	1.94	0.14
Lentil	0	0.00	0.00	0	0.00	0.00
Pond	0	0.00	0.0	21	13.55	0.34
Wetland	26	33.33	0.47	33	21.29	0.41
Grassland	0	0.00	0.00	0	0.00	0.00
Mud pool	0	0.00	0.00	0	0.00	0.00
Fallow	0	0.00	0.00	36	23.23	0.42
Stream	1	2.80	0.11	25	16.13	0.37
River	0	0.00	0.00	0	0.00	0.00
Canal	0	0.00	0.00	1	0.65	0.08
Total	78	100		155	100	

Seasonal Habitat Utilization by crane code: Chatra.

Habitat	Mar/Jun 1993 Sum (n = 112)	%	STDS	Jul/Sep 1993 Sum (n = 84)	%	STDS
Paddy	0	0.00	0.00	20	23.81	0.43
Wheat	11	9.82	0.3	0	0.00	0.00
Mustard	0	0.00	0.00	0	0.00	0.00
Lentil	0	0.00	0.00	0	0.00	0.00
Pond	13	11.61	0.32	0	0.00	0.00
Wetland	10	8.93	0.29	49	58.33	0.00
Grassland	9	8.04	0.27	0	0.00	0.00
Mud pool	2	1.79	0.13	0	0.00	8.43
Fallow	55	49.11	0.5	8	9.52	0.30
Stream	8	7.14	0.26	7	8.33	0.28
River	3	2.68	0.16	0	0.00	0.00
Canal	1	0.89	0.09	0	0.00	0.00
Total	112	100		84	100	

E. Crane Count

The existing roads were used as transects and crane counts were carried out along the roads. The sample is approximately 110 square km, but the area covered during the survey by four people is 50 km x 1.5 km (.75 km on either side of the road for crane search) was 75 sq. km. The cranes were counted twice (on 22 and 25 September 1993) at mid-day. To cover the maximum area possible, four different routes were taken by four people.

The mean number of cranes sighted was 45, with a density of 0.6 cranes per km². The mean number of active nests recorded was 10.5, and the mean clutch size was 1.4 eggs per nest. Only one downy chick was observed.

F. Nest Site Location & Dimension

Sarus cranes begin to nest at the onset of the September monsoon. Prior to the monsoon, the high temperature and low humidity cause damage to the eggs. The monsoons provides relief with the rainy weather. Another possible reason is the availability of abundant aquatic animals and succulent shoots to feed their growing chicks. As evident from the study of Chatra and Kedar pairs, sarus cranes nest in the same site if it is protected.

G. Nest Study

Sarus crane nest site location and size were studied in 1992-93. Twenty-four nests, including one renesting, were sampled for analysis. Incubating sarus cranes were observed from August until the end of October. In 1992 they were most often found nesting in paddy fields (60%), whereas in 1993 they were recorded nesting chiefly in the pond (42.9%). This change may have to do with the difference in precipitation during the monsoon. The 1992-93 combined result showed that they prefer to nest first in paddy fields, then in ponds and flooded grasslands, and rarely in flooded forests (Figure 4).

H. Nesting Habitat

The mean water depth around the nest was 24.75 cm (St. Dev. 34.97). However, the water depth at specific points varied greatly due to the differences between habitats associated with nesting, e.g. paddy fields and ponds (see Nest Study table). The distance to the nearest upland area applies only to the nest built in the pond; the mean distance was 22.50 m (St. dev. 34.17) (Figure 5).

Cranes preferred to nest near shrubs, as they provided camouflage for their nest. The mean distance between nests and shrubs was 4.79 m (St. dev. 7.41). Generally, trees were not available near nest sites with a mean distance of 153.13 m (St. dev. 232.29). The mean distance to the settlement or houses was 345.83 m (St. dev. 349.2).

The dome-shaped nests were made of leaves and roots of grasses uprooted from the surrounding vegetation. Generally, the nests were oval in shape and had a mean length of 103.71 cm (St. dev. 66.94) and a mean breadth of 86.38 cm (St. dev. 48.49). The mean height of the nests was 26.5 cm (St. dev. 22.36). Atop each nest was a depression to accommodate the egg.

I. Clutch Size

The mean clutch size was 1.08 eggs per nest. Because one of the 14 nests observed in 1993 was a re-nesting attempt, only 13 nests were sampled to determine clutch size. The mean egg loss was as high as 52%. The eggs were mainly lost to human causes (Figure 6).

J. Bird Diversity

A total of 238 bird species were recorded within a 30 km radius of Lumbini. They were assigned to homogenous ecological groups (Kotpal 1988/89), which relate to their specific habitat requirements. More than two thirds of the bird species were categorized as mixed habitat dependent (forest, grassland and farm land); about one third were wetland dependent.

These 238 species of birds belong to 17 orders and 55 families. Although altitudinal variation is minimal and no pristine habitat remains, bird diversity is relatively high. More than 40% of the species belongs to the Order Passeriformes. Other important orders are Falconiformes, Charadriiformes, Ciconiformes and Anseriformes. There are, on the average, a little over four species per family of birds in Lumbini. The Accipitridae and Sylviidae families have the greatest number of species represented in the LDP (Figure 7).

Nearly half of Lumbini's birds are non-migratory; a slight majority of the species are migratory or partially migratory. Most of the migrants are winter visitors (e.g. ducks and harriers), and a few are breeding summer migrants (e.g. Asian paradise flycatcher, cinnamon bittern, and cuckoos). All of these birds play significant role in controlling the insect population, seed dispersal and pollination (Figure 8).

Discussion/Conclusion

The annual home range of the three pairs of cranes differed considerably. The seasonal home range also varied greatly due to a dry climate (affecting food availability), social interaction (communal roosting) and nesting activity.

The Nagina and Chatra pairs roosted and nested in the LDP where they retained their roosting and nesting territories from year to year. In contrast, the Kedar pair was recorded nesting in the paddy fields near Parsa village and changed its site year after year. In 1992 this pair was recorded nesting in late October; they may be late-nesters. Because our study ended in September 1993, we may have missed their nesting.

Seasonal crop rotation determined the time budget for habitat utilization. During both the monsoon and dry seasons, wetlands such as paddy fields, streams and mud pools (42.77%) represented important habitat for sarus cranes. During the monsoon season, cultivated land, planted primarily with rice, and swollen rivers and streams provided food and nest sites for the sarus cranes.

After the rice harvest, most of the paddy fields were left fallow. During this period, sarus crane use of fallow land (24.37%) was high. The cranes also showed a preference for foraging in wheat fields (8.44%), over the grasslands and mustard fields.

The crane density in the study area was 0.6 bird per km². The chick survival was very low. In a pre-nesting, communal flock of 66 cranes, only three were juveniles, i.e., only 4.5% of the population were young cranes. This indicates nesting failure and/or loss of unfledged chicks.

Paddy fields and ponds provided favorable nesting habitat for sarus cranes. The sarus cranes also nested in the flooded grasslands of the LDP.

Generally, sarus cranes prefer to build their nests away from human settlement and tall trees. Water around the nest and sometimes small shrubs to camouflage the nest were important factors in nest site selection. The mean clutch size was 1.08 eggs per nest, and the egg loss was considerably high (52%).

Six pairs of sarus cranes, four of which nest, reside in Lumbini. The flooded grassland is the key habitat to their nesting. Lumbini comprises of forests, grasslands, rivers and ponds. This particular ecosystem has sheltered many species of higher vertebrates. The LDP forest land supports breeding colonies of herons, egrets and other forest and grassland birds. The *Typha* grass and other tall grass provide nesting habitat for buntings. Grass seed provides food for most of the passeriformes.

The communal roosts of harriers, storks, egrets, herons, myna, parakeets and other passerines found inside LDP are incredible. Ongoing habitat improvement is expected to increase the number of bird species in the future.

Recommendations

1. A variety of trees and shrubs representative of Buddha's life should be planted to diversify food sources for wildlife. Native trees should also be planted along the roads as fodder for village livestock.
2. Old wetlands at Lumbini Development Project should be restored and new ones created. A surface area of 365,000 cubic meters should be excavated approximately 2.5 to 3.5 m deep.
3. Game fencing (5 m x 4,700 m) should be erected to reduce possible crop damage of farmers by herbivores from the LDP. The fencing will also reduce potential conflicts between conservationists and farmers.
4. A captive crane breeding facility with an adjoining office complex and educational center should be developed for sarus cranes. Management of the breeding facility should include the construction of 4-8 large ponds, as well as maintenance of the existing ponds and river beds.
5. Public ponds should be stocked with native fish for local people to demonstrate the wise and multiple use of wetlands. Community involvement should be sought for this effort.

Tentative Work Plan

Phase I

- Prepare report (Crane Ecology & Bird Conservation).
- Lease land from Lumbini Development Trust.
- Assess floral and fauna diversity and water and soil quality.
- Create plan of action for habitat management.

Phase II

Excavate soil for wetland creation.
Study floral and faunal response to habitat modifications.
Plan to captive breed cranes recovered from villagers.
Use radio telemetry to study reintroduced cranes.

Phase III

Monitor modified habitat and the response of sarus cranes and other wildlife towards it.
Erect game fencing and introduce rare lowland mammals (e.g. the black buck).

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Figure 1: Climatological Record

STATION : BHAIRAHAWA				LAT. 27°03'			
INDEX : 0705				LONG. 83°26'			
				ELEVATION : 109 m			
TEMPERATURE (° C)			RELATIVE HUMIDITY (%)		RAINFALL (mm)	Max. in 24 hrs (mm).	Date
1992	MAX.	MIN.	0845 hrs	1745 hrs			
JAN	21.9	8.9	96.5	68.3	6.1	3.6	31
FEB	22.9	9.4	92.7	55.6	13.0	8.6	6
MAR	32.5	14.1	64.9	30.6	0.0	0.0	
APR	38.2	19.2	42.4	20.7	3.5	3.5	30
MAY	36.0	22.5	59.8	38.8	68.8	37.7	4
JUNE	36.5	25.0	67.2	46.6	135.4	50.3	10
JULY	33.2	25.1	79.4	69.6	349.7	113.3	15
AUG	33.1	24.5	82.4	75.2	269.7	87.7	7
SEPT	33.0	24.3	86.0	75.8	162.8	43.4	29
OCT	31.3	20.4	88.5	70.4	160.2	50.0	13
NOV	29.2	14.5	89.5	59.6	5.2	4.2	23
DEC	23.8	10.2	97.5	75.9	0.0	0.0	
MEAN	31.0	18.2	78.9	57.3	97.9		
					ANNUAL 1174.4	113.3	15 JULY
					MONSOON (78.13 %)		
Source : Department of Hydrology & Meteorology, Nepal.							

