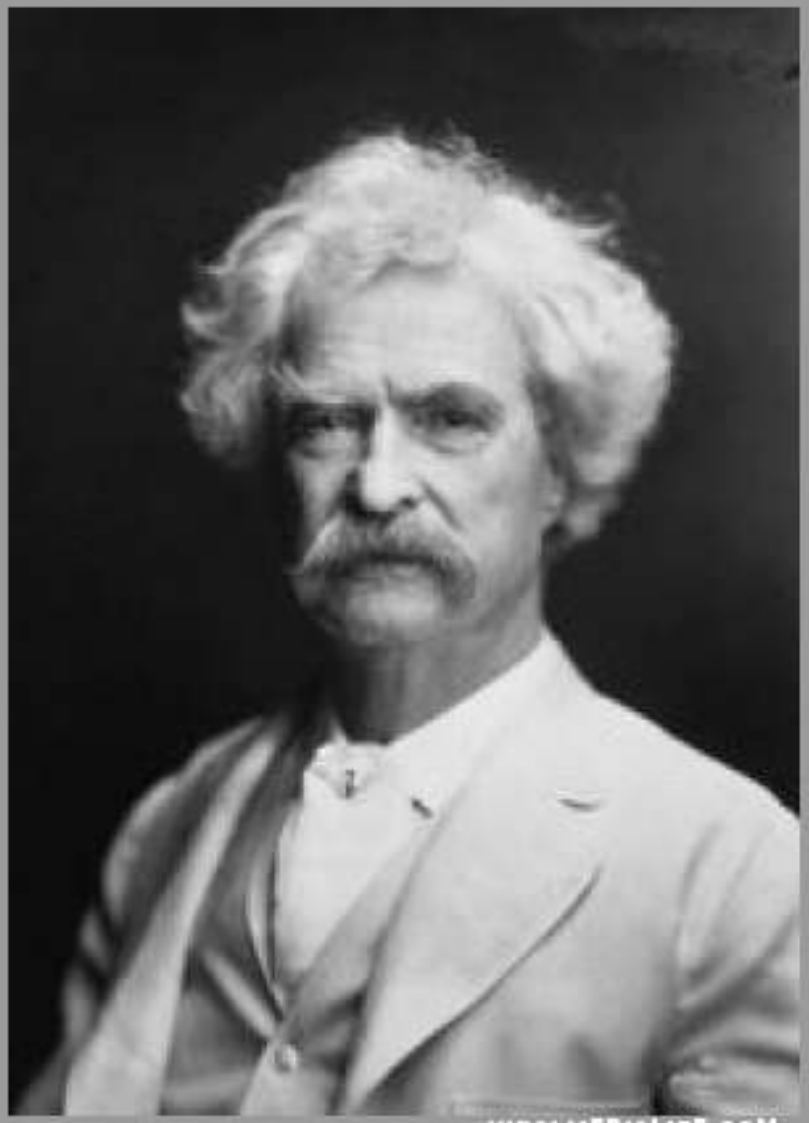
Natural Capitalism Solutions

WATER AND LIFE

A Presentation by L. Hunter Lovins



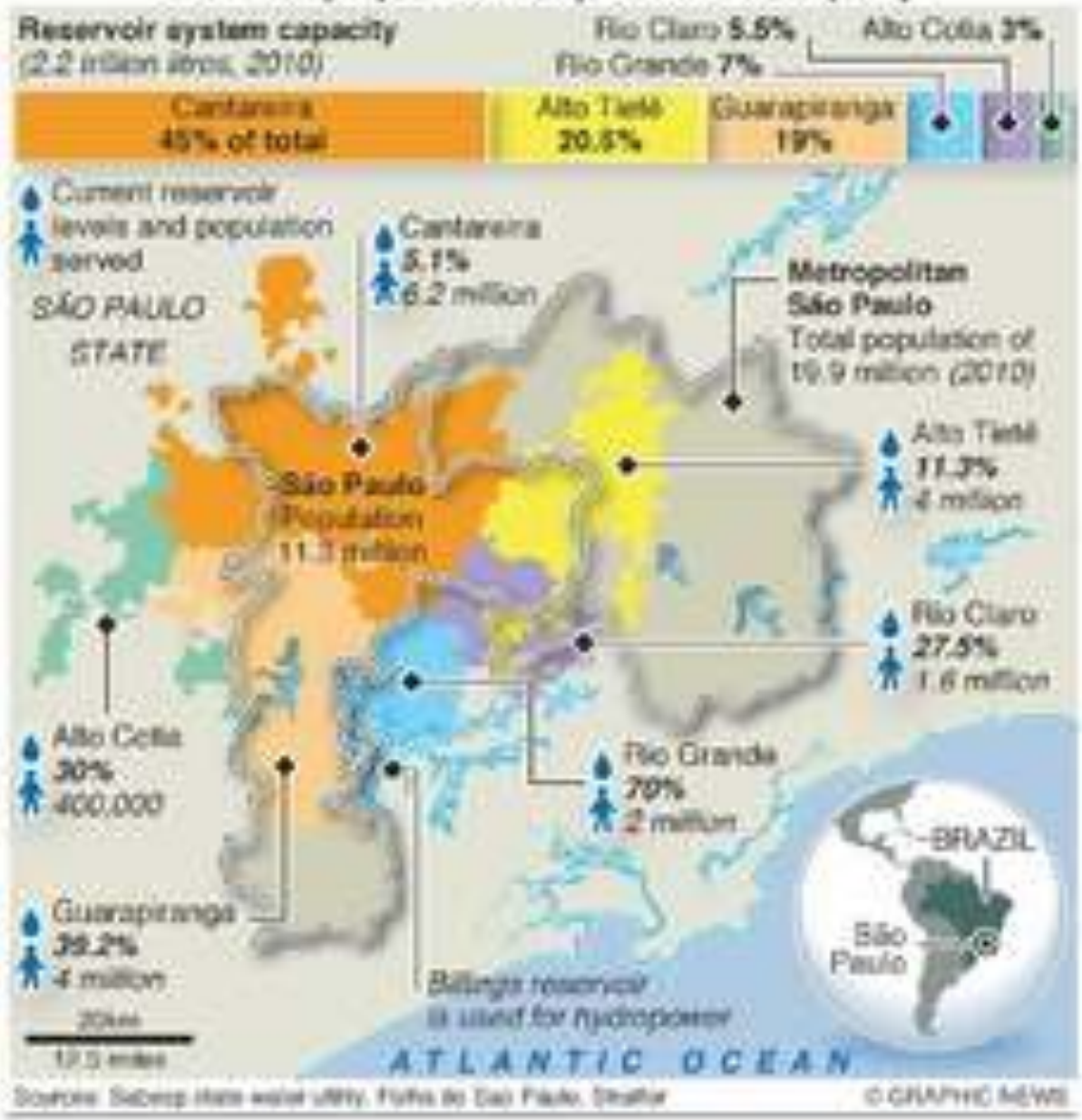
VIRALMEDIALIFE.COM

WHISKEY IS FOR DRINKING WATER IS FOR FIGHTING OVER.

MARK TWAIN

São Paulo faces extreme water rationing

Residents of Brazil's biggest city face cuts to water supplies of up to five days a week, with the Cantareira reservoir system – which supplies 6.2 million people – down to just 5.1% of its capacity



Sophore: Sabesp state water utility, Folha de São Paulo, Stratfor

© GRAPHIC NEWS


© China Foto Press / Barcroft Medi

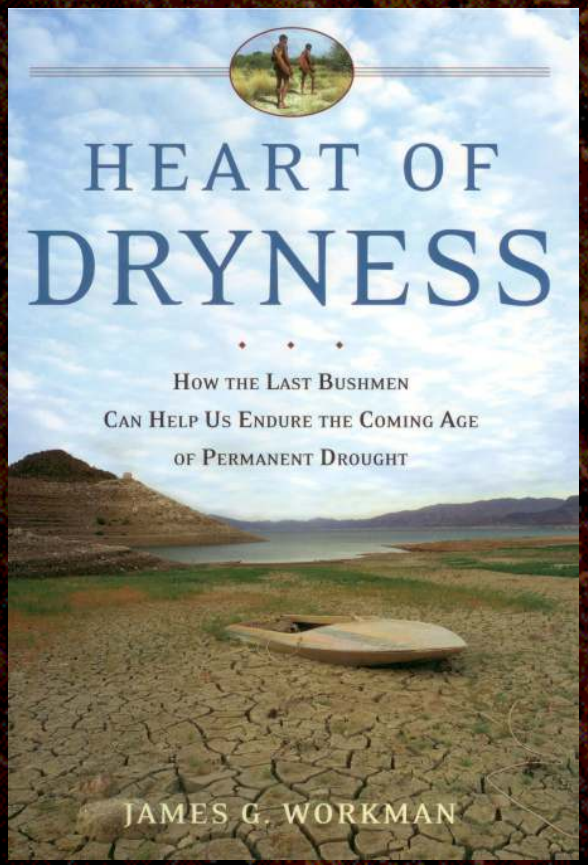
70% of water used in China goes to agriculture, 20% is used in the coal industry. Both are concentrated in China's north, which gets only 20% of China's total moisture.

In northern China, the average water per capita is only around 200 cubic meters. In Beijing, consumption levels were 70% greater than the total water supply in 2012.

Jamie Workman

As a journalist, I learned to follow the money. As you trace economic power to its source, you discover that water infuses our bloodstream and brain, our food, our electricity, our politics....

Even if we stop all carbon and greenhouse gas emissions, the world will keep warming.



As it does, sudden deluge will alternate with longer, hotter, droughts. Floods let us store less; droughts leave us less to store. These extremes affect irrigation, depleting food supply. The lack of water also cuts energy production, depleting power supply.

Climate adaptation literally boils down to water adaptation.

Our so-called “more developed societies” still irrigate deserts, deplete aquifers, blend urine and feces with tap water, kill salmon runs with dams, and evaporate more water than we consume.

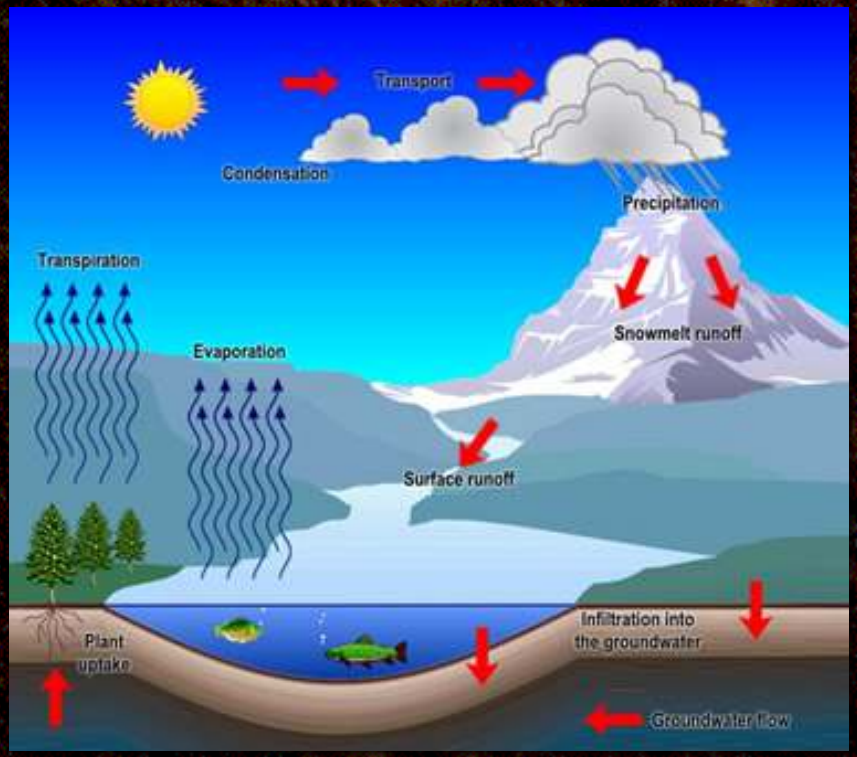
Because of such profligate waste we’re now hitting a wall, a limit to growth.

Bushmen have lived with that wall for 30,000 years. Their proven strategies point us toward a softer, alternative approach, and they do so with laughter and dance. .

Water is life
It underpins all prosperity

Two in three humans are thirsty
while water is a a $500 billion market

Scarcity of Water



3% of earth's water is fresh water

2% is locked as glacier ice

< 1% of all the earth's water is fresh water we can use.

