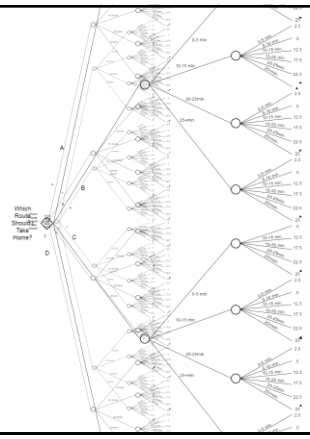
WFA8433-Natural Resource & Conservation Decision Making

Class 6. Types of decision making philosophies in natural resources; Structuring and quantifying objectives; Decision making and working with stakeholders

Housekeeping

- Suggested readings:
  - Conroy & Peterson Chapter(s): 1-3
- Assignment(s): Structuring Objectives – more to follow
- Group work: if time allows
  - Identifying project/problem

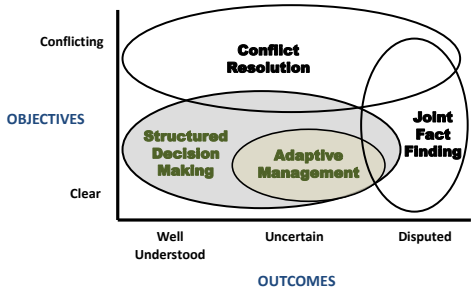
80 Paths!



Challenge for you

- Can you think of an efficient way to get probabilities for ALL 80 paths?

What About Adaptive Management?



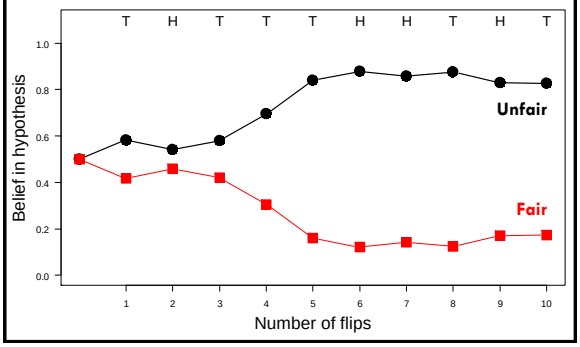
We can use each flip to learn… Learning by doing!

Hypotheses

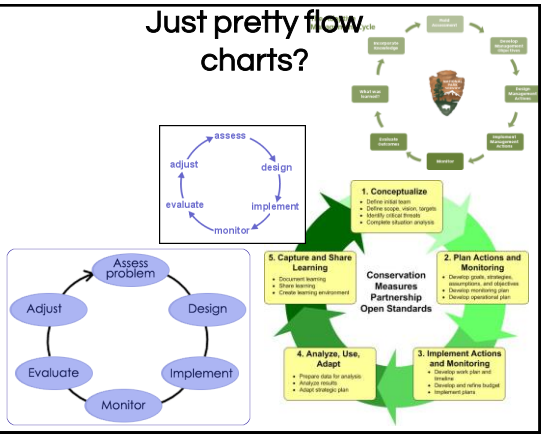
1. Fair: probability of head = 50%
2. Unfair: probability of heads = 30%

***Each** flip provides additional information to learn from.*

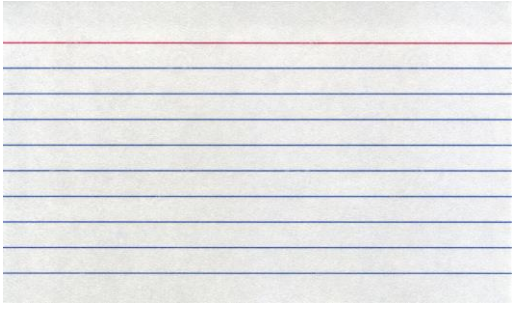
Strong support for an unfair coin!



Just pretty flow charts?



How Does Adaptive Resource Management Work?



