Managing Prairies for Biodiversity and Ecological Resilience

Chris Helzer

Director of Science

The Nature Conservancy- Nebraska

The Nature Conservancy

Ecological Resilience =
Ability to Remain Within a “Stable” State

Prairie

Range of Stability Domain

Disturbances (fire, grazing, drought, etc.) move the prairie around in the bowl

As long as it stays in the bowl…

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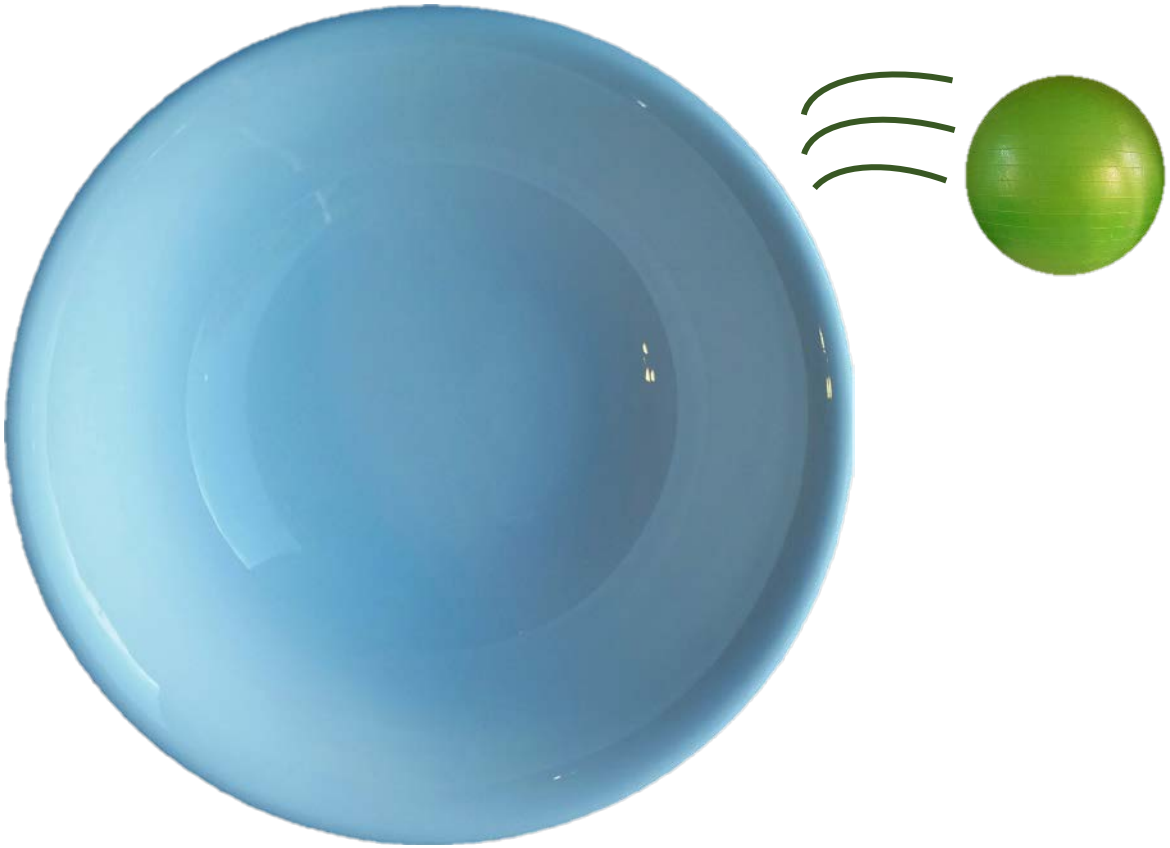
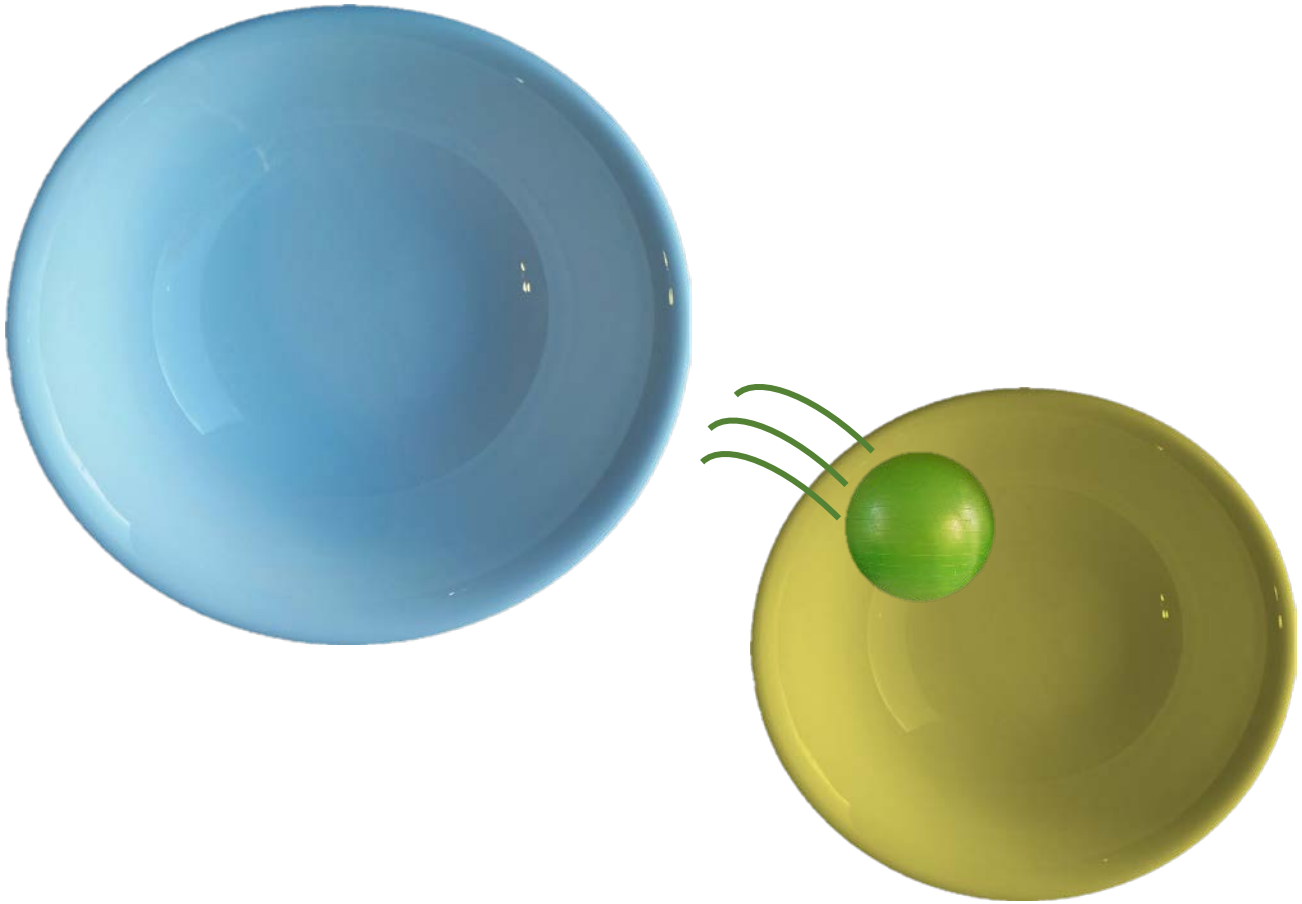
It maintains its integrity
(it's still a prairie)

But if it leaves the bowl…



…it becomes something different



Stable State Thresholds

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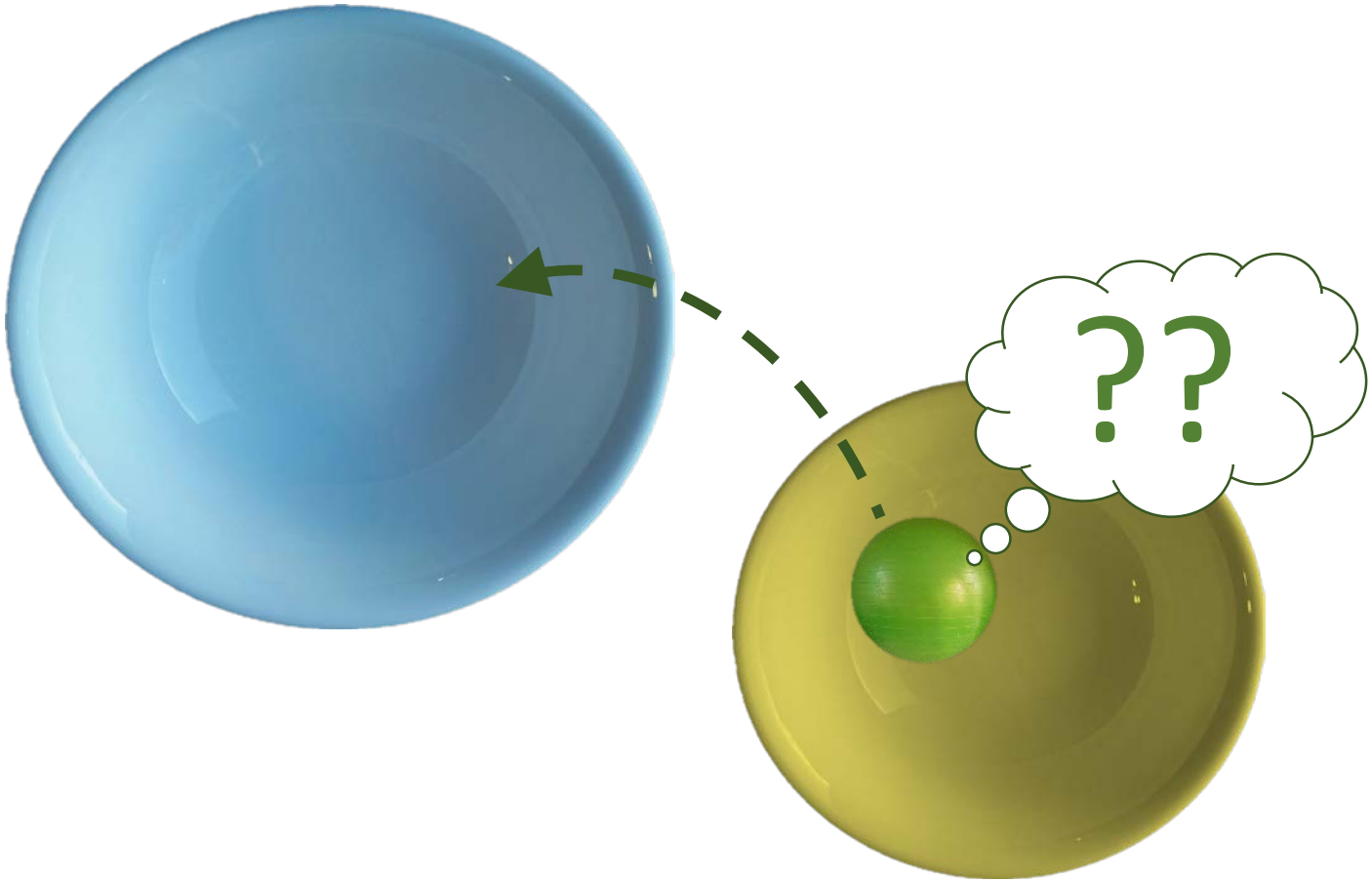
…and it’s VERY difficult to go back



Stable State Thresholds

<u>Degraded Prairie:</u>
Local extinction of many plant/animal species

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Stable State Thresholds

<u>Degraded Prairie:</u>

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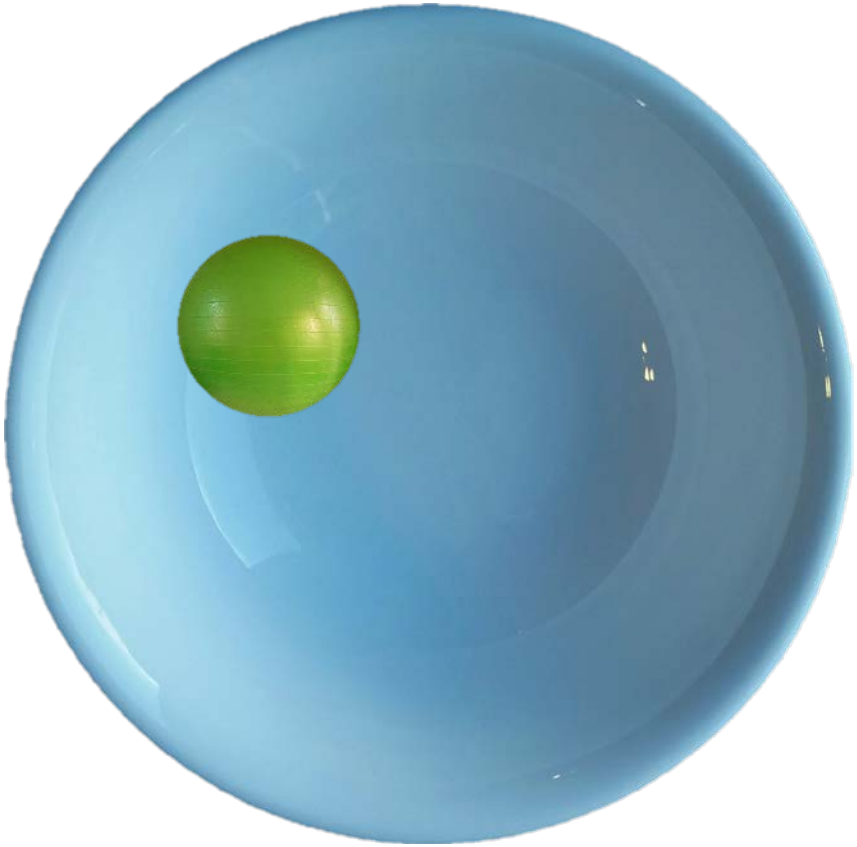
= Loss of productivity and function

= New Stable State?

Our job as prairie managers?

Keep the ball in the bowl.



Importance of Ecological Resilience

Maintain productivity and ecological function in the face of:

- **Drought**
- **Invasive Species**
- **Habitat Loss/Fragmentation**
- **Etc**

Less work needed to manage resilient grasslands

Alternative states are less productive (agriculturally and ecologically)

Resilience Influenced By:

Diversity of Function

-Nitrogen-fixing plants
-Pollinator insects
-Soil nutrient cycling
-Etc.

Diversity of Response

-Response to drought
-Response to summer grazing
-Response to fire
-Etc.

How Do We Build/Maintain Ecological Resilience in Prairies?

