Great Lakes Governors Propose Historic Water Resources Compact
[From American Bar Association's *Trends*, Vol. 36, Issue 2]
By Noah D. Hall[1]

Introduction

The Great Lakes hold twenty percent of the world's available freshwater and ninety-five percent of the freshwater in the United States, and together with their tributaries provide drinking water for forty million people in the region. Yet the lakes are fragile and vulnerable to depletion: less than one percent of the water is renewed annually. Eight states – Michigan, Wisconsin, Ohio, New York, Indiana, Illinois, Minnesota, and Pennsylvania – share the Great Lakes with the Canadian provinces of Ontario and Quebec. These states and provinces have a long history of unfulfilled handshake agreements with lofty goals of joint management and water conservation. However, a new proposal by the Great Lakes Governors would create an interstate compact to jointly manage diversions and large water losses, as well as create uniform standards for state management of all water withdrawals.

History and Background

In 1985 the Great Lakes states and provinces signed the Great Lakes Charter, a non-binding agreement for notice and consultation on proposed diversions and consumptive uses of Great Lakes water exceeding five million gallons per day (mgd). They also promised to individually manage and regulate large diversions and consumptive uses of Great Lakes water, and to register and collect basic data on all withdrawals greater than 100,000 gallons per day (gpd). Unfortunately, compliance has been inconsistent. Whereas some of the region's states have fairly comprehensive water management policies, others have practically nothing.

More substantively, Congress passed the 1986 Water Resources Development Act (WRDA) with a provision granting the Great Lakes Governors authority over new diversions. The Act provides that "[N]o water shall be diverted or exported from any portion of the Great Lakes within the United States, or from any tributary within the United States of any of the Great Lakes, for use outside the Great Lakes basin unless such diversion or export is approved by the Governor of each of the Great Lakes States." 42 U.S.C. Sec. 1962d-20(d). This federal law is popularly referenced as the Governor's "veto" authority, because any single Governor can deny a Great Lakes diversion. However, the Act lacks any standards, public process, or enforcement provisions, and only applies to one subset of water withdrawals – diversions of surface water out of the basin.

Recognizing the Act's shortcomings and limitations, Congress amended section 1962d-20 in 2000 to "encourage the Great Lakes States, in consultation with the Provinces of Ontario and Quebec, to develop and implement a mechanism that provides a common conservation standard embodying the principles of water conservation and resource improvement for making decisions concerning the withdrawal and use of water from the Great Lakes Basin." 42 U.S.C. Sec. 1962d-20(b)(2). This provision not only encouraged the creation of decision-making standards, but also referenced the need for management of in-basin waters uses in addition to diversions.

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Growing Pressures on the Great Lakes

As world supplies of quality drinking water diminish, the Great Lakes have become a tempting option for global export. In 1998 a foreign corporation, the Nova Group, received preliminary approval from Ontario to export Great Lakes water by tanker to Asia. Although the approval was later withdrawn, the incident demonstrated the need for new science-based standards to protect the Great Lakes from global export schemes and challenges under international trade agreements. Additionally, as the population (and political power) of many arid U.S. states continues to grow, so too has the fear within the Great Lakes region of massive water diversions.

Increasing pressure to access Great Lakes water also comes from communities just outside the watershed divide. In many parts of the region, the surface watershed divide extends only a few miles from the lakeshore, separating inner cities from growing suburbs. Milwaukee, for example, is within the basin; yet extending beyond the watershed divide to the west are its suburbs, some of which have depleted local water supplies and seek to tap the Great Lakes.

Finally, there is increased concern about the potential impacts of large, unregulated water losses within the basin, such as massive agricultural irrigation systems. Depleted aquifers, drained streams and wetlands, and declining inland lake levels demonstrate the once-held fallacy of abundant and limitless water.

Annex 2001

Recognizing the limits of existing laws and policies and the growing threats to the Great Lakes, the region's Governors and Premiers signed a non-binding Annex to the Great Lakes Charter Agreement in 2001. Popularly referred to as Annex 2001, the agreement established fundamental principles for management of Great Lakes water:

1. Preventing or minimizing water loss through return flow and implementation of environmentally sound and economically feasible water conservation measures; and

2. Preventing significant adverse individual or cumulative impacts to the quantity or quality of the waters and water-dependent natural resources of the Great Lakes Basin; and

3. Improving the waters and water-dependent natural resources of the Great Lakes Basin.

In the agreement, the Governors and Premiers committed to develop a binding agreement to apply these principles to all water withdrawals (not just diversions) within the Great Lakes basin, including tributary surface waters and groundwater. The agreement is expressly limited to new or increased withdrawals; existing withdrawals are not covered.

The most promising principle in the agreement was the improvement standard, which recognized that limiting harm is no longer enough. Users of Great Lakes water must leave conditions better than they found them.

The Proposed Compact

After signing Annex 2001, the Council of Great Lakes Governors established a Water Management Working Group (aided by an Advisory Committee of stakeholders) to implement the Annex 2001

principles. The Draft Great Lakes Basin Water Resources Compact as well as the Draft Great Lakes Basin Sustainable Water Resources Agreement were formally released by the Council of Great Lakes Governors on July 19, 2004. The proposal will be subject to a 90-day public comment period, with dozens of regional and state public meetings and hearings throughout the region.

(For copies of the proposed documents, schedules of hearings, and forms to submit comments, see the Council of Great Lakes Governors website, www.cglg.org/1projects/water/Annex2001Implementing.asp, or visit www.speakongreatlakes.org for additional information.)

The compact uses a two-part structure and design to manage new or increased water withdrawals in the Great Lakes basin. First, it establishes a Compact Council – comprised of each of the Great Lakes governors – with authority to review large diversions and consumptive losses of Great Lakes water. Second, the compact requires that each of the states implement state programs that meet the same minimum standards for reviewing all withdrawals not subject to Compact Council review.

The Compact Council has the authority to review all diversions above one mgd and consumptive uses above five mgd. Diversion is defined as the transfer of water from the Great Lakes basin into another watershed, or from the watershed of one of the Great Lakes into that of another. Consumptive use is defined as that portion of water withdrawn from the Great Lakes basin that is lost or otherwise not returned to the basin due to evaporation, incorporation into products, or other processes. Consumptive use varies based on the type of water use. Both the one mgd threshold for diversions and five mgd threshold for consumptive uses are averaged over any 120-day period. Compact Council approval of diversions requires a unanimous vote, while approval of consumptive uses requires a supermajority (6-2) vote. Approval may only be given when:

1. The need for the proposed water withdrawal cannot be reasonably avoided through the efficient use and conservation of existing water supplies;

2. The water withdrawal is limited to quantities considered reasonable for the purposes proposed;

3. All water withdrawn is returned to the respective watershed, less an allowance for consumptive use of the applicable water use sector;

4. The withdrawal results in no significant individual or cumulative adverse impacts to the quantity or quality of the waters and water-dependent natural resources of the Great Lakes basin;

5. The withdrawal proposal incorporates environmentally sound and economically feasible water conservation measures;

6. The withdrawal proposal incorporates an improvement to the physical, chemical or biological integrity of the waters and water dependent natural resources of the Great Lakes basin; and,

7. The withdrawal complies with all applicable state and federal laws as well as regional interstate and international agreements.

Individual states are required to manage and regulate all withdrawals below the Compact Council thresholds of one mgd for diversions and five mgd for consumptive uses based on the same standards, with several notable qualifications:

1. Individual states will have up to ten years from the effective date of the compact to manage and regulate withdrawals of water for in-basin use below the Compact Council review threshold.

2. Withdrawals for in-basin use below 100,000 gpd (averaged over any 120-day period) are not required to be managed or regulated by the states.

3. The improvement standard (paragraph 6 above) does not apply to withdrawals of water for in-basin use below the Compact Council review threshold.

These standards are merely minimums; states may have stricter standards for withdrawals both above and below the Compact Council review thresholds.

The Compact Council may issue compliance orders relating to water withdrawals and seek remedies of equitable relief and civil penalties. Upon a vote by seven of the eight Compact Council members, the Compact Council may also bring a petition in federal court to suspend the state's voting rights if the court finds the state to be in violation of its compact duties.

The compact also contains provisions for promulgating and enforcing rules; ensuring public process, notification, and hearings; and consultation with federally recognized tribes and Canadian provinces. Judicial review for state decisions would follow state administrative procedures and be heard in the respective state court.

In addition to the compact, the Governors and Premiers have proposed a good faith agreement between the states and Canadian provinces. Whereas a binding agreement would be politically and legally impractical, the good faith agreement encourages the same minimum standards on both sides of the border. The good faith agreement also contains significantly more detail as guidance to the Compact Council and individual states and provinces for promulgating their respective rules and regulations.

Next Steps

Following the public comment period, the Governors will continue their discussions and hope to finalize the proposed agreements in early 2005. The proposed compact would then need to be ratified in each of the state legislatures and approved by Congress. The states obviously have a challenging road ahead, but the reward – precedent setting water management policies for the world's greatest freshwater resource – justifies the effort.

The Sustainable Water Resources Roundtable
April 5-6, 2005 Ann Arbor, Michigan
Exploring Research Needs for Sustainable Water Resources
Roundtable Discussion concerning Water Policy/ Law/ Ethics
David Urban, Land and Water Resources, Inc.

Water Policy and the Great Lakes

The main point of this discussion is-

> Market-based solutions can effectively help sustain water resources in the Great Lakes Basin by improving distribution, allocation and ecosystem health.

I will first discuss three different views of environmental protection, and then show how these views are embodied in water resource policy. I will then present a case study of how these different views have worked in Federal wetland policy. I will then discuss how these different views are working out in state water policy on Great Lakes Water. Finally I will argue that the states in Great Lakes water policy need to support market based solutions to sustain water resources and ecosystem health.