Figure 2: Daily Movement of Sarus

<u>Crane Code</u>	<u>Daily mean area coverage (ha.)</u>	<u>STDS</u>	<u>Daily mean distance coverage (km.)</u>	<u>STDS</u>
Kedar	121.78	140.24	2.89	2.78
Nagina	22.58	34.6	2.65	2.14
Chatra	70.28	248.86	3.78	1.92
Total	214.64		9.32	
Mean	71.55		3.11	

Figure 3: Seasonal and Annual Home Range (by plotting the outer most location)

<u>Season</u>	<u>Kedar (ha.)</u>	<u>Nagina (ha.)</u>	<u>Chatra (ha.)</u>	<u>Mean (ha)</u>
Nesting (1992 Sep/Oct)	6	35	79	40
Post nesting (1992/93 Nov/Feb)	232	474	577	426
Pre Nesting (1993 Mar/Jun)	520	45	1725	763.4
Nesting (1993 Jul/Sep)	702	24	19	248.4

Figure 4: Nest Study

<u>Nest Location & Dimension</u>	1992		1993		1992 & 1993 Combined	
	Mean	STDS	Mean	STDS	Mean	STDS
Distance to nearest Upland	18	33.60	25.71	35.46	22.50	34.17
Distance to nearest Shrub	4.8	6.27	4.79	8.36	4.79	7.41
Distance to nearest Tree	185	147.29	130.36	281.26	153.13	232.29
Distance to nearest House	410	292.31	300.00	388.79	345.83	349.20
Water Depth (cm)	13.2	16.80	33.00	42.34	24.75	34.97
Nest Size L (cm)	131.1	76.76	84.14	53.47	103.71	66.94
Nest Size B (cm)	104.7	44.72	73.29	48.30	86.38	48.49
Nest Size H (cm)	20.7	12.70	30.64	26.99	26.50	22.36

Figure 5: Nesting Habitat

<u>Nest Habitat</u>	<u>1992</u>	<u>1993</u>	<u>Combined (1992/93)</u>
Flooded Forest	0	1 (7.1%)	1 (4.2%)
Flooded Grassland	2 (20%)	4 (28.6%)	6 (25%)
Pond	2 (20%)	6 (42.9%)	8 (33.3%)
Paddy	6 (60%)	3 (21.4%)	9 (37.5%)
Total	10 (100%)	14 (100%)	24 (100%)

Figure 6: Clutch Size

<u>Clutch Size of Sarus</u>	<u>1992</u>	<u>1993</u>	<u>Combined (1992/93)</u>
No. of Nest	10	13	23
No. of Eggs	8	17	25
Clutch Size	0.8	1.3	1.08
Clutch size	0.8	1.3	1.08
No. of Egg loss	4 (50%)	9 (52.94)	13 (52%)

Figure 7: Bird Eco-group

Eco-group	No.of sps.	%
Swimming & Diving	29	12.18
Shore & Waders	48	20.17
Birds of Prey	31	13.03
Terrestrial	12	5.04
Arboreal	113	47.48
Aerial	5	2.1
Total	238	100

Figure 8: Bird Status

Status	No.of sps.	%
Non-migratory (N)	112	47.06
Migratory (M)	72	30.25
Partial migrants (P)	52	21.85
Uncertain (?)	2	00.84
Total	238	100

Human Attitudes and Cranes in Nepal's Tarai Region by Mahendra Shrestha

Mahendra Shrestha is a senior conservation officer with the Department of National Parks and Wildlife Conservation in Nepal. He is actively associated with bird conservation in Nepal. He has a M.Sc. degree in zoology/ecology from Tribhuvan University, Nepal and is currently pursuing a M.S. in conservation and development at University of Wisconsin-Madison.

Nepal has had substantial success in conserving its biological diversity by creating a network of protected areas. Currently, they cover nearly 11% of the total land area. The law protects 26 mammals, 9 birds and 3 reptiles. Major conservation emphasis is given to the protection of charismatic megafauna.

Conservation and People

Impressive as they are, Nepal's conservation achievements have not been without conflicts. The "success stories"—the establishment of numerous protected areas in Nepal—have often come at a cost to local communities (Heinen 1993; Sharma & Shaw 1993). For local subsistence farmers, conservation usually involves hardship. New restrictions on land use limit access to arable land and essential resources such as firewood and fodder. In addition, when protected wildlife species damage crops, farmers receive no compensation. Consequently, local farmers are not generally supportive of designated reserves. The "fence and fine" approach to nature protection (Wells and Brandon 1992), perhaps justifiable at the initial stage, has had the undesirable result of making current wildlife conservation more difficult. This history of conflict represents a significant obstacle, given that biodiversity as a whole can not be protected within the confines of a refuge. Conservation outside protected areas is also important and depends largely on people's attitudes and behavior.

Nepal's wildlife coexists with 19 million people, whose average income is \$160 per year (Anon 1992). Over 90% of the people living in Nepal's rural areas are subsistence farmers who depend heavily on the local natural resources. Challenged to meet even their most basic subsistence needs, rural Nepalis can rarely afford the luxury of conservation, especially when conservation measures conflict with their immediate interests.

The Tarai

The Tarai region (the southern lowland belt) in Nepal constitutes about 17% of the land area. Until recently, the Tarai was an extensive wilderness with high biodiversity characterized by tropical and subtropical forests with tall grasslands. Only a small number of Tharu, a largely indigenous group, resistant to malaria, resided in the region. However, in the 1960s the demographic landscape of the area changed dramatically, as malaria control programs prompted mass migration of Nepal's hill people to the Tarai lowlands. This migration, coupled with the increased growth rate, has attributed to the current high population density in the region. Currently, 47 percent of the Nepalese population resides in the Tarai (Anon 1992).

Cranes and People in the Tarai

Loss of habitat

Other than the areas associated with fast flowing rivers and streams; there are few wetlands in Nepal. Eutrophication of many lakes and reservoirs has been a serious problem. In addition, the extensive agricultural farming system and the continued transference of land under cultivation have caused the disappearance of many critical habitats, including wetlands. Habitat loss has consequently made Nepal's rivers, natural and man-made reservoirs (which support 130 species of waterfowl) and seasonal wetlands in agricultural areas even more important for cranes and waterfowl. For example, waterfowl thrive in the agricultural fields of the Tarai from June to September when monsoon rains inundate the land.

Habitat use conflict

The sarus crane (*Grus antigone antigone*) is the only resident crane species in Nepal. Common cranes (*Grus grus*) and demoiselle cranes (*Anthropoides virgo*) are passive migrants. Once commonly found throughout the entire Tarai belt, sarus cranes are found only in western Nepal. Within their current range, sarus cranes exist in agricultural lands with varying degrees of human interaction. Sarus cranes have not been reported to occur in any of the protected areas on a regular basis.

Loss of natural wetland habitat has forced the sarus crane to inhabit small ponds, water reservoirs, river systems adjacent to farmlands and moist agricultural land. During the rainy season, cultivated lands with rice paddies inundated to a certain level become ideal breeding and foraging habitat for sarus cranes. The rice stalks also serve as cover for the chicks and help them escape from predators.

Conflicts arise when sarus cranes use the rice seedlings as nesting materials for breeding. Although the crop damage is negligible, the farmers resent the damage it causes. Fortunately, local community sentiments and taboos regarding the sarus crane restrain people from killing cranes. Many local farmers consider the presence of sarus cranes on their farm an indication of a bumper harvest that year. Nevertheless, habitat use conflict with farmers poses a serious threat for the long term survival of sarus cranes. Two preliminary surveys conducted along the Tarai (Suwal and Shrestha 1988; Suwal and Shrestha 1991) recorded only 28 and 43 individuals, respectively. Now considered threatened in Nepal, sarus cranes are clearly vulnerable to demographic, genetic and environmental changes and natural catastrophes.

Other Human Threats

Other threats are nest or egg damage (done primarily by children), egg and young chick predation by jackals and domestic pigs, pesticides, human encroachment and grazing. Hunting by new settlers and visitors from the city who do not share the local tradition of venerating, and consequently protecting, cranes worsen the problem.

People's Attitudes

Assessing human attitudes and potential for conflict is critical to achieving the long term goals of conservation (Hough 1988; Gadgil 1992). Local attitudes toward conservation often determine its effectiveness and deserve the attention typically given to biological factors—population genetics,

habitat requirements and wildlife reserve shape, size and designs. In the case of the sarus crane, which primarily inhabits farmland, long term species viability rests on people's attitudes. The migratory demoiselle and common cranes face a similar situation. Many are killed by the farmers during migration when they stop over to feed on the grains in farm lands.

Nearly 95% (N=58) of the people in the present sarus crane range in western Nepal do not mind its presence on their farms (Suwal and Shrestha 1988). Some people (34%) understand that habitat loss is the main cause of decline in the sarus crane population. A significant number of people (86%) understand the importance of birds in agricultural ecosystems.

The Future of Sarus Crane Conservation

It has become a recognized truism that resources owned in common are invariably subject to overexploitation (Hardin 1968). Protection of migratory birds, wildlife, wetlands and forests is affected by this common property principle. However, there are a number of examples where such resources are managed collectively by controlling access to the resources. Public cooperation and public awareness are important to achieving such a goal. Local values and culture (taboos and beliefs) should be incorporated into educational outreach efforts and expanded. At the same time, it is important to develop an approach which minimizes people's antagonism towards cranes and wetland conservation. One way to achieve this is to create a symbiotic relationship between conservation and local economic development.

In addition to working with communities near protected areas, there are several specific actions that can be taken to ensure a safe future for sarus cranes. Management and development of wetlands in the Lumbini Development Project Area for cranes is a promising consideration at present. Other options include relocation of and reintroduction to safe areas like Koshi Tappu Wildlife Reserve in eastern Nepal and captive breeding.

Summary

Nepal has succeeded in conserving some of the wildlife within the protected areas. However, the restrictions on resource use and exclusion of people have serious implications for future conservation efforts. Particularly, many endangered species not found within reserve confines face serious threats of antagonism between the conservation agencies and people. The long term viability of sarus crane, which is the only resident crane species in Nepal, rests on the attitude and behavior of people. Certain immediate conservation measures are urgently needed for saving the population from extirpation.



