LIVING LIGHTLY ON THE EARTH

Tribal Perspectives on Energy Efficiency, Sustainable Infrastructure, Indigenous Science, First Foods, and Post-Carbon Governance.

Stuart Harris, CTUIR Department of Science and Engineering

BPA, Portland, November 14, 2008

Section 1 – Tribal Perspectives

Section 2 – Climate Science

Section 3 - Governance and Planning

Securing the Homeland

Governance for the people, by the people:

- **Support the infrastructure for commerce**
- **Provide services for the population**
- **Provide for the well-being of the people**
- **Set bounds, protect rights and resources**

Utilities
Clothing
Language
Shelter
Workforce
Land Base
Domestic violence
Offices
Religion
Justice
Roads
Friends
Food
Clinic
Safety
Cultural Resources
Social Services
Potholes and stop signs
Emergency Preparedness
Clean Water
Insurance
Truancy
Voting
Connectivity, Communications
Water & sewer
Energy

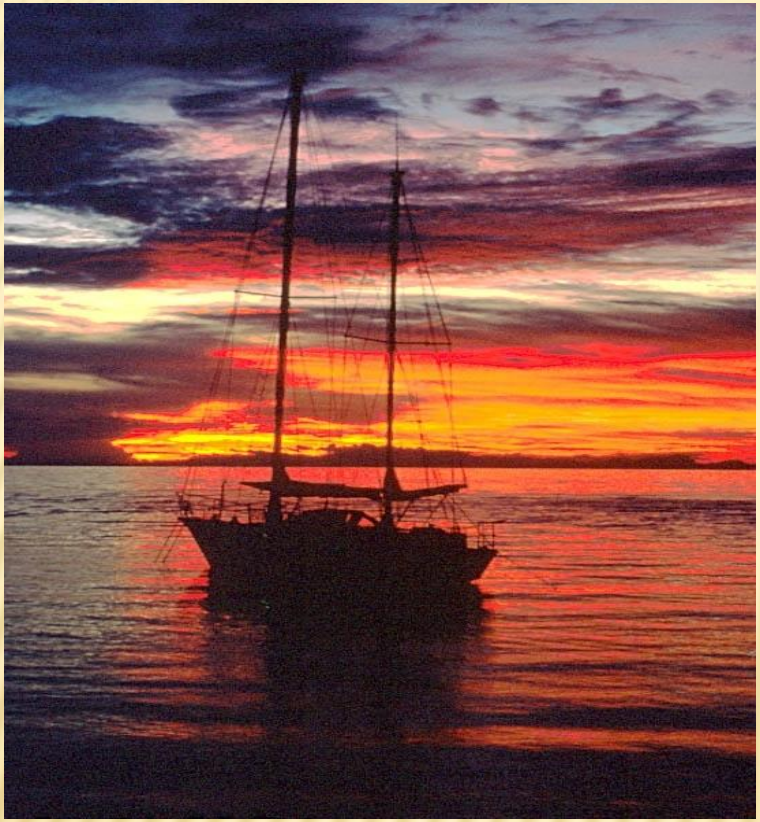
CLIMATE CHANGE

Securing the Future

THE PERFECT STORM

We are sailing into UNCHARTERED TERRITORY

What should we be planning for?



A peaceful three-hour tour?

A little warmer,
a little more sunscreen.

Global Disruption?

Fact: The whole climate is changing: the winds, the ocean currents, the storm patterns, snow packs, snowmelt, flooding, droughts.

The CTUIR Department of Science & Engineering hosted a workshop on <u>Adaptive Governance & Climate Change</u>

150 people attended

- Scientists
- Tribes
- Community groups
- Civic leaders
- Politicians
- CTUIR BOT

August 19,20 2008
Wildhorse Resort

Several slides have been borrowed from the speakers in my talk today.

Purpose of the workshop on Adaptive Governance & Climate Change

Premise: **Climate change is real and it's happening now. Our new generation of leaders needs to be:**

- **culturally grounded (know what values to preserve)**
- **technically informed (know what to do)**
- **politically savvy (know how to build partnerships)**
- **managerially skilled (know how to get things done).**

- **Day 1 – Reviewed climate science for the Pac Northwest**
- **Day 2 - Find ways to use it on a local scale. Officials from the tribes, cities, counties, the state of Oregon and some industry officials discussed how adaptation and mitigation planning can be approached regionally and locally.**

Examples of adaptive governance

Knowledge plus goals tells us what governance actions should be taken for adaptation and mitigation

Traditional science:
- Tamanwit
- First Foods
- Traditional Diet

+

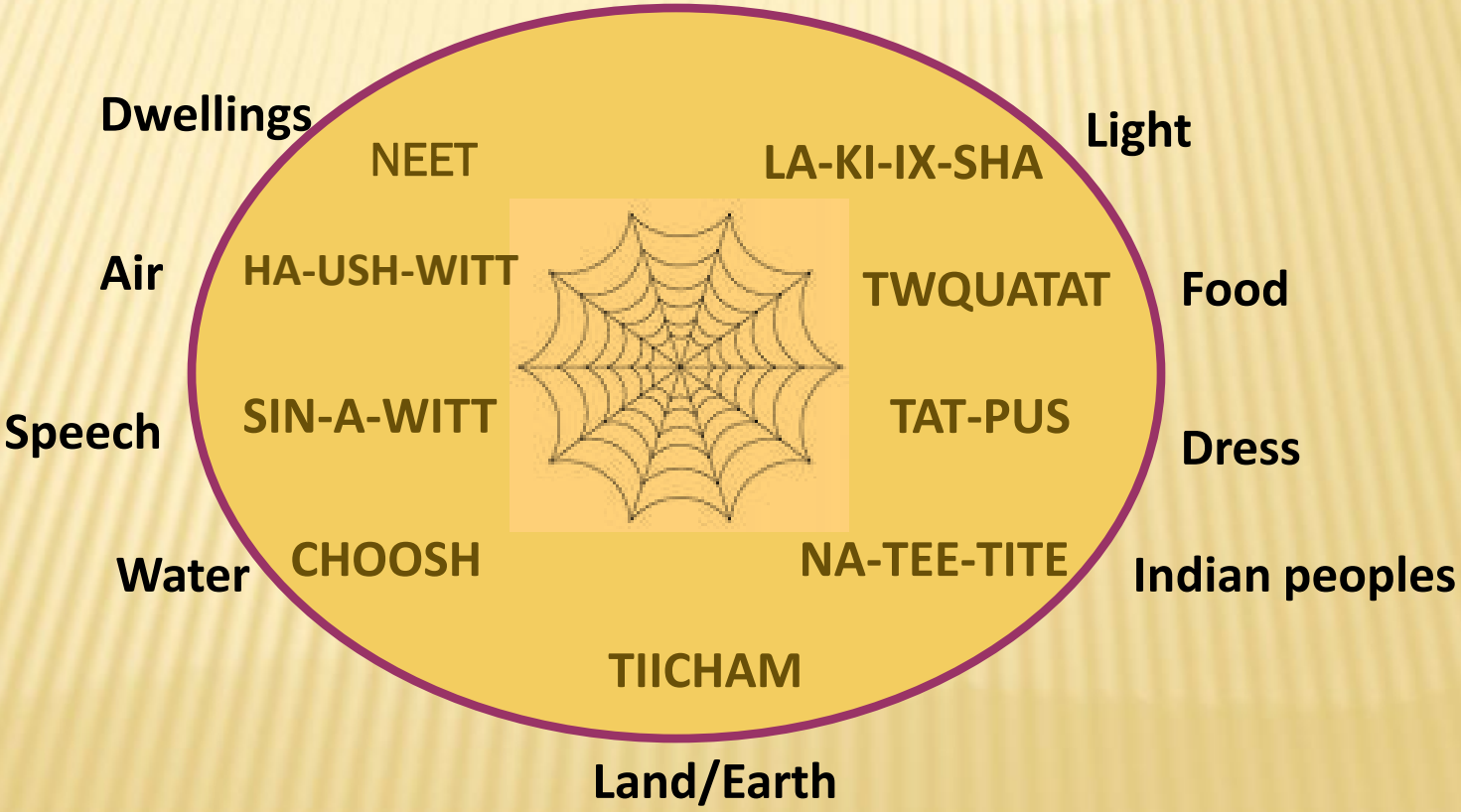
Western data:
- Climate data
- Energy transitions

Goals
- Buy local food
- Buy renewable energy
- Systems-based planning
- Green jobs

Governance
- Sell local food
- Produce local energy
- Homeowner support
- Strategic partnerships
- Distributed ecological sensors. Indicators.
- Workforce training

Tamánwit and First Foods (a CTUIR-wide Initiative)

- Ties food and serving order to the landscape
- Reflects explicit Treaty-identified resources
- Research into ecological process and restoration



First Foods

By the time of the vernal equinox many important roots and salmon are ready for harvest. Each April a thanksgiving feast, *kauite*, is held to celebrate the return, or the beginning, of the salmon and roots. April is known as the moon of the *gegi`t* roots (*Lomatium canbyi*). Soon the roots of the cous, *xamsi*, (*Lomatium cous*) along the Blue Mountains are ready to be harvested.

Serving Order

WATER

AQUATICS

- Salmon – chinook, coho, sockeye, steelhead
- Lamprey
- Mussels
- Trout, Whitefish, Suckers

