

# **Innovative Eco-Logical Research: Highlights of the Upcoming Transportation Research Board (TRB) Annual Meeting**

**Thursday, January 12, 2012**

**2:00 – 3:30 PM Eastern**



## **Presenters**

- ***Todd Lickfett*, U.S. Fish and Wildlife Service**
- ***Mehmet Egemen Ozbek, Ph.D.*, Colorado State University**
- ***Mike Culp*, Federal Highway Administration (FHWA), Office of Natural Environment**

**Moderated by: Mary Gray, FHWA Office of Project Development and Environmental Review**

# Transportation Research Board (TRB)

- One of six major divisions of the National Research Council
- **Mission:**  
“To provide leadership in transportation innovation and progress through research and information exchange, conducted within a setting that is objective, interdisciplinary, and multimodal.”
- **Services:**
  - Information exchanges
  - Research and related programs
  - Policy analyses and recommendations
  - Publications
- **91<sup>st</sup> Annual Meeting: January 22-26, 2012, Washington, D.C.**



[www.trb.org](http://www.trb.org)

# Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects

- Addresses challenges in planning for ecosystems and infrastructure:
  - Duplication of efforts
  - Uncertainty and lack of predictability
  - Results: piecemeal mitigation



# Ecological Session at TRB

Enabling Planning-Level Ecological Decision Making

Monday Jan 23, 1:30 pm - 3:15 pm Hilton,  
Connecticut Ave. DC

- **US Fish and Wildlife Service LEAP and NiSource**
- **US Army Corps of Engineers Watershed Investment Tools**
- **USEPA/USGS National Atlas of Sustainability Measures**
- **California Statewide Advance Mitigation Initiative**



# TRB Strategic Highway Research Program (SHRP 2)

## Integration of Conservation, Highway Planning, and Environmental Permitting

### Using an Outcome-Based Ecosystem Approach

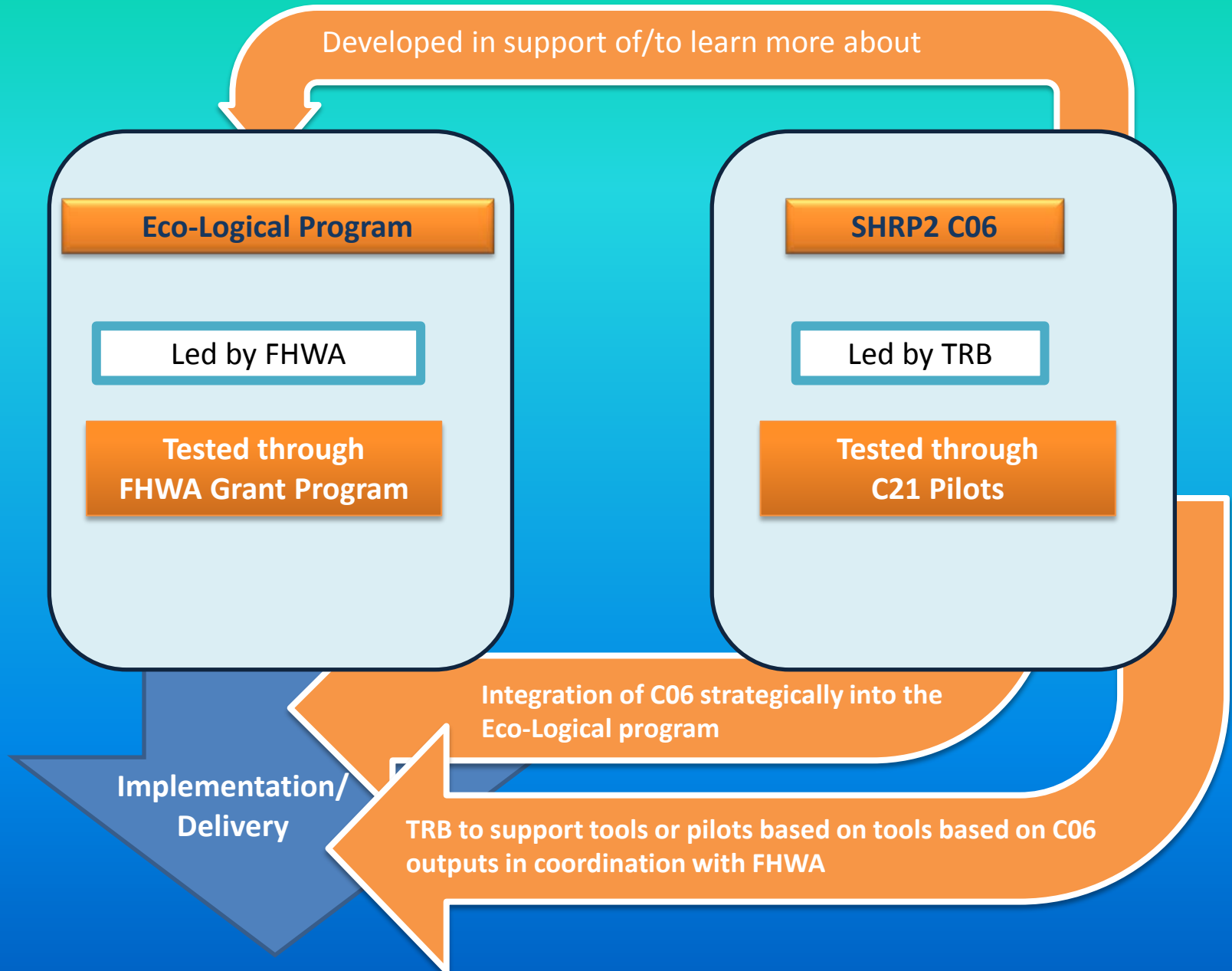
1. Integrated Ecological Framework
2. Agency specific integrated approach to conservation and transportation planning

