

Cross-site synthesis: Patterns & drivers of plant reproduction across LTER sites

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1. WHAT IS MAST SEEDING?

- **Mast seeding** is the pattern of synchronous & highly variable production of seed crops by a population of perennial plants^{1,2}; it is widespread both taxonomically and geographically³.
- Abundant seed crops ('**mast events**') are orders of magnitude higher than low seed years, which has **cascading impacts in ecosystems**^{4,5} (Fig. 1).
- Environmental drivers of mast-seeding patterns include **temperature** and precipitation^{6,7}.
- There remain **major knowledge gaps** in understanding **emergent properties of mast seeding** at a **community level** & their **sensitivity to climate** across broad geographies.

Working Group Objective: Synthesize data to identify patterns and drivers of reproduction in plant populations across LTER sites.

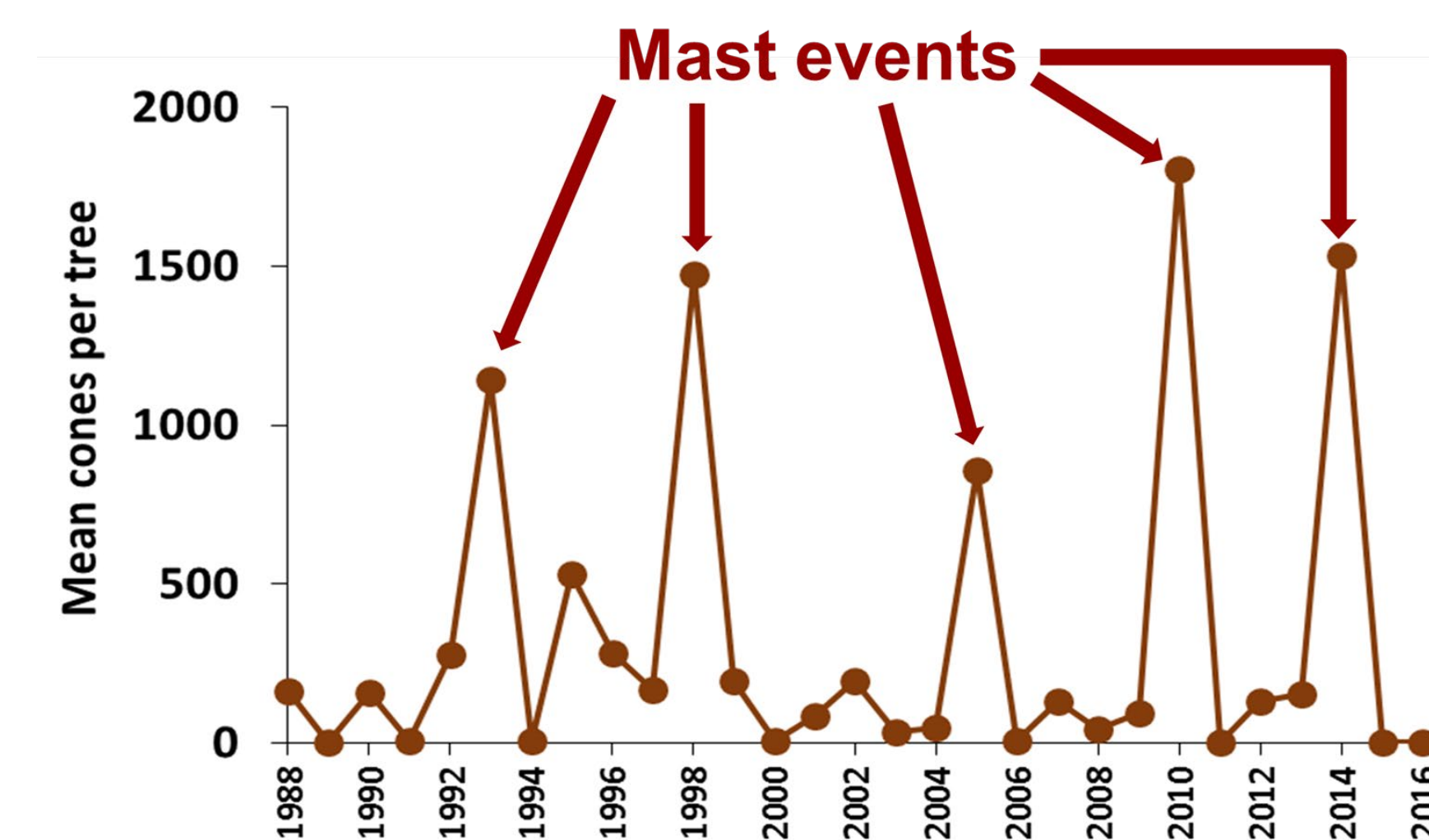


Fig. 1: Mast events show reproduction **orders of magnitude higher** than during intervening periods of low reproduction.

2. LTER DATASETS

- Our working group has compiled time series of woody plant reproduction (trees, shrubs) from **LTER sites** (Fig. 2).
- Data come from either seed traps (sizes vary) or from direct counts of reproduction on trees.