LAND MAMMALS

- Mule deer, Elk, Whitetail deer, bighorn, mountain goat, bison, moose

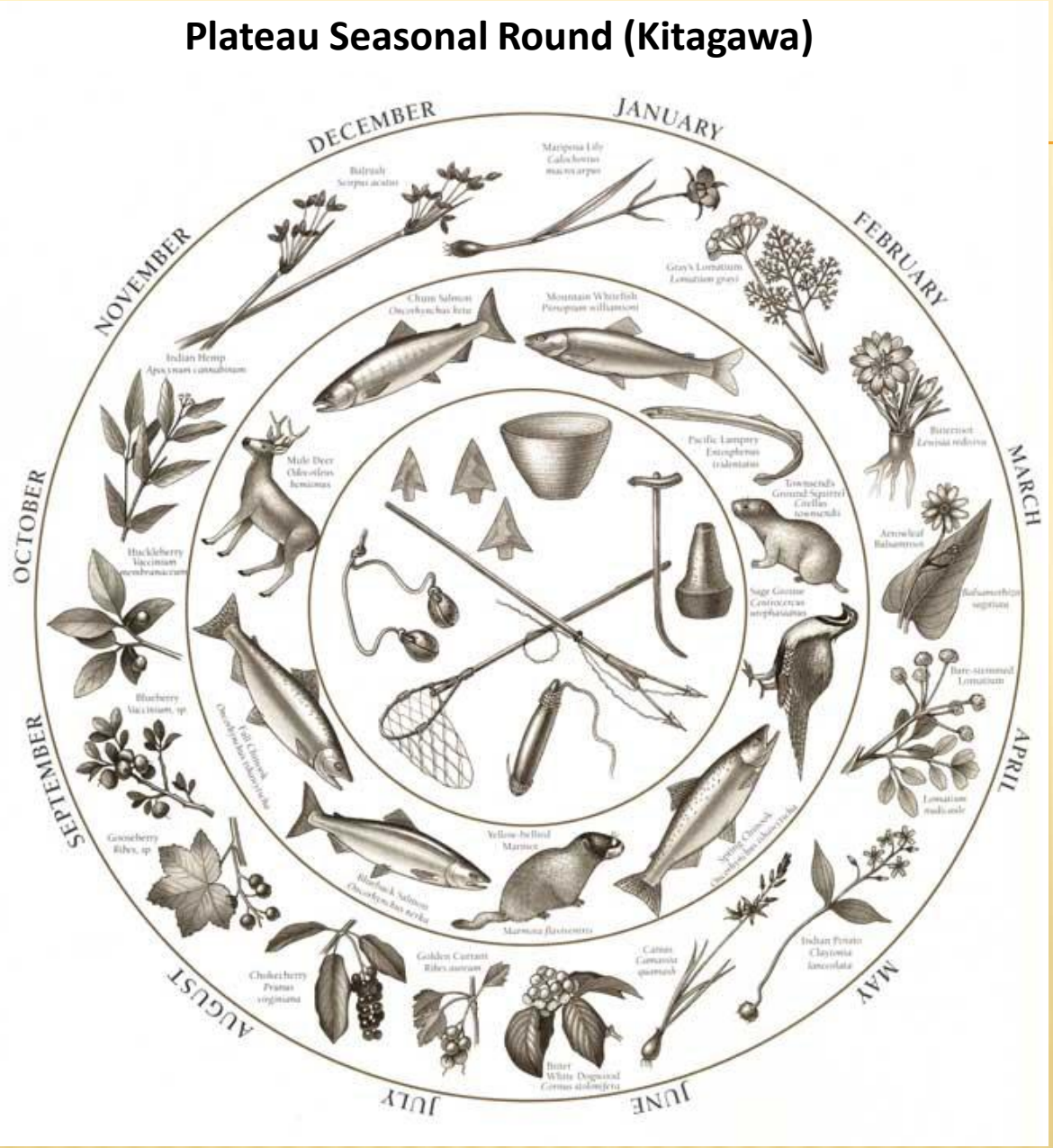
ROOTS

- Cous, Camas, Celery, Carrot, Bitterroot (also moss, greens)

BERRIES

- Chokecherry, Huckleberry

Plateau Seasonal Round (Kitagawa)



Re-naturalizating our way of life.

Local and seasonal resources and activities.

13 Months

People had to know every kind of tree that was up in the mountains. They had to know all the names of the different kind of plants and what they were for. We had conservation and botanical and environmental science.

http://www.trailtribes.org/umatilla/camp-life-and-seasonal-round.htm

Integrating modern and traditional science with Tribal values and policy

Identify Cultural Keystone Species

Incorporate Traditional Environmental Knowledge

Use geospatial and other technical data for vegetation mapping and sustainability

Continue video and oral archiving; oral tradition

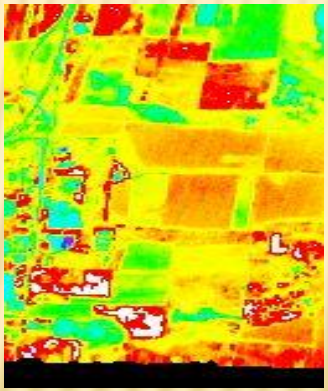
Staff with Physics, Chemistry, Toxicology, Risk Assessment, Botany, Engineering

Collect data, research, write technical reports.

Ecological Data and Tamánwit

- Sensor networks to detect climate-related changes in plants, insects, trees, ecosystems are needed.
- Ecologically and culturally important species.
- Blended traditional science and western science

Tribal people
In the field



Remote sensing

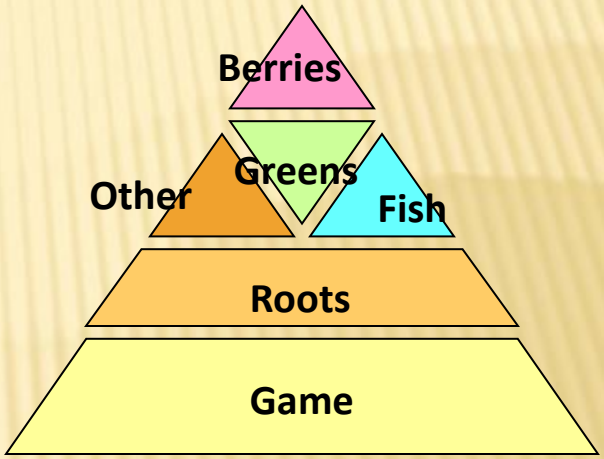
Modern
Instrumentation

Staff and academic
scientists

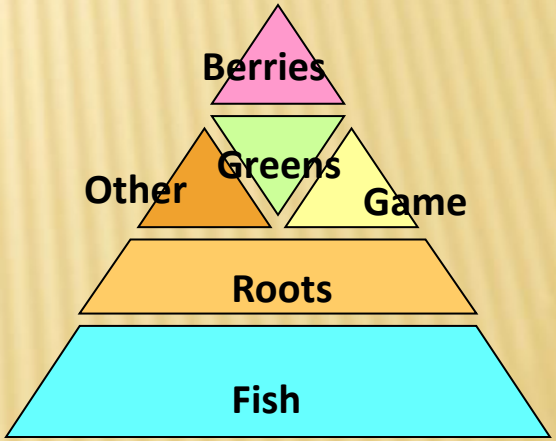
First Foods & CTUIR Diets

Food Category	Grams Per Day	Kcal per day	% of 2500 kcal
Fish	620	1000	40%
Game, fowl, eggs (reversed for upland Tribes)	125	150	6
Roots	800	800	32
Berries, fruits	125	125	5
Greens, medicinal leaves, tea, stems, pith…	300	300	12
Other: sweeteners, mushrooms, etc.	125	125	5%

Cayuse (Upland peoples)



Walla Walla, Umatilla (River peoples)



Edible and/or materially useful resources includes 200 plant and animal species

Harper & Harris 2006

We have choices for Sustainable Infrastructure

SUSTAINABLE INFRASTRUCTURE AND TAMÁNWIT

- Maintain the physical infrastructure while protecting ecological and cultural infrastructures
- Infrastructure must be physically and philosophically compatible with sustainable development
- Level the playing field for all types of infrastructure
- Increase the value of prevention and stewardship

Spend $10,000 to ask an engineer

Ask an elder

From S.G. Harris. "A Native American Perspective on Sustainable Infrastructure." New York University, Institute for Civil Infrastructure, April 22-23, 1999.

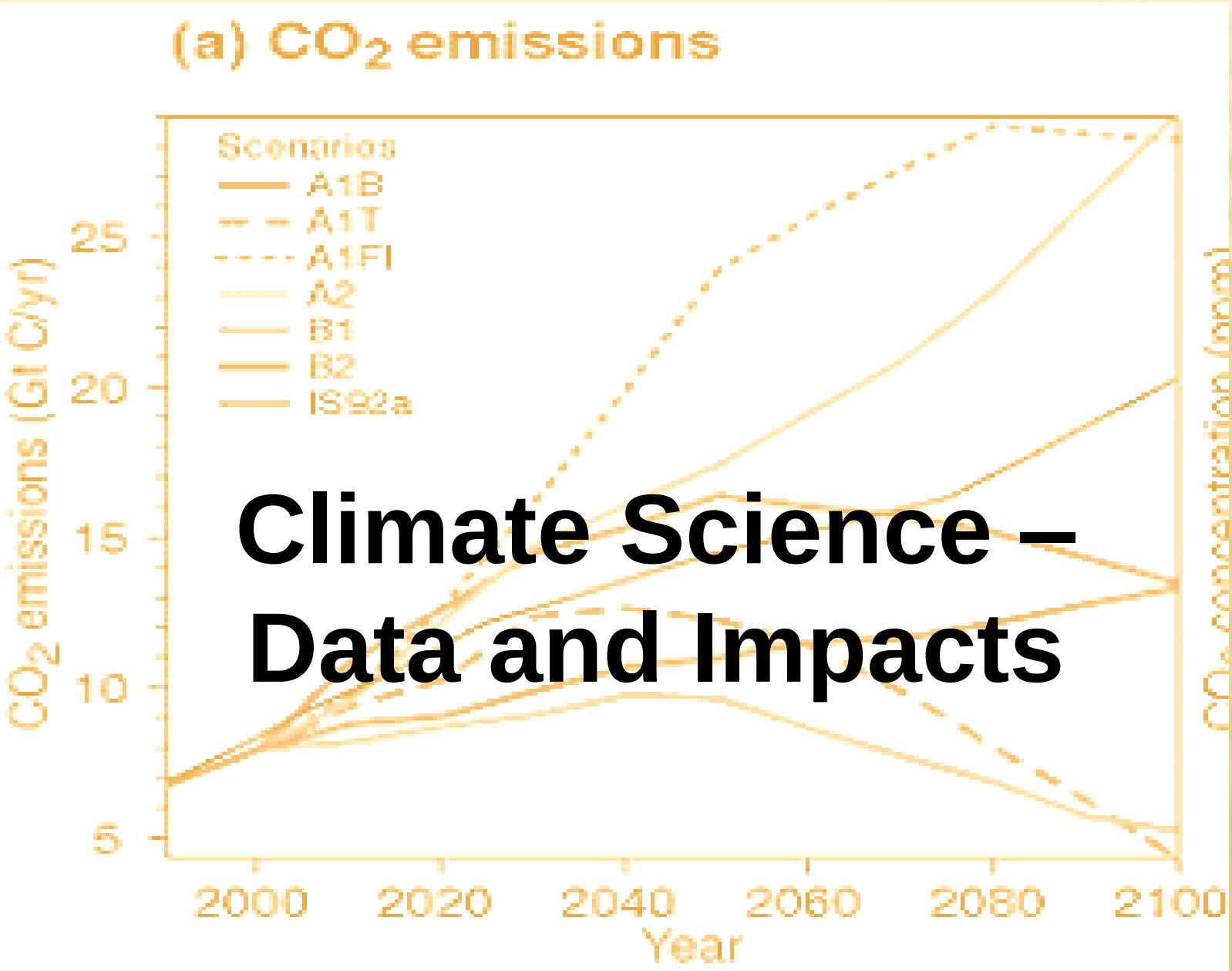
Long-Term:

Strange combinations of High-Tech Cities and Low-Tech Ecovillages with Smart-Tech off-grid homes.