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1. Species Diversity

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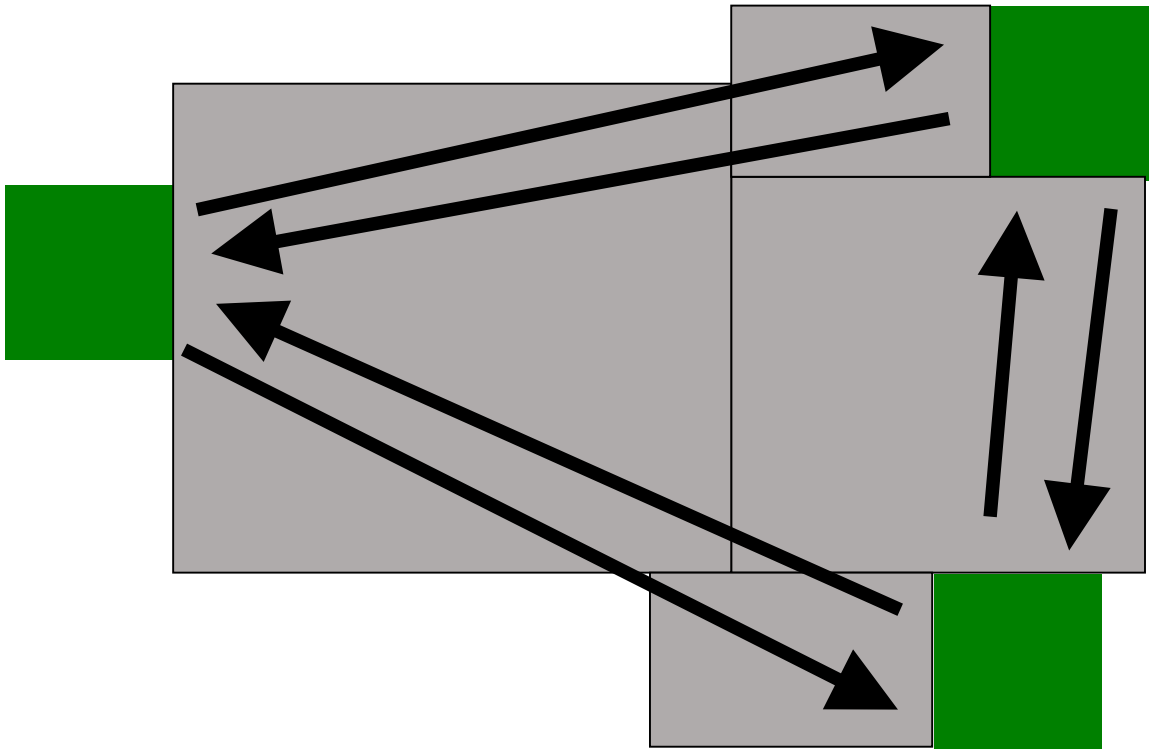
2. Prairie Size/Habitat Redundancy

How Do We Build/Maintain Ecological Resilience in Prairies?

3. Habitat Connectivity



Strategies That Promote Ecological Resilience

Prairie protection

- Prevent loss/fragmentation of remaining grasslands

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Today

Prairie Management

- Prescribed Fire
- Grazing
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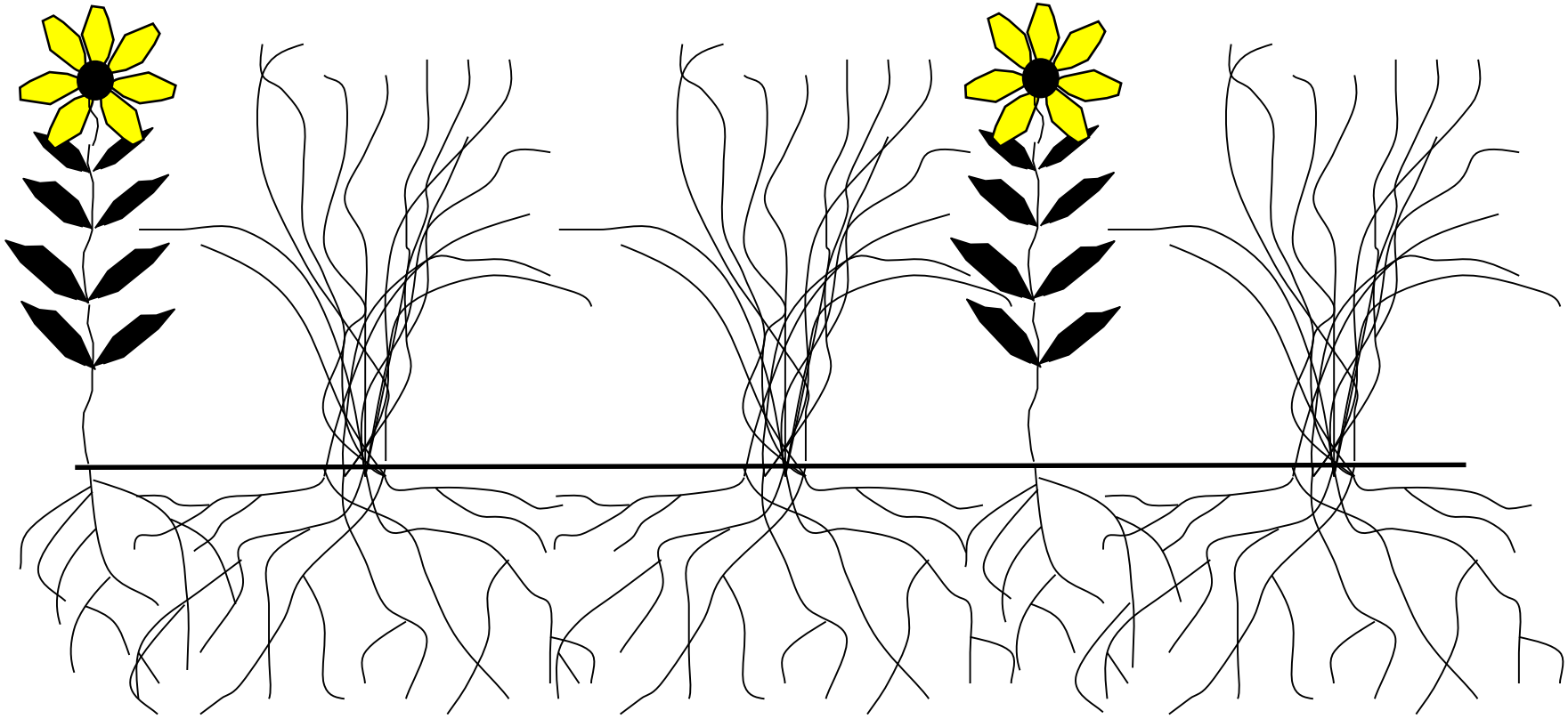
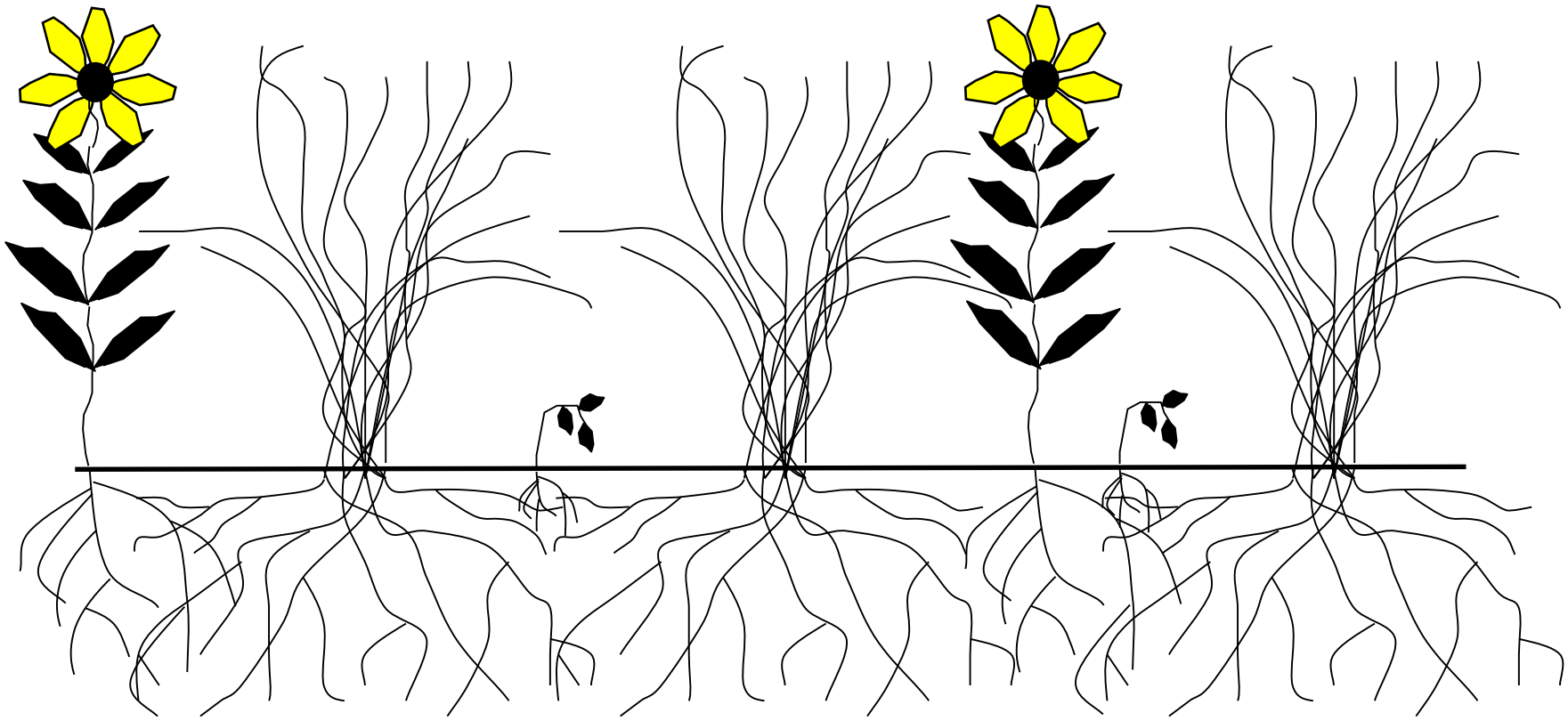
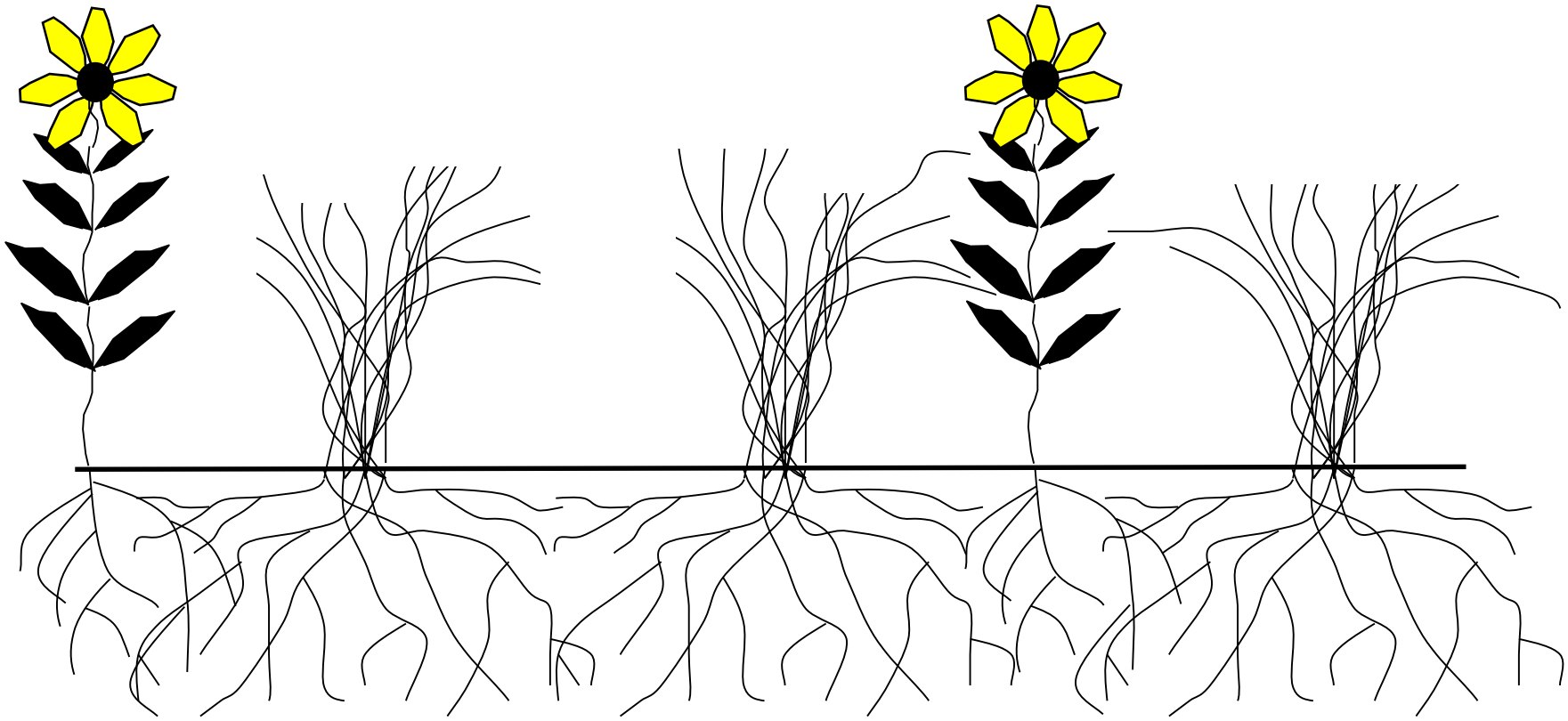
Illustration: Dominant grasses monopolizing light and soil resources



