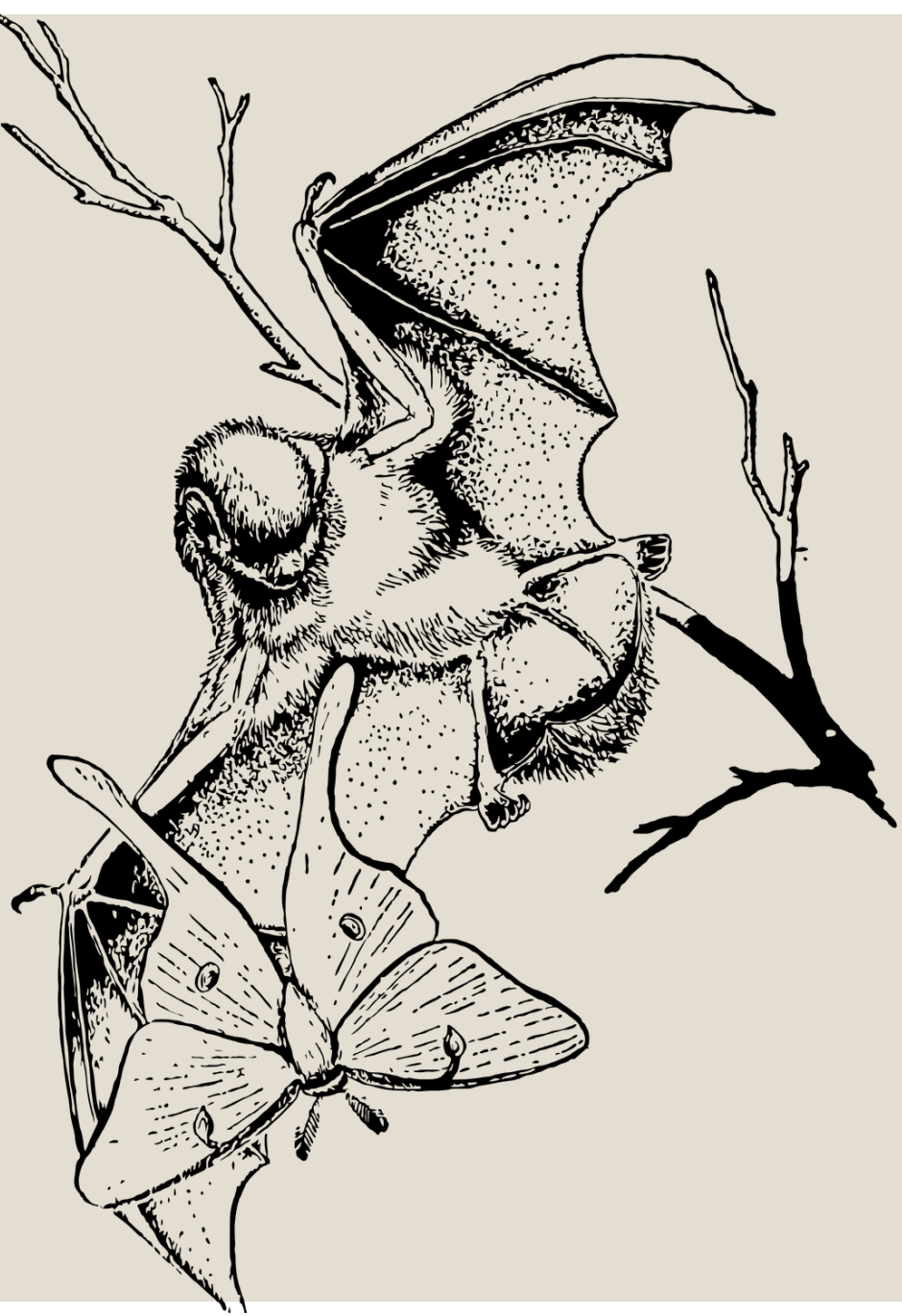

Forest Management and Bats

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About Me!

Hometown from the United States

9 years!

San Francisco State University, BS

Angelo State University, MS

University of Illinois Urbana-Champaign, University, PhD Candidate

What is Forest Management?

- The science and practice of overseeing, planning, and manipulating forest ecosystems
- Ranges from low to high intensity interventions

Who Manages Forests?

Forest management involves collaboration among:

- Foresters and consultants
- Federal, state, and tribal agencies
- Private landowners (≈56% of U.S. forest land)
- Logging professionals and contractors

Management Goals

Key management actions include:

- Economic $$$
- Forest health
- Habitat and ecosystem conservation
- Hazard mitigation (fire, pests, disease)

Habitat Components

- Food
- Cover
- Nesting habitat
- Brooding habitat
- Roosting
- Hibernating areas
- And many more

- Species-specific responses

Food

- Plants/tree materials
- Mast that is produced by the plants/trees
- Insects that live in or on the plants/tree
- Trophic cascades