Address to People by Bruce Babbitt

Bruce Babbitt, Secretary, U.S. Department of the Interior and former governor of Arizona works for environmental reform within governmental channels.

I accepted this invitation from your president some weeks back—I think actually in January. He told me what an extraordinary sight this was. And he said, “By the way, the last time we invited a high ranking official from the Department of the Interior out here, the cranes didn’t show.” To which I said, “Of course not. Why would they during the past 10 years?!” And then I had a sinking feeling. I wondered what was going to happen!

But I must tell you the cranes delivered in timely and magnificent fashion this morning. It’s really one of the most extraordinary spectacles on this planet. I stood out there, as I’m sure all of you have, in the darkness just listening to the symphony of sound, looking up at the starry skies, this cacophony of extraordinary vitality and abundance. As the sun came up, I thought this must be what the world was like once upon a time in many, many places in many, many streams, in many, many neighborhoods. And now we are reduced to just a few of these places. Watching the cranes jostling about in the water, I thought these extraordinary birds have assembled as coming into the narrow constriction of an hour glass, coming up from across Mexico, New Mexico, Texas and the Gulf Coast. By some magic and mystery of creation and evolution, here they are, vulnerable together in all of their beauty before they, by some mysterious movement—time and destiny—begin to spread back to the north. And all of that emphasized to me the extraordinary importance of this mission we have together, to say to the rest of humanity and to our fellow citizens, we can’t let anymore of this disappear. We have an absolute obligation to draw the line and say we will conserve the remnants we have left.

Now, what I’d like to do for a few moments is see if I can cast the problem and the challenge here on the Platte River by taking you on a short tour of the Pacific N.W., central Texas and the Everglades. As I describe what we in the Clinton Administration are attempting to do, I invite you to reflect on the meaning of these other places as they apply here in central Nebraska to the Platte River and all of the species including the cranes on this river.

As I see it and as I saw it when I took this job, we have a new and extraordinarily complex environmental challenge ahead of us. In the past, the victories were often kind of easy because there was a lot of empty space in this land of ours. Our predecessors often scored an environmental victory simply by creating a national park out on the back 40, putting rangers in it and saying, we have fulfilled our obligation to a natural environment and ecosystems which seemed broad and inexhaustible in many ways beyond mortal peril.

But don’t you see how things have changed? Because what we’re learning, what we’ve learned in the Everglades, for example, is that it is not enough to simply put a fence around a piece of property. The Everglades are dying. It’s not because the Audubon Society and the National Park Service are not taking care of Corkscrew and the Everglades—they are. They’re dying because of what’s happening 50 miles away in Lake Okeechobee and 50 miles beyond that because of climatic changes driven by the living habits of people living in New York, Chicago, Los Angeles, Calcutta and Tokyo. And that’s just a way of saying that the empty spaces that once made nature seem stronger, more resilient and more

impregnable than it really is are now filling up, and there aren't any boundaries. In the final analysis it will be up to us to see if we can find new equilibrium with nature, to see if we can make peace with our surroundings and learn to live a little more lightly on the land.

Now briefly, I want to stop in the Pacific Northwest because what we learned in the Pacific Northwest was that as empty spaces filled up, the Northern Spotted Owl sent us a distress message which said: This ecosystem is crashing. There are too many stresses on it. The national parks won't work; they're too small. We have to reach across the entire ecosystem and find a balance. What we saw was that because of the failure of action, a federal judge wound up saying to federal agents, you're not doing your job, you're violating the law, and issued injunctions.

Well our response was to go to Portland, Oregon and call together representatives from the BLM, the Forestry Service, the EPA, the National Marine Fishery Service, the Indian tribes, the State of Washington, the State of Oregon and the Universities. I remember the day in February last year when I called together scientists and specialists from those agencies and stood outside a room about this size. As they came in I said, "There's a box there on that table and I want you to take your badge off and put it in that box. I want you to understand that you're entering this room not as a representative of some agency... I want you, all of you, to understand that we're looking at this entire system... We have a map on the wall which illustrates the West Cascade System from Puget Sound all the way down to the Trinity River in California. You've got to start in your heads erasing the jurisdictional lines because we can't have a plan for this piece of land, for that piece of land, for here, for there. We must see a hope. We must understand the interrelatedness and the diversity of the entire system—the salmon in the rivers, the birds in the trees and the habitat in which they live." And now a year later, we are moving back before a federal judge, saying to him we've heard the command of the law. But more than that we have heard the voices speaking in that ecosystem about the need to find equilibrium and to demand that all activity in that entire system be conducted henceforth on a sustainable basis.

Now, the next problem that came into my life in the early months of last year was down in central Texas in a place called the Edwards Aquifer—an interesting problem because an aquifer is out of sight. It is out of sight and all too often out of mind because people don't fish in it, don't swim in it, and nobody's ever seen a sun set over a groundwater aquifer. But what we learned in central Texas was that it all relates—because a federal judge in central Texas, at the request of the Sierra Club, had enjoined any more groundwater pumping in the city of San Antonio and in the agricultural areas way up in west Texas, because way out in east Texas a series of great vernal pools and springs feeding the headwaters of rivers running in the other direction were being dried up by groundwater pumping.

And, once again, the only possibility was to call together county governments, city governments, agriculturalists and environmentalists from different parts of Texas, put them together and say: We must produce a sustainable water yield from this ecosystem. Before the year was out, the Texas legislature for the first time in its entire history had passed a groundwater management act. A statement that, again, when a system is stressed to the point of no return, we are confronted with the systemic question: What are the sustainable levels of use by the city of San Antonio, by farmers up in western Bexar County, by river users down below in east Texas and by fisherman in the estuaries outside of Corpus Christi? All of whom are using exactly the same resource.

I suppose the 800 pound gorilla of my tenure in this job has been the Florida Everglades—an area of special importance not only because of its uniqueness, the only area of its kind, certainly in this country

and probably in the entire hemisphere and maybe in the entire world. The Everglades also are a place of spiritual beginnings for this organization, the Audubon Society, who, before the federal government or the American people had ever awakened to these kinds of realities, was on the scene in the early 1900s risking lives and committing resources—making a statement that I think has rippled outward for now an entire century. It all began there. And it is the one place most at risk in all of the United States because it can't be saved within the boundaries of a park. It is a system. It is a system balanced between sky and land, saltwater and freshwater in the most extraordinarily balanced equilibrium. Now, all of a sudden, in that one area we have a convergence of economic forces and people posing in the most dramatic way the question of whether or not we have the collective will to find that equilibrium and to say we will use this precious land and water system only on a sustainable basis.

Right up on one side, we have the city of Miami moving in less than a hundred years from a country village to a million to two million to three million people drawing the Biscayne Aquifer dry, moving across into the floodways of the Everglades. Just to the north, courtesy of the United States Government, we have an agricultural area which was created by severing the artery of the Everglades, cutting the flow way in two, and artificially draining the water, not through the Everglades, but out to the sea. And the response that we have been trying to put together with the help of your leadership in Southern Florida is the obvious one. To say we can no longer tinker with just parts, we can't have partial solutions, we can't do one thing at a time. We have to have the courage to lift our heads and say we must deal with all of these forces. We must array them in a way which says we're no longer going to live in ecosystems where you allow this kind of demand to accumulate up to the point that it simply drives the most vulnerable and the least protected use of all to destruction and extinction.

Now, I invite you to come back to where we are today because these cranes which converge for such a brief period of time and then disperse from this river are also at risk for exactly the same reasons. The Platte River for 100 years has seemed to most to be an inexhaustible resource that our fathers, grandfathers and grandparents came to this region and began to develop it in isolation from each other. Reclamation projects in Wyoming, mining and urban development on the South Platte in Colorado, a big and productive irrigation system right here in central Nebraska always developed in isolation. But well meaning people looked across the horizon and said there aren't any limits, this is a god given and inexhaustible land, and of course, always assuming most unhappily that nature, the environment and the biodiversity of the land symbolized by those birds was a fixed constant—that there was always space and there was no need to factor these realities in. And here we are at the end of the 20th century, once again asking the question, can we find balance? Can we come together and find a sustainable way of living within the limits of the ecosystem and arraying our uses in a way that says there will be room?

We can make peace with the diversity and the glory of this ecosystem. And we can rearrange the way we live on the land to live in equilibrium with those realities. Now, I believe that unlike the Everglades, where surely we are past the 11th hour going toward midnight, here in the Platte River Valley we have a little more time. It's not 11 o'clock. It's probably an hour earlier in the cycle, but there's still room—there's still room if we are willing to look up across state lines and to begin to say we are all related. What happens in Colorado matters to the habitat in Grand Island, Nebraska. What happens in Wyoming has impacts on your reserve on this river, and we must now begin the process of looking at the resource whole and saying to agricultural interests: You have an obligation to the entire system, for efficiency and for conservation of water management, of marching across all of the uses and seeing, while there is still time enough and space enough, that we can put it together.

And as the final, but really the first piece of this process, we can't make the assumption that what's left over is for the ecosystem. Because when you say "what's left over for the ecosystem," the answer inevitable, always, relentlessly is... nothing. Therefore the cut to the ecosystem, if you will, has to start at the top of the analysis. And that, of course, is the role that I play in this time and place together with the Fish and Wildlife Service. It's a role in which you have an obligation and a partnership role. It is a role that we can expand outward to include a lot of other good people on the state and local level, because I honestly believe that there is time. If we dedicate our efforts starting today and say it will not be left out, we can find a balance. It does impose obligations on all parties, and the cut to nature—the process by which we reach that equilibrium and make our peace with this river valley—will not be forgotten.

The Evolution of a Crane Refuge in the Northwest Frontier Province by Mohammed Mumtaz Malik

Mohammed Mumtaz Malik is the Conservator of Wildlife for Pakistan's Northwest Frontier Province. Protecting wildlife and their habitats from the high mountains of the Hindu Kush to the wetlands of the Indus River plain, he is responsible for numerous rare wildlife species, including the snow leopards, two species of cranes, and several species of endangered pheasants.

It is springtime in Kearney. Everywhere you go, hundreds and thousands of cranes are seen feeding in the fields and meadows. When I came here in 1990, I was amazed at the number of cranes. I sat in the blinds along the river and thought I was one of them.

