

Skill Check Week 6: Decisions under uncertainty part 1

Course: NAT_R 8001 Decision Analysis for Research and Management of Natural Resources

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Instructions:

You are a wildlife manager in a refuge who is designing a prescribed burn management plan for a grassland bird. You will complete the following skills check exercises to help inform your burn decision. **Tasks were developed by Sarah Converse and Brielle Thompson*

Task 1: Identify uncertainty type

For the three following uncertainties:

- 1) Identify the type of uncertainty, and 2) Suggest a way that it could be resolved

Uncertainty #1: What is the correct hypothesis regarding how grassland bird nest success varies with extent of prescribed burn within territories?

$$H1: \text{logit}(S_t) = \beta_0 + \beta_1 * \text{burn}_{ex_t}$$

$$H2: \text{logit}(S_t) = \beta_0 + \beta_1 * \text{burn}_{ex_t} + \beta_2 * \text{burn}_{ex_t}^2$$

Uncertainty #2: Expert A believes that a heavy burn would be the best alternative, and Expert B believes a moderate burn would be the best choice

Uncertainty #3: In a nest count survey there is variation in the number of eggs found in a nest

Task 2: Calculate EVPI to determine whether we should undertake research to determine which hypothesis is true?

Hypothesis	Belief	Predicted Survival under Alternative and Hypothesis	
		Alternative 1 (A1) Heavy Burn	Alternative 2 (A2) Moderate Burn
H1	0.4	0.7	0.3
H2	0.6	0.45	0.65

Steps to take:

1. Calculate EV for each alternative

$$EV(A1) = Pr(H1)*V(A1|H1)+Pr(H2)*V(A1|H2) = 0.4*0.7 + 0.6*0.45 = 0.55$$

$$EV(A2) = Pr(H1)*V(A2|H1)+Pr(H2)*V(A2|H2) = ? \text{ [You will answer!]}$$

2. Calculate $EV(\text{Uncertainty}) = ?$ [You will answer!]

Hint the maximum between $EV(A1)$ and $EV(A2)$

3. Calculate $EV(\text{Certainty}) = Pr(H1)*\max_A V(A|H1)+Pr(H2)*\max_A V(A|H2) = ?$ [You will answer!]

4. Calculate $EVPI = EV(\text{Certainty}) - EV(\text{Uncertainty}) = ?$ [You will answer!]

- What is the EVPI?

Task 3: Adaptive Management

There is still extreme uncertainty on whether hypothesis 1 or 2 is correct regarding how grassland bird nest success varies with extent of prescribed burn within territories

$$H1: \text{logit}(S_t) = \beta_0 + \beta_1 * \text{burn}_{ex_t}$$

$$H2: \text{logit}(S_t) = \beta_0 + \beta_1 * \text{burn}_{ex_t} + \beta_2 * \text{burn}_{ex_t}^2$$

For the next 4 years, your team has four plots of land that you will experiment with doing alternative 1: a heavy burn, alternative 2: a moderate burn, alternative 3: a light burn, and alternative 4: no burns

Your task:

Explain how an adaptive management program might be performed to resolve uncertainty in our two hypotheses?