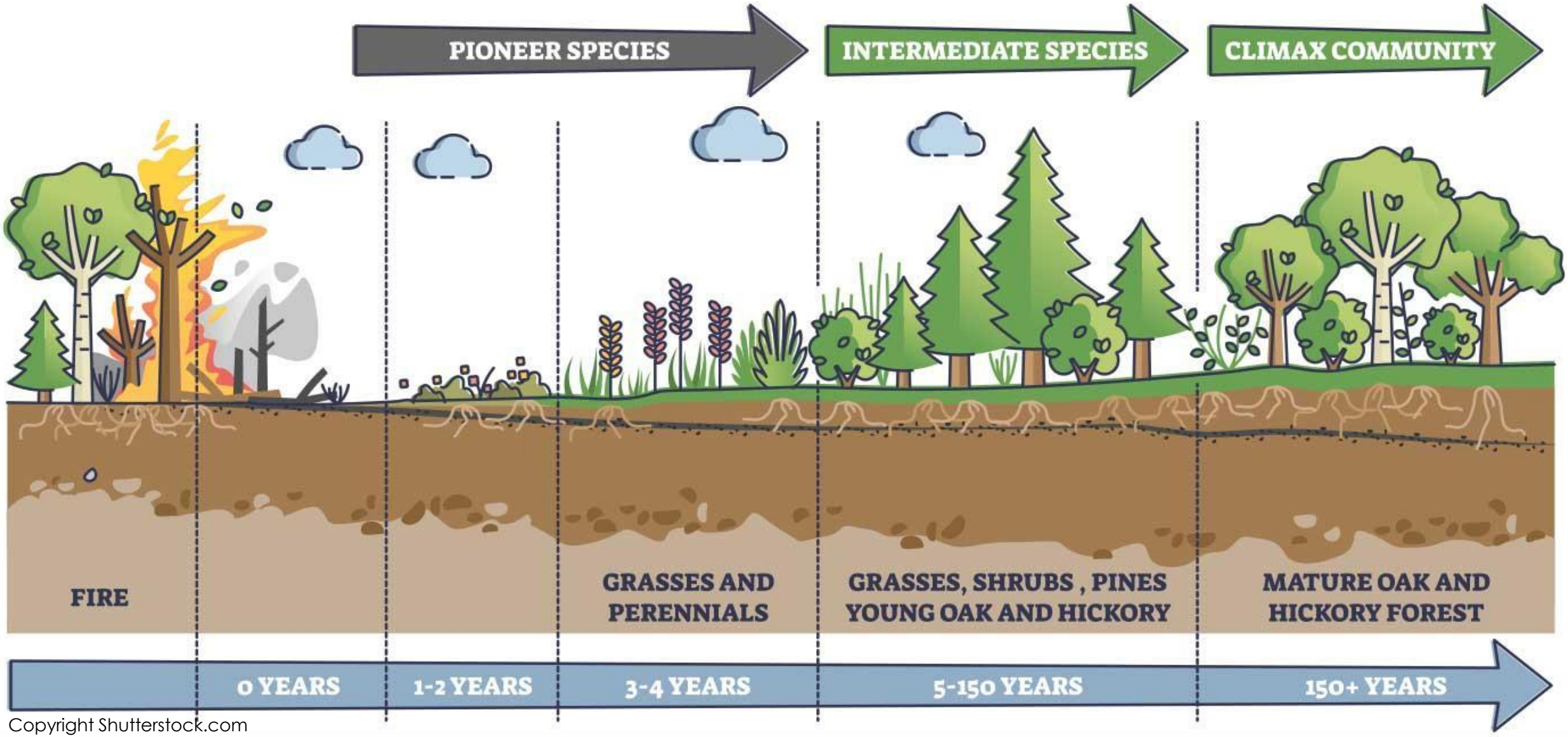
Cover

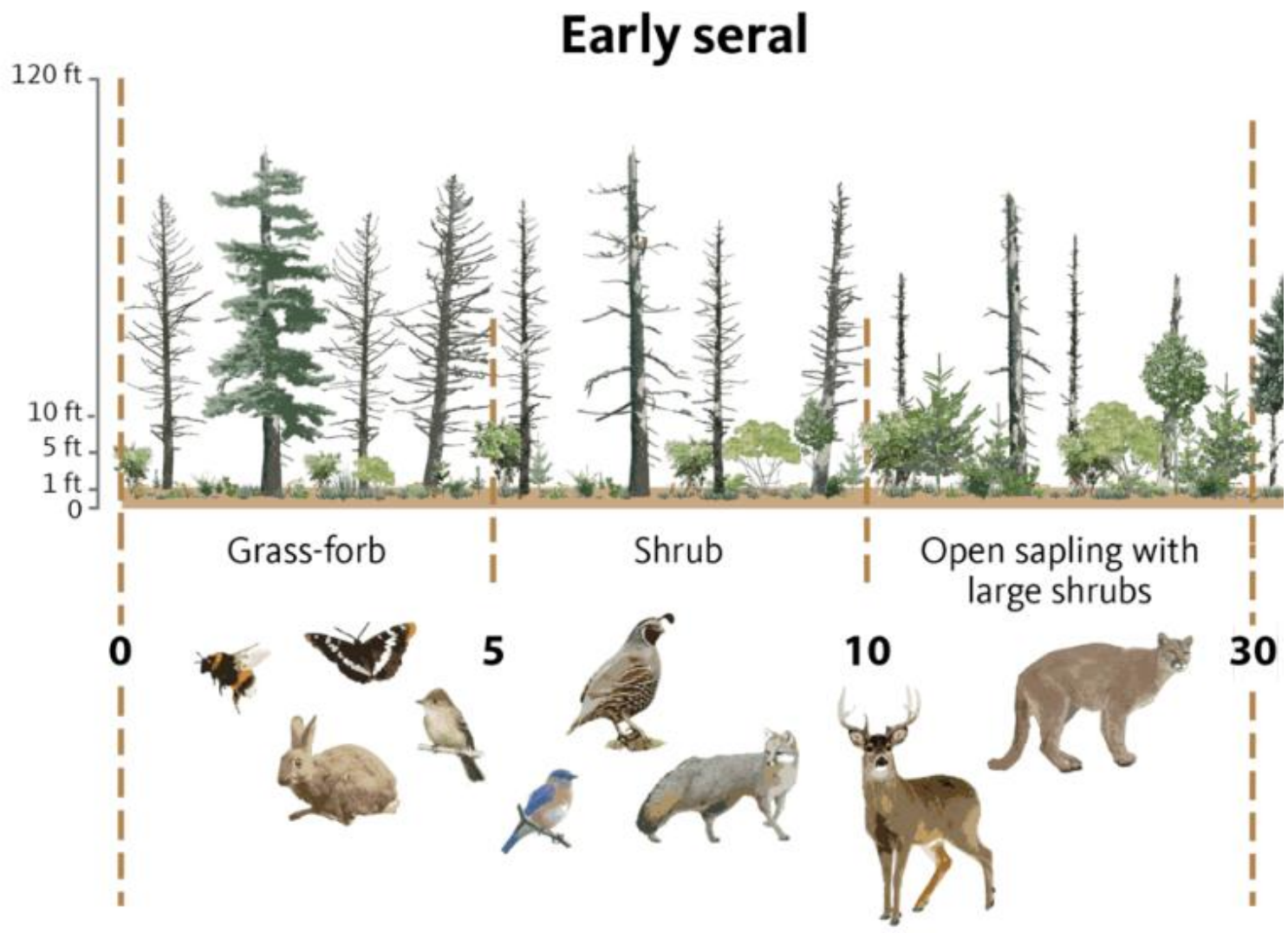
- Help reduce energy expenditure
  - Escape or concealment
  - Reproductive
  - Resting and loafing
  - Roosting
  - Travel
  - Winter