### Through Development of an Outcome-Based Ecosystem-Scale Approach and Corresponding Credit System

1. Cumulative Effects and Alternatives Analysis
2. Regulatory Assurances
3. Ecosystem Crediting



# Ecosystem-Based Decisionmaking





# Questions?



**Eco-Logical:**

[http://www.environment.fhwa.dot.gov/ecological/eco\\_entry.asp](http://www.environment.fhwa.dot.gov/ecological/eco_entry.asp)

**Eco-Logical Webinar Series:**

[http://www.environment.fhwa.dot.gov/ecological/eco\\_webinar\\_series.asp](http://www.environment.fhwa.dot.gov/ecological/eco_webinar_series.asp)



# USFWS Landscape-scale Energy Action Plan (LEAP)

## Presentation on Online Information Systems and Data Tools for Eco-Logical Decision-making

January 12, 2012

Todd Lickfett  
R6 Ecological Services  
[todd\\_lickfett@fws.gov](mailto:todd_lickfett@fws.gov)





# LEAP Objectives

**Avoid, minimize, and mitigate impacts to Trust Resources** by providing biologists and planners with information, analyses, and decision support tools to inform project siting early in the planning process

***LEAP products:***

Landscape-scale Vulnerability Assessments (LVAs)

Trust Resource Lists & Information

Policy Information

Conservation Frameworks (Internal Document)

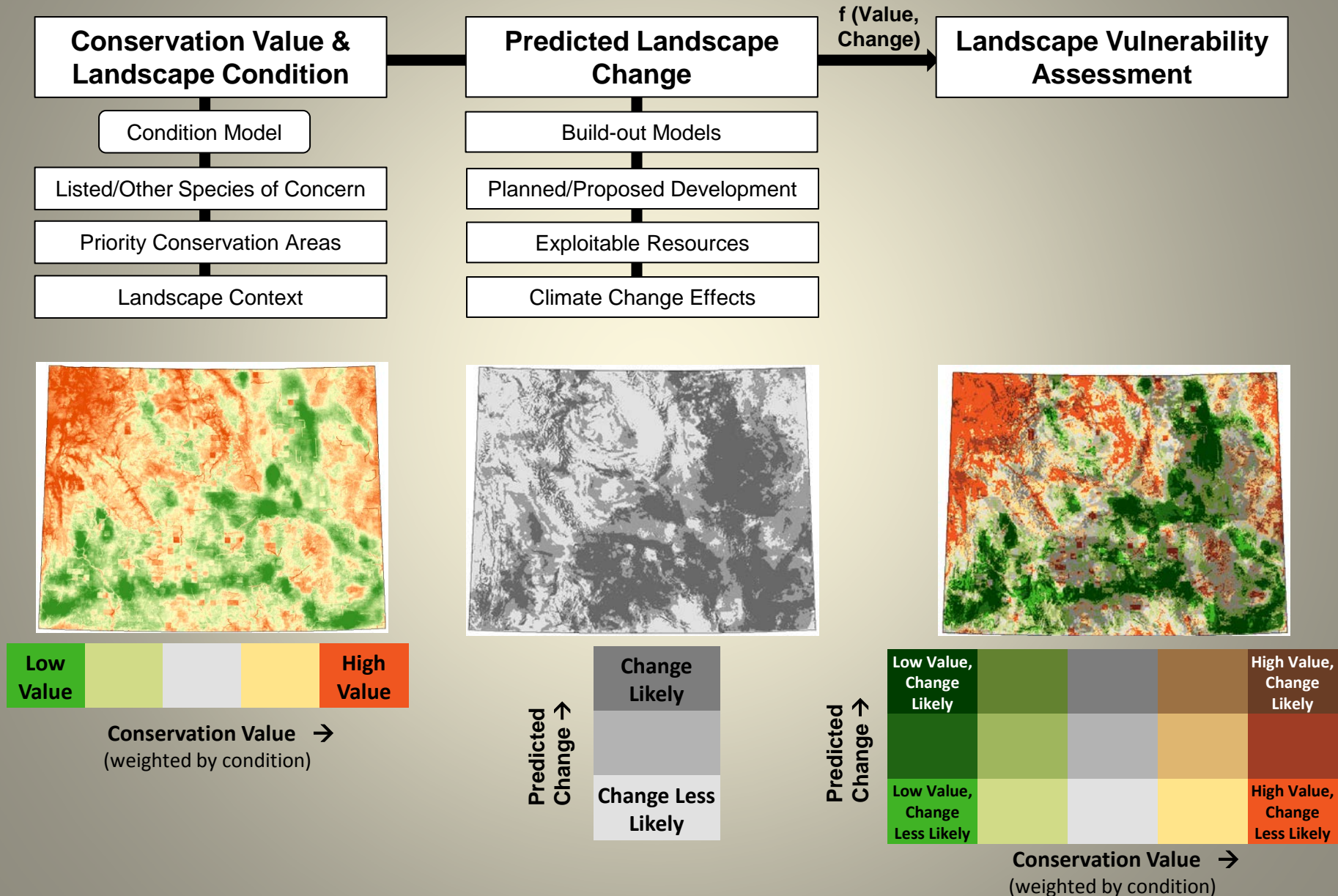
Conservation Measure Reports

Report Builders (Biological Assessments etc.)


