Climate Change Adaptation in the Context of Access and Infrastructure Design in the National Parks and Forests

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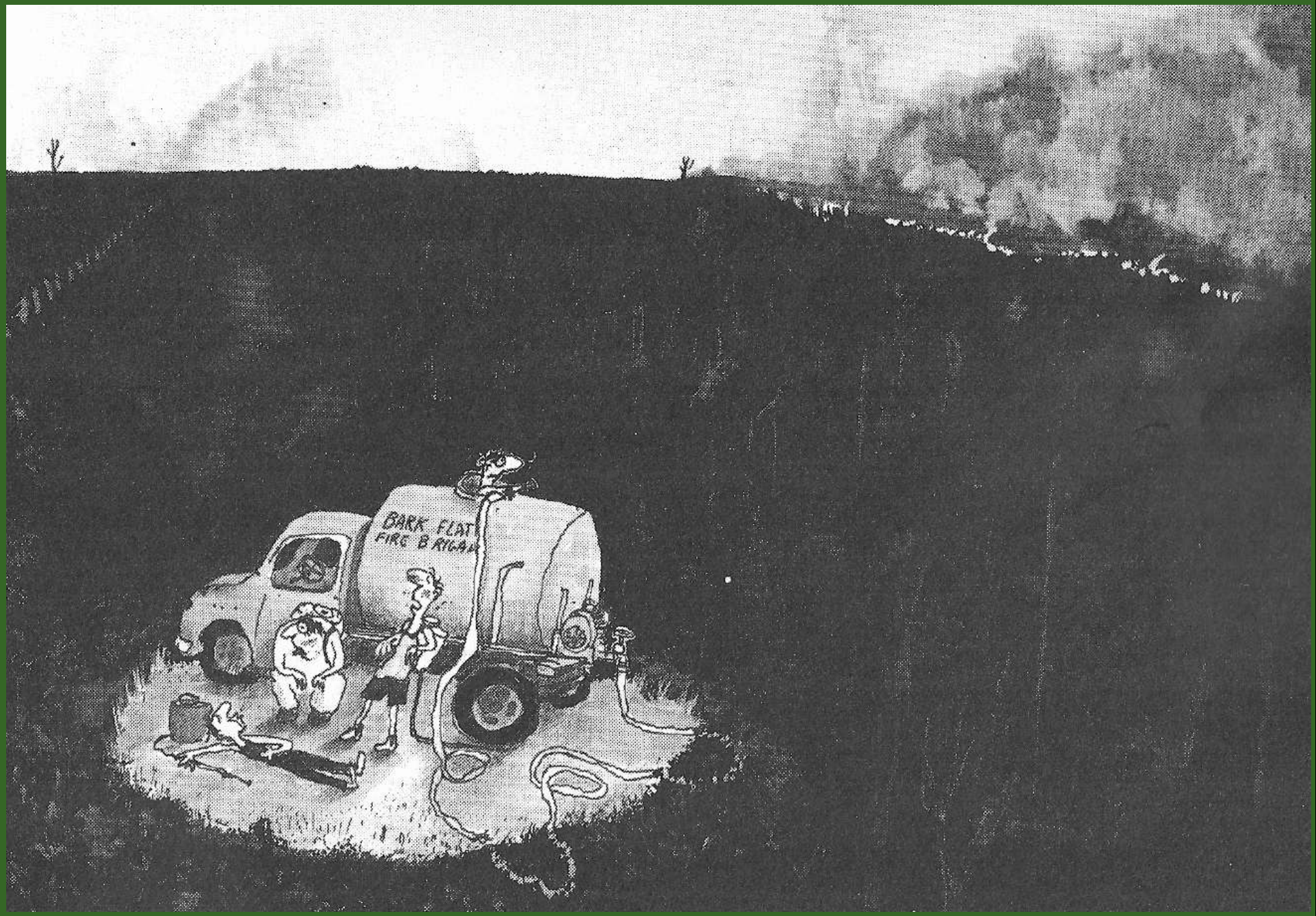

BARK FLAT
FIRE BRIGADE

Approaches to Adaptation and Planning

- **Anticipate changes.** Accept that the future climate will be substantially different than the past.

