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PRESENTATION

Water: The Common Denominator

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WATER: The Common Denominator

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The Goal of My Presentation

- **Present some thoughts on the scientific, political and economic aspects of water, energy and food.**
- **Provoke some discussion and contemplation on larger issues.**
- **Stress the importance of these issues in a local and global arena.**
- **The role of education (universities, colleges, high schools, primary schools) on water, energy and food.**

A gallon of gasoline/petrol (regular) in United States is about $2.00

A gallon of bottled water where you buy petrol is about $ 9.00

SOMETHING IS TERRIBLY WRONG

The Challenge

- **Feeding the world while preserving the environment (soil, water and air) is a serious challenge which deserves our collective attention.**

That is why we are here for a serious discussion (and I intend to have one)

Managing resources versus exploiting resources

THE ROAD AHEAD

Challenges & Opportunities

NO WATER

NO LIFE

NO FUTURE

…cannot separate water from civilization (life) and development

WATER IS A RESOURCE, NOT A COMMODITY

MANAGE IT,
DON'T EXPLOIT IT

.....We use water to clean whatever stinks, but when water stinks, it is difficult to clean it

MYTH OR FACT?

Most people still think of water as an abundant and renewable resource.

It isn't.

Statistics show quite the opposite to be true.

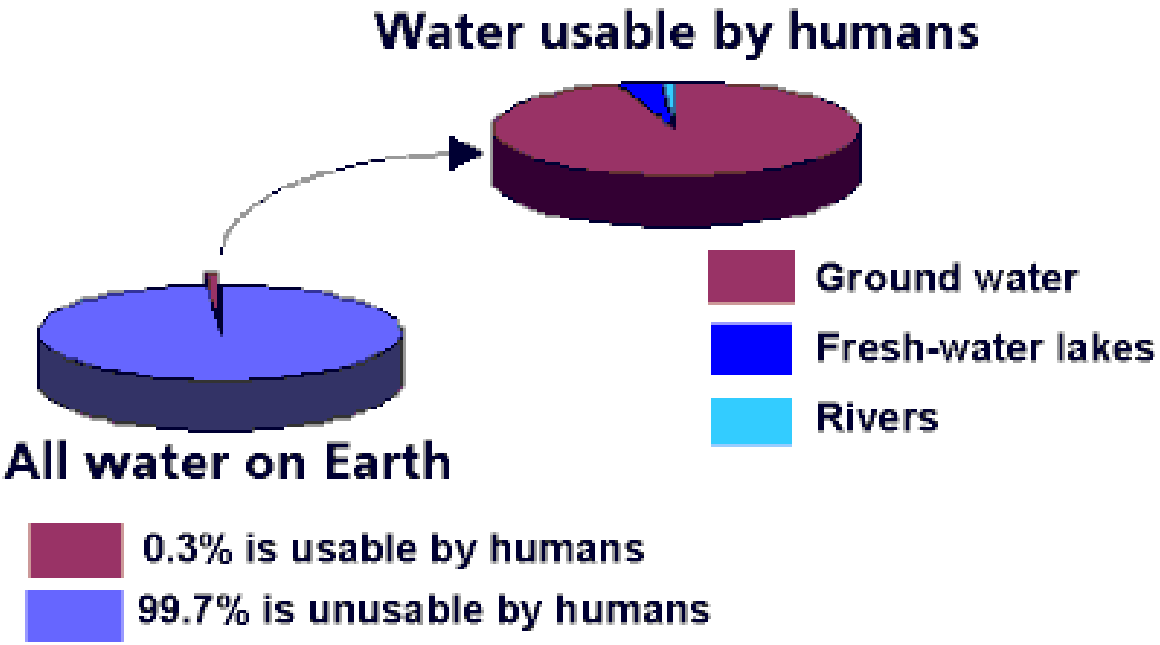
- **Water is the world's most abundant resource, BUT**
  - **less than one percent is suitable for drinking.**

- **Safe drinking water remains inaccessible to about 1.1 billion people worldwide.**
  - ✓ **Mostly in developing countries**

Water source	Water volume (cubic miles)	Percent of total water
Oceans	317,000,000	97.24
Icecaps, Glaciers	7,000,000	2.14
Groundwater	2,000,000	0.61
Fresh-water lakes	30,000	0.009
Inland seas	25,000	0.008
Soil moisture	16,000	0.005
Atmosphere	3,100	0.001
Rivers	300	0.0001
Total water volume	326,000,000	100%

Source: Nace, U.S. Geological Survey, 1967 and
The Hydrologic Cycle (Pamphlet), U.S. Geological Survey, 1984

How much of Earth's water is usable by humans?



