

Panther Recovery Implementation Team-Recovery Criteria Sub-Team Meeting

Workshop Notes

May 3-4, 2016

FWC FWRI-St Petersburg

Welcome & Opening Remarks

- Kipp: this sub-team is based on the technical side
- Frame of Reference
 - o Kipp: PRIT determined that it was necessary to look at the Panther Recovery Plan as a priority at its first meeting in Big Cypress – a number of topics grew out of this meeting with one item being the review of the existing recovery criteria – some question about their utility and whether they should/shouldn't be revised. Originally: this sub-team was formed to review the criteria, this wasn't one agency or one perspective or one person's idea – it was a group idea to perform the review.
 - o David: the sub-team members will be providing recommendations to the PRIT, the Service will then determine where to go with the recommendations, this is a major revision/rewrite of the recovery plan, many view this as a relatively young plan and question why it is being revised now. Therefore, people will be looking closely at this process.
 - o Questions
 - Mike – what was the motivation to form the sub-team? 30+ team member effort to develop the recovery plan and some of the team members saw a need to increase helpfulness of the criteria (address concerns to measure success). Not a conclusive decision to change the criteria, so the PRIT put together a sub-team to look at it.
 - Randy: Consensus of PRIT is that the criteria are inaccurate? Yes, but looking to this team for recommendations. Address M, A, and R in the SMART.
 - Mike: SMART – should all each component of “SMART” be addressed? Does ESA require having Achievable criteria? **Parking Lot Item**
- Thoughts from Team Leaders & Members
 - o Keep it simple
 - o Don't wait for another 3 years to act on something
 - o There is room for improvement in the criteria
- Icebreaker: Magic wand and 3 things you would change about your professional working conditions

Problem Statement Formation– Focus for current Panther Recovery review/effort

- List of deficiencies/issues to address/consider
 - o Minimum viable population size is only one predictor of persistence probability and not a very good one, criteria hinge on this
 - o It is difficult to obtain statistically robust estimates of population size
 - o Sufficient habitat for 240 – “sufficient” is not measurable, potentially not achievable, not well defined (criteria #2)
 - o Not specifically adaptable: uncertainty, how to craft criteria that are specific given current knowledge, but recognize that new knowledge be incorporated
 - o Plan doesn't distinguish where to have population “management units” clearly (meta-population, sub-population, individuals north of the river discussion)

- Meta-populations & geography captured incorrectly (i.e., barrier) – recovery plan constructed a meta-population of south Florida including some area north of the river but the river is seldom crossed, core interbreeding panthers of the south Florida population is south of the river
 - South central Florida component
 - Area south of the river was insufficient to support the 240 –this is the main reason why this meta-population was set AND likelihood of crossing the river was low at the time
 - How did the team think of meta-populations during Recovery Plan development? Believed south central FL (south of I-4) would have panthers eventually, population pressure would push individuals across the river and establish populations northward and across south central Florida (at least). This would be a slow process that could be enhanced by management efforts.
 - Two populations of 240: south of the river would be the core and north of the river would be the same. The second population would be elsewhere (i.e., another state). Sub-populations in south Florida comprise the meta-population.
 - Separate populations, redundancy and resiliency – how does this play into the criteria?
 - Where is the stochasticity?
 - Redundancy: PVA models that established the 2 models based on unrealistic assumptions, especially habitat loss
 - Flexibility of the criteria (related to the above) – are there many ways to achieve success or only one? Any configuration could achieve the overarching criteria.
 - Word of caution regarding flexibility in criteria (Seth)
 - Inadequacy of threats-based criteria
 - Uncertainty in models – how is this handled?
 - Involvement of other states – low participation or flat out rejection
 - Recovery Plan doesn't refer to recovery in other states. What happens outside of Florida? (Address this in criteria or in the discussion?)
- List of Strengths
 - 95% probability of persistence over 100 years is a strong link to statute and a good guiding principle for other criteria
 - Redundancy is also considered a strength – where to draw the line is under discussion
 - Habitat component included in criteria
 - Refinement of criteria as opposed to massive alterations? (Brief discussion, something to keep in mind)

PRIT Recovery Criteria Sub-Team Problem Statement

Current panther recovery criteria are strong in probability of persistence and provide for redundancy in population structure; however, several key factors should be addressed in either refinement of existing or creation of new criteria. These are:

- Population size is difficult to estimate effectively.
- Demographic criteria are incomplete (need more than one, identify most important).
- Geographically pertinent population units need reassessment; Spatial structure of the populations needs to be defined.
- Resiliency, redundancy and representation need to be more clearly considered.
- Alternative pathways to recovery need to be considered.
- Threats-based criteria are inadequate (includes habitat).
- Recovery criteria need to acknowledge uncertainty and be responsive to new information (be adaptive).
- Landscape for recovery (political, actual panther population range, consideration of historical range).