Bat Cover

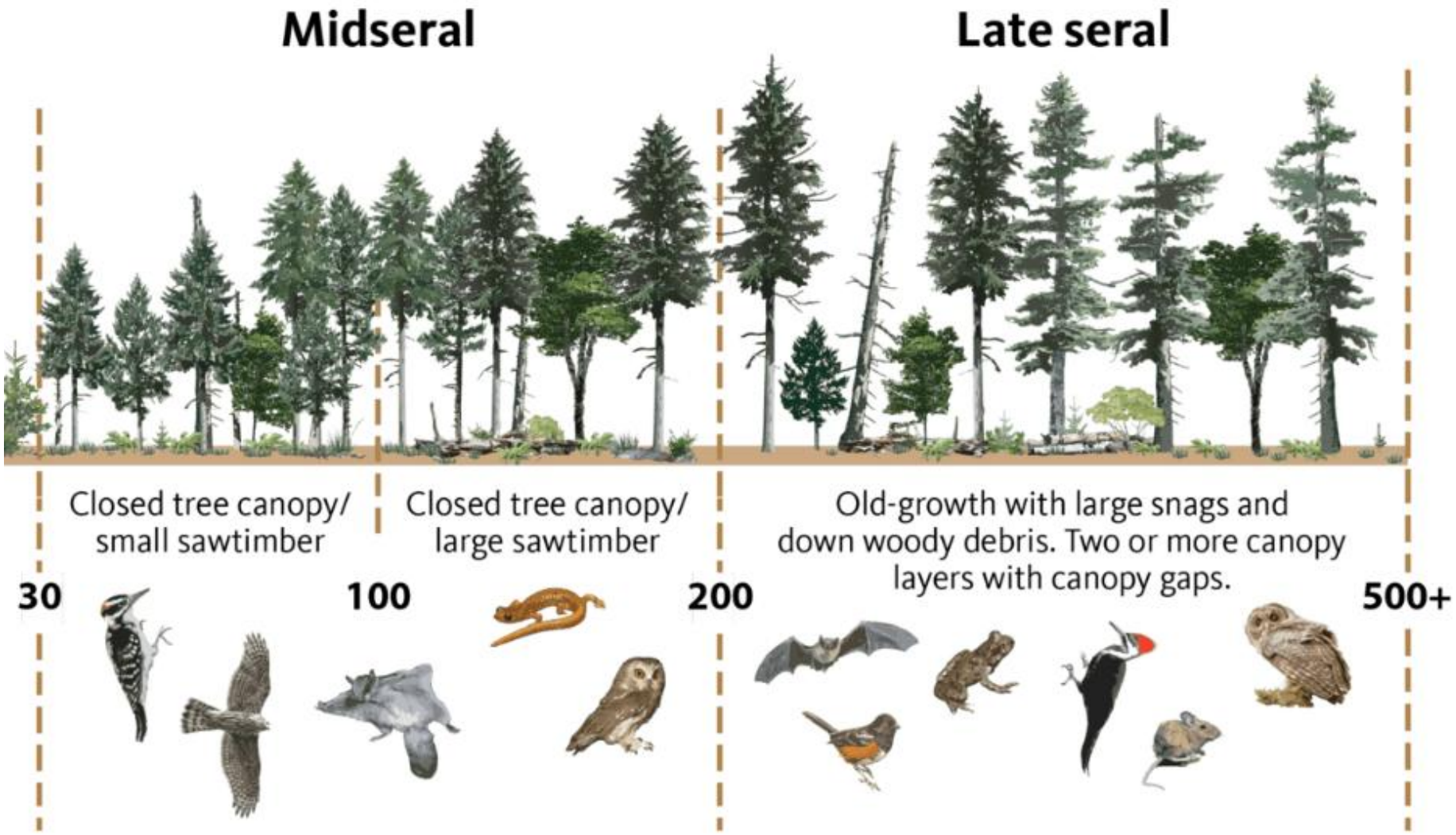
- Under loose or exfoliating bark
- Inside cavities or woodpecker holes
- In cracks and crevices of snags (standing dead trees)
- Foliage

SECONDARY SUCCESSION





Credit: Stephen Fitzgerald and Gretchen Bracher, © Oregon State University



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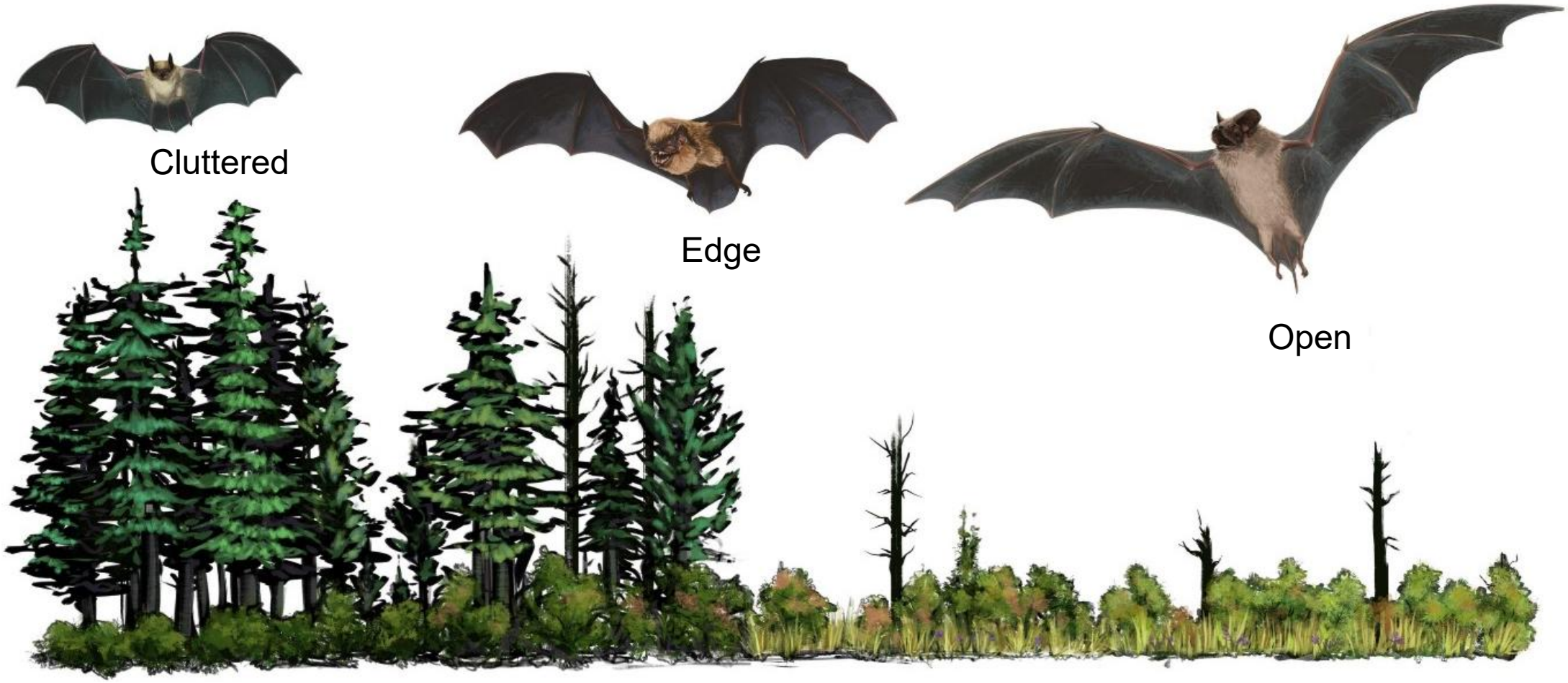