LEAP Data Portal @ USGS ScienceBase



# ***DRAFT*** LEAP Landscape Vulnerability Assessment (LVA)



# LEAP Integration with IPaC

 **U.S. Fish & Wildlife Service**  
**IPaC - Information, Planning, and Conservation System**  
Environmental Conservation Online System

Search

IPaC Home Page Initial Project Scoping Project Builder FAQs

**Step 1**  
Location

**Step 2**  
Activities

**Step 3**  
Trust resources list

**Step 4**  
Conservation measures

**Natural Resources of Concern**


An online Endangered Species Act species-list is available on this page for your project area, represented by the office(s) listed below.

The Endangered Species Act species-list below is for planning purposes only -- it is not an official species-list.

To request an official species-list, click the Request an Official Species-list link to the right and follow the instructions.

WYOMING ECOLOGICAL SERVICES FIELD OFFICE  
5353 Yellowstone Rd, Suite 308A  
SHELDON, WY 82804  
(307) 772-2374  
<http://www.fws.gov/wyominges/>

Project location map:



Project Counties:  
Carbon, WY

Project type: Transportation

**Endangered Species Act Species-list**  
There are a total of 16 species in your species-list

Species that may be affected by your project:

Birds	Candidate	species info	Wyoming Ecological Services Field Office
Greater sage-grouse ( <i>Centrocercus urophasianus</i> ) Population: entire			
Least tern ( <i>Sterna antillarum</i> ) Population: interior pop.	Endangered	<a href="#">species info</a>	Wyoming Ecological Services Field Office
Piping Plover ( <i>Charadrius melodus</i> ) Population: except Great Lakes watershed	Threatened	<a href="#">species info</a>	Wyoming Ecological Services Field Office
Whooping crane ( <i>Grus americana</i> )	Endangered	<a href="#">species info</a>	Wyoming Ecological Services Field Office

LEAP products will be delivered to the public through the ECOS-IPaC system

## Conservation Measure Reports

-provide species/project-specific BMPs

## Landscape-scale Vulnerability Assessments

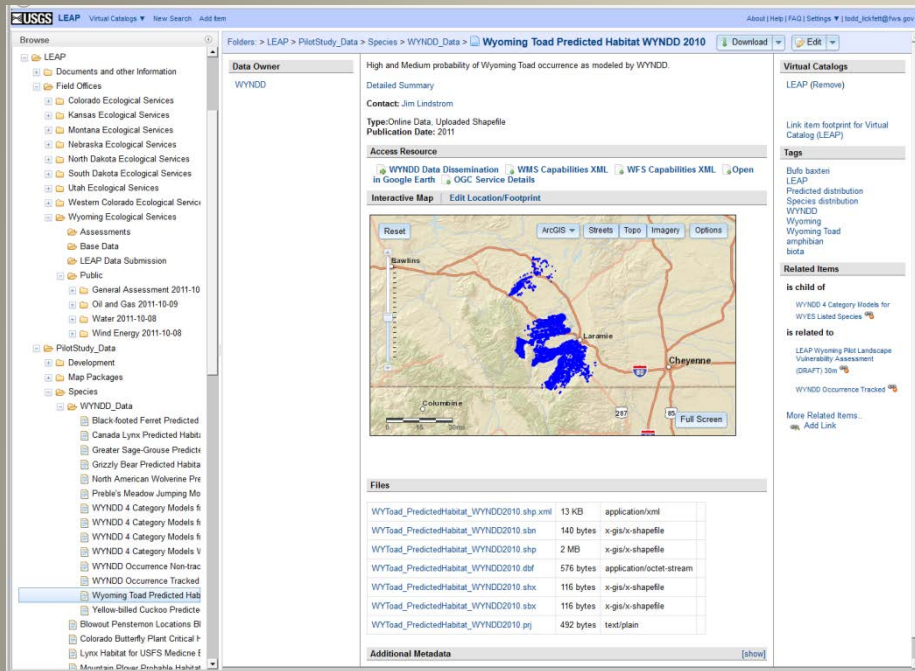
-maps delivered through interactive mapper  
-project area "scores" for comparison  
-list of LVA elements  
-links to LEAP Data Portal

## Trust Resource Lists

-expanded to include non-listed Trust species (migratory birds, raptors)



# LEAP Data Portal @ USGS ScienceBase



Searchable catalog of spatial data

Integrates with other data management platforms

***LEAP assessment data:***

LVA data bundles

Data processing scripts

Documentation

***Other data themes:***

Species Distribution & Range

Land Use/Land Cover

Land Ownership & Protection

Landscape Context & Metrics

Current Development & Disturbance

Proposed Development

Predictive Models



Wyoming Toad, *Bufo baxteri* (Endangered)

# Applications to Transportation Planning

**LEAP products will facilitate the Eco-Logical approach by providing information for landscape-scale decision-making**

- where* to site projects
- what* resources will be affected
- how* to avoid, minimize, and mitigate impacts

Enhanced coordination with FWS

- Faster project delivery
- More efficient use of \$\$
- Improved conservation

Highway 40, under construction in Vallejo, California, in 1958.