- **Use scenario based planning** over long time scales to evaluate options rather than the historical record.

- **Expect surprises** and plan for flexibility and robustness in the face of uncertain changes rather than counting on one approach.

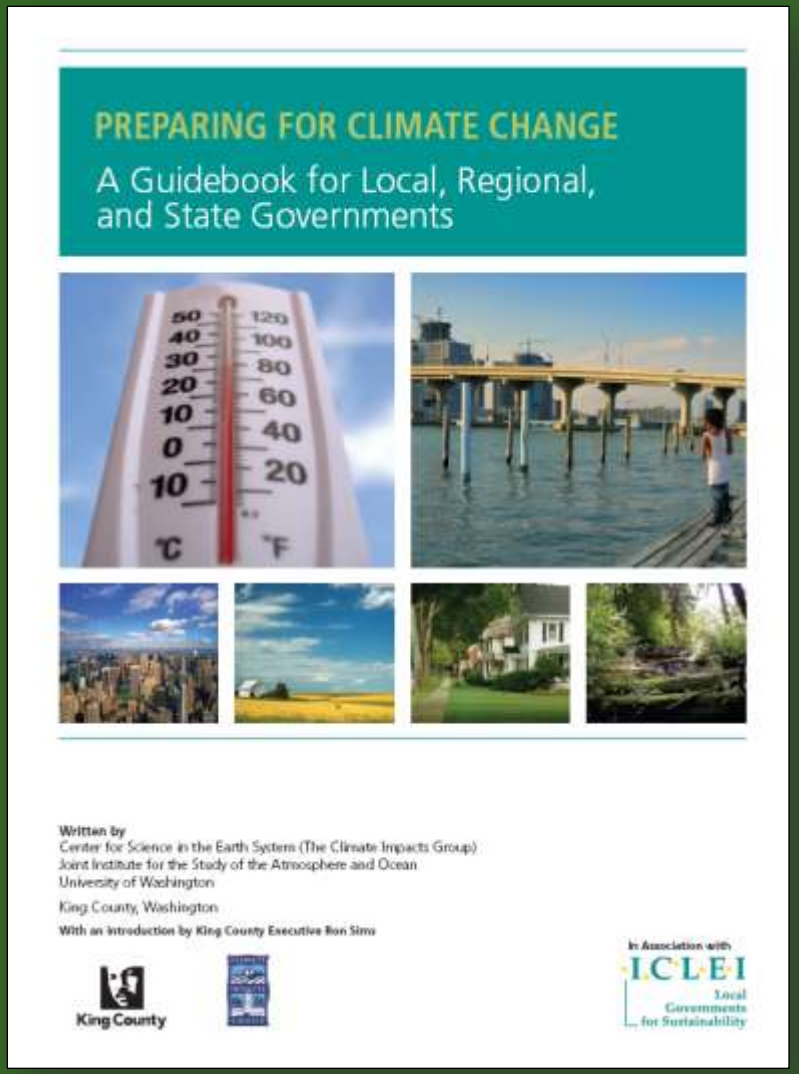
- **Plan for the long haul**. Where possible, make adaptive responses and agreements “self tending” to avoid repetitive costs of intervention as impacts increase over time.

Scenario Based Planning

- Emphasizes robust design over optimal design.

- Intentionally avoids “prediction” of outcomes and instead explores the overall performance of alternatives in response to key uncertainties.

- Motivation for writing grew out of October 2005 King County climate change conference
- Written by the CIG and King County, WA in association with ICLEI – Local Governments for Sustainability
- Written to compliment ICLEI's "Climate Resilient Communities" Program
- **Focused on the process (not a sector), and written for a national audience**



www.cses.washington.edu/cig/fpt/guidebook.shtml

Adaptive Planning Defined

Aims to **increase community and ecosystem resilience** to climate change by taking steps to proactively reduce the risks associated with climate change.