- **Of all the water present on our planet, only**
  - ✓ **2.5% is fresh.**
  - ✓ **0.007% is readily available to people via rivers, lakes, and reservoirs.**

- **Freshwater is a finite and vulnerable resource essential to sustain life, development and the environment.**

- **Management of this resource is expected to emerge as one of the greatest challenges facing humankind during the 21st century.**

- **Despite significant improvements (development) in recent decades.**
  - ✓ **Over 1 billion people still lack access to safe water**
  - ✓ **Nearly 2 billion lack safe sanitation.**
  - ✓ **An estimated 10,000 people die every day from water and sanitation related diseases**
  - ✓ **Thousands more suffer from a range of debilitating illnesses.**

- **The impact of inadequate water and sanitation services falls primarily on the world's poor.**

Sustainable Irrigation

- **Agriculture is the largest user of fresh water globally, and:**
  - ✓ **irrigation practices in many parts of the world are:**
    - **biologically, economically, and socially unsustainable**
    - **wasting water, energy, and money; drying up rivers and lakes; reducing crop yields; harming fish and wildlife; and causing water pollution.**

WATER

- **Water, food and energy are intimately interlinked.**
- **However, water is the common thread required to grow food and generate energy, making it key for global food and energy security.**
- **A significant amount of water is required and used to produce food and energy.**
- **Agriculture is the dominant user of freshwater**
  - ✓ **using about 70% of global accessible freshwater drawn from rivers, lakes and aquifers for irrigation to produce food, feed, fiber and biofuels**
  - ✓ **10% is used for domestic applications and**
  - ✓ **20% for industry**

ENERGY

- **Conventional energy production (hydroelectric and thermoelectric) is largely dependent on abundant supply of freshwater.**

- **Conversely, about 8% of generated energy is used for pumping, treating and transporting water to consumers.**

- **Human population is putting unprecedented stress on global water resources and energy demand.**

WATER

- **WATER is one of the resources in increasingly short supply**
- **Much irrigated land relies on groundwater (subterranean water, as in aquifers), and in many areas, this groundwater is being withdrawn faster than it is recharged**
- **As an example, the US, India, Libya and Saudi Arabia all rely on groundwater for irrigating large areas, and all are over-pumping many of their aquifers**

CLIMATE CHANGE

- **Climate change is a new stressor disrupting the global water system, particularly availability and distribution of freshwater.**

- **Increasing climate variability (extreme heat, extended droughts, floods) is already testing the resilience of water and energy systems in many parts of the world.**

- **Shortage of freshwater shall threaten global food and energy security.**

POLICY

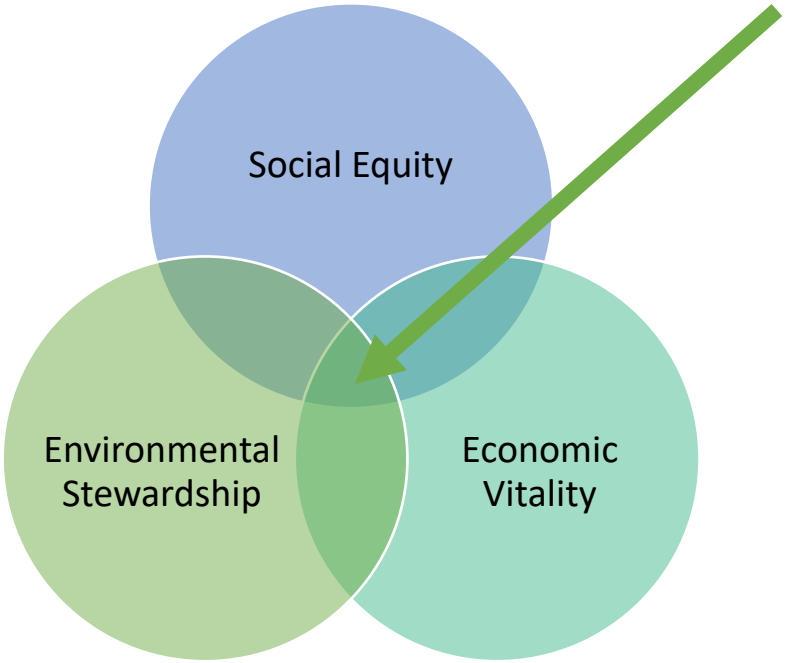
- **Given the nexus among water, food and energy,**
  - ✓ **more attention should be given to water and energy policy**
  - ✓ **where planning and management must be integrated**
  - ✓ **to encourage conservation, innovation and sustainable use.**