[www.dipity.com/ctownsley](http://www.dipity.com/ctownsley)

# LEAP Status



## Wyoming pilot completion in 2012

- expand to include all R6  
(MT, WY, CO, UT, ND, SD, NE, KS)

## Opportunities for cooperation with FWS

- data sharing & collection
- peer-review of spatial analyses
- partnerships

### **LEAP Contacts:**

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*todd\_lickfett@fws.gov*

*Pam Repp*

*pam\_repp@fws.gov*

## 2012 TRB Annual Meeting

*Session 331: Enabling Planning-Level Ecological Decision Making:  
Recent Progress in the Development of National Online Information  
Systems and Environmental Performance Measures*

*Monday, January 23, 1:30 – 3:15PM @ Hilton*



# A Quantitative Decision-making Framework to Evaluate Environmental Commitment Tracking Systems for the Colorado Department of Transportation

Eco-Logical Webinar Series  
January 12, 2012

Presentation based on:  
TRB Paper 12-1533 and  
CDOT Research Report 2011-13

Mehmet E. Ozbek, Ph.D.  
Assistant Professor and  
Graduate Program Coordinator  
Department of Const Mang.  
Colorado State University

Caroline M. Clevenger, Ph.D.  
Assistant Professor  
Department of Const. Mang.  
Colorado State University

# Background

- Environmental commitments are actions that are intended to avoid, minimize, or mitigate environmental impacts of a project
- Environmental commitments are required as conditions of project approval during the environmental review process
- The purpose of an Environmental Commitment Tracking System (ETS) is to provide a means of tracking the status of environmental commitments as well as maintaining necessary information tied to those commitments
- Implementation of an effective ETS can provide the means necessary to demonstrate to all stakeholders that commitments have been met

# Research Need and Purpose

- **NEED:**

- Colorado Department of Transportation's (CDOT) need to adopt an ETS to implement statewide

- **PURPOSE:**

- To evaluate the ETSs used by a number of state DOTs to determine which ETS would be the most beneficial for long-term implementation at CDOT

# Research Approach

A quantitative decision-making framework was developed consisting of four steps:

**Step 1** - Conduct interviews with stakeholders to identify the features that CDOT prefers to have in its ETS

**Step 2** - Assign weights to those features to establish their importance relative to each other based on CDOT's preferences using a rigorous quantitative method (i.e., Analytic Hierarchy Process)

**Step 3** - Collect data from eight state DOTs through surveys to identify which features their ETSs have

**Step 4** - Perform a quantitative evaluation of those ETSs according to the features preferred by CDOT and their respective weights to assign a quantitative score to each state DOT's ETS

# Step 1- Conducting Interviews to Identify Features

The interviewees were selected based on their knowledge of ETSs, the fact that they would be ETS end-users at CDOT, and/or because of their involvement with the CDOT NEPA process

Interviewee*	Affiliation	Position
1.	CDOT	Planning and Environmental Manager – Region 1
2.	CDOT	Deputy Water Quality Program Manager
3.	CDOT	Environmental Project Manager – Region 1
4.	FHWA - Colorado Division	Environmental Program Manager
5.	CDOT	South Program Manager – Region 4
6.	FHWA - Colorado Division	Program Delivery Team Leader
7.	CDOT	Environmental Planner
8.	CDOT	Program Engineer – Region 5
9.	CDOT	Resident Engineer – Pueblo Region 2

\*: There were two interviewees who did not want their affiliation/position reported

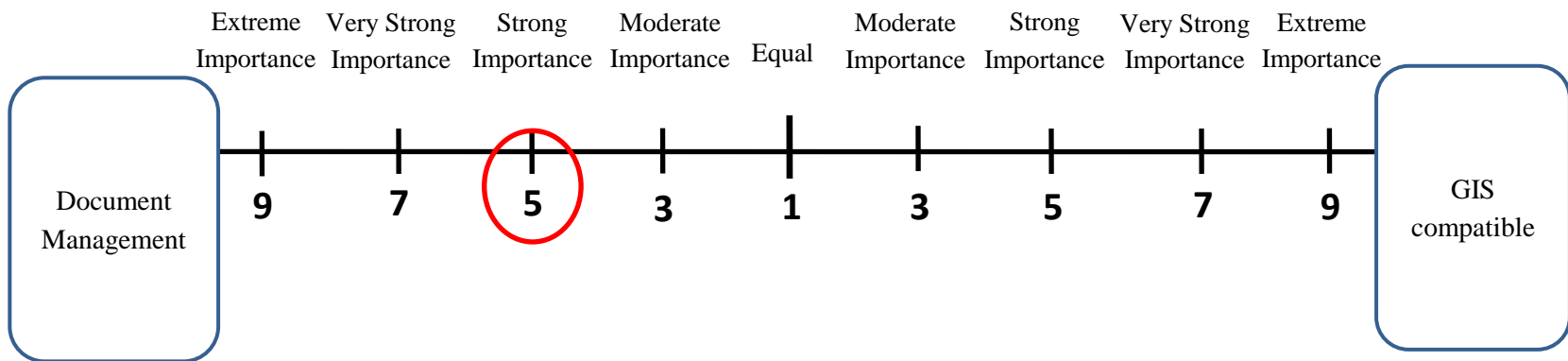
# Step 1- Conducting Interviews to Identify Features

- 1) **Allow external stakeholders to input/edit information**: ETS allows for external project stakeholders (e.g., agencies like FHWA, contractor, etc.) to input/edit information in the tracking system for those projects which they are involved with.
- 2) **Control which CDOT employees can view information**: ETS has the capability to assign permissions to a select group of CDOT employees allowing only them to view tracking data for a given project.
- 3) **Document Management**: ETS has the capability to manage documents (i.e., storing and linking related documents such as word and pdf files for easy retrieval and/or versioning control).
- 4) **GIS compatible**: ETS has the capability of integrating with GIS.
- ...
- 18) **Sort and filter data**: Users can find and view only the commitments and permits that are relevant to a particular person or project.



