Long-term monitoring of flood impacted wildlife populations

Preble's meadow jumping mouse
(Zapus hudsonius preblei)

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Long-term monitoring

Monitor responses of wildlife and habitat to flood impacts.

"Long-term" = monitor change over time to establish trends

- What is the status and pattern of distribution of wildlife populations following the flood?
- How are wildlife and habitat responding to flood and restoration activities over time?
- What changes are occurring in the system in the years following the flood?

Monitoring provides us with scientifically-based, quantitative information that enables us to make environmentally sound, informed planning decisions and to set appropriate goals for management and restoration of our environmental resources.

The wildlife group at Parks and Open Space recognized the need to establish a long-term monitoring program to monitor and assess the responses of wildlife inhabiting the riparian and aquatic ecosystems impacted by the flood. Monitoring will allow us to answer questions about the status and distribution of wildlife impacted by the flood and helps us to track the progress of their recovery as the systems regenerates following this large natural disturbance event.

Riparian ecosystems in the semi-arid west are known to harbor greater than 90% of the regional biodiversity and provide essential habitat for a number of Boulder County Species of Special Concern, including the federally Threatened Preble’s meadow jumping mouse.

Benefits of long-term monitoring:
1. Measure and predict the status of species and habitat impacted by the flood,
2. Use this information to inform wise resource management and land use decisions,
Small Mammal Trapping

Preble’s meadow jumping mouse (PMJM)  
(Zapus hudsonius preblei)

- Endemic to CO and WY
- Federally **THREATENED**  
  (protected under ESA)
- Threats – Habitat alteration,  
  degradation, and fragmentation  
  due to:
  - Over grazing
  - Urban development
  - Alteration of natural hydrologic  
    processes

1. **Endemic** to CO Front Range and foothills of south-central WY
2. Federally **THREATENED** – protected under ESA
   1. **THREATS**: Habitat alteration, degradation, and fragmentation due to over  
      grazing, urban development, and alteration of natural hydrologic processes.

Glacial Relic: Once the glaciers receded from the front range of Colorado and the  
fothills of Wyoming and the climate became drier, the Preble mouse was **confined to**  
the **riparian systems** where moisture was plentiful. The **eastern boundary** for the  
Preble's is likely defined by the dry shortgrass prairie, which may present a barrier to  
eastward expansion.

Western Jumping Mouse (Zapus princeps)  Same genus as PMJM but different species.  
Also found in moist habitats near water, but occur above 7,600’ elevation.
**Small Mammal Trapping**

*Preble's meadow jumping mouse (PMJM)*

*(Zapus hudsonius preblei)*

**Sub-species** of meadow jumping mouse.

**Habitat:**
- Well developed riparian habitat
  *(Grasses, forbs, shrubs, trees)*
- Adjacent grassland community
  *(High graminoid diversity)*
- Nearby water source

**Diet:** Insects, seeds, fungi, moss, pollen

**Habitat:** Typical habitat for Preble's is comprised of well-developed plains riparian vegetation with adjacent, relatively undisturbed grassland communities and a nearby water source.

These riparian areas include a relatively dense combination of grasses, forbs, and shrubs. Preble's are know to regularly range outward into adjacent uplands to feed and hibernate.

**Diet:** Consists primarily of insects, seeds, fungi and pollen and shifts seasonally.
An indicator species is an organism whose presence, absence or abundance reflects a specific environmental condition.

Indicator species can signal a change in the biological condition of a particular ecosystem, and thus may be used as a proxy to diagnose the health of an ecosystem.

Especially those that are rare, sensitive, or dependent on particular habitat or environmental conditions.

PMJM good indicator species because it is both naturally rare AND dependent upon a particular habitat type. Sensitive to changes in health of riparian ecosystem.

Can use an indicator species as a surrogate for overall biodiversity, monitoring the outcomes of management practices by observing changes in the distribution or demography of populations of indicator species.

Provide target conditions for restoration activities. PMJM have evolved with and are adapted for specific habitat type. If we understand what PMJM habitat requirements are, we have a good indication of what a healthy and natural riparian ecosystem should look like, providing a target for restoration.

