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Advancing State and Tribal Programs

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The Wyoming Reference Site Experience

Presented by

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Background

- Began by Kurt King
- Method development began in 1990
- Field trials in 1992
- Project ran full-scale 1993-1997
- Lesser role from 1998 to 2002
- Increasing again in 2003

Objective:

- **Identify sites (or reaches) within each ecoregion of Wyoming that are least-impacted by human influences.**
- **Impact defined by the presence of potential stressors, not by any biological or water quality endpoints**

Working Definition of Reference Condition

- **Least-impacted = essentially means "best available"**
- **Does not necessarily support excellent fishing or crystal clear water (especially for Plains streams)**

Reference site data used to:

- **Define existing water quality and habitat conditions**
- **Document subsequent water quality improvement or deterioration**
- **Evaluate effectiveness of watershed improvement projects**

Reference site data used to:

- **Develop biological criteria for assessment of designated use support using ecoregions as the primary framework**

The Wyoming Reference Site Project can be divided into three main parts:

- **1) Identification of candidate reference (and nonreference) sites**
- **2) Screening candidate sites**
- **3) Evaluation and refinement**

1) Identification of candidate reference sites

- A nomination form was distributed to private organizations and federal, state, and local agencies asking for nomination of candidate reference sites
- This was the “1st cut”

Respondents were asked to…

- **Identify a minimum of three streams or stream reaches for each ecoregion (map provided) within their management district or area of knowledge that are of reference quality**

- **Consider the following criteria….**

Criteria:

- Be least-impacted or un-impacted (left undefined)
- perennial
- accessible
- 2nd through 5th order (Strahler)
- 1/4 mile upstream or 1+ miles downstream of a lake or reservoir (later changed)
- no point-source discharges in reach

Identification of candidate non-reference (impaired) streams

- **Nomination form distributed**
- **Were asked for three from each ecoregion**
- **Criteria**
  - Be impaired (left undefined), gave some examples of stressors
  - Be perennial, accessible, 2nd thru 5th order

Results

- 165 candidate reference sites nominated, covering all five of the Omernik Level III ecoregions in Wyoming
- 142 nonreference sites were nominated

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Screening of candidate sites

- **Reference site checklist**
  - Observe/document watershed and reach characteristics in the **field**
    - land use(s)
    - point/nonpoint sources
    - road locations and densities
    - stream/riparian characteristics
  - Map work, NPDES file review, etc., in **office**

YES	NO	A YES, indicates that an item is present and connected (linked or joined) to the stream reach. If YES, describe.
		Point discharges present?
		Hazardous waste sites, landfills?
		Mines or oil fields?
		Feedlots, poultry farms, or hatcheries?
		Urban, industrial, commercial, or residential land use?
		Channelization?
		Dams (do not include beaver)?
		Transportation (rail lines, etc.) and utility corridors (electrical, phone, etc.)?
		Logged or burned forests?
		Intensively grazed or cropped lands?

Criteria

- **All ecoregions**
  - No waste sites, landfills, urban or industrial land use
  - No dams (excluding beaver and some low head dams and most irrigation diversion structures)
  - Less than 20% of watershed logged or burned
  - No intensively grazed or cropped lands

Criteria

- **Mountain ecoregions**
  - No point sources
  - No mines
  - No feedlots, hatcheries
  - Channelization >15 yrs prior and channel has stabilized

Criteria

- **Plains ecoregions**
  - Point discharges (single or combination) >3 mi. upstream, less than 1% contribution to flow
  - Non-hard rock mines >3 mi. upstream, point source criteria met
  - No feedlots (NPDES criteria), hatcheries if point source criteria met
  - Channelization >2 mi upstream, no apparent affect on reach

YES	NO	Minimally disturbed, typical areas or potential natural landscapes. Is the stream reach located within or adjacent to:
		Agricultural or range oases?
		Old growth forests, woodlots?
		Roadless areas?
		Areas containing distant or disconnected roads only?
		Preserves, refuges, exclosures?

YES	NO	Accounting for natural differences related to Ecoregion and stream type, does the stream reach have:
		Extensive riparian vegetation (all along the shoreline providing buffer) and old vegetation (woody debris or overhang)?
		Complex riparian structure (canopy, understory, ground cover)?
		Complex channel morphology (mixture of habitat types)?
		Minimal shoreline modification (presence of riprap, removal of vegetation, saplings, etc., exotic plant species introduction)?
		Complex habitat structure (variable substrate esp. gravel, cobble, boulder, large woody debris, overhanging vegetation, undercut banks, macrophytes)?
		Minimal chemical stressors (look for pipes, dumps, landfills, lawns, connected cropland)?
		Minimal channel/flow manipulation (straightening, levees, riprap, other control structures; dams, irrigation canals, field drains)?
		Minimal sedimentation and turbidity?
		No water sheen, minimal odors, films, scums?
		Evident wildlife (including fish) and benthos?
		Minimal evidence of humans and human activity?
		Minimal evidence of livestock?