# Step 2- Assigning Weights to Features

- A well-structured quantitative multi-criteria decision analysis method, Analytic Hierarchy Process (AHP), was utilized
  - Pairwise comparisons between two elements at a time: “Which of the two is more important, and how much more important is it?”
  - Once all comparisons are made, mathematical computations (based on matrix algebra) are performed to assign weights to those elements
  - AHP also requires the calculation of the consistency ratio (C.R.). C.R. is a measure to identify how consistent the participant was
- 18 features → 153 pairwise comparisons performed by six respondents



- C.R. of the group=0.028 (<0.10 is acceptable)

# Step 2- Assigning Weights to Features

Metric	Weight
Track deleted or modified commitments	0.1468
Track permits	0.1406
Standard Reports	0.0979
Sort and filter data	0.0975
Generate notifications	0.0693
Document Management	0.0537
GIS compatible	0.0526
Control which CDOT employees can input/edit information	0.0495
Integrate with ProjectWise	0.0432
Store data in a single centralized file	0.0395
Differentiate between CAT X, EA, & EIS	0.0371
Web based	0.0368
Allow multiple CDOT employees to input/edit information	0.0361
Integrate with SharePoint	0.0269
Allow ALL CDOT employees to view information	0.0208
Allow external stakeholders to view information	0.0194
Control which CDOT employees can view information	0.0170
Allow external stakeholders to input/edit information	0.0153

# Step 3- Collecting Data from State DOTs about their ETSs

Features	Colorado (CDOT)	California (Caltrans)	Florida (FDOT)	Kentucky (KYTC)	New York (NYSDOT)	Tennessee (TDOT)	Texas (TxDOT)	Virginia (VDOT)	Washington State (WSDOT)
Track deleted or modified commitments	X		X	X		X	X	X	X
Track permits	X	X	X	X	X		X	X	X
Standard Reports		X	X	X	X	X	X	X	X
Sort and filter data		X	X	X	X	X	X	X	X
Generate notifications		X	X			X	X	X	
Document Management		X	X				X	X	X
GIS compatible			X					X	
Control which DOT employees can input/edit information		X	X	X	X	X	X	X	X
Integrate with ProjectWise									
Store data in a single centralized file		X	X	X			X	X	X
Differentiate between CAT X, EA, & EISs	X	X	X	X	X		X	X	X
Web based			X	X		X	X	X	X
Allow multiple DOT employees to input/edit information		X	X	X	X	X		X	X
Integrate with SharePoint							X		
Allow ALL DOT employees to view information		X	X	X		X		X	X
Allow external stakeholders to view information			X				X		
Control which DOT employees can view information	X	X	X	X	X	X	X	X	
Allow external stakeholders to input/edit information			X				X		

# Step 4- Quantitative Evaluation of ETSs

Technical Features	Colorado (CDOT)	California (Caltrans)	Florida (FDOT)	Kentucky (KYTC)	New York (NYSDOT)	Tennessee (TDOT)	Texas (TxDOT)	Virginia (VDOT)	Washington State (WSDOT)
Track deleted or modified commitments	0.1468		0.1468	0.1468		0.1468	0.1468	0.1468	0.1468
Track permits	0.1406	0.1406	0.1406	0.1406	0.1406		0.1406	0.1406	0.1406
Standard Reports		0.0979	0.0979	0.0979	0.0979	0.0979	0.0979	0.0979	0.0979
Sort and filter data		0.0975	0.0975	0.0975	0.0975	0.0975	0.0975	0.0975	0.0975
Generate notifications		0.0693	0.0693			0.0693	0.0693	0.0693	
Document Management		0.0537	0.0537				0.0537	0.0537	0.0537
GIS compatible			0.0526					0.0526	
Control which DOT employees can input/edit information		0.0495	0.0495	0.0495	0.0495	0.0495	0.0495	0.0495	0.0495
Integrate with ProjectWise									
Store data in a single centralized file		0.0395	0.0395	0.0395			0.0395	0.0395	0.0395
Differentiate between CAT X, EA, & EISs	.0371	0.0371	0.0371	0.0371	0.0371		0.0371	0.0371	0.0371
Web based			0.0368	0.0368		0.0368	0.0368	0.0368	0.0368
Allow multiple DOT employees to input/edit information		0.0361	0.0361	0.0361	0.0361	0.0361		0.0361	0.0361
Integrate with SharePoint							0.0269		
Allow ALL DOT employees to view information		0.0208	0.0208	0.0208		0.0208		0.0208	0.0208
Allow external stakeholders to view information			0.0194				0.0194		
Control which DOT employees can view information	0.0170	0.0170	0.0170	0.0170	0.0170	0.0170	0.0170	0.0170	
Allow external stakeholders to input/edit information			0.0153				0.0153		
<b>TOTAL</b>	<b>0.34</b>	<b>0.66</b>	<b>0.93</b>	<b>0.72</b>	<b>0.48</b>	<b>0.57</b>	<b>0.85</b>	<b>0.90</b>	<b>0.76</b>
<b>Ranking</b>	<b>9</b>	<b>6</b>	<b>1</b>	<b>5</b>	<b>8</b>	<b>7</b>	<b>3</b>	<b>2</b>	<b>4</b>

# Conclusions and Future Research

- Recommend further exploration of
  - FDOT's ETS (supports 93% of CDOT's preferences)
  - VDOT's ETS- 90%
  - TxDOT's ETS- 85%
  - CDOT's existing ETS- 34%
- The analysis and recommendations are intended to minimize ETS development costs and ultimately to provide CDOT with an effective, efficient, and reliable ETS to track environmental commitment completion on projects
- The quantitative decision-making framework can be used by any state DOT. The implementation of the framework requires a minimal amount of resources, mainly in the form of time commitment
- Future research should investigate:
  - Ease of use
  - User satisfaction
  - First cost and Operational cost

Please hold all questions until the  
end of the webinar.