IT’S NOT JUST ABOUT THE MOUSE!!! Example of information we can get from habitat studies that can inform restoration.
Small Mammal Trapping

Benefits from long-term monitoring

- Opportunity to study wildlife responses following a large infrequent natural flood event.
- Document post-flood distribution of PMJM in the County.
- Aid in development of strategic resource management plans to restore habitat and habitat connectivity.

1. Unique opportunity to study wildlife following a large infrequent natural flood event. Then use what we learn to inform management and guide our response to future floods.

   1. Important for regulatory compliance in flood recovery efforts.
   3. Information from 2014 trapping season has already been used by Federal, State, and Local entities in regulation of flood recovery activities.

3. Aid in the development of strategic resource management plans to restore habitat and habitat connectivity.

Connectivity is important for long-term viability of PMJM on the landscape. Needs for dispersal, gene flow, and resiliency to large and destructive natural disturbance events. Example of a fragmented linear riparian corridor where hypothetical PMJM populations are isolated and disconnected.
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Benefits from long-term monitoring

Inform development of policy and planning documents

Build foundation for Species Conservation and Recovery Plan for PMJM

- Directive from County Commissioners from the ERE update process.

1. Inform development of policy
   1. Example: BCCP-ERE, map of PMJM Habitat Conservation Areas
   2. These are important land use planning tools that help to protect our important environmental resources.

2. Build foundation for Species Conservation and Recovery Plan for PMJM
   1. Outcome from ERE update process, directed by Commissioners to develop these plans for priority species in the county.
When trying to answer a question, there is a tendency for people to visit areas they expect to find what they're looking for, but of this kind of surveying can lead to a bias toward higher quality sites, or particular types of animals.

It might even be tempting to census the whole area for the sake of completeness, but considering time and money, it's more effective to survey representative sample areas on the landscape. Once an area of interest is defined, representative samples of that area can be used to make inferences about the area as a whole, with estimates of the likely error.

Since our samples must be representative of the whole area of interest- even those places not visited- but we shouldn't choose them ourselves because of bias, how can we select our sample without falling into this trap? The most frequently used methods, and the best, are random sampling and regular sampling. Strategies based on random, random stratified or regular sampling (also known as systematic sampling) are likely to be most robust, therefore we use a method called GRTS: Generalized Random Tessellation Stratified.
Small Mammal Trapping
- Study Design -

Sample Site Selection (GRTS)
Small Mammal Trapping

- Study Design -

Trapping

- Sampled 14 sites
- First week of June through the second week of September
- 250 traps along 1 km reach of stream
- 3 consecutive nights

Sampled 14 sites
First week of June through the second week of September
250 traps along 1 km reach of stream
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Small Mammal Trapping
- Study Design -

Habitat Monitoring

- Track post-flood succession of riparian vegetation.
  - Relate trends to PMJM occupancy/colonization/extinction

- Documented:
  - % cover for trees, shrubs, forbs, graminoids, bare ground/litter.
  - Anthropogenic impacts at site
Documented PMJM presence at all sampled properties along St. Vrain Creek where PMJM had been historically captured.
- Montgomery,
- Western Mobile,
- Gage,
- Pella Crossing

All PMJM captures occurred along St. Vrain Cr. or the South Branch ditch.
No PMJM were captured at BCPOS properties on Left Hand Creek, Boulder Creek, Rock Creek, Coal Creek, or the intermittent stream sampled on Caribou Springs Ranch.
Small Mammal Trapping

- Results -

- Documented new location for PMJM on St. Vrain Creek
- Golden-Fredstrom
- Eastern most PMJM capture on St. Vrain Creek
- Site previously sampled (1997 and 2000), PMJM no. detected
All PMJM captures occurred along St. Vrain Cr. or the South Branch ditch.

No PMJM were captured at BCPOS properties on Left Hand Creek, Boulder Creek, Rock Creek, Coal Creek, or the intermittent stream sampled on Caribou Springs Ranch.
Small Mammal Trapping
- Next Steps -

- Data analysis
- Use first year data to fine tune study
  - Better assessment of data needs
  - Number of sites
  - Number of years
  - Number of covariates
- Continue study as stream corridor recovers from flood.

"After closer investigation, it's become clear that we need to enter more than one value."
Flood Impacts – through the lens of an ecologist
Habitat damage from flood

Scouring
Habitat damage from flood
Sediment Deposition
Habitat damage from flood

Downcutting of Channel
Here we see evidence of bank erosion. Some bank erosion is a direct result of flood flows. Some bank erosion may be ongoing as a result of changes in channel morphology from the flood that have created an instability in the system.