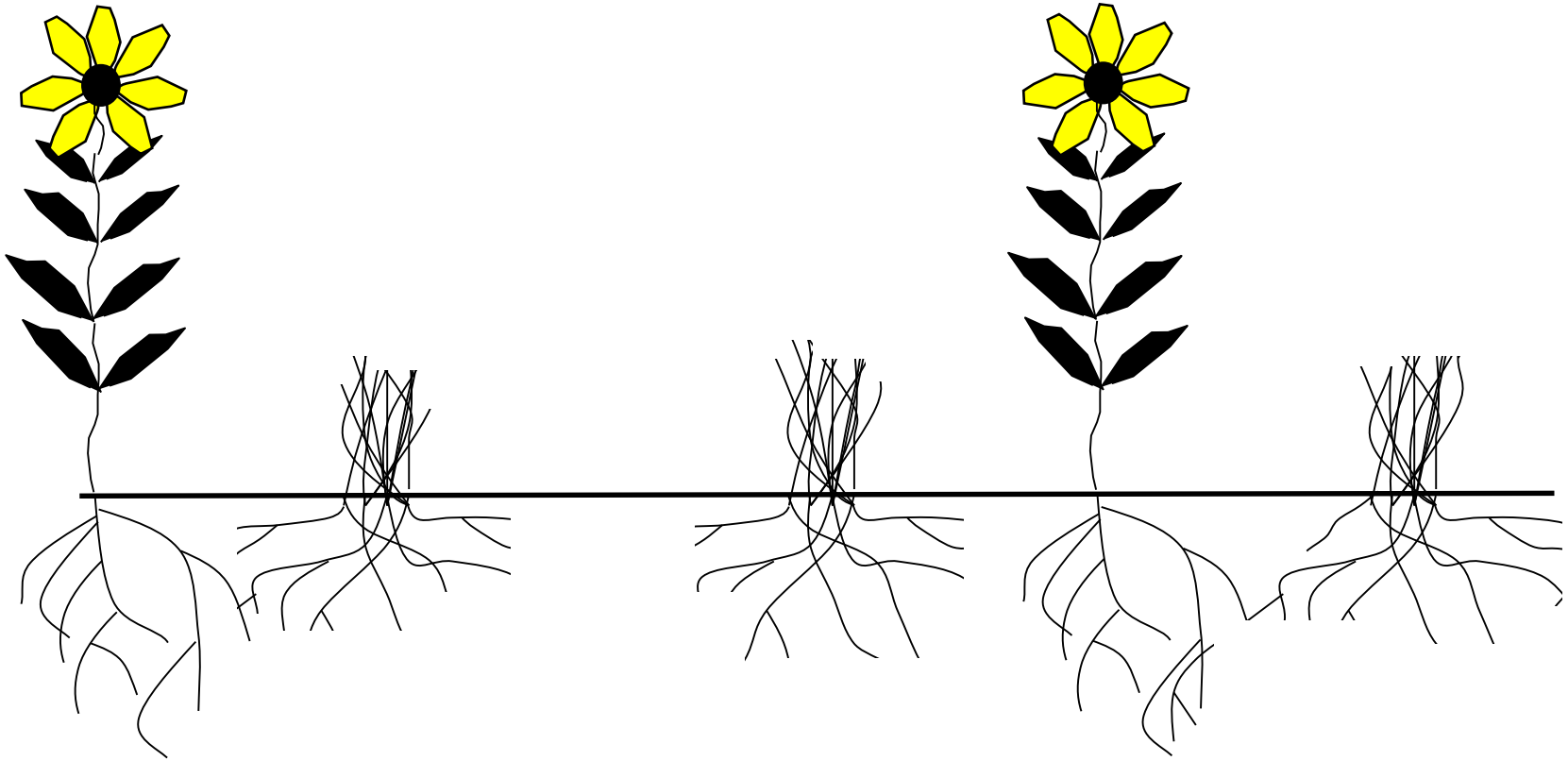
No room for recruitment of new plants



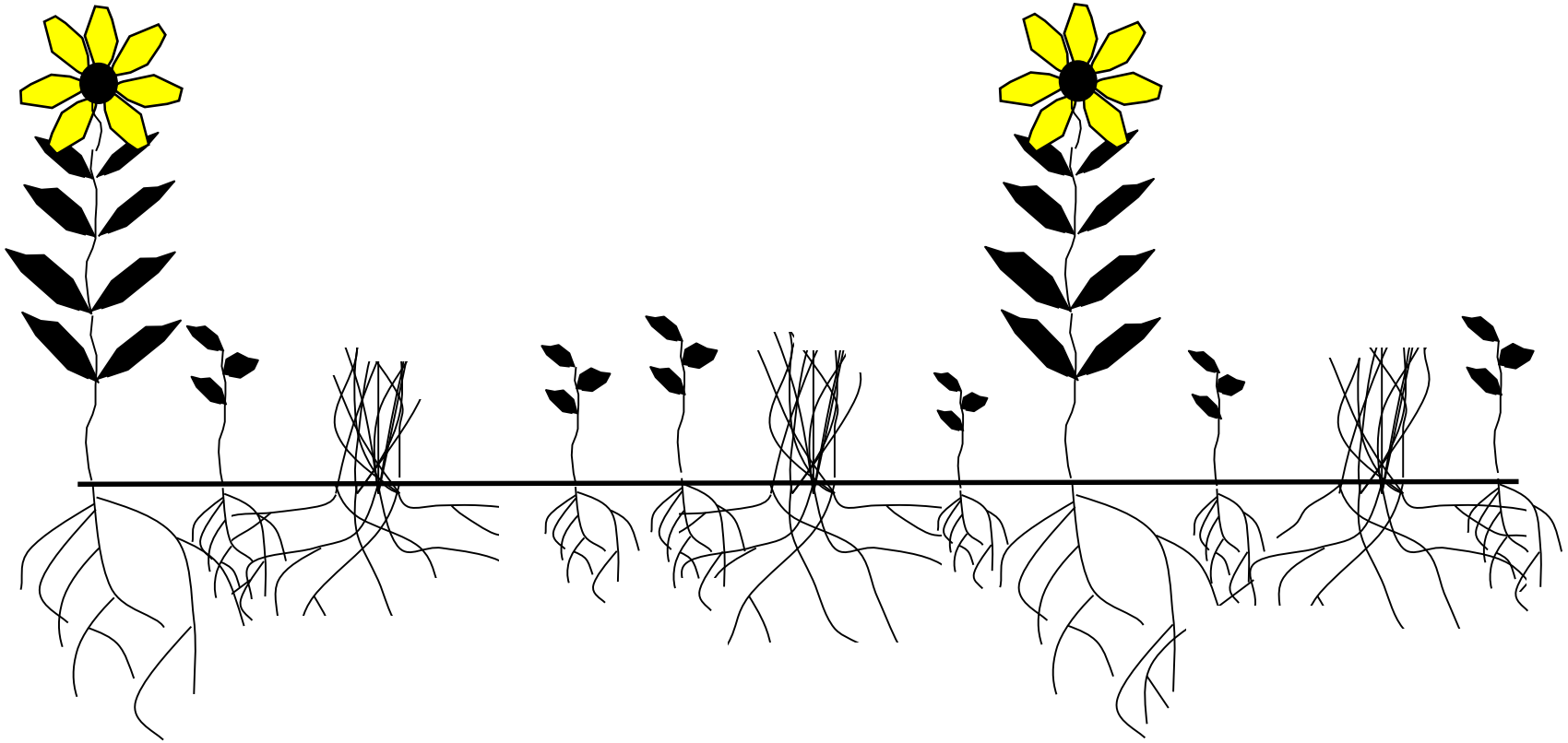
Moderate defoliation doesn’t alter much



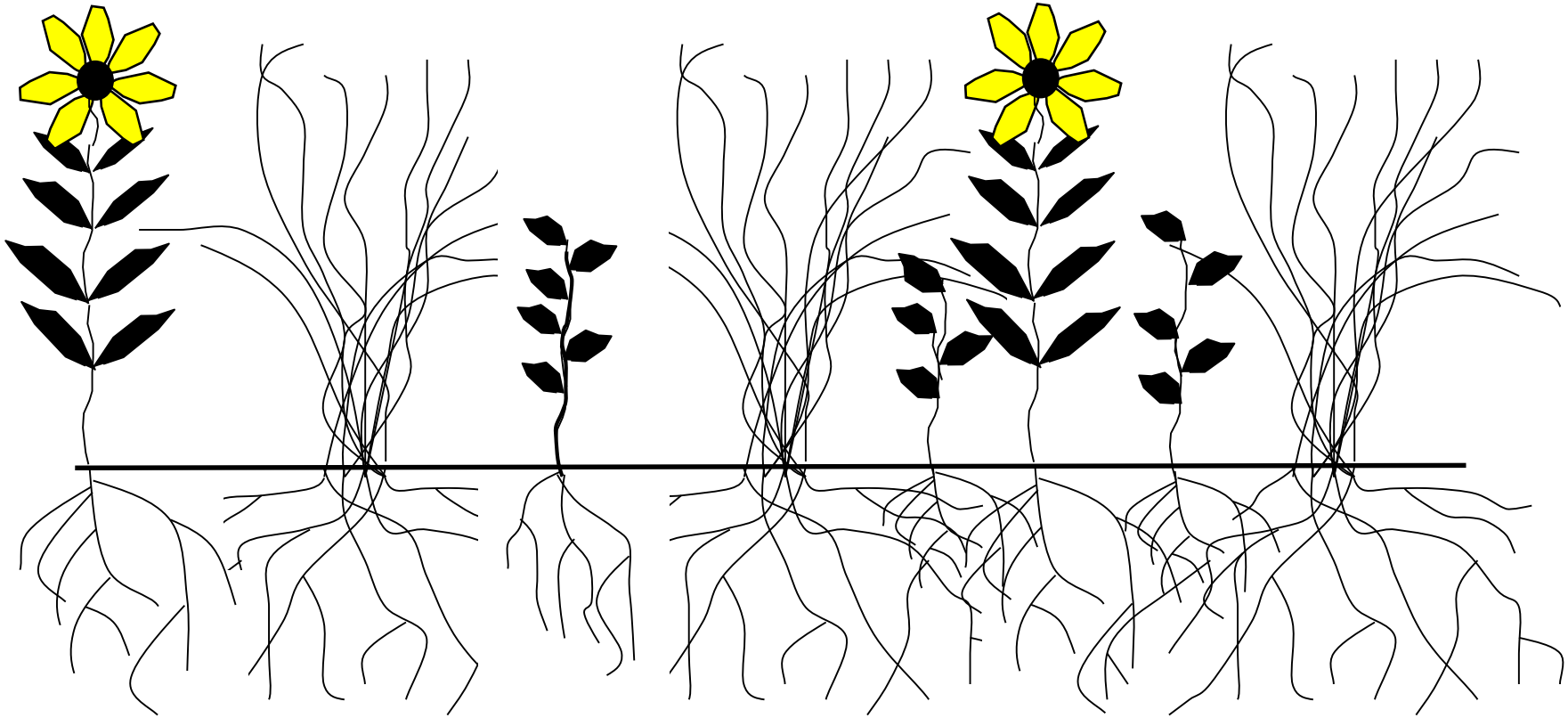
Severe defoliation greatly reduces root mass and opens soil to light



…providing chances for both short-lived and long-lived plants to establish



Some will drop out as grasses recover, others will persist

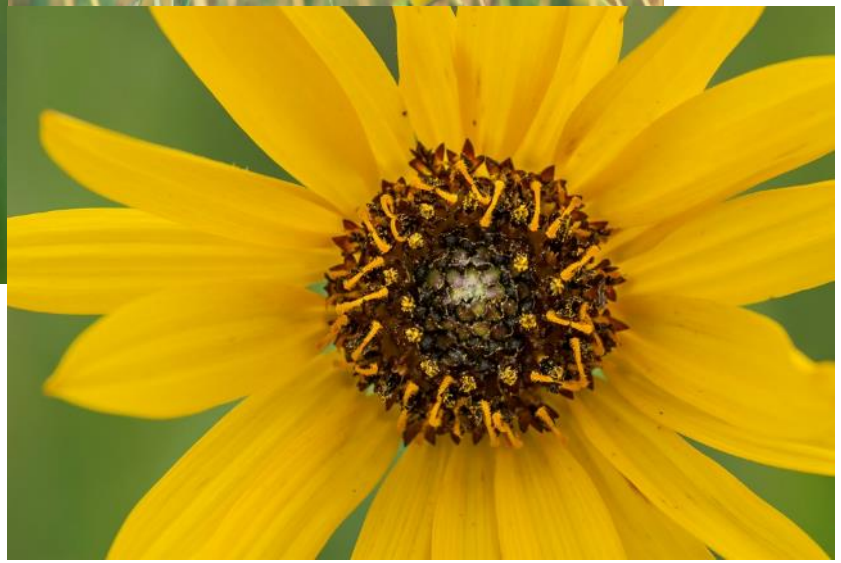


Timelapse imagery of prairie patch recovering from 2012 drought/wildfire
TNC Niobrara Valley Preserve, Nebraska