## **ACKNOWLEDGMENT**

The research work described herein has been funded by CDOT. The opinions and findings are those of the authors and do not necessarily represent the views of CDOT. Authors would like to thank the CDOT Study Panel members and interview participants for their invaluable suggestions and contributions to this research.





# FHWA's Sustainable Highways Self-Evaluation Tool (INVEST)

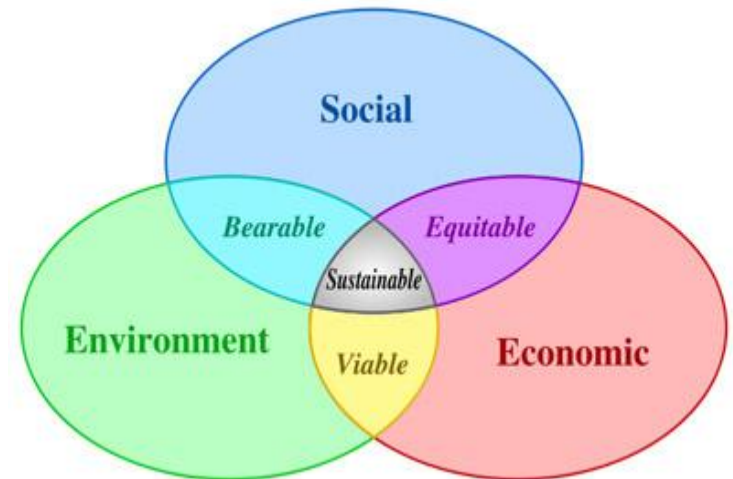
Mike Culp

Team Leader, Sustainable Transport and Climate Change Team  
Office of Planning, Environment & Realty

Eco-Logical Webinar  
January 12, 2012

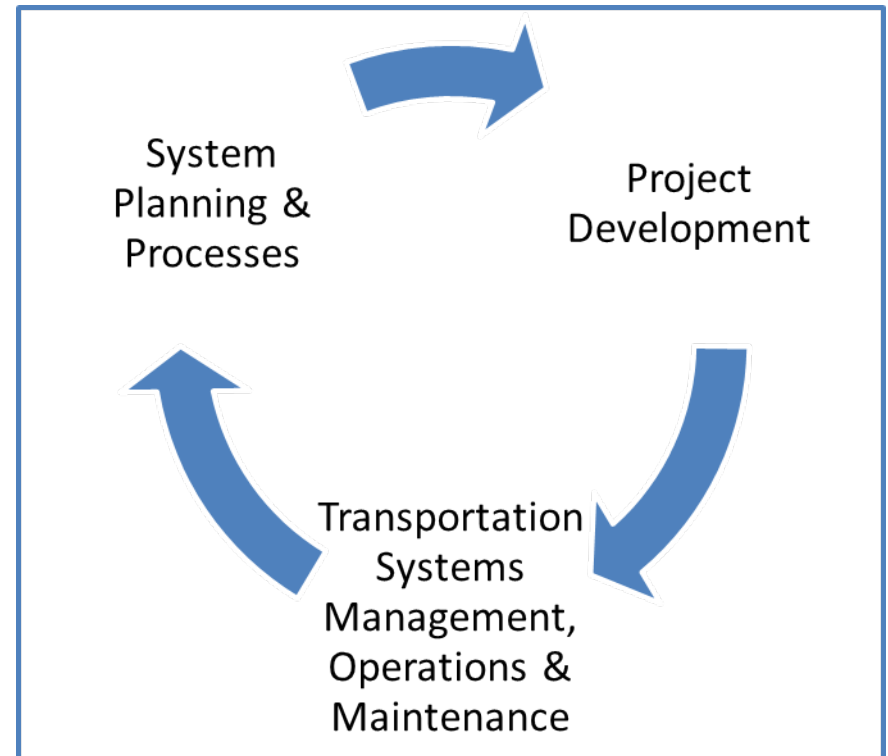
# What is a Sustainable Highway System?

- Satisfies functional requirements
  - Fulfills transportation goals and needs
  - Addresses development and economic growth
- Avoids, minimizes, reduces impacts
  - Environment
  - Consumption of resources
- Addresses environmental, economic, and social equity dimensions (triple bottom line)
- Sustainability addressed throughout the project lifecycle



# Sustainability and the Project Lifecycle

- For sustainability to be fully integrated into highway and transit programs, it must be considered throughout the project lifecycle
- Must address sustainability from planning through operations



# Examples of Sustainable Practices

- **System Planning**
  - Integrated Planning
  - Mitigation banking
  - Fiscal planning
- **Project Development**
  - Cost Benefit Analysis
  - Construction Equipment Emission Reduction
  - Recycling and Reuse of materials
- **Operations and Maintenance**
  - Strong asset management
  - Roadside vegetation management
  - Infrastructure maintenance



# Sustainability and FHWA

- Deliver Federal Aid Highway Program in a more sustainable way
- Make wise investment decisions w/ limited resources
- Take advantage of opportunities to include sustainability throughout the decision making process
- Encourage change in professional practice
- Stress more sustainable practices, get them to be applied/implemented
- Go beyond compliance
- Seek Balanced solutions