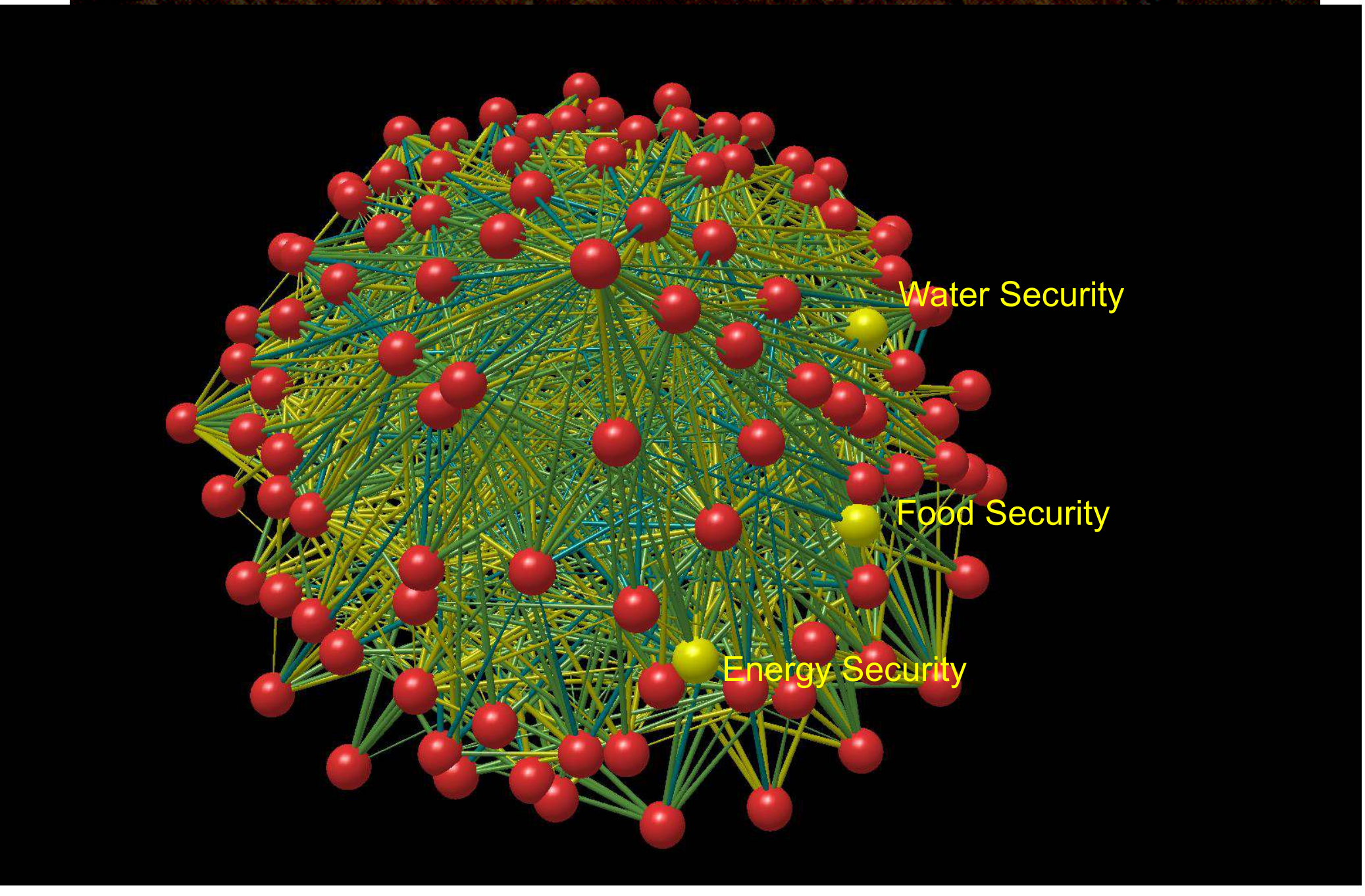
WATER: THE OIL OF THE 21ST CENTURY

Worldwide H_2O usage doubling every 21 years

Since 1900, a 6X increase in H_2O use

- Rising standards of living
- Unsustainable levels of irrigated agriculture

Energy Water Food Security Nexus



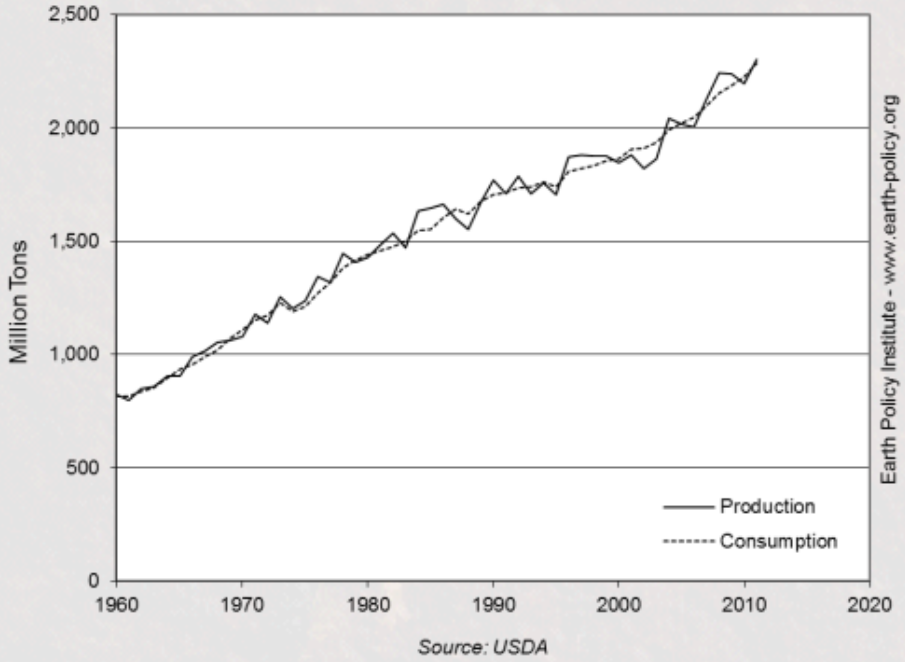
Feb 2012 the UN released Resilient People, Resilient Planet: A future worth choosing

The 22-member panel said a new blueprint for growth and low-carbon prosperity must be "mainstreamed" into economic policy as quickly as possible

By 2030 the planet will need at least
50% more food,
45% more energy and
30% more water.

Precarious Global Food Situation

World Grain Production and Consumption, 1960-2011



Source: USDA

- Dangerously small margin between grain consumption and grain production
- Now we face long-term trends that:
  - increase food demand
  - limit food production

We are only one poor harvest away from chaos in world grain markets.

Photo Credit: iStockPhoto / Tobias Helbig


REUTERS

Nexus of Water, Food and Energy

COOLING water for coal fired and nuclear-powered electricity generators is the largest volume user of freshwater in the U.S.

Second is irrigation for agriculture.

Water Flows Uphill To Money

In Colorado farmers pay about $30 for an acre foot of water.

Oil and gas companies are paying as much as $1,000-$2,000 for an acre foot.

Use of Water

Fracking a typical vertical well requires up to 1 M gallons of water.

Horizontal well can use up to 5 million gallons.

Nexus of Water, Food and Energy

Water Needs:

Coal/Nuclear = 500 gal/ MWh

Combined cycle Nat. Gas = 200 gal/MWh

Nexus of Water, Food and Energy

70% of water use globally is for agriculture

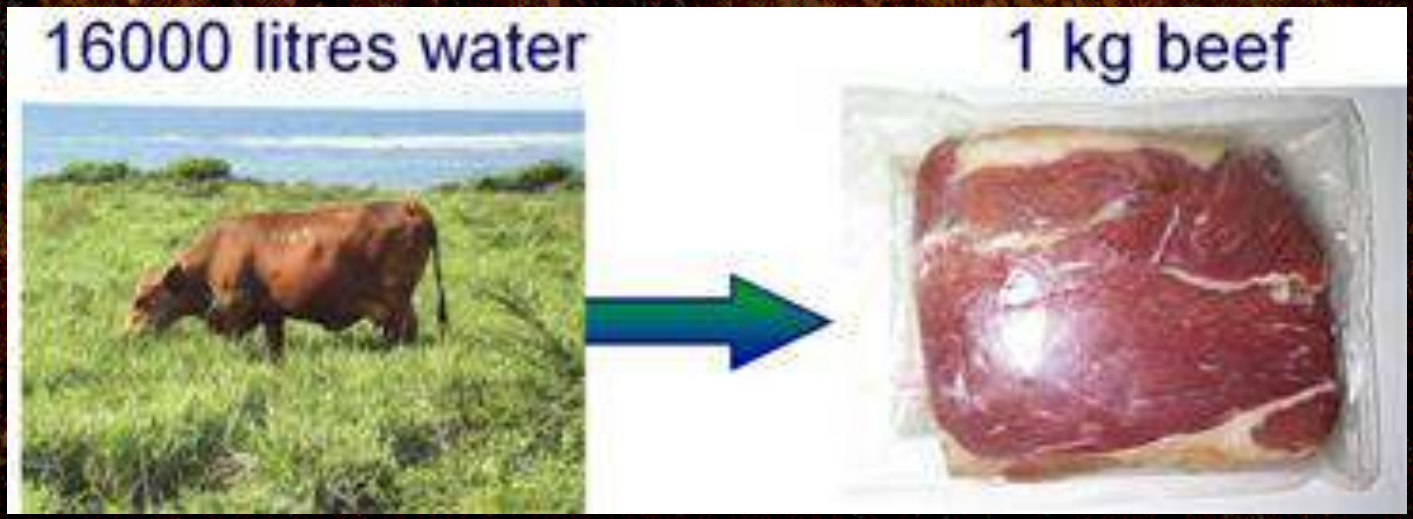
40% of the world's food supply is grown in places where crops cannot survive solely on rainfall, requiring irrigation

Flood-irrigated rice field in California

Nexus of Water, Food and Energy

40 percent of the world's food supply is grown in places where crops cannot survive solely on rainfall, requiring irrigation

Industrial food production



Agriculture = Polluting

EPA: agricultural practices cause 70% of all pollution in U.S. rivers and streams.

- In the US, 40% of rivers, lakes, and coastal waters are so contaminated that they are unfit for humans to fish in, swim in, or drink.

Impact on Supply Chain

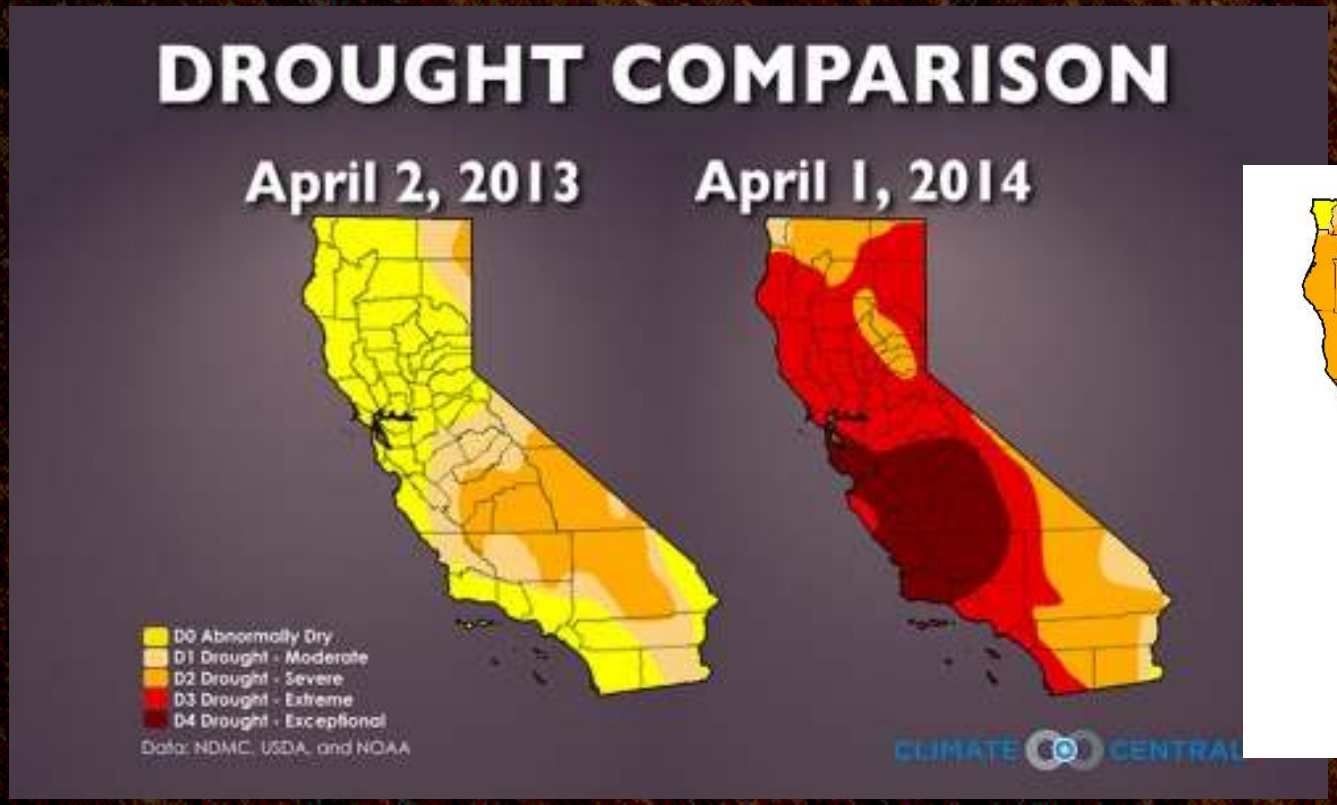
2012 U.S. Drought

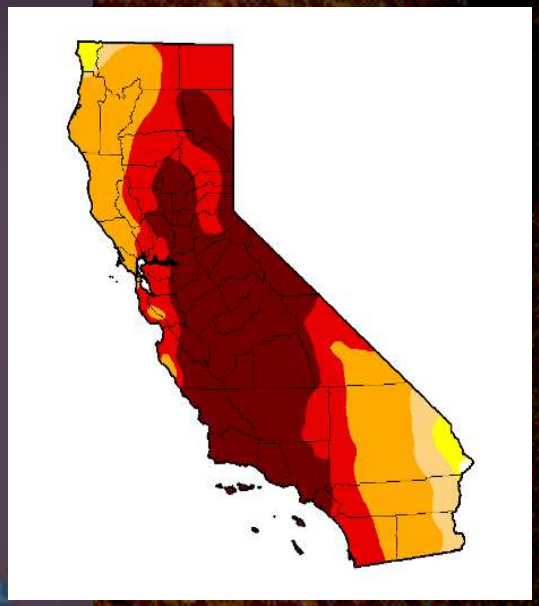
Raised global food prices 10%

Flooding in Thailand

Manufacture 40% of hard drives - Insured loss of $20 billion.

Climate change in CA: $7.4 billion lost in 2014





"By the end of the century, the nation's 'salad bowl' could be a dust bowl. We're looking at a scenario where there's no more agriculture in CA. I don't see how their cities can keep going"

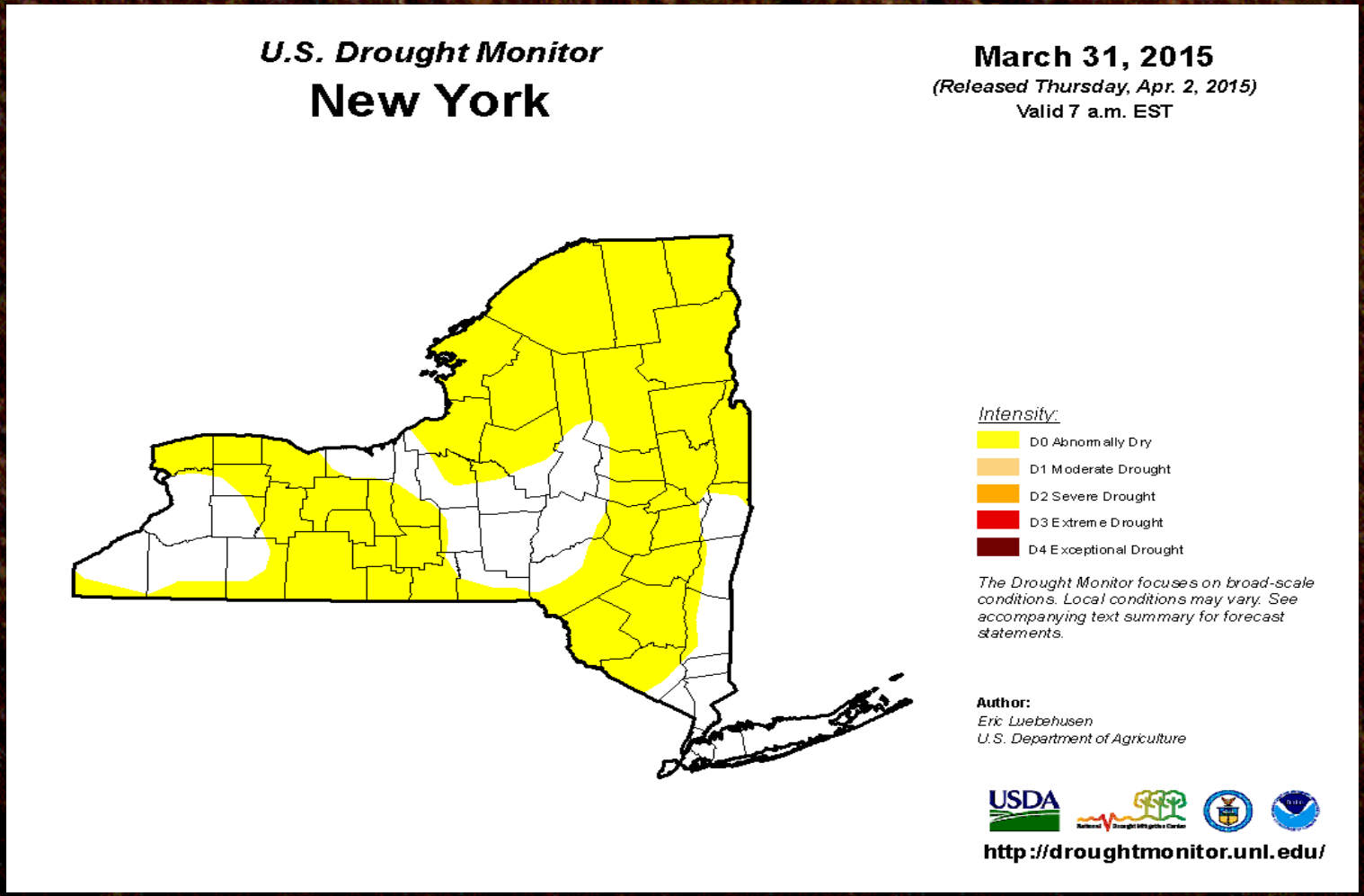
California's Drought History

“We're talking about things we've never seen before.”