Desired Future Conditions

Proposed draft Desired Future Condition (DFC) presented to the team for discussion: *To achieve long-term viability of the Florida panther to a point where it can be reclassified from endangered to threatened, and then removed from the Federal List of endangered and threatened species.*

- Sub-Team Discussion regarding above proposed draft DFC:
 - o DFC about the criteria rather than the panther
 - o Remove “then”
 - o This sounds like the Recovery Goal of the plan rather than this sub-team. Correct.
 - o These criteria need to achieve the Recovery Goal
- Team decided to write a new DFC, **see bolded text below.**

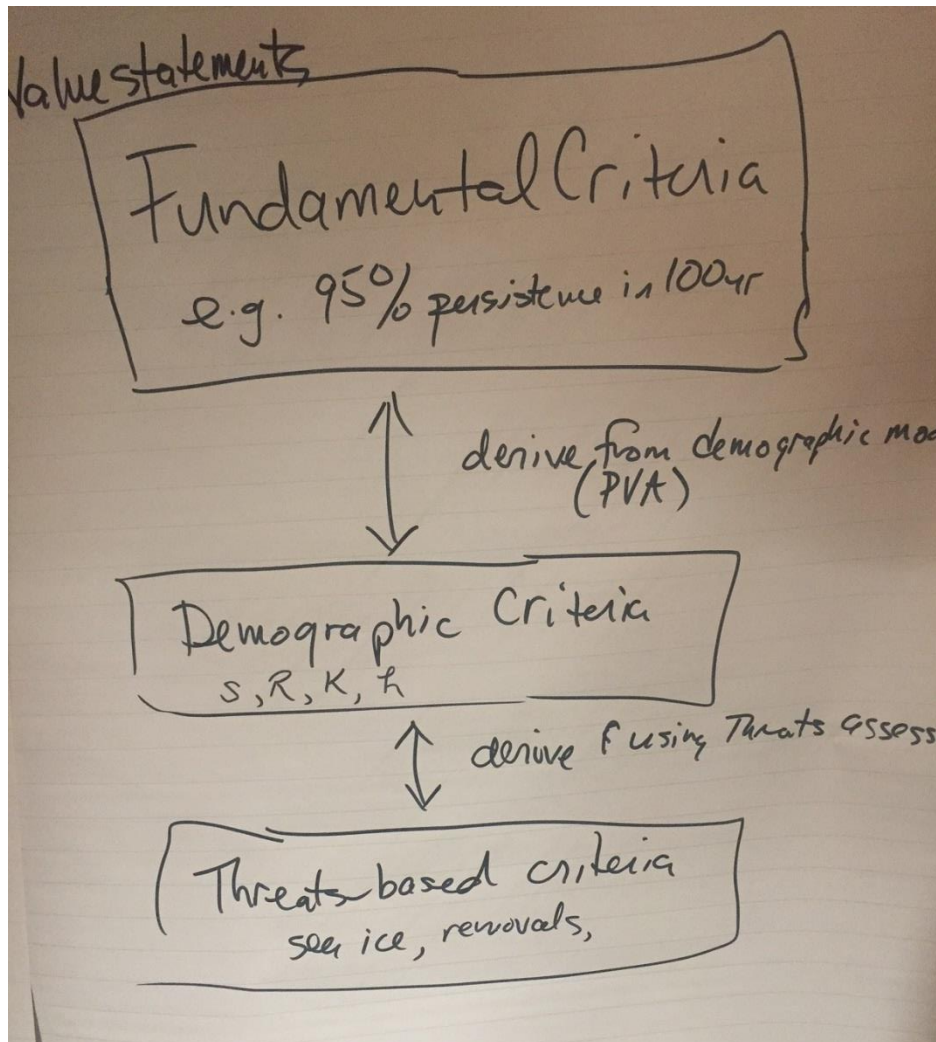
PRIT Recovery Criteria Sub-Team Desired Future Condition:

To have approved, objective and measurable recovery criteria that provide multiple pathways to measure recovery success that are recognized as science informed (consider SMART)

- *Note:* All factors within Problem Statement addressed by above DFC
- Incorporate other states in recovery?
 - o Discussion: Sub-Species vs. Distinct Population Segment
 - ESA: significant range of historical habitat perspectives, save the segments that remain – left with only one for FL panther, mandates enough to have viability
 - Specific management actions are beyond the scope of this team
 - Mechanism to do a 4D rule if dropped to threatened (cannot help with Section 7)