- **International policy initiatives on efficient and effective water and energy management is not only necessary but compelling.**

POLICY

- **Considering the interlinkages between food and energy production using water, the choices we make about water, food, and energy should:**
  - ✓ **Consider climate change as a driving force, adaptation and mitigation.**
  - ✓ **Predicting our future is one dimension, preparing for it is quite another.**

What do we mean by "sustainable"?



<u>Defining sustainability</u>: an action that balances available resources to create lasting solutions to current demands without jeopardizing the ability of the organization, the community and the environment to be viable and secure in the future.

WORKING DEFINITION @ FAMU

The teaching, research, engagement and application of socio-economic, ecological and technological innovations that maintain the long term health and viability of the university, our region and the world.

WHY TEACH/RESEARCH SUSTAINABILITY?

- **Train a generation of leaders who can help address major challenges in our society**
- **Prepare students to apply critical thinking & systems thinking principles in their professional fields.**
- **Contribute to a broad field of inquiry**

WATER

- **Water and Economics**
  - Supply and Demand
  - Water as a Commodity
  - Privatization of Water
- **Water and Conflict**
- **Water and Terrorism**

Water Supply and Demand

- **Water is a renewable resource, but is not unlimited in quantity**

- **Not only a question of quantity – location and quality are also critical variables**

Water and Economics

- **As can be seen from the supply and demand information, water is becoming a "scarce" resource, at least in some parts of the world.**
- **The classic definition of economics is a tool for the allocation of "scarce resources".**
- **As the division between supply and demand widens, there is an increasing view that water is a commodity.**
- **However, water is also a "social good" – that is, a right or property held for all and often controlled or regulated by governments.**

Water as a Commodity

- **Consequently, there is a conflict with philosophy about water and social justice.**

Access to basic water and sanitation are universal rights, and cannot therefore be negotiated as commodities

***NGO statement at the Hague*, 2000**

Water has an economic value in all its competing uses and should be recognized as an economic good

International Conference on Water and the Environment

Dublin, Ireland, 1992

Privatization of Water

- **This conflict is no where better demonstrated than in the increased trend towards "privatization" – the transfer of production, distribution and/or management of water into private hands out of government control. This raises some significant questions.**

Privatization of Water (Questions for Thought)

- **Are water supply and sanitation a basic responsibility of government?**
- **Can privatization ensure service to under-represented and under-served communities?**
- **Will privatization lessen or exacerbate economic inequities?**
- **Can "water trade" be regulated by WTO, GATT, NAFTA or other international trade agreements?**

Water and Conflict

- **The idea that population growth and limited resources lead to conflict over limited resources is not new:**

This natural inequality of the two powers of population and of production in the earth . . . form the great difficulty that to me appears insurmountable. . . . the contest [is] a struggle for existence, and . . . fought with a desperate courage, inspired by the rejection that death was the punishment of defeat and life the prize of victory.

An Essay on the Principle of Population
Thomas Malthus, 1798

Water and Conflict

Conflicts over water are also not new.

- **In the mid 19th Century in Mexico, the dispute access to the waters of a disputed river created bitterness and animosity between two drought-hit southern Indian states.**

"*Fight Over A Waterhole*"
By Remington

Water and Conflict

- **Within the US, fights over water in the West have led to political deals, organized crime, riots and killings – from the Owens Valley pipeline incident in 1905 to the Klamath River dispute of today between environmentalists, farmers and American Natives.**

- **In the Middle East tension between Turkey and Syria over the Euphrates and the Ataturk Dam in 1989 led to a Syrian MIG shooting down a Turkish survey plane, killing five.**

Water and Conflict

- **The fight over water privatization is also becoming violent. In this picture, a local factory workers in Cochabamba, Bolivia faces off with riot police during demonstrations against the privatization of Bolivia's water system.**

WARNINGS OF POSSIBLE WARS ON WATER

- **Many experts speculate that the shortage of water could lead to major political conflicts around the world, or in the worst cases, war.**

