Integrity of Risk Assessment Science Underlying USDA Policy: Flawed ‘Science’ and Models Used to Restrict Domestic Sheep from National Forests

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Big Win for Payette National Forest Bighorn Sheep

by KEN Cole On MARCH 26, 2014

Assessment of Risk of Physical Contact between Rocky Mountain Bighorn Sheep and Domestic Sheep in the Snow Mesa Sheep Allotment Grazing Landscape

Rio Grande National Forest
Divide Ranger District

2013

Payette NF Risk Analysis of Disease Transmission between Domestic & Bighorn Sheep

Domestic sheep allotment
Science --- science ethos

- Highly disciplined, faithful pursuit of truth, relating to natural phenomena
- Critical, skeptical, but open, non-prejudicial mindset
- Employs non-fallacious, logical reasoning
- Truthful search for, and rendering of, facts

- Science and risk assessment are used as a cornerstone of government policy, employing ‘best available science’. 
Risk assessment

• **Risk**: Probability of an event in given time period
• Integration of diverse and well-researched data
• Systematic framework to estimate risks
• Elements of risk --- what factors predict risk; must make a science-based case

• **Caveat**: Methods can be manipulated to fit desired policy --- ‘tail wagging the dog’
Scientific Guidelines for Risk Assessment---
‘best available’ or ‘state-of-the-art’ science

Motivation:
Stakeholders ‘---seek institutional safeguards --- ‘ against distortion of risk assessments by policy makers (Rodricks, ‘Calculated Risks’, 2007)
Risk assessment elements

Research
Clinical studies
Epidemiology
Pathology
Microbiology
Agent in environment
Rates of contact
Exposure rates

Risk Assessment
Hazard Asmt
Agent*
Effects*
Mechanisms*
Causality*
Dose Response*
Risk change by dose change*
Exposure Asmt
Populations
Doses*
Time period*

Risk Mgmt
Excessive risks?
Control options?
Optimal solutions?
Risk assessment: National Academies

- Hazards assessment: Critical phase
  - Adherence to rigorous science
  - Convincing data on mechanisms, dose-response, exposure risk, causality

- “Well conducted epidemiologic studies that show a positive association between the agent and the disease are accepted as the most convincing evidence about ---disease”

- Without extensive and necessary data, risk assessment ’--- must be forsaken.’ (Rodricks)
Risk assessment models---in general

- All models are wrong --- some are less wrong
- Models do not create or ‘prove’ fact and should not be interpreted as fact or new information
- Offer possible insights, especially complex phenomena
- Some general types:
  - Conceptual
  - Statistical
  - Mathematical
- Require solid foundation in fact and logic; mathematical/statistical theory
- However, easy to ‘jigger’ assumptions to produce models that support policy
Question
What causes pneumonia in bighorn sheep? What is the ‘causal’ role of a specific bacteria in pneumonia or, say, of contact with domestic sheep?

Conceptual Model (pneumonia experts)
Pneumonia = weather + stress + parasites+ bacteria + viruses + age + nutrition + domestic sheep contact + etc.
Epidemiologic model of pneumonia complex: Model for bighorn sheep (hypothetical)

Statistical Epi Hypothesis Model

\[
\text{Prob (pneu)}_t = Y + X_1 \text{Temp}_t + X_2 \text{Cumsnow}_t + X_3 \text{Stress}_t + X_4 \text{Worm}_t + X_5 \text{Virus}_t + X_6 \text{Bacteria}_t + X_7 \text{Age}_t + X_8 \text{Kcal}_t + X_9 \text{Domsheep}_t + \text{error}.
\]

Such studies have not been reported for pneumonia in bighorn sheep; thus, critical and necessary epidemiological evidence does not exist for domestic sheep as a cause of pneumonia in bighorn sheep. (National Academies *sine a qua non* requirement.)
Prediction models

• What is the probability of some specified event taking place during some time period?
• Requires well-established causality if an infectious disease is the event
• Conceptual model development
• Biological model → Mathematical model
• Probability $= 0$ → $1$ (0 to 100%)
Predict probability of agent transmission after entering a room of people: conceptual model
Infectious disease transition state model: ‘available science’ transmission model

Susceptible

Exposure-contact-transmission

Infected

Latent

Clinical

Shedding

Recover

Immune

Carrier or Non-carrier

Death

Time
Event-states for agent transmission: what has to take place

• The person must be susceptible (not infected)
• Must contact another individual
• That individual must be infected and
• Must be shedding the agent and
• Must be shedding a dose that is infectious for the susceptible individual
Assumed probability values (hypothetical) acquired from research