Results

- **Of 155 nominations statewide, 121 were verified as reference (73%)**

- **Of the 142 nonreference sites nominated**
  - 26 verified as highly disturbed (impaired)
  - 92 verified as moderately disturbed
  - 24 actually considered reference quality


OCT 9 '98


SEP 27 '93


OCT 17 '99


OCT 5 '94


SEP 29 '93

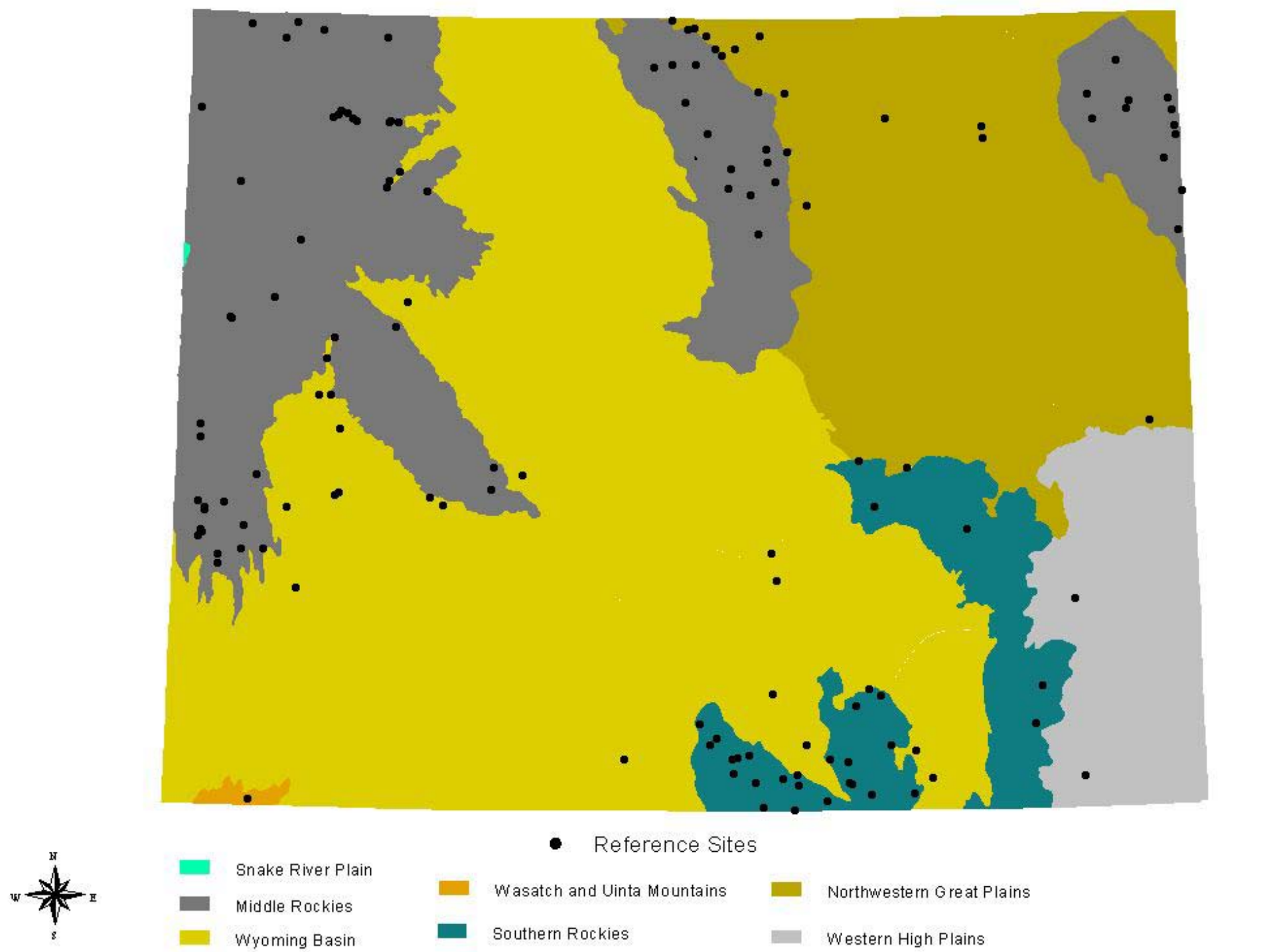

OCT 7 '95

The good and the bad of this approach

- **Good**
  - Nominations tapped into local/regional expertise
  - Were politically correct, spurred local involvement
  - Limited windshield time
  - Strong dataset in the mountains and foothills

The good and the bad of this approach

- **Bad**
  - Few plains reference sites were identified because respondents felt very few streams met the criteria that were given
  - Plains reference sites tended to be near the mountains and of montane origin
  - Subject to personal biases of those who were consulted
  - Some just wanted a free assessment!


Reference Sites
Snake River Plain
Middle Rockies
Wyoming Basin
Wasatch and Uinta Mountains
Southern Rockies
Northwestern Great Plains
Western High Plains
N
W
E
S

The Bad, continued

- **Few low gradient montane sites were nominated**
  - Had visual appearance of impairment
  - More sensitive to disturbance
  - More prone to being disturbed

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3) Evaluation and Refinement

- **Efforts to develop biocriteria became the tool for evaluation and refinement**
- **The IBI development process quickly identified shortcomings of the dataset…..**

It confirmed what we already knew…

- **Too few plains (NGP and WHP) reference sites**
- **Needed more “interior” Plains sites**

And pointed out what we didn't know…

- **We needed more low gradient (Rosgen E) montane sites**
- **We needed better representation of the montane elevation gradient**

Approach to getting the necessary data

- **Hard work using GIS, consultation with local experts, field time**
- **Incorporating probabilistic design into existing monitoring strategy** (may serve multiple purposes)
- **Other datasets**
  - Montana Plains REMAP data
  - Wyoming EMAP data
  - EMAP GIS Approach??

Lessons learned

- **Foresight**
- **Uniformity (field, lab, QA/QC)**
- **Patience is a virtue**
- **Professional judgement can’t be excluded**