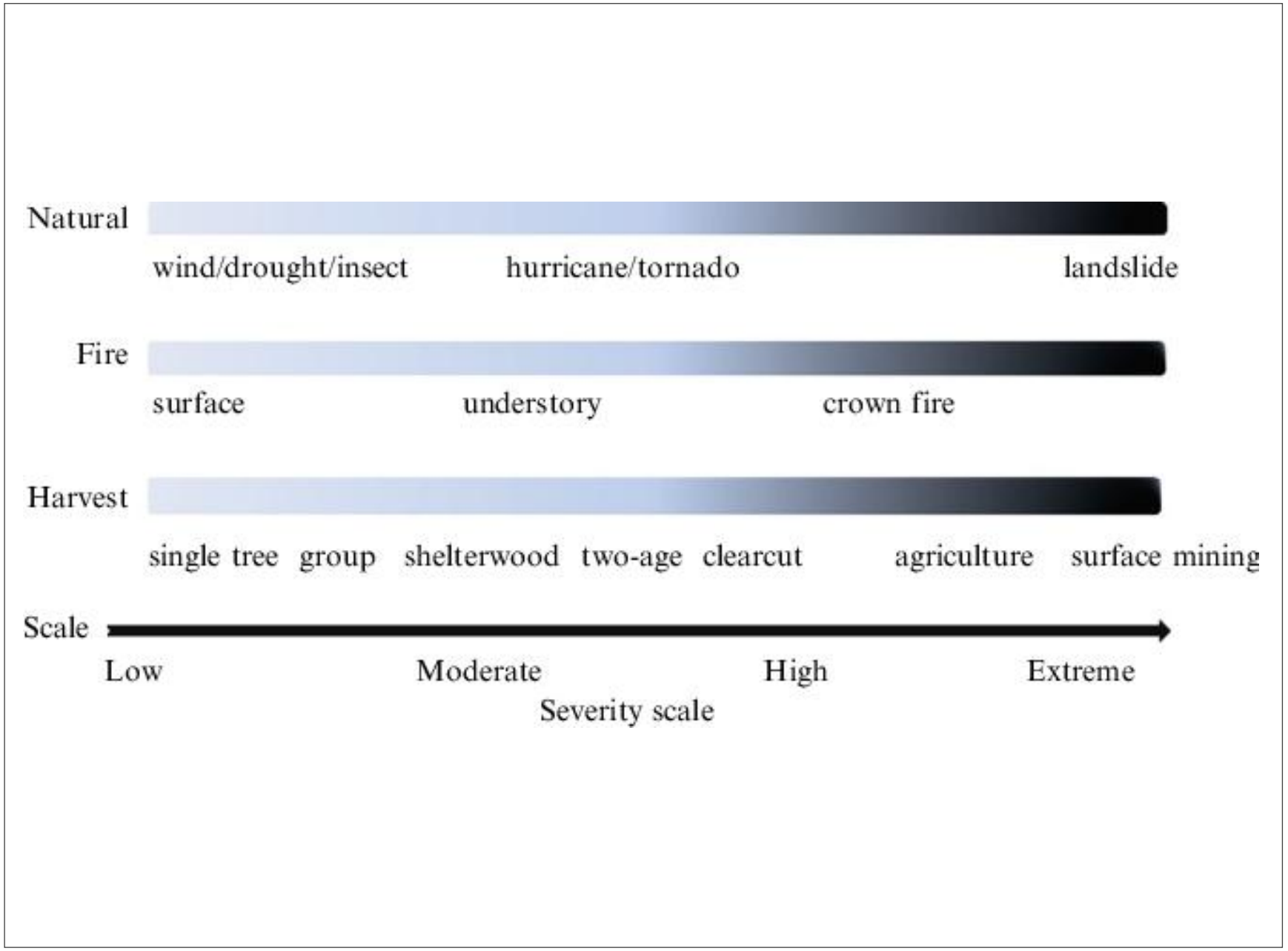
Blakey et al., 2019

Hov s?

Credit: Stephen Fitzgerald and Gretchen Bracher, © Oregon State University

Disturbances and Management

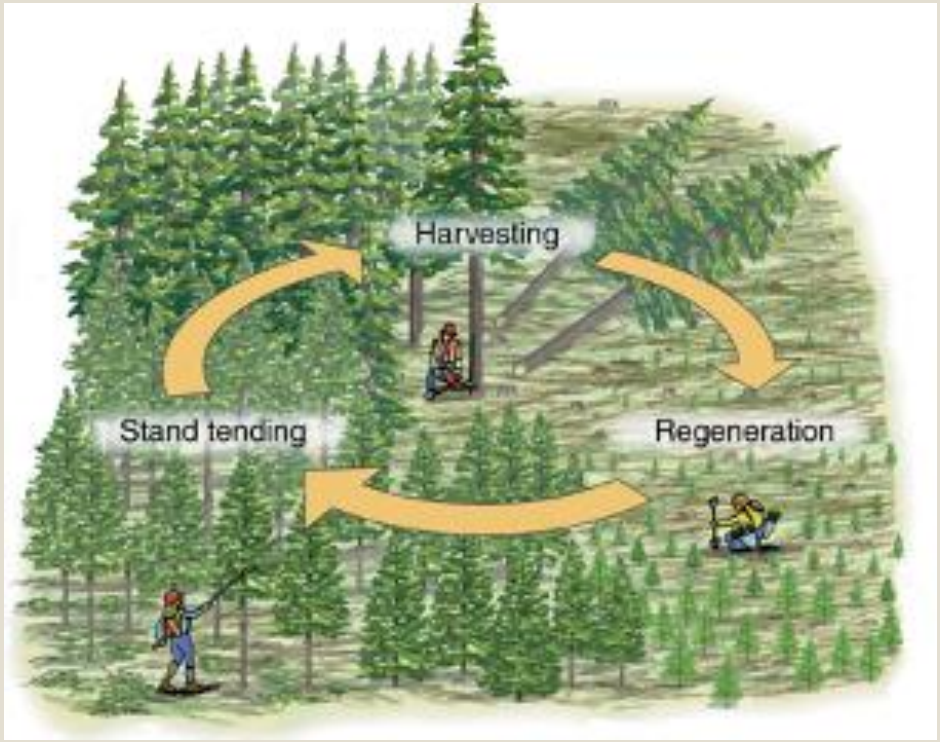
- Natural or human-driven
  - Wildfires
  - Flooding
  - Storms
  - Insect outbreaks
  - Management
- Reset succession partially or completely



Understanding Disturbance Regime

What is Silviculture?

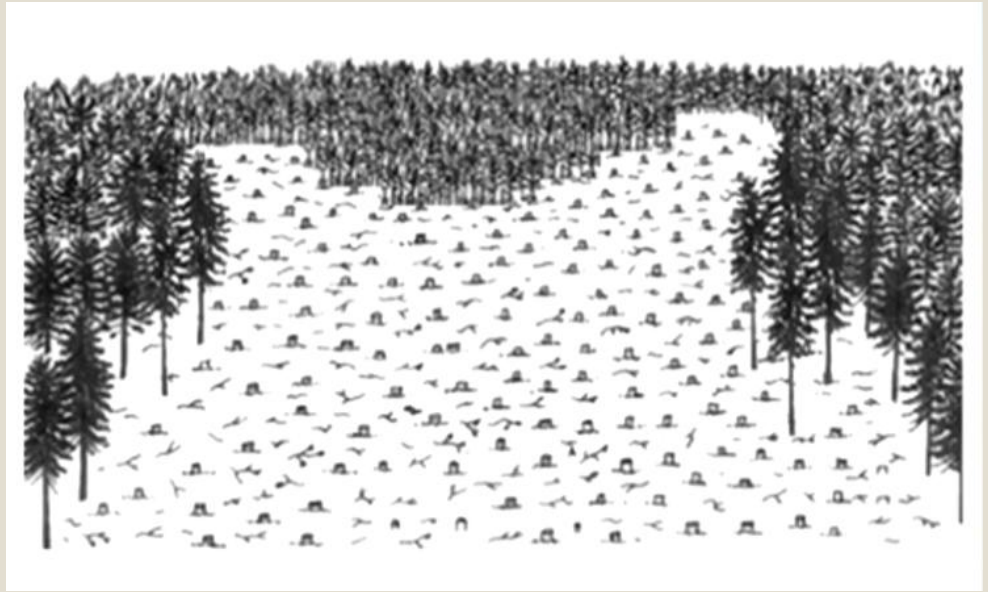
It is the art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.