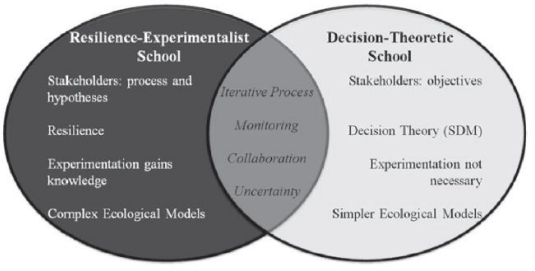


Figure 1. A comparison of the two dominant adaptive management schools of thought: the Resilience-Experimentalist Adaptive Management School and the Decision-Theoretic Adaptive Management School.

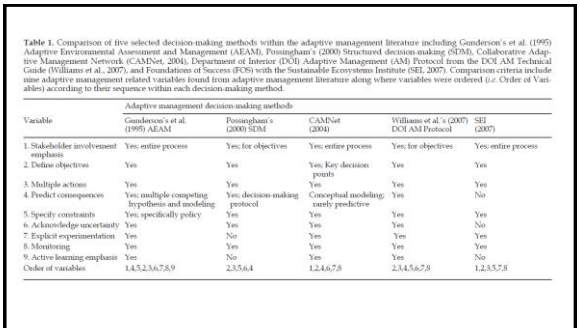


Table 1. Comparison of five selected decision-making methods within the adaptive management literature including Gunderson's et al. (1995) Adaptive Environmental Assessment and Management (AEAM), Possingham's (2000) Structured decision-making (SDM), Collaborative Adaptive Management Network (CAMNet, 2004), Department of Interior (DOI) Adaptive Management (AM) Protocol from the DOI AM Technical Guide (Williams et al., 2007), and Foundations of Success (FOS) with the Sustainable Ecosystems Institute (SEI, 2007). Comparison criteria include nine adaptive management related variables found from adaptive management literature along where variables were ordered (i.e. Order of Variables) according to their sequence within each decision-making method.

	Adaptive management decision-making methods				
Variable	Gunderson's et al. (1995) AEAM	Possingham's (2000) SDM	CAMNet (2004)	Williams et al.'s (2007) DOI AM Protocol	SEI (2007)
1. Stakeholder involvement emphasis	Yes; entire process	Yes; for objectives	Yes; entire process	Yes; for objectives	Yes; entire process
2. Define objectives	Yes	Yes	Yes; Key decision points	Yes	Yes
3. Multiple actions	Yes	Yes	Yes	Yes	Yes
4. Predict consequences	Yes; multiple competing hypothesis and modeling	Yes; decision-making protocol	Conceptual modeling; rarely predictive	Yes	No
5. Specify constraints	Yes; specifically policy	Yes	Yes	Yes	Yes
6. Acknowledge uncertainty	Yes	Yes	Yes	Yes	No
7. Explicit experimentation	Yes	No	Yes	Yes	Yes
8. Monitoring	Yes	Yes	Yes	Yes	Yes
9. Active learning emphasis	Yes	No	Yes	Yes	No
Order of variables	1,4,5,2,3,6,7,8,9	2,3,5,6,4	1,2,4,6,7,8	2,3,4,5,6,7,8	1,2,3,5,7,8

Decision have to be made

Decision have to made regardless of certainty and information

- 2 dominant philosophies of ARM
  - Decision theoretic -
  - Resilience-experimentalist ARM
- * Learning about system resilience - cap
- * Emphasis on shared understanding among stakeholders during the entire process

Resilience-experimentalist ARM

- Learning about system resilience – capacity of system to return to a state
- Emphasis on shared understanding among stakeholders during the entire process

My perception(s): Resilience-experimentalist

- Longer to implement, front loading on learning by experimentation
  - Complicated models
  - Subject to partial controllability issues, what if experiment fails?
  - Can you completely control river flows?
  - Can you completely control burn intensity?
- Examples
  - Glen Canyon management
  - Florida Everglades
- Integrate learning into decision?

My perception(s): Decision Theoretic

- Quickerprocess-if problems, objectives, and alternatives are clear and STAKEHOLDER buy in
- More efficient - emphasis on decision, objectives, and simple models
- Helpful to have a 'champion'
- Examples
  - Black duck management
  - Lemhi Bull Trout
  - Red Knots and Horseshoe Crabs

Why are ARM Philosophies Important?