2014 – (Two Years After Fire.) Bison on site throughout recovery period

2015 – (Three Years After Fire.) Both photos from mid June

Stiff Sunflower



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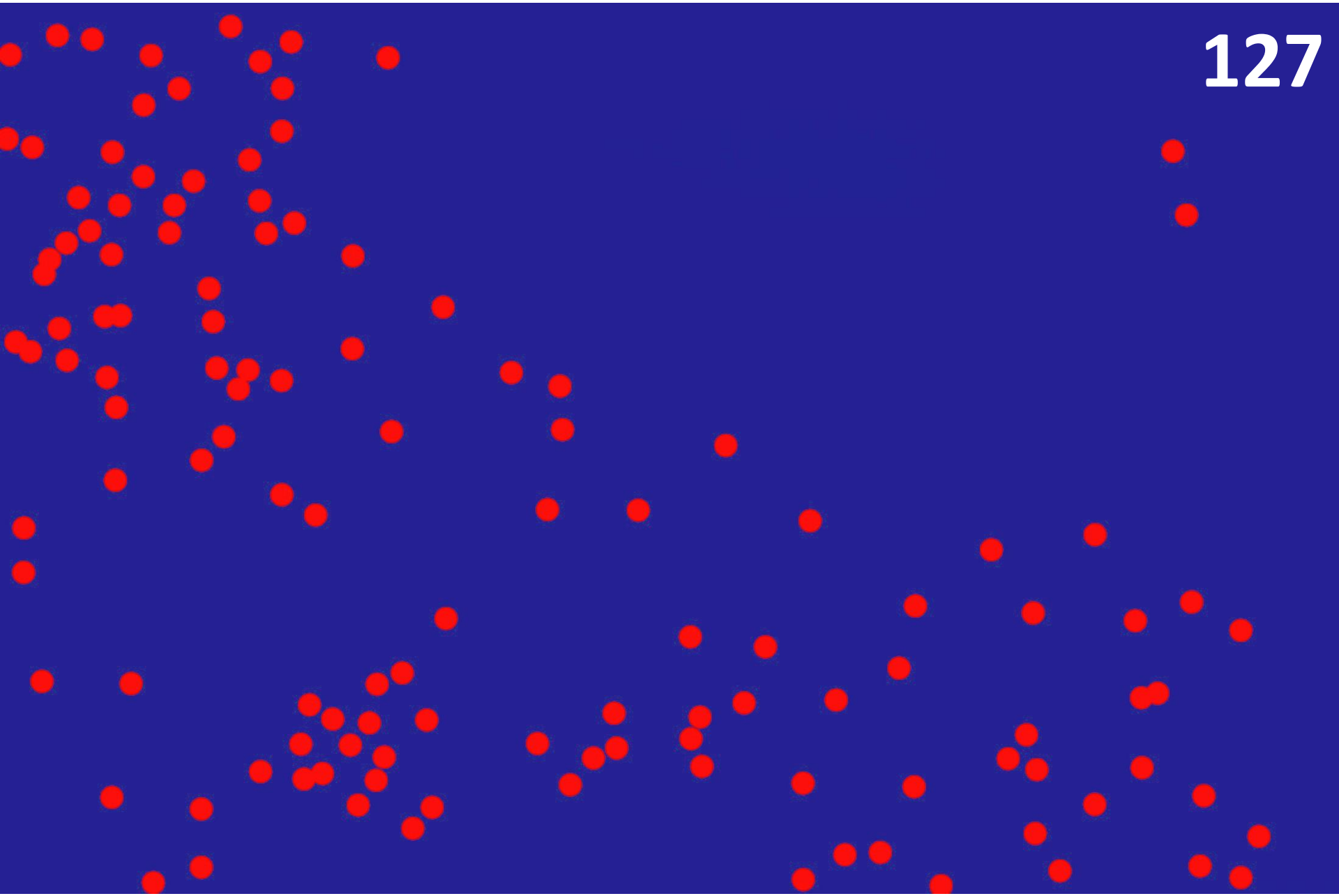
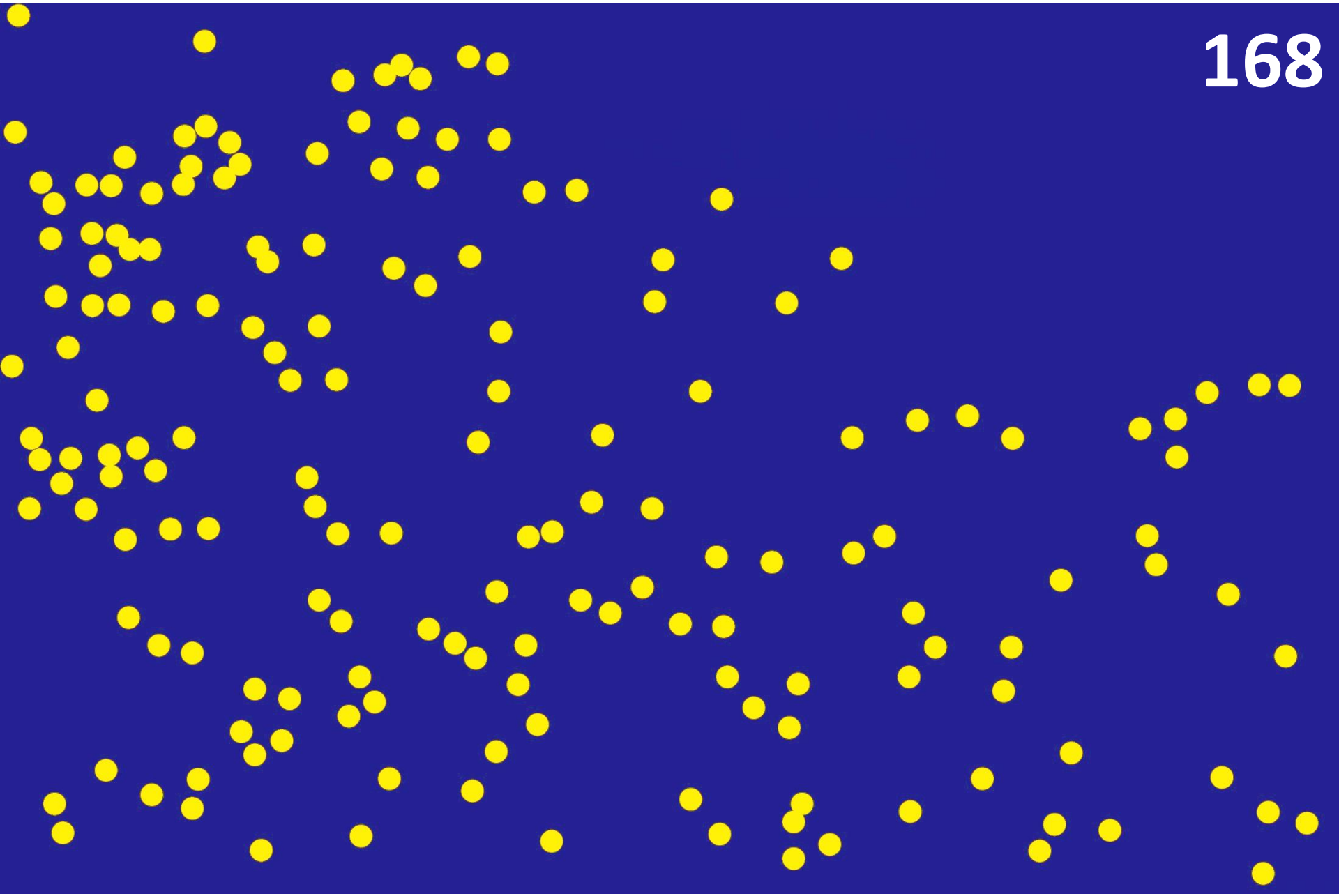


Stiff Sunflower - 2015



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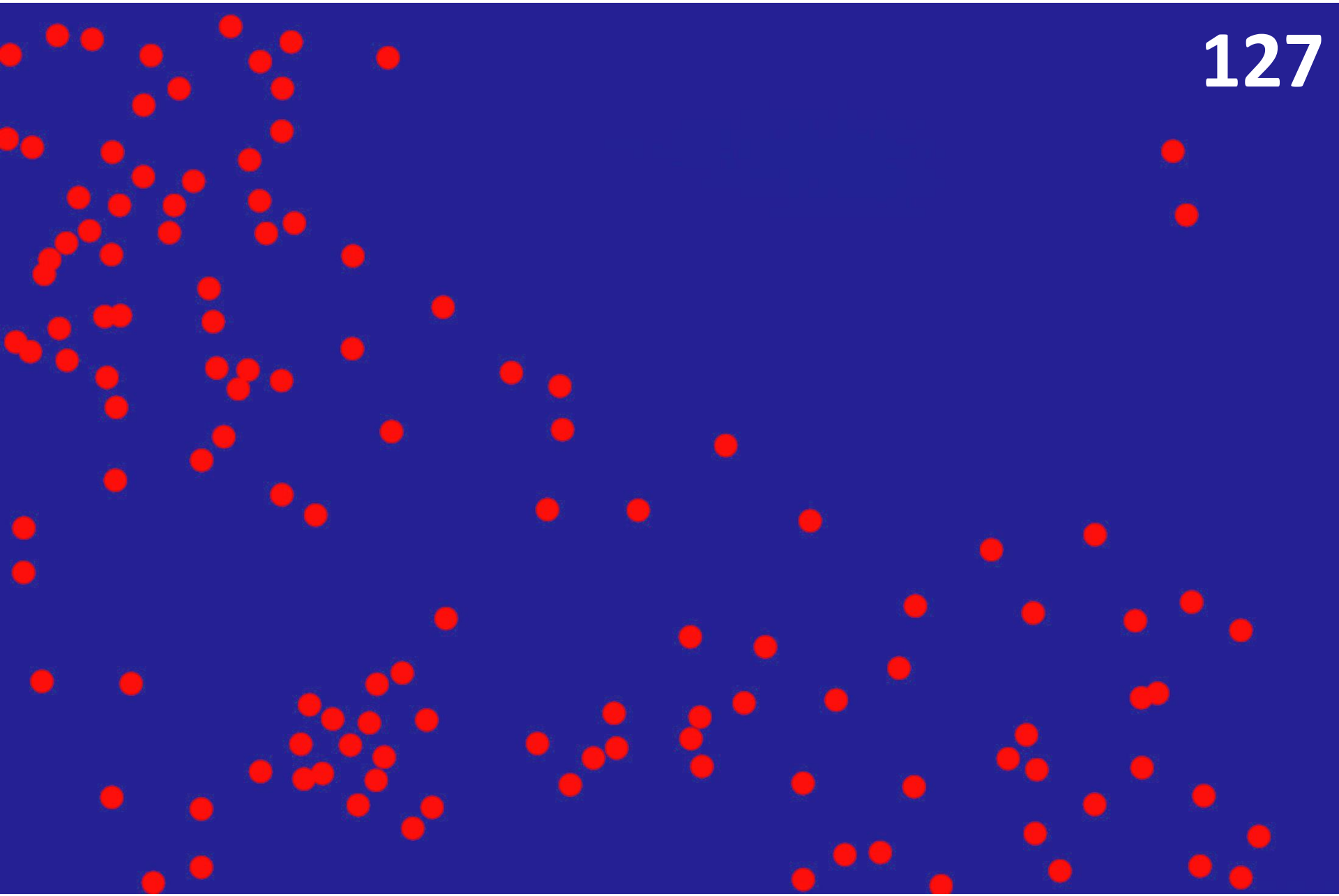

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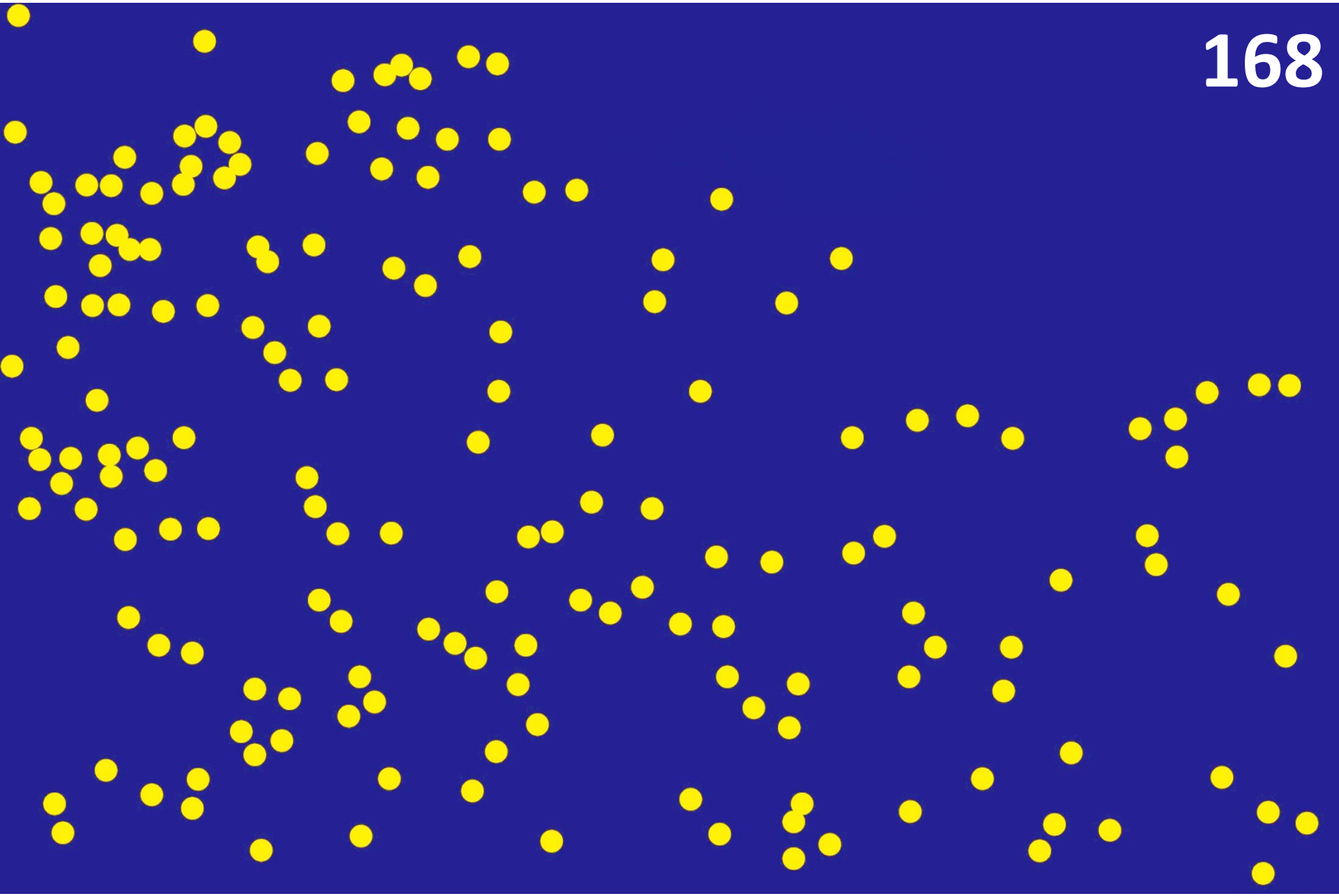

Western Ragweed

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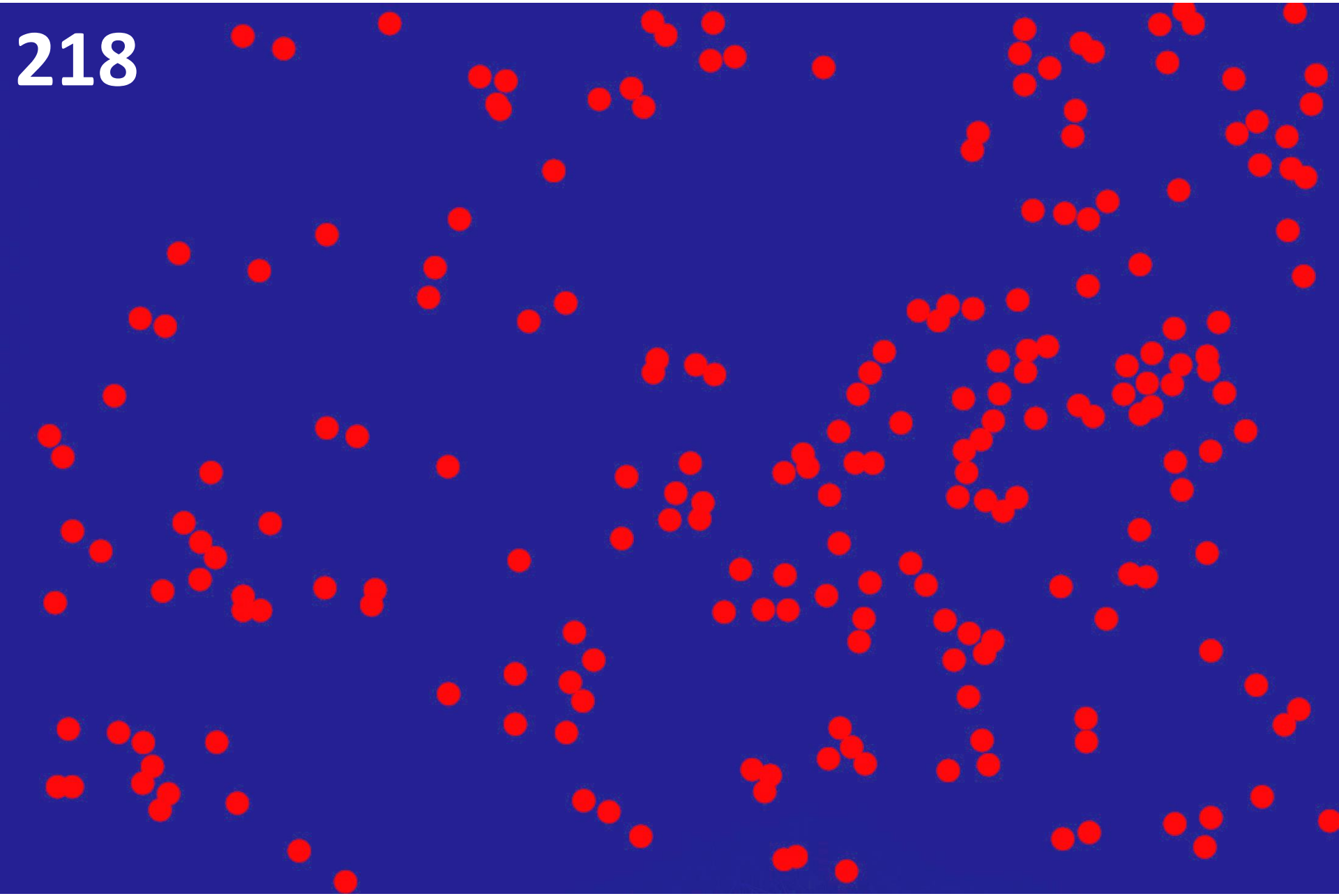