Three Approaches to Water Policy

> "Ruin is the destination toward which all men rush, each pursuing his own best interest in a society which believes in the freedom of the commons" – Garrett Hardin in "The Tragedy of the Commons"

Although one can argue whether or not we have reached the point of ruin of the Great Lakes in particular and the environment in general, the debate about how to protect the environment has been going on in this country for many years. John Muir and Henry Thoreau were the forefathers of a preservationist view of the environment. This view held that human action degraded the environment. Many in the environmental movement today hold this view of the human relation to the environment and take action to protect and preserve from this philosophy. This view believes that education of the population about environmental benefits and good will leads to protection of the environment. I will call this view the Preservationist view.

Others such as Garrett Hardin and Lester Brown view the abuse of the environment as a result of viewing the environment as part of the commons

which can be used for “free”. When the water, air and land are held in commons, then each person attempts to maximize the value they can obtain from that piece of the environment irrespective of how others are using it. This view argues that the environment should be viewed as a “commodity” for purposes of environmental protection and sustainability. I will call this view the Hardinian view.

A third view calls for no restraint on the use of environmental resources. I will call this view the Commonist view. While often self-described as a “Free Market” view, the Commonist agenda is really a commitment to a “Free Lunch.”

These three views are based ultimately on the competing views of the state of humans- the Erasmus view that humans are basically good or Luther and Calvin’s view of man as basically corrupt.

The result of these competing views of the environmental protection has lead to three different approaches to environmental and natural resource policy. The Preservationist view first tries to educate the world about the benefits of the environment, and expects that humankind will voluntarily stop environment degradation. When this doesn’t occur, the Preservationist attempts to restrain human use of the environment. This has lead to the creation of nature preserves, and attempts in the Great Lakes to stop all additional withdraws of water from the Great Lakes.

The Hardinian View calls for an enclosure of the commons, which is the allocation of the various natural resources such as water to entities who will take responsibility for the care and use of that resource. When allocation takes place, without subsidy, the true value of the resource is identified.

The Commonist view argues that one should continue operating the way one has always been operating.

Current Water Policy in the United States

Currently, the Midwest and Eastern states work under a “commons” system of water management for both surface and groundwater. This regional approach to water rests upon the reality that states east of the Mississippi have traditionally been blessed with an abundance of water. Under this regime, property owners can use the water that flows through their land without worry or constraint, as long as the downstream user is not adversely

affected by the upstream use. In addition, groundwater has traditionally been viewed as separate from surface water, and freely available to any who drill for it.

In the Western states where the climate is generally arid and water is scarce, the "allocation method" of water management dominates. A whole history of case law and precedent has decided who is allowed to use the water and for what capacity.

While many argue that western water law has neglected the environment, the theory and practice of ownership of every drop of water in the west can allow a system where the environment can be maintained in a healthy state, if a fair, transparent market backed by fair, transparent laws, is allowed to emerge. I argue that the insertion of artificial demands and price support for various interests, backed by government sanctioned manipulation and lack of transparency, is what has caused the decline of the environment in the west.

Current state of Water Policy in the Great Lakes

In 1999, the Ontario based NOVA group applied for a permit to divert water from the Great Lakes and ship it by tanker to "Asia." The NOVA group was taking advantage of the commons view of Great Lakes water, and attempting to solve the shortage of water in another part of the world, and make money doing so. This was no different than the multitude of public and private water supply entities which take advantage of the commons view of Great Lakes water. These other private and public water supply entities take the water for free and sell it to others, or freely use it in manufacturing processes, and make money during the process. What captured public attention, fear and trembling was that the NOVA group was attempting to move water in a novel (for the Great Lakes) method and to a novel location.

The action by NOVA led to an outcry by many people. The Preservationist environmentalists called for the protection of the Great Lakes and pushed for no comodification of the water even though water has been treated like a commodity for years. The traditional "Commonist" entities like industrial and public water supply users called for the free use of Great Lakes water, but only for entities within the Great Lakes.

The Governors and Premiers of the Great Lakes States, who had previously agreed to work together under the aegis of the "Great Lakes Charter" started

working on regulations to control the use of Great Lakes water. In 2001 they signed the Great Lakes Charter Annex in which they agreed to create regulations by 2004 for the use of Great Lakes water. Draft regulations were promulgated in late 2004 and over 10,000 different groups and individuals commented on the draft regulations. The groups were divided between the differing viewpoints on how to handle Great Lakes water. As a result the Water Working Group, which is made up of representatives of each state which borders the Great Lakes is reworking the regulations and will publish a re draft in summer of 2005.

In addition to these efforts, other regulations and treaties have a play in Great Lakes water use. The Federal government in the 1986 Water Resource Development Act delegated to the states the power to agree on water diversions, even though the Great Lakes should fall under federal purview due to the Commerce Clause of the Constitution. International trade laws, such as GATT, also have legal implications as to what can and cannot be done with Great Lakes water.

The Great Lakes are at a point where many people are wrestling with how to rework environmental water policy. There are many other entities besides the NOVA group who want to use Great Lakes water. Many communities just outside the basin are facing depletion of their water resources which often are derived from groundwater.

Wetland Case Study

I am going to discuss another water policy which is in effect, the policy on wetlands, and show how a Hardinian view can make a positive impact on water policy. I hope to use this case study to show how this view can make a positive impact on Great Lakes water policy.

Many studies have been conducted which demonstrated that wetlands are important for not only wildlife but for humans. Wetlands act as nature’s kidneys, cleaning the water, and act as flood storage to prevent flooding. Other studies demonstrated the amount of wetland lost over the centuries since European immigration changed the landscape. The loss became so noticeable that various groups pushed to either prohibit or regulate the fill of wetlands and waters. Ultimately a balance was reached between those who wanted to prohibit the fill and those who wanted to keep the commons open.

The Federal government regulates the placement of pollution, including fill into “waters of the United States” under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. “Waters of the United States” have been defined by various courts and Congress to include “wetlands” To fill “waters” one must obtain a permit from the US Army Corps of Engineers. For many years the Corps only regulated the placement of fill in navigable channels under Section 10, that is where commercial navigation occurred. When Section 404was passed in the mid 1970s the Corps extended the jurisdictional reach and took over placement of fill within waters which flowed into navigable channels. Then through court action, the Corps extended the reach into wetlands adjacent to channels. In the late 1980’s one could fill up to 10 acres of wetland with little or no permitting. By the mid 1990’s the limit was 1 acre, then 0.25 acres and now in the Chicago District, the limit is 0.1 acre of wetland can be filled without extensive permitting.

The Commonists argued that wetlands were tied to land ownership, and that one should be able to do what one wanted on one’s own land. The Preservationists argued that no wetlands could be filled. They were instrumental in getting a sequencing policy created: “Avoid, minimize, and then mitigate” The idea was that someone who wanted to fill a wetland should prove that they could not avoid the wetland to get a permit. If they could not prove the need, they should not be able to obtain a permit. If they could prove a need, they should minimize the impact to the wetland. Only after avoiding or minimizing, should an entity be allowed to fill. If they needed to fill, they should mitigate for the loss, preferably on the same site as the fill.

What developed over years was a patchwork of small disconnected wetlands spread out in the midst of suburban land use with degraded ecosystem functions. Wetlands which were being created onsite were being created by developers with no incentive to create high quality ecosystems. In addition the regulatory authorities were overwhelmed with the responsibility of working through the sequencing process and determining if the mitigation was acceptable. This command and control approach to wetland mitigation resulted in a failure to protect the resource.

In the early 1990’s groups of environmental entrepreneurs and regulators looked at the failure of the system to protect the environment and tried a market approach to wetland policy. The approach was to let private and governmental entities to restore and create large scale wetlands which could be used for mitigation. An entity which desired to fill in wetlands could pay

the wetland mitigation entity a fee to take over responsibility for the mitigation requirements which the agencies demanded. A series of economic and ecosystem controls were put into place to ensure that these wetland mitigation areas were functioning.

As a result of this approach, called wetland mitigation banking, developers have been freed to do what they do best, and large scale landscapes are restored for ecosystem health.

Problems still existing with the wetland mitigation banking system. Many of the regulatory agencies are not actively enforcing to the extent possible the filling of wetlands. There is still is a belief that no wetlands should be filled and that there is no way mitigation can ecologically function the same as a natural wetland. The system still retains vestiges of a "command and control" ideology. None the less, more and more both regulatory agencies and those concerned with the health of the environment are seeing the benefits of the system, which result in the aggregation of large parcels of land preserved and enhanced, while allowing the use of other lands for other purposes.

Implications for future Water Policy.

I believe that the most sustainable approach to supporting both human use and ecosystems is through a regulated market mechanism. We are facing a world where the commons (that is water resources) needs to be enclosed. We have the lessons, both good and bad of western water policy and of the wetland mitigation world which can guide us in the formation of this new policy.

I do not believe that either the Preservationist view or the Commonist view of the environment is sustainable.

Our operating assumption is that regulatory drivers and a set of constraints are necessary to create and structure supply and demand for sustainable projects. A market-based system requires an assignment and guarantee of "value" for the market to succeed. This value can be established by one off trades between two parties, but to make the work sustainable, a regulatory framework which establishes what the asset is, must be created. Justice Oliver Wendell Holmes, Jr., emphasized the essential role of government in creating "property," whether real or intellectual. Absent governmental action to create and secure property interests in ideas, objects, processes and

functions, there may be a perceived “value,” but the value is not publicly secure, i.e., “property,” for those who create and use it. Once “property” is created, then “value” can be assigned to that property and it can be compared to and traded with other kinds of property with value.

It is possible that without a regulatory driver, the only way that projects which improve the health of the Great Lakes ecosystem will occur will be through grants and government action, both of which are fragmented and subject to other competing needs, and arbitrary, changeable individual preferences. Sustainability requires greater durability and security.