Silvicultural Treatment

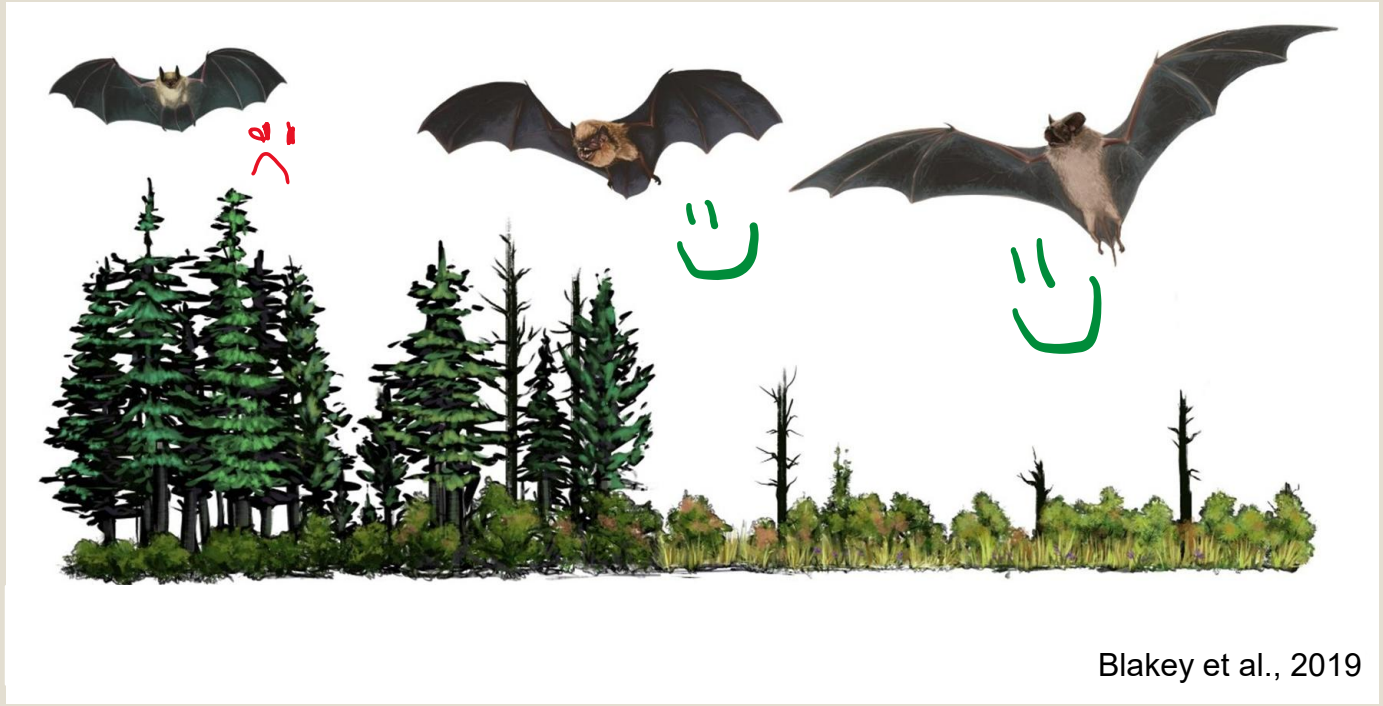
Clearcutting

Treatment	Advantages	Disadvantages
An even-aged regeneration system in which essentially all the trees in a stand are removed in a single entry	(+) Relatively simple to implement operationally	(-) Visual impact
Regeneration may derive from sprouts, advanced regeneration, or seedling reproduction.	(+) often effective way to "restart" degraded stands with a more desirable species mix	(-) Significant alteration to wildlife habitat
Shade-intolerant species fastest initial growth	(+) Treatment area of 20 acres can balance silvicultural and aesthetic goals	(-) Potential alteration of hydrological patterns

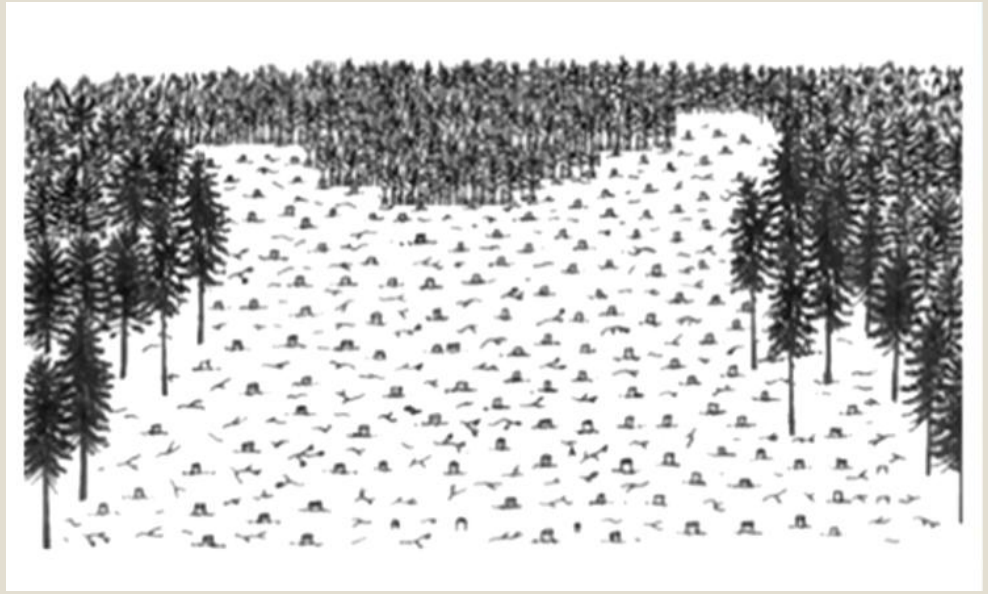


Silvicultural Treatment

Clearcutting



Blakey et al., 2019



Silvicultural Treatment

Shelterwood cut

Treatment	Advantages	Disadvantages
An even-aged regeneration method that reduces the overstory canopy by approximately 50% in the first entry and completely within 10 years. The high shade that results favors more shade-tolerant seedlings and sprouts	(+) Less hydrologic alteration	(-) Appropriate harvesting equipment and operator care are required to implement treatment with minimal disturbance to the residual stand
	(+) In some systems, can be effective for oak generation	(-) Significant alteration to wildlife habitat

Silvicultural Treatment

Shelterwood cut

Blakey et al., 2019

Silvicultural Treatment

Single-tree selection

Treatment	Advantages	Disadvantages
Removal of individual trees in a stand to provide growing space for un-even aged regeneration	(+) Visually non-intrusive	(-) Very difficult to apply in practice without increasing potential site damage
Favors shade-tolerant species	(+) Retained forest structure benefits some wildlife species	(-) Often results in a selective or diameter-limit cut

