LANDSCAPE DESIGN
SCENARIOS FOR
WATER CONSERVATION
IN THE MIDDLE ROCKIES
1 Understanding

2 Application

3 Communication
<table>
<thead>
<tr>
<th>TIME</th>
<th>EVERYONE</th>
<th>THEMES</th>
<th>PERFORMANCE TARGETS</th>
<th>INVOLVEMENT</th>
<th>ME</th>
<th>N+E</th>
<th>H-N-L</th>
<th>FINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WATER (irrigation)</td>
<td>90/60/30</td>
<td>50, 90%</td>
<td>50/75/100</td>
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<tr>
<td></td>
<td>EDIBLE/MED/THERAPEUTIC</td>
<td>30/20/10</td>
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<tr>
<td></td>
<td>NATIVES %</td>
<td>90/60/30</td>
<td>150, 90%</td>
<td>100/50/68/75</td>
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<tr>
<td></td>
<td>POLLINATORS %</td>
<td>90/60/30</td>
<td>25, 50</td>
<td>25</td>
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<tr>
<td></td>
<td>OPEN SPACE %</td>
<td>75/50/25</td>
<td>related to turf</td>
<td>50/80/80</td>
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<tr>
<td></td>
<td>ACTIVE PLAYSPACE (Unusable)</td>
<td></td>
<td>75/50/25</td>
<td>5/3/3/3</td>
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<tr>
<td></td>
<td>COST (upfront)</td>
<td>5/3/3/3</td>
<td></td>
<td>5</td>
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<tr>
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<td>TURF %</td>
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<tr>
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<td>ENERGY %</td>
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<td>MULTI-USE SPACES %</td>
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<tr>
<td></td>
<td>W/HH</td>
<td></td>
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<tr>
<td></td>
<td>SERIOUS/IMPENDING</td>
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<td>COMMUNITY ENHANCEMENT</td>
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</tbody>
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Legend:
- HH/US: High High/Low Usual
- W: Water
- E: Energy
- E?: Cost (upfront)
- HH: Multi-use Spaces
- HH: Community Enhancement
- X: Combine
- O:加热/冷却
- Δ: 相关
- &/$/#: 相关
- E?: Cost (upfront)
Montana showcases over 50 unique ecological systems throughout the state (MTNHP, 2015). Each system boasts a wide variety of plant materials that together create beautiful scenes in the Montana landscape. Explore the option of landscaping your own piece of Montana in a fashion that is true to Montana by rewilding your own back yard with these plants.

love it? show it.

Want to see a remnant of this ecosystem? Go explore!

location: Peets Hill along Bozeman Trail
Parking available off S. Church Ave. & E. Story St.
Bozeman, MT 59715

Want to see a remnant of this ecosystem? Go explore!

location: Sypes Canyon Trail
Parking available up Sypes Canyon Rd. & Churn Rd.
Bozeman, MT 59715

Credit: Maggie Crowley
DESIGN APPROACH
Making a case using landscape performance

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- Location: Peets Hill along Bozeman Trail
  - Parking available off S. Church Ave. & E. Story St.
  - Bozeman, MT 59715

- Location: Sypes Canyon Trail
  - Parking available up Sypes Canyon Rd. & Churn Rd.
  - Bozeman, MT 59715
WATER

- Problem: water quantity is declining within the Bozeman watershed every year
- Sustainable Sites Approach: use of rain water that falls on the site; use of plant selection
- In 2015, consumption for single family homes from June - August was 540 million gallons of water
- Compared to September - May where 317 million gallons of water were used

According to the 2014-15 Bozeman Water Conservation Report responsibly planned native plantings, like those along N 7th avenue, require only 86% of the water a conventional turf landscape of comparable size\(^1\). Many small to medium sized bees will only fly 200' from their nest to harvest pollen and nectar\(^2\). If that radius were planted with drought-tolerant native plants rather than conventional turf\(^*\) it would save 18,300 gallons of water per year in addition to creating pollinator habitat.

\(^*\)This assumes that the only additional watering the turf would need would be 1" per week for the driest third of the year.

\(^1\) 2014-15 Bozeman Water Conservation Report
\(^2\) The American Gardener Nov/Dec: Gardening for Native Bees, by Jessie Keith

Credit: Elizabeth Ritchie
VEGETATION & SOILS

- Problems: bee population is going down by 40-50% (in 2015 according to the USDA) and loss and compaction of productive top soil
- Sustainable Sites Approach:
  - use of native and drought tolerant plants to conserve water
  - create diverse habitat that contributes to seasonal interest
  - create stability for top soil

Credit: Elizabeth Ritchie
VEGETATION & SOILS

MORE THAN JUST GRASS GREEN...