Toward A National Set of Water Sustainability Indicators

Sustainable Water Resources Roundtable

Indicator Working Group

April 6, 2005

Purpose of Working Group

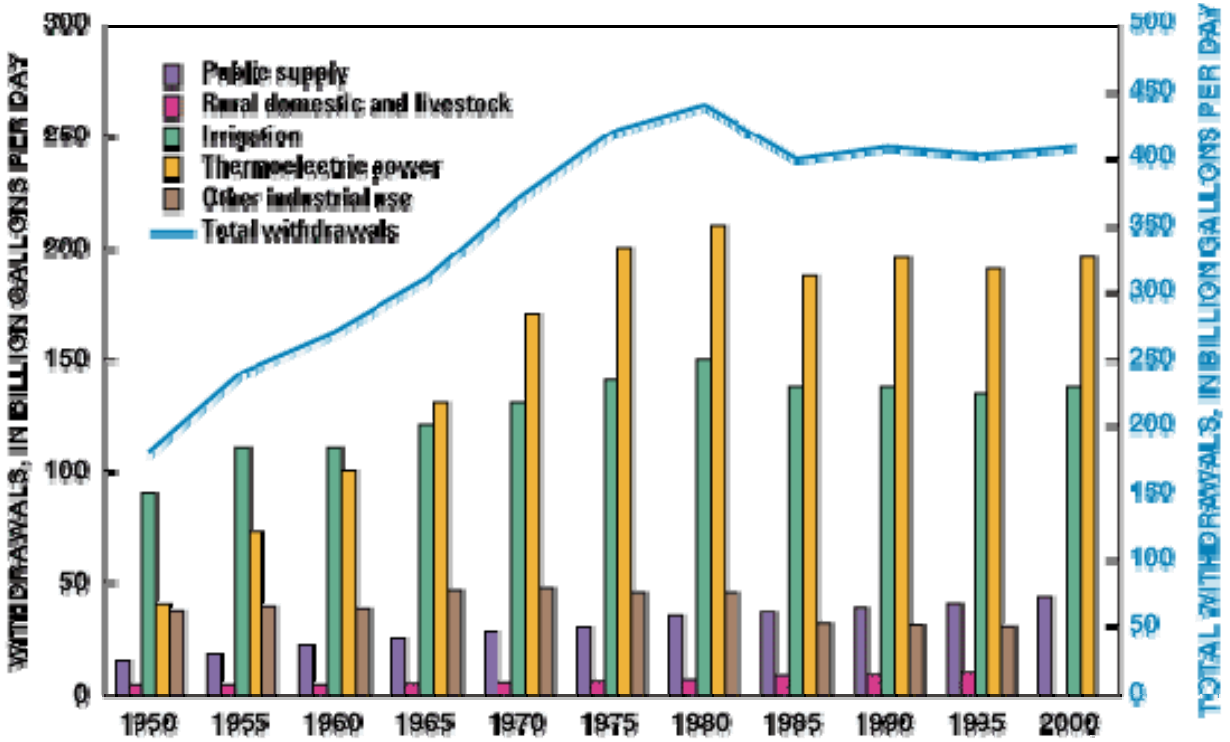
- To develop a set of criteria and indicators relevant to the sustainability of water resources in the US

Water use in South Florida supports agriculture, Everglades habitats, Miami

Definition of Indicators

- Performance measures that aggregate information into useable forms
- Routinely published statistical measures of natural or socio-economic phenomena

Example: Trends in Total US Water Withdrawals, 1950-2000



Why Develop Indicators?

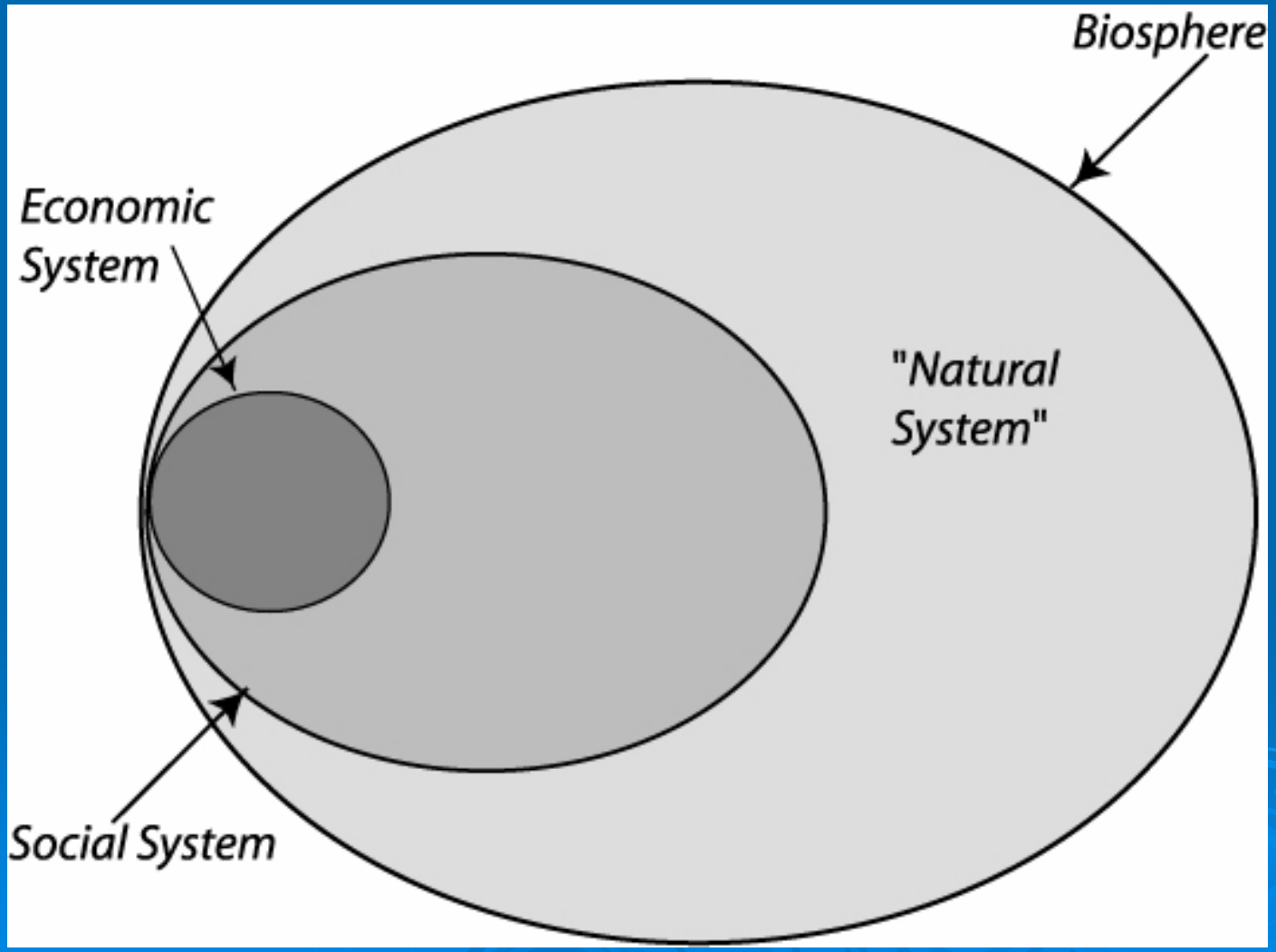
- To affect the way decisions are made over time
- To improve information flow ("chatter") in the many forms in which it is exchanged

A National Set of Indicators Should Be

- Comprehensive
- Well organized
- Valid
- Trusted
- Routinely reported
- Accessible
- Easy to interpret into understandable stories

Phase 1: Develop a Conceptual Framework for Selection of Criteria and Indicators

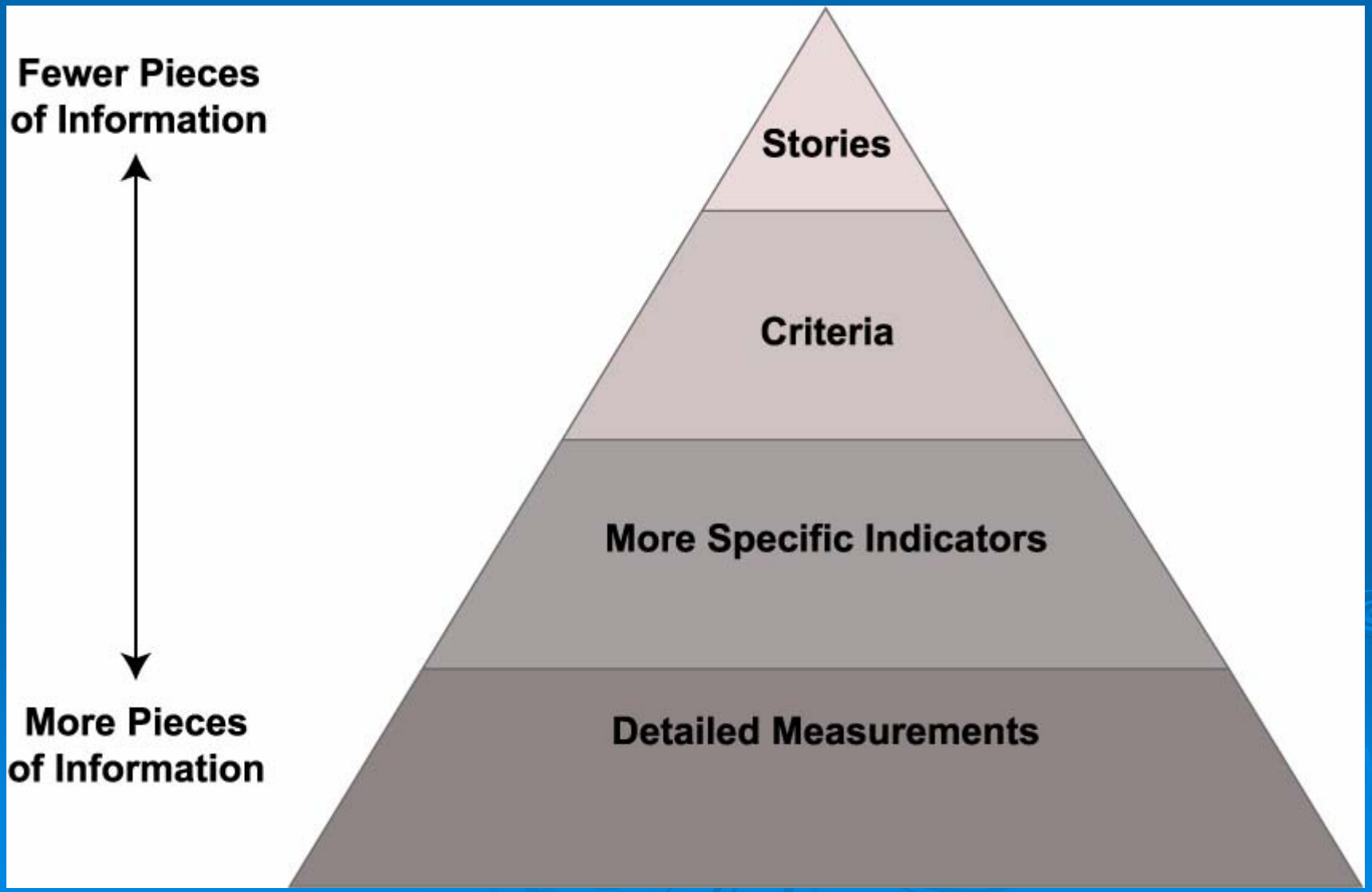
General Systems Perspective



Capital Maintenance

- Achieve sustainability by maintaining the capacity of natural, social, and economic capital to meet human and non-human needs
  - Capital: The capacity to produce a flow of value over an extended time