Key Notes from the CIG Adaptation Guidebook:

- Adaptation is an ongoing, collaborative process.
- Not “Climate Proofing”, but rather collective actions taken to increase resilience and reduce vulnerabilities.
- Adaptation involves the planned development of social and professional networks.
- The tools, analyses, and decision processes that we use in adaptation planning are not radically different from what planners and managers are already doing.

Planning for Climate Change

- Collect and review basic information on climate change impacts to your region
- Build internal and external support for climate change preparedness
- Create your preparedness team
- Identify your community's vulnerabilities to climate change
- Develop and implement your preparedness plan
- Measure your progress and update your plan

Guiding Principals for Planning

- Increase public awareness of climate change and projected impacts
- Develop and maintain technical capacity to prepare for and monitor climate change impacts
- "Mainstream" information about climate change vulnerabilities, risks, and preparedness into planning, policy, and investment decisions
- Increase the adaptive capacity of built, natural, and human systems in your community.
- Strengthen community partnerships that reduce vulnerability and risk.

Identifying “Low-Hanging Fruit”:

“No Regrets”

“Low Regrets”

“Win-Win”

Impacts of Climate Variability and Climate Change on Transportation Systems and Infrastructure in the Pacific Northwest

Flooding on Interstate 5 near Chehalis, WA on Jan 8, 2009. (Source: SeattlePI.com)

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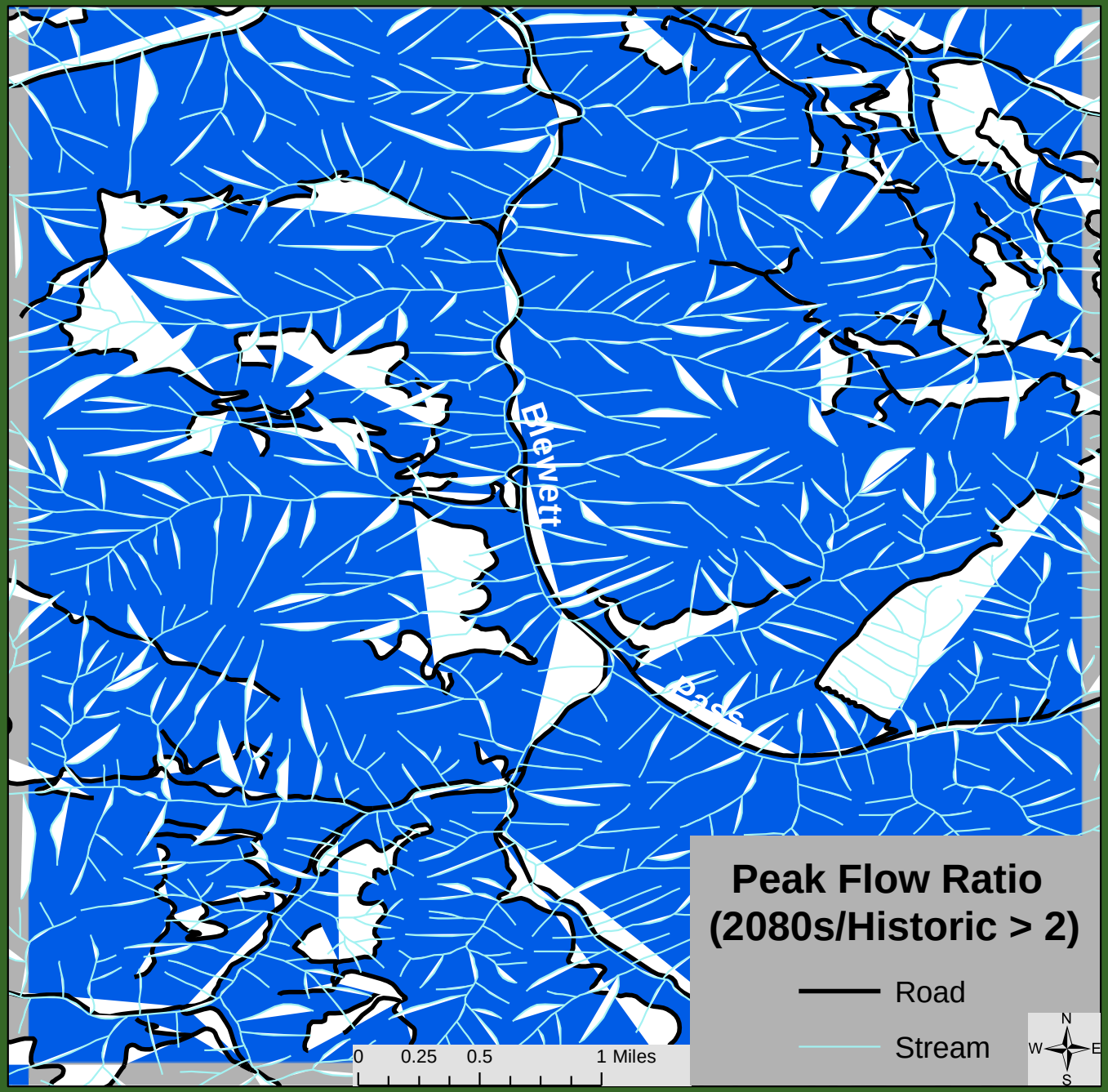
Blewett
Peak Flow Ratio
(2080s/Historic > 2)
Road
Stream
0
0.25
0.5
1 Miles
N
W
E
S