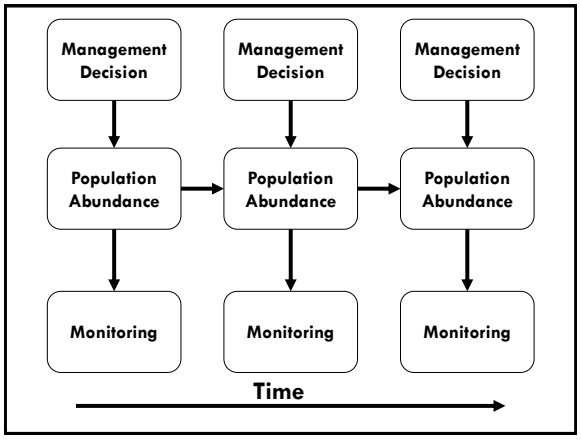
- Conflict views in how ARM should proceed
- Which one is right? … it depends…
- Conflicting guidance from Science Advisory Panels

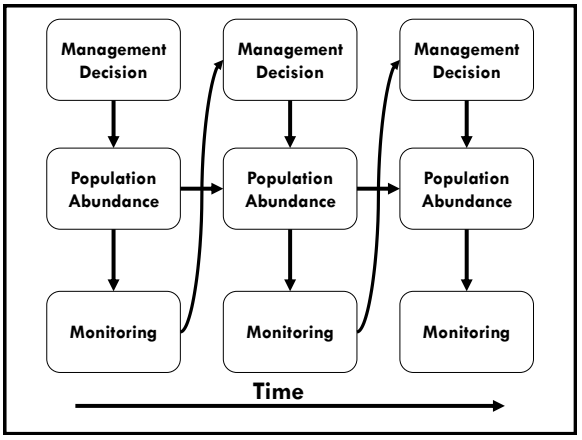
ARM - Uncertainty

- Deals with structural uncertainty
- LOTS of uncertainty in how to <u>actually do it…</u>
- Can it be a formal process?

ARM

"~~Big data~~ is like teenage sex: everyone talks about it, nobody really knows how to do it, everyone thinks everyone else is doing it, so everyone claims they are doing it…" (Dan Ariely, Duke University)


Management Decision
Management Decision
Management Decision
Population Abundance
Population Abundance
Population Abundance
Monitoring
Monitoring
Monitoring
Time