Information Concepts



Phase 2: Develop a Comprehensive Set of Criteria and Indicators

Economic System Criteria

- Capacity to make water of appropriate quality and quantity available for human uses
- Economic well being resulting from use of water and affected land resources

Economic System Criteria

- Capacity to achieve economic value resulting from the use of water-related ecological resources
- Value of investments to maintain or enhance the quality and quantity of water

Social System Criteria

- The social well being resulting from the use of water and water-related ecological resources
- The social capacity for the management of water and related land resources for sustainability, including human health and well being

Ecological System Criteria

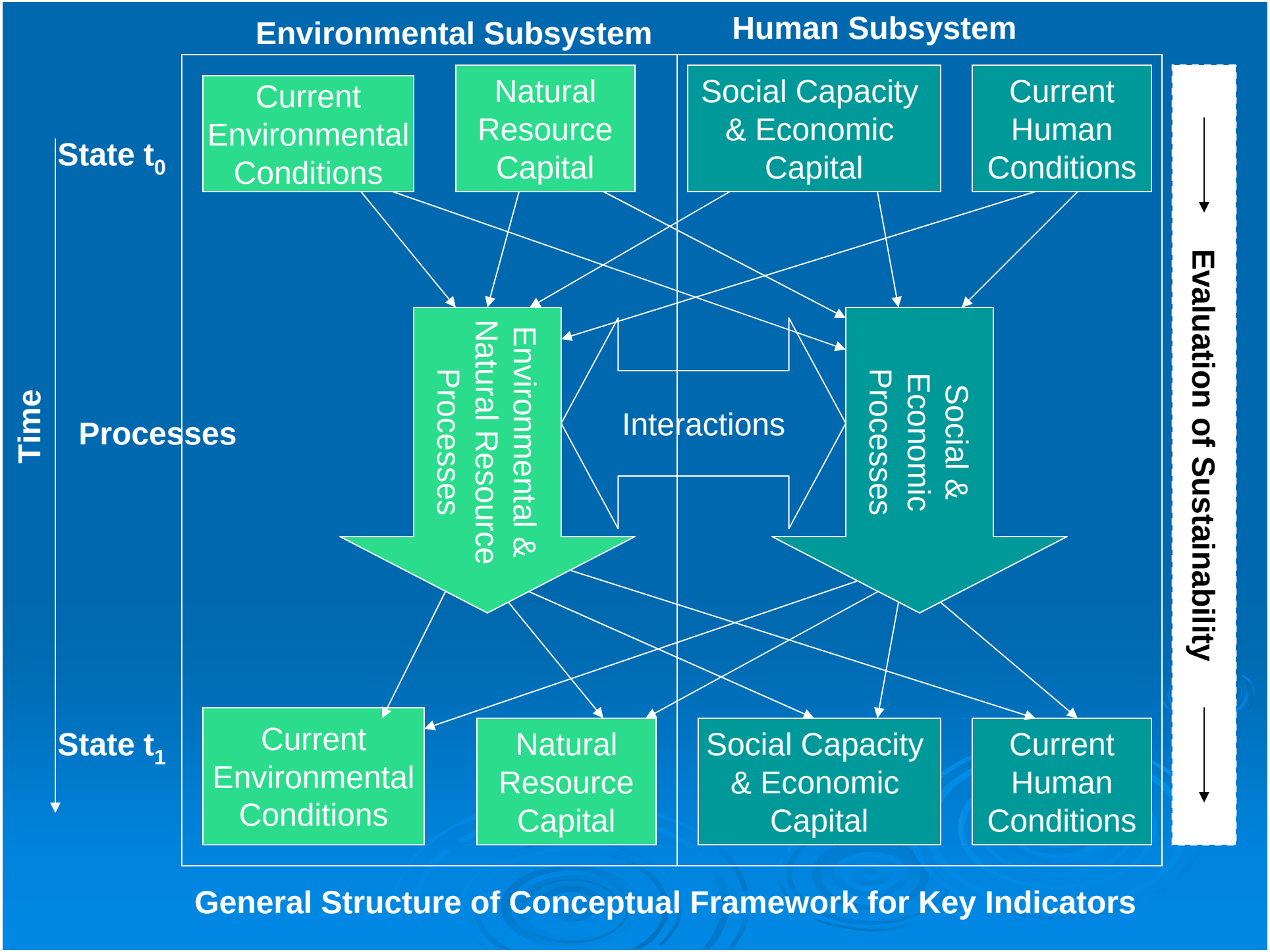
- Capacity to make water of appropriate quality and quantity available to support ecosystems at multiple spatial and temporal scales
- Integrity of water-dependent ecosystems at multiple spatial and temporal scales

Categories, Sub-Categories, and Specific Indicators

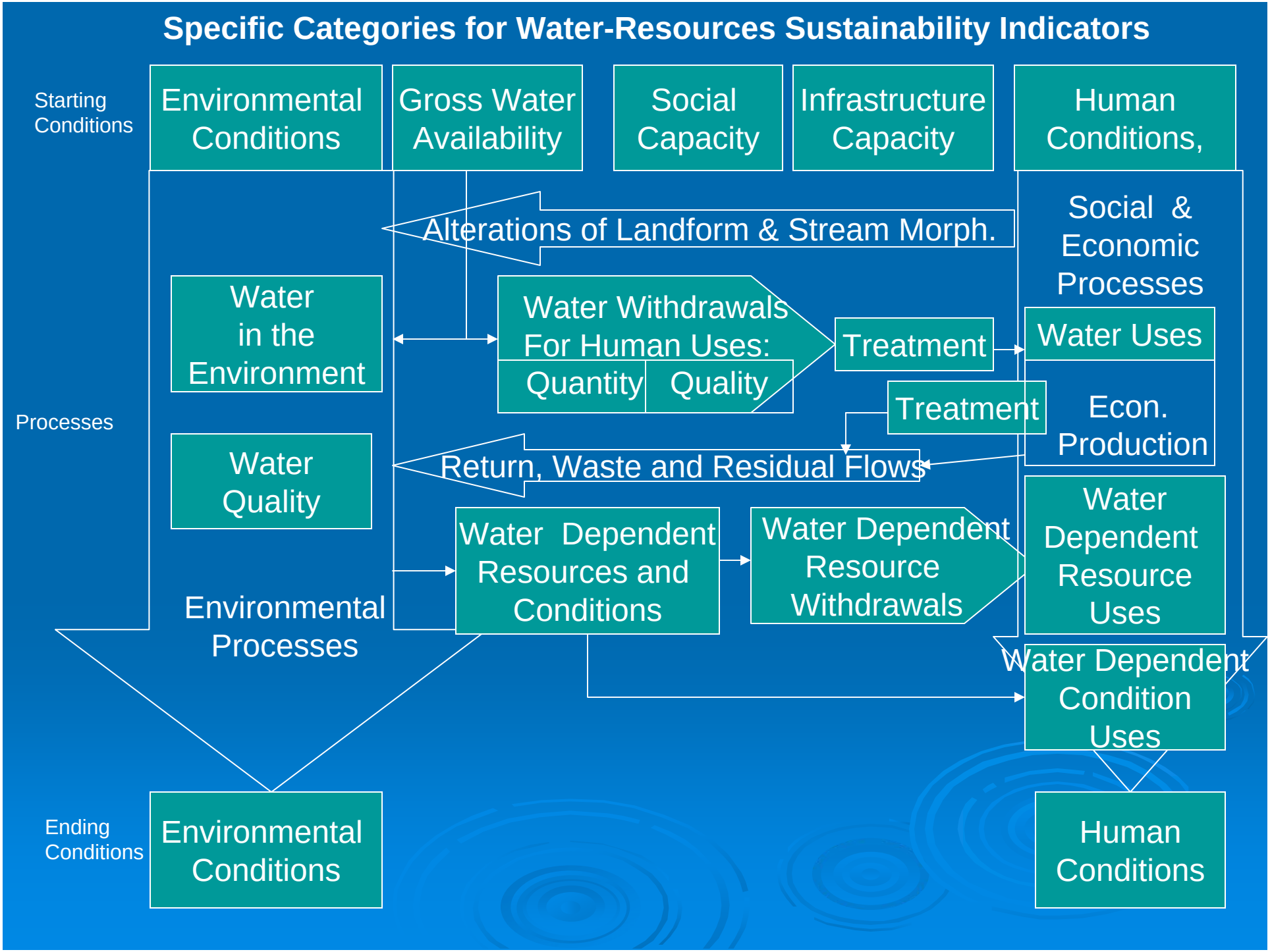
- Indicator categories and sub-categories identified within each of the Criteria
- Nearly 400 indicators/measurements were recommended

Phase 3: Identify A Small Set of Key Indicators

- For a broad range of interests
- To convey a general sense of the sustainability of water resources