Vulnerability:

Current engineering design standards (based on historical records) may underestimate future risks of high flow and debris in streams, causing premature failure at stream crossings, increased maintenance costs, and increased impacts to access and ecosystems.

These risks may change substantially through time.

Strategic and Tactical Planning Objectives

Strategic Planning Objective:

- Reduce maintenance costs associated with infrastructure failure at stream crossings.

Tactical Planning Objectives:

- Decommission roads in high risk areas.
- Improve culvert design process.
- Use inherently robust infrastructure where appropriate

Strategies for the Design of Infrastructure in a Non-Stationary Environment

Strategy 1: **Update Existing Decision Support Tools Using Recent Retrospective Data**

- Works reasonably well for slowly and monotonically changing variables like temperature.
- Works badly for cyclical variables like precipitation.

Strategy 2: **Create Forward Looking Design Standards Using Models**

- Important in the case of long lived infrastructure and likely impacts e.g. infrastructure design accounting for sea level rise or flooding.
- Difficult to implement when the uncertainty in the direction or magnitude of projections is large.
- Implies adoption of a new paradigm (models replace observations) and implies professional agreement on standards (both very challenging).

Strategy 3: **Bayesian Approaches: Monitoring and Adaptive Management**

- Works best with relatively short design windows, where designs can be updated in response to observed failure rates
- Requires a well-designed monitoring systemand regular updating process (neither of which may be in place).
- Bayesian systems work really badly in cases where impacts intensify through time and previous actions cannot be reversed (e.g. floodplain management).

Strategy 4: **Flexible Infrastructure Design**

- Build for short term needs but maintain flexibility to increase protection as needed.
- Expandable sea walls are a good example
- Bridges?

Strategy 5: **Robust Systems Design**

- Use of “half moon” fish passage culverts is a great example.
- Robust infrastructure may cost more.
- Using the same robust design in all cases may reduce administrative, design, and per mittingcosts.

Strategy 6: **Focus Additional Design Resources on Susceptible Areas**

- This approach is attractive in that is doesn't require updated design standards, and instead relies primarily on professional judgment
- Results in additional cost (time), which must still be justified based on evidence of increased risk.