Transition spaces and front-yard gardens

Hydronet

Ziggurat



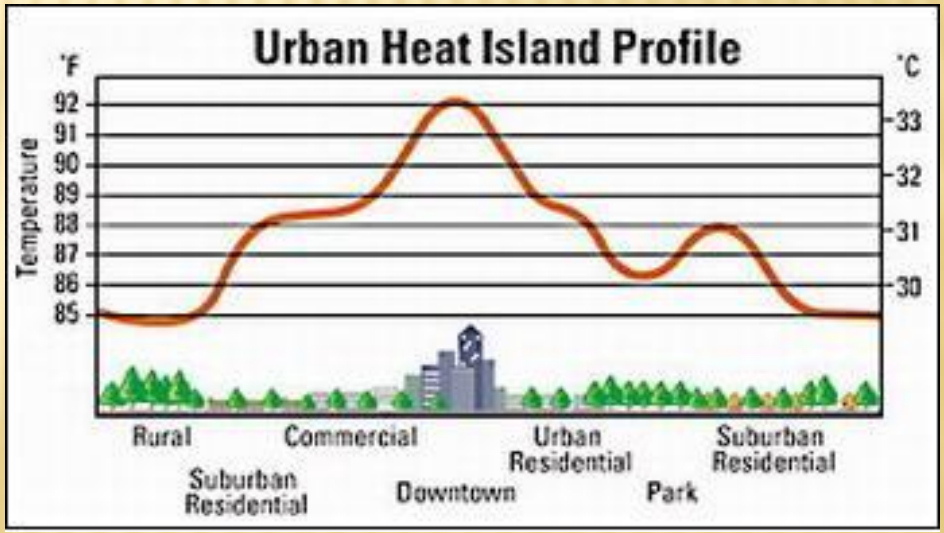
Climate Science – Data and Impacts

Global Carbon Project – IPCC says 6 degrees C likely by 2100

Despite an economic downturn in 2007, US emissions rose by 2% and China by 7% (global average was 3%). Globally, 2007 carbon dioxide emissions puts the planet on track for the most severe effects of climate change, including a rise of sea levels, covering significant regions in water, and monster storms. [Sept 29, 2008]

http://www.abcnews.go.com/Technology/AheadoftheCurve/wireStory?id=5884934

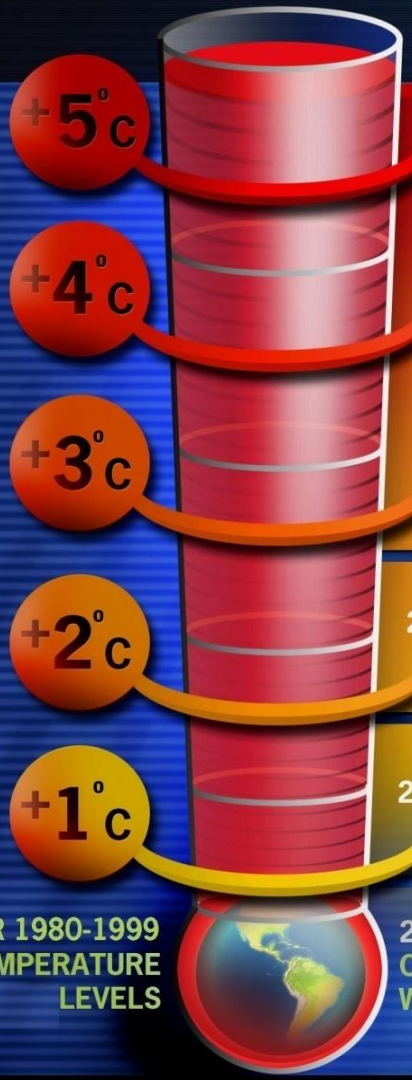
Cities will be warmer than vegetated areas.



http://www.inlandnewstoday.com/story.php?s=4042

RISING IMPACTS OF GLOBAL WARMING

WITH CONTINUED INTENSIVE RELIANCE ON FOSSIL-FUELS AND EMISSIONS INCREASES



EXTINCTION OF MORE THAN 40% OF KNOWN SPECIES
GLOBAL ECONOMIC LOSSES OF UP TO 5% GDP
COMMITMENT TO AT LEAST PARTIAL MELTING OF GREENLAND AND W. ANTARCTIC ICE SHEETS, EVENTUALLY RAISING SEA-LEVEL 13-20 FEET

SUBSTANTIAL BURDEN ON HEALTH SERVICES
GLOBAL FOOD PRODUCTION DECREASES
ABOUT 30% OF GLOBAL COASTAL WETLANDS LOST

MAJOR CHANGES IN NATURAL SYSTEMS CAUSE PREDOMINANTLY NEGATIVE CONSEQUENCES FOR BIODIVERSITY, WATER AND FOOD SUPPLIES
WIDESPREAD CORAL MORTALITY
MIILLIONS MORE PEOPLE FACE FLOODING RISK EVERY YEAR

INCREASED RISK OF EXTINCTION FOR 20-30% OF KNOWN SPECIES
MOST CORALS BLEACHED
INCREASING MORTALITY FROM HEAT WAVES, FLOODS AND DROUGHTS

DECREASING WATER AVAILABILITY, INCREASING DROUGHT IN MANY REGIONS
INCREASING WILDFIRE RISK, INCREASED FLOOD AND STORM DAMAGE
INCREASING BURDEN FROM MALNUTRITION, DIARHOEAL, CARDIO-RESPIRATORY AND INFECTIOUS DISEASES

NET www.net.org

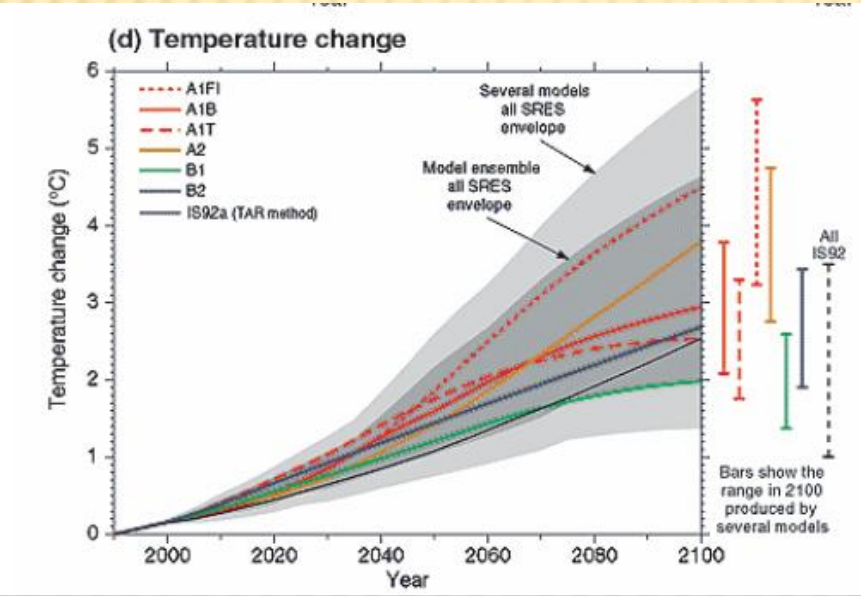
Source: IPCC Fourth Assessment Report, Working Group II Summary for Policymakers. Timing of temperature increases based on IPCC scenarios that assume continued intensive reliance on fossil-fuels and emissions increases. Emissions reductions would reduce the amount and rate of warming.
Conversion of temperature increases—Celsius to Fahrenheit: 1°C = 1.8°F; 2°C = 3.6°F; 3°C = 5.4°F; 4°C = 7.2°F.

Produced by National Environmental Trust.

Climate Change Science

Climate Science is clear. The Pacific Northwest can expect:

- At least 4° of warming;
- Altered and unpredictable weather patterns;
- More winter precipitation as rain. Less snowpack;
- Earlier spring freshet, lower summer flows;
- Higher water temperatures in tributaries.

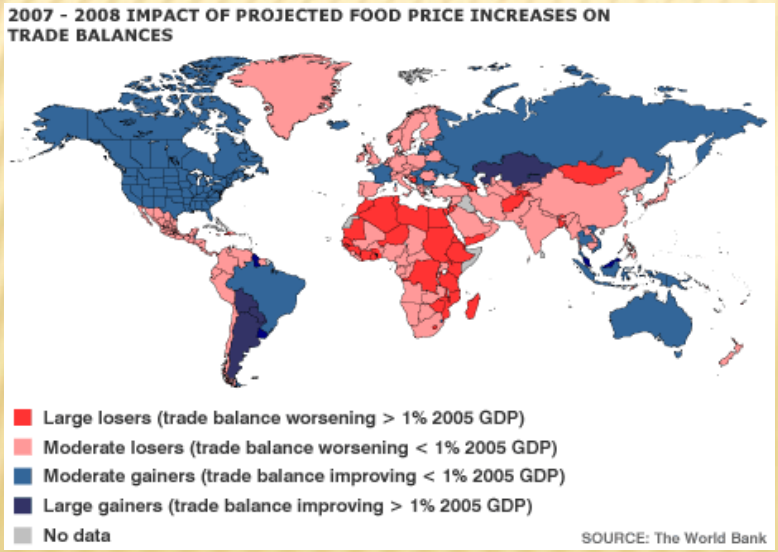


- Vegetation will be stressed, move, or disappear.
- Agriculture will be stressed.
- Water conflicts will occur.
- Population will increase in the Umatilla Basin.

National and Global Impacts

Global Impacts:

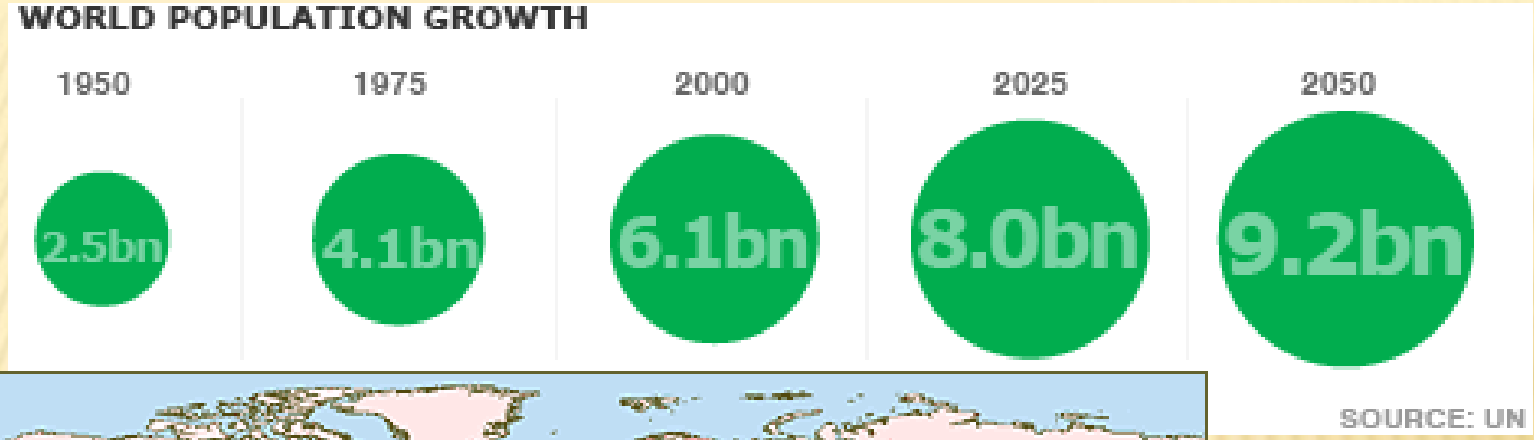
- Some countries will not have enough food or water.
- There will be winners and losers in food, water, and oil prices.
- Losers cannot be expected to quietly starve. They will fight or move. Climate refugees will stress many governments.