Silvicultural Treatment

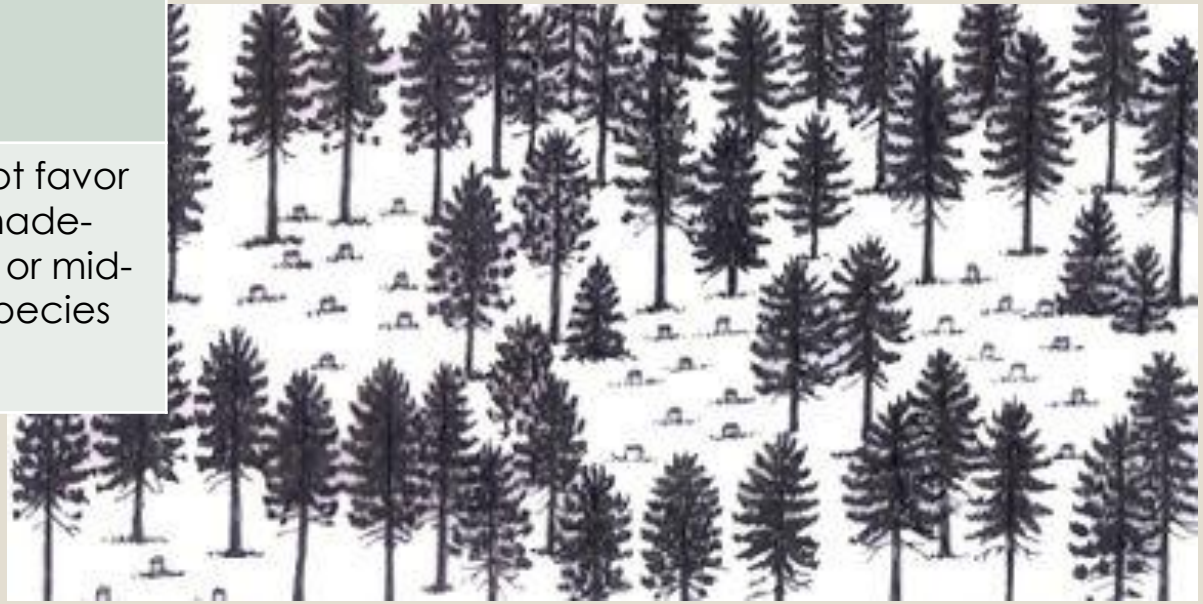
Single-tree selection

Blakey et al., 2019

Silvicultural Treatment

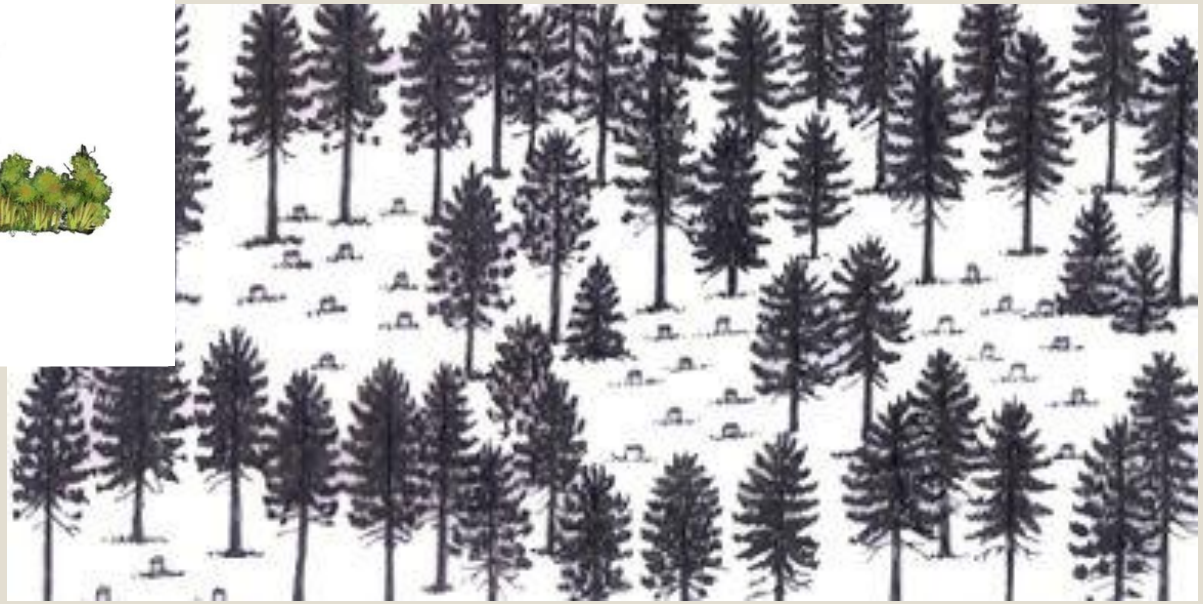
Group-tree selection

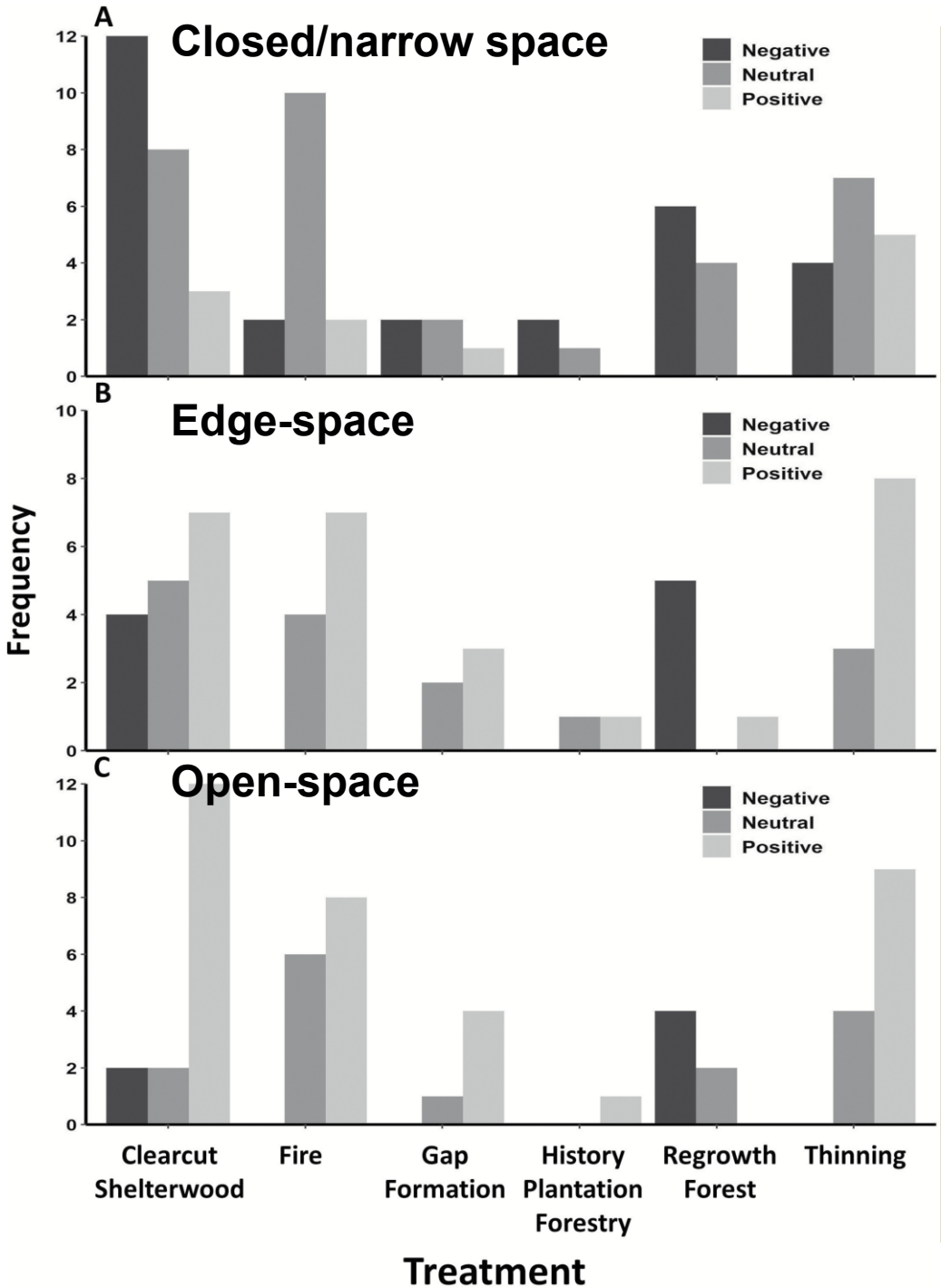
Treatment	Advantages	Disadvantages
Uneven-aged regeneration treatment involved the removal of desirable and undesirable trees of similar age, size, or species within a 0.25-3.0-acre area. Similar to patch clearcuts, but with smaller holes in the canopy	(+) Limited visual impact	(-) Frequent entries may be impractical to implement and or/damaging to sensitive soils
	(+) Retained forest structure benefits wildlife	(-) May not favor desired shade-intolerant or mid-tolerant species