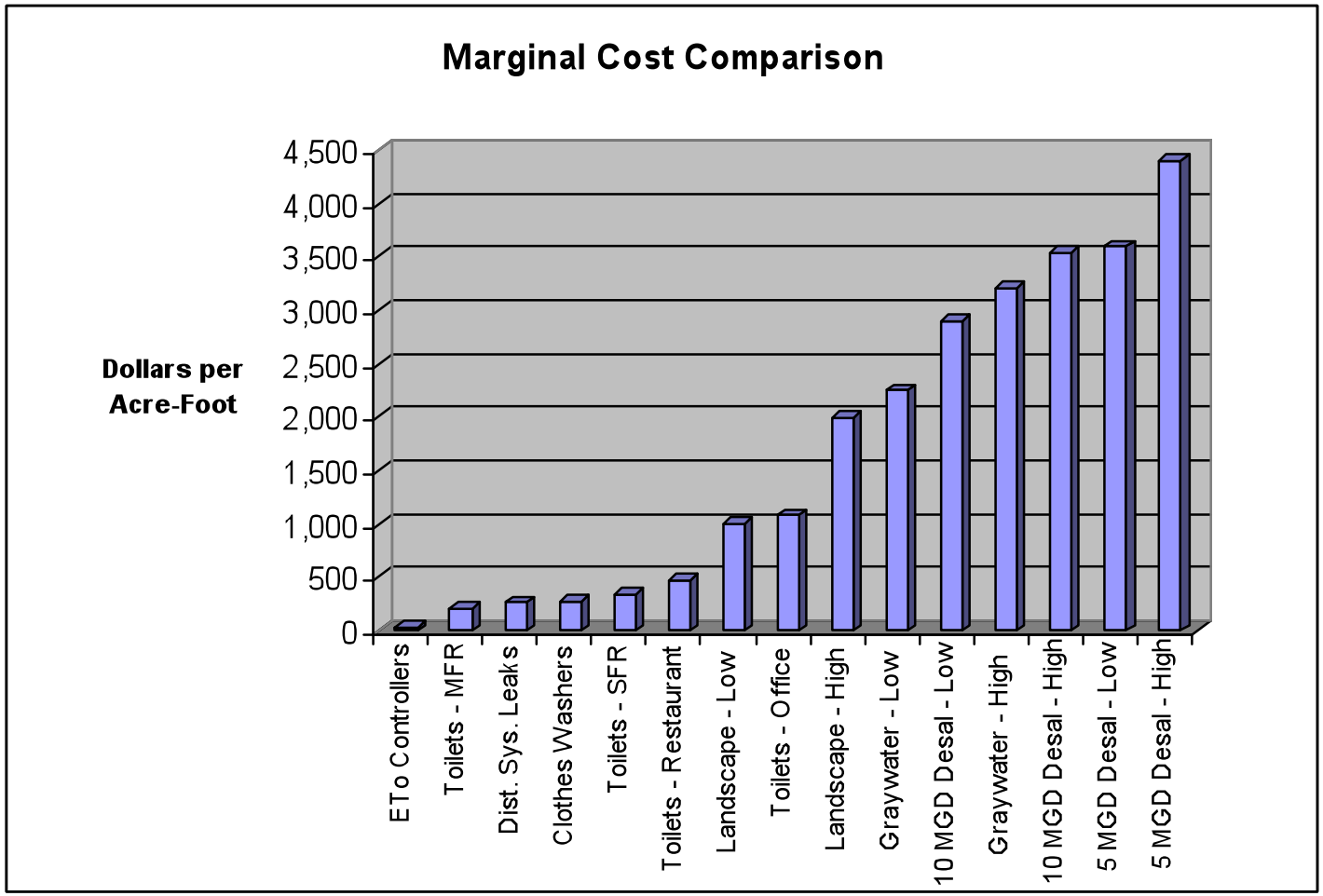
- David Rizzado, Chief Snow and Water Forecaster - CA Dept. of Water Resources

California’s annual spring snowpack survey

NY counties that are abnormally dry



Marginal Cost Comparison Desalination vs. Conservation
Capital cost $105M Annual operating cost of $3M - $4M.

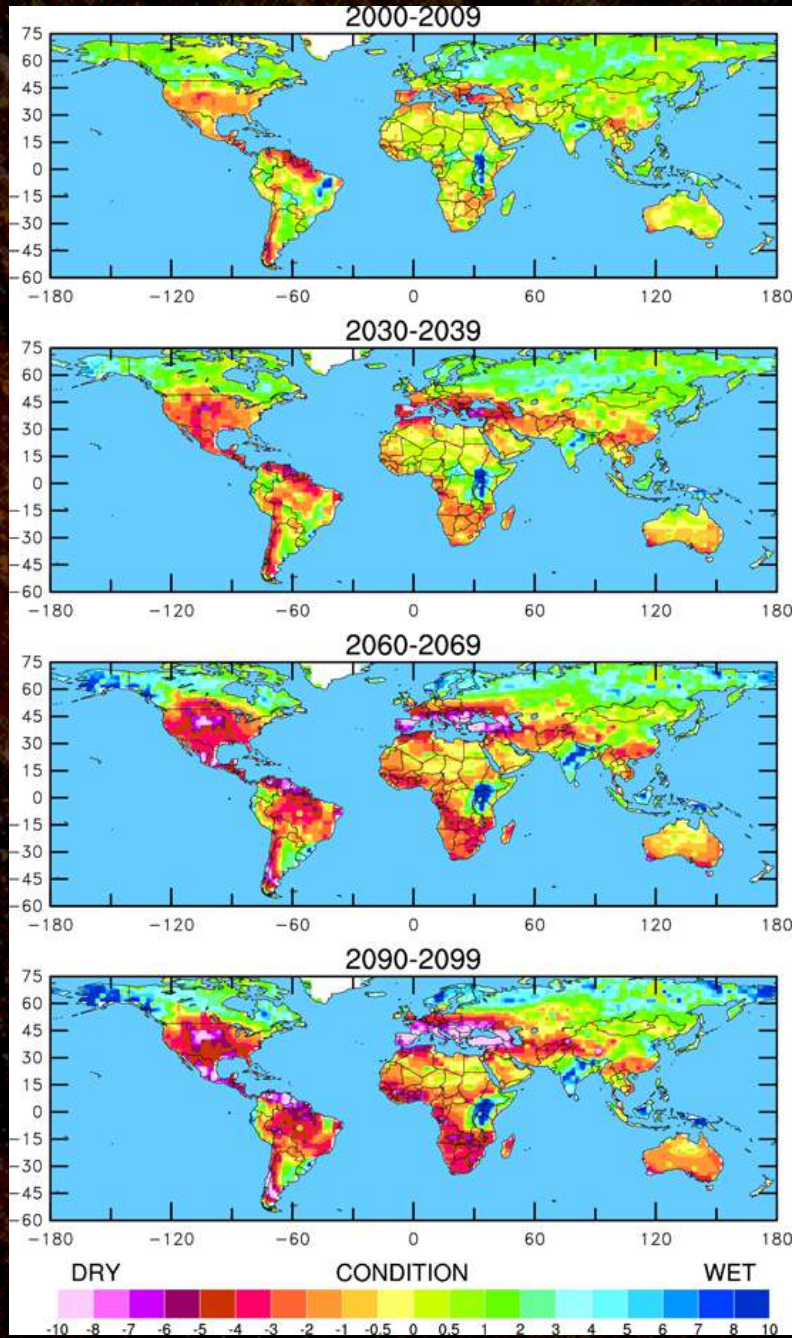


- ***Desalination - estimated at $2900 - $4400 per acre-foot***
- ***All proposed conservation programs combined - $1111***

(Sustaining Our Water Future, 6/09 ReportFoodandWaterWatch.org)

Climate projections grim:

Increasing droughts, extreme weather, and growing pressures on agricultural land



Nov 2011 study from IEA
April 2012 study from OECD

"Unless world leaders take immediate and coordinated action, modern industry will lock the world into a calamitous temperature rise of up to six degrees C.

In such a world, demand for energy, food, and water will overwhelm the planet"

Extreme Precipitation

Sea-level Rise

Increasing Summer
Heat Waves

Increased Drought &
Decreased Snow Pack


2011, a new record: 14 weather related disasters with damages over $1 billion.
2013 6th year in a row with weather related damages over $10 billion. 2013 – 2014 20 billion dollar storms 2014 only $8 billion
© Mike Theiss


BREAKING NEWS
BLACK FOREST FIRE BURNING IN EL PASO COUNTY
ONE OF 3 FIRES BURNING IN COLORADO RIGHT NOW
The beginning of summer in Colorado