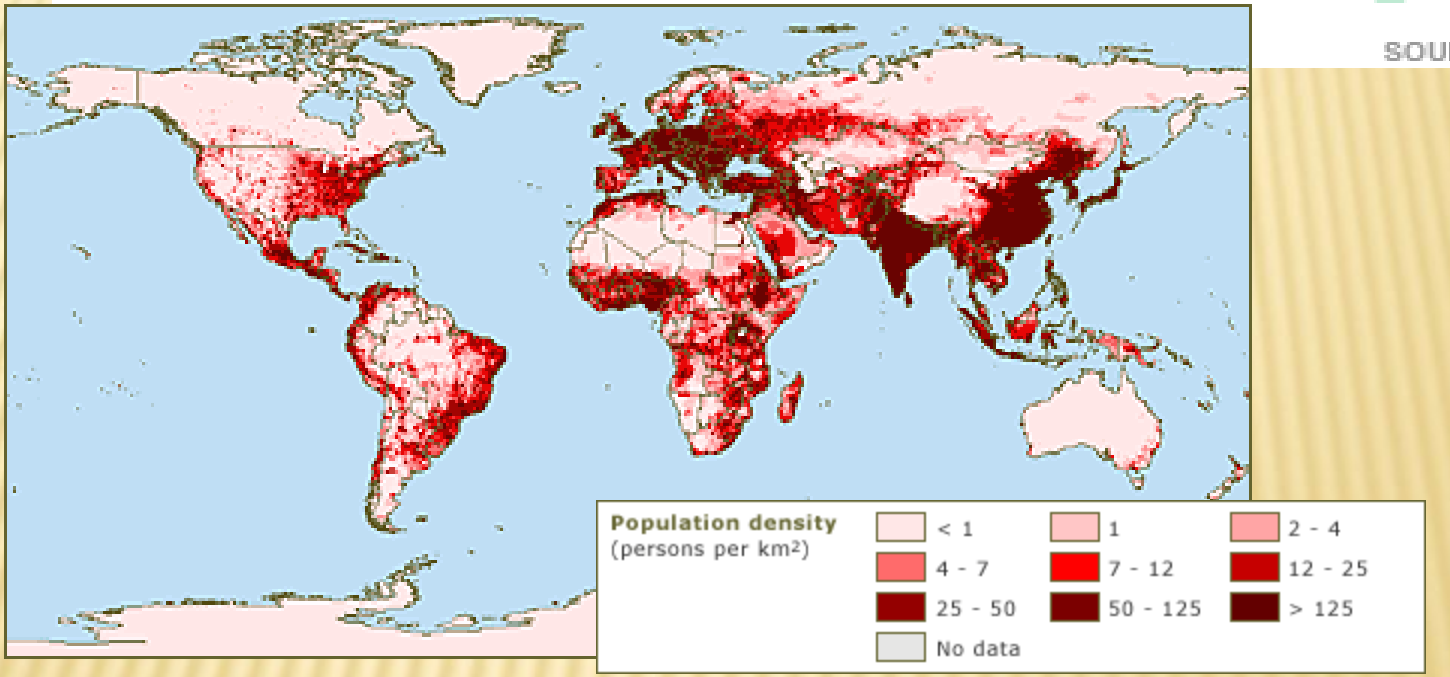


Food Price Winners and Losers

National Impacts:

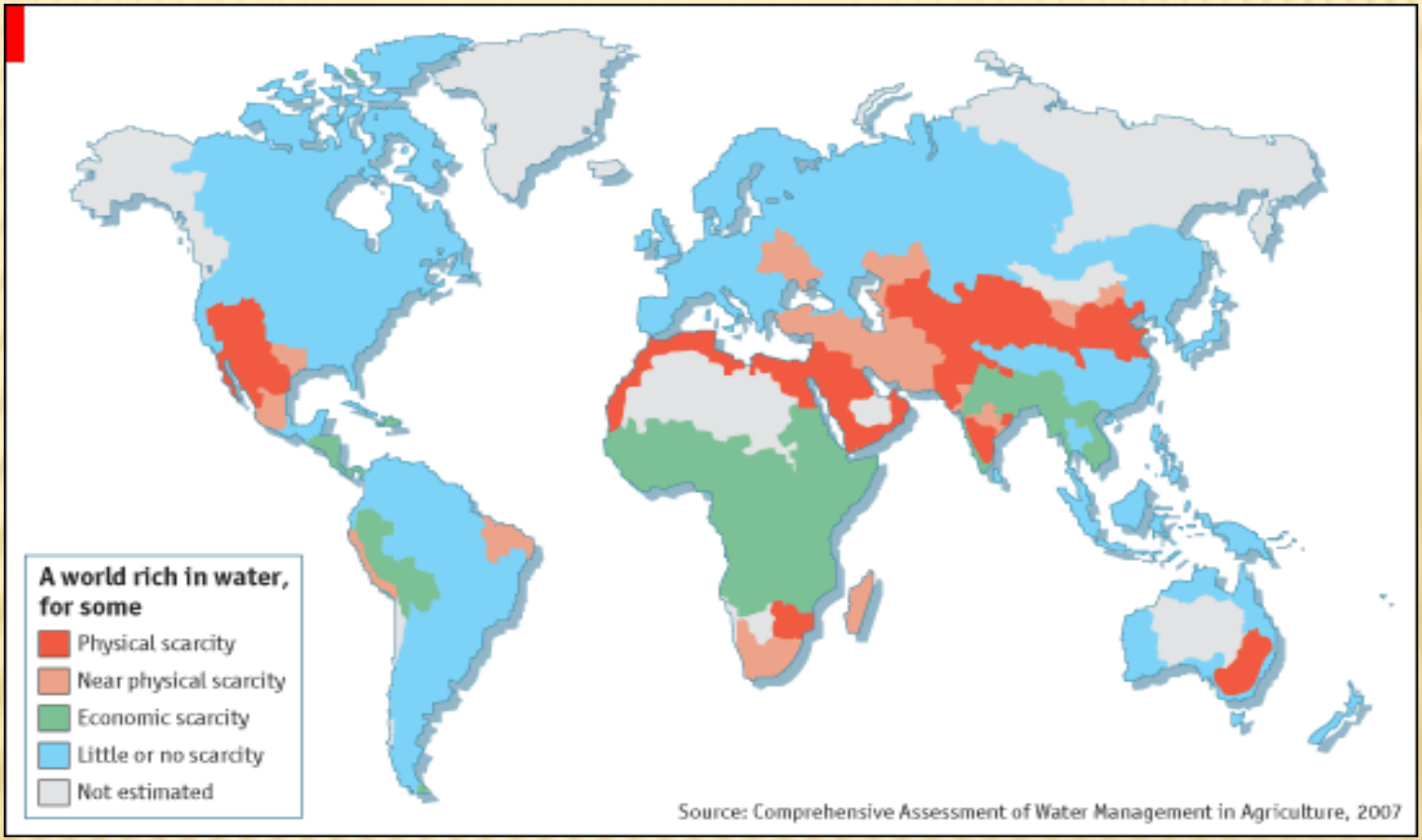
- Energy transition to renewables.
- Infrastructure is crumbling.
- Lifestyle changes will be faster and greater than most people realize.
- National debt means that federal assistance will be minimal.





Some projections predict that global population will begin to decline after 2030. Even so, that is 3X more people than there is food and water. Urban megacities are already buying water rights from rural counties. Umatilla County will grow by 1.5x to 4x in population.

Water Stress & Water Shortage



***** Alarming case law *****

In WA, CO and Utah, you do not own the rain that falls on your house and yard!!

Fact: Plants are Moving

Climate Change Pushes Plants Out of Their Comfort Zone
By Lauren Cahoon
*Science*NOW Daily News
26 June 2008

Mosaic of plants that are moving up the Alps in elevation

http://sciencenow.sciencemag.org/cgi/content/full/2008/626/3?etoc

CLIMATE CHANGE IMPACTS TO AG

- Water supply
- Average temperatures
- Temperature extremes
- Growing seasons
- Fire frequency
- Invasives

How will the Agriculture Sector interact with the Energy Sector (cap and trade, sequestration, conservation, etc.)?

From Stephanie Page, Oregon Department of Agriculture

FUTURE PNW CLIMATE TRENDS

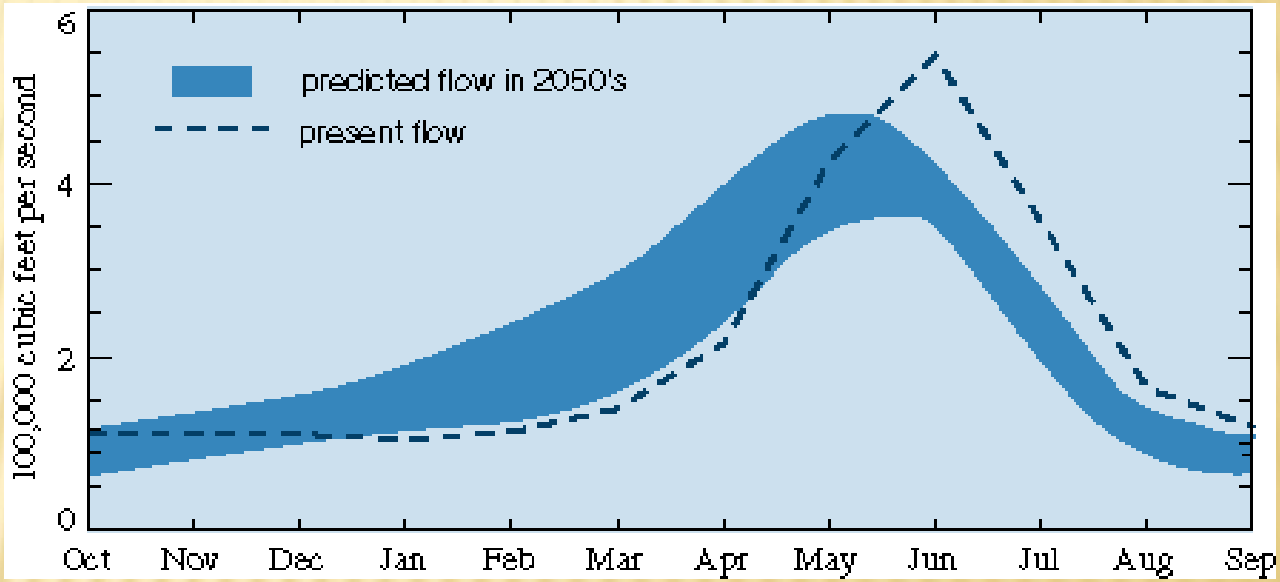
- Warming – very high probability.
- Wetter winters – moderate probability.
- Drier summers – moderate probability.
- Extreme weather – high probability.
- Increased drought – high probability.
- Abrupt Climate Change – low probability.