TURF GRASS

FULL/PART SUN

PART SUN/SHADE

Credit: Haley Craven
HUMAN HEALTH & WELL BEING

- Problem: there is not enough focus on restorative and stimulating spaces within landscapes
- Sustainable Sites Approach: aim to not just be aesthetically pleasing

- CASE STUDY: Elmer Avenue Neighborhood Retrofit, California
  - increased neighborhood satisfaction by 90%
  - increased property values and curb appeal
  - saved residents $120-$360 annually by being a self watering site
  - improves water quality by reducing concentrations of lead by 60%, copper of 33%, and total suspended solids by 18%

Credit: landscapeperformance.org
MATERIALS & ENERGY

- Problem: the energy used for material acquisition and disposition deserves more thought

Going 500 miles to get materials requires 15 trees to sequester the amount of carbon produced by emissions...

Going 200 miles requires about 5 trees...

Going 50 miles requires about 2 trees...

- Sustainable Site Approach:
  - Reduce the distance of where materials are coming from
  - Reuse materials on site
  - Use of recycled materials
BASELINE PERFORMANCE
METHOD

Analyzed Parcels

- Single Family Equivalent (SFE) properties
- Geographic variability in City of Bozeman
- Parcel layout typology - orientation, alley/street garage
- Median home value ($350,000)

Data Collection

- On-site survey
- Mapping & drafting software
- Microsoft excel for four performance themes
91% Turf grass coverage

3.6% Drought tolerant species coverage

84,280 Gallons of Water needed annually (EPA Water Sense)

7000 Gallons above E.P.A. water use standards

1268 Gallons Avg. potential Roof redirection with a ½” rain event

Unsustainable

With the current water consumption rates we will not be able to meet our cities growth projected over the next 50 years.

We need a more “sustainable solution”……
VEGETATION & POLLINATORS

**Tree Coverage Per Species**

- **Quaking Aspen**
- **Green Ash**
- **Chokecherry**
- **Paper Birch**
- **Rocky Mountain Juniper**
- **Purpleleaf Sandcherry**
- **Limber Pine**
- **Siberian Cedar**
- **Crabapple**
- **Colorado Blue Spruce**
- **Austrian Pine**
- **Japanese Tree Lilac**

**Non-Native**

**Native**

**Everything Else**

- **Kentucky Bluegrass**

**Percent of Total Vegetative Cover That Can Withstand Drought**

- **3.6% Drought Tolerant**

**Other Vegetative Coverage**

**Percent of Total Plants inventoried* With Wildlife Value**

- **49.5% Birds**
- **19.8% Butterflies**
- **22.2% Bees**
Human Health & Well-Being

Avg. property value increase due to trees in the front lawn is currently **$344** (National Tree Benefits Calculator)

Year-round sensory experiences are low due to the extremely high amounts of turf (97%)

Restorative spaces are limited. Primary engagement with landscape is through mowing & limited play

Therapeutic & medicinal properties are limited due to the uniformity of turf

PERFORMANCE TARGETS & SCENARIO DEVELOPMENT
## Scenario

<table>
<thead>
<tr>
<th>Threshold</th>
<th>Features &amp; Performances</th>
<th>Notes</th>
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<tbody>
<tr>
<td></td>
<td>% of water use reduction (gallons/season)</td>
<td>% use of native plants as increase (square feet)</td>
</tr>
<tr>
<td>High</td>
<td>90+</td>
<td>90+</td>
</tr>
<tr>
<td>Medium</td>
<td>60+</td>
<td>60+</td>
</tr>
<tr>
<td>Low</td>
<td>30+</td>
<td>30+</td>
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<tr>
<td>SCENARIO TRESHOLDS</td>
<td>FEATURES &amp; PERFORMANCES</td>
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<td>--------------------</td>
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<tr>
<td>THE SURVIVOR</td>
<td>URBAN farmer</td>
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<tr>
<td>native beauty</td>
<td>KEEP MT wild</td>
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<tr>
<td>the minimalist</td>
<td>the entertainment zone</td>
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<td>FAMILY VALUES</td>
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<td><img src="image6" alt="Montana" /></td>
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