General Structure of Conceptual Framework for Key Indicators


Specific Categories for Water-Resources Sustainability Indicators
Starting Conditions
Environmental Conditions
Gross Water Availability
Social Capacity
Infrastructure Capacity
Human Conditions,
Alterations of Landform & Stream Morph.
Social & Economic Processes
Water in the Environment
Water Withdrawals For Human Uses:
Quantity
Quality
Treatment
Water Uses
Processes
Treatment
Econ. Production
Water Quality
Return, Waste and Residual Flows
Water Dependent Resources and Conditions
Water Dependent Resource Withdrawals
Water Dependent Resource Uses
Environmental Processes
Water Dependent Condition Uses
Ending Conditions
Environmental Conditions
Human Conditions

A Simpler Framework of Four General Categories

- Water-resources capacities and their allocation to different uses and functions
- The consequences of water-resources allocation, including human uses of water and water-dependent resources and conditions

- The effects of those consequences on environmental and human conditions
- Key processes and driving forces that underlie these capacities, allocations, consequences, and effects

Next Steps

- Complete a draft list of key indicators
- Seek comments on this list
- Prepare a report describing the indicators (by September 30)

Charge for Afternoon Discussions

- Scan draft list of indicators for relevance and clarity
- Provide feedback on how the list could be improved

U.S. Department of Energy
Energy Efficiency and Renewable Energy

SWRR Workshop on Research Needs

Role of Renewable Resources

Laura Miner-Nordstrom

Photo source: Windmillers' Gazette http://www.windmillersgazette.com/images/photo18.jpg

Overview

Energy-water and the role of renewables

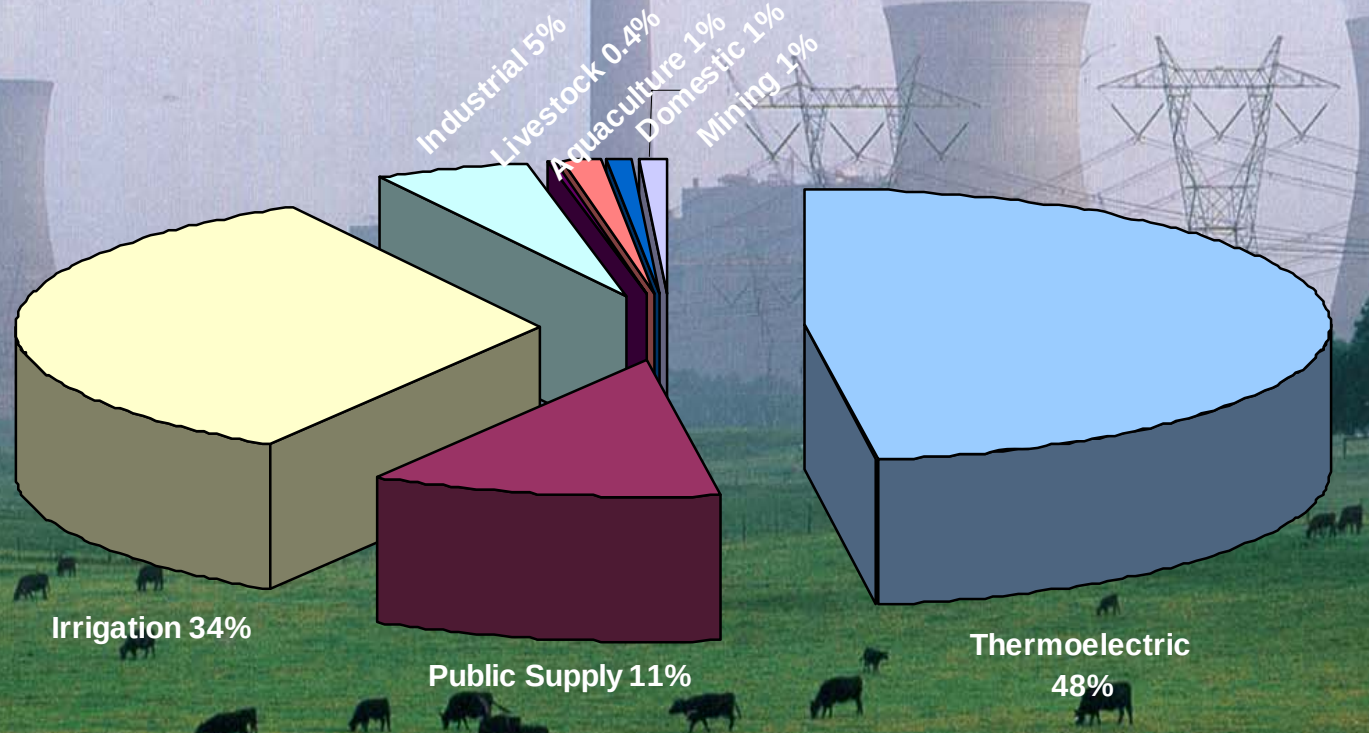
DOE Lab Group

DOE Wind Program

Research Needs

Energy-Water and the Role of Renewables
Overview

Estimated Water Withdrawals in the US in 2000

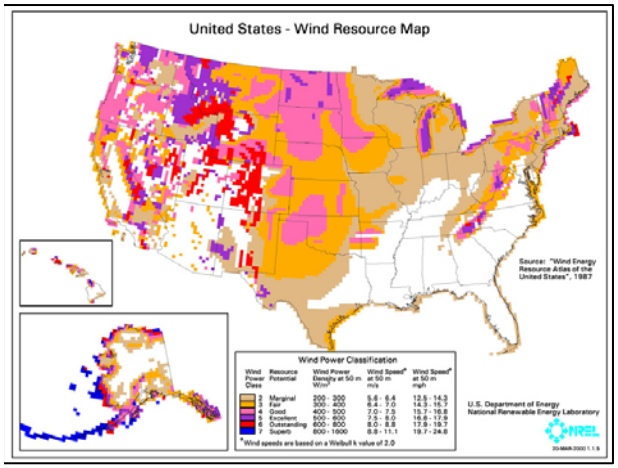


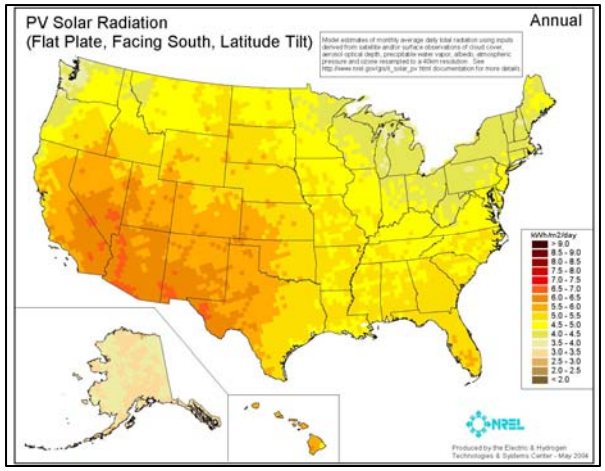
Graph source: USGS Circular 1268 March, 2004