Other recovery effort experiences and Lessons Learned (Note: refer to previous PowerPoint presentations)

- Polar Bear Recovery Plan (Mike Runge)



- Criteria in hierarchy with 3 levels:
 - Fundamental Criteria are value statements, measurable of future status
 - Demographic Criteria – what are the demographic conditions to meet the Fundamental Criteria, measure of current status
 - Threats-based Criteria – derived using a threats assessment against the 5 factors
- Lessons Learned:
 - Establishing this overarching framework upfront took time but was very helpful to the team, participants understood where everything fit
 - Multiple Pathways? Ex: thresholds are in range format
 - The further down the hierarchy, the more likely the criterion will need to be updated based on new information
- FWS Recovery Planning Process (Seth Willey)
 - Recovery criteria update is a major update to the plan

- Goal & Objectives – good ones from the previous version
- Recovery criteria: demographic, threats-based (not explicitly called out but necessary), definitions of “threatened” and “endangered”
- Recovery Action Tables (a good place to start when writing a Recovery Plan, see in Seth’s PowerPoint)
 - Showing the flow between the different parts of the Recovery Plan – threat, criteria, action, result
- Panther Recover Plan, p183, Threats Analysis
- Lesson Learned: when charting path to recovery, identify threats that will persist in the long-term
- Document Relationships – new vision for recovery planning (see PowerPoint)
 - Species Status Assessment includes the background, the “story” while the core recovery plan can be short and to the point, list of actions can be broader, develop an on the ground implementation plan
- Original Work by the Panther Recovery Team – criteria (PVA) (Randy Grau)
 - Refer to PowerPoint slides – Basic Model Runs slides
 - With demographic data at the time, high chance of persistence. PVA models were very sensitive to kitten survival (good data not available at the time)
 - Minimum viable population size – not a popular concept but looking at this, 240 panthers determined for MVP
 - Growth rate 3%/year
 - Population Viability Results –(see slide)
 - Communicate with stakeholders about there being multiple value/model choices available, selected the model of 240 based on risk tolerance, etc. Could have selected a different number. All model are science informed.
 - Uncertainty – modern uses of PVA to address this
- Recent PVA Modeling (Madan Oli, Jeff Hostetler)
 - Kitten survival – incorporated many sources of the data but not all (PIT tags)
 - Kitten survival is density dependent
 - Overall density independent estimate was 0.32
 - Population and genetic diversity on the rise
 - Population modeling & PVA
 - Incorporate uncertainty in the vital rates
 - Kitten survival
 - Sensitivity of population persistence to uncertainty of demographic estimates or ability to change the demographic estimates
 - Positive growth rate is a transient factor that you want during recovery, have this criteria for a short time (not long-term, though)
 - Interim criteria?
 - Parameters left out of the models (e.g., catastrophic events) and if added might decrease probability of persistence

Overarching Structure: *participants discussed options for criteria modification and a pathway to recovery success while refining frame criteria thresholds.*

- How to modify/create criteria under an overarching structure
- **Fundamental Criteria Discussion** (using Polar Bear Recovery Plan criteria structure)

- Modify, **Option B**: 95% probability of persistence over 100 years for the sub-species [and sufficient habitat and range distribution to provide resilience, redundancies, and representation]
 - What is the equivalent overarching probability of distinction implied by the existing criteria?
 - Can be achieved by other means (i.e., 99.75% = 2 populations at 95%; but what if instead we have 3 populations at 87%?)
 - Redundancy about probability of persistence or redundancy about distribution?
 - Address policy questions

- Run criteria identification for **Option A** (as written): 95% probability of persistence over 100 years for AN individual population (independent or fairly independent units of that sub-species, there is one right now)
 - Goal: long-term viability, viability = 95% probably of persistence
 - p98 clarifying statement
 - Reclassification from E to T: 2 viable populations, natural or through management
 - Standard is high
 - Delisted completely: 3 viable populations, self-sustaining/natural
 - 240 is the demographic criterion, a restatement of the 95% persistence

- **Option C: (Chosen by the team as the preferred option.)** Provide current Fundamental Criteria (#1 and 2), Provide modified Fundamental Criteria and step down criteria with modified Fundamental Criteria
 - **95% probability of persistence over 100 years for the Florida panther (i.e., suitable resilience and redundancy); and**
 - **Sufficient distribution to provide representation; this would be achieved with two viable populations for down listing and three populations for delisting.**
 - Distribution – ensure this many panthers thriving in this amount of space
 - Representation of different genetic stocks or representation of different ecological lifestyles (swamp panthers, etc.), etc. – panthers very adaptable, so may not need this. No unique groups.
 - Distribution across historic range
 - Presence in suitable habitat
 - Resilience and redundancy is captured in 95% probability criterion
 - Define sufficient habitat and range – in Florida?
 - How do we measure success? The model only or consider representation too (panthers in x% of range)?
 - “Throughout all or a significant portion of its range” – how much of the historic habitat is still around. Avoid significant portion of range but agree to have multiple options and a bigger chunk than we have
 - Not equal to historic range. It’s looking at current range and is tied back to viability.

