River Restoration

and Existing Dams

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42,000 Dams in 140 Countries

New Zealand 86  Papua New Guinea 3
South Africa 539  Albania 306  Zimbabwe 213
Romania 246  Nigeria 48  Bulgaria 188  Ivory Coast 22
Czech Republic 118  Congo (DRC) 16  Russia 91  Angola 15
Yugoslavia 69  Namibia 13  Slovakia 50  Madagascar 10  Slovenia 30
Cameroon 9  Croatia 29  Ghana 5  Mauritania 9  Bosnia-Herzegovina 25
Burkina Faso 8  Ukraine 21  Ethiopia 8  Ethiopia 29  Mozambique 8
Azerbaijan 17  Lesotho 7  Romania 18  Swaziland 6  Hungary 15  Georgia 14
Sudan 4  Uzbekistan 14  Zambia 12  Botswana 3  Kyrgyzstan 11
Malawi 3  Tajikistan 7  Benin 2  Latvia 5  Guinea 2  Moldavia 2  Mali 2  Senegal 2
Seychelles 2  Sierra Leone 2  USA 6375  Tanzania 2  Canada 793  Togo 2  Gabon 1
Suriname 1  China 22,000  Uganda 1  India 5291  Japan 2675  South Korea 765  Thailand 204
Malaysia 59  Chinese Taipei 50  Syria 41  Sri Lanka 46  South Africa 46  Phillipines 45  Iraq 18
Turkey 625  Indonesia 56  Algeria 107  Pakistan 71  Morocco 92  North Korea 29  Tajikistan 2  Iran 66
Cambodia 5  Bangladesh 1  Taiwan 1  Spain 1187  Laos 1  France 569  Italy 524  United Kingdom 517
Brazil 594  Norway 335  Mexico 557  Germany 311  Argentina 101  Sweden 190  Chile 88  Switzerland 196
Venezuela 74  Austria 140  Colombia 49  Portugal 103  Cuba 49  Finland 55  Peru 41  Cyprus 52  Greece 46
Dominican Republic 11  Equador 13  Iceland 20  Costa Rica 9  Macedonia 18  Honduras 9  Ireland 36  Bolivia 6
Belgium 18  Panama 6  Denmark 10  Uruguay 6  Netherlands 10  El Salvador 5  Luxembourg 3  Australia 486  Fiji 2
A Look at Just One U.S. State…

World Population: 6,345,363,055
World Commission on Dams – 3 Year Study

- 50% of World’s Rivers Have Dams
- 80 Million People Displaced by Dams
- 3.5 Billion People Live in Water Stressed countries
- 2 Billion People Lack Electricity

Purpose and Value of Dams

- Irrigated Agriculture
- Electricity
Purpose and Value of Dams

Salinity Control

Conservation (Wetlands)

Purpose and Value of Dams

Vanport Flood 1948

Pearl River Flood 1951

Flood Control
Purpose and Value of Dams

Water Supply

Affects of Dams – Irretrievable Losses

- Lotic vs. Lentic Habitat
- River vs. Reservoir Function
- Inundation Losses
- Footprint Losses
Affects of Dams – Reparable Losses

- Water Quality
- Instream Flows
- Dam Operations
- Fish & Wildlife Habitat
- Geomorphic and Hydrologic Processes

To Remove or Not to Remove
that was the question…

- Lower Snake River Dams
- Madison Dam
- Milltown Dam
- Elwha and Glines Dams
- Cabinet Gorge and Noxon Rapids
- Upper Missouri River Dams
- TVA Dams
Lower Snake River Dams – **Issues**

- Salmon Restoration
- Energy Losses
- Navigation Eliminated
- Flood Control Reduced
- Cost $3.2 Billion
- Annual Cost $350 Million

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Lower Snake River – **Solutions**

- In-River Juveniles Passage
- Improved Dam Operations
- “Natures” Hatchery Practices
- Improved Transportation
- Improved Upstream Habitat
- Reduced Commercial Harvest
Madison Dam, Montana - Issues

- Excessive Water Temperatures
- Blue Ribbon Trout

Madison River - Solutions

- 14 Alternatives Studied
- Thermal Model
- Weather Forecast Model
- Decision Support System
Milltown Dam
Clark Fork and Blackfoot River - Issues

- Metal Contaminated Sediments
- 6 million cubic yards
- Old Dam
- Ice Jams
- Bull Trout Passage

Milltown Dam - Solutions

- Stabilize Dam and Sediment in Situ
- Fish Ladder (temporary or permanent)
- Dredge Sediments
- Remove Dam
- Reconstruct Habitat
- ARCO and EPA Struck Deal to Remove
Elwha & Glines
Canyon Dams - Issues

- Endangered Species
- Salmon Restoration in National Parks
- Native American Treaty Rights

Elwha & Glines - Solutions

- Eicher Screens Fish Passage Research
- Dam Removal
- NPS and James River Struck Deal to Remove
Cabinet and Noxon Dams – *Clark Fork River - Issues*

- Bull Trout Fish Passage
- Dissolved Gas

**Clark Fork River - Solutions**

- Adult Capture Research
- Pheromone Attraction Studies
- Habitat Restoration
- New Outlet Structures
- Genetics
Upper Missouri River Dams - Issues

- Contaminated Mobile Sediments
- Copper and Arsenic

Missouri River - Solutions

- Automated Sampling System
- Sediment Mobilization Model
- Modified Dam Operations
- Potential Flushing Operations
- Potential Dredging Operations
TVA Dams - Issues

- Dissolved Oxygen
- Temperature
- Peaking Power Needs

TVA - Solutions

- DSS for Power Operations
- Balance Thermal and Hydro Operations
- Minimum Flows
- Labyrinth Weirs
Summary

- Many dams (42,000) create impacts
  - Some can be fixed; some cannot
- Dams have value, so...
  - Costs and benefits need to be weighed
- Creative solutions are needed
  - A sense of humor sometimes helps...

Jokes at the Hydroelectric Dam