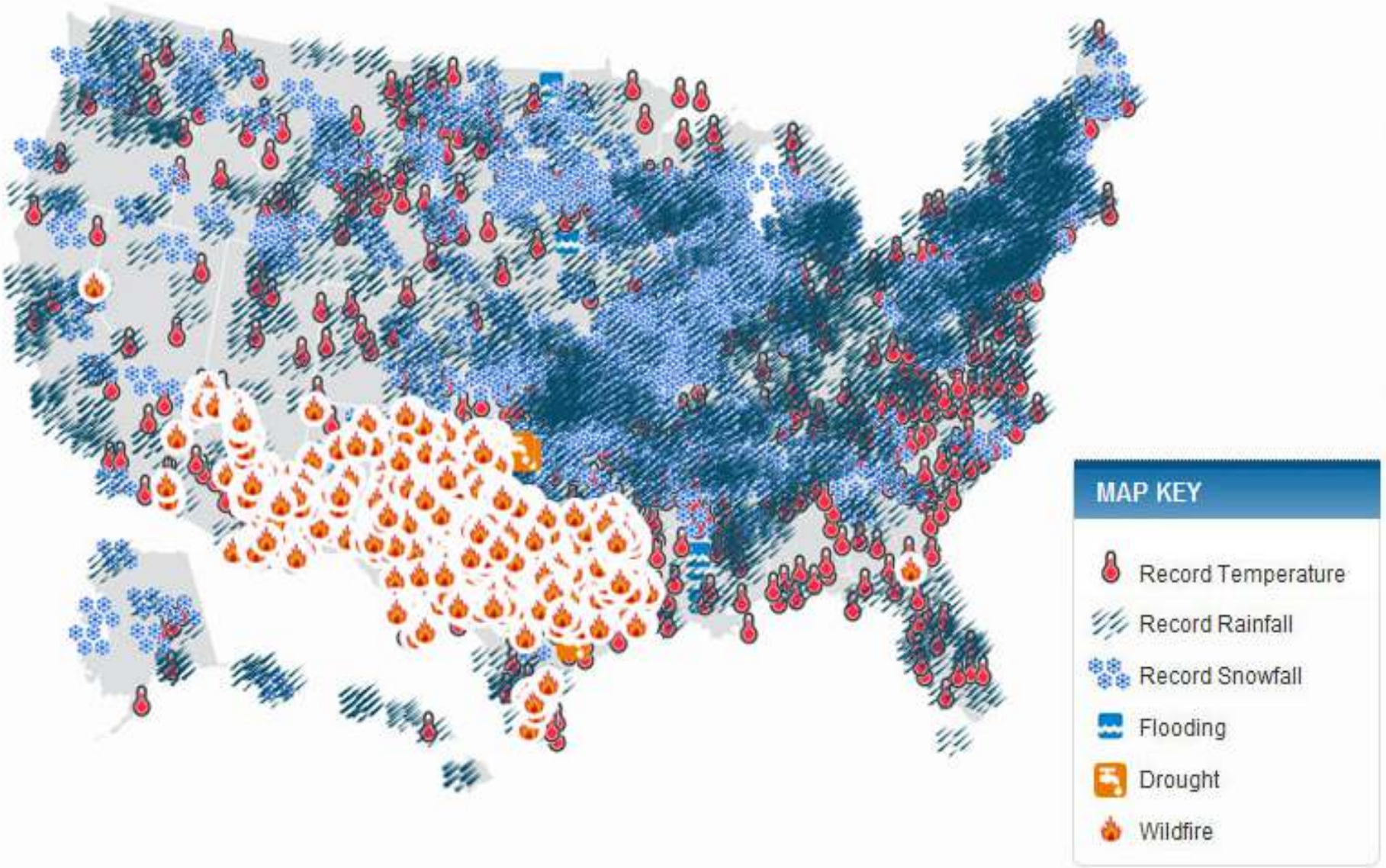
The end of summer in Colorado


C34

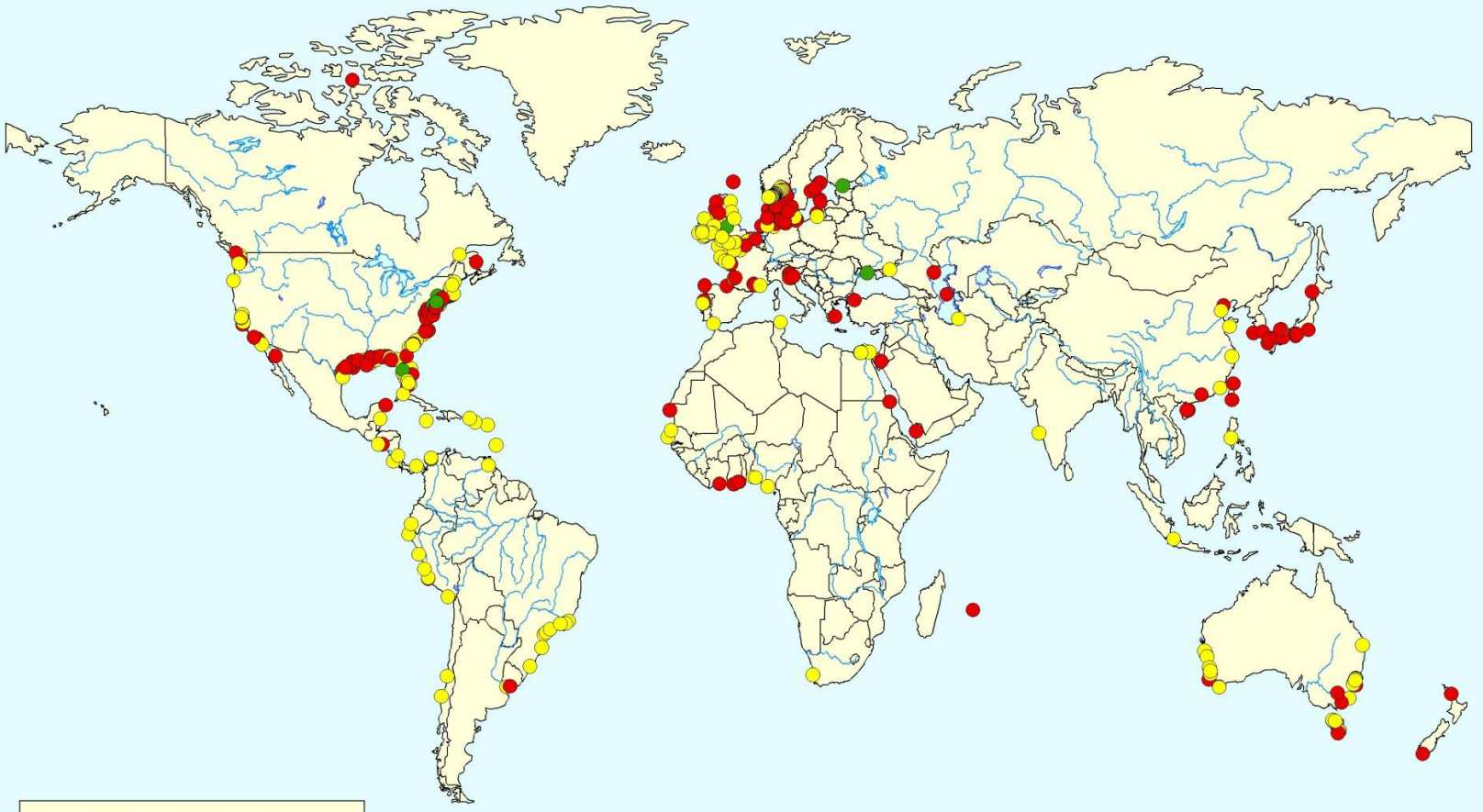

86
Street

Extreme Weather Map

2011: Thousands of Weather Records Broken in the US, Costs Climbing



World Hypoxic and Eutrophic Coastal Areas



Eutrophic and Hypoxic Areas

- Areas of Concern
- Documented Hypoxic Areas
- Systems in Recovery

N
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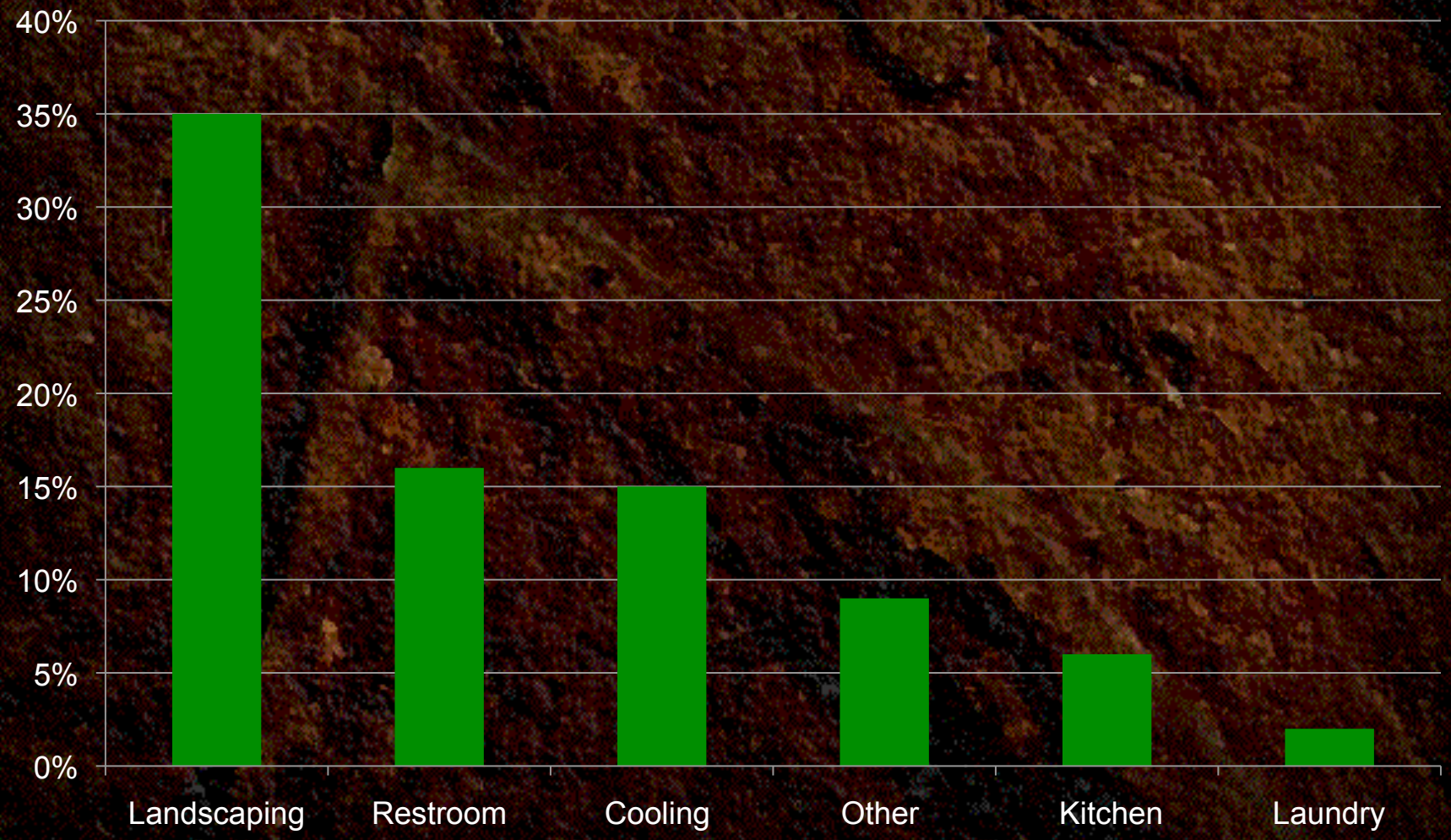
Data compiled from various sources by R. Diaz, M. Selman and Z. Sugg.

Average Water Use:
For a Commercial Building



Polluted waters

Nature creates conditions conducive to life

The Ultimate Evidence:

Synthetic Compounds Found In Mother's Milk

HALOGENATED COMPOUNDS
chlorodifluoromethane
chlorotrifluoromethane
dichlorofluoromethane
chloromethane
trichlorofluoromethane
dichloroethylene
Freon 113
methylene chloride
chloroform
1,1,1 – trichloroethane
carbon tetrachloride
trichloroethylene
chloropentane
chlorobenzene
iodopentane
3-methyl-1-iodobutance
chloroethylbenzene
dibromodichloromethane
dichlorobenzene
trichlorobenzene

ALDEHYDES
acetaldehyde
methyl propanal
n-butantal
methylbutanal
crotoaldehyde
n-penanal
n-hexanal
furaldehyde
n-heptanal
benzaldehyde
n-octanal
phyenyl acetaldehyde
n-nonanal
methyl furaldehyde
n-decanal
n-undecanal
n-dodecanal

KETONES
acetone
methyl ethyl ketone
methyl propyl ketone
methyl vinyl ketone
ethyl vinyl ketone
2-pentanone
methyl pentanone
methyl hydrofuranone
2-methyl-3-hexanone
4-heptaonone
3-heptaonone
2-heptaonone
methyl heptaonone
furyl methyl ketone
octanone
acetaphenone
2-nonanone
2-decananone
alkylated lactone
phthalide

OXYGENATED ISOMERS
C_4H_6O
$C4H_8O$
$C_5H_{10}O$
$C_4H_6O_2$
$C_7H_{10}O$
$C_7H_{14}O_2$
$C_6H_6O_2$
$C_6H_{16}O$
$C_7H_8O_2$
$C_9H_{18}O$
$C_8H_6O_2$
$C_{10}H_{12}O_2$
$C_{10}H_{14}O$
$C_{10}H_{16}O$
$C_{10}H_{18}O$
$CH_{10}H_{20}O$
$C_{10}H_{22}O$
C_9H_8O

ALCOHOLS
methanol
isoproponal
n-proponal
1-butanol
1-pentanol
x-furfuryl alcohol
2-ethyl-1-hexanol
phenol
2,2,4-trimethylpenta-1,3-diol
x-terpineol

ACIDS
acetic acid
decanonic acid

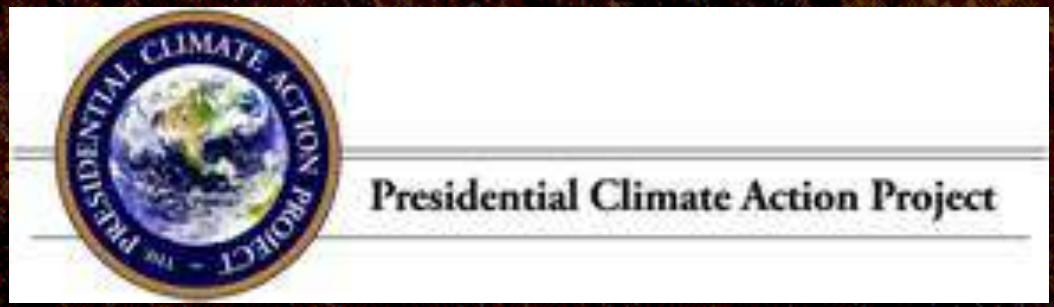
Nature as mentor

Design that adopts the experience of life, refined by 3.8 billion years of rigorous testing.

All products that didn't work were recalled by the Manufacturer.

New Rule

If we insist on ruining the planet, we have to stop claiming we're a "superior species".



Water Savings

Water-efficiency measures can reduce water and sewer costs by up to 30 percent.

Water Conservation Best Practices

1. Metering and conservation rate structures
2. Landscape rules and regulations
3. High-efficiency fixture and appliance replacement
4. Rules for new construction
5. Education and outreach

Water Conservation Best Practices

Landscape rules and regulations

- Efficient irrigation practices reduce water by up to 35%.

Rules for New Construction

- More efficient buildings use 15% - 30% less water than standard.

Water Savings

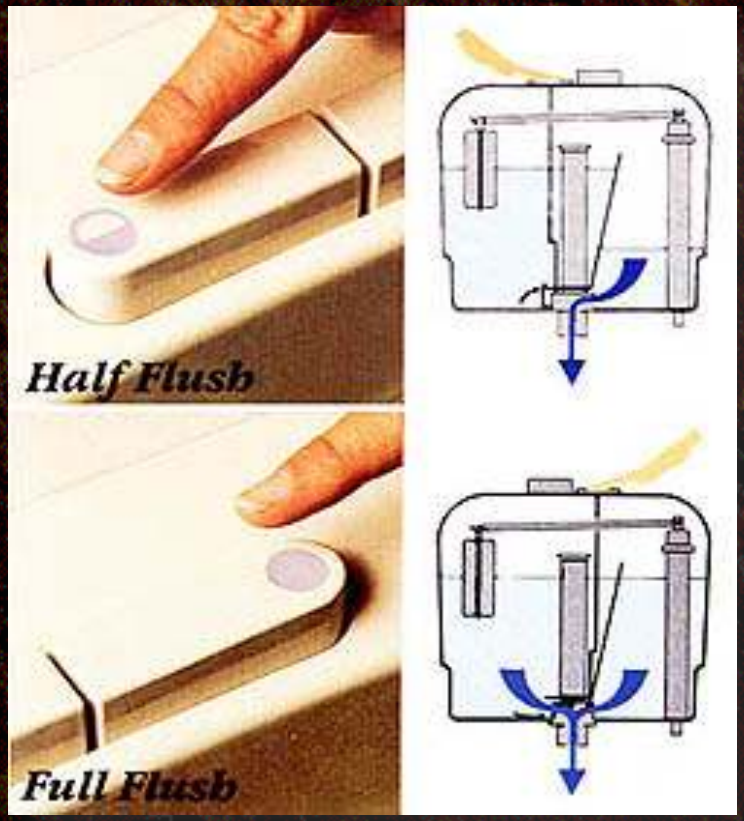
On average commercial businesses pay over $2,000 annually on water.

Commercial businesses can pay anywhere from $1.61 to over $5.00 per thousand gallons of water.

One leaky toilet can waste as much as 22,000 gallons in one year.