- 1 South Florida viable population – enough to down list or delist? Maybe ok for a down listing but not a delisting
- The “sufficient habitat” portion (what was once included in the second criterion above) may feed into the probability of persistence –Team Agreed. It will later be defined at a different hierarchical level
- Recovery Plan Objectives (this team not provided authority to modify): page 95, option is not on the table to only focus on south and south central Florida, key objectives is to have a viable population outside of this area
 - Suggests that the 2 and 3 populations cannot be modified
 - The 95% is not in the recovery goal or objectives, though.
 - FC #2 – new suggestions, add statement about 2 and 3 viable populations...see above
- FCs a step-down from objectives, reiterating
- Define “population: in FC #2.
 - Objective – identifying expansion north of the river as still 1 population.
- Consider how modification looks to stakeholders
 - **Need to present in a Table:** current, recommendation, explanation/why – end product that explains process, transparency way of showing this
 - Changing at the fundamental level doesn’t necessarily deal with the science, and policy judgements
- Team seems to be reluctant to break away from 2 populations and 3 populations?
 - Policy judgement outside of team’s charge? Team Leaders – No: Provided for in the existing PR plan goals
- Threats shaped the criteria – incorporate all threats possible into models

Fundamental Criteria

1. 95% probability of persistence over 100 years for the Florida panther (i.e., suitable resilience and redundancy); and
2. Sufficient distribution to provide representation; this would be achieved with two viable populations for down listing and three populations delisting.
 - NOTE: Define “viable” and “population”

Secondary Criteria

- Demographics
 - **Team: Mike, Jeff, Madan**
- Threats
 - **Team: Kipp (prey), Randy (habitat), Seth (Factor D – regulatory), Roxanna (human-caused mortality)**
 - Sub-Categories:

- Brainstorm: Habitat loss, fragmentation, SLR/nuisance flooding, human-caused mortality, disease, stochastic events (hurricanes, etc.), lack of prey availability
- Appendix B (shifted from brainstorm to looking at this threats analysis): Threats Analysis Using the Five Listing Factors
 - South Florida: See Factor A and E
 - Reintroduction: See Factor A, D and E
 - Take high and very high in stress rank and use these as the list of threats, then contemplate developing criteria for each one (or a criterion can address multiple)
- Identify how much a threat needs to be reduced to be considered “abated enough” to down list or delist.
- Genetics
 - **Team: Dave, David**

Day 1 Homework: each team member drafts 1 criterion (overlap is fine)

DAY 2

Achieving Recovery: What can the team do to achieve identified recovery criteria concepts? Who needs to do what to ensure pathway to successful recovery?

- Data gaps

What makes for good criteria additive to the SMART elements?

- They need to be measurable
- Achievable issues:
 - May be cases where criteria may not be achievable, but that's alright under the ESA
 - Counting panthers is the challenge
 - Is the monitoring achievable-measurability issue
 - Need to avoid lowering the bar to make criteria achievable
 - Science-based criteria are the objective
 - If options for criteria are available, operate with the one that is most measurable and "achievable"

Recovery Plan Criteria Development

- **Note:** see next page, "Draft Modified Panther Recovery Criteria"

Sub-Team's Next Steps:

- Sub-team fine tune criteria, reach back out to technical experts
- Provide meeting materials to team participants 3rd week in May (meeting report)

DRAFT MODIFIED PANTHER RECOVERY CRITERIA

- Word smith these criteria post-meeting through electronic contacts and meetings
- Handle SMART later or in some cases, not at all.