U.S. Department of Energy
Energy Efficiency and Renewable Energy

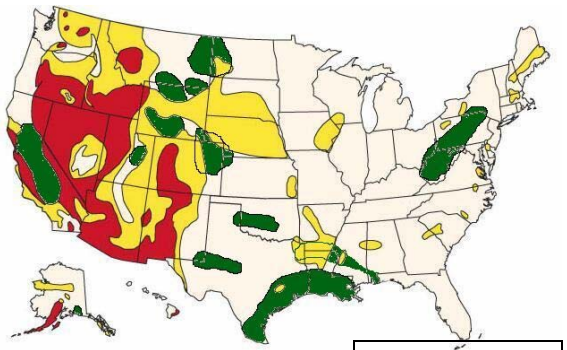
Energy-Water and the Role of Renewables

Resources



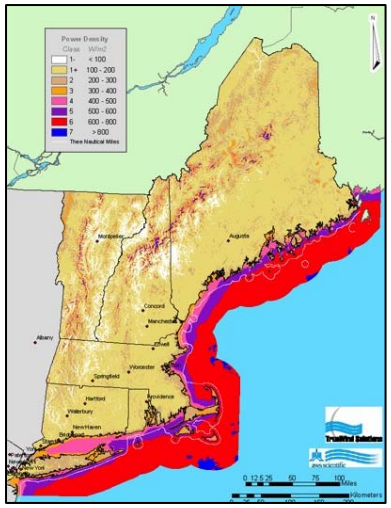


Geothermal and Geopressured Resources

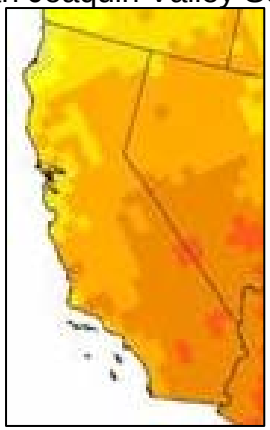


Yellow – Fair to Moderate
Red – Good to Excellent
Green - Geopressured

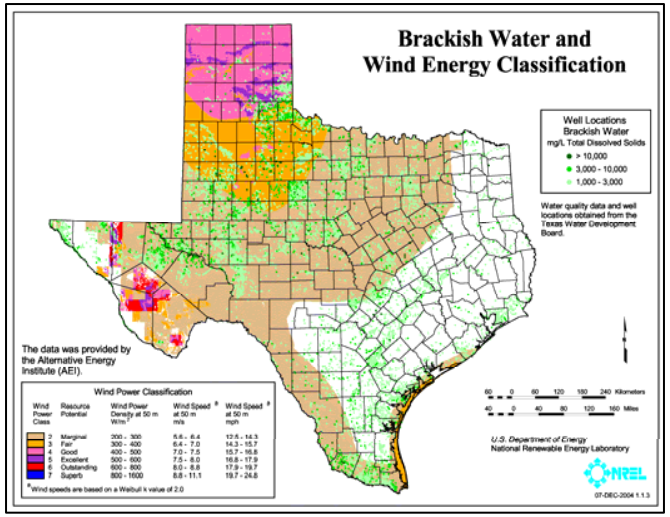
Northeast Offshore Wind



San Joaquin Valley Solar



Texas Wind Desalination



Competition For Water Limits Supply for Power

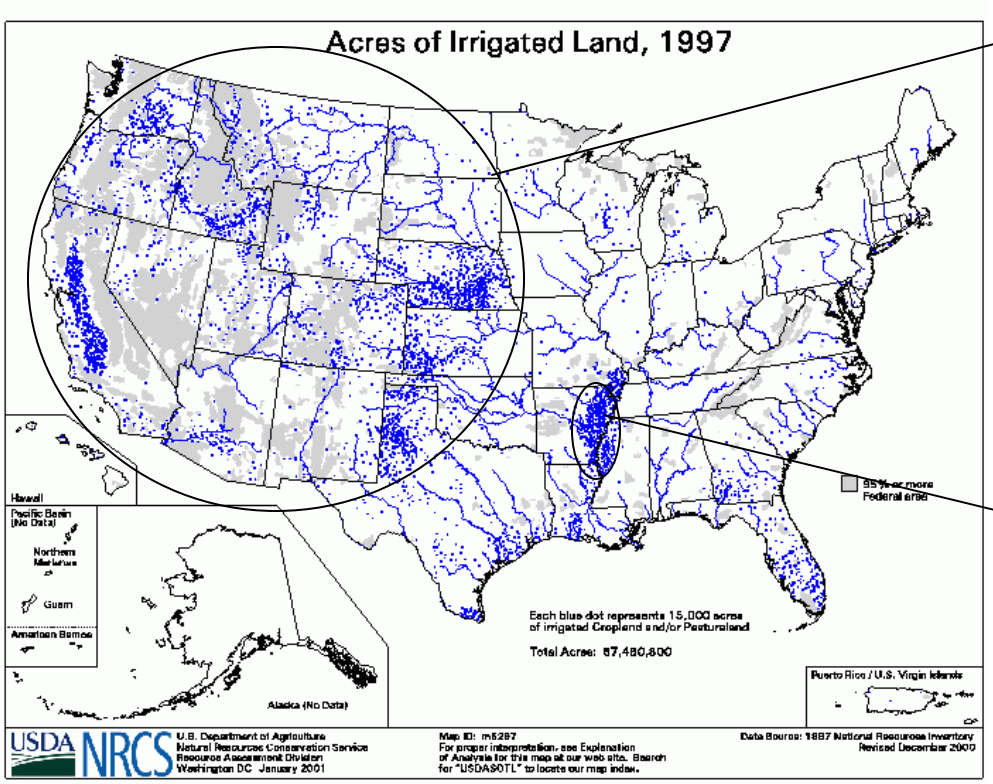
- Georgia Power Loses Bid to Draw Water from Chattahooche
  - *Miami Herald, February 2002*
- EPA Orders Mass. Power Plant to Reduce Water Withdrawals
  - *Providence Journal, RI, July 2002*
- Idaho Denies Water Rights Request for Power Plants
  - *U.S. Water News Online, August 2002*
- Duke Power Warns Towns in Charlotte, N.C., Area to Cut Water Use
  - *The Charlotte Observer, NC, August 2002*
- Company Ends Fight for Power Generator on NJ-NY Border
  - *The Record, NJ, September 2002*
- New Mexico Utility Plans to Increase Power, Use No More Water
  - *Albuquerque (NM) Journal, June 2003*
- Pennsylvania Nuclear Power Plant to Use Wastewater from Coal Mines
  - *The Philadelphia Inquirer, July 2003*
- Utilities Warn of Power Crunch if Flows Are Cut
  - *Greenwire, July 2003*

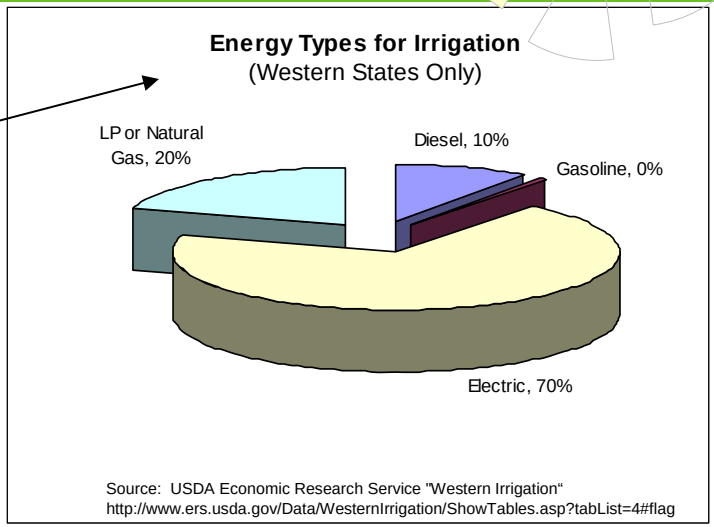
Source: Mike Hightower Sandia National Lab NREL Wind Water Prospects Meeting, November 15 2004 http://www.nrel.gov/wind_meetings/wind_water/ppt/hightower.ppt

U.S. Department of Energy
Energy Efficiency and Renewable Energy

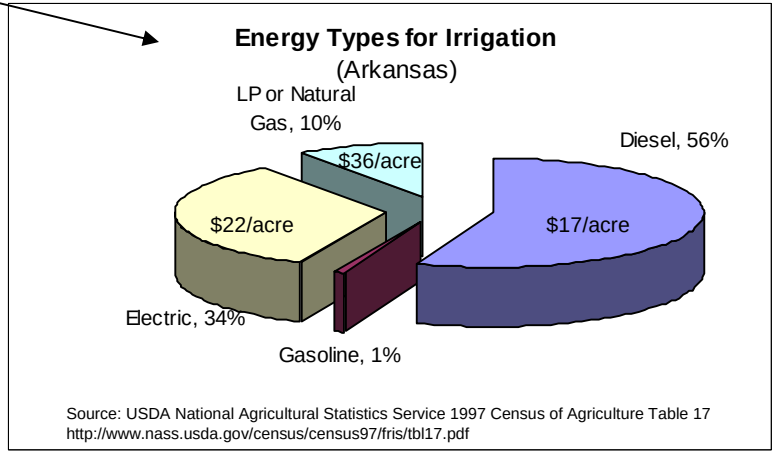
Energy-Water and the Role of Renewables

Irrigation



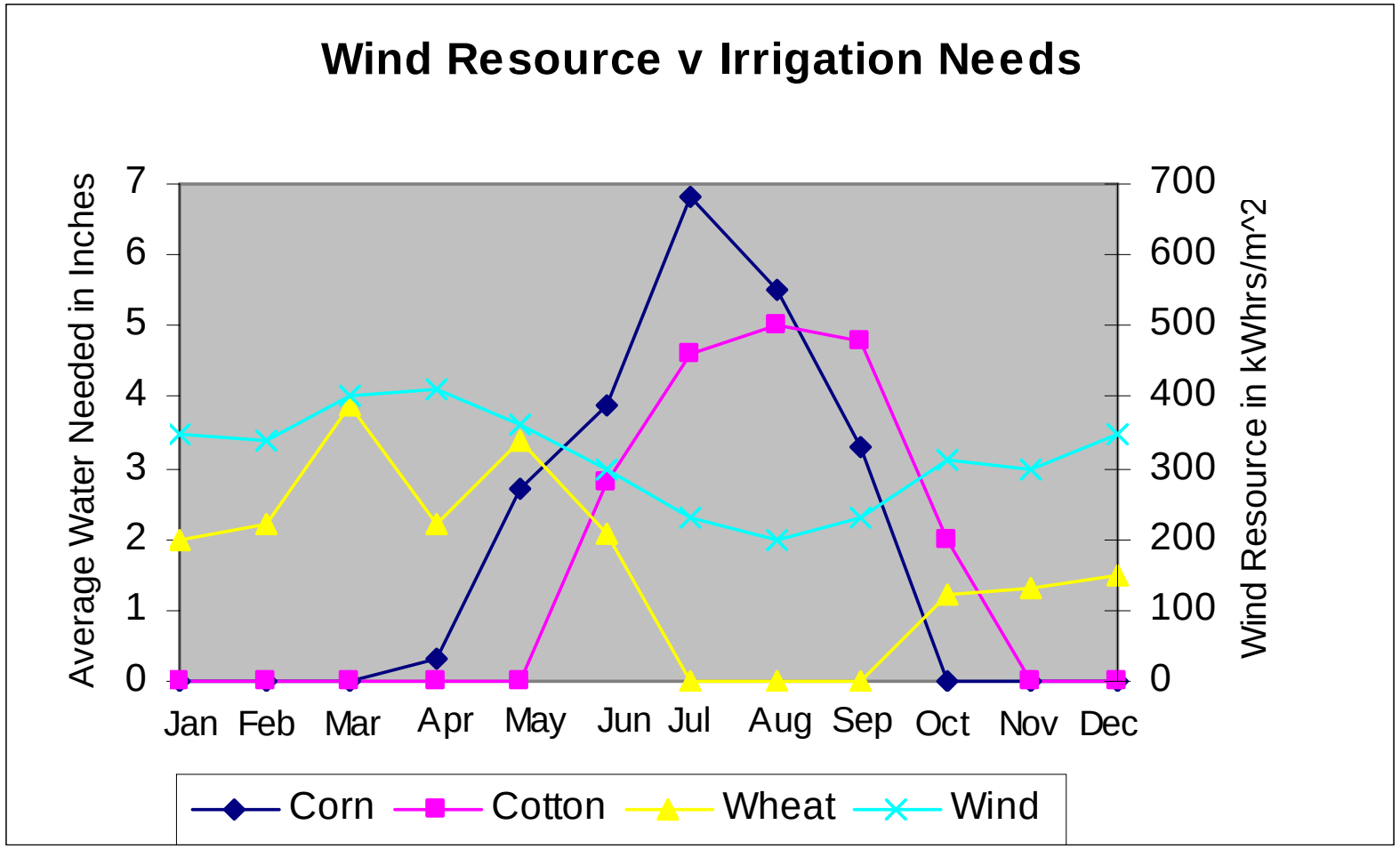


Source: USDA Economic Research Service "Western Irrigation"
http://www.ers.usda.gov/Data/WesternIrrigation/ShowTables.asp?tabList=4#flag