Management Decision
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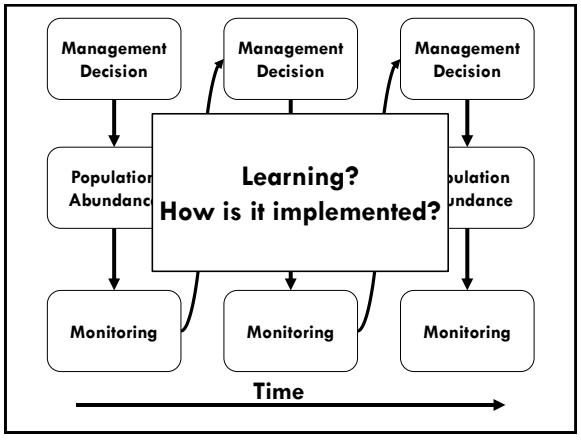
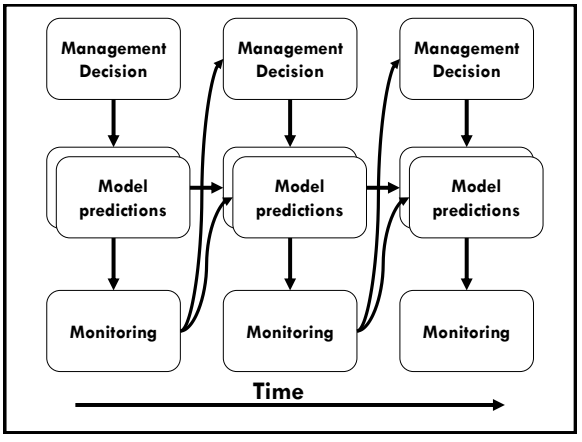
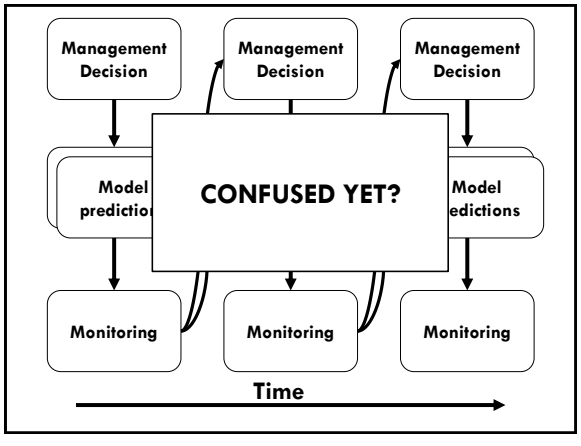
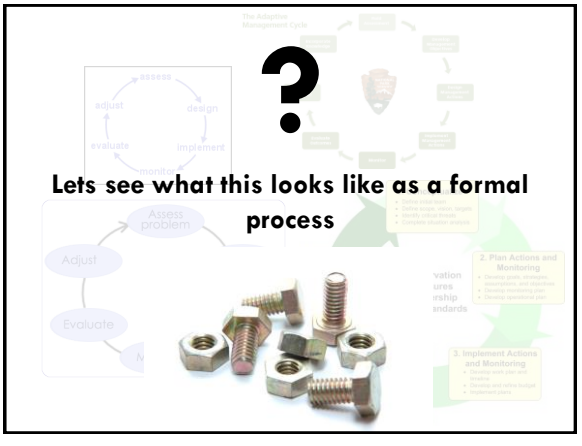
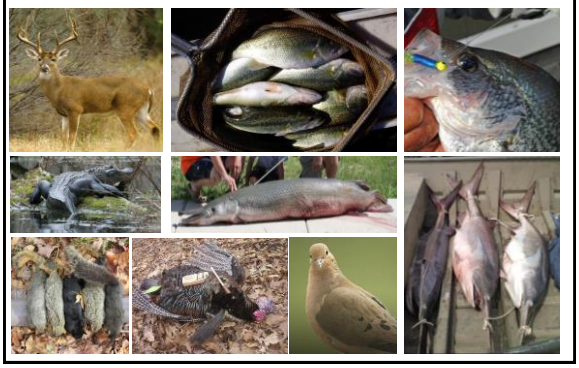

Management Decision
Management Decision
Management Decision
Learning?
How is it implemented?
Monitoring
Monitoring
Monitoring
Time


Management Decision
Management Decision
Management Decision
Model predictions
Model predictions
Model predictions
Monitoring
Monitoring
Monitoring
Time


Management Decision
Management Decision
Management Decision
CONFUSED YET?
Monitoring
Monitoring
Monitoring
Time


?
Lets see what this looks like as a formal process

Adaptive harvest management



A population of harvestable critters

500 to 2000 critters

Some preliminaries

- Harvest rate decisions
  0.1, 0.2, 0.3, & 0.4

Sustainable… evaluate over an **"infinite" time horizon

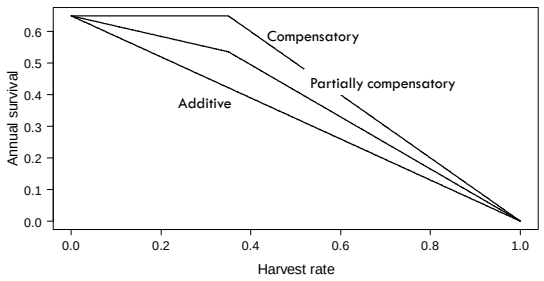
Abundance	Optimal** harvest rate
500-750	?
750-1000	?
1000-1250	?
1250-1500	?
1500-1750	?
1750-2000	?