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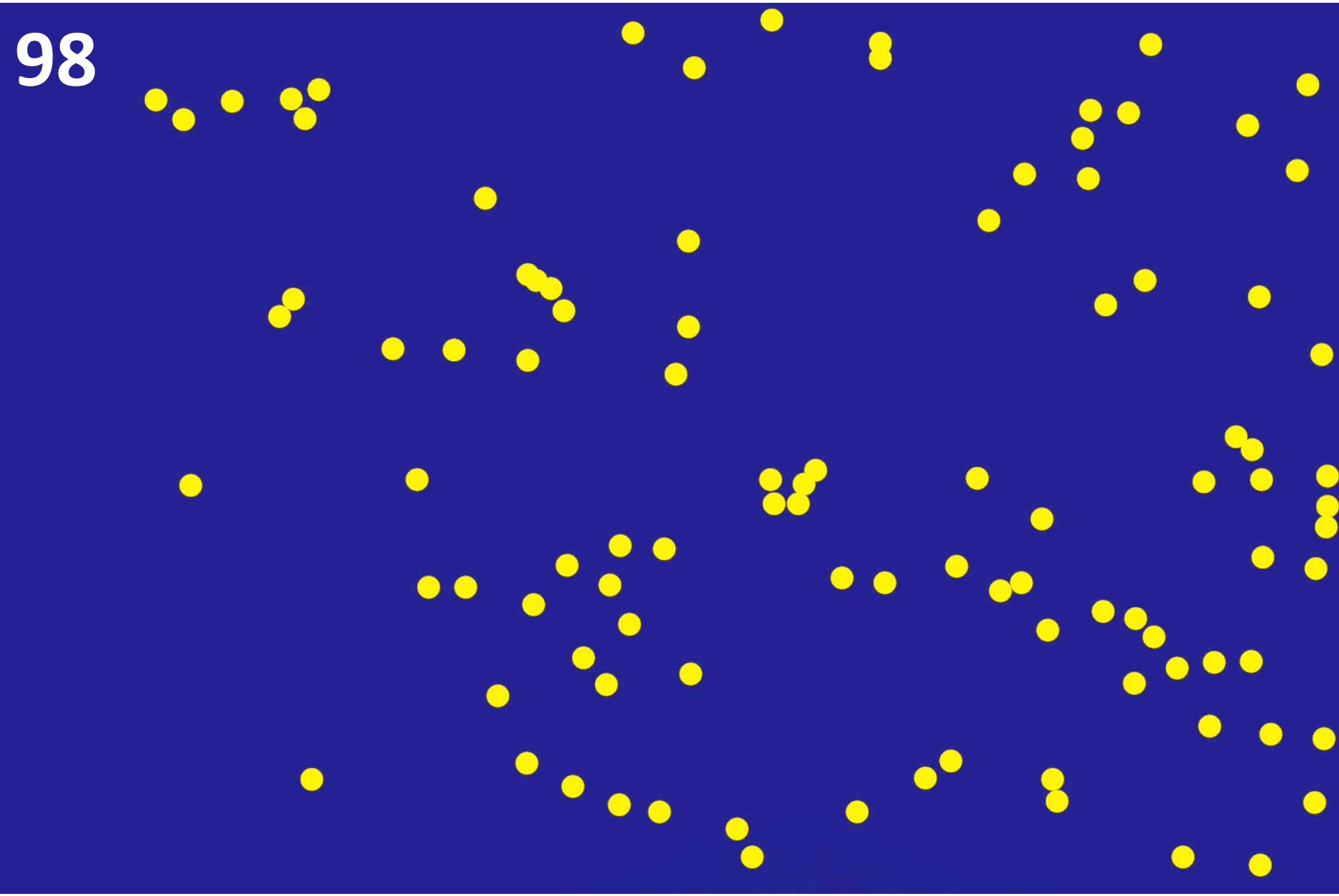

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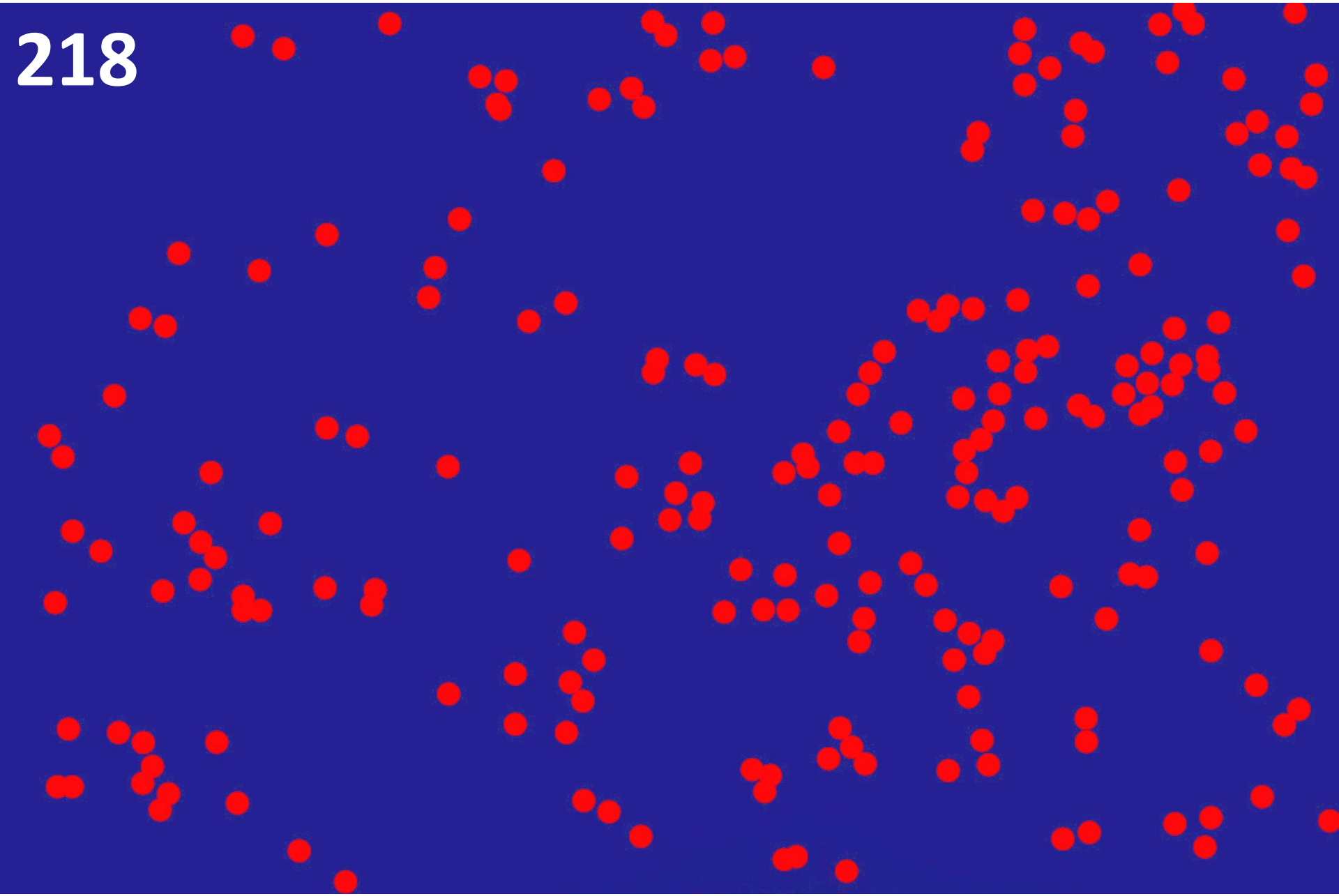

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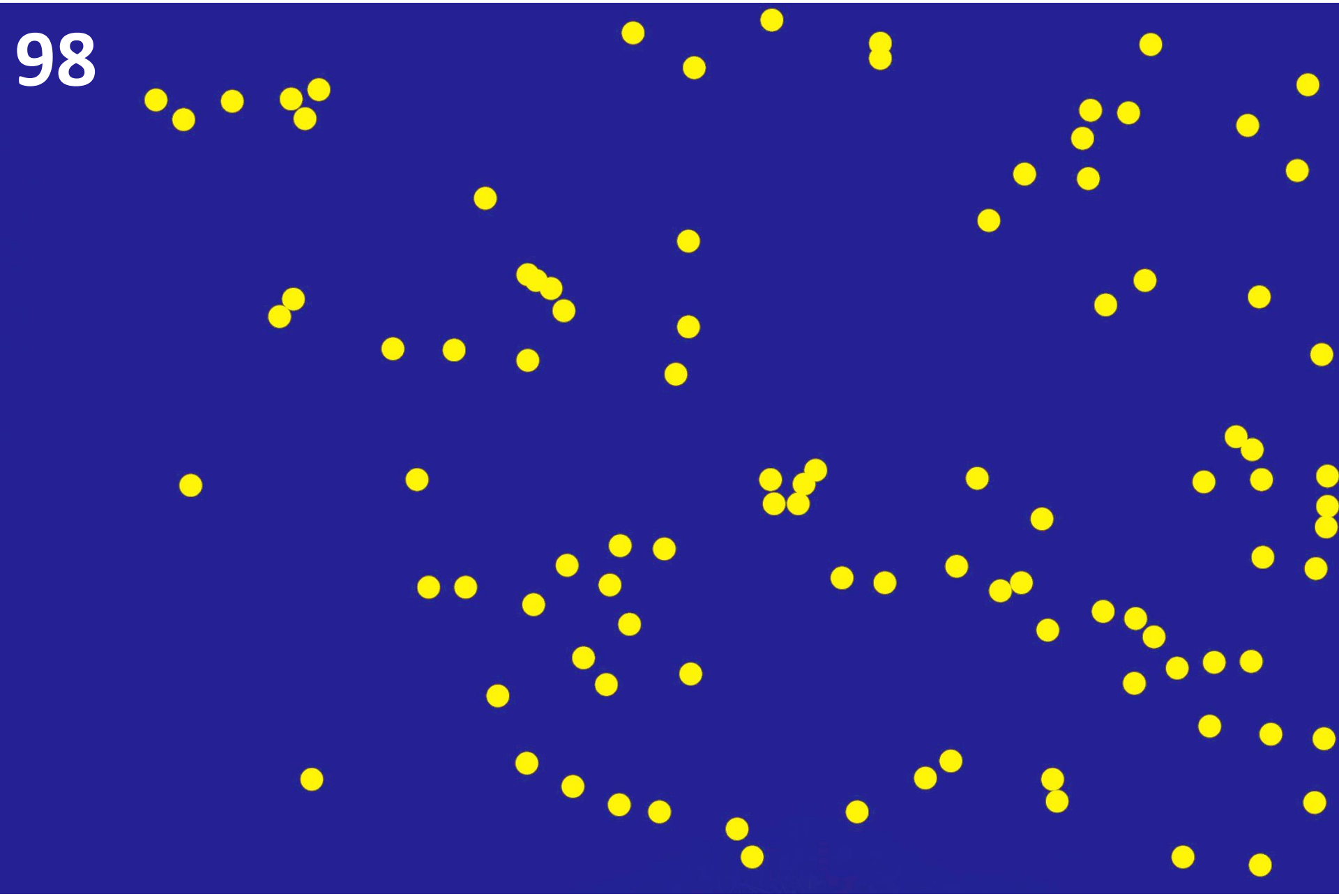

Who Wants Weeds??

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Pollinators

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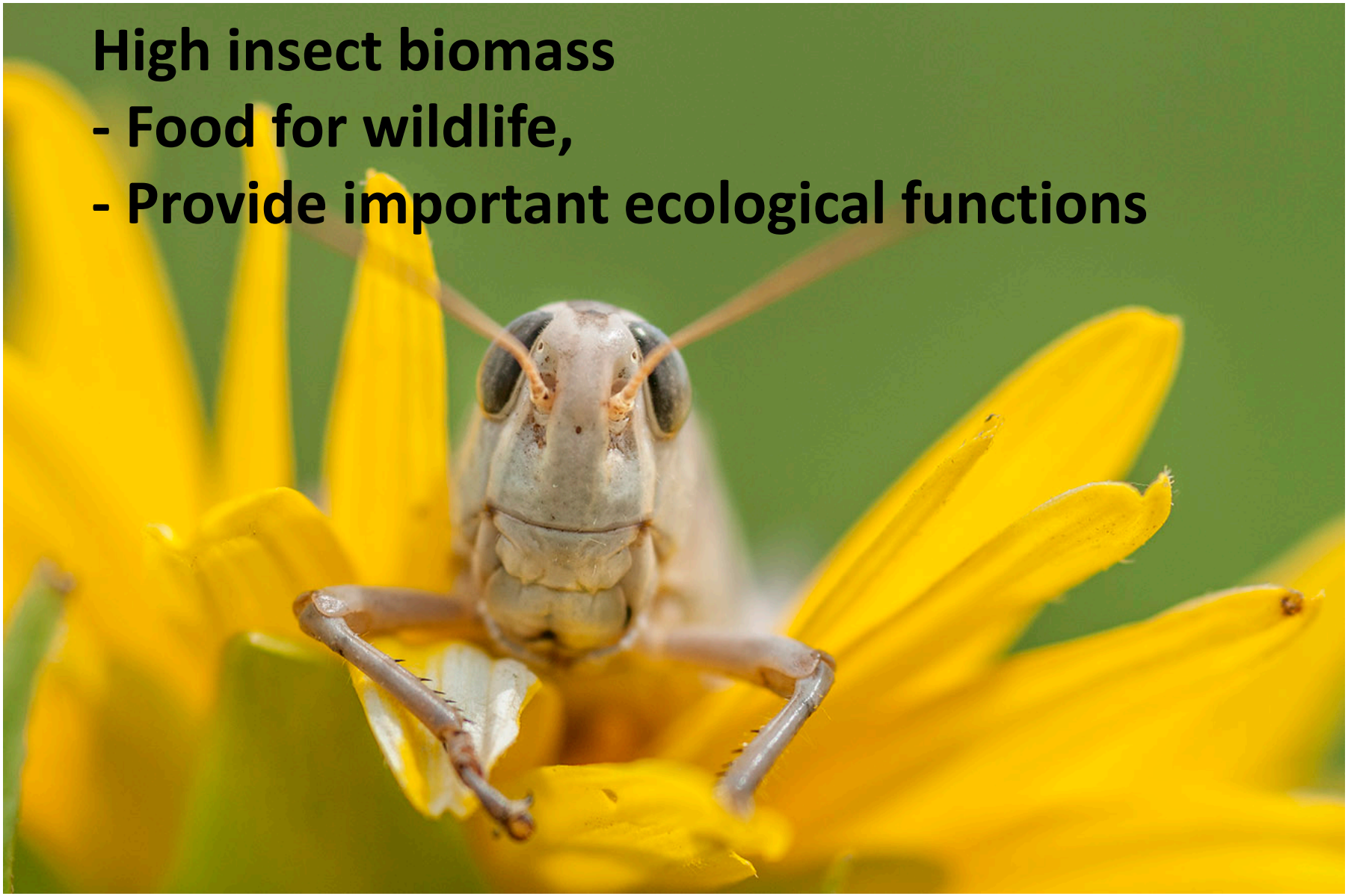
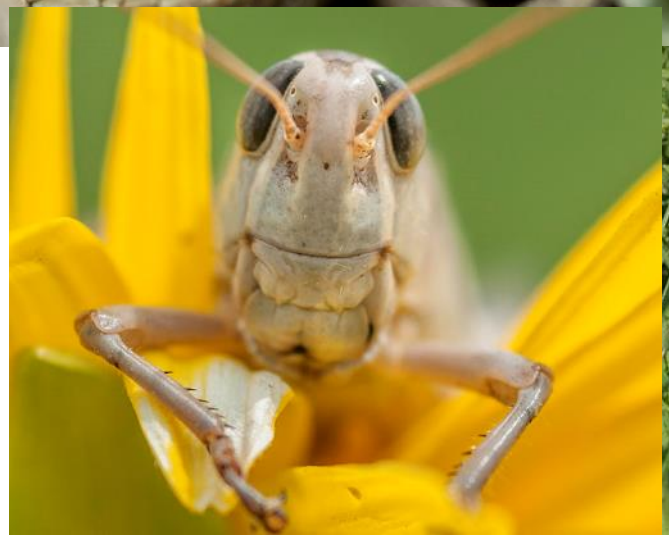


Who Wants Weeds??