# Overview of INVEST

- Voluntary Web-based Tool
- Lists “sustainable criteria” based on best practices for three project phases:
  - Systems Planning (SP)
  - Project Development (PD)
  - Systems Management, Operations and Maintenance (OM)
- Each criterion assigned a points based on expected sustainability impact
- In coordination with ASCE/ACEC/APWA effort



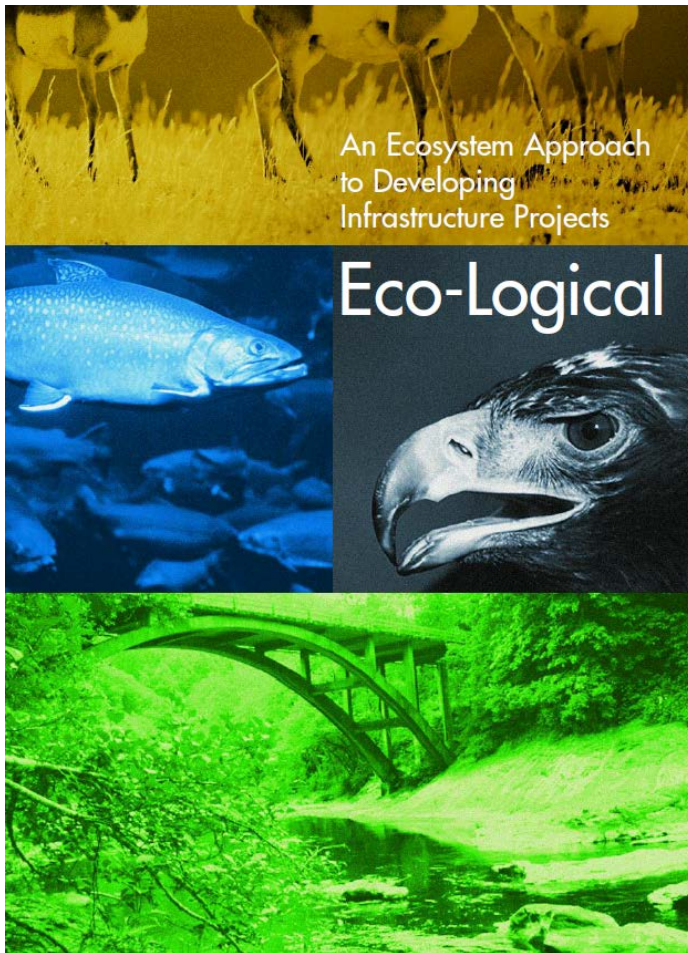


# INVEST Goals

- Encourage sustainable highway practices
  - Internal improvement
  - External recognition
- Help agencies measure sustainability and quantify tradeoffs
- Provide a framework for communicating with stakeholders about sustainability
- Establish a method for evaluating sustainable highway systems, projects, programs



# Support for Eco-Logical Principals



- Encourages integrated planning, PEL approaches
- Promotes engagement of resource and regulatory agencies
- Encourages links b/n planning and project decision making



# System Planning Criteria

SP-1 Integrated Planning: Land Use  
and Economic Development

SP-2 Integrated Planning: Natural  
Environment

SP-3 Integrated Planning:  
Community

SP-4 Accessibility

SP-5 Safety Planning

SP-6 Multimodal Transportation

SP-7 Freight Planning

SP-8 Travel Demand Management

SP-9 Air Quality

SP-10 Energy and Fuels

SP-11 Financial Sustainability

SP-12 Analysis Methods

SP-13 Congestion Management

SP-14 Linking Asset Management and  
Planning

SP-15 Linking Planning and NEPA

SP-16 Infrastructure Resiliency



# SP-2 Integrated Planning: Natural Environment

Goal	Integrate ecological considerations into long range transportation plans (LRTP), corridor plans, and the TIP/STIP process. Proactively support and enhance sustainable ecological function through the coordination of transportation and natural resource planning.
Points	1-10 Points
Requirements	<p><b>3 points.</b> Develop and adopt policies that encourage metropolitan or statewide transportation planning to incorporate ecological considerations into transportation plans and the planning process.</p> <p><b>3 points.</b> Develop institutional mechanisms that engage natural resource and regulatory agencies regularly in creating plans and programs (e.g. technical advisory committees).</p> <p><b>4 points.</b> Assemble data on natural resources and apply system or landscape scale evaluation techniques (e.g. the Eco-Logical Ecosystem Approach/Regional Ecosystem Framework ) to assess ecological conditions and avoid and/or minimize potential impacts of planned transportation projects to the natural environment.</p>



# SP-15 Linking Planning and NEPA

Goal	Incorporate planning documents and decisions from the transportation planning process into the environmental review process.
Points	2 - 10 points
Requirements	<p><b>2 points.</b> The Agency has a program to consult with NEPA practitioners throughout the system-level planning process to ensure the material produced 1) Can be incorporated into subsequent NEPA documents in accordance with FHWA and CEQ regulations; 2) Will aid in establishing or evaluating the purpose and need of the projects, reasonable alternatives, impacts on the built and natural environment, or mitigation measures, and 3) Is in a form that is accessible during the NEPA scoping process and can be appended or referenced in the NEPA document.</p> <p><b>4 points.</b> Agency has documented procedures for linking the system-level planning process with NEPA.</p> <p><b>4 points.</b> Agency successfully incorporates analysis, decisions, and documents from the system-level planning process on specific NEPA projects. The planning studies can produce analyses and decisions for FHWA review and consideration.</p>





[www.sustainablehighways.org](http://www.sustainablehighways.org)

U.S. Department of Transportation  
Federal Highway Administration

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## Welcome!