Structural uncertainty

Where learning occurs

- *Effect of harvest: Additive, Compensatory, Partially compensatory*
- *Important as you can't harvest populations with additive mortality as hard as compensatory ones!*

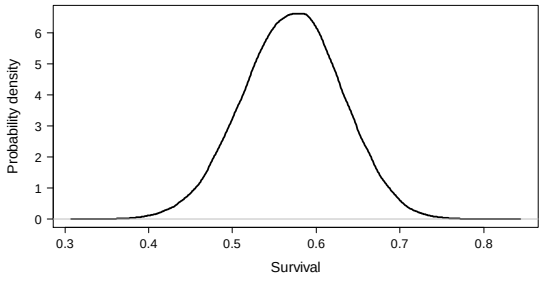
Learning: 3 hypotheses of the effect of harvest on a population



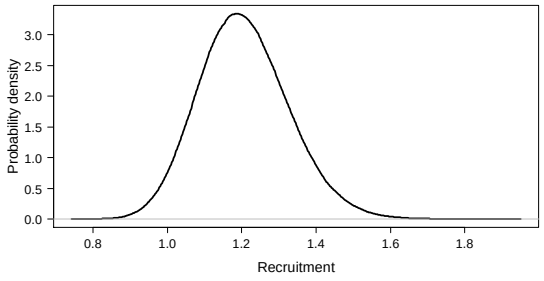
Parameter uncertainty

- *Survival*
- *Recruitment*
- *Current population abundance*

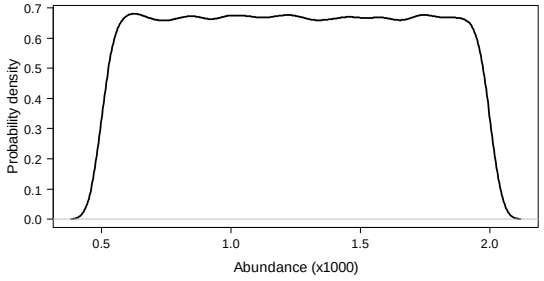
Survival uncertainty



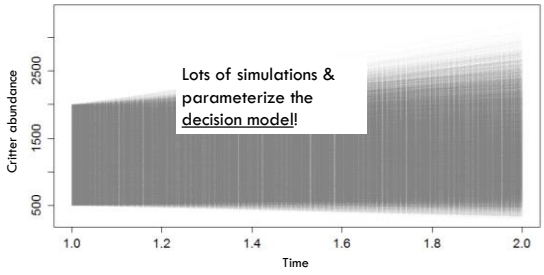
Recruitment uncertainty



Current population abundance



Optimal harvest policies given uncertainty



Optimal harvest policies

Abundance	Optimal harvest rate
500-750	0.1
750-1000	0.1
1000-1250	**0.1**
1250-1500	0.3
1500-1750	0.3
1750-2000	0.3

Optimal sustainable harvest rates given uncertainty from decision model

Implement decision, monitor, and compare

Monitoring data

Critter abundance	120 0

Additive	0.33
P. Compensatory	0.33
Compensatory	0.33

Prior beliefs

Now implement harvest decision

Implement decision, monitor, and compare

Monitoring data

Critter abundance	1200	1000	
Additive	0.33	933	0.01
P. Compensatory	0.33	988	0.76
Compensatory	0.33	1037	0.23

Learning

Model predictions

Update optimal harvest policies given our learning

Abundance	Optimal harvest rate
500-750	0.1
750-1000	**0.1**
1000-1250	*0.2*
1250-1500	0.3
1500-1750	0.3
1750-2000	0.3

Can harvest more since there is evidence for partial compensation

Implement decision, monitor, and compare

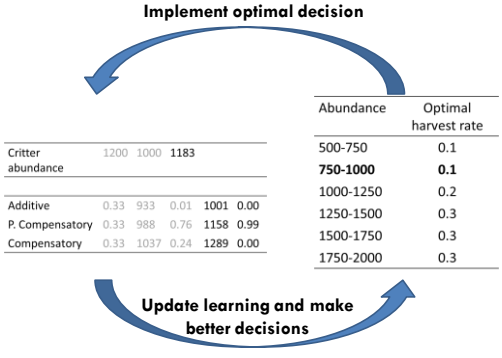
Critter abundance	1200	1000	1183		
Additive	0.33	933	0.01	1001	0.00
P. Compensatory	0.33	988	0.76	1158	0.99
Compensatory	0.33	1037	0.24	1289	0.00

Update optimal harvest policies given our learning

Abundance	Optimal harvest rate
500-750	0.1
750-1000	*0.2*
1000-1250	***0.2***
1250-1500	0.3
1500-1750	0.3
1750-2000	*0.4*