Brood-rearing and/or nesting cover

Who Wants Weeds??

Easy thermoregulation (patches of sun and shade)



Shifting mosaic of habitat patches

- Provide patches that represent the broadest possible spectrum of habitat types.

- Shift the location of those patch types every year - avoid simple repetitive patterns.

Habitat Conditions – Vegetation Structure

Examples of Habitat Structure:

- Tall dense vegetation

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Management Treatments ➡ Habitat Patch Types

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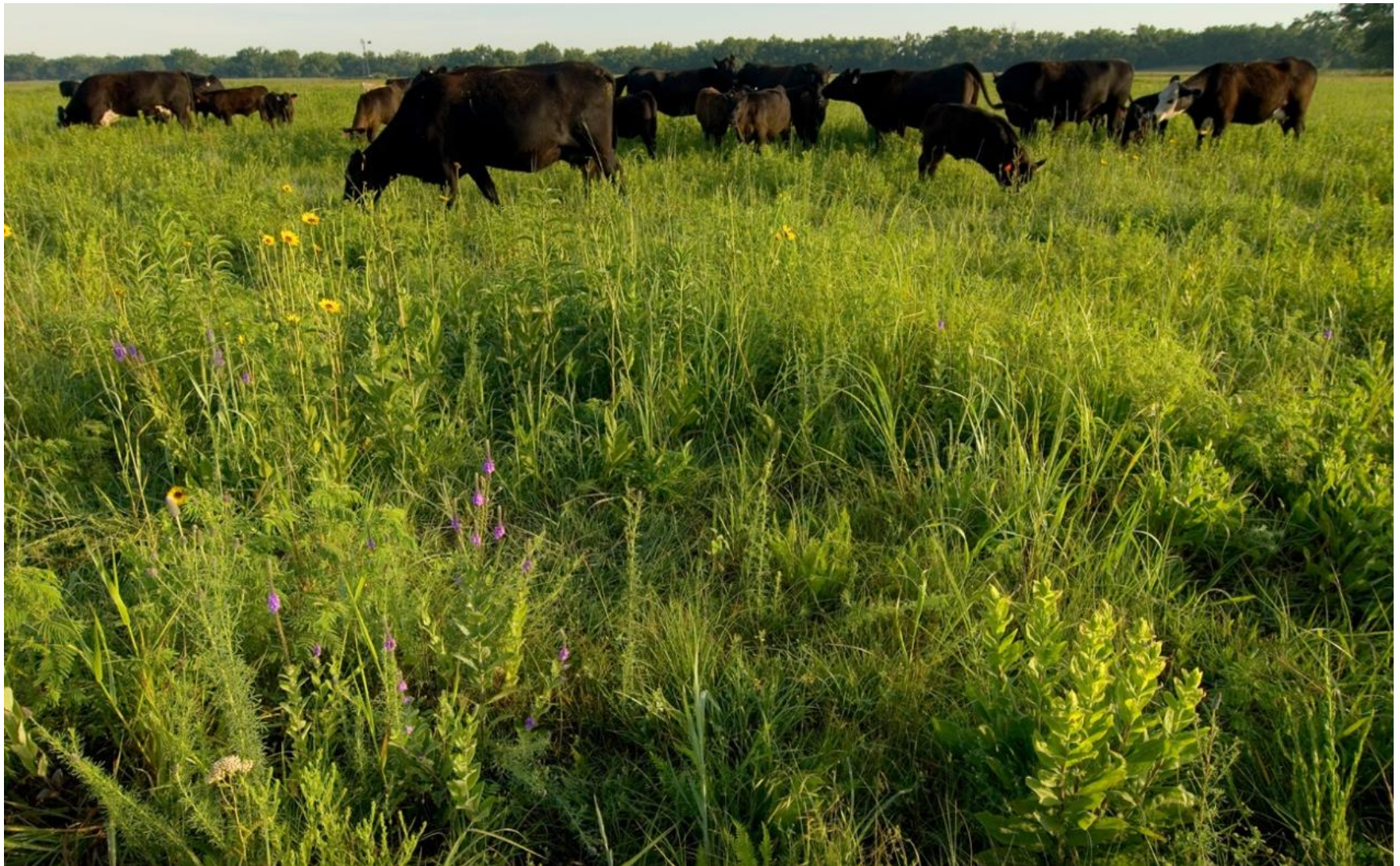
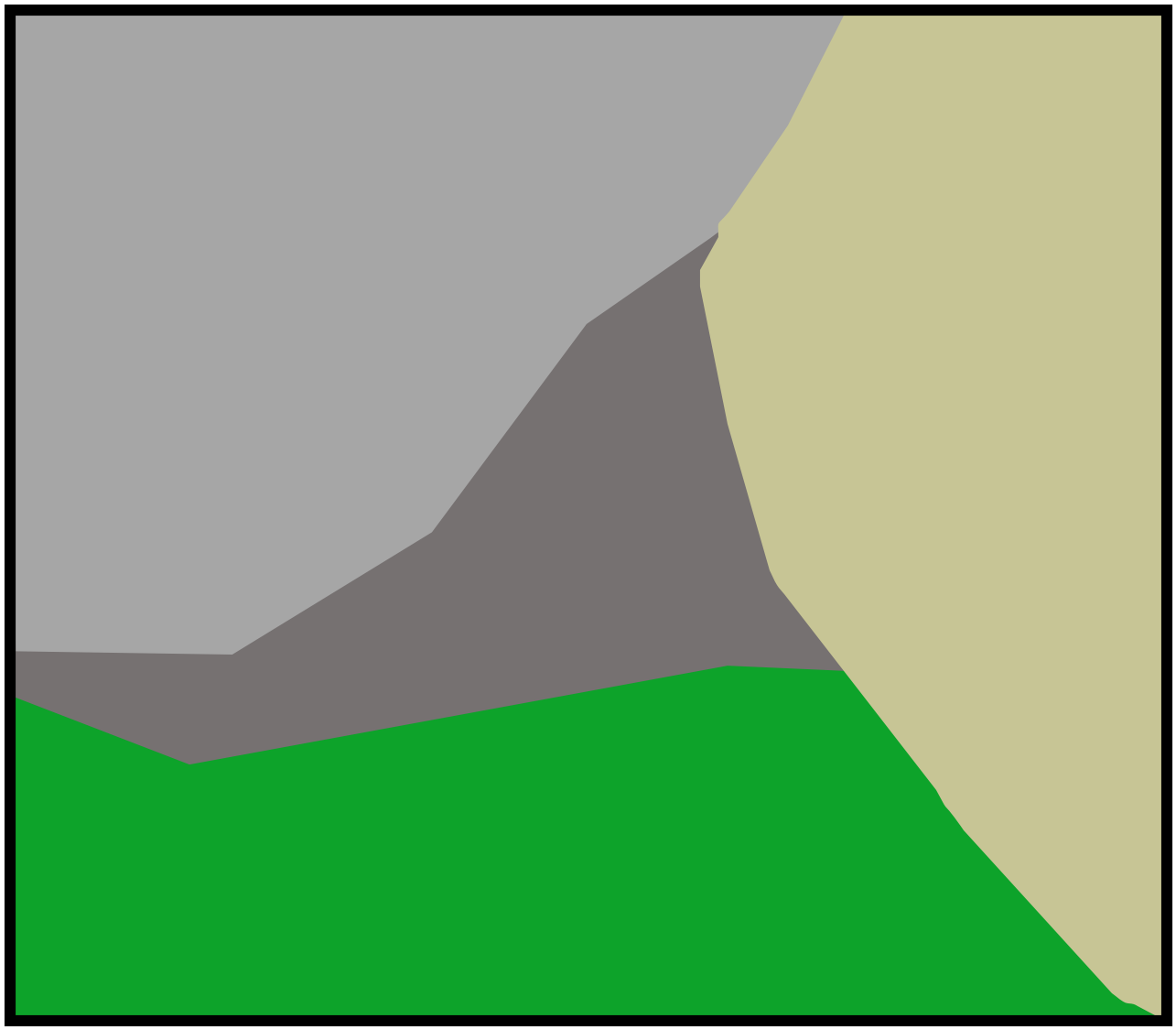
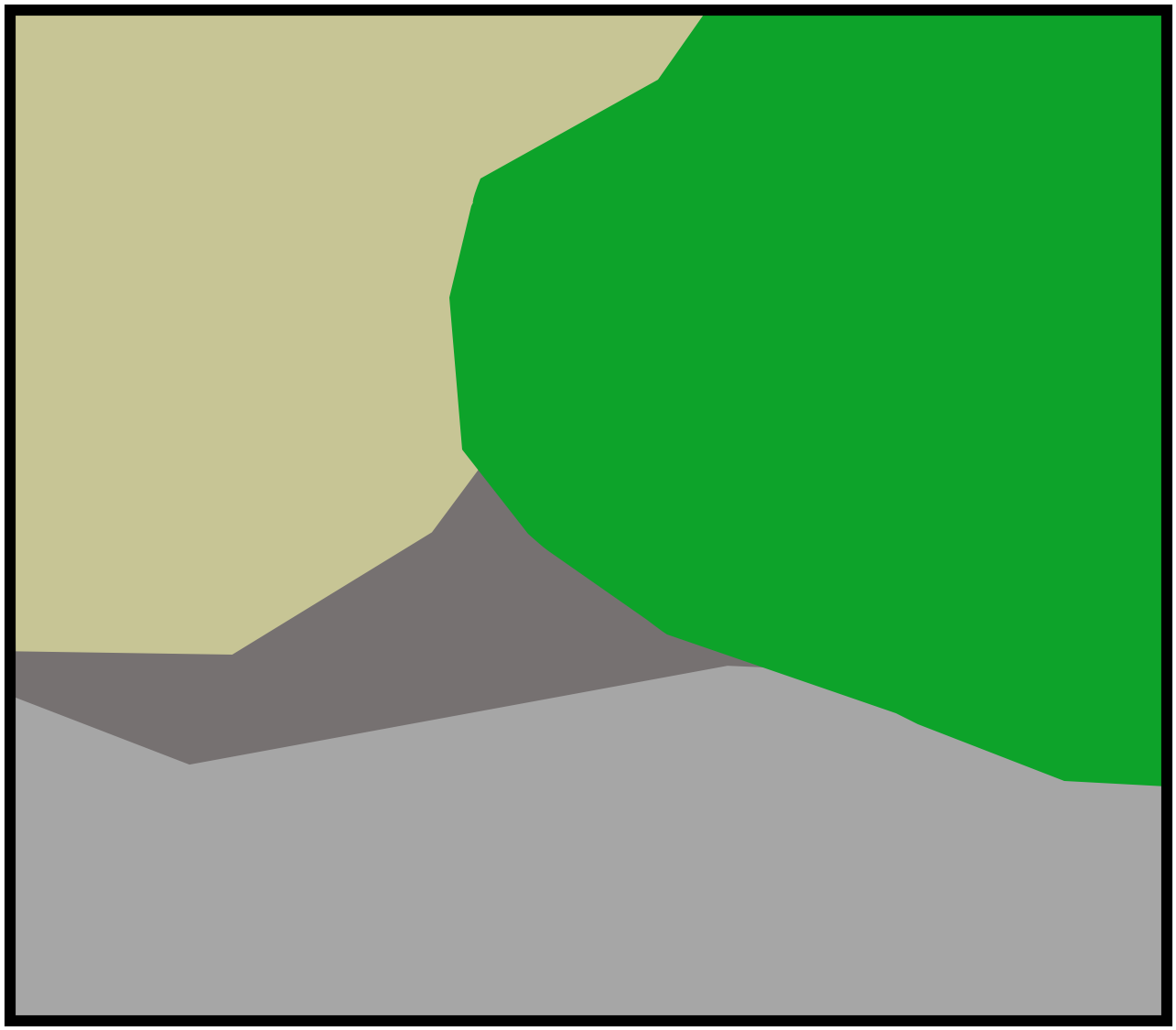
Fully-recovered prairie = tall dense vegetation