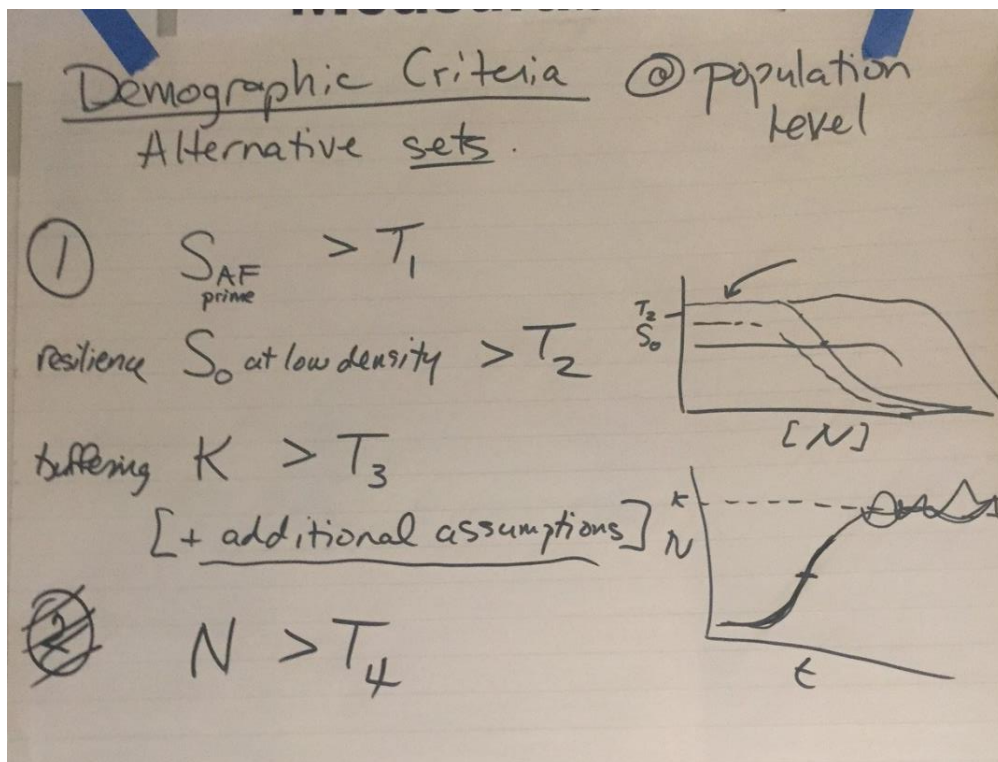
Demographics: (Presented by Mike Runge)

Team: Mike, Jeff, Madan

Presenting several optional, alternative sets of recovery criteria:

- Step down proxy of probability of persistence
- Written at the population level
- Tradeoffs between these sets
- **Continue to work further on Set 1 and Set 3:**

Demographic Set 1:

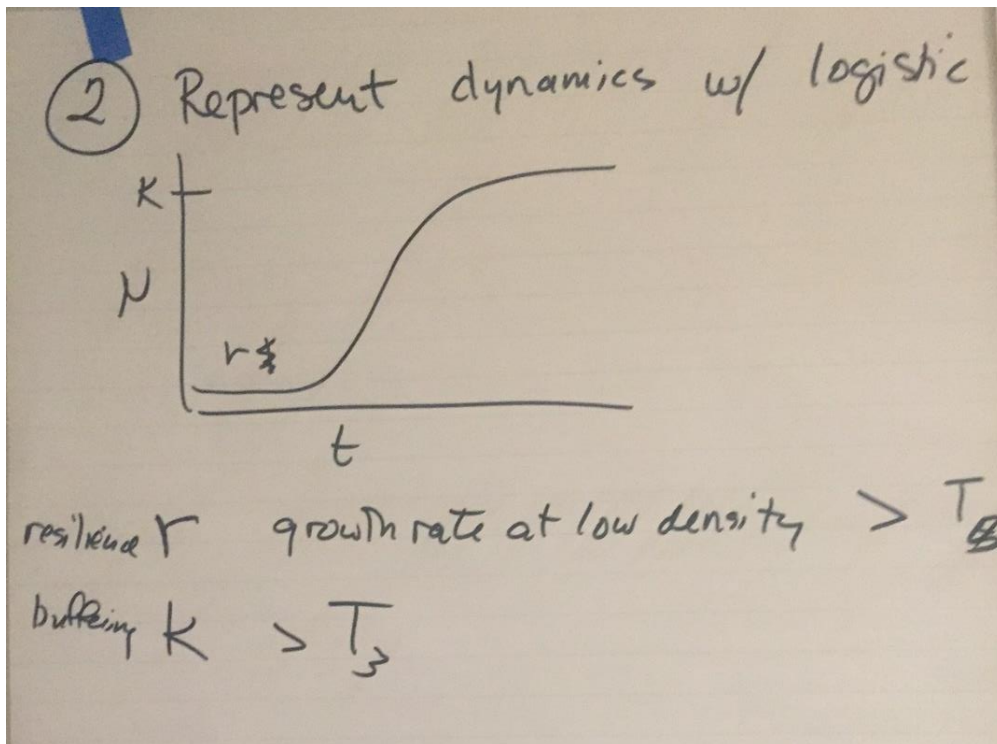


- Prime adult female survival > Threshold 1 [number or a range; would need to explain a the range (i.e., not hit the minimum for all)]
 - Not difficult to measure, good estimates
- Kitten survival at low density > Threshold 2 (when population size is small)
 - At low density confers resilience, high resilience = high probability of persistence
 - Challenge: PIT tag but not able to get them back reliably, extrapolating what kitten survival is at low density, changes in heterozygosity over time
- Carrying Capacity > Threshold 3
 - Buffering
 - Challenge: carrying capacity is hard to measure

- [Plus additional assumptions: at least 1 adult male, breeding rate of the females is at a healthy rate, sub-adult survival rates are satisfactory = understanding of life history and research, these are not areas of concern. The concern is female survival, kitten survival, enough habitat and space for there to be enough animals to buffer against extinction]
- $N > \text{Threshold 4}$ (minimum population size)
- Challenges: difficult to estimate 3 out of the 4 variables, would have to specify what constituted an appropriate PVA (density dependence, take into account different life history strategies, uncertainty in the parameters, etc.)

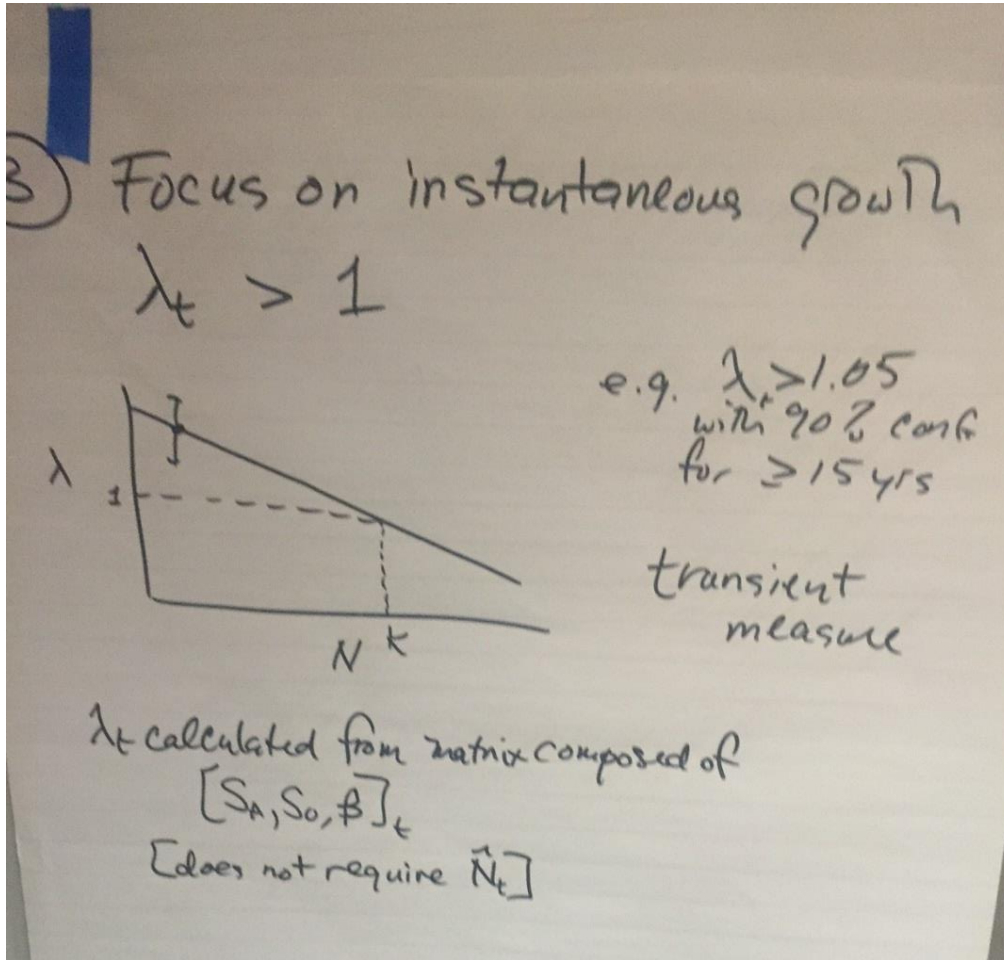
Different targets for each of the 3 populations?