- Must be susceptible: \( \text{Prob(Susc)} = 0.9 \)
- Contact with another person: \( \text{Prob(Cont)} = 0.2 \)
- Contacted person must be infected: \( \text{Prob(Inf)} = 0.1 \)
- If infected, must shed: \( \text{Prob(Shed if inf)} = 0.5 \)
- If shed, must be infectious dose: \( \text{Prob(Dose if shed-if inf)} = 0.5 \)
Probability (prediction) model for transmission

\[ \text{Prob}(\text{Trans}_t) = \text{Prob}(	ext{Susc}) \times \text{Prob}(	ext{Con}) \times \text{Prob}(	ext{Inf}) \times \text{Prob}(	ext{Shed if inf}) \times \text{Prob}(	ext{Dose if inf and if shed}) \]

\[ \text{Prob}(\text{Trans}) = 0.9 \times 0.2 \times 0.1 \times 0.5 \times 0.5 = 0.0045 \]

Or 1 in 222
How to distort models:
Payette Risk Assessment

Prob(Trans) = Prob(Susc) x Prob(Con) x Prob(Inf) x Prob(Shed if inf) x Prob(Dose if inf and shed)

= 0.9 x 0.2 x 0.1 x 0.5 x 0.5  = 0.009

or

Prob(Trans) = 0.9 x 0.2 x 0.1 x 0.5 x 0.5  = 0.2

or

Prob(Trans) = 0.25 or 1.0 (25% or 100%)*

*Payette and Snow Mesa Risk Assessments
• A process to estimate accuracy (e.g. diagnostic test accuracy); validation does not mean ‘valid’
• Compare predicted with what is actually observed
• Identify anomalous, nonsensical models
• Never achieve 100% agreement
• How much agreement is enough? 80%, 60%, 40%? – Who gets to decide?
Legal Guidelines for Scientific Evidence

- Use validated models
- Publication does not mean ‘valid’
Domestic sheep allotment (Payette)

Prob(Trans) = 1.0 (100%)
Domestic Sheep Allotment (Payette)

Prob(Trans) = 1.0 (100%)
Fraudulent claims of causality

“---extirpation [of bighorn sheep] due to respiratory diseases, which can be transmitted by domestic sheep or goats (Besser et al. 2012b, Cassirer et al. 2013), ---“. USDA/FS Snow Mesa EA 2013

Deceptive trick to believe pneumonia is ‘transmitted’ from domestic sheep. Presenting false testimony; scientific perjury.

— Diseases are not transmitted; disease agents are
— Neither paper supports the statement
  • Neither study examined any transmission data
  • Neither study examined any domestic sheep

Obfuscation of the truth
Fallacious thinking in concluding causality

• Fallacies

Post hoc ergo propter hoc: I observe a bike rider who later developed cancer; thus, bike riding caused his cancer

Correlation-equals-causation: Post WWII export of iron ingots was correlated 99% with US birth rate; thus, export of iron ingots caused the births

• Incorporation of fallacious thinking fosters deceptive and illogical conclusions
Fallacious thinking in concluding causality: Payette and Snow Mesa RAs

Post hoc ergo propter hoc: I observe a domestic sheep near a bighorn sheep, which later experienced pneumonia; thus, domestic sheep transmit pneumonia to bighorn sheep.

Correlation-equals-causation: Weeks of co-mingling bighorn sheep and domestic sheep in highly confined, stressful conditions was correlated with an observation of pneumonia in bighorn sheep; thus, on the range, domestic sheep transmit pneumonia to bighorn sheep.
Pillars of risk assessment: How did FS’s ‘best available’ science fare?

- No epidemiologic studies of bighorn sheep disease
- No hazard assessment
- No exposure assessment for domestic sheep
- No epi studies for etiologic agents *Mannheimia haemolytica* or *Mycoplasm ovipneumoniae*
- No dose-response assessment
- No validation of models
Flawed models, risk assessments--- policy?

- FMD spread model: UK 2001 FMD epidemic--- ‘the Emperor’s new clothes’. >6 million head killed
- FMD risk assessment: NBAF (DHS/USDA) ‘ --- flawed methods and assumptions ---’ (NAS)
- CDC Ebola model: 1.4 million deaths by Jan 2014
- Brazil and Argentina beef import into US: FMD
- Biosecurity policy to control next FMD epidemic in the US based on:
  - Vaccination models
  - Spread models
  - Model for detection of FMDv in bulk milk
USDA Risk Assessment for Importation of Argentine Beef: Biosecurity deception?

- FMD Vaccination - Low Beef Price
- FMD ‘Free’ - High Beef Price

Price gradient encourages movement of animal/product to FMD-free zone.
Feb 6: 1300 kg seized.
March 24: 150 kg seized.
What constitutes ‘best available science’?

- What if ‘best available science’ is inadequate, or wrong?
- What is the expectation for ‘state-of-the-art science’?
- What does ‘available’ mean? Available to USDA?
- What quality of science is acceptable to animal industries?
Strategies to mitigate risk of bad science: Outside-independent reviews

- Require outside, independent review of USDA, DHS proposals impacting policy/decision
- Outside, independent review and approval of completed studies impacting policy or decisions
- Resolutions to USDA, DHS, etc
- Congressional action: law supporting science integrity
Thank you

Comments?

Questions?

“Nature will tell you a direct lie if she can.”  Darwin