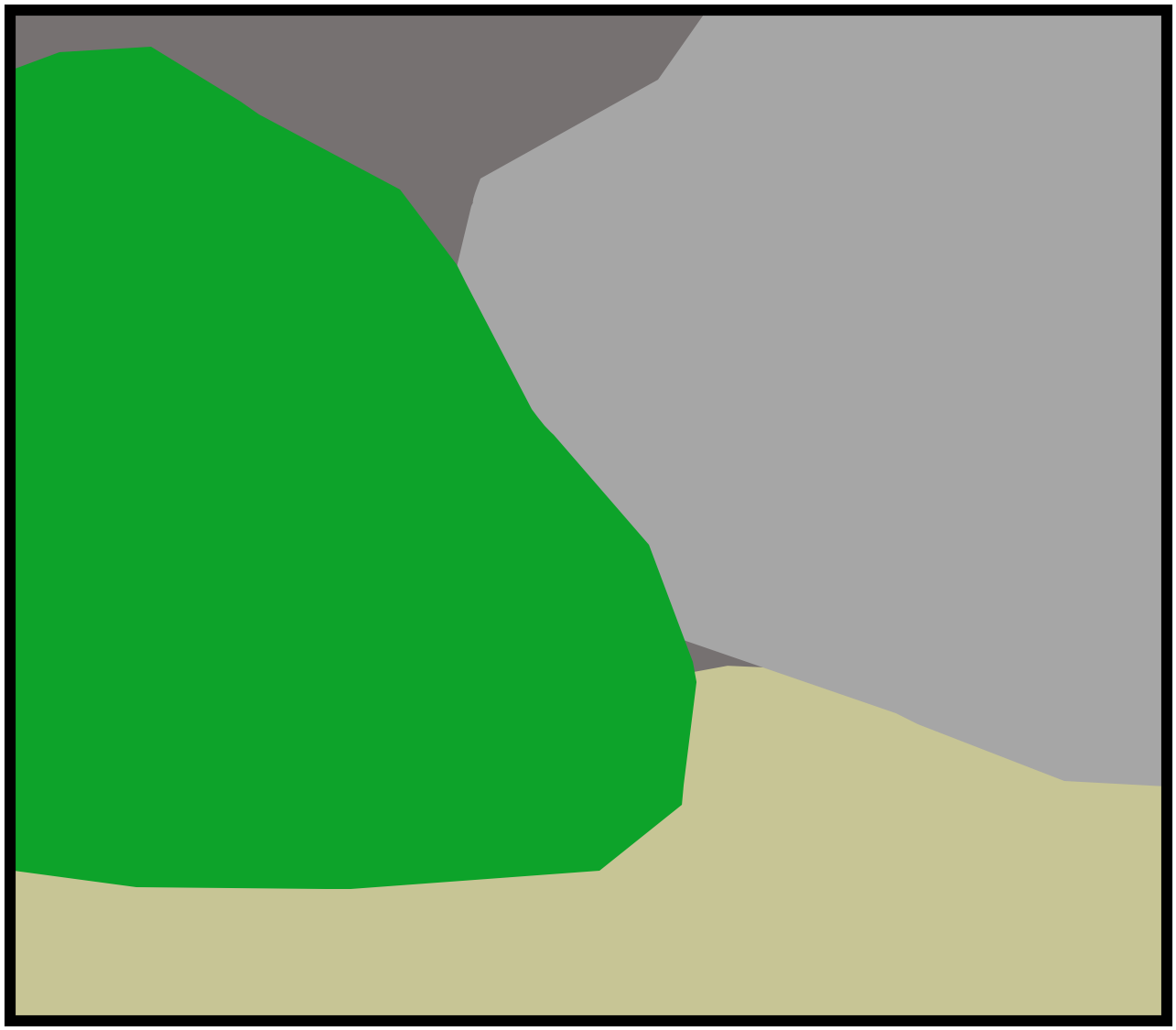
Long-duration, moderate intensity grazing provides valuable habitat
But it's only one of many important types

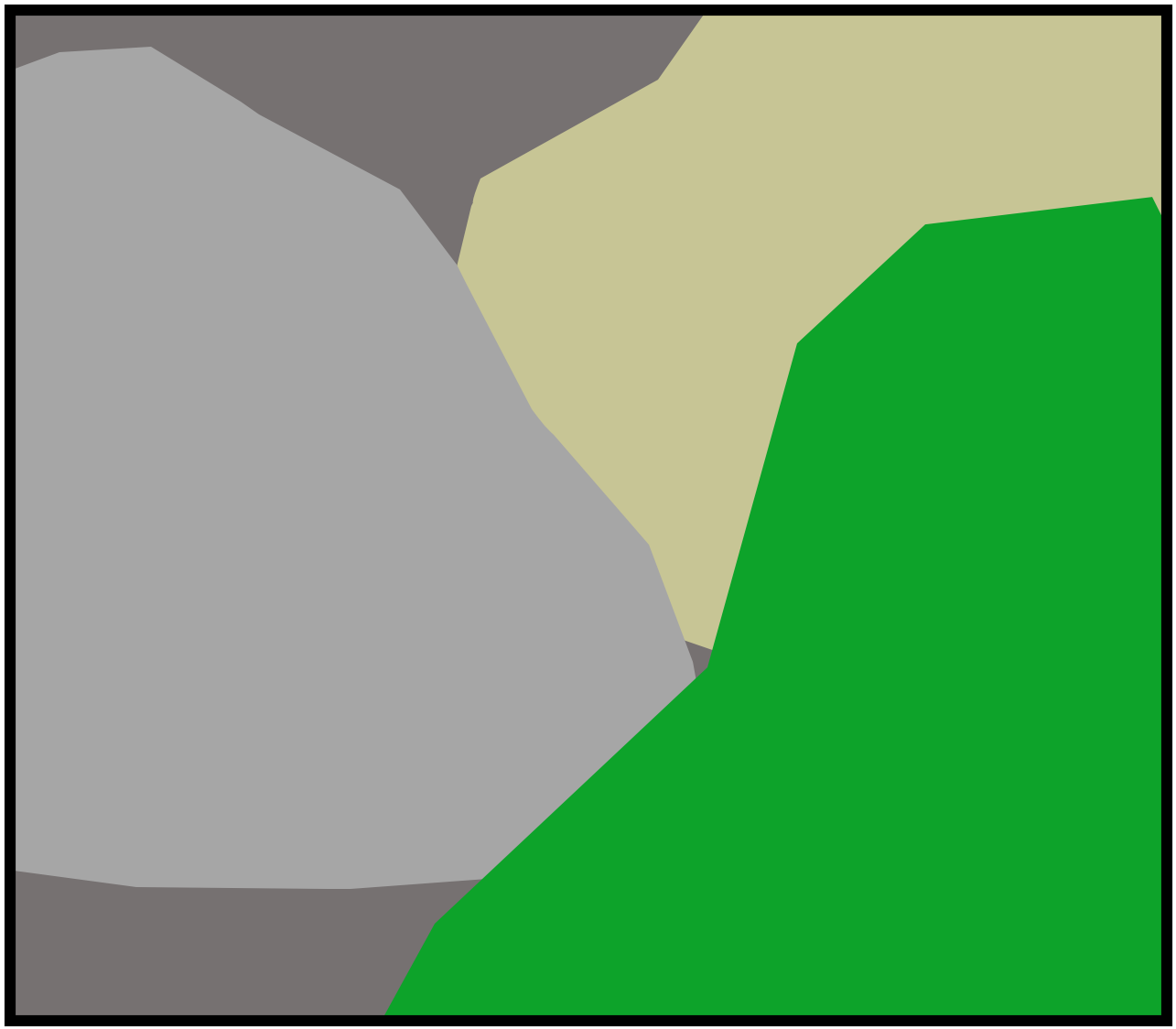


Important: vary location of each habitat type through time









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- Maintains Biological Diversity

Value of Long Grazing Periods (and Long Rest Periods)

Shorter grazing period = faster recovery (no weedy period)

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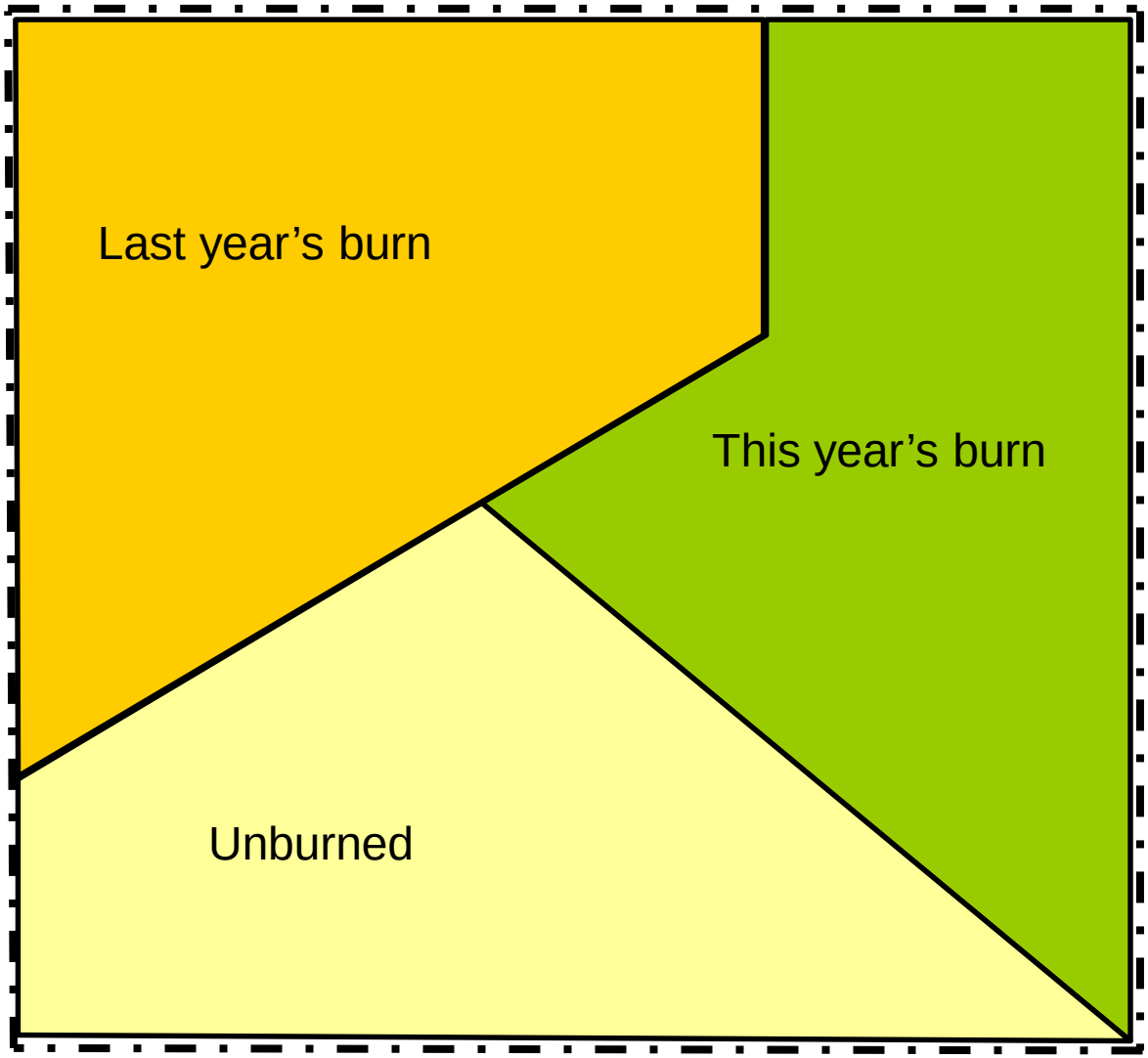
Fast rotations with moderate grazing = very little heterogeneity in habitat

Example 1: Patch-Burn Grazing



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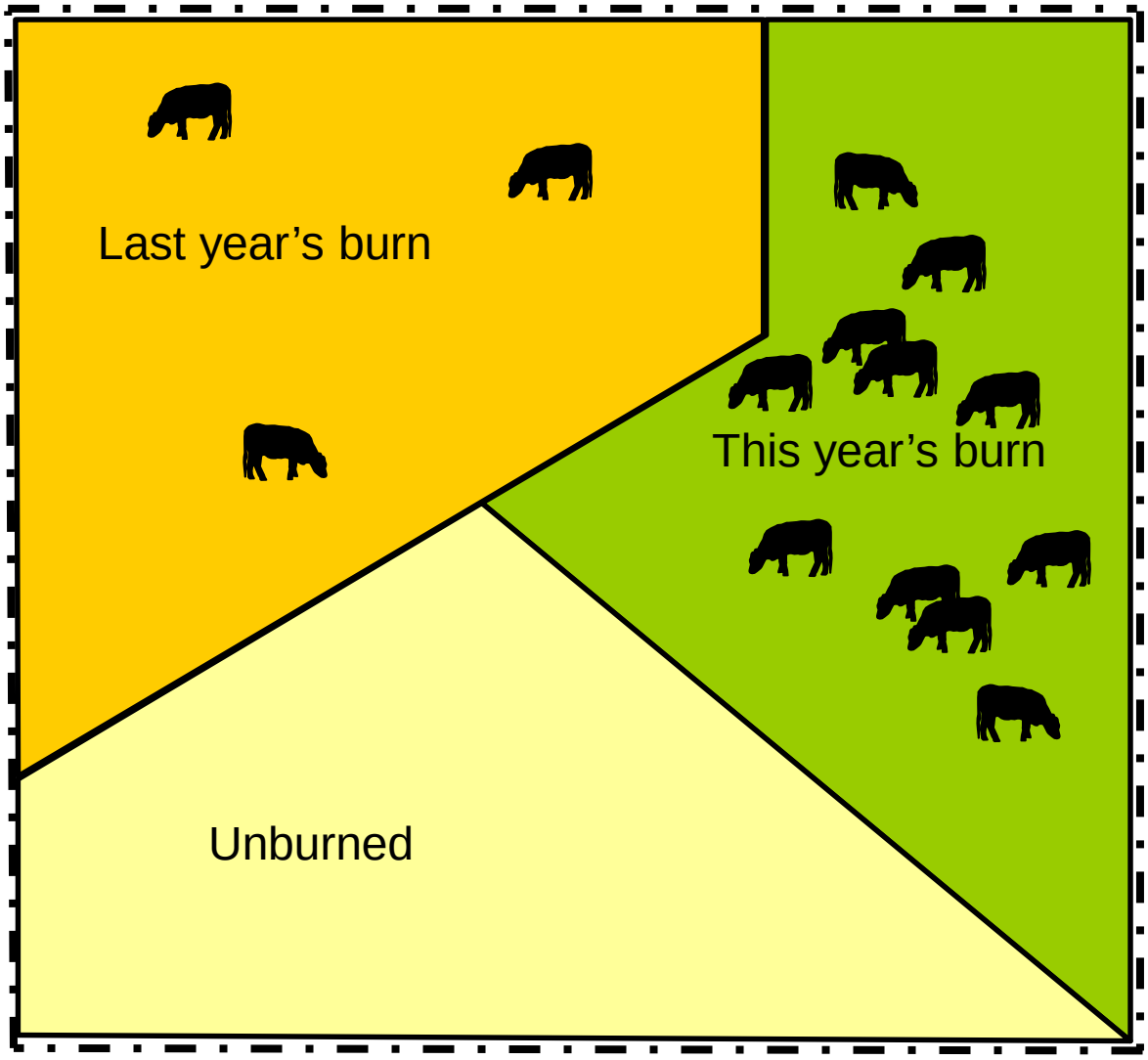