### Pilot Test Version of INVEST, the FHWA Sustainable Highways Self-Evaluation Tool

This website represents a significant revision of the FHWA Sustainable Highways Self-Evaluation Tool that was released as a Beta Version in the Fall of 2010. Called the "Infrastructure Voluntary Evaluation Sustainability Tool", INVEST is a practical, web-based, collection of best practices that allow states to integrate sustainability into their transportation projects. The use of the tool is voluntary and can be used by states or other project sponsors to measure the sustainability of their projects.

We received many valuable stakeholder comments on the Beta Version, and have made some significant changes to improve the tool and to address many of the comments. A few of the major modifications:


### What do you want to do?

#### Learn

A guided tour through this website to learn about sustainable highways and integrating sustainability best practices into projects, programs, and processes.

#### Browse

A gateway to browse the complete set of criteria that can be used to evaluate



# Next Steps for INVEST

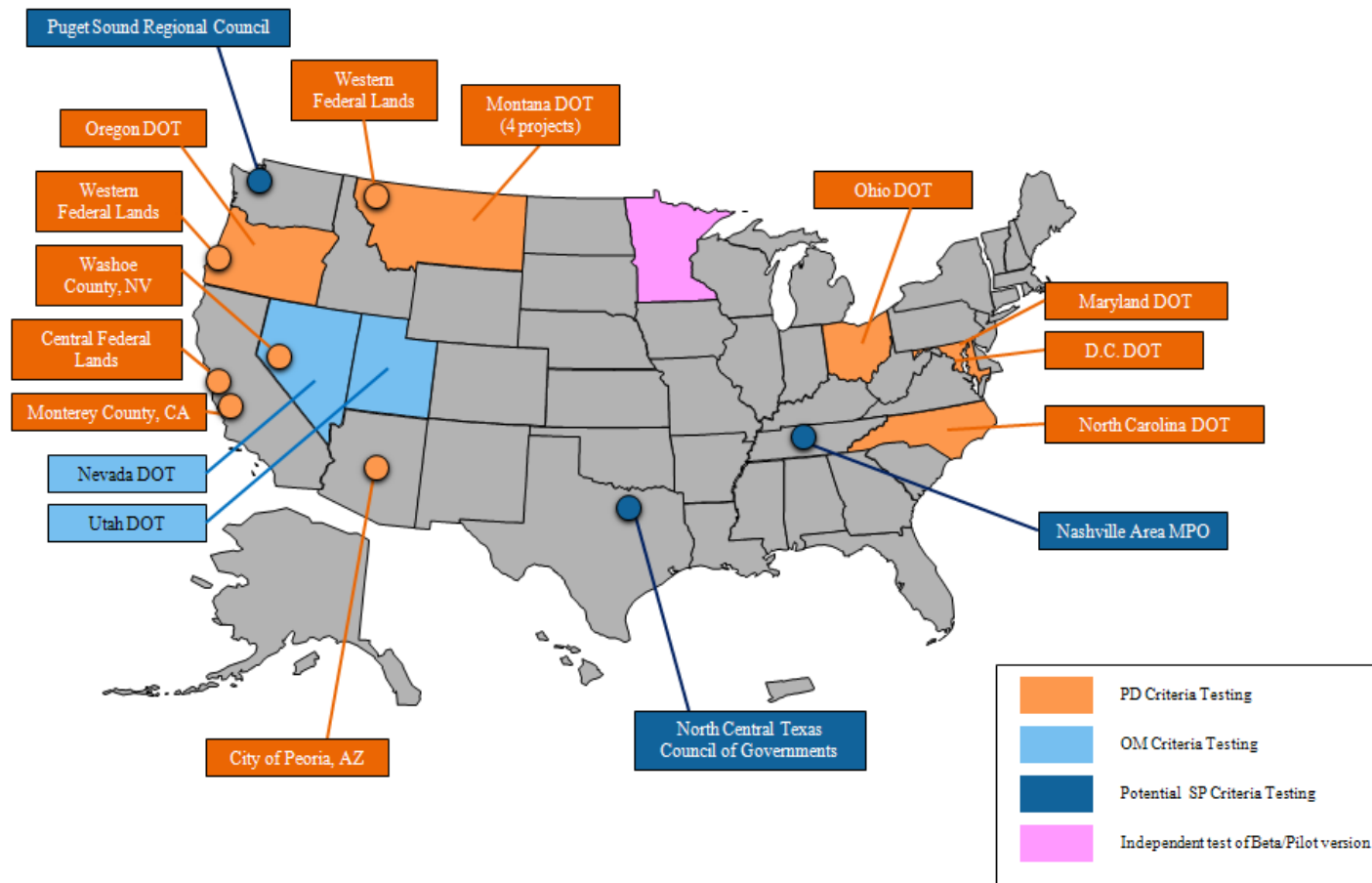
- **Pilot Testing**
  - PD criteria - done
  - OM criteria - complete in January 2012
  - SP criteria - complete in February 2012
- **Weighting & Scoring review - ongoing**
- **Updates to Website - ongoing**
- **Version 1.0 Release - Spring 2012**



# Pilots

## INVEST Pilot Test Locations

Updated: December 13, 2011





[www.sustainablehighways.org](http://www.sustainablehighways.org)



# Thank You!

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