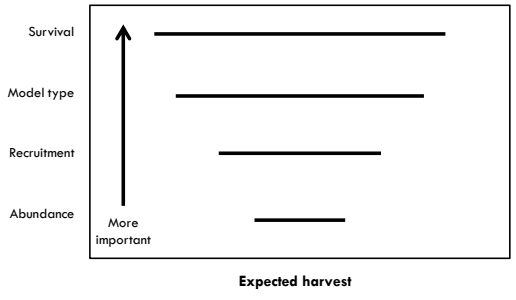
Can harvest more since there is evidence for partial compensation

Implement optimal decision



There we go, we are learning by doing!

Integrating research and monitoring: Sensitivity



The ARM Provides A Process To

- Use management actions to learn
- Integrate monitoring data
- Inform research needs
- Improve decisions
- Include public participation & values

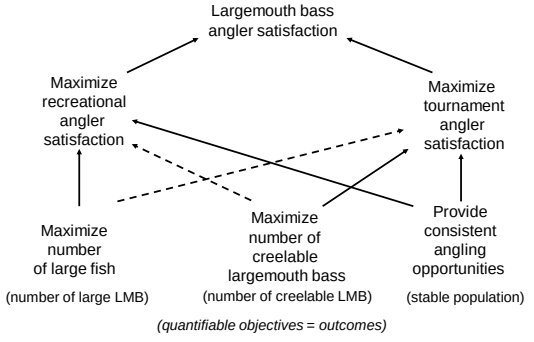
In the context of your decisions!

NATURAL RESOURCE DECISION MAKING DEPENDS ON OBJECTIVES

For both SDM and ARM

Need to structure them…

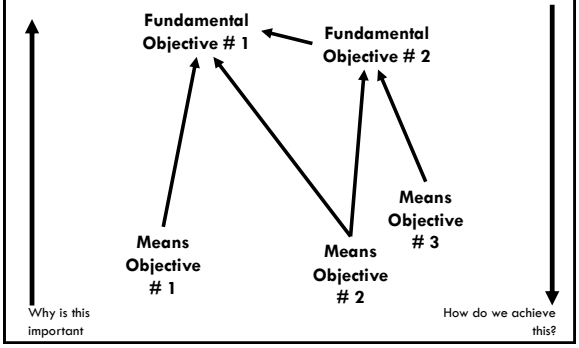
Structuring Values and Objectives



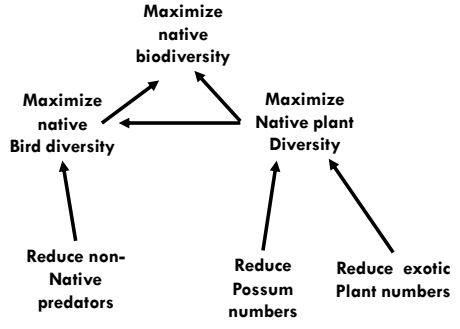
Easy… I know my objectives

- Rarely the case
- 2 types
  - Fundamental: DM truly values and wants
  - Mean: means to achieving fundament objectives
- Need to istinguish between the 2
- Clarity and specificity is KEY
- Rejection of objectives due to perceived conflict,
  - Could be treated as tradeoffs if articulated
- Tunnel vision of DMs restrict objectives to ones the perceive to be achievable or feasible – limits creativity

Identifying Fundamental & Means Objectives



A realistic example



Are the Objectives Clear?

1. Maximize native biodiversity
2. Maximize native plant diversity
3. Maximize native bird diversity
4. Reduce non-native predators
5. Reduce possum numbers
6. Reduce exotic plant numbers

Linguistic Uncertainty

Maximize native bird diversity?

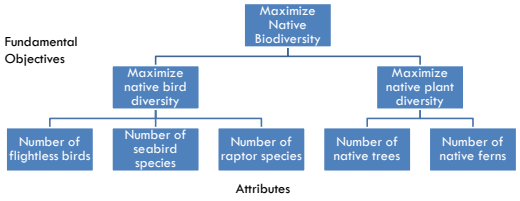
- Abundance? Richness?

How do you define that?