Etching a fly into the porcelain improves aim and reduces spillage by 80% - example of process control

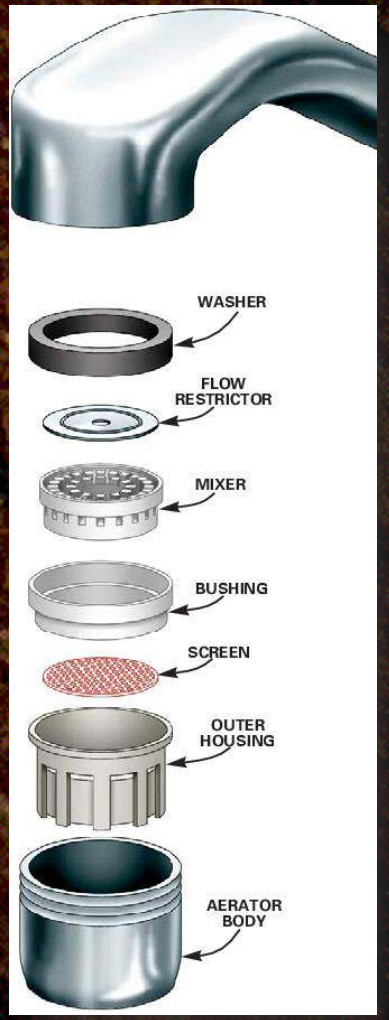
Indoor Water Use: Replace Toilets



A dual flush toilet can reduce water usage by up to 77% when compared to standard models that use 2.9 gallons each flush

Indoor Water Use: Faucet Aerators

- Savings of about $25 annually
- Provides 33% ROI per faucet
- Optimize the flow of water while increasing water stream function and reducing waste.
- Reduces water usage by 40 percent



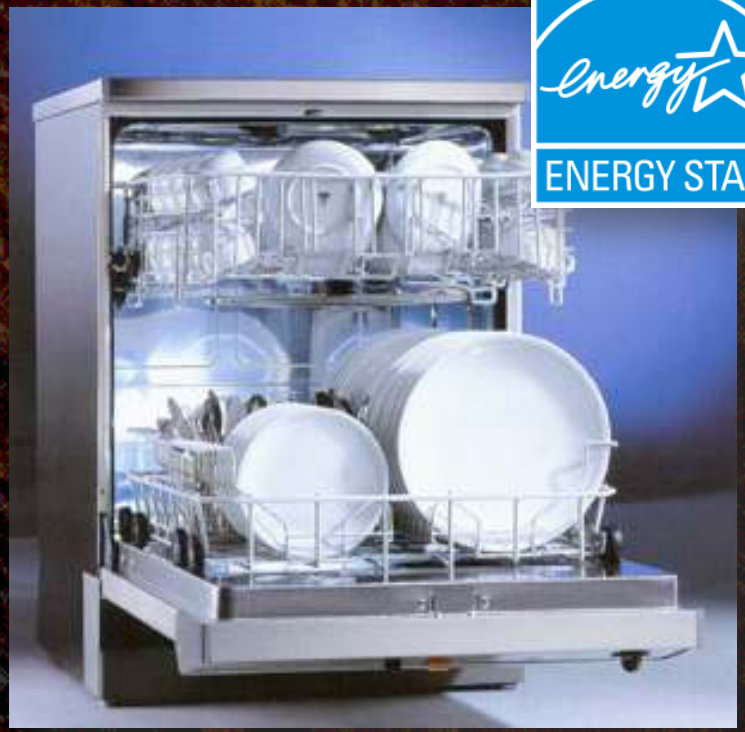
Indoor Water Use: Showerheads

High efficiency showerheads will reduce water use by 40%, presenting savings of up to $100 per showerhead, and giving a 111% ROI.

Indoor Water Use: Dishwashers

Newer dishwashers consume about 800 gallons less water annually than older models.

Lower electricity costs by 25 percent compared to older dishwashers.



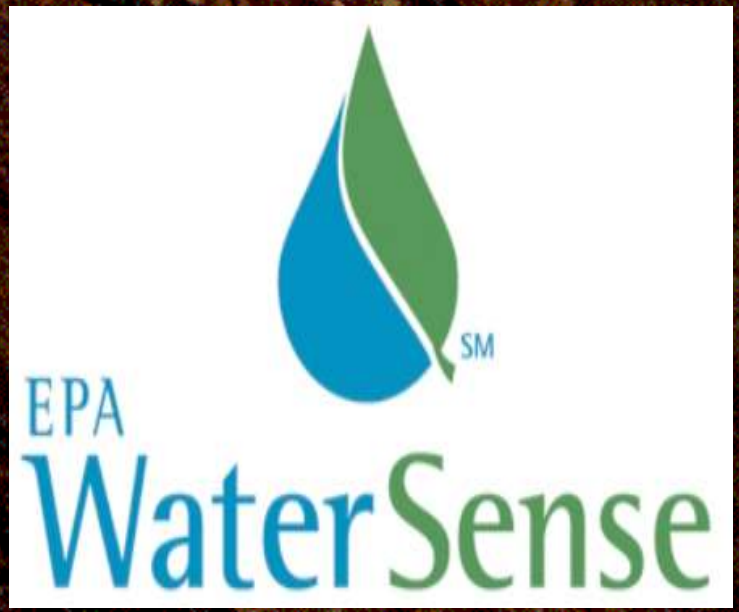
Indoor Water Use: Drinking Water

For each gallon of water that is bottled, an additional two gallons of water are used in processing

On average bottled water costs about $9.85 a gallon, while tap water costs about $0.01 per gallon

EPA WaterSense

WaterSense brings together local water utilities and governments, product manufacturers, retailers, consumers, and other stakeholders to promote water efficiency.



EPA WaterSense

Reducing consumption of water saves, electricity and reduces GHG emissions.

In 2009 EPA WaterSense saved:

-4.9 Billion KwH

-1.7 Million MT of GHG emissions

-36 Billion gal. of water

Total savings = $267 Million

How much should water cost?

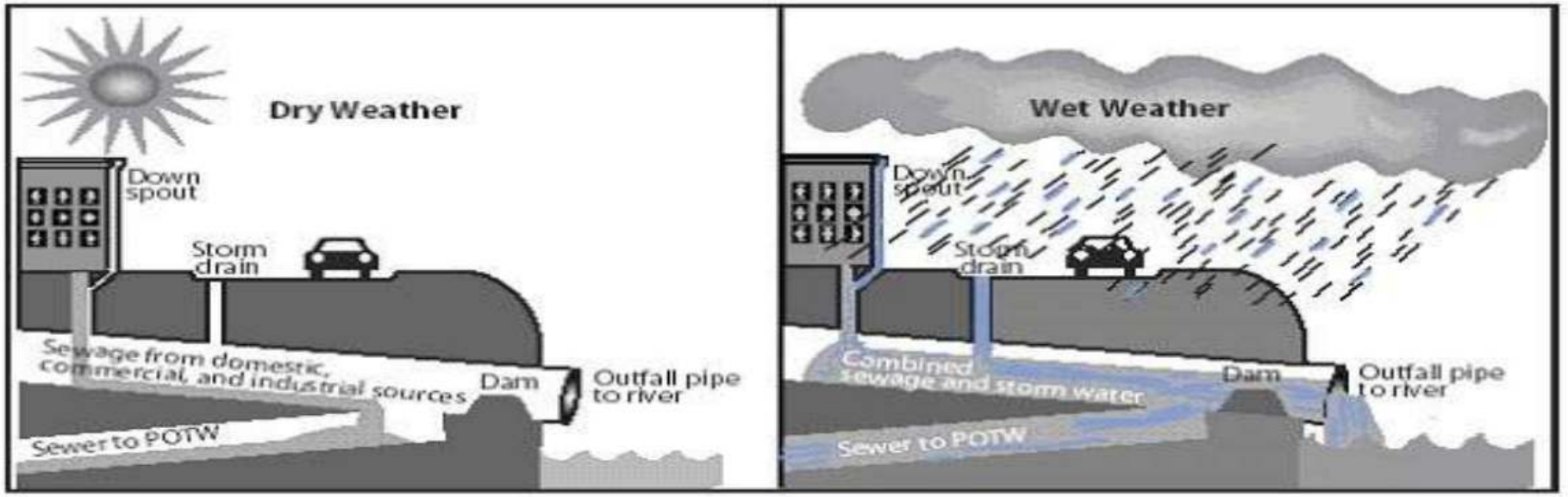
Metering and conservation rate structures.

Metering: 10% – 40% reduction vs. un-metered.

Rate structure: Varies by structure and rates. Reduction range: 0% –30%.

Effects of high imperviousness: sewer overflows

Combined Sewer Overflow



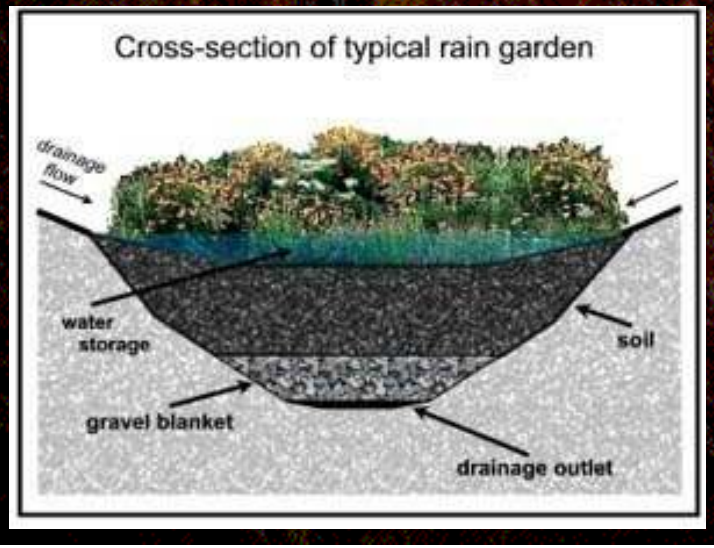
About ten percent of the CSOs in the United States are found in NYS. There are approximately 937 CSO outfalls in NYS.

$2.4 Billion in green infrastructure and $1.4 Billion in Gray Infrastructure to Target the city's Most Impaired Waterbodies

YardWorks

Collaboration between the Cornell Landscape Architecture Department, the Cornell Lab of Ornithology and the Cornell Cooperative Extension links residents with Cornell students who help them install sustainable landscaping....

Like rain gardens



Rain barrels

Restorative Redevelopment

Retrofit and redevelopment activities that improve the value and livability of the city while effectively restoring natural processes and functions.

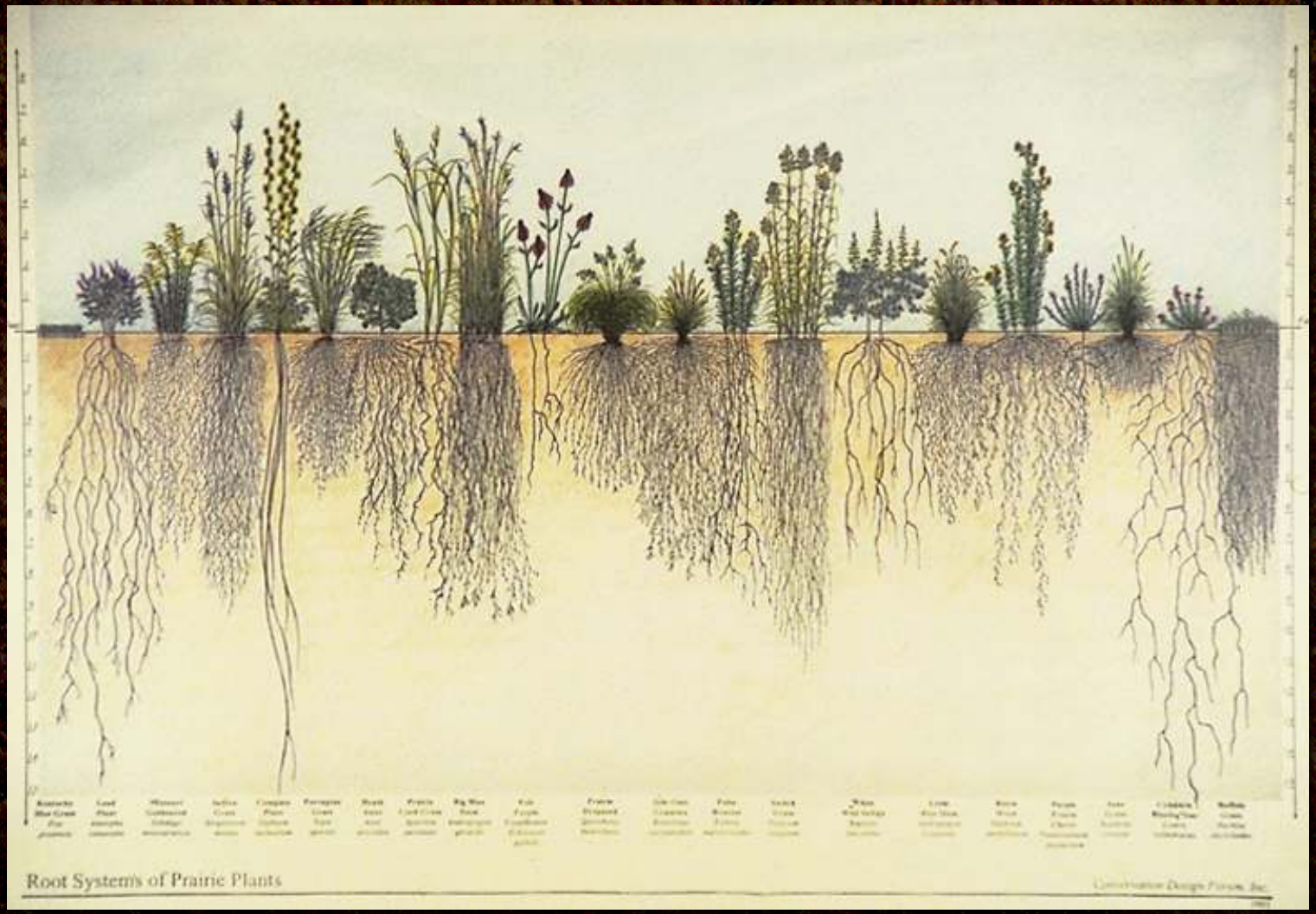
Impervious surface reductions

Minimum pavement driveways

Reinforced grass paving

Courtesy of Grasspave Co

High-performance plantings



High-performance plantings

Daylighting

Roofmeadow™ in Philadelphia

Improving Our Most Valuable Resource

American Rivers
Rivers Connect Us

Online tool in 2013 to help communities

- Improve green infrastructure
- Save water
- Reduce stormwater

Will focus on:

- Financing options
- Planning and regulation
- Green infrastructure
- Community examples

The second mouse gets the cheese

How would you design a sewage plant if you had to live downwind?

Eco Machine™ at Oberlin College

The Body Shop had an Eco Machine™ in its boutique in Toronto

Berea Eco Machine Spring 2004

Living Building Challenge

4500 sq ft greenhouse, Eco-machine - has to generate its own energy, use no outside water, and be produced using local materials.

Algae to treat sewage waste and generate heat in buildings

Installing vertical photobioreactors (PBRs) into large commercial buildings to generate algae growth, produce heat.

Pilot installed on La Defense complex near Paris – French Government mandate that commercial buildings produce more energy than they use, and purify or recycle water

Competitive at 4,000 m2 - “A 4000 m2 algae farm installed on a 10,000 floor area building would generate 40 kWh per m2 of floor surface per year.”

