Taking the pulse of a mesquite savanna on the SRER

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What are the consequences of woody plant encroachment?

1. Rangeland productivity
2. Ecosystem services
3. Energy and mass exchange
4. Scaling from local to global biogeochemical cycles
Taking the pulse of an ecosystem

Water

Energy

Carbon dioxide
How does woody plant encroachment affect the “pulse” of an ecosystem?
Current focus

Understand how interannual and intra-annual variations on precipitation affects CO$_2$ exchange in a mesquite-encroached grassland

1. Precipitation
2. Vegetation status
3. CO$_2$ exchange
Methodology
Precipitation
<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>1936-2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter (Dec. - Mar.)</td>
<td>59</td>
<td>61</td>
<td>35</td>
<td>65</td>
<td>98 (57)</td>
</tr>
<tr>
<td>Monsoon (Jul. - Sep.)</td>
<td>153</td>
<td>243</td>
<td>229</td>
<td>221</td>
<td>203 (70)</td>
</tr>
<tr>
<td>Annual Precipitation</td>
<td>285</td>
<td>335</td>
<td>289</td>
<td>330</td>
<td>377 (92)</td>
</tr>
</tbody>
</table>
Vegetation
Is this redistribution ecologically significant?

Spring and late summer growth supported by tap roots
NEE
Net Ecosystem Exchange of CO$_2$

Ecosystem C loss

\text{g C m}^{-2}

2004
2005
2006
2007
**Photosynthesis**

- Blue line: 2004
- Green line: 2005
- Red line: 2006
- Cyan line: 2007

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**Respiration**

**NEE = R - GEP**
Where did we come from?
Where are we headed?
The graph shows the normalized deviations of precipitation over time for both winter and summer seasons. The upper graph indicates periods of Carbon Gains and Losses, while the lower graph highlights Carbon Losses. The x-axis represents years from 1975 to 2005, and the y-axis represents normalized deviations of precipitation.
Conclusions

- 2004-2007 may be a preview of things to come
- As annual drought severity ↑, NEE ↑
- Spring drought led to no changes in spring $R$ and enhanced summer $R$
- Summer drought increased net $\text{CO}_2$ loss by decreasing amount of late season growth
“The desert is beautiful! Yeah it is.”
P. Mesquitey