Stream bank erosion leads to a disproportionate sediment supply, stream channel instability, land loss, habitat loss

When riparian vegetation is changed from woody species to annual grasses and/or forbs, the internal strength is weakened, causing acceleration of mass wasting processes. Annual bank erosion rates were increased by three orders of magnitude due to willow eradication and conversion from woody species to a grass/forb riparian community on Wolf Creek, Colorado (Rosgen 2001a).
Habitat damage from flood

Avulsion

Habitat damage from avulsion:
1. Dewatering of former riparian corridor
2. Degradation of existing riparian habitat where new channel was cut
Habitat damage from emergency response

Heavy machinery activity in creeks and riparian areas

1. Removal of important habitat features (e.g. wood)
2. Disturbance of already sensitive post-flood stream bed
3. Hazardous materials spills
4. Alteration of channel morphology created from flood (more change may result in more or perpetuated instability)
1. Artificial modification of spatial arrangement of sediment deposits that some riparian vegetation rely on
   1. Willow and cottonwood both capitalize on sediment deposition characterized by particular grain size.
1. Disconnected flood plain
2. Increased elevation may preclude the establishment of riparian vegetation that necessitate early access to ground water.
   1. Vegetation important for stability and erosion protection.
Habitat damage from emergency response

Restoring pre-flood alignment and conveyance

- Channel alignment
- Channel straightening
- Restoring flow capacity (Trapezoidal channel)
- Artificial stream morphology
  - Loss of natural riffle-run-pool sequence.

1. Straightening of channel may increase stream velocities, promoting erosion and altering the development of natural channel morphology appropriate for a given stream type.
2. Restoration of channel capacity conventionally achieved through creation of a trapezoidal channel.
   1. Artificial stream morphology that does not promote natural stream processes or ecosystem health
      1. Loss of riffle-run-pool sequences found in natural streams.
      2. Sediment transport altered
1. Restoring flow to the pre-flood channel may help to reconnect riparian vegetation to ground water that is dependent upon. Riparian veg may otherwise die off.
2. Help maintain more stable sediment balance.
3. Prevent predatory warm-water game fish from
1. Scouring has created backwaters and off-channel pools that serve as vital habitat for a number of sensitive native fishes, as well as sensitive amphibians (NLF)
Benefits to riparian and instream habitat from flood
- Creation of new habitat -

Establishment of 'riffle-run-pool' sequences

We saw the development of natural riffle-run-pool sequences post-flood. These are natural stream features that are important for maintaining stream processes and providing habitat heterogeneity that is important.
1. New channel creation may lead to future development of new riparian vegetation, resulting in an expanded riparian corridor, if former channel maintains access to water.
1. Post-flood sediment deposits can be considered vacant real estate for the germination and establishment of flood adapted riparian vegetation (e.g. willows, cottonwoods). Flood processes are crucial for recruitment of young cottonwoods to replace old and dying trees.
Benefits habitat from flood recovery activities

Removal of trash, hazardous materials, debris
Resource management challenges for flood recovery

- Weeds
  - Competing with natives in post-flood establishment

- Restoration
  - Holistic planning for multiple benefits
  - Target conditions

- Flood impacts continue......
  - Creek stabilizing still
  - Persistent erosion
  - Lag effect on vegetation and associated wildlife

We are faced with many challenges as land stewards in our efforts to recover from the flood events. From an ecology or wildlife perspective, we are concerned with the restoration of functional ecosystems by restoring habitat and facilitating natural processes that maintain this habitat.

1. **Weeds**: Invasive weeds capitalize on disturbance. We saw a lost of disturbed ground following the flood. These weeds can and will outcompete establishing native vegetation, if not managed.

2. **Restoration**: We are challenged with providing input towards the development of holistic stream restoration that meets multiple objectives (e.g. agriculture, ecosystem function, recreation). Balancing the demands of various stakeholders and the time scale of different recovery efforts can be challenging.

   1. In stream or habitat restoration, we need to have realistic and science based goals and objectives. One of the more difficult challenges can be agreeing upon target conditions for restoration.