

# Forest Service Research: Customer Expectations

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# Critical Role of Research

- ◆ Good natural resources and environmental stewardship decision making requires good science
- ◆ Research must integrate the ecological, economic and social sciences to advance the science of sustainability
- ◆ Inherent uncertainties and limitations must be made clear to users of the research
- ◆ Researchers must acknowledge the role values play in the research and decision processes

# In a Nut Shell

- ◆ Research should be—
  - Objective and impartial
  - High quality
  - Relevant
  - Timely
  - Balanced
  - Well communicated

# Objective

- ◆ Utilize the scientific method –
  - Properly frame the issues
  - Formulate the question or hypothesis
  - Design proper experiments or surveys
  - Analyze results
  - Draw proper conclusions and inferences
  - Publish in peer reviewed literature
  - Communicate to broad audience

# Objective

- ◆ Beliefs and values of the scientist may influence this process
- ◆ How does the scientist learn about the questions?
- ◆ The formation of questions or testable hypotheses is challenging and can introduce unintended biases

# Objective

- ◆ Illustration of hypothesis formation (asking the right question) –
  - Suppose we wish to support a claim that more than 65% of the LS/OG reserves in western Washington national forests contain northern spotted owls
    - Null hypothesis:  $\rho \leq .65$  (assumed to be true)
    - Alternative hypothesis:  $\rho > .65$  (claim)

# Objective

- The hypothesis with an equality sign is the null and its complement the alternative
- To support a claim it must be defined as the alternative hypothesis
- We assume that the null hypothesis is true
- We always test the null hypothesis and either reject it as false or fail to reject it

# Objective

- Suppose our sample survey data yields a mean percentage of 0.67 based on a sample size of  $n = 35$
- In this case, we fail to reject the null hypothesis
- There is insufficient evidence to support the claim that more than 65% of the LS/OG reserves contain northern spotted owls
- If the null is true (as we believe) a correct decision is made
- If not, an error has been committed and we try to keep this error rate rather low – usually around 5%



# Objective

- As an aside, we note that researchers are concerned with two types of errors –
  - Rejecting a true null hypothesis (akin to sending an innocent person to jail) Type I error
  - Failing to reject a false null hypothesis (akin to letting a guilty person go free) Type II error
- If we try to decrease one type of error the other increases
- To decrease both types of error we need larger sample sizes at increased expense

# Objective

- ◆ Suppose we alter the statement to support a claim that more than 50% of the LS/OG reserves in western Washington national forests contain northern spotted owls
  - Null hypothesis:  $\rho \leq .5$  (assumed to be true)
  - Alternative hypothesis:  $\rho > .5$  (claim)
- Now, we reject the null hypothesis and conclude that the alternate hypothesis is probably true

# Objective

- ◆ Which claim and/or hypothesis is more legitimate?
- ◆ Key is formulate the testable hypothesis prior to collecting the data
- ◆ How does a researcher decide?
- ◆ Other hypotheses are also possible -- to refute a claim we set it up such that the claim is placed in the null hypothesis

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# High Quality

- ◆ Scientists conducting the research are well qualified
- ◆ All research must meet existing scientific protocols
- ◆ Experimental and survey procedures used are well designed and executed
- ◆ Publications peer-reviewed

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# Relevant

- ◆ Focus science on key issues of relevance to society
- ◆ Take an interdisciplinary and integrated view
- ◆ Involve multiple scales from stand to landscape levels to capture synergistic effects of sustainability
- ◆ Social, economic and ecological metrics must be kept in balance in research program

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# Timely

- ◆ Conduct both short-term and long-term studies
- ◆ Involve universities in the latter to maintain data warehouse
- ◆ Establish monitoring activities in conjunction with on-going adaptive management to promote short-term efforts
- ◆ Disseminate information as rapidly as possible

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# Balanced

- ◆ Long-term vs. short-term research
- ◆ Conduct research across the ecological, social and economic disciplines and seek new discoveries at the boundaries

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# Well Communicated

- ◆ Publish in peer reviewed outlets
- ◆ Condense key findings into short and easy to read news letters
- ◆ Place all findings on the web
- ◆ Utilize streaming video and other technologies to expand audience acceptance

# Research and Policy

- ◆ It may not be sufficient to conclude the research process with the communication of results
- ◆ How can we ensure that scientists, resource professional and policy makers are asking the right questions?
- ◆ Convene knowledgeable parties in a neutral forum where open discussions take place prior to initiation of research

# Research and Policy

- ◆ The forum can perform five functions –
  - **Decision Making (1)** Stakeholders and decision makers can discuss complex and often contentious issues in a neutral and science-rich setting
  - **Collaborative Analysis (2)** Scientists and policy staff can collaborate on research and analytical work that supports decision-making

# Research and Policy

- ◆ The forum can perform five functions –
  - **Information Repository (3)** Complex projects need access to multiple databases and other information that often exist at dispersed locations
  - **Educational Observatory (4)** Forum space can have access for classroom interaction and student participation and work



# Research and Policy

- ◆ The forum can perform five functions –
  - **Research Aimed at Long-Term Solutions (5)** The collaborative working partners can introduce existing knowledge into deliberations
- ◆ Possible forum topics include –
  - Wild fire in the West
  - Climate change
  - Water resource issues



Government

- Federal & State Land Managers
- Fisheries Managers
- Urban Growth Planners
- Water Resources Managers

Industry

- Agriculture and Range Operators
- Forest Land Managers
- Oil and Mining Explorers
- Real Estate Interests

NGOs and Other

- Watershed Councils
- Tribal Resource Managers
- Land Conservancy Organizations



# The End