From Kyle Dittmer, CRITFC

COLUMBIA BASIN WATER

Impacts of climate change on streamflow

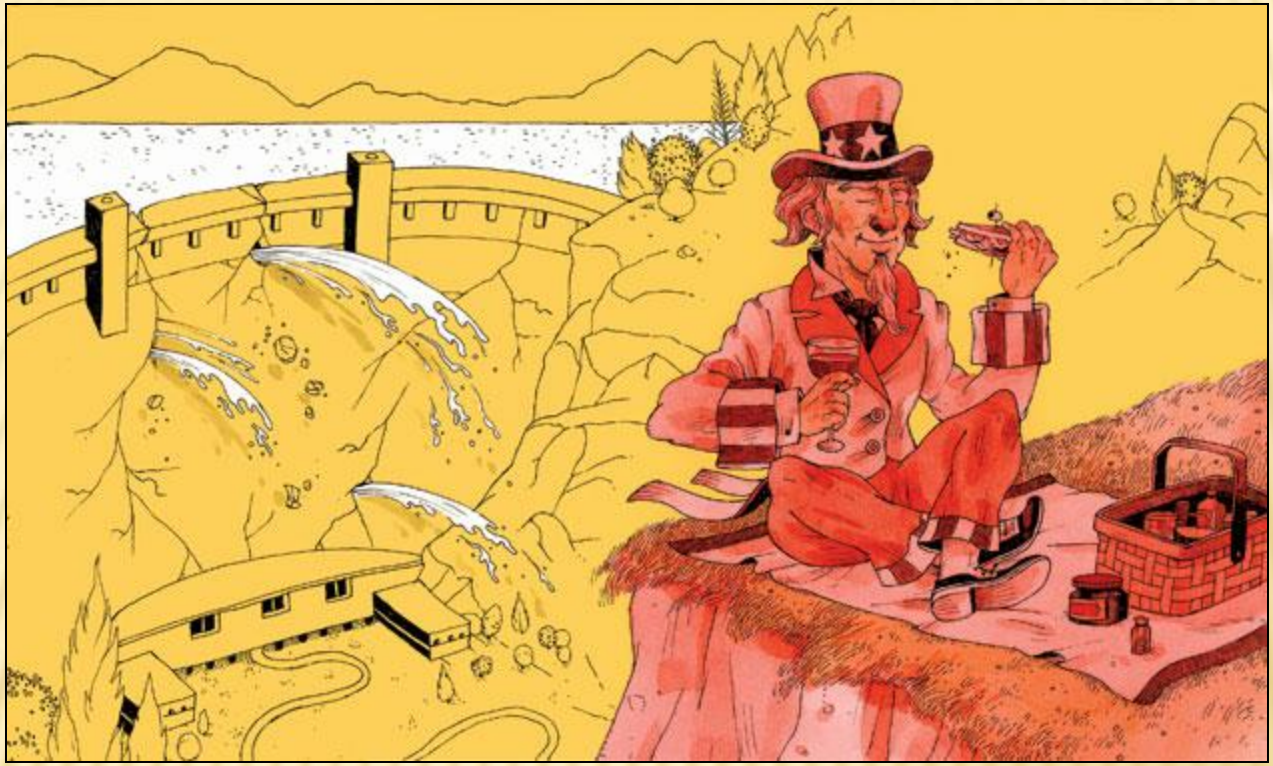
- Less snow, earlier melt means less water in summer
  - irrigation
  - urban uses
  - fisheries protection
  - energy production
- More water in winter
  - energy production
  - flooding



Natural Columbia River flow at The Dalles, OR

Source: P. Mote, University of Washington

Infrastructure Replacement Costs



http://www.popularmechanics.com/rebuildingamerica

<u>Infrastructure Needs</u> – water pipes, sewers, POTW capacity, roads, bridges, ports.

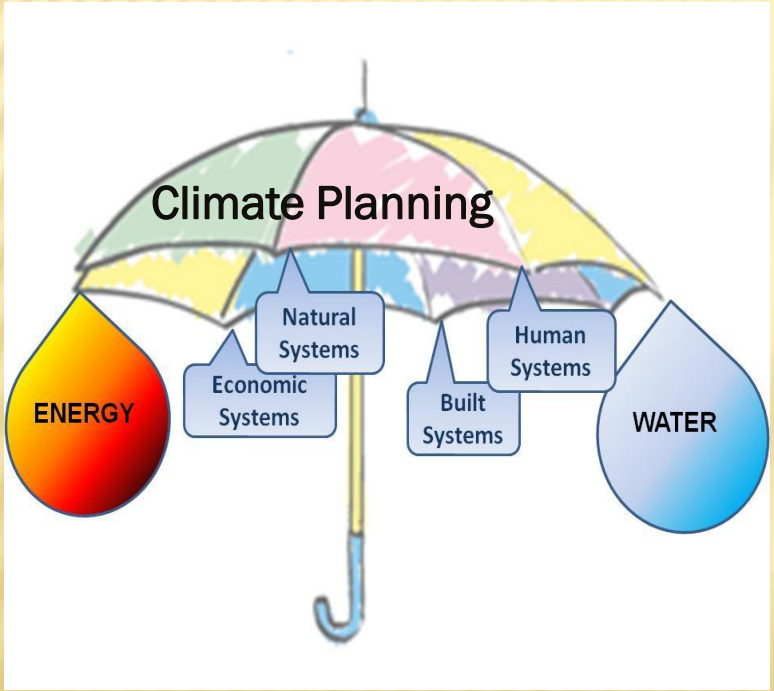
<u>Megacenters</u> are expected, so civil engineering projects must also be supersized. – Cascadia, San Francisco, Southern Calif & Long Beach, Texas Triangle, etc.

<u>Consequence:</u> Privatized toll bridges and toll roads. The federal budget cannot replace water treatment systems – will this increase water pollution? Pay-Go?

Adaptive Governance

Our leaders will need to be:

- **Culturally grounded, environmental ethic**
- **Technically trained in climate, energy, planning (*know what to do*);**
- **Managerially skilled (*know how to do it*);**
- **Governmentally agile (*lead the changes by empowering the people*).**



- **Civilizations rise and fall by their water, energy, and food resources.**
- **Governmental policies and practices can make the transition easy or hard. This is a choice.**
- **We can survive as a region if we:**
  - **plan carefully but forcefully,**
  - **form coalitions with neighbors,**
  - **support the community to take early action.**

For a Glimpse into the Future

A1/B2 Scenarios (at least 4 degrees and 650 ppm CO2; most likely outcome):

- **500 ft down in elevation**
- **800 miles south**
- **Big-city heat and CO2 islands**

Danger of complacency and over-simplification: "So what if Seattle looks like Tuscon (hot and dry) or Tampa (hot and wet) – they're doing fine."

Alternative future Scenarios

Various authors have envisioned future scenarios for adaptation processes and quality of life outcomes, with assumptions about energy; water & food; human nature (violence, cooperation, pragmatism, optimism); population; and governmental intervention. For example:

Last Man Standing – Lifeboats – Power Down – Snooze/Lose
(R Heinberg – Power Down)

Ecotopia – Mad Max – Star Trek – Big Government
(R Costanza)

Scramble – Blueprint ***(Shell Oil)***

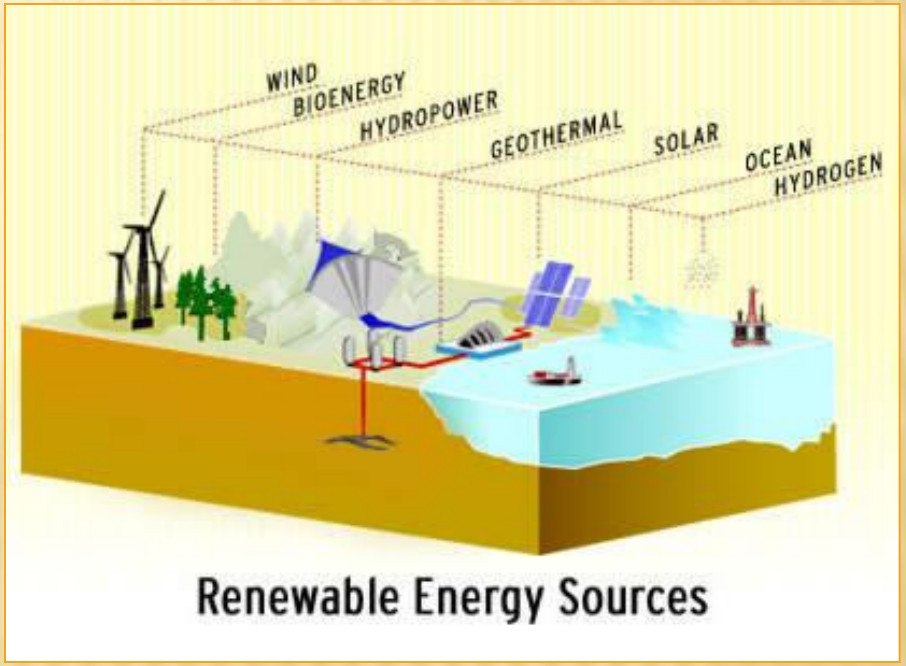
Visioneering is useful but only if backed up by science, facts, and structured values-focused thinking.

Al Gore: Energy Crisis Can Be Fixed (7-17-08)

Says Situation Is Dire, But Not Irreversible If Americans Start Rigorous Green Plan Now; Set 10-year Clean Energy Goal - $1.5 Trillion

Gore: We've got to end our dependence on oil and coal. The new demand for oil and coal from China and these other fast-growing countries means that the only way we're going to escape the rising prices and the dependence on foreign sources is by switching to renewable sources.

T. Boone Pickens is investing in water rights and wind. "We can't drill our way out of this challenge."



http://www.cbsnews.com/htdocs/energy/renewable/framesource.html

The IPAT Equation by Paul Erlich

Impact = **P**opulation × **A**ffluence × **T**echnology

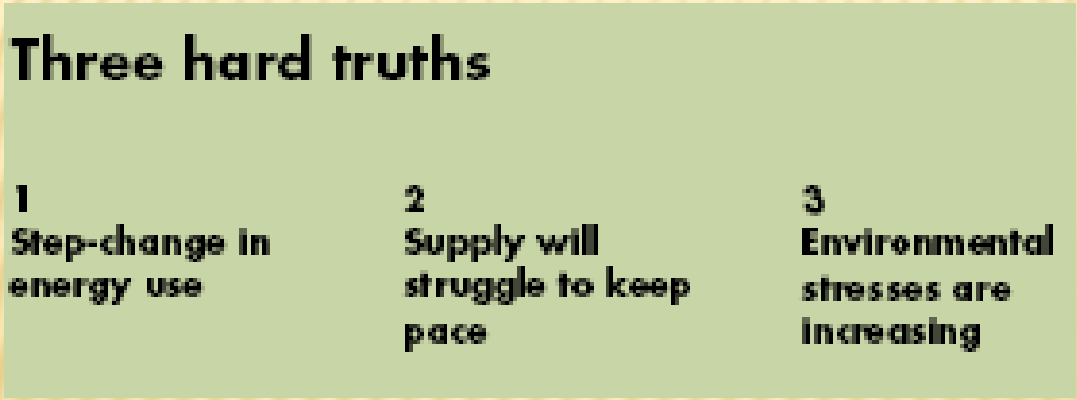
Where:
I = Human Impact on the natural environment
P = population
A = affluence (consumption per capita)
T = technology (environmental impact per unit of consumption, e.g. CO2).