Algae versatility

Algae lamp that takes carbon out of the air

Absorbs 150 – 200 times the CO2 of a tree

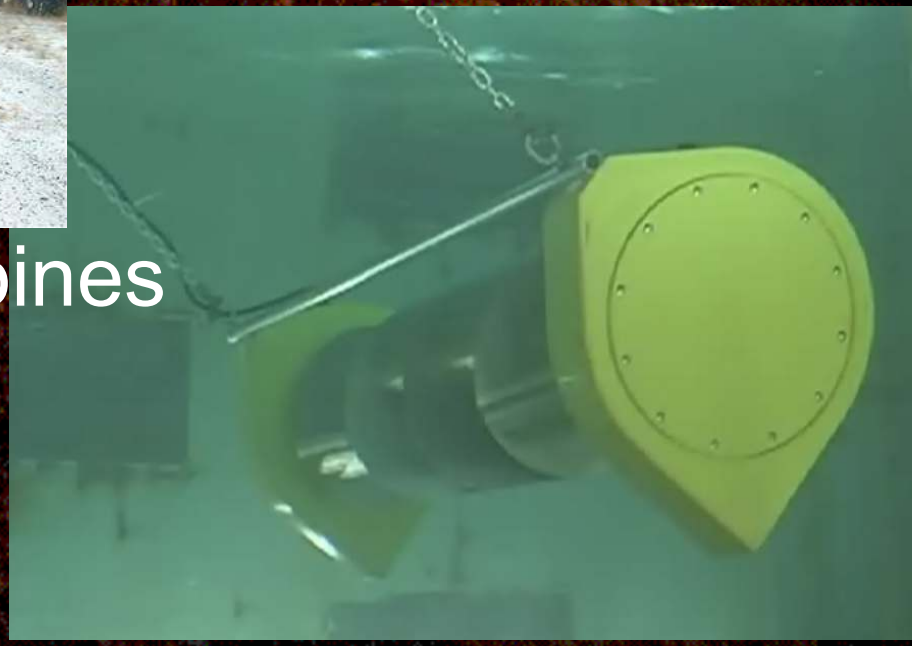

Americans buy more than 9 billion bottles of water a year

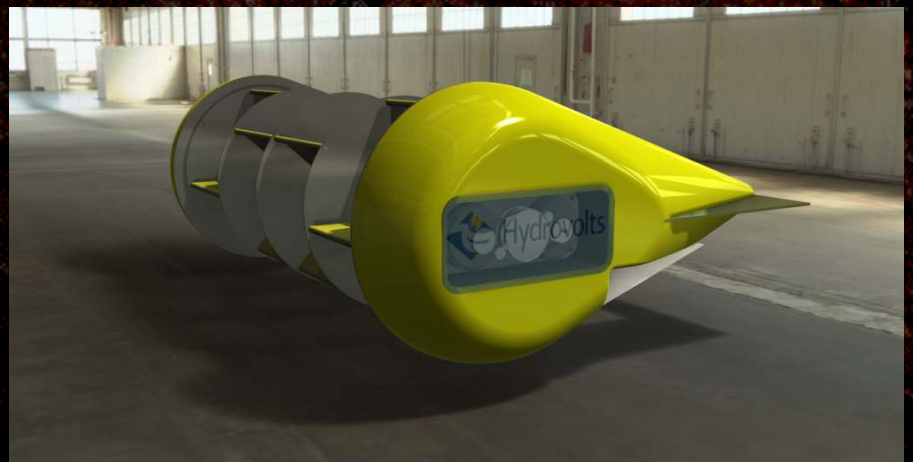
Method is making its bottles out of recycled plastic –

25% of it harvested from the oceans

Hydrovolts

Hydrokinetic Canal Turbines





Autodesk
Clean Tech Partner

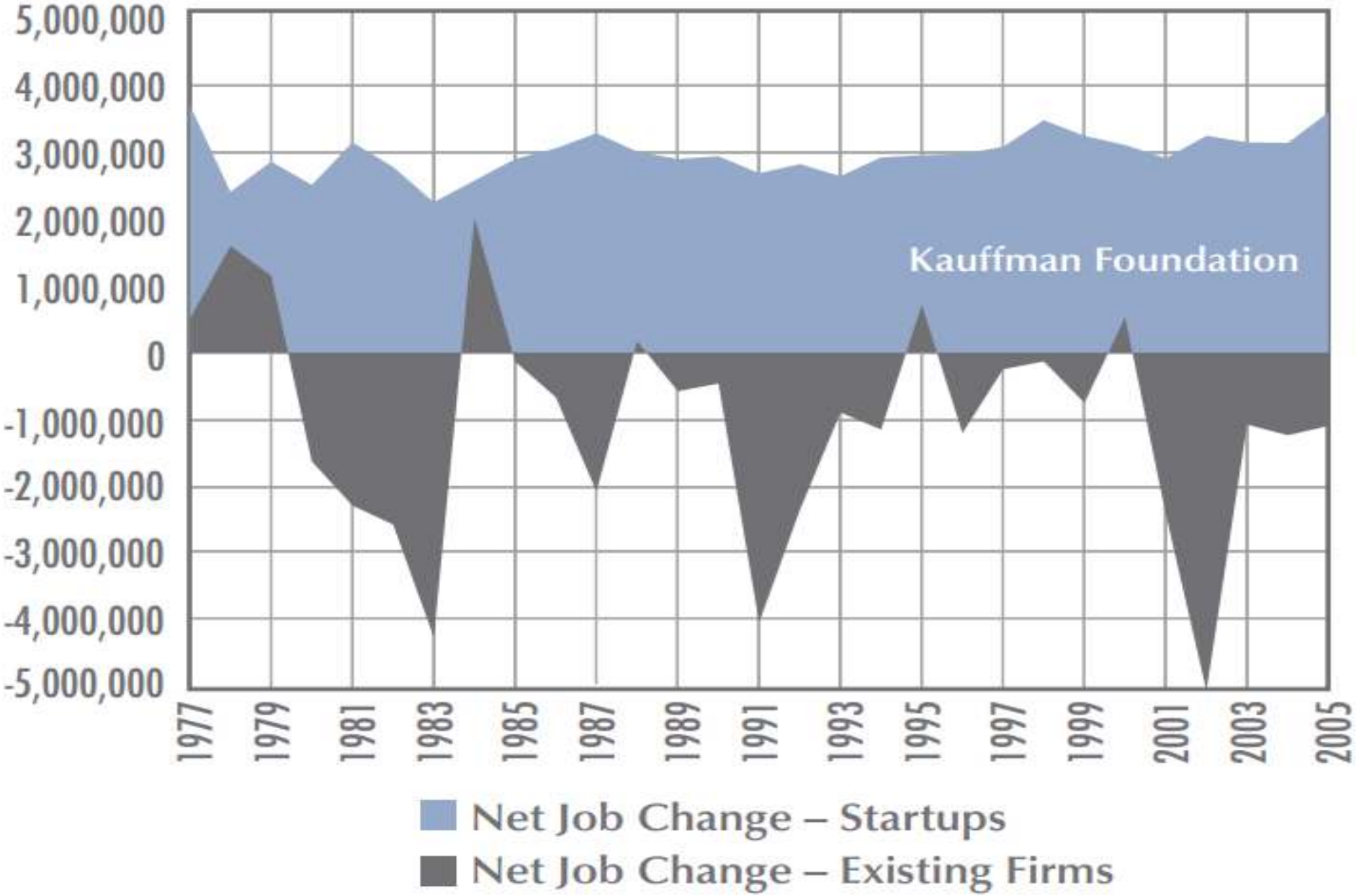
Weaving Homes

Weather-proof fabric attached to bendable, compressed plastic which can open to create vent holes and exits and seal to keep warm.

Strong, sturdy structure that can fold up, collect rainwater and charge a battery with solar fabric.

Developed by Abeer Seikaly, with the Weaving a Home project

Startups Create Most New Net Jobs in the United States



Economic Realities:

Saving energy strengthens the entire economy

Table 9: Economic Impacts per Average Megawatt Savings

Economic Impact Measure	Impact per aMW Saved
Output	$2,230,572
Wages	$684,536
Business Income	$125,882
Jobs	22

Source: Calculated by ECONorthwest using 2002 Energy Trust spending and energy savings impacts.

two entrepreneurs harnessing human nature:

Instead of guilt, fear, rations or restrictions…

Trust ‘invisible hands’ of innate self-interest -- esp. greed & envy

Enable metered accounts to earn & own equal EcoShares of water

Establish online ‘click’ markets within ‘brick’ natural water monopoly

Reward local trades who sell saved water credits… race to conserve

SmartMarkets

AquaJust

unlock your liquid assets

Home | **MyAquaJust** | Trades | Community

Arnold, See Your Use and Conservation Below!

Daily EcoShare Gallons Allocated

150
Gallons

Current Use

Change +4 %
Gallons Remaining 107 (68%)
Gallons In Use 43 (32%)

EcoShares Saved

This Month 23.47
Year to Date 149.13

How You Compare

Account Summary

MyAquaJust Account Summary

Account # **AJ123456**

Your Ecoshares will roll over into your AquaJust Vault, unless you would prefer to:

Collect EcoRewards | Buy & Sell EcoShares | Donate EcoShares

Your EcoShares' current cash value is:

$43.67

One week ago your EcoShares would have earned you at least: $39.42.
Next week what will they be worth? Check out: Trading Tools and AquaJust Community.

Compare My Use

Monthly Water Usage Compared

Your household water use is measured in CCFs.
1 CCF = 100 cubic feet = approx. 748 gallons

New Messages

09/15/2009 - Nancy Pelosi
Commercial Prices Offered to Residents

09/16/2009 - Jerry Brown
Tankless Water Heater

09/16/2009 - Diane Feinstein
Want to sell your EcoShares at a Premium?

ALL MESSAGES

AquaJust On The Go

Arnold,
are you an iPhone User?

If so, be sure to download AquaJust to your phone so you can save, trade, and reward yourself while on the move! The power of AquaJust in the palm of your hands - **FREE**!

DETAILS

Robot that cleans solar panels without water:
ROI < 2 years - In use in Negev, CA

Competitive Interests

Invested $1 billion building a market presence in India

Received heavy criticism for taking water from local farmers.

Indian Government nearly revoked license to operate.

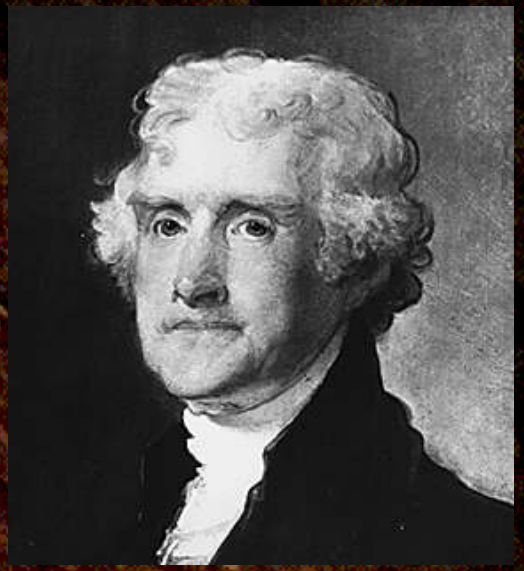
Competitive Interests

Indian plant uses 900,000 liters of water:

- 2/3 of it to clean bottles and machinery

Who will be first to develop waterless cleaning technology for Coca-Cola?

In Pursuit of Wealth



"Agriculture ... is our wisest pursuit, because it will in the end contribute most to real wealth … and happiness."

-Thomas Jefferson to George Washington

“To plant a garden is to believe in Tomorrow”

Supporting and Preserving California Family Farms

Certified Farmers' Markets of Sacramento County

Replay

Sustainable Agriculture

In 1940 we produced 2.3 calories of food energy for every calorie of fossil fuel energy we used.

Now it takes 10 calories of fossil-fuel energy to produce a single calorie of modern supermarket food

UnSustainable Agriculture

The production, manufacture, and transport of synthetic fertilizers is the largest agricultural energy use

Representing on average 38%, but up to as high as 50% of energy use

Sustainable Agriculture

The overall resource efficiency of our farming operations has decreased even while we have produced more food.

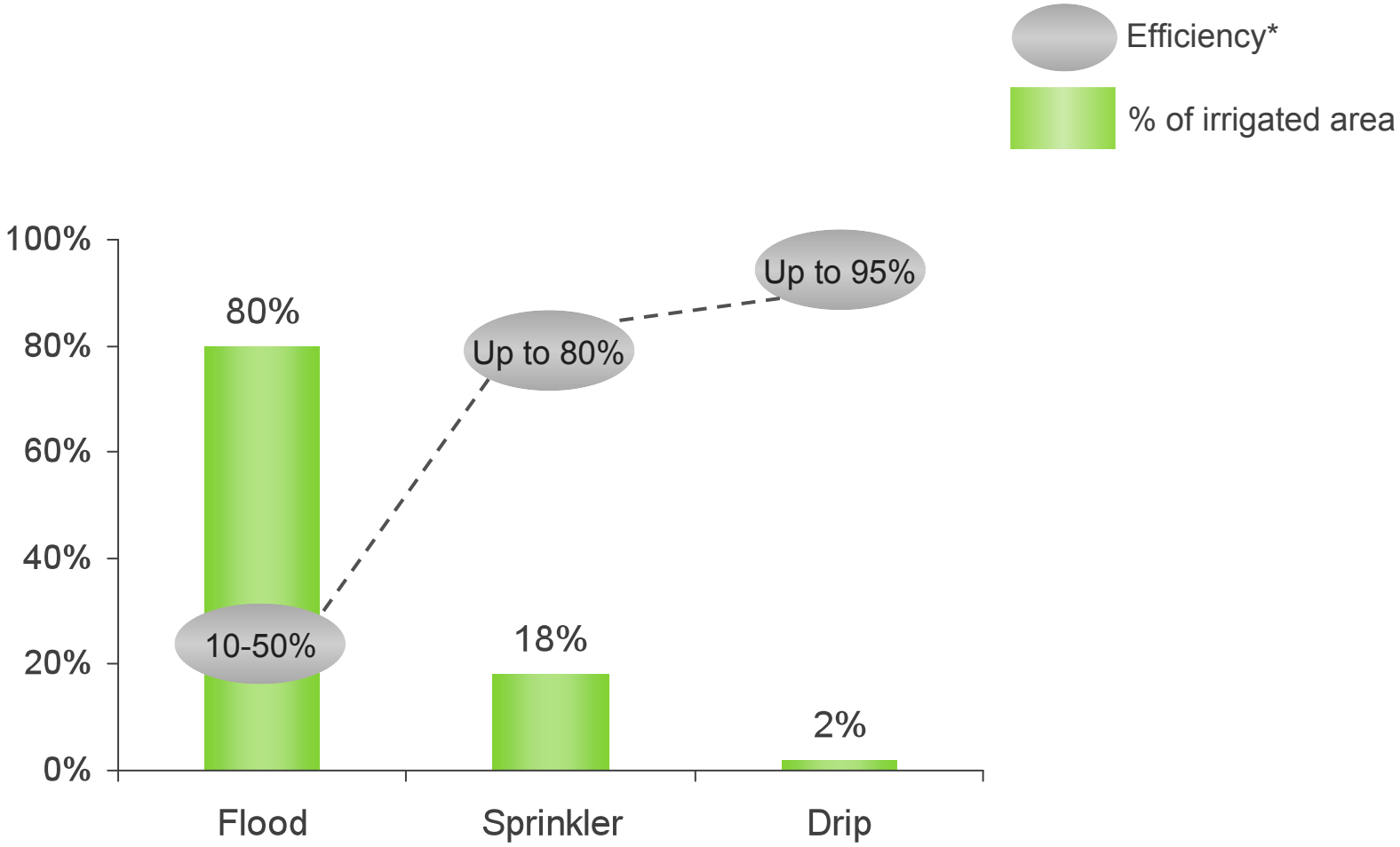
What would a sustainable agriculture system look like?