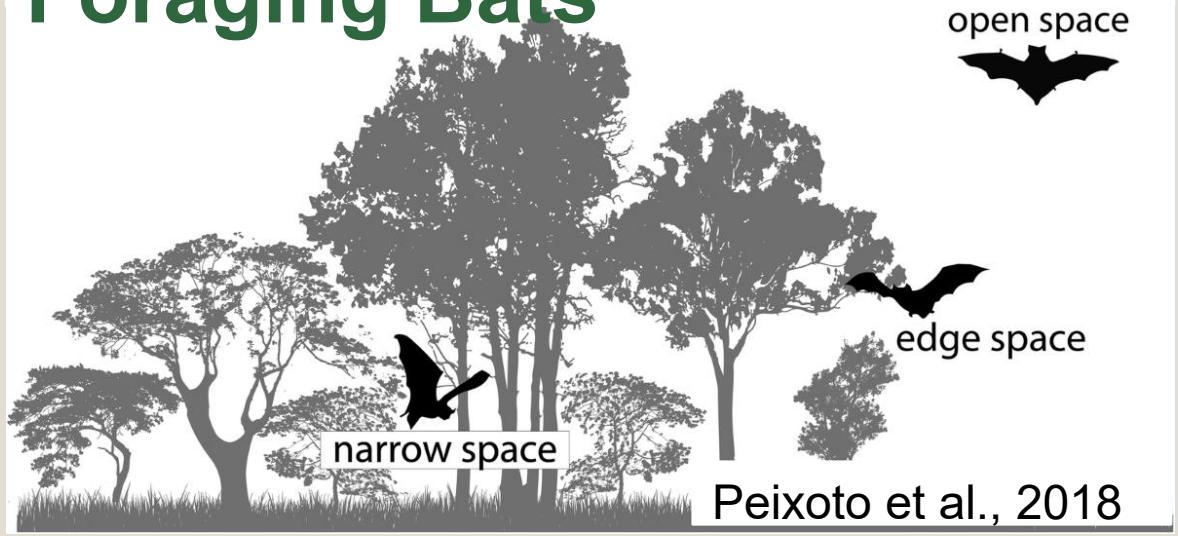
Silvicultural Treatment

Group-tree selection





Foraging Bats



Peixoto et al., 2018

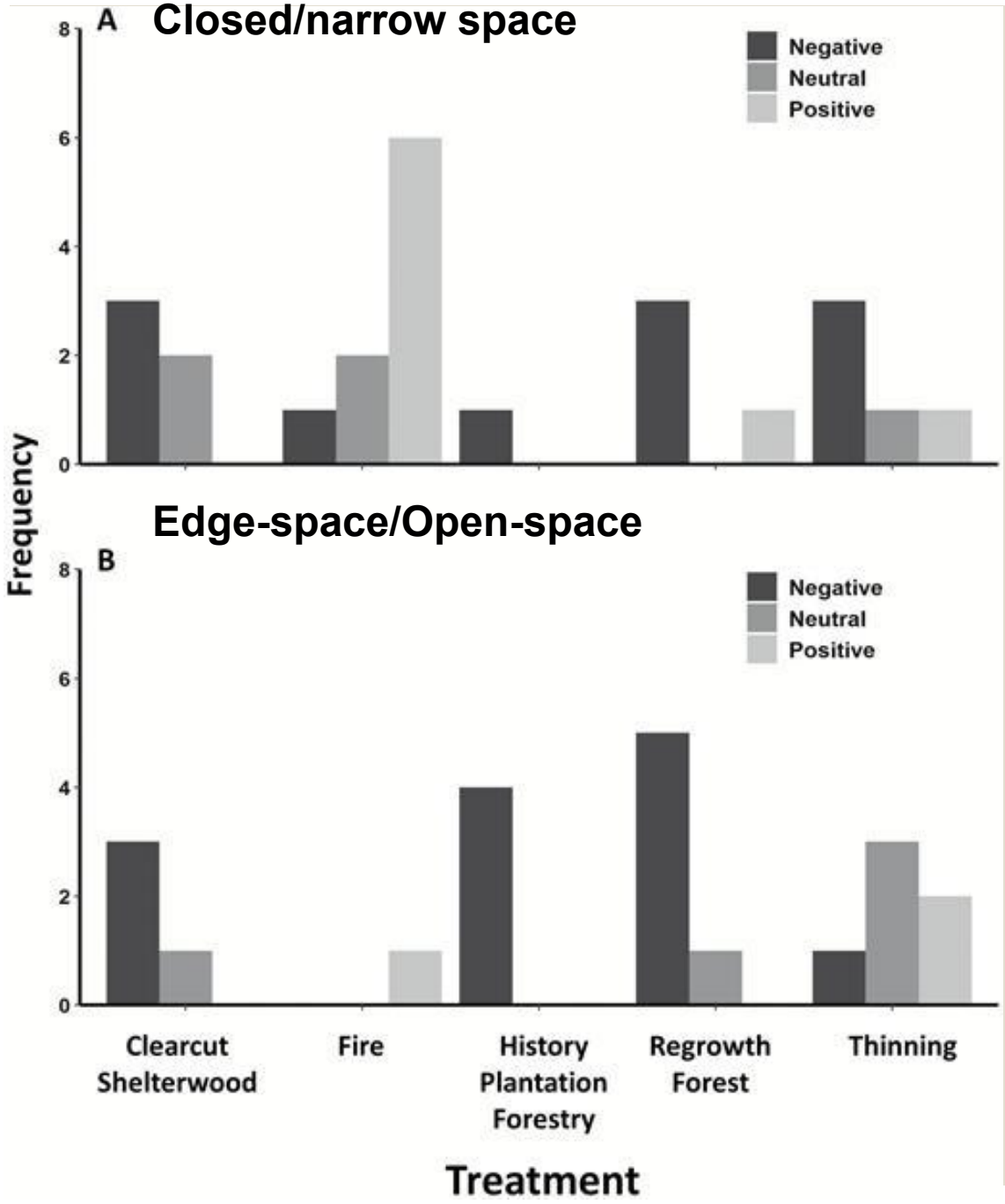
Number of studies in which the foraging responses of temperate insectivorous bats to silvicultural treatments were negative, neutral, or positive: (A) closed-space bats, (B) edge-space bats, (C) open-space bats.