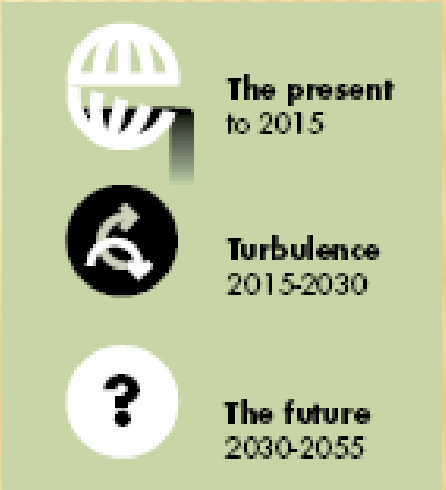
As ***P*** rises, and ***T*** rises, ***A*** will inevitably decline, not rise.

Conclusion: **Sustainability requires that *Impact* must be reduced. We are now living in a closed global system. Continued economic growth is not possible since we have reached the finite extent of natural resources and since global population has far exceeded the carrying capacity of the earth.**

SCRAMBLE – lots of individual plans and projects, incremental progress, but not coordinated toward an overall integrated goal.

BLUEPRINT – Integrated, cross-sectional, inter-disciplinary, inter-agency master plan; regional, national and inter-national plans aligned.

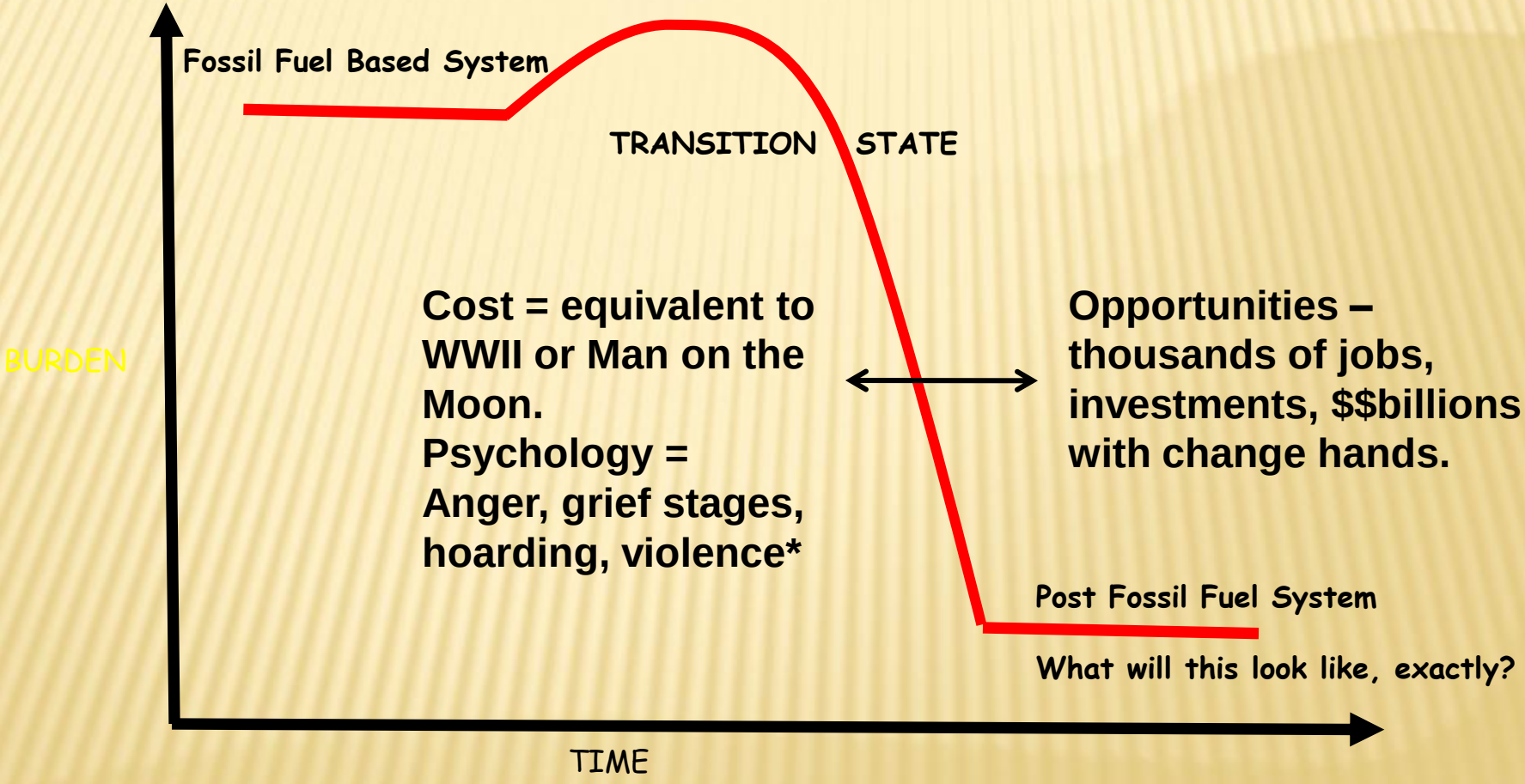




http://www.shell.com/home/content/aboutshell/our_strategy/shell_global_scenarios/shell_energy_scenarios_2050/shell_energy_scenarios_02042008.html

The Transition State – Hard for All

Modified from Cylvia Hayes, 3e3trategies



* Our experience with Euro-immigrants has not been pleasant. They will want the few resources we have been able to protect.

MANAGING *AS* CLIMATE CHANGES:

- Key drivers, such as climate and technological change, are unpredictable with great accuracy
- Human action in response to projections is reflexive
- The system may change faster than the models can be recalibrated, particularly during turbulent periods of transition. Projections may be most unreliable in precisely the situations where they are most desire
- *Adaptations in many cases are driven by crises, learning and redesign: Thresholds are usually noticed after they're exceeded.*
- *How fast will changes occur? How fast will we respond? Will it be abrupt or gradual?*

From Roger Pulwarty, NOAA, IPCC

DEALING WITH CLIMATE CHANGE: MITIGATION AND ADAPTATION

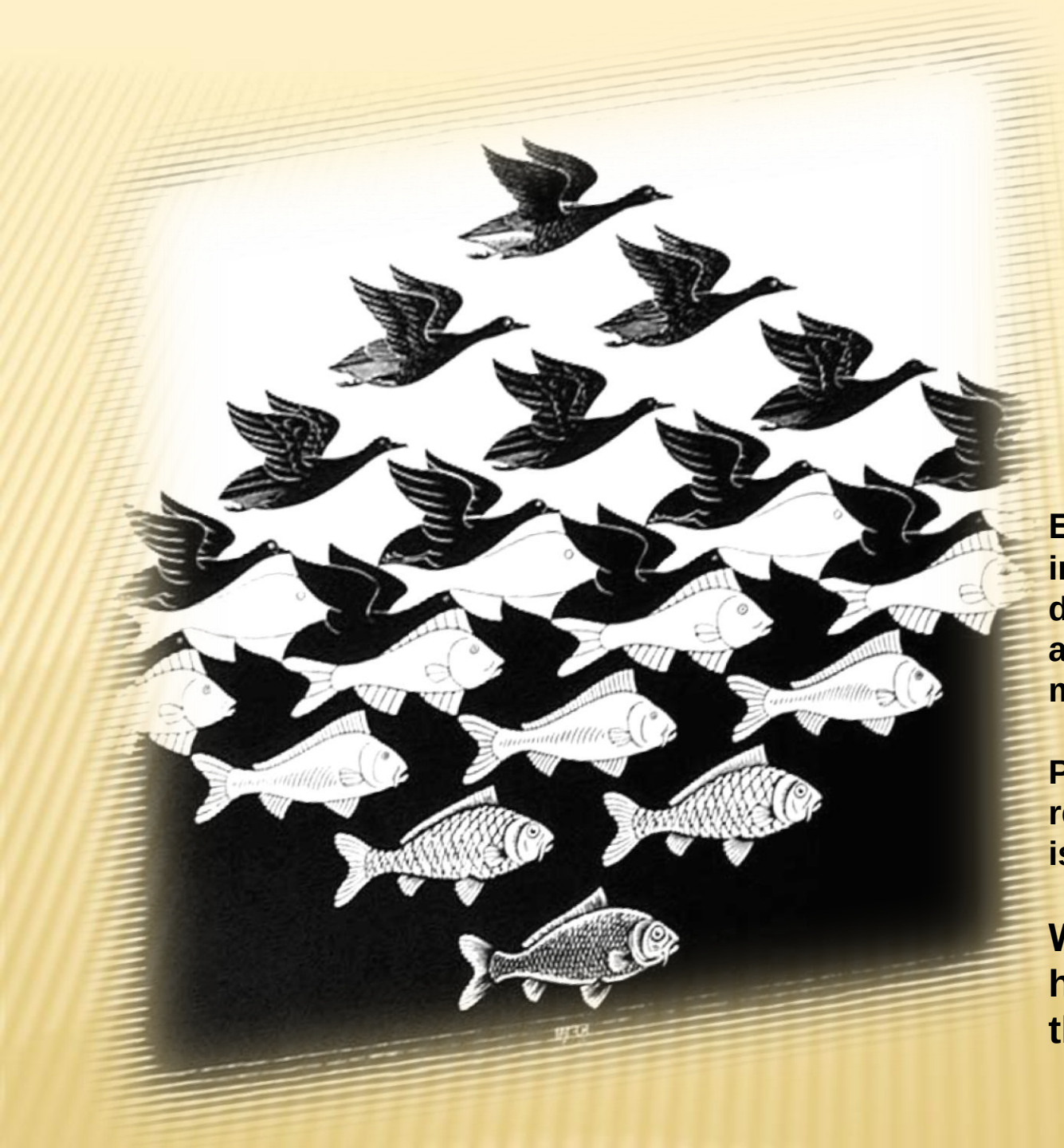
Mitigation activities

Reducing emissions of greenhouse gases

Adaptation activities

Managing the change that occurs as mitigation strategies are implemented.