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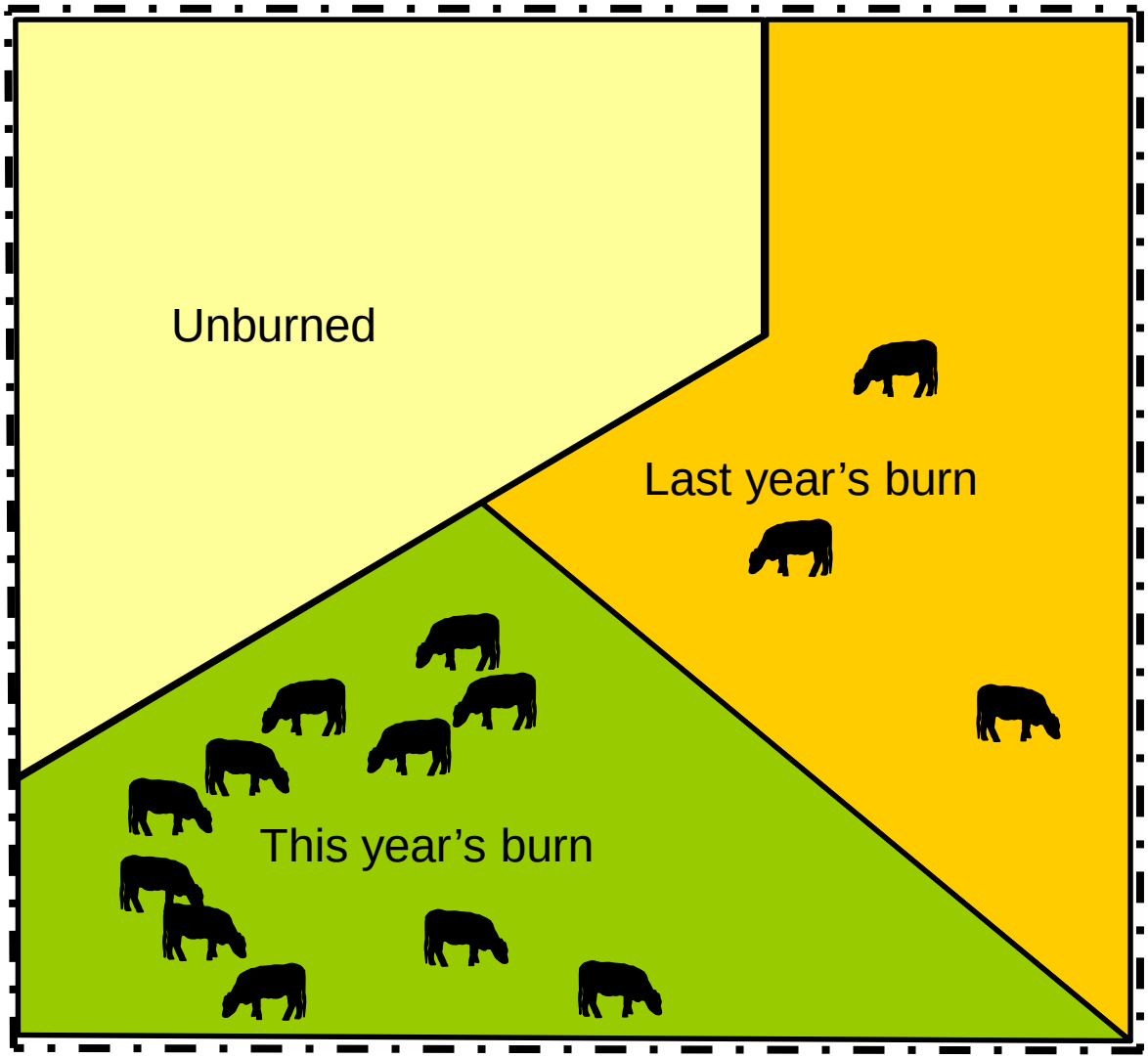
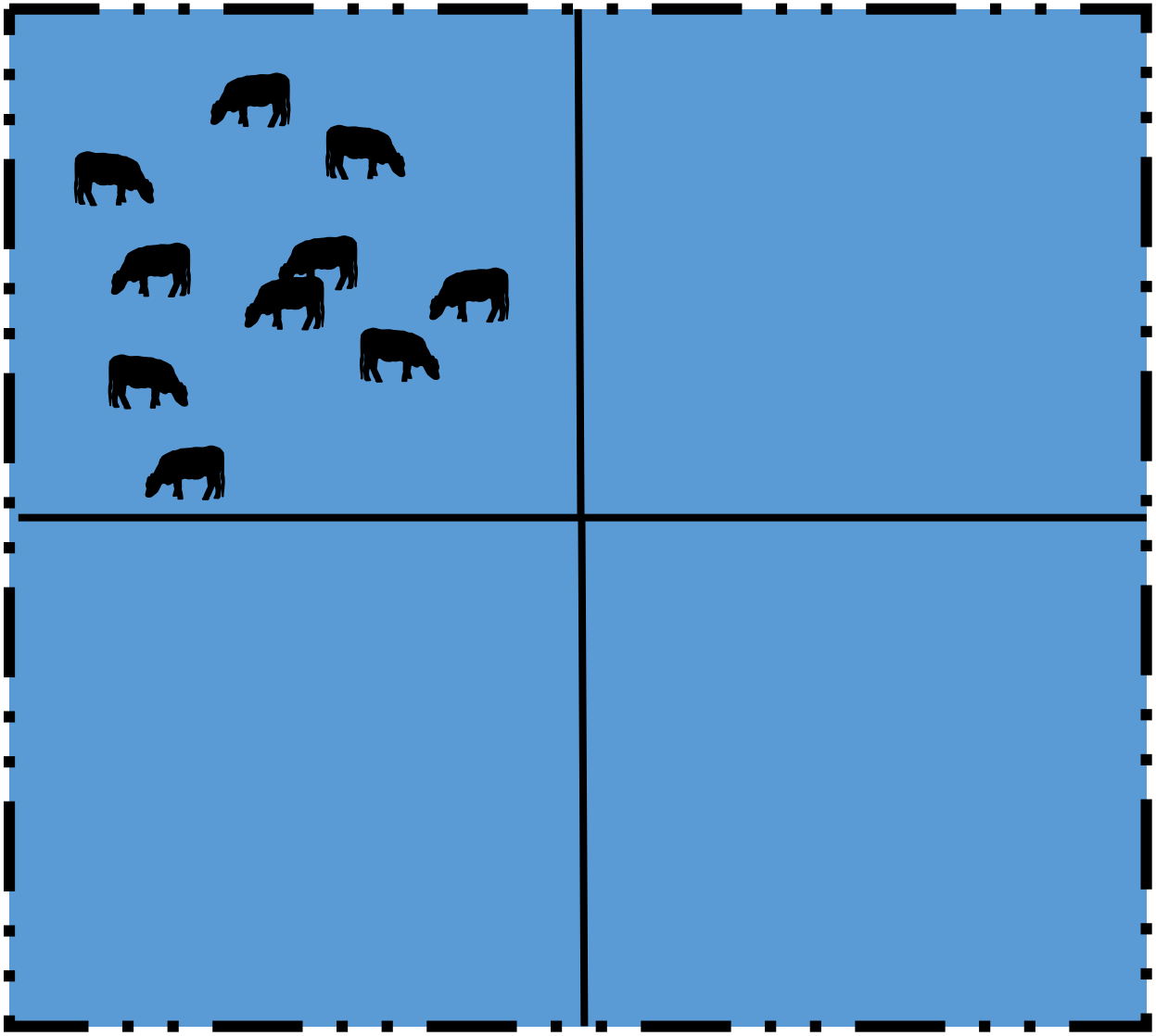


Example 2: Open-Gate Rotation



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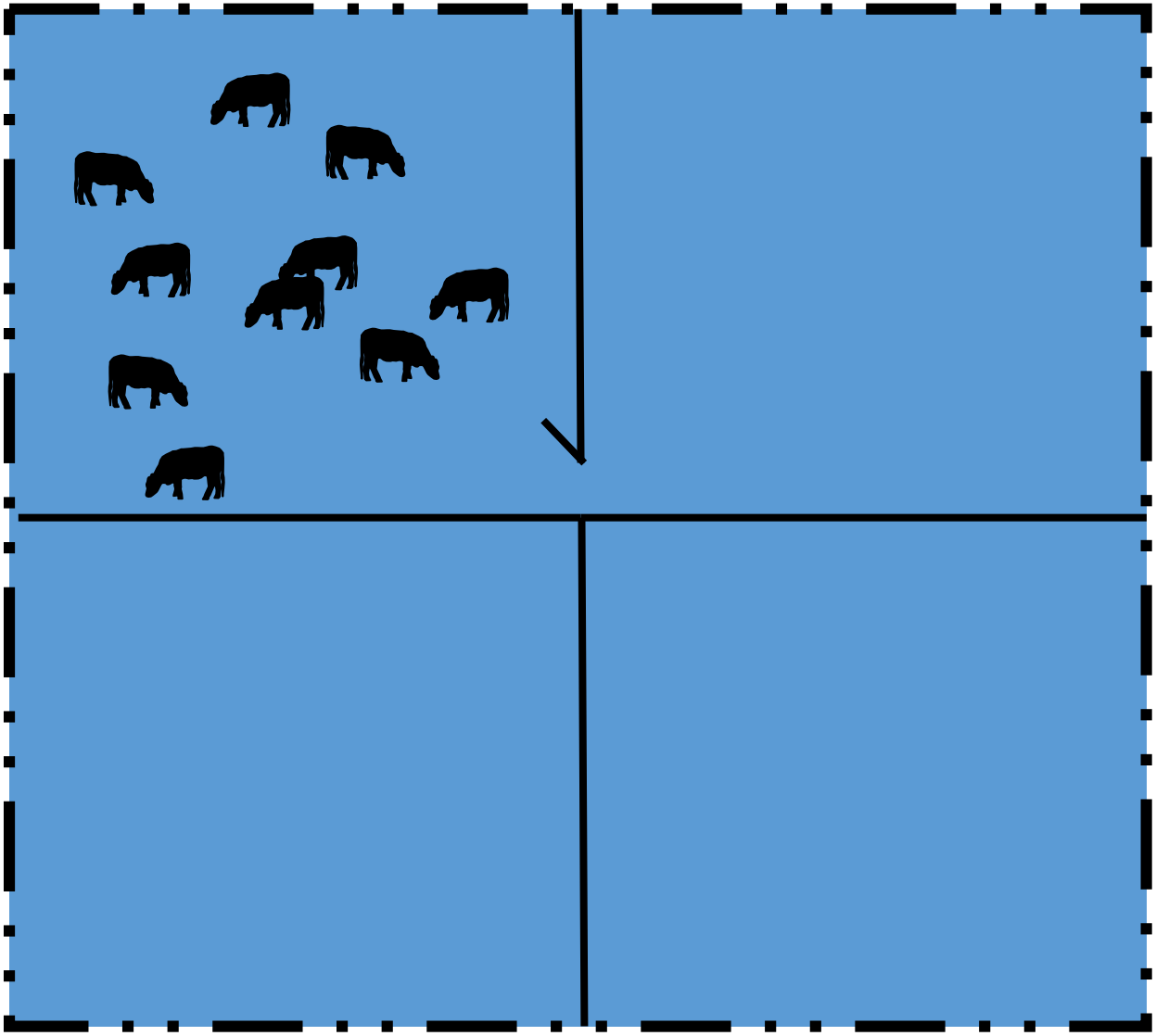

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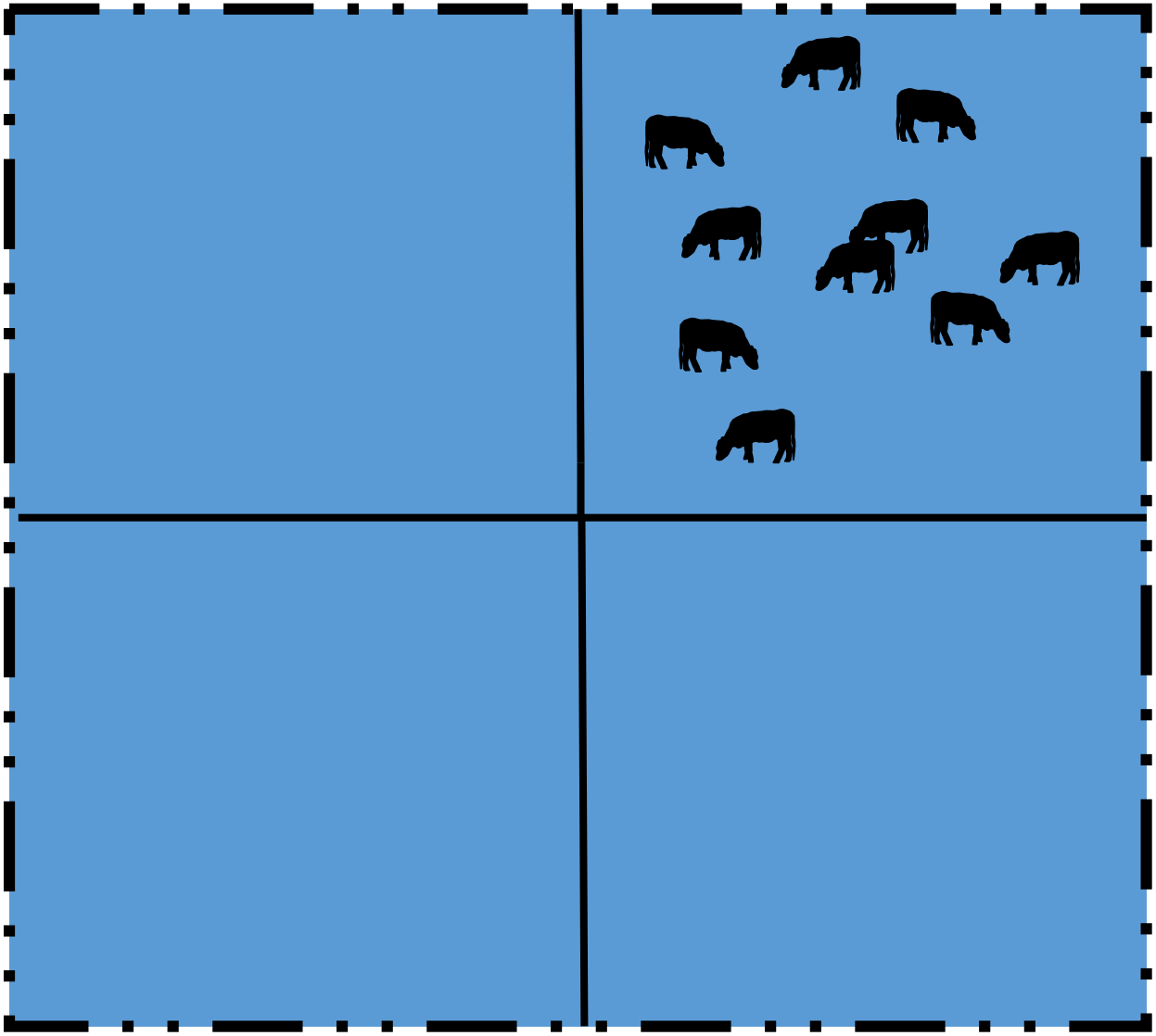

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