In Pakistan's Northwest Frontier Province (NWFP), you see cranes in the fields, markets and meadows. However, the sandhill cranes found in Nebraska are wild, while the common cranes and demoiselle cranes found in Pakistan are pets. Traditionally, the people of the Northwest Frontier Province caught cranes and caged them for life.

During migration, cranes coming from Siberia migrate through the NWFP on their way to lower Sindh and India. Some may even spend their winters in the southern parts of Pakistan. During this time, people establish hunting camps around the water bodies and use their pet cranes as decoys. At night the hunters separate the pairs of cranes which causes them to call loudly to each other. Wild cranes flying overhead are attracted by the calling and approach the hunting areas below. The hunters then toss up a lead-weighted string called "sooya" and pull the cranes to the ground. The hunters later clip the wild cranes' wings and take them home for pets.

Crane conservation in Pakistan was not a priority issue before 1982. It took declining numbers of Siberian cranes to arouse interest for crane conservation. The Siberian crane is an endangered species—and the most threatened of all cranes in Pakistan. The population of Siberian cranes that fly through Pakistan has declined steeply since 1964 from 200 to about 30 in 1980. This was a big concern for environmentalists who thought that Siberian cranes might be facing problems on their journey through Pakistan to India.

People thought that traditional crane hunting in Pakistan could be a major reason for the decline in Siberian crane populations. To investigate this concern further, in 1982 I began work with Dr. Steven Landfried, an environmental educator from Wisconsin, and Mr. Dave Ferguson with the U.S. Fish and Wildlife Service, and together we visited a number of hunting camps. What we found was that many people could not recognize Siberian cranes and were not aware that they may be inadvertently catching them.

Our first task was to determine the hunters' knowledge of crane populations. Second, we needed to investigate the extent of their hunting. We thus designed a questionnaire and conducted surveys about their knowledge and attitude toward cranes.

One hundred forty-one questionnaires were distributed, and hunters outside the camps were formally surveyed. Although we think the response was underreported, reports show there have been 3200 common cranes and 2400 demoiselle cranes kept in captivity during recent years. Fifty-one percent of these birds were caught and 42% were purchased. This indicates there is business and trade in cranes. People also present cranes as gifts to officers and politicians.

There are a number of reasons why people go hunting. The main reason is the tradition of sport. Other reasons include getting out of the village and having time away from their wives.

Only 58% percent of surveyed hunters said that the population of cranes is decreasing, yet 90% report that their catches have declined. So while most hunters know they are catching fewer cranes than before, they do not consciously connect this to the decline in the overall crane population. The hunters either do not think about it, or they assume the changes in the numbers are caused by factors beyond their control.

Alarmed by the survey results, we felt there was an immediate need to establish a refuge. Our findings indicated that the crane population and catch were declining, there were no safe resting or feeding places for cranes, there were no places for the cranes to feed along the Kurram and Indus Rivers, which are hundreds of miles long, and there was an immediate threat to the Siberian cranes. We did not find evidence of Siberian cranes coming through this loop. We wanted to create a refuge on the Kurram or Indus so there would be at least one safe place for cranes to rest and feed during their migration.

As the Indus River flows out of the mountains, the water is immediately diverted and stored for irrigation. The downstream flow is decreasing daily. There are now at least five dams on the Indus River. Upstream, more dams are being built and Pakistan is planning to have at least two more dams on the Indus. Therefore, our situation with dams and rivers is similar to that in America. The irrigation department determines when, where and how much water is left in the river—and this decision is made regardless of the river flow, wildlife or wetlands.

The Northwest Frontier Province has land most unfavorable for living. Nevertheless, you rarely see uninhabited areas. When you have to feed millions and millions of people, plans that are morally, politically and personally correct must play a role. Environmentalists usually find it difficult to convince people and politicians with their own interests and agendas to work for the environment.

Confronted with this situation, we had to establish a crane refuge. The proposed sites for the refuge were on the Indus River and the Kurram River, a tributary of the Indus; important stopover sites for migrating cranes and waterfowl.

In 1990, I came to Kearney and saw the Platte River. I went back to Pakistan and selected the Kurram River as the most suitable site for the crane refuge, a refuge of 20 square km. Within the refuge, 0.5 square km were fenced off and captive cranes that some of the hunters had caught were placed in the area. The idea was that the captive cranes would attract wild cranes and the cranes would eventually start to use this area as a crane refuge. Today, our refuge has a staff of ten people and an operating budget of U.S. \$10,000—and cranes are starting to use it.

We established the refuge in January of 1992. We have had two complete seasons, spring and fall of 1992 and 1993. In spring of 1992 there were not many birds using the area; only 11 demoiselle cranes and 16 common cranes came to the refuge. But in spring of 1993, the numbers had risen. The visits increased to 110 demoiselle cranes and 107 common cranes. The same trend holds for the fall seasons. In fall 1992, there were 177 demoiselle cranes and 33 common cranes. In the fall of 1983, there were 281 demoiselle cranes and 107 common cranes.

I am quite encouraged to see the cranes using this area. With effective protection and the passage of time, I am sure this will be an important crane refuge area along their migratory route. I hope that one day it will be a scene as spectacular as the cranes on the Platte River.

Integrating Education & Research for Cranes in Pakistan

by Steven E. Landfried

Dr. Steven Landfried has worked on crane research and conservation education projects for the International Affairs Office of the U.S. Fish & Wildlife Service since 1980. He served as Public Affairs Officer for the International Crane Foundation from 1979-1981. He has written more than 25 articles and contributed to numerous international conferences. During the school year, Dr. Landfried works as coordinator of an Alternative Learning Program at Stoughton High School in Wisconsin.

It's a great pleasure for me to be at the Audubon conference today in Kearney.

The international component at this crane conference is important because it puts habitat preservation along the Platte River into a larger perspective. I applaud Ken Strom and Heather Whitaker for making this possible for us—and for me.

In the next 45 minutes I will share some slides that illustrate interesting ways in which my colleagues and I have integrated educational activities with research about crane migrations in Pakistan. First, a little history about the project.

Back in 1980, I was invited by Dave Ferguson—the PL-480 Foreign Currency Exchange Coordinator of the International Affairs Office of the U.S. Fish & Wildlife Service in Washington—to go to India to publicize the plight of the central population of Siberian cranes (*Grus leucogeranus*). At that time only thirty-three Siberian cranes still visited the Subcontinent, and what is now known as Keoladeo National Park was under tremendous pressures from the expanding human population of nearby Bharatpur. Originally the hunting grounds for the Maharaja of Bharatpur and his guests, the place was infamous for its great bird hunts . . . the most notable of which were recorded on this slate monument. As you can see, a party of thirty-seven shot 4,732 birds on a single day in 1937.

By the early 1980s, the primary threat to Siberian cranes in India was local villagers whose domesticated buffaloes were fouling water, tearing up vegetation and disturbing birds. Little was known about these problems around India or internationally, so Dave wanted me to publicize the threats to the park and its winter guests—the Siberian crane.

Publicity efforts in India in 1980-81 focused on villages around Bharatpur, the state of Rajasthan and national print media. One educational strategy designed to foster local support for the bird sanctuary in Bharatpur included counts of Siberian cranes and one of India's most beloved birds—the sarus crane (*Grus antigone antigone*). Patterned after crane counts in my native state of Wisconsin, the first sarus crane count brought together key constituencies whose support was essential nationalizing the 29 hectare sanctuary. It included students, teachers, scientists, government officials, representatives of the media and members of the Keoladeo Natural History Society. I'm pleased to say the sarus crane count at Bharatpur celebrated its 10th anniversary last year—and, as always, stressed the importance of the area to international migratory birds like the Siberian crane.

My work in India spurred a desire to learn more about Siberian crane migrations to—and from—India. The birds had to pass over Pakistan, so I turned to colleagues at the Bombay Natural History for potential contacts there. Among the names I was given was that of Tom Roberts, a British expatriate working in Pakistan. Tom proved to be the only person to have described live crane catching in the North West

Frontier Province (NWFP). Tom and I shared correspondence in 1981 while I was wrapping up a two year stint as Public Affairs Officer for the International Crane Foundation (ICF). The ICF wasn't doing any work in Pakistan, so its co-founders—Ron Sauey and George Archibald—encouraged me to "go for it." Shortly thereafter, I accepted Tom's invitation to visit the country to meet with leading conservationists and crane hunters in the North West Frontier Province.

In December 1981, I flew to Pakistan. The second day sticks in my mind because I saw this poster at the Pakistan Forest Institute which read: "Earn Foreign Exchange through Wildlife." Needless-to-say, I knew immediately that I'd stumbled on fertile ground for environmental education. Subsequent conversations with a crane hunter from Bannu suggested that he may have shot—and eaten—three white cranes at a crane hunting camp along the Kurram River during the 1960's. Contacts with wildlife department officials suggested that crane hunting observed by Tom Roberts was on the rise.

Alarmed by the implications of the crane hunting for Siberian cranes, I asked for three weeks leave from teaching duties to observe crane hunting camps in the Kurram Valley in October, 1982 with Tom Roberts and my colleague, Mumtaz Malik—who had just taken over as Conservator of Wildlife for the NWFP. Mumtaz took us to visit remote areas of the province, including the beautiful setting you see here—with the Kurram River in the foreground and rugged mountains in the background. Who would have guessed at the time that 10 years later the Lakki Crane Refuge—which Mumtaz detailed a few minutes ago—would be found at the same site!

The NWFP—and the Kurram Valley in particular—is a fascinating place to visit. The Pashtu speaking tribes there see themselves as family. The Pathans are the largest tribe in the world, and their hospitality and ferocity are legendary. They are proud of their heritage and their ability to eventually drive out anyone who has tried to conquer them—including the Greeks, the British, and most recently, the Soviets. Guns are everywhere—leaving one feeling like they are back in the Wild West. Predictably the guns of the NWFP are aimed at wildlife as well as people, and hunting is deeply ingrained in the cultural sinews of the area. As you would guess, migrating cranes are among the many creatures that fall prey to ubiquitous guns and the lead-weighted cords used by crane hunters to snatch descending cranes from the air. The purpose of our journey was to educate ourselves about the magnitude of the crane hunting, to better understand the appeal of the sport to hunters and to educate the hunters about the plight of the Siberian crane.

The magnitude of the crane hunting in the Kurram Valley was much greater than anticipated. We saw hundreds of demoiselle and common cranes in cages. Some hunters transport their cranes on top of characteristically colorful Pakistani buses as men return from the hunt in droves. Conversations with hunters and Bannu wildlife staff led us to estimate that as many as 5,000-6,000 cranes were being held in captivity. Unfortunately, few of the hunters had any sense of the possibility that their sport might be threatening the survival of the Siberian crane or reproduction of their more numerous crane cousins.

We also found genuine concern on the part of hunters that their captive demoiselle cranes (*Antropoides virgo*) and common cranes (*Grus grus*) were not breeding well—and that young cranes produced in captivity often did not survive long. Those concerns produced an important point of common concern from which cooperation between conservationists and hunters could build. Indeed, two years later, the head of the bird section of the National Zoo in Washington traveled to the Kurram Valley to study captive cranes breeding there and to make recommendations about ways to improve it.

Let's take a close look at a crane hunting camp. Here we see a typical camp along a small tributary of the Kurram with 15-20 crane cages and a hut for the hunters. Hanging from the side of this hut are 8-10 sooya—the 100 foot long lead weighted cords used to catch cranes. Some of the hunters have rifles; today others have copies of Russian machine guns. Family feuds and occasional kidnapping of foreigners create some danger when foreigners travel through the area. As a result, several wildlife staff accompanying us carry weapons of their own.

Few sports are fairer than live crane catching. As you all know, cranes are very wary birds and the idea of plucking them from the sky with 100 feet of cord almost defies imagination. Just image yourself trying to catch sandhill cranes along the Platte River with a relatively short cord! How do they do it?

Most crane hunting is done on cloudy, stormy nights when the migrating cranes must descend to avoid the elements. Crane hunters place their caged decoys along a river bed and provoke carefully trained decoy cranes to begin calling. Soon all the cranes in the camp are calling—creating a din that can be heard for miles by migrating cranes. The wild birds think the sound of cranes signals safe haven and are attracted to the camp. They begin to call as well and the return call finds 10-15 crane hunters quickly arranging themselves in a long line. The hunters twirl the sooya before throwing them skyward with hopes of wrapping a cord around the outstretched wings of the descending cranes. The cords are attached with a loop to the little finger of the hunters—who rush to capture any cranes whose flight has been impeded by the cord around their wings. The flight feathers of captured birds are clipped and the birds are quickly put in a nearby tent before being taken to nearby villages for domestication or gifts to friends.

Unfortunately, many of the crane hunters are illiterate and have little knowledge about the notoriously slow breeding rate of wild cranes—or their biological history or requirements. Back in 1982, common and demoiselle cranes were still numerous and crane hunters felt their hunting had little impact on the survival of migrating cranes. Some had observed the fidelity of captive crane pairs to each other and their slow rate of reproduction. But few displayed any appreciation of the impact of their sport on the ability of the cranes to maintain or restock their numbers in the wild. Because the depletion of the Indo-Soviet flock of Siberian cranes was so great, virtually none of the hunters had seen the white cranes—much less known about their brush with extinction.

Our brief four day visit made clear that a great deal of research and education was needed. With the encouragement of Mumtaz Malik, Tom Roberts and WWF-Pakistan, and Dave Ferguson at the International Affairs Office of the U.S. Fish & Wildlife Service in Washington, D.C., I applied for an unpaid leave of absence from teaching duties during the spring of 1983 to lead research and educational efforts in Pakistan and India. One semester leave was granted, and I left in early February 1983 to make a presentation to an International Crane Conference in Bharatpur with Tom Roberts about crane hunting threats in Pakistan.

After a brief tour of the demoiselle and common crane wintering grounds in Gujarat, India with ICF co-founder Ron Sauey, I left for Peshawar, Pakistan to work with Mumtaz Malik and Ashiq Ahmad of the Pakistan Forest Institute on a research questionnaire designed to gather data on the magnitude of crane hunting, factors motivating hunters, and matters of concern to them. In addition, we developed questions to determine whether any Siberian cranes had been seen; we thought they might occasionally pass through the Kurram Valley on migration from Bharatpur to Lake Abi-Estada in Afghanistan.

Design and administration of the questionnaire proved challenging for several reasons. First, the NWFP

Wildlife Department staff had never conducted survey research before so training sessions had to be organized. Second, the local tribes spoke three different dialects of Pashtu and great care had to be taken to assure that the content of the questionnaire was translated accurately—and, to be certain local linguistic sensibilities would not be trod upon. Third, we had to deal with the fact that the Pashtu language makes no differentiation between crane species (they are all known as "koonj"). This required that we teach wildlife staff and the hunters how to differentiate crane species from one other and egrets or herons. In short, research and educational functions became inextricably intertwined from the start of our project in Pakistan—and remain so today.

Training of the field staff and administration of the questionnaire took three to four months in March and April 1983. Photographs document some of the fascinating things we saw—like a pair of tame common cranes searching for food in a large puddle near a busy intersection. Here we see a flock of domesticated cranes grazing through a farmer's field. These calling cranes announce the arrival of strangers into a walled family compound. You can see why there is little wonder why the crane hunters use their pet cranes as watchdogs!

Having seen hundreds of thousands of very wild cranes along the Platte River, you probably find it hard to imagine how the Pakistanis get their cranes so tame. Basically, the answer comes from a careful desensitization process worked out by the crane hunters over many decades. It is a process which involves putting newly captive cranes in cages along busy highways so they are quickly inundated with the sights and sounds of humankind. The birds are fed daily and soon become used to the service. After several months, they are allowed to wander around compounds or nearby fields. They bond to their masters and learn to return "home" with little coaxing. Flight feathers are trimmed periodically to keep them from flying away. With time, crane owners will allow a few of their most trusted birds to grow back their flight feathers so they can fly. Sadly, however, I have seen cranes grow so lazy and out of shape that their owners literally have to chase the birds to get them to fly. So, like human children, pet cranes get very lazy when too much is done for them.

Well, what did we find motivates the crane hunters? As you might guess, many of the same things that motivate hunters the world over: male bonding, the enjoyment of getting out in nature, getting away from a spouse, predatory instincts—and, in this case—the sheer challenge of catching an elusive bird. Some hunters are also driven to obtain a treasure of nature for a close friend or relative. We found that relatively few men engaged in crane hunting as a source for food or commercial gain.

The research and education work with the crane hunters and wildlife department staff consumed a great deal of time. Our project also targeted six other groups: local government officials, the provincial governor, federal officials in Islam-abad, members of conservation groups like the World Wildlife Fund-Pakistan, students at the Pakistan Forest Institute and children from the crane hunting villages (from whom the next generation of crane hunters would be drawn). While approaches varied somewhat with the audience, because few people knew much about cranes or the value of wetlands to international birds or people meant we had to play teaching roles with all of them.

Illiteracy in rural areas forced us to use visual aids. Our slide projector became indispensable—as was an ability to improvise on where to show them. Needless-to-say, having a portable generator came in handy, too. It was really an adventure for this high school teacher—and you can quickly understand why I felt I had just substituted a Wisconsin classroom for a whole bunch of them in Pakistan and India. Talk about an experience!

The situation is further complicated by the presence of about 3.5 million Afghan who escaped the turmoil of their homeland and came to Pakistan. Their presence has placed great strain on the environment and made things more difficult for the wildlife department. Siberian cranes used to rest in Afghanistan at Lake Abi-Estada—more or less north of the Kurram Valley. I have worked with the Food and Agricultural Organization (FAO) of United Nations for several years in hopes of expanding our crane research and education work in Pakistan to Afghanistan. Finally, this last winter, ICF funded a young man's research for a month around Lake Abi-Estada. Unfortunately, he did not find any evidence that Siberian cranes had visited the area recently. With luck this is just a start and I am hopeful that Ken Strom and Audubon can bring Afghans to the Platte conference in a few years.

The Afghans have brought a huge quantity of arms with them into the Northwest Frontier Province. I did not grow up around guns, so part of my education in Pakistan has been to become more comfortable around them.

The fact that large areas of the NWFP are in tribal areas presents another challenge to crane research and educational efforts. As true with Indian reservations in the U.S., the tribal areas are semi-autonomous and provincial laws often mean little there. Permission to travel is required from a local political officer (himself a member of the tribe) whenever one wants travel into the tribal areas. Armed tribal guards must accompany both visitors and wildlife staff (who carry arms) into tribal areas. Limited access to tribal areas makes it difficult impose and encourage crane conservation measures.

A basic element of Pathan culture is the code of Puckhtunwali—which requires the extension of wonderful hospitality to guests and the imposition of great vengeance whenever Pathan honor is injured. My hope is that we can build on their age-old concept of hospitality to justify crane conservation. Perhaps we can persuade the hunters to see passing cranes as guests who pass through their homeland twice a year—guests who should be allowed the freedom to pass without danger or arrest.

Another way we have tried to broaden the hunters' perspective on the international nature of their cranes is to involve them in banding exercises near the Baran Dam. Few Pakistani crane hunters have the opportunity to travel and we thought that banding the birds with Russian and English language tags would enhance their appreciation and interest. Here you can see Mumtaz and some hunters attaching a leg band on a common crane. While banding, some wild cranes flew overhead and the first instinct of one man was to point his gun in that direction. Only quick intervention by Mumtaz prevented its discharge.

The challenges of working in an area without any history of conservation was also demonstrated a few minutes later when I noticed that the newly tagged cranes weren't flying away. The reason? A crane hunter had surreptitiously tied turbans under the wings of the birds—making it impossible for the birds to fly or for us to see their dirty work! This all reaffirmed that we still had a lot of work to do. It is my hope that we can actively involve crane hunters migration studies in the years ahead. Perhaps the use of satellite tracking devices will appeal to their imagination and sense of pride.

A major ally in the early years of crane work in the NWFP was its martial law governor, Lt. Gen. Fazle Haq. An avid hunter and crane owner, he was gradually won over to the side of wildlife conservation—to the point that he even gave up hunting before leaving office in 1987 when democracy returned to Pakistan. He was particularly helpful in pushing new crane hunting and possession laws through the provincial assembly in 1984. In addition, he arranged for news clips of our meetings at the Governor's Mansion to be included on the Pakistan evening news. This gave our project greater credibility with hunters, provincial officials and authorities in the Islamabad central government.

Interestingly, the strong leadership of Fazle Haq would also prove to have detrimental effects on the Pakistan crane project. As a military leader, his approach was to give an order and expect others—including Mumtaz—to follow it. To some extent, we got caught up in that mentality and failed to seek hunter input into the project sufficiently. Without active involvement in project planning, hunters saw restrictions on crane hunting and increases in crane possession fees as unfair conditions imposed by outsiders. Many came to see the wildlife department as adversaries—rather than as friends with the same goal—and Mumtaz had his hands full when democracy returned in 1987. The hunters organized a political action group and crane hunting fees were either reduced or eliminated by the Provincial Assembly.

Good lessons were learned from this experience and since 1988 we have actively sought to cultivate personal relationships with the crane hunters. In fact, I've spent most of my Christmas vacations since then in Pakistan to get to know hunters better and to inform them about exciting advances in satellite tracking technology. The hunters have increasingly seen us as genuinely concerned about preservation of their sport and have begun to actively suggest ideas for crane conservation. Some of those ideas include: decreasing the number of crane hunting days, reducing the number of hunters and crane camps, banning crane shooting in tribal areas, and restricting crane hunting to the fall. Eliminating the spring hunt would give cranes an opportunity to return to their breeding grounds without danger.

Moving ahead, we see slides taken at the new Lakki Crane Refuge in December, 1992 . . . the same spot Tom Roberts and I had visited with Mumtaz in the fall of 1982. Needless-to-say, it was a thrill to see what persistence can achieve—and why Mumtaz has been recognized with a well-deserved award at this conference.

The future of the Lakki Crane Refuge—and its sister sanctuary on the nearby Indus River—depend, in large measure, on the support of crane hunters and villagers scattered throughout the area. Education plays an important role in that future and we are hopeful that groups like Audubon and the International Crane Foundation will lend their support by developing educational displays and materials for the refuge and by bringing Pakistanis to the United States for training.

The International Affairs Office of the U.S. Fish & Wildlife Service has already done so—contributing generously to the creation of local language versions of the film—"*Crane Hunters of Pakistan*"—and the filmstrip—"*Cranes of the Subcontinent: Great Birds in Peril.*" By the end of August, we will be able to distribute video tapes of these resources to Pashtu, Urdu, and Dari speaking people in crane hunting areas of Pakistan and Afghanistan. VCR's have become common as Pakistanis have returned from jobs in the Gulf states. We are hopeful that hunters receiving the tapes will share them with friends, relatives and neighbors—essentially drawing them into the process of conservation education.

Crane conservation in Pakistan—and wetland preservation along the Platte River—must start at the grass-roots level. For that reason my immediate dream is to bring two to three crane hunters and a local educator to the Platte next spring to see the fruit of hard work between farmers, hunters and conservationists along your flyway: hundreds of thousands of cranes! And I'd like to challenge you—my colleagues from ICF and Audubon—to help make that dream come true.

In closing, I want to take us back to India . . . to Bharatpur where my own odyssey on behalf of the Siberian cranes first began in 1980. Here you see a picture I took this winter of the only two Siberian cranes seen at Keoladeo National Park this winter. They are not wild Sibes—they are captive breed, semi-wild reared

birds released into the sanctuary in hopes that they would associate with wild Siberian cranes and migrate north to the tundras of the Kunovat River. Unfortunately, no Siberian cranes arrived in Bharatpur and these two birds were returned to captivity.

The apparent demise of the Indo-Soviet flock of Siberian cranes may be a harbinger of things to come for their more numerous migratory cousins—the demoiselle and common cranes. . . . and maybe for your sandhill cranes as well. Although widely separated in miles, the Platte River and the Indus River share common threats posed by escalating human populations. While your cranes are still numerous, who knows what their fate will be as wetland development and the thirst of growing millions reduce the water available to these shrinking rivers? Who knows what 30-40 years will bring? Will your children still be able to see 300,000 cranes along this fragile river? Let's do more than hope so.

In any case, please know that efforts to preserve and protect the Platte River for wildlife and future generations is a successful model that we can take to Pakistan for inspiration. People can make a difference! Any help you can give to forge further connections between crane lovers along the Platte and the Indus will be greatly appreciated!

Perceptions of Wildlife in Northeast China and Prospects for Conservation

by Wang Xiaohong and Charles H. Trost

Wang Xiaohong received a Master's degree from Northeast Normal University, Changchun, Jilin Province, People's Republic of China. Currently, she is working on her Ph.D. under Dr. Charles Trost, Professor of Avian Ecology at Idaho State University, Pocatello, Idaho.

Introduction

Traditionally, the Chinese view of wildlife has been strongly utilitarian. For thousands of years, the Chinese people have been using the land to make a living, and have used many of the plants and animals for medicinal purposes. The idea of conservation has only recently come to the country. Since the mid-1980s, when conservation was recognized as an essential and important alternative to utilitarian land use, China has been increasing the number of Nature Reserves established yearly. This shows the development of a positive attitude towards conservation, especially considering its relative nonexistence 20 years ago.

Conflict Between People and Wildlife

China is an agriculturally based country. Eighty percent of its population is subsistence farmers. For thousands of years, the Chinese people have been plagued with starvation from wars or famine. In general, wildlife and natural plant communities were viewed as something that could be used for survival. For the last ten years, although there are still some poor areas, starvation has not been a problem. China is self-sufficient and able to consider land and wildlife for conservation.

Because of the huge population (about 1.1 billion) and because conservation has been accepted only recently, some traditional land uses are still in direct conflict with the preservation of natural systems. Reserves have been established around existing villages, threatening the life styles of the indigenous people. For example, reed cutting has been a livelihood in most crane reserves prior to the establishment of reserves. Local people sell reeds to paper factories to make money, and they combine them with mud to build houses and fences. Reeds are also used as fuel. In some areas reed cutting constitutes 70-80% of the local income.

But, standing reeds serve as important shelter for cranes and other waterbirds. Research indicates these birds prefer to nest and roost in areas of high reed density where they are less likely to be disturbed by predators (Ma, 1982; Feng and Li, 1986; Zhu, 1991). People know that reeds are important for cranes, but due to economic forces beyond their control, they are driven to harvest reeds even in crane reserves (Ma and Su, 1991).

Freshwater fishing also brings people and cranes into conflict. Unregulated fishing is a year round activity. This poses a serious threat to the cranes' food supplies. For many years there were no restrictions on fishing equipment or attempts to manage the harvest. Chinese conservationists are still struggling with the problem of how do people and birds share the population of fish from the same pool.

Historically, Chinese people have used herbs and animals for medicinal purposes. In northeast China, the abundant plant and animal resources found in the Changbai Mountains make it a natural medicinal

resources area. However, because of unorganized access, some of the natural resources have decreased tremendously.

The large human population in China has a great effect on wildlife. Even with the restricts of one child per couple, the population is increasing at the rate of 1,700,000 individuals per year. At the same time, farmland is decreasing by 300,000 ha/yr. In the past forty years, per capita farmland has decreased by half from 0.18 ha to 0.085 ha/person (Jin and Wang, 1992). The rapidly increasing human population is certainly intensifying the conflicts between people and wildlife conservation. However, because China now grows enough food, the government has the luxury to set aside large tracts of land for wildlife.

Scientists' involvement and government action

In China, there is a National Wildlife Committee with branches in each province. In order to determine the wildlife resources and their distribution, the committee meets regularly to organize scientific inventories and field research throughout the province. On the basis of their research, the scientists evaluate wildlife populations and make suggestions directly to the National People's Congress (NPC), the highest level of government. The NPC then enacts laws or establishes reserves to protect wildlife and plant communities.

Since the mid 1980s, the NPC has enacted a series of laws to protect the natural environment including the Environmental Protection Law, the Forest Law, the Grassland Law, the Water Law, the Fishing Law and the Wildlife Protection Law. Each year the executive State Council establishes more National Reserves. By the end of 1993, there were approximately 800 reserves throughout China, occupying 5.6% of the total land area. Forty of these reserves are at the international level (9 reserves are in the International Man and Biosphere Plan). About 100 reserves are at the national level, similar to the United States' National Parks.

An important element in China's conservation program is to make the people who live on the land aware of conservation laws and protected areas. To do this, the government has launched a national media campaign to educate the population about the need to protect their natural resources. In addition, there are now about 100 journals on the environment and wildlife protection. Each province has its own Environmental Protection Journal. A course of lectures about The Wildlife Protection Law was serialized in the Wild Animals Journal. The Ministry of Radio, Film and Television regularly broadcasts movies and TV programs concerning wildlife. The "Wildlife" program on the Central TV channel has become one of the children's favorite programs. The popular radio program "Half Hour at Noon" normally includes some general information about wildlife. Each year, nationwide, April to May is designated as the "Loving Birds Action" period. This is the breeding season of most birds, and at this time the government offices and schools use the media to organize people and promote a program called "Loving Birds and Protecting Birds." Many schools organize visits to museums to increase their students general knowledge of birds.

Each March 12 is "National Plant Trees Day." On this day, all provincial governments organize people to plant trees in their homes and villages. Everyone, including officers in the central government, becomes involved in this national action. There are five large shelter belt systems throughout China planted to decrease soil erosion from wind and water. They are in the upper and middle reaches of the Yangzi River, the coastal area, the plain area and in Taihang Mountain area Forest Projects; but the most extensive projects are in the three northern regions (northeast, north China, northwest). In forty years

effort, 100 billion trees have been planted. They cover an area of 38,300,000 ha, increasing the forest coverage from 8.6% in 1949 to 12.9% in 1992 (Jin and Wang, 1992). Most of these trees are native poplars which provide habitats for nesting birds and other wildlife.

Wildlife protection courses are becoming more prevalent in the educational system. At present, two colleges have Departments of Wildlife Protection and more than 70 universities have a Department of Environmental Protection. Biology courses are begun in junior high school. In the primary schools, the natural science course includes conservation ideals.

In the area of medicinal uses for natural products, the Chinese government has made some real progress at the cost of losing huge profits. For 300 years, since the Ming Dynasty, China used tiger bones as a medicine to cure rheumatism. In order to protect the tiger, on May 29, 1993, the State Councils prohibited trade in tiger bones as well as rhinoceros horns. Six of the ten most famous medicines of the Beijing Tongren Tang Medicine Store used tiger bones and rhinoceros horns as ingredients. Today, they have stopped producing these medicines and between 34% and 50% of their profits are lost. Throughout China this will amount to about 2 billion RenMinBi (RMB), which is about 250 million dollars. On January 12, 1994 the Jilin government burned more than 50 kg of confiscated tiger bones near the Songhua River. To offset this loss, scientists have found a tiger bone substitute with a similar curative effect. It is the bone of the Plateau Zokor (*Myospaiax baileyi*), a small cave rodent, widespread in Sichuan, Gangsu, Qinghai and Tibet Plateau. Also, scientists are trying to use buffalo horns to substitute for endangered rhinoceros horns, which are thought to have aphrodisiac properties. To protect wild herbs, every Province has begun to cultivate medicinal herbs for their own use.

The conflicts between population, natural resources and the environment must be solved by an effective population policy and an environmental protection policy. Thus, our one-child policy (excluding minorities, who can have two) and recent environmental protection policy have been the two basic ways China is changing its treatment of wildlife and native plant communities.

Wildlife Reserves in Northeast China

1. Xianghai Wetland Nature Reserve

Xianghai Nature Reserve (45°N, 122°E), established by Jilin Province in 1981, is a refuge for endangered waterbirds and covers 105,467 hectares. Reservoir comprises 62.5%, reed marshland 14.4%, grassland 9.3%, forest 7.7% and farmland 6.1%. Over 10,000 people live in 25 villages within the boundaries of the refuge (Bouffard, 1993) and were present before it was declared a reserve. This Nature Reserve protects one of the largest breeding grounds of four species of cranes. These are the red-crowned (*Grus japonensis*), the white-naped (*G. vipio*) (both endangered), the common (*G. grus*) and the demoiselle cranes (*G. virgo*). The reserve also provides important migration stopover sites for two additional cranes, the Siberian (*G. leucogeranus*) and hooded cranes (*G. monacha*) (both are endangered). The area is also important for other endangered species such as the great bustard (*Otis tarda*), oriental white stork (*Ciconia boyciana*), Eurasian white spoon-bills (*Plasalea leucorodia*), and many other wading birds. A 70,000 ha reservoir in the reserve provides essential habitat for thousands of swimming birds. It attracts whooper swans (*Cygnus cygnus*) and whistling swans (*C. columbianus*), as well as many nesting birds such as swan geese (*Anser cygnoides*), mallards (*Anas platyrhynchos*), northern pintails (*A. acuta*), common shelducks (*Tadorna tadorna*), spot-billed ducks (*A. poecilorhyncha*), Eurasian coots (*Fulica atra*), white-winged black terns (*Chlidonias leucoptera*), great cormorants (*Phalacrocorax carbo*),

herring gulls (*Larus argentatus*), black-headed gulls (*L. ridibundus*), little grebes (*Pociceps ruficollis*) and great-crested grebe (*Podiceps cristatus*). The grassland and forest areas are habitats for skylarks (*Alauda arvensis*), crested lark (*Galerida cristata*), horned lark (*Eremophila alpestris*), lapwings (*Vanellus vanellus*), gray-headed lapwings (*V. cinereus*), both Barn (*Hitundo rustica*) and red-rumped swallows (*H. daurica*), the Eurasian hoopoe (*Upupa epops*), ring-necked pheasants (*Phasianus colchicus*), daurian partridges (*Perdix dauricae*), brown (*Lanius cristatus*) and northern shrikes (*L. excubitor*), gray starlings (*Sturnus cineraceus*), black-tailed hawfinch (*Coccothraustes migratorius*) and penduline tits (*Remiz pendulinus*). There are also many nesting black-billed magpies (*Pica pica*) on the reserve, as well as the common cuckoo (*Cuculus canorus*) which is a brood parasite of the passerine birds. Some of the most abundant mammals are gray wolves (*Canis lupus*), red foxes (*Vulpes vulpes*), badgers (*Meles meles*), raccoon dogs (*Nyctereutes procyonoides*), yellow weasels (*Mustela putorius*), hedgehogs (*Erinaceus europaeus*), zokors (*Myaspalax aspalax*), muskrats (*Ondatra zibethicus*) and roe deer (*Capreolus capreolus*).

2. Momoge Wetland Nature Reserve

Momoge Nature Reserve (46°N, 124°E) is one of the eight bird refuges in China and is also a marshland habitat. It has a total area of 10,000 ha. It is an alluvial plain formed by Nenjiang River and its branches. According to initial estimates, there are a total of 137 species of birds on the reserve, about 20 mammals, 10 amphibians, 20 fish and 300 species of plants.

3. Zhalong Wetland Nature Reserve

Zhalong Nature Reserve (47°N, 124°E) is located in Helongjiang Province in the western part of the Songnen Plain. It covers about 210,000 ha and provides habitat for 6 crane species. It protects a breeding ground of red-crowned cranes and is also an important migratory stopover for hundreds of Siberian and hooded cranes. Zhalong is not only important for endangered cranes, but also provides refuge for about 100 species of breeding birds and over 100 additional species that migrate through (Su, et al. 1987).

4. Changbai Mountain Nature Reserve

Changbai Mountain is located at the border of Jilin province of China and North Korea, and has a total area of 190,000 ha. The altitude varies from 500 meters to 2,770 meters above sea level. Changbai Mountain was once an active volcano, but is now dormant. The reserve encompasses river valleys, marshlands, tablelands, slopes, playas, a mountain lake and a crater.

Many complex environmental conditions influence the vertical distribution and diversity of the plants. In general, the plant distribution is a mixed forest of deciduous trees and conifers (600-1000m above sea level), a pine forest (1000-1800m), a beech (*Betula ermani*) forest (1800-2100m) and mountain tundra (2100m and above). Changbai Mountain Nature Reserve contains most of the plant species found between the temperate and the Arctic zones. It is a sample of the northern Eurasian mountain ecosystem, a natural museum where the ecosystem remains intact. The vast Changbai forest contains a large area of the original forest and is home to a diverse and large genetic reservoir of animals, plants and microbes. There are some relic Tertiary plants such as the Korean pine (*Pinus koriensis*), the Yeddo spruce (*Picea jezoensis* var. *microsperma*), the endemic firs (*Abies nephrolepis* and *A. holophylla*), the Japanese yew (*Taxus cuspidata*) and the cork tree (*Quercus mongolica*). There are also some tundra plants such as Leanal herb (*Linnaea borealis*), cowberry (*Vaccinium vitis-idaea* and *V. uliginosum*), rhododendron

(*Rhododendron spp.*) and mountain red-spotted stonecrop (*Sedum spp.*). Altogether, about 1500 species of seed plants, containing more than 800 medicinal herbs, as well as edible algae and fungi, are found here.

About 50 species of mammals, over 300 species of birds and 1000 species of insects are found in the reserve. Several world famous mammals, such as the tiger (*Leo tigris*), leopard (*Leo pardus*) and sika deer (*Cervus nippun*) live here. There are also Asiatic black bears (*Selenaretos thibetanus*), lynxes (*Lynx lynx*), sables (*Martes flavigula*), otters (*Lutra lutra*) and yellow weasels. The beautiful Mandarin duck (*Aix galericulata*) and Chinese merganser (*Mergus squamatus*), which are endangered, also reside here.

There is a lake called "The Lake of Heaven" at the crater. It is about 1,000 km² and is the origin of three principle rivers, the Songhua, the Tumen and the Yialu. Water escapes from a breach at the north part of the lake forming a 68 meter water fall. A group of 1000 m² hot springs are located not far from the waterfall. They contain various minerals that are good for one's health and curing illnesses. All these unique natural resources make Changbai Mountain a famous tourist attraction.

The People's Reaction and the Prospect of the Future

Since China is an agriculturally based country and has the immense pressure of population growth, China's environmental protection policy must be integrated with farming, grazing, fishing and planting orchards. This process is called "Sustainable Agriculture" or "Agricultural Ecology." "Agricultural Ecology" is a new land use approach, yet a very effective way to benefit both humans and nature.

Every province in China now has an Environmental Protection Institute (EPI), and each major city within the province also has an EPI. In 1982, the Beijing Environmental Protection Institute set up an agricultural ecology experiment in a suburb county, Liuminying. Scientists skilled in agricultural conservation methods were assigned to the village. These consultants trained the farmers in ecologically sound farming methods in order to increase their production while protecting natural resources. After six years of hard work, they formed an agricultural product system with high production, high quality and low cost. It is an agricultural ecosystem that is highly effective, stable and reasonable. Since 1984, thousands of scientists from 120 countries have visited this experiment. The press of world population on natural resources necessitates that a more viable and ecologically sound farming system be developed worldwide. The experiment in China's Liuminying village illustrates how this can be done. In 1987, Liuminyin was named "The World Agriculture Ecological Village" by the United Nations Environment Project Agency and was evaluated as one of the 500 best environmental protection areas in the world. Because of this successful experience, many other provinces have begun to set up similar experiments. Today, China has hundreds of agricultural ecology villages.

In Xinzhou, a forest area in Hubei Province, the local EPI helped the farmers establish a functional forest ecosystem with birds in the sky, forest on the ground, wild and domestic ducks on the water and fish in the water. A complete natural food chain has been formed. Every year, farmers can harvest ducks, fish and trees on a sustained basis (worth about 400,000 RMB) without monetary investment because they use the natural regulation effectively. Similar examples can now be found in practically all Chinese provinces.

The government's past twenty years of wildlife education, and its more recent emphasis on conservation have made the people more aware of laws enacted to protect wildlife and the environment. This crusade has enlightened the public to the need for protecting their natural resources and has now become a part of the people's way of life.

In Liaoning Province a resident farmer, Liu Chunsheng, used his savings to buy marble and carved the Environmental Protection Law, the Animal Protection Law of China and the Lyon Declaration of the United Nations' Environmental Protection Congress. He displayed them at the nature reserves to educate the people. He and his family did this hard work without any payment. In order to restore the ecosystem, many farmers have moved to deforested mountains to plant trees.

In Sichuan province, the only region with Giant Pandas, the government has developed a long-term plan to relocate villagers within this reserve. The process takes time and education to help individuals realize the value of preserving the reserve. The same plan might be carried out in the crane reserves of Jilin Province. Relocating people from within the reserves is an option in China, not available in countries of the West (although theoretically land might be condemned for a reserve).

China has moved rapidly in the last 10 years in the area of conservation. She has established many kinds of natural reserves and made a great effort to protect endangered species. Unfortunately, China lacks money and wildlife management knowledge to meet the growing need for wildlife conservation. With the world's largest human population, minimizing human impact and saving endangered species is a challenge not only for China, but for the entire international conservation community. China needs the cooperation of foreign experts in wildlife management to fulfill her commitment to protecting wildlife and natural resources.