How about:

- Number of flightless bird species
- Number of seabird species
- Number of raptor species

Fundamental Objectives Hierarchy



Fundamental objectives types

1. Competing-objective can be satisfied but not enough resources
2. Conflicting-direct conflict, satisfying one objective has a detrimental effect on another
3. Hidden-Important but unspecified, if all objectives are satisfied will the problem be solved? No, then there are hidden objectives
4. Stranded-No connection to means objectives, therefore you cannot fulfill objectives

FERAL CATS

Trigger

Home » Animal diseases » Starkville feral cat is first rabies case in Mississippi since the 60s

Starkville feral cat is first rabies case in Mississippi since the 60s

by STAFF

August 20, 2015 | Animal diseases | 1 Comment | 19 views

Mississippi health officials are reporting the first case of rabies in a land animal in the state in 54 years. The case was identified in a feral cat in Starkville described as a small, black and white kitten.

Exposures to the rabid cat were reported in downtown Starkville and in a remote area in the general vicinity of developed portions of the Thad Cochran Research Park near the campus of Mississippi State University (MSU).

Testing of the cat's brain tissue at the Mississippi Public Health Laboratory confirmed that the cat was infected with rabies. Rabies is commonly found in bats in Mississippi and has been found in feral and wild animals in bordering states in previous years.

Health officials urge anyone who may have been bitten or scratched by a

Problem

Detection of rabid feral cats in Starkville has alarmed residents. Citizens have petitioned the city mayor to eradicate cat populations in light of recent rabies detections and perceived negative impacts of feral cats on native birds. In response cat lovers and animal cruelty groups have petitioned the mayor to prevent any eradication programs.

```
##        first       last                                  group
## 1   Carolina    Baruzzi N-G conservation organizations (eg TNC)
## 2     Terrel   Christie          Local animal control authority
## 3    Stephen   Clements          Local animal control authority
## 4  Giancarlo    Coppola  Animal welfare organizations (eg PETA)
## 5     Daniel      Firth  Animal welfare organizations (eg PETA)
## 6    Mariela  Gantchoff Concerned members of the general public
## 7    Chelsea  Gilliland  Animal welfare organizations (eg PETA)
## 8      Emmet        Guy Concerned members of the general public
## 9     Bryant      Haley  Animal welfare organizations (eg PETA)
## 10    Hunter    Hatcher Concerned members of the general public
## 11   Matthew       Ivey  Animal welfare organizations (eg PETA)
## 12  Johannah   Mccollum Concerned members of the general public
## 13      Leah      Moran          Local animal control authority
## 14    Marian     Morris N-G conservation organizations (eg TNC)
## 15     Ciera     Rhodes          Local animal control authority
## 16   Michael     Rhodes  Representatives from local governments
## 17   Bradley Richardson N-G conservation organizations (eg TNC)
## 18    Andrew  Shamaskin Concerned members of the general public
## 19    Andrew      Smith Concerned members of the general public
## 20   Shannon   Westlake          Local animal control authority
## 21   Treyvon    Strange          Local animal control authority
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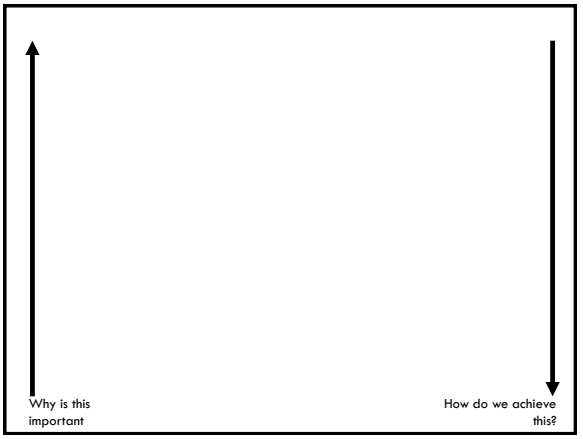

Homework-01

- Due by next Friday by 5 pm
- Please submit as a PDF you can use whatever you would like to create the figure (e.g., word, powerpoint). Create a means objectives network (maximum 25 objectives please) of your personal career aspirations. Identify your fundamental objectives and be sure to include two or more means objectives for each fundamental objective. DO NOT FORGET to use the key phrases.