From Lara Whitely Binder,
Climate Impact Group
University of Washington



Paradigm Shift from Scramble to Blueprint, or incremental response?

Example: add 1” of insulation for every degree warmer, or shift all at once to new design and more flexible codes?

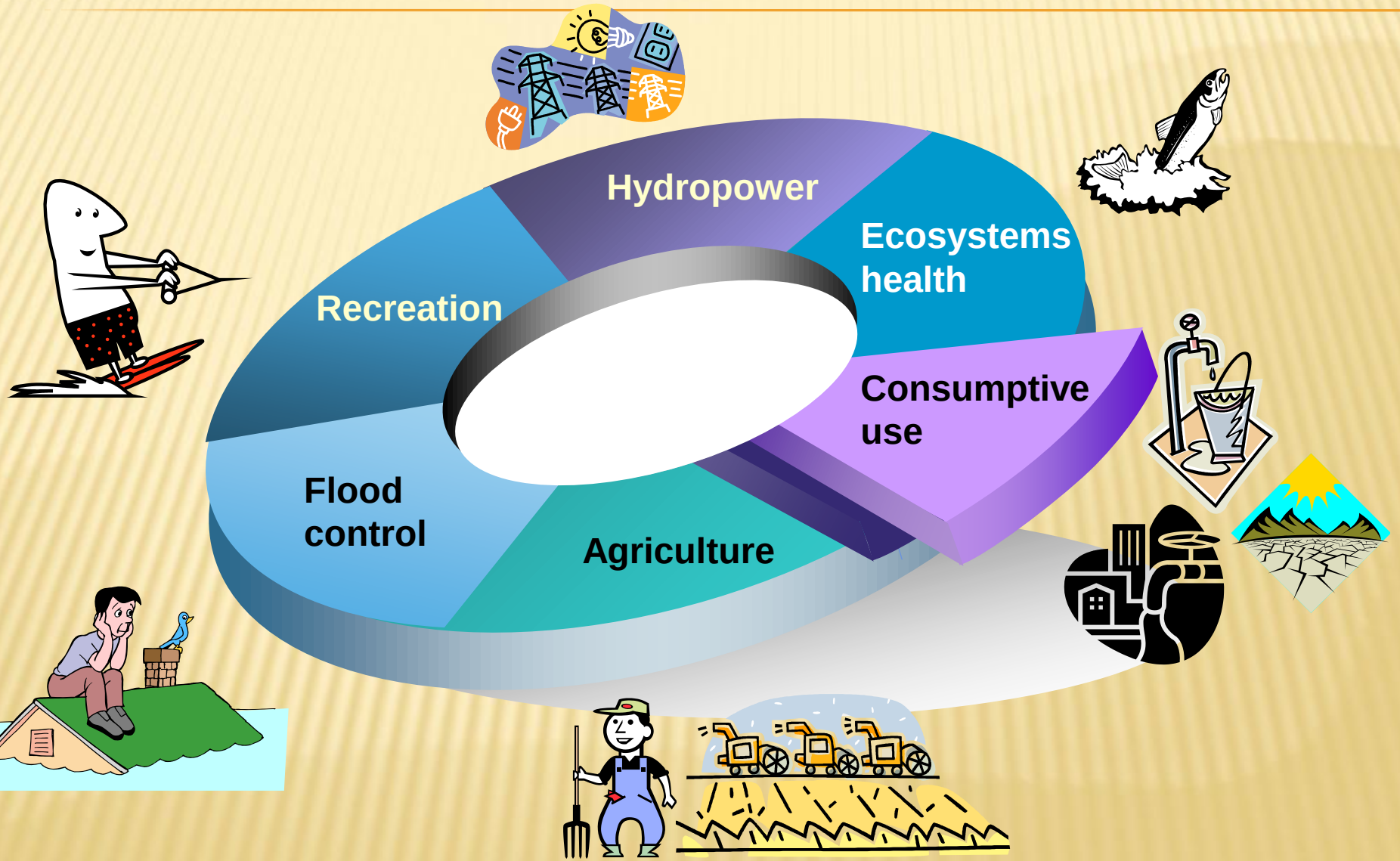
Perils of incremental response for some issues; OK for others.

Will “governance” help or hinder these changes?

Climate change is a slow-motion and sustained emergency

- Some acute emergencies will be more frequent or more severe; others stressors will be slower to develop.
- DHS-FEMA-CDC have tested planning and evaluation processes for emergency preparedness, and require certain report and evaluation formats (HSEEP). They have many online tools.
- Climate planning should combine monitoring, risk management and emergency preparedness tools.
- There are also investment opportunities - alternative-energy, infrastructure, waste management, and energy efficiency.

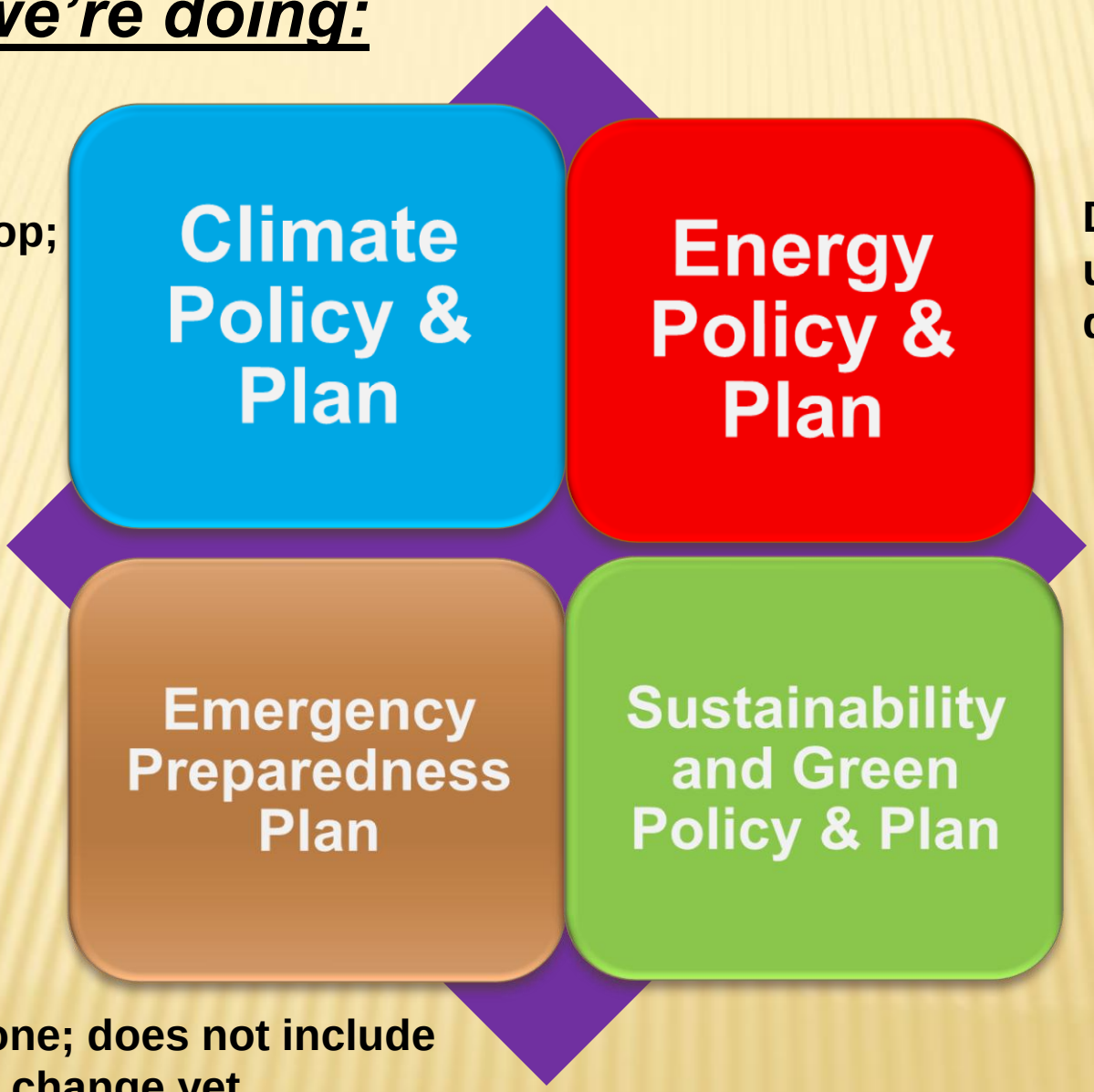
Competing values



From Roger Hamilton, U of Oregon

What we're doing:

One workshop; No plan

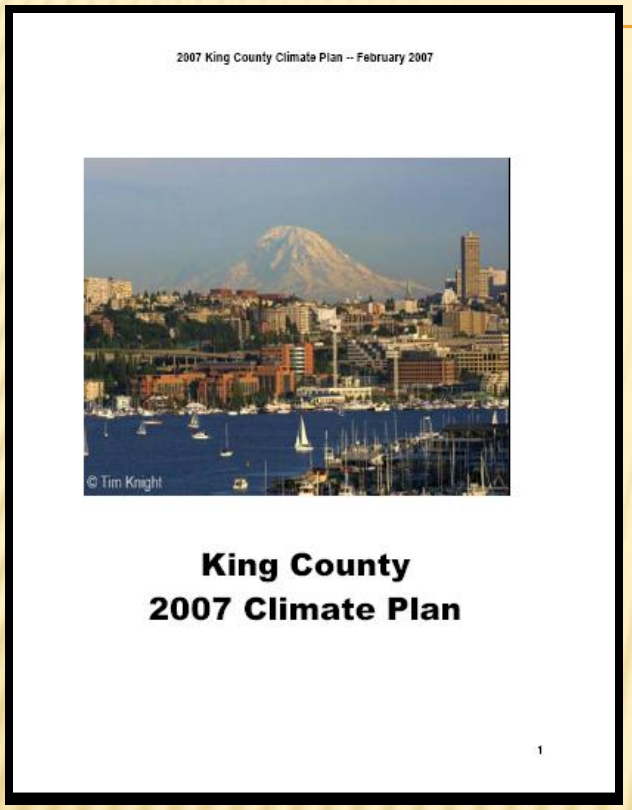


Draft policy under development

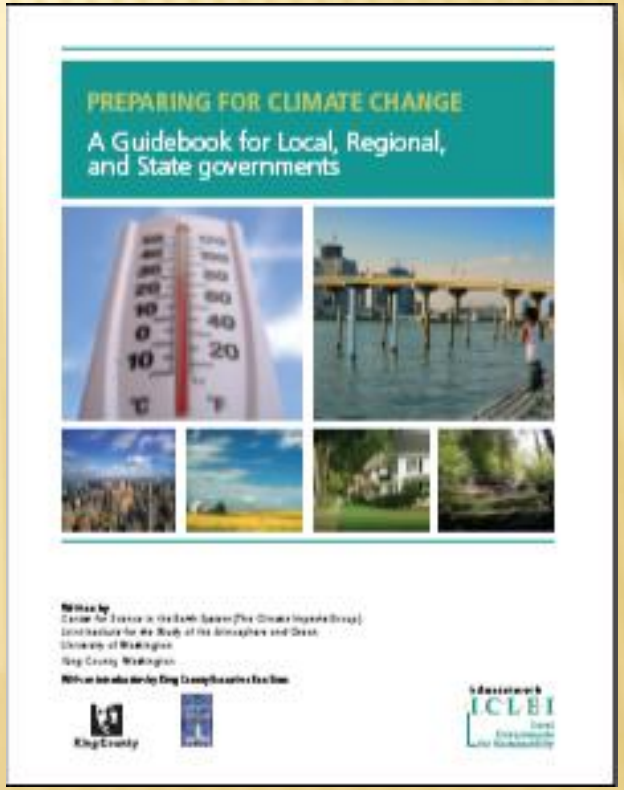
Nothing yet

Draft done; does not include Climate change yet.