Source: USDA National Agricultural Statistics Service 1997 Census of Agriculture Table 17
http://www.nass.usda.gov/census/census97/fris/tbl17.pdf

Energy-Water and the Role of Renewables
Irrigation

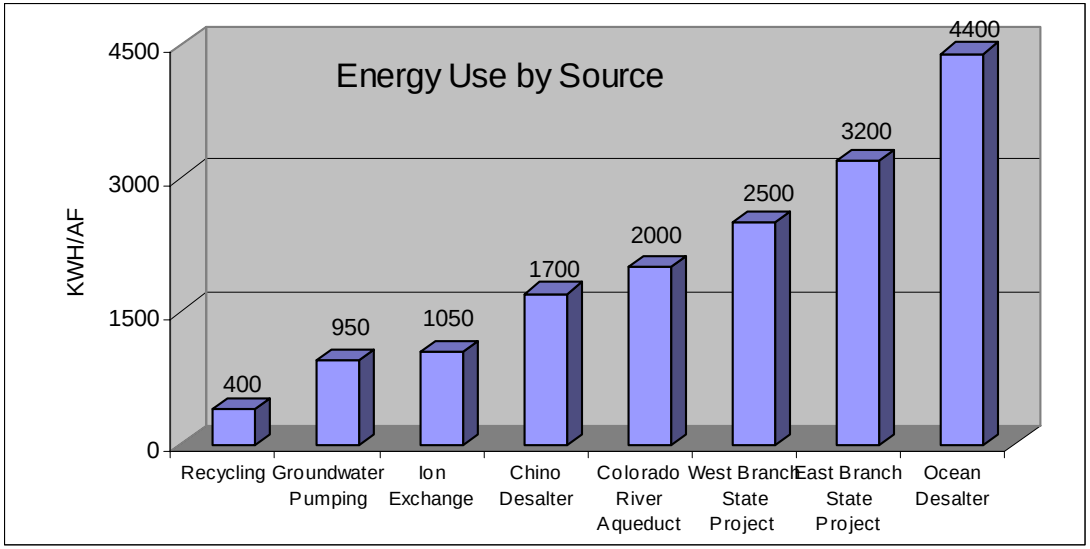


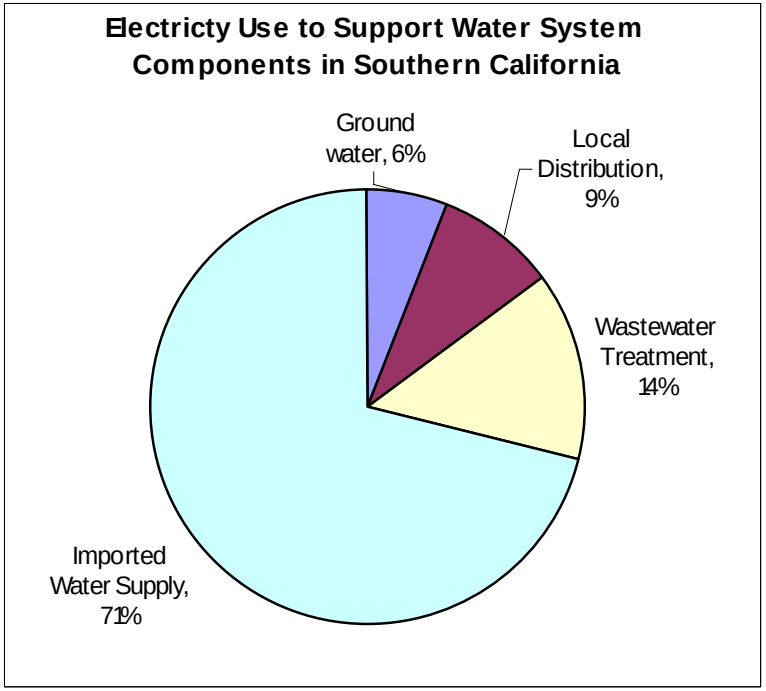
Source: R. Nolan Clark USDA Agricultural Research Service NREL Wind Water Prospects Meeting, November 15 2004
http://www.nrel.gov/wind_meetings/wind_water/ppt/clark.ppt

Energy-Water and the Role of Renewables
Public Supply

Energy for Water

- Pumping
- Treating
- Distribution (local and imported)





Graphs Source: Robert Wilkinson UC-Santa Barbara NREL Wind Water Prospects Meeting, November 15 2004 http://www.nrel.gov/wind_meetings/wind_water/ppt/wilkinson.ppt

Energy-Water and the Role of Renewables
Public Supply

Renewable Energy Powered Water Treatment

Challenges

- Variable loads (solar and wind)
- Location of resource
- Hybrid systems
- Thermoelectric plants and desalination plants co-location have intake water advantages
- Large scale seawater desalination still in its infancy in U.S.

Opportunities

- Hull, Massachusettes (wind)
- Texas Tech University (wind)
- Imperial Valley (geothermal)

Source: www.hullwind.org

Energy-Water and the Role of Renewables

Public Supply

Federal Research

- Bureau of Reclamation FY04 research project - U of Hawaii
- Tularosa Basin Facility
  - Desalination of brackish groundwater
  - Concentrate management
  - Renewable energy sources for desalination
  - Public information and education

U.S. Department of Energy
Energy Efficiency and Renewable Energy

DOE Lab Group

Argument

- Water is a limited resource
- Sustainable withdrawal of freshwater is a national issue
- Energy and water and inextricably linked
- Science and Technology can help resolve challenges at the energy-water nexus
- Action is needed now

Responsibility

- Many federal agencies are involved currently, but none are tasked with:
  - Water related impacts on energy
  - Water used by energy production
  - Energy used by water systems

Roadmap

Federal Legislation

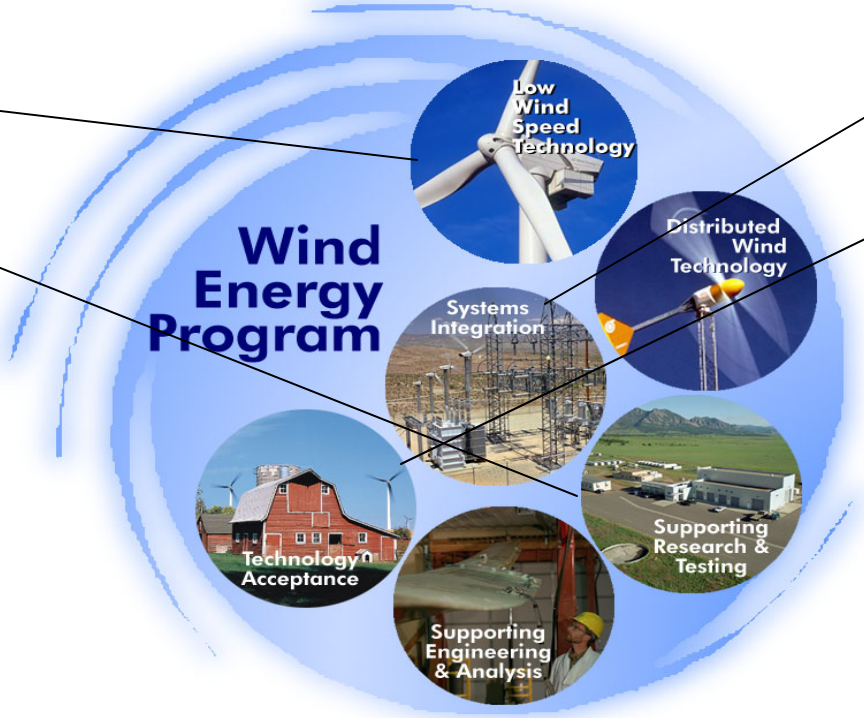
U.S. Department of Energy
Energy Efficiency and Renewable Energy

DOE Wind Program

GE component design for wind-desalination

Special Energy Projects solicitation

Texas Tech University wind-desalination project



Situation analysis of 6 wind-water opportunities
(see www.nrel.gov/wind_meetings/wind_water/)

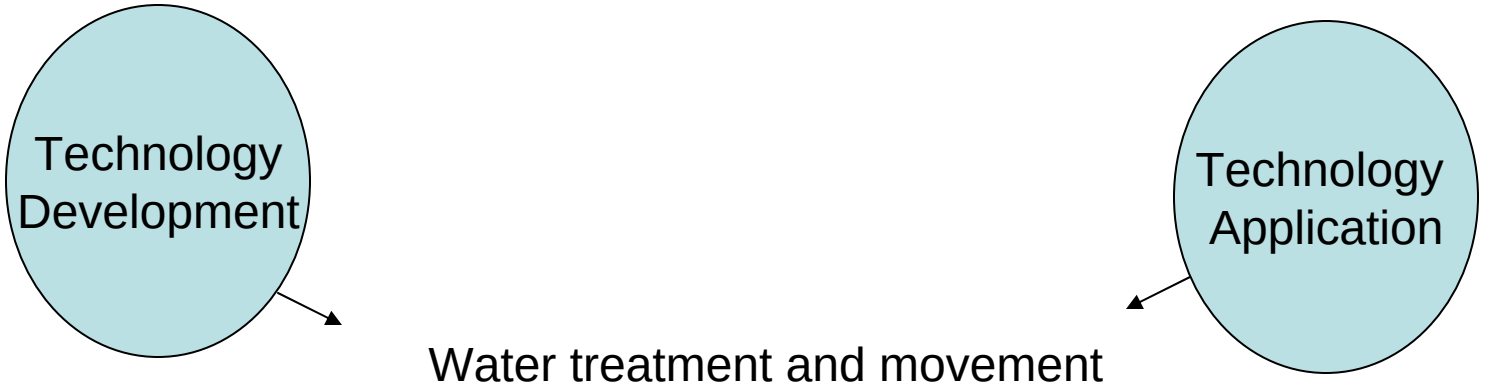
NREL energy-water group (first meeting: Feb, '05)