- Criteria for inclusion of plant reproduction datasets:
 - Minimum time series length = 10 years; Data identified to species.
 - Omit data when: i) seeds for a species found in <5% of traps, or ii) ≥80% of zeros, or iii) <4 non-zero years across the time series.

3. MAP OF LTER SITES & PHOTOS

- LTER sites with data collection on woody-plant reproduction span latitudes from 18°N (Luquillo) to 65°N (Bonanza Creek) (Fig. 2).
- Species at LTER sites show mast-seeding patterns, with high temporal variability (Table 1, Fig. 2).

Table 1: Temporal variation in seed production (coefficient of variation (CV)) differs greatly across LTER sites, as does **synchrony** (r_{Spearman}) between pairs of species within sites. Time series lengths, and the number of species in datasets are also shown. Sites are ordered by latitude.

LTER Site	N _{years}	N _{species}	CV _{mean}	r_s mean (min, max)*
Bonanza Creek	62	7	2.36	0.04 (-0.40, 0.57)
Andrews Forest	61	10	1.14	0.53 (-0.22, 0.99)
Hubbard Brook	28	3	1.13	0.54 (0.36, 0.82)
Sevilleta	23	3	1.54	0.21 (0.09, 0.38)
Coweeta	28	20	0.50	0.08 (-0.60, 0.75)
Luquillo	30	more to come...		

*A correlation matrix was created for each LTER site. The mean (min, max) pairwise correlations are shown.