Demographic Set 2: Logistic Growth Curve



- Represent dynamics with logistic [reference graphs on flip chart]
- Growth rate at low density $> \text{Threshold 5}$ (resilience)
- Carrying Capacity $> \text{Threshold 3}$ (buffering)
- [not an ideal option, a more general option – option 1]

Demographic Set 3: Focus on instantaneous growth rate (how fast is the population growing right now?)



- Instantaneous growth rate now > 1 [reference graph on flip chart]
 - Easiest to get measurements for (avoid density dependence, don't have to measure K)
 - **Example draft Criterion: Instantaneous growth > 1.05 with 90% confidence for $> \text{ or } = 15$ years**
 - Transient measure: use during the phase of active movement away from a depleted state
 - Would you need a next measure to get to probability of persistence measure?
 - Doesn't answer if we are far enough out of "trouble," can't say we are recovered but that we are recovering, great status measurement for progress but not a good criterion of recovery
 - Could be a reintroduction criterion
 - Set 1 and 2 are capturing short and long-term picture
 - Objective, data-based, not influenced by individual ideas about what needs to be included in, for example, the PVA (see additional assumptions identified in Set 1) – everyone would calculate the same or very similar number for instantaneous growth rate

- Field work/Achievability: Marking kittens, marking adults, does not require minimum population #
 - Could include information from camera traps if developed
- Lower bound of confidence interval needs to be above 1 (similar to manatee criteria)

Genetics:

Team: Dave, David

*****Exchange of individuals and gene flow among populations can either be natural or through management for both reclassification and delisting.**

Discussion of above:

- Sub-Team proposes change regarding the current criteria calling for natural movement only for delisting (example of FL population and Arkansas population – unlikely that natural movement will occur)
- One recovery unit/recovery zone, south Florida is the only population right now, can be sub-populations within?
- Default approach of USFWS: prefer to not intentionally design recovery plan to be conservation reliant, design recovery in a way that it can achieve its goals naturally but if that fails, assisted migration can be used as a fallback – insert language “as needed” (examples: wolves, prairie dogs)
- Criteria are overlapping
- Expression of inbreeding – immediate threat. Not focused to date on preparing the species for long-term future with a changing planet.
- Is an isolated FL panther population biologically sustainable? Are there metrics for when human assistance is needed again?
- **Reference page 91 in Recovery Plan, first sentence, first paragraph**
- Criterion or a trigger? Goal is heterozygosity, so are the metrics triggers?
- **NEXT STEPS** post-meeting by Genetics Sub-Team:
 - Decide whether these are criteria that we want to move forward with and develop specific metrics.
 - Genetics should be monitored but conduct an evaluation to filter
 - Filtering Answer the following 3 questions (Mike R.):
 - From the statutory standpoint and associated guidance, is the goal for genetic diversity to prevent inbreeding depression or also to ensure long-term adaptive capacity? (policy question)
 - If addressing preventing inbreeding depression, will also be addressing long-term. There is overlap here.
 - What are the fundamental standards to consider in setting the desired future condition for genetic diversity? (policy question)
 - How much genetic diversity is “enough?”
 - What is the relationship between these three criteria? Is there a best one? Do we need all three? (scientific question)

Genetic Criterion 1: Maintain an effective population size of X in each population for Y years.

- Microsatellite data already being collected, can get this number using this data source
- Fill in x and y once more information is gathered

Metrics

- N_e – Effective population size [multiple studies on large carnivore species]

Genetic Criterion 2: A viable population must maintain 90% of their heterozygosity projected over X panther generations (representation).

- This criterion can be used to get at criterion 1
 - Means of monitoring genetic health of the population over time
- Possible Metrics to Consider** (all metrics are currently measurable/calculated with data we have right now)
- H_e – Expected Heterozygosity [issues when compared study to study, used often in the literature]
 - IR – Internal Relatedness
 - HL – Homozygosity by loci
 - A- Allelic Richness
 - F_{Temporal} – Assess temporal changes in allelic diversity

Genetic Criterion 3: Maintain an acceptable level of genetic structure (gene flow) among populations.

Metrics

- F_{st} (shows genetic differentiation between populations, keep this less than a threshold)
 - Number of effective migrants
- Adapt to health and disease issues

Threats-based:

Team: Kipp (prey), Randy (habitat), Seth (Factor D – regulatory), Roxanna (human-caused mortality)

Habitat – distribution, security and reproduction

80% or X of Y management units annually occupied by females with kittens on secure habitat blocks of 100 square miles [see existing recovery plan, 2-5 panthers/100 square acres] of relatively contiguous habitat, totaling Z acres [see recovery plan].