Sustainable Agriculture

- Build healthy topsoil
- Minimize use of fossil fuels
- Plant crops suitable to local climate
- Use a whole systems approach to farm management

Efficiency potential in irrigated agriculture

Global irrigation



* water usage / water withdrawal
Source: World Bank

Whole-system approaches

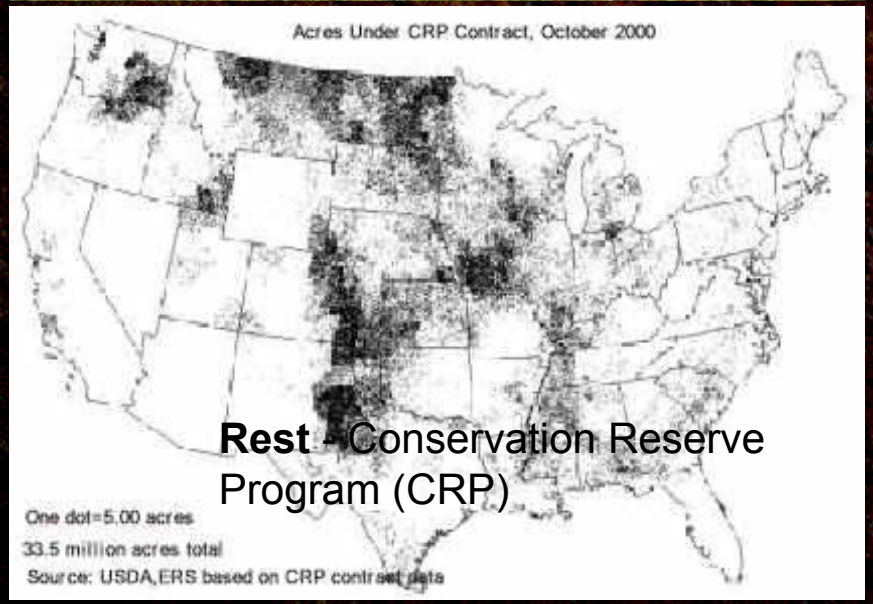
Improved carrying capacity even on degraded rangelands

Allan Savory


ALLANSAVORY

Current Practices Aren't Building Soil or Vegetation

Technology – Grass seeders

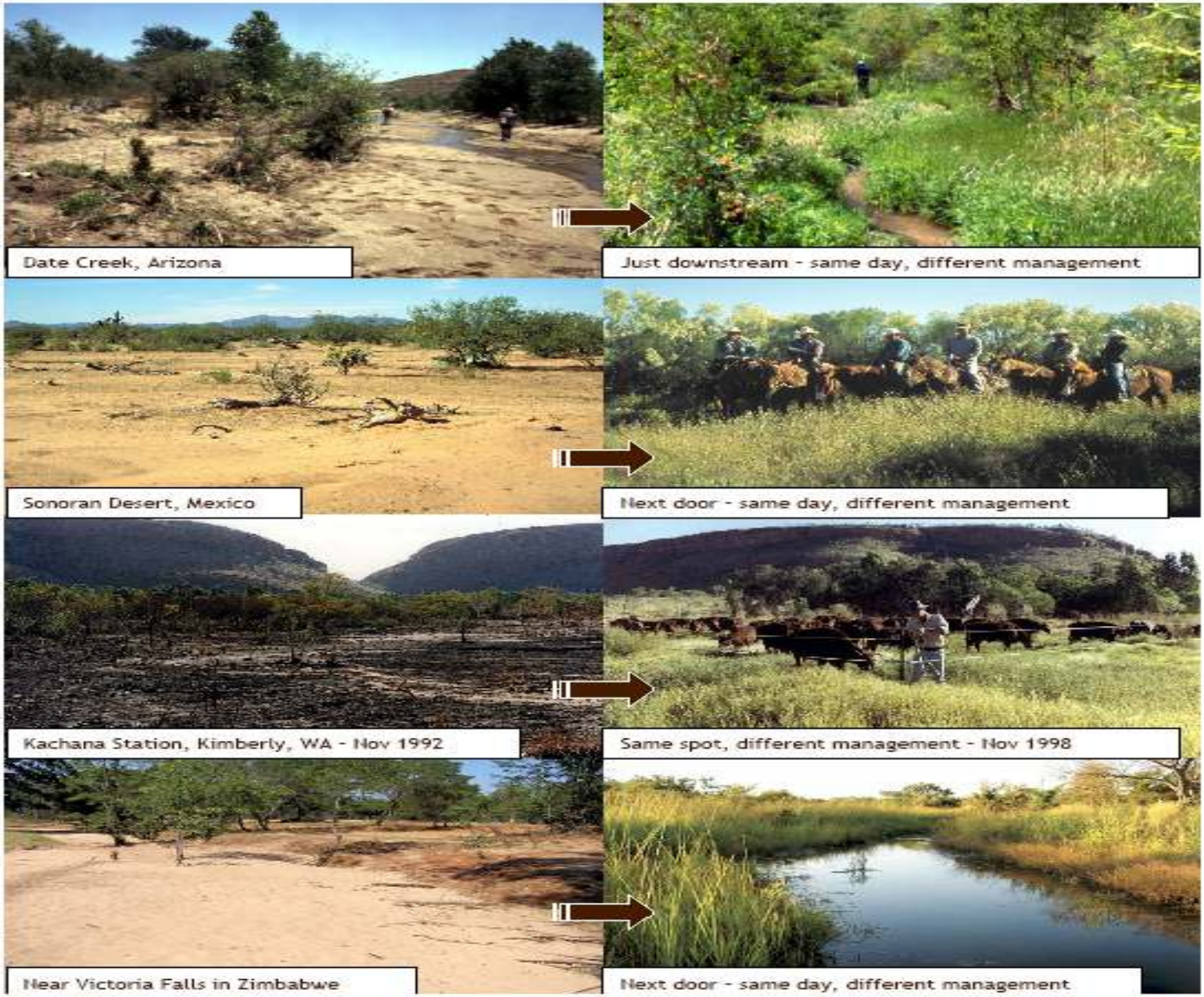


Rest – Conservation Reserve Program (CRP)

Fire - Systematic Land Burning

Grazing – Continuous over/under-grazing

Change the management - change the land.



Wyoming – both taken same day

- Left-side upstream, managed holistically (260% inc in livestock over 10 years)
- Right-side is downstream land managed ‘conventionally’

Programs to reclaim land using animals

Even on acid mine tailings

TOP STORIES IN LIFE & CULTURE 1 of 12

The Power of the Doodle: Improve Your F...

2 of 12

Tech Timeout for Grown-Ups

3 of 12

One Notch Better Than Organic?

A Platform for Moving Bodies

LIFE & STYLE

Grass-Fed Milk Is Taking Off With Health-Conscious Shoppers

At Almost $6 a Half-Gallon at Whole Foods and Other Stores, Milk From Cows That Don't Eat Grain Is Considered Healthier Than Organic

By SARAH NASSAUER CONNECT

Updated July 29, 2014 8:58 p.m. ET

For some shoppers, organic isn't enough. They want grass-fed milk.

The pricey milk isn't only organic. It comes from cows fed mostly grass, and never corn and soy.

We are called to be architects of the future, not its victims.

- Buckminster Fuller

Natural Capitalism Solutions

L O N G M O N T, C O L O R A D O

www.natcapsolutions.org

Competition requires firms, industries, and nations to ask the following key questions:

Competitiveness – Building Wealth in the Global Economy

Strategy

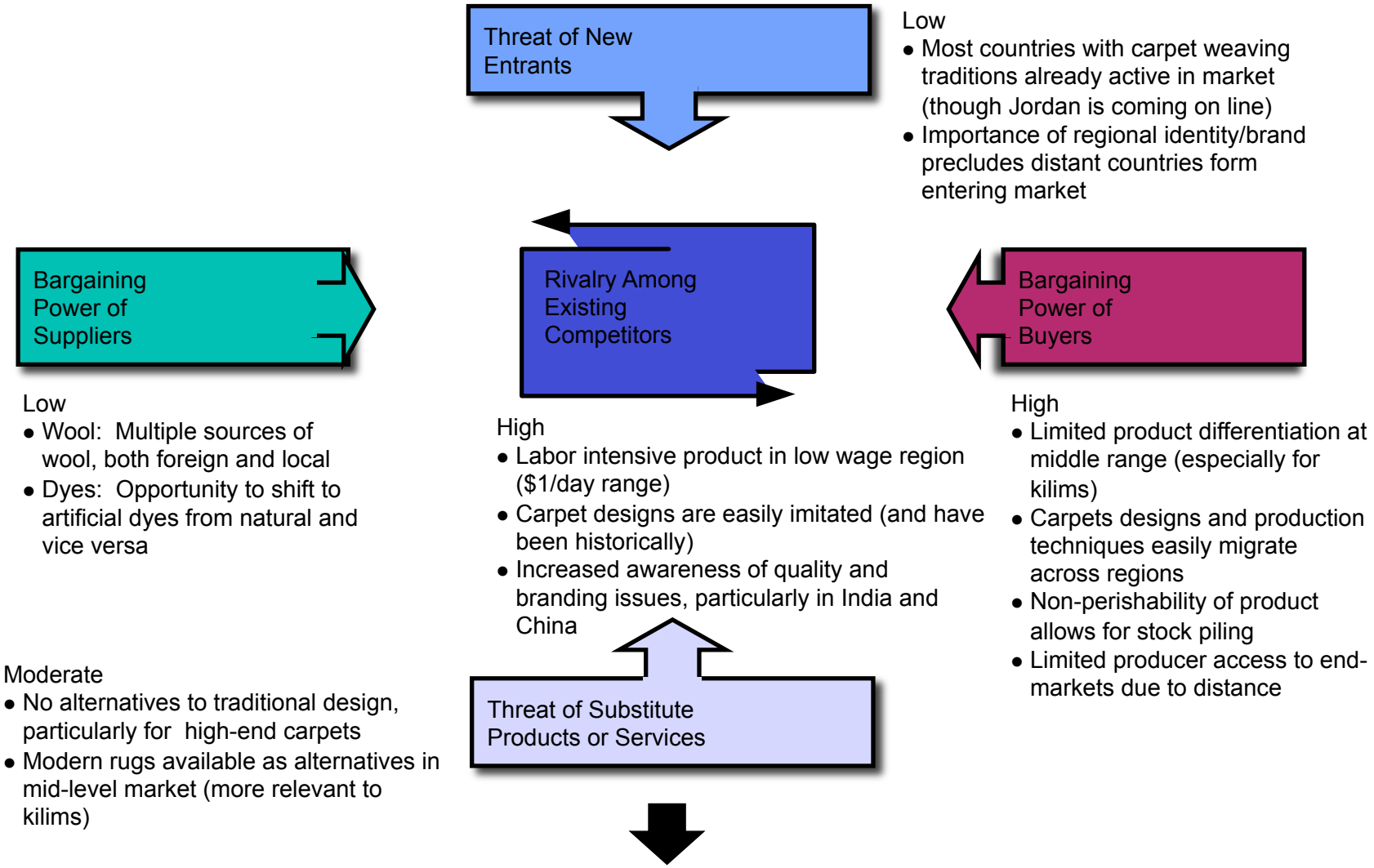
- What do we sell and to whom?
- Why do our customers buy from us rather than our competitors?
- What prevents our competitors from imitating us and taking away our best customers?

Operational Effectiveness

- Do we seek the greatest return on all forms of capital?

Strategy, Positioning and Sustainable Advantage

Carpet Industry Dynamics



The market is highly competitive, with high design mobility, but there are differentiation opportunities at higher ends of the market. This will require aggressive branding.