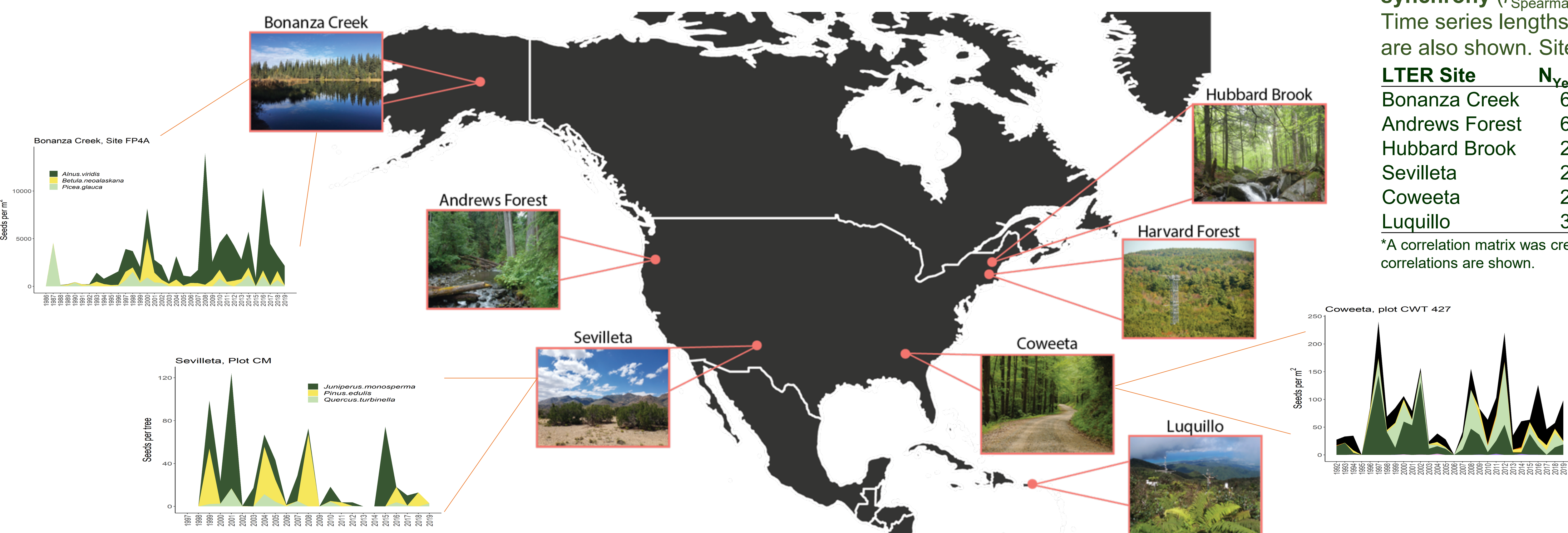


Fig. 2: LTER sites collecting annual reproduction data in woody plants span a **wide range of biomes**. Inset are photos depicting each site, and **total reproduction** for species at plots within three sites as examples of the **temporal dynamics**.



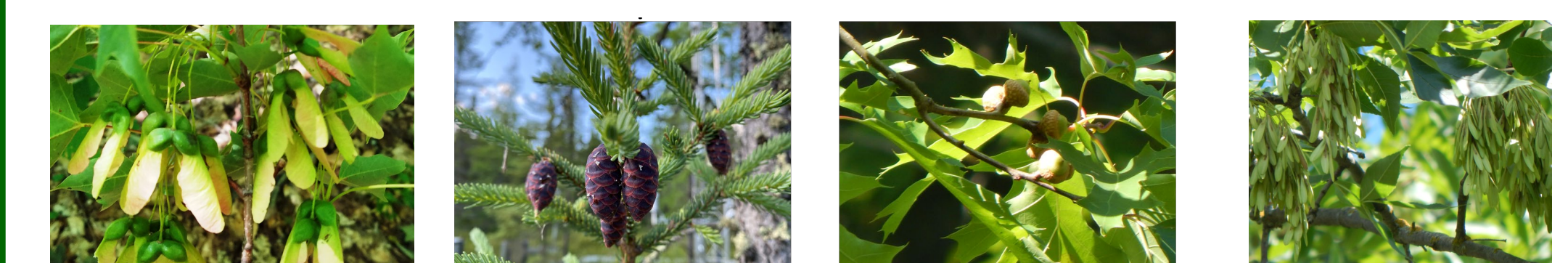
LTER Synthesis working group members on a hike. Apr 2022.

4. QUESTIONS BEING INVESTIGATED

- Community-level synchrony in mast-seeding patterns across species and across LTER sites. How does community-level synchrony vary across biomes?
- How are mast-seeding metrics related to species attributes?
- How does mast seeding behavior & seed production response to climate vary in relation to a species climate zone?

5. OPPORTUNITIES FOR USING SYNTHESIS DATA PRODUCT

- Mast seeding is a resource pulse.
- Connections between seed production & plant community dynamics.
- Connections between mast-seeding and seed-eating small mammals & bird population dynamics.



Acer saccharum *Picea mariana* *Quercus rubra* *Fraxinus americana*
Example reproductive structures included in the LTER datasets.

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