Don't reinvent the wheel…



King County Plan



National: Climate Change Guidebook

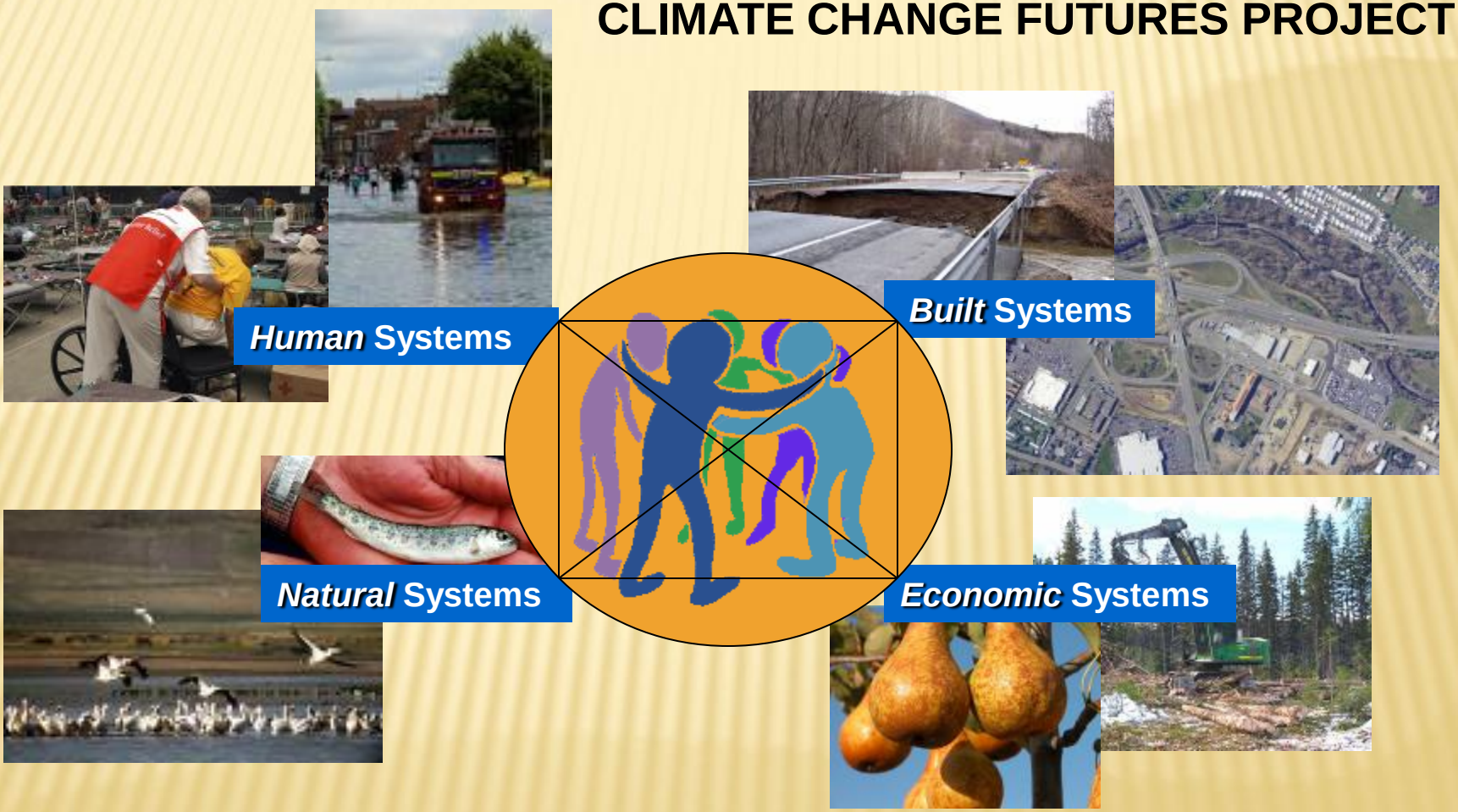
What can be done at a watershed level?

- More flexibility and adaptability built in our ecosystems and economies. Prepare for increased weather variability and extremes.
- Reduce greenhouse gas emissions. Use more "green" energy (wind, solar) and less oil. Sequester greenhouse gas.
- Promote natural water storage via Watershed, Riparian, Floodplain restoration.
- Grow trees on tribal lands for carbon sequestration credits ("cap & trade").
- Improve Columbia basin runoff forecasting to help in Federal hydro operations
- Put climate change in management plans: BiOp, NPCC Amendments, etc.

From Kyle Dittmer, CRITFC

We are forming Partnerships …

Rogue River
CLIMATE CHANGE FUTURES PROJECT



From Roger Hamilton, University of Oregon

ROGUE FUTURES FORUM

Rogue River WORKSHOP GOALS

Human **Systems**

Built **Systems**

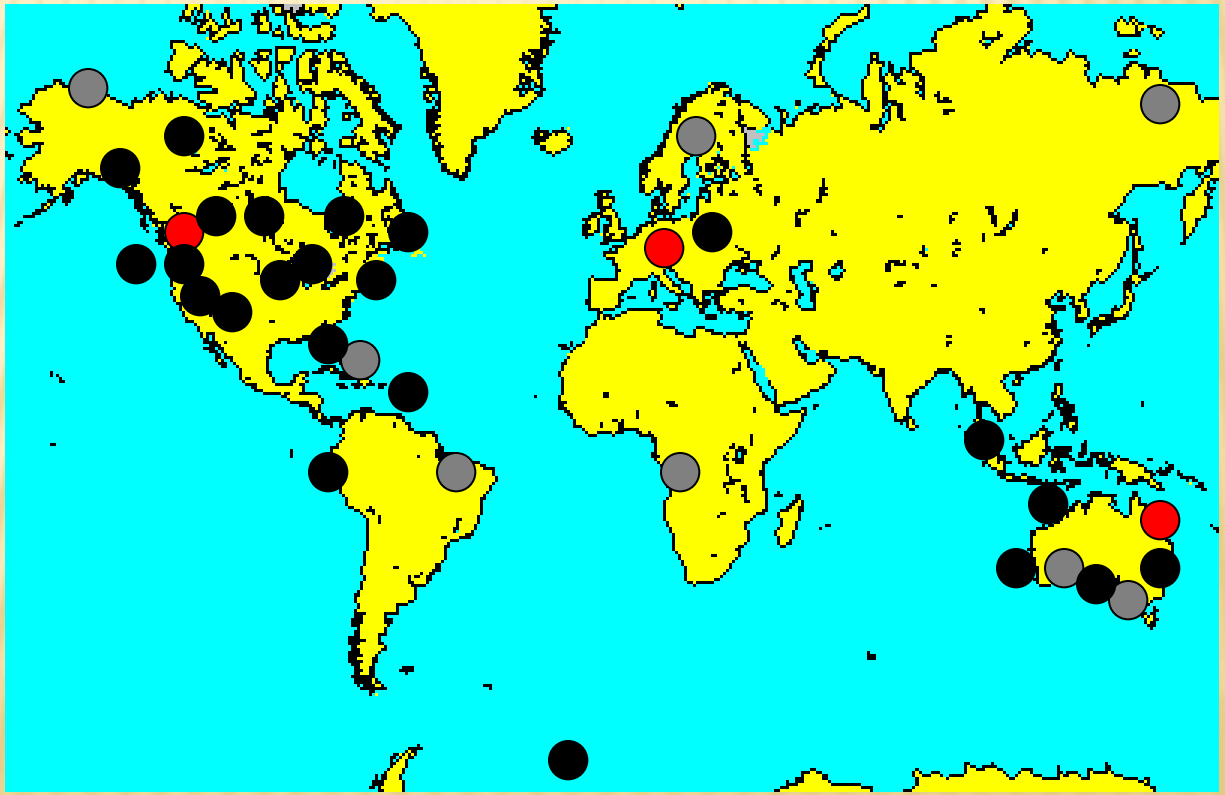
Economic **Systems**

- **Predict range of impacts for Natural, Human, Built, and Economic Systems in the Rogue Basin**
- **Identify strategies and policies for increasing resistance and resilience to prepare for climate change**
- **Identify scientific data gaps, research needs and monitoring processes to direct further inquiry and measure success**

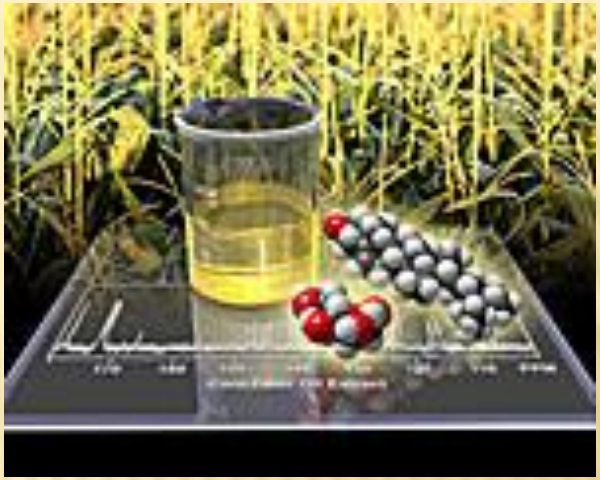
From Roger Hamilton, University of Oregon

TRACK RECORD FOR IMPLEMENTATION OF ADAPTIVE MANAGEMENT:

Successful Modeling failure Implementation failure



From Roger Pulwarty, NOAA, IPCC



DOSE growth areas:

- **Climate Science**
- **Energy Planning and Biofuels**
- **Native plant research and propagation**

Do you have a green job yet? You will…

A new report from the nonprofit American Solar Energy Society shows that as many as 1 out of 4 workers in the U.S. will be working in the renewable energy or energy efficiency industries by 2030.

Request to BPA: Help us with workforce development.

Needs:

- **Talk to our high school students about future jobs and work habits.**
- **Help us develop practical high school ‘green-future’ curricula**
- **Help establish scholarships for vocational training (Pre-STEP)**
- **Help us develop practical leadership development curricula**
- **Help us fund a Tribal Energy/Climate Planner position**

Looking back from 2050