- **Over 20 countries depend on the flow of water from other nations for much of their supply. And more than 300 of the world's river basins are shared by two or more countries.**

CITIES RUNNING DRY

China: **Between 1983 and 1990, the number of cities in China that were short of water rose from 100 to 300; those with a serious water problem, from 40 to 100. In the year 2000, Beijing Municipality suffers a daily water shortfall of 500,000 cubic meters.**

MEXICO: **Mexico City, having over-pumped the Mexico Valley aquifer, is now forced to pump its water supply a distance of 180 kilometers and up 1,000 meters from the Cutzamala River at much higher cost. The city faces the prospect of exhausting its supply in the year 2000.**

INDONESIA: **Jakarta has so depleted its underground aquifers that seawater has seeped 15 kilometers inland making the supply saline. Investments in pipelines to bring water from other sources are eventually expected to top $1 billion.**

Source: *IWSA, Managing the Global Environment; National Report from Beijing Municipal Waterworks Company, 1993. McIntyre, Peter; Protecting the Well, Noordwijk Conference, The Netherlands, March 1994.*

Here are the main water hot spots to watch for:

- **The Jordan Litani system and the West Bank aquifers. Israel and Jordan are already using more water than they get--so where is the necessary incremental supply to be found?**

- **The Nile. Egypt downstream, Sudan, Ethiopia and even Uganda upstream. And a resource already stretched very thin.**

- **The Tigris-Euphrates system, Turkey upstream, Iraq and Syria downstream. Wars have already been threatened in this system, and Turkey's massive Anatolia Project (xxx dams and reservoirs) is certain to make things worse.**

- **The Ganges system between India and Bangladesh, and the Indus between Pakistan and India--in a region famous for its saber-rattling, where the two countries have been at war many times, most recently over Kashmir.**

Here are the main water hot spots to watch for: …cont'd.)

- **The Carvery River in southeastern India, the country's fourth largest, has already set off pitched battles between troops and citizens from two Indian states, Karnataka and Tamil Nadu.**

- **The North African Iittoral. No major rivers to speak of, but Libya's mining of the sub-Saharan aquifer is causing alarm among her neighbors, most notably Algeria.**

- **Botswana and Namibia in South Africa have several times come close to war over Namibia's threat to divert waters away from the Okavango system, home to Botswana's major source of water and one of Africa's last great refuges for wildlife.**

- **Other areas where water is in critical supply but there the threat of war is much less, include the Parana system, the Colorado system, and much of sub-Saharan Africa.**

1. Southern Africa

Namibia wants water from the Okavango River for its cities, but neighboring Botswanans fret that won't leave enough for their delta wetlands.

2. South Asia

India and Bangladesh have signed a 30-year treaty to share water from the Ganges River; the pact will help 40 million farmers in Bangladesh who rely on the river during the dry season.

3. Northern Africa

Egypt, long the dominant user of the Nile, faces encroachments on the river from Ethiopia and Sudan

4. East Asia

After Malaysia threatens to cut back on its water shipments, Singapore starts a crash program to expand and conserve water supplies.

5. North America

Mexico is angry over US plans to reduce seepage from irrigation canals off the Colorado River; reduced seepage will mean less water for dry northern Mexico, which pumps water on its side of the border from underground reservoirs.

Water and Conflict (Questions for Thought)

- **Is there any way to avoid increasing conflict as water resources become increasingly scarce?**
- **What is the trade-off between the development of water resources for a nation-state by a government, and the development of water as a commodity for export (either by the government or privately) for economic development within the nation or region?**
- **Can "water wars" be managed by the UN or other international peace organizations?**

Water and Terrorism

- **Because water is a critical part of any nation's infrastructure, water supply, treatment and distribution systems become a potential target – not only in war, but for terrorists.**

- **The current concern involves one of three scenarios.**

  - ✓**Physical attacks against water companies, water or waste treatment facilities, or dams.**
  - ✓**A deliberate introduction of biological contaminants like viruses, cysts, E. coli, anthrax spores, etc.**
  - ✓**A deliberate introduction of some type of hazardous chemical compound.**