- Management units determined by implementation team
- Applies to a single population (i.e., multiple management units within the South Florida population)? Or does this apply across multiple populations (e.g., South Florida)?
- Alternative index for degradation of panther habitat units (PHUs) (Randy)
- See habitat-based criteria in current plan
 - Dependent on the 240 but this number to be discussed
 - Improve on this? Increase measurable?
 - Describes “sufficient” in the explanation text below the criterion (~4800 square miles)
- Need to identify minimum number of units (current plan identifies 3) as well as persistence
- What is a management unit and does it interact with the other aerial factors

Discussion for Habitat Criterion:

- 80 or some other high percentage
- Denning habitat – important, some portion of contiguous habitat must include habitat for denning.
- X number of relatively contiguous acres of (bright red to yellow)...
- X number of acres to be occupied = suitable

- Occupied, breeding, distribution, reproduction
- Habitat = security, distribution and reproduction as a surrogate for habitat quality
 - 200 square mile area, 10% in flatwoods, x number of females can breed
 - Focus on structure rather than habitat type (allow to adapt to whatever area the panther may den in)
- Security – purchase it or have an easement
- (1) amount of habitat (2) animals in the habitat and for recovery we need both

Roads – Roxanna

Total number of road-related panther mortalities does not reduce the probability of persistence below 95% for 100 years. [a minimum standard]

OR

The rate of road-related mortality is less than 1 - T_1 – other sources of mortality (see demographic criteria – Set 1, allowable mortality rate of adult females)

- *Note female component:* sub-adult males primarily what is being measured by road mortality.

Discussion for Road Criterion:

- Data from *radio-tracked* sub-adults and adults and cause specific mortality rates – estimated for males 5% annual mortality from vehicles and approximately 3% of females die/year from vehicles across age classes (paper, Jeff)
 - Many of these individuals are not spending a lot of time crossing roads
- NOTE: Check on mortality in other puma populations; develop thresholds bounds related to these populations → this can be addressed with the PVA, actually. Recruitment rates may be different for other populations.
- Use concept of sustainable take to indicate how much mortality can be tolerated in each of the age classes? “What is the sustainable **take** of panthers (roads, other causes, etc.)?” [One Question]
- Why did sub-team focus on roads? It’s a technical fix type of problem (not perfect but there are actions), well-monitored, can count them
- “What is the adult female prime survival rate that is needed?” question in Demographics, so for this criterion it is “What is the total mortality that can ‘be allowed.’” [Second Question]
- What is the threshold rate for mortality from vehicles?
- All new and modified roads are looked at...this is an action
- Discussion topic of sub-team: Road mortality doesn’t impact the PVA?
- Standalone metric looking at transportation? measurable, important to identify independently
- Majority of human-related panther deaths are road related, use language similar to Seth’s
- Transportation very high in the threats analysis
- The yellow text reiterates the demographic criterion

Prey– Kipp

Panther prey bases are adequate to support a stable or growing panther population, and important prey species such as white-tailed deer are monitored and managed for long-term sustainability.

- Deer management plan takes panthers into consideration?
 - Deer essential to panthers

- Deer management units and population targets – measurable, quantifiable
- Add numbers later
- If this doesn't happen, seen in demographics
- Polar Bear plan – sea ice criterion related to prey availability, bigger issue was the platform used to hunt rather than the prey availability, likely to lose platform before primary prey item
 - Unsure if there is a substitute for panther prey, though
 - Can/can't assume habitat suitability = adequate prey
- If increase prey, are we increasing resiliency or increasing buffer?
- Medium ranked threat in Threat Assessment – could be a high or very high if assessment run today with current events
 - Deer have crashed in some areas, cattle depredation increased
 - **Is the loss of prey a significant threat to panthers today?**
 - A yes vibe so continue working on it
- Prey is included in habitat criterion...
- **NOTE:** Check other recovery plans for large carnivores about a prey criterion

Factor D (Delisting Criterion for Remnant Threats) – Seth

Develop with partners a Conservation Strategy to outline remnant threats (those threats that are likely to persist after delisting) and how they will be managed in the absence of Federal ESA protections (i.e., after delisting). These commitments (those articulated in the Conservation Strategy) should be incorporated into regulation as possible.

In cooperation with partners, develop a post delisting monitoring period considering the biology of the species (6 year life cycle of the species) as well as the likely duration / period of concern for remnant threats. Employ this methodology for several generations leading up to delisting, if possible, to prove its effectiveness.

Discussion for Factor D Criterion:

- Post-listing Management Plan typically the route taken. A remnant threat criterion like this is rarely addressed in the Recovery Plan.
- Would/Could down listing trigger this effort?