Qualitative synthesis of temperate bat responses to silvicultural treatments—where do we go from here?

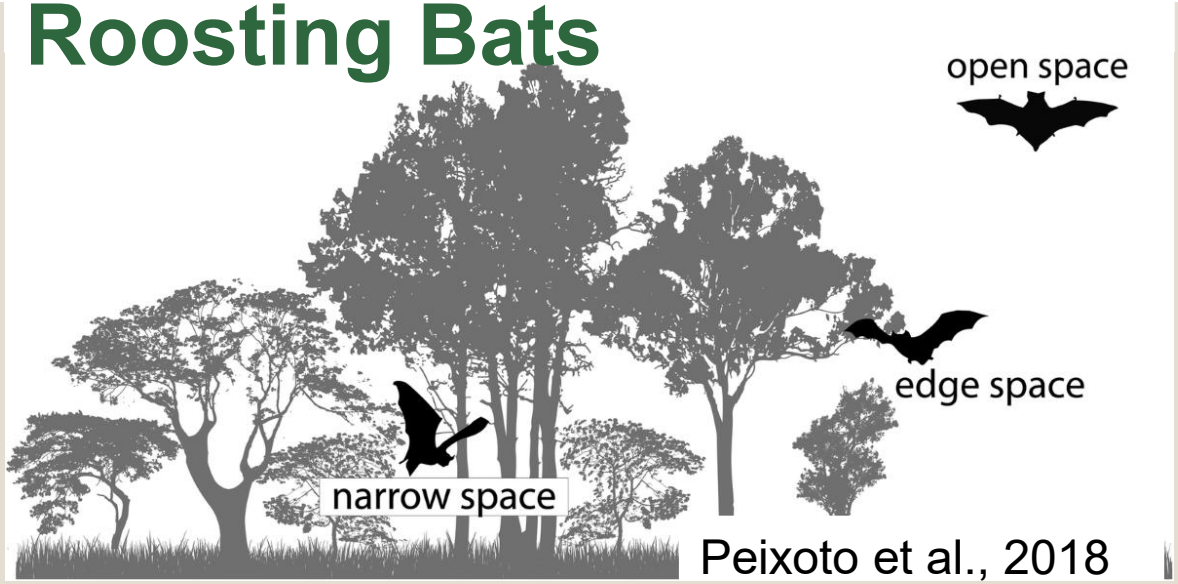
Susan C Loeb

Journal of Mammalogy, Volume 101, Issue 6, December 2020, Pages 1513–1525, https://doi.org/10.1093/jmammal/gyaa089

Published: 06 August 2020 **Article history**



Roosting Bats



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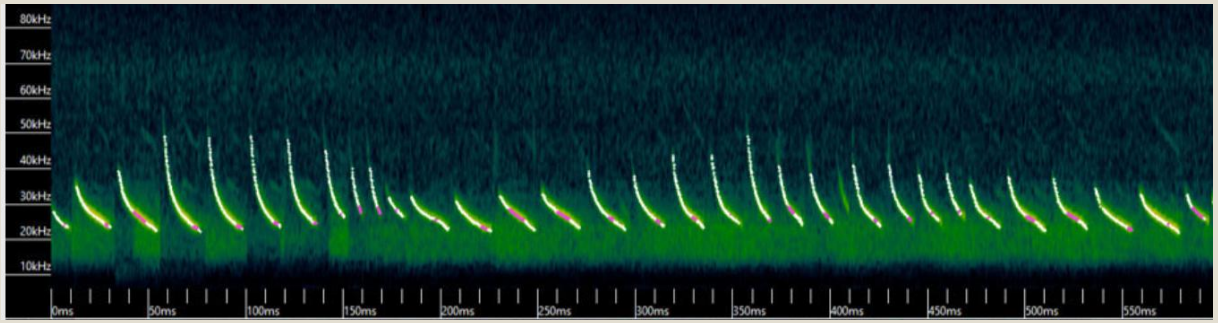
Designing a Study of Bats in Managed Forests

Start With the Management Question + Match Design to Scale

- What treatment(s)? (thinning, shelterwood, clearcut, fire, plantation history, regrowth)
- What outcome? (foraging habitat, roost availability, stress/fitness, community shifts)
- Pick the comparison: **treated vs. untreated controls**, or **BACI** (before–after–control–impact)
- Landscape scale: how bats move and select habitat mosaics (edges, riparian areas, openings)

Measure Activity — Acoustics

- Acoustics: activity, occupancy, responses (closed/edge/open-space foragers)
- Interpret as “foraging/commuting activity” (since calls can’t always separate behavior)
- Link activity to habitat metrics (canopy openness, clutter, edge density)



Add Mist-Netting or Harp Trapping — Who Is There?

- Assess population, health, and species diversity
- Enables the identification of endangered species
- collect physiological data, genetic samples, or attach transmitters for telemetry.

Add telemetry to learn how bats use the landscape

- Radiotelemetry or GPS tags (species/size dependent)

  Outputs:
  - home range size
  - commuting corridors (e.g., riparian, roads, hedgerows)
  - habitat selection (used vs. available; selection for edges/openings vs. cluttered stands)
  - foraging patches

Quantify roost ecology + roost types

- Roost finding via telemetry + emergence counts
  Classify roosts:
  snags / cavities
  bark crevices
  live tree cavities
  foliage roosts (many tree bats)
  structures (when relevant)

- Measure roost availability & quality:
  snag density, DBH, decay class
  canopy cover at roost, distance to water, edge proximity

- Compare roost selection vs availability (selection/avoidance)

Video by Dr. Reed Crawford

Include insect studies for insectivorous bats

- Sample prey across treatments:

  light traps, malaise traps, pitfall

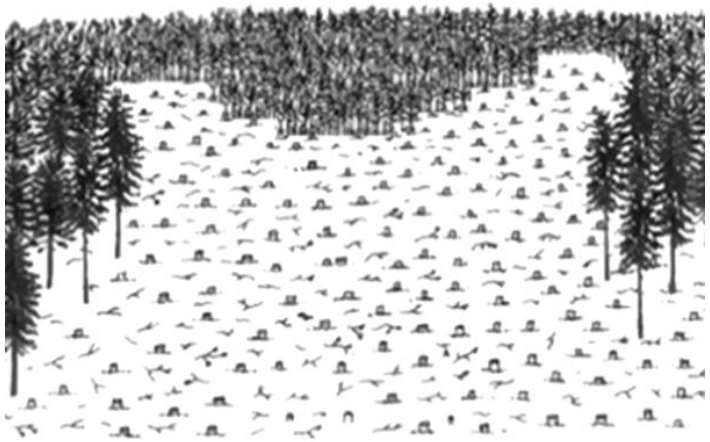
- Metrics:

  insect biomass, abundance,

  diversity/community composition

Conclusions

- Forest management shapes wildlife habitat by altering forest structure, vegetation, and successional dynamics
- Different silvicultural treatments create different habitat conditions
- Bat responses to forest management are strongly tied to their foraging strategies
- Maintaining structural and successional diversity across the landscape is key
- Well-designed research helps managers understand how forest practices



Thank you!