Water and Terrorism

- **The effects of water distribution disruption and the potential contamination of drinking water sources from the shutdown of waste treatment facilities were vividly demonstrated by the blackout in the Northeast US in August.**
  - ✓ **In Cleveland, loss of electricity resulted in raw sewage flowing into Lake Erie and contaminating beaches. Backflow resulted in contamination of the water distribution system.**
  - ✓ **The shut down of water treatment plants resulted in thousands of people without water, industry shutdowns, and a dramatic increase in water borne illnesses – all having significant economic impact.**

Water and Terrorism

- **Current systems may or may not be able to deal with an intentional introduction of a biological agent or chemical contaminant.**
  - ✓ **Biological or chemical contaminants dumped into the water source of a city could be highly diluted by the time they reached a treatment plant.**
  - ✓ **Water treatment methods now in place (e.g. flocculation, filtration, and disinfection) may also effectively remove or kill many types of chemical contaminants or infectious agents before they entered the distribution system.**

Water and Terrorism (Questions for Thought)

- **What research might be needed to address the issues associated with potential terrorist attacks on the water infrastructure of a nation?**

- **Can the results of studies which demonstrate vulnerability be published without fear of providing critical information to terrorists? Possible retribution from governments? Should such research be published at all?**

- **How should/will the distribution of research funds in the US, Europe, Asia, Africa etc., be affected by these concerns?**

HIGHER EDUCATION AND SUSTAINABILITY

Institution of Higher Education

- **Institutions of higher education hold a unique position in society**
  - ✓**They are places of knowledge production, knowledge perpetuation, and knowledge dissemination**
  - ✓**Unique potential to encourage synthesis and integration of different types of knowledge**
  - ✓**Enhance the application of knowledge to social change**

Role of Higher Education to Societal Transition Towards Sustainability

- **Perceived as an institution that needs to be changed, OR potential change agent**
- **The distinction between the two is critical/important**
- **I think we have to deal with both**

Higher Education as a Change Agent

- **Higher education can model sustainable practices for society by:**
  - ✓ promoting sustainable behavior on campus
  - ✓ promoting sustainable practices on campus
  - ✓ promote learning related to how society can maximize sustainable behavior

- **Higher education can teach:**
  - ✓ the skills of integration, synthesis, and systems-thinking
  - ✓ how to deal and cope with complex problems

Higher Education as a Change Agent

- **Higher education can conduct use-inspired, real world problem-based research that is targeted to:**
  - ✓ **Urgent sustainability challenges facing society**

- **Higher education can:**
  - ✓ **promote and enhance engagement of individuals and institutions both within and outside higher education**
  - ✓ **Resituate universities as transdisciplinary agents, highly integrated with and interwoven into other societal institutions (bring the university to society in a holistic approach**

An agenda for action

- **Research (holistic, system approach) …research is a critical tool in developing a sustainable future, and universities have a responsibility to contribute through their scholarly activities**
  - ✓ **interdisciplinary research programs that aims to improve understanding of the interactions of humans and the earth system to deliver science-based tools for analyzing socio-economic and environmental consequences of strategies seeking to adapt to environmental, social and technology changes.**

- **Education/Training (new professionals/experts)**

- **Extension/Outreach (Science translation)**

- **Involvement/Participation (Individually, Collectively, Public sector, Private sectors, local, global)**

- **Science based solutions, use of technology, Best Management Practices (BMPs)**

- **Conservation and ecocitizenship**

An agenda for action

- **Is it too late to do anything (including talking) about sustainability?**
  - ✓ **It is not too late to have a significant impact on sustainability (e.g. future climate change and its effects on us).**
  - ✓ **With appropriate actions by governments, communities, individuals, and businesses, we can reduce the adverse impact of humans on environment**

- **Many of the actions that we can take to address sustainability will have other benefits (e.g. cleaner water and air, healthier society, peace, etc.).**

- **In addition, communities can take action to prepare for the changes we know are coming.**

An agenda for action

- **The gravity of the current environmental crisis in many countries is the result of many years of under-investment in environmental and social issues.**

- **Investment in sustainable future is not only necessary, but compelling (otherwise we will be negating our very own existence).**

Sustainable society

Sustainable society is one which meets its needs without diminishing the future prospects of future generations.

Humanity has the ability to make development sustainable or unsustainable.

Indicators of non-sustainable environment

- Loss of biodiversity
- Soil erosion
- Water logging and salinization
- Desertification
- Depletion of water resources
- Pollution (of water, air, soil)
- Global warming/Climate Change
- Human population imbalance relative to other species

Thank you