The Productivity Frontier

Excellent

Strategy

Poor

Poor

Excellent

Operational Effectiveness

Strategy and Productivity
The Productivity Frontier: The Coffee Industry

Strategy

Excellent

Poor

Costa Rica

Hawaii

Jamaica

Vietnam

Losers in Competition

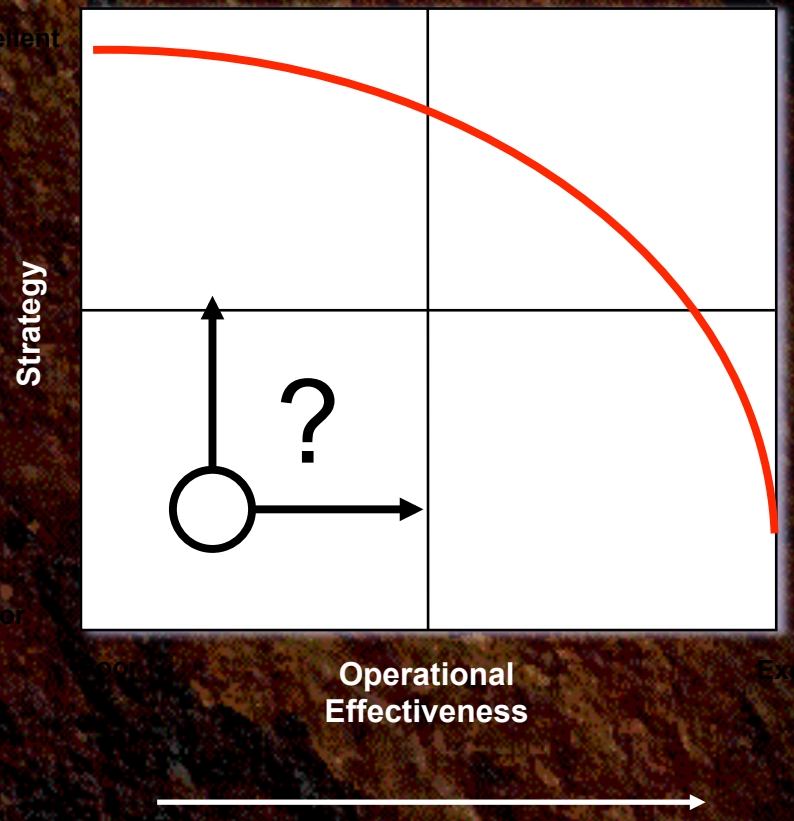
Operational Effectiveness

Excellent

** Coffee Exports*

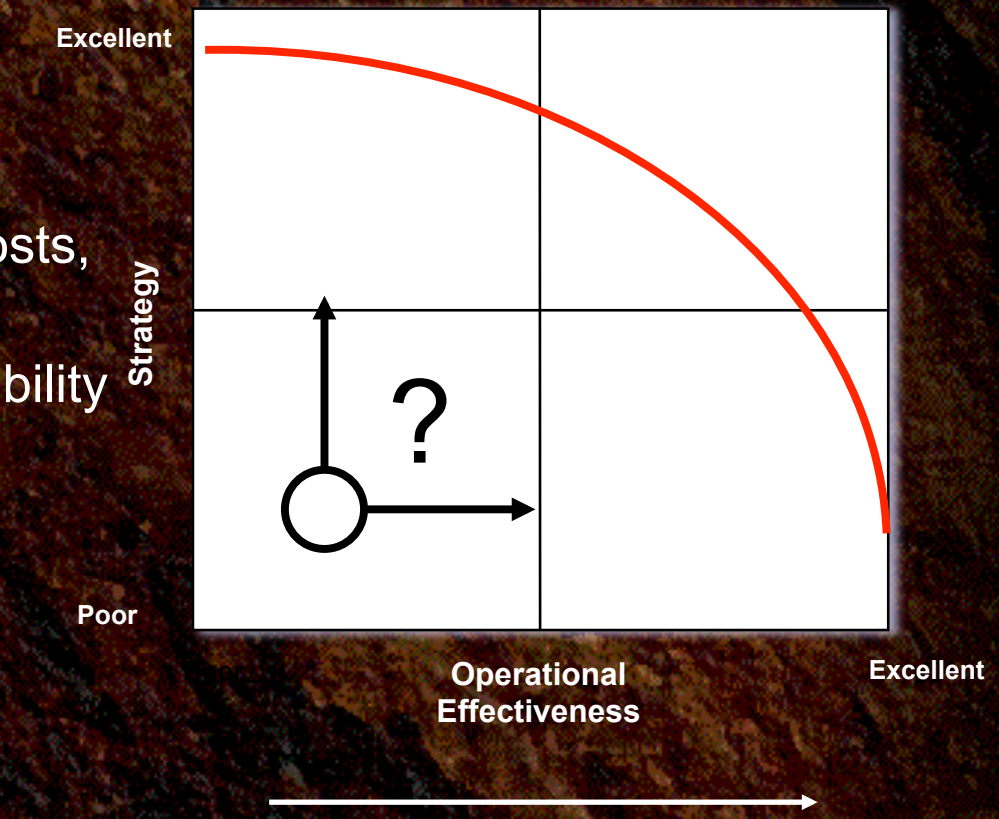
Strategy Effectiveness – Opportunities for Development

- **Strategy**
  - **Environmentally sound niche markets**: organic food, eco-tourism, bamboo, products from natural/recycled materials
  - **Solutions based business models:** temperature control services versus energy for heating and cooling
  - **First mover advantage:** eliminate toxins, reduce pollutants
  - **Design innovation:** biomimicry[1], green buildings
  - **Environmentally sustainable technology:** renewable energy, recycled materials



Operational Effectiveness – Opportunities for Development

- **Operational Effectiveness**
  - **Resource Productivity[1] / Efficiency:** reduce energy costs, reduce input costs
  - **Waste Elimination:** responsibility for product lifecycle[2], create secondary income sources, reduce inputs
  - **Maximize Economic, Environmental, and Social Return:** workforce efficiency
  - **Systems Thinking:** closed loop processes, cluster development
  - **Full Cost Accounting:** track non-financial indicators / externalities



Water supply from groundwater

Well drilling Pump installation and maintenance

Automatic irrigation and watering systems

Water quality testing and assurance

Water Pressure and Water Storage Tanks

Water Filters and Disinfection

Water pollution control/ prevention/ remediation

Leach field installation and maintenance

Septic Tank installation and maintenance

Water pollution control and prevention technologies

Pump Station installation and maintenance

Swimming pool maintenance

Water-efficient appliances

Water-efficient appliances

Water-efficient industrial processes

Stormwater management

Storm drain installation and maintenance

Catchbasin installation and maintenance

Pond outlet installation and maintenance

Wetland design, installation, maintenance reporting

Stormwater management systems

Roof and gutter systems

Green roof retrofit, new roofs, growing media production, maintenance

Rain barrel installation and maintenance

Rain garden plant and mulch supplies

Wastewater treatment

Chemical and biological processes

Plant design, engineering, construction

Biosolids for fuel or fertilizer, and other byproducts

Water-based transportation, recreation, and production

Ferries, including alternative powered Boat building: kayaks, canoes, sailboats

Fisheries and hatcheries, aquaculture

Marinas and shoreline infrastructure, soft engineering options

Fishing supplies, education, location, easements

Water-energy linkages

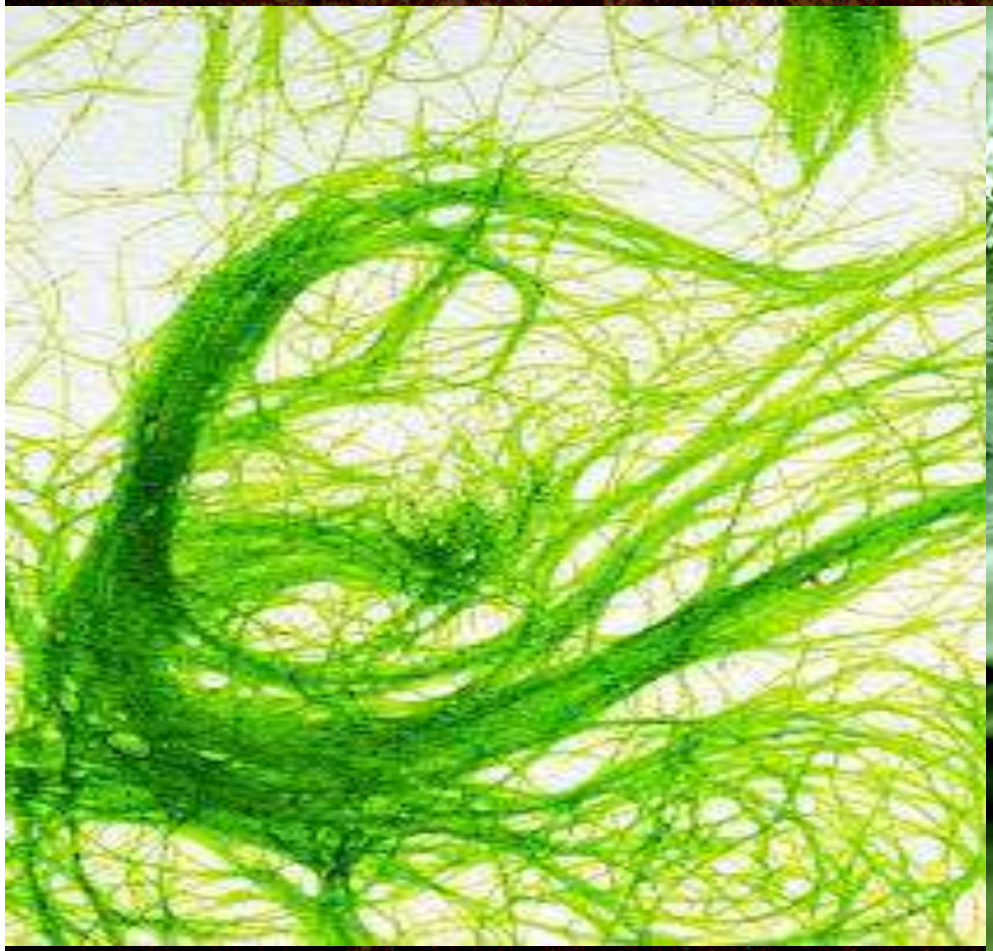
Hydro power Tidal power

THERE IS NO SILVER BULLET

BUT WE SURE HAVE SILVER BUCKSHOT

Fuel from Algae

Solazyme - Jonathan Wolfson



Fuel from Algae

2010 - Solazyme's algae derived Naval distillate fuel successfully demonstrated in ships

Numbers

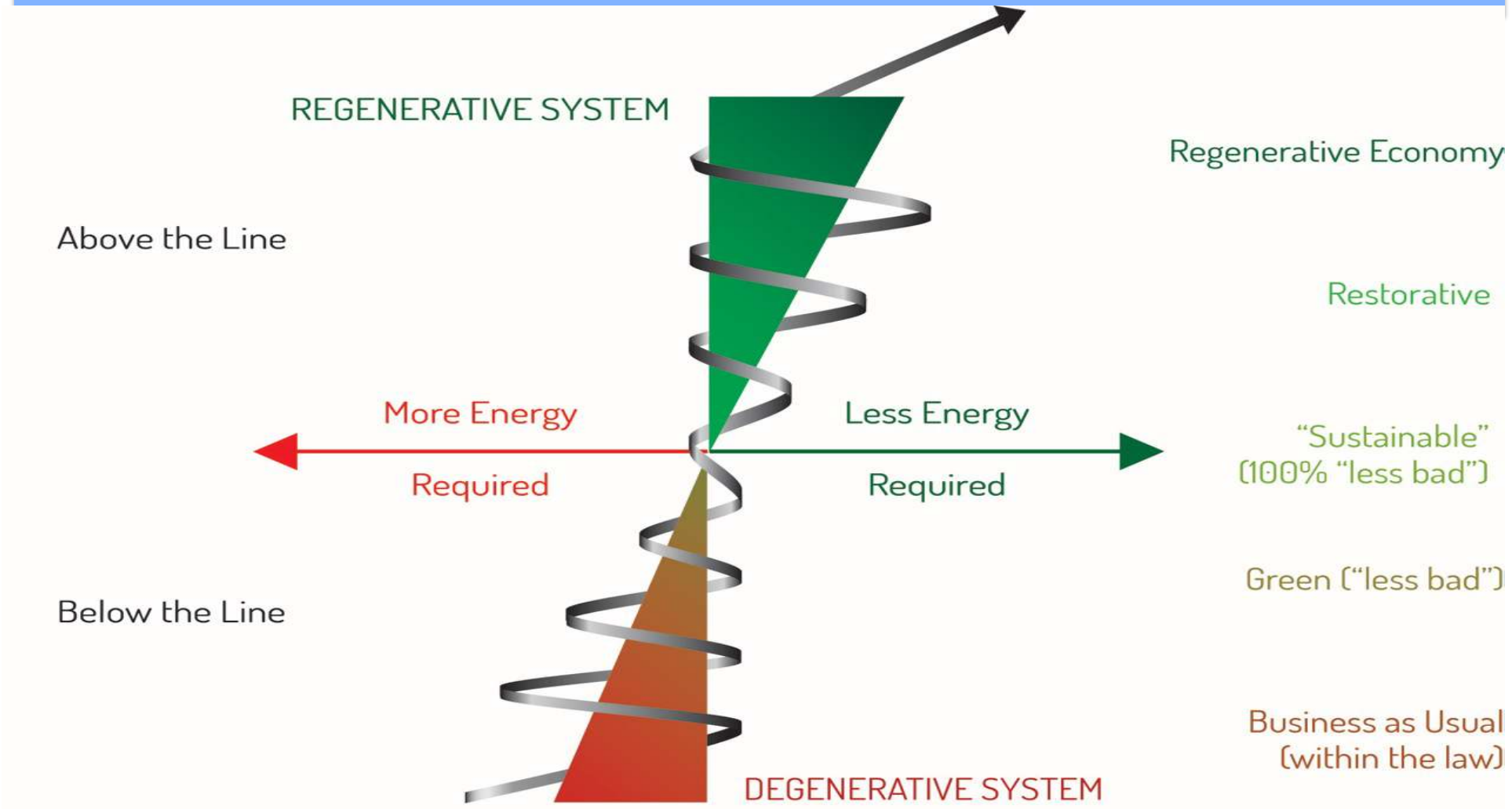
Energy used to transport and process water ~ 13% of the energy budget for a typical municipality;

CA 20% of electricity, 30% of non-power plant natural gas

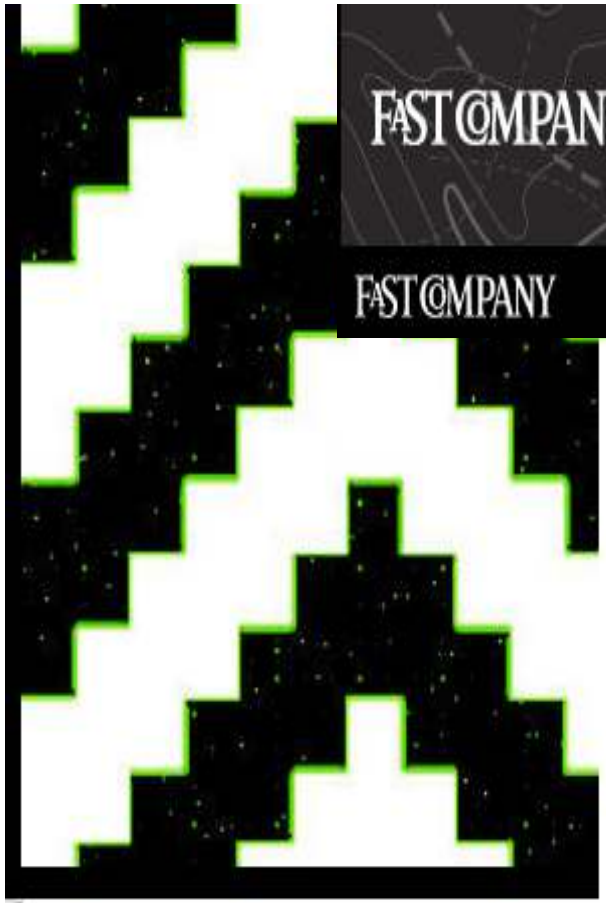
Water and wastewater treatment facilities, combined, consume more than 3 billion kWh of electricity per year

Natural systems are sustainable

because they are Regenerative



Derived from Bill Reed, Regenesis Group



FAST COMPANY CREATIVE BRAINTRUST

FAST COMPANY DESIGN EXIST CREATE LABS FEATURES EMAILS ISSUES

Creating A "Regenerative Economy" To Transform Global Finance Into A Force For Good

What if the economy protected people and the planet?

Co.EXIST

John Fullerton and Hunter Lovins

8 elements of regenerative capitalism

- in right relationship
- holistic wealth
- innovative and adaptable
- empowered participation
- edge effect abundance
- robust circulation
- seeks balance
- honors community and place