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Mining the Middle: Building Community Consensus for Conservation **by Judith LaBelle**

Judith LaBelle has had a multi-faceted career focused on matters relating to land use, the environment, and nonprofit organizations. Prior to assuming her present position as President of The Countryside Institute, Ms. LaBelle served as Corporate Counsel to the National Audubon Society.

In preparing these remarks I realized that the title could have been shortened to "Building Communities," for without strong communities we will not be able to develop an effective consensus for conservation. In many parts of this country, our towns and cities are no longer communities—places where residents have developed ways to mediate and accommodate varied interests within an overarching set of shared values; where people feel a sense of responsibility and stewardship for the place in its many elements—people, land, water, wildlife and cultural resources.

We hear a great deal about reinventing government, but we also need to focus on reinvigorating community and democracy. In *A Sand County Almanac*, Aldo Leopold suggested that ethics develop in sequence, first between individuals, then between individuals and society and lastly between individuals and the environment. Leopold urged that we work on this latter set of relationships, which he termed the "land ethic." But we need to work on the underlying ethics as well.

A prime example of this relationship breakdown between individuals and society is the property rights movement. Respect for property rights is a key component of our political and economic systems. But the extreme form that refuses to recognize reciprocity among rights and responsibilities, in fact, will undermine those systems.

Justice William O. Douglas, while taking a taxi through Washington D.C., is said to have noticed the inscription on a government building that read "The past is prologue." He pondered this, then asked the cab driver what he thought it meant. The driver paused only a moment before he responded: "You ain't seen nothing yet." There are times when that sounds like a threat—but seeing the level of enthusiasm and concern at this conference today, it sounds like a promise. That is our challenge—to make a future of great promise.

So how do we go about this rebuilding of communities? The Countryside Institute (TCI), created about four years ago, seeks to help communities deal more effectively with change by fostering an integrated approach to the conservation of cultural, historic and natural resources. Among its primary programs is the International Countryside Stewardship Exchange. TCI is the institutional home and lead partner for this program, which is run in collaboration with government and nonprofit partners both here and abroad.

Here is how the program works in a region

TCI helps organize a regional coordinating committee with representatives from a wide range of interests, including all levels of government, nonprofits and private organizations. The regional coordinating committee defines issues of concern within the region and produces a request for proposals. Communities are then encouraged to apply for the opportunity to host an Exchange team. To apply, a community must organize a broad-based local coordinating committee which defines the issues of greatest local concern.

Based on the identification of these issues, TCI works with its foreign and domestic partners to assemble teams of eight professionals with the background and experience needed to assess the local problems and develop recommendations for action. TCI also provides overall guidance regarding planning and administration. After 4 to 6 months of further organizing, the Exchange team arrives and spends five days meeting with people representing a wide range of interests in the community. Then, the local coordinating committee hosts a public meeting and the team presents its observations and recommendations.

Benefits from the Exchange accrue on several levels. The creation of the coordinating committees on regional and local levels fosters coalition building. The Exchange week provides an opportunity for these coalitions to have a visible and early success. The Exchange team's report provides the community with an honest snapshot of itself. The team has no authority, so community members are very frank with them. The team listens respectfully to everyone, and by doing so, stimulates community members to listen more attentively to each other. (The various players almost always say that they talk to each other. And they probably do, but it becomes clear that they often do not listen.)

In effect, the Exchange is a form of preventive diplomacy. It provides an opportunity to identify and respond to problems before they become a crisis. And it provides a catalyst for moving forward in an effective manner.

For the team members, who are accomplished mid-career professionals, it provides an opportunity to work with peers from other disciplines and from other countries on a real case study. It results in professional rejuvenation, a renewed recognition of the need to work collaboratively and innovative approaches.

We are currently working toward an Exchange in the Chesapeake Bay Region to be held this fall. Over thirty organizations, including the Environmental Protection Agency, the National Park Service and a wide range of state officials and nonprofits, are serving on the regional coordinating committee which will choose three communities from among the fourteen that applied to host Exchange teams. All of the communities will be within the Chesapeake Bay watershed; a major theme will be how these communities can remain vital places to live and work, while respecting the need to protect and restore the watershed.

Other Exchanges, including one with eight sites in 1995, are in the planning stages. We anticipate that each Exchange will work with a cluster of communities that are related in some way to a common resource—whether a watershed, river or trail system.

What guidance can we glean from the Exchange experience?

1. We learn the importance of broad-based coalitions. The coalitions that are developed on the regional and local levels are not just environmental. They also include representatives of organizations concerned about economic development, historic preservation, social services and agriculture—all of the interests whose authority (both moral and political) will be needed to move forward toward what are sometimes termed "sustainable communities." Too often we miss opportunities because these organizations are on separate tracks and their common interests are unknown. The Exchange encourages these coalitions to reach out to those who have become disenchanted and disenfranchised. In many communities this includes those who are the closest to the land and therefore essential players. This is especially important

if the Exchange and the coalitions it engenders are to provide the groundwork for effective longterm action.

2. Mining the middle. It is essential to look hard for common interests and concerns and build on them. Personal, working relationships that engender the trust needed to deal with big issues must be built. One way to begin this process is to start with small projects and gradually build to more important ones—"small steps for small feet."

3. The importance of confirmation. As a catalyst for further community action, the team members "from away" confirm the value of the community and its resources, the importance of the community's concerns and the common nature of their problems—they are not alone.

4. Patience. Coalition-building is a slow process and small steps, successfully completed, are key to building trust and assuring participants there are no hidden agendas.

5. The need to celebrate and save our cities. Livable cities are the answer to urban sprawl, otherwise the pressure will be unstoppable. Unless we build a connection between the city and the country neither region will have a healthy community. This underscores the issues that relate to social justice, the need for diversity and environmental justice.

There is a great deal of hard work ahead as we attempt to rebuild our sense of community and develop a consensus for conservation—to make "you ain't seen nothing yet" a promise rather than a threat.

Appendix I: Speakers' Addresses & Telephone Numbers

George Archibald
Director, International Crane Foundation
E-11376 Shady Lane Road
Baraboo, WI 53913
Tel: 608-356-9462
Fax: 608-356-9465

Peter A.A. Berle
President, National Audubon Society
700 Broadway
New York, NY 10003-9501
Tel: 212-979-3000
Fax: 212-979-3188

Charles Bicak
Professor of Ecology, University of Nebraska
Biology Department
University of Nebraska at Kearney
Kearney, NE 68849
Tel: 308-234-8883
Fax: 308-234-8157

Jim Harris
Deputy Director, International Crane Foundation
E-11376 Shady Lane Road
Baraboo, WI 53913
Tel: 608-356-9462
Fax: 608-356-9465

Judy LaBelle
President, The Countryside Institute
190 Riverside Drive
New York, NY 10024
Tel: 212-595-4985
Fax: 212-724-2223

Steven Landfried
Landfried Consultants
The Big House
11350 W. State Road 59
Evansville, WI 53526
Tel: 608-873-8848
Fax: 608-882-5533

M. Mumtaz Malik
Conservator of Wildlife
NWFP Forest Office
Shami Rd
Peshawar, Pakistan
Tel: 92-522-73184
Fax: 92-521-270-442

Sergei Smirenski
Coordinator, Amur River Conservation Project
Socio-Ecological Union
4 Luchnikov per., #10-11
Moscow, Russia

Mahendra Shrestha
309 D, Eagle Heights Apts.
Madison, WI 53705
Tel: 608-238-9462

Kenneth Strom
National Audubon Society
Project Coordinator, Sharing the Earth
4225 Weld County Rd. 1 1/2
Erie, CO 80516
Tel: 303-828-0612
Fax: 303-828-0612

Rajendra Nar Singh Suwal
Biologist, Gaida Wildlife Camp
924 Chhatrapaty
Kathmandu 13 NEPAL
Tel: 9771-214245
Fax: 9771-411933

Chuck Trost
Idaho State University
Department of Biological Sciences
Pocatello, ID 83209
Tel: 208-236-3337
Fax: 208-236-4570

Patricia Waak
National Audubon Society
Director, Human Population and Resource Use
4150 Darley, Suite 7
Boulder, CO 80303
Tel: 303-499-5155
Fax: 303-499-0286

Wang Xiaohong
PhD Candidate, Idaho State University
1230 College Road
Pocatello, ID 83204
Tel: 208-232-0233

Appendix II: Population Resources

The following population resources are available from the National Audubon Society's Human Population and Resource Use Department, 4150 Darley Avenue, Suite 7, Boulder, Colorado 80303.

Sharing the Earth: Cross-Cultural Experiences in Population, Wildlife and the Environment

Documents a groundbreaking international exchange program between wildlife managers in the U.S. and their counterparts in developing countries to study the impact of human numbers and activities on the wildlife and habitat. Over 80 full-color photographs from sanctuaries around the globe and 13 original watercolor illustrations. Hardcover: \$34.95. Softcover: \$24.95.

Human Population and Wildlife: An Audubon Perspective

Accompanying video to the *Sharing the Earth* book. Includes slide footage of case studies in Pakistan, Kenya and Guatemala. One hour color video available in PAL and NTSC VHS. \$25.00.

People and the Planet

A joint magazine of the United Nations Population Fund, the World Conservation Union, the International Planned Parenthood Federation published in cooperation with international organizations involved with various aspects of population, environment and development. \$1.00 for a sample copy.

What is the Limit?

Audubon's popular video on population and the environment. Presents a probing discussion of the interrelationships between human population growth, environmental degradation, resource depletion, habitat destruction and the ethical considerations for the future. Video and accompanying discussion guide: \$25.00.

Finding the Balance?

The sequel to *What is the Limit?* Presents creative solutions to growth and resource management. Documents the experience of four communities in Costa Rica, Texas, California and Nebraska in meeting crises related to human population growth and consumption. (40 min.) \$25.00.

Population—How to Make a Difference Video

The latest in Audubon's How to Make a Difference video series, this short video examines issues of family planning, women's health and education that are critical to developing countries, as well as the "throw-away" lifestyle found in developed countries like the United States. Special segments on lobbying, the home video as environmental tool and "green living." \$12.95.

Also available are population policy papers (*Population and Water Resources*, *Population and Energy* and *Population and Forests*), population fact sheets (on forests, wildlife and wetlands), extra copies of the special population issue of the *Audubon Activist* and Audubon's networking journal for population activists, *Action International*.

Now available is *Faith, Justice and a Healthy World*, A Guide on Population and Environment for People of Faith.