White Paper on municipal water use and prospects for wind energy

Technology Development

Technology Application

Research Needs



Water treatment and movement

Matching energy resource with need

Examples:
Treating produced water with mobile wind turbines
Offsetting natural gas or diesel fuel for irrigation with wind or solar
Using wind to desalinate water in offshore or inland applications
Using geopressure resources to directly desalinate water

Briefing for SWRR

Great Lakes Restoration

A Regional Collaboration

Agenda

- Great Lakes Resources
- Priorities of Governors
- Executive Order
  - Interagency Task Force
- Regional Collaboration
  - Sustainable Development

Great Lakes Resources

- Great Lakes cover 94,000 square miles and drain area about twice that size
- Basin includes all or parts of eight states and two Canadian provinces
- Population of 35 million (U.S. and Canada)
- Contain about 9 quadrillion gallons of water, or 18 percent of the world's freshwater supply
- Coastline of 10,000 miles


Hudson Bay
Ogoki Project
Diversion Dam
Central Dam
Lake Nipigon
Nipigon River
Long Lake
Long Lake Project Central Dam
Aguasabon River
Thunder Bay
Minnesota
Ontario
Québec
Lake Superior
Duluth
Keweenaw Peninsula
Sault Ste. Marie
Lake Superior Control Structure
St. Marys River
Lake Michigan
Lake Huron
Green Bay
Wisconsin
Michigan
Milwaukee
Bay City
Chicago
Chicago Sanitary & Ship Canal
Illinois
Illinois Waterway
Indiana
Ohio
Toledo
Cleveland
Detroit River
Lake St. Clair
St. Clair River
Lake Erie
Pennsylvania
Great Lakes Drainage Basin
Ottawa River
Ottawa
Montreal
Cornwall
Massena
St. Lawrence River
St. Lawrence River Control structure
Kingston
Cape Vincent
Toronto
Lake Ontario
New York
Oswego
Niagara Falls
Rochester
Welland Canal
Niagara River
Buffalo
U.S. Army Corps of Engineers, Detroit District

Great Lakes Priorities

- In a January 2001 letter to the Governors of the eight Great Lakes states, Members of Congress asked the states to define their priorities for the Great Lakes
- In October 2003, the Governors outlined their nine priorities for the Restoration of the Great Lakes

Governors' Priorities for the Great Lakes

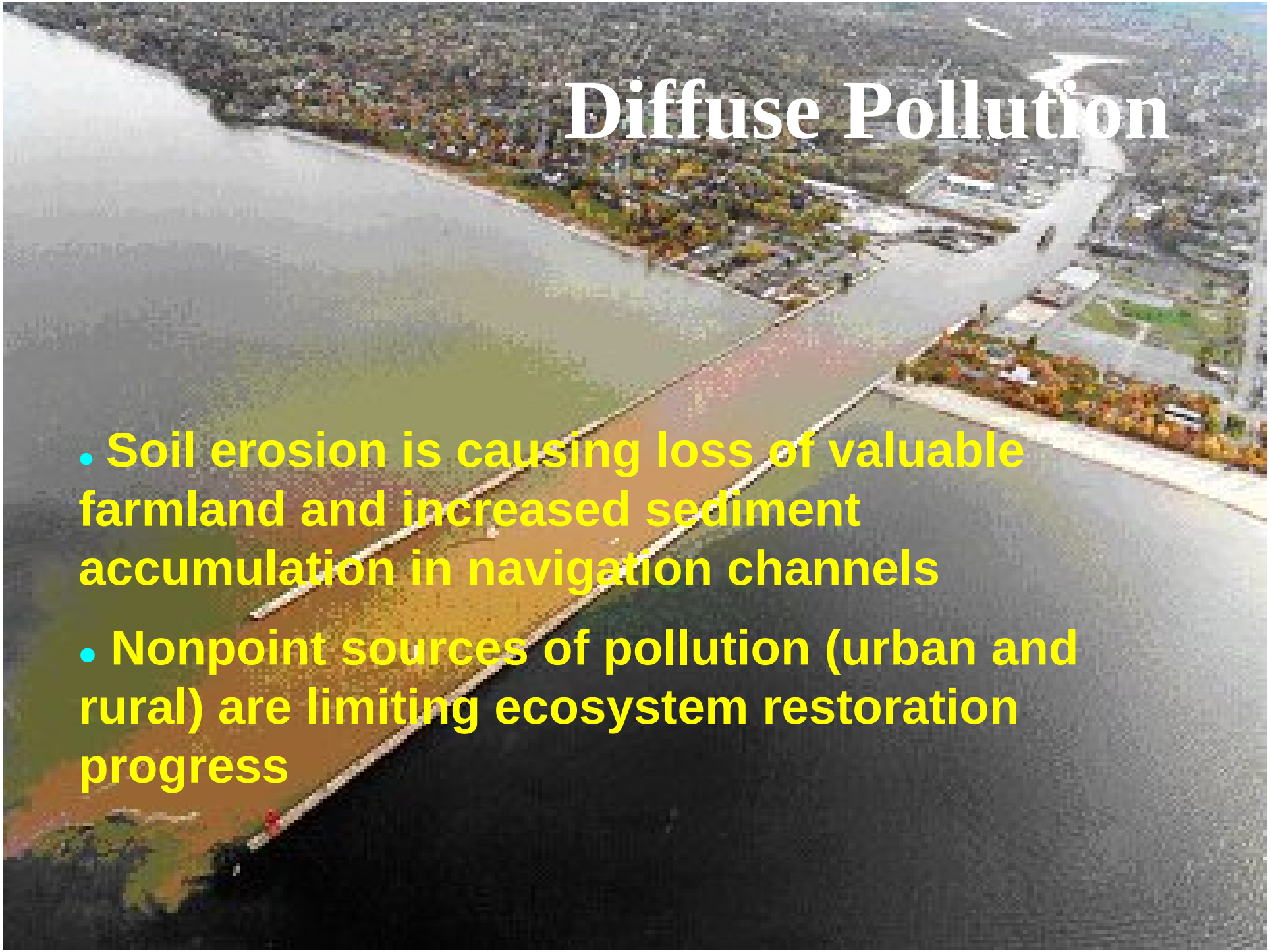
- sustainable water use and management
- human health (fishable, swimable, drinkable)
- non-point/diffuse pollution
- toxic contaminants
- invasive species
- fish and wildlife habitat/coastal wetlands
- restoring beneficial uses at Areas of Concern
- information and data management
- sustainable economic development

Water Management

- Great Lakes are drinking water source to 40 million residents in U.S. and Canada
- Water levels and flows partially regulated by Boards of International Joint Commission (IJC)
- Diversion of Great Lakes water is a lighting rod issue in Basin
- Governors and Premiers have initiated process (Annex 2001) to develop binding framework to regulate water withdrawals and diversions

Human Health

- Untreated waste from combined sewer systems causes loadings of pollutants and fecal contamination, forcing beach closings
- In some urban areas of Great Lakes beaches are closed up to half the Summer
- Number one issue to Great Lakes mayors, who have become major political force under leadership of Mayor Daley



Diffuse Pollution

- Soil erosion is causing loss of valuable farmland and increased sediment accumulation in navigation channels
- Nonpoint sources of pollution (urban and rural) are limiting ecosystem restoration progress

Toxic Contaminants

- **Water quality has been severely degraded by pollution from industrial and municipal discharges, as well as agricultural and non-point sources**
- **Persistent, toxic and bioaccumulative contaminants continue to be discharged from air deposition and sediment loadings**

Invasive Species

- **Sea lamprey, round goby, zebra mussels, and others are impacting the Great Lakes ecosystem, sports fishery, and water supplies**

Aquatic Habitat

- Biological resources of the Great Lakes have been stressed by pollution and development in coastal areas
- Great Lakes fishery has been highly altered by introduction of non-native species, both intentionally and unintentionally
- Joint Strategic Plan for Great Lakes Fisheries developed by binational Great Lakes Fishery Commission in partnership with states, provinces and tribes

Restore Beneficial Uses

- 43 Areas of Concern (AOC) designated by Great Lakes Water Quality Agreement due to impairments to beneficial use of Lakes
- U.S. has not delisted any of its 31 AOCs to date
- Contaminated sediments contain a legacy of pollution that is limiting restoration at most AOCs

Data Management

- Management of water resources within large watershed to balance needs of diverse users, including navigation, hydropower, recreation, riparian, and ecological interests
- Information on system being collected by two countries, eights states, two provinces, and numerous tribal agencies

Sustainable Development

- Navigation infrastructure is 50-100 years old, in need of rehabilitation and not configured for modern transportation modes
- Recreation has become a major industry in region, representing $20-30B annually
- Urban sprawl and related land use are straining infrastructure for transportation, water supply, and wastewater

Executive Order 13340

- Signed by President in May 2004
- Defines Federal policy to support local and regional efforts to restore and protect the Great Lakes ecosystem, acting through a regional collaboration
- Creates Great Lakes Interagency Task Force
- Annual report to President on progress and recommendations

Interagency Task Force

- Nine cabinet level agencies
- Chaired by EPA Administrator
- Partner with states, tribes and local governments to establish regional collaboration
- Ensure that Federal programs are effective, coordinated and environmentally sound
- Regional Working Group

Regional Collaboration

- Framework document signed by agency heads, governors, mayors and tribal leaders in ceremony on 2 Dec 04
- Develop strategic plan for Great Lakes protection and restoration within one year
- Adopt restoration priorities defined by governors and mayors
- Teams established for each priority issue

Regional Collaboration

- Sustainable Development Strategy Team developing recommendations for six categories of resource use
  - Land use and development
  - Industrial activities
  - Agriculture and forestry
  - Recreation and tourism
  - Water infrastructure
  - Transportation

Regional Collaboration

- Research is an overarching issue that each Team is to address
- SWRR discussion will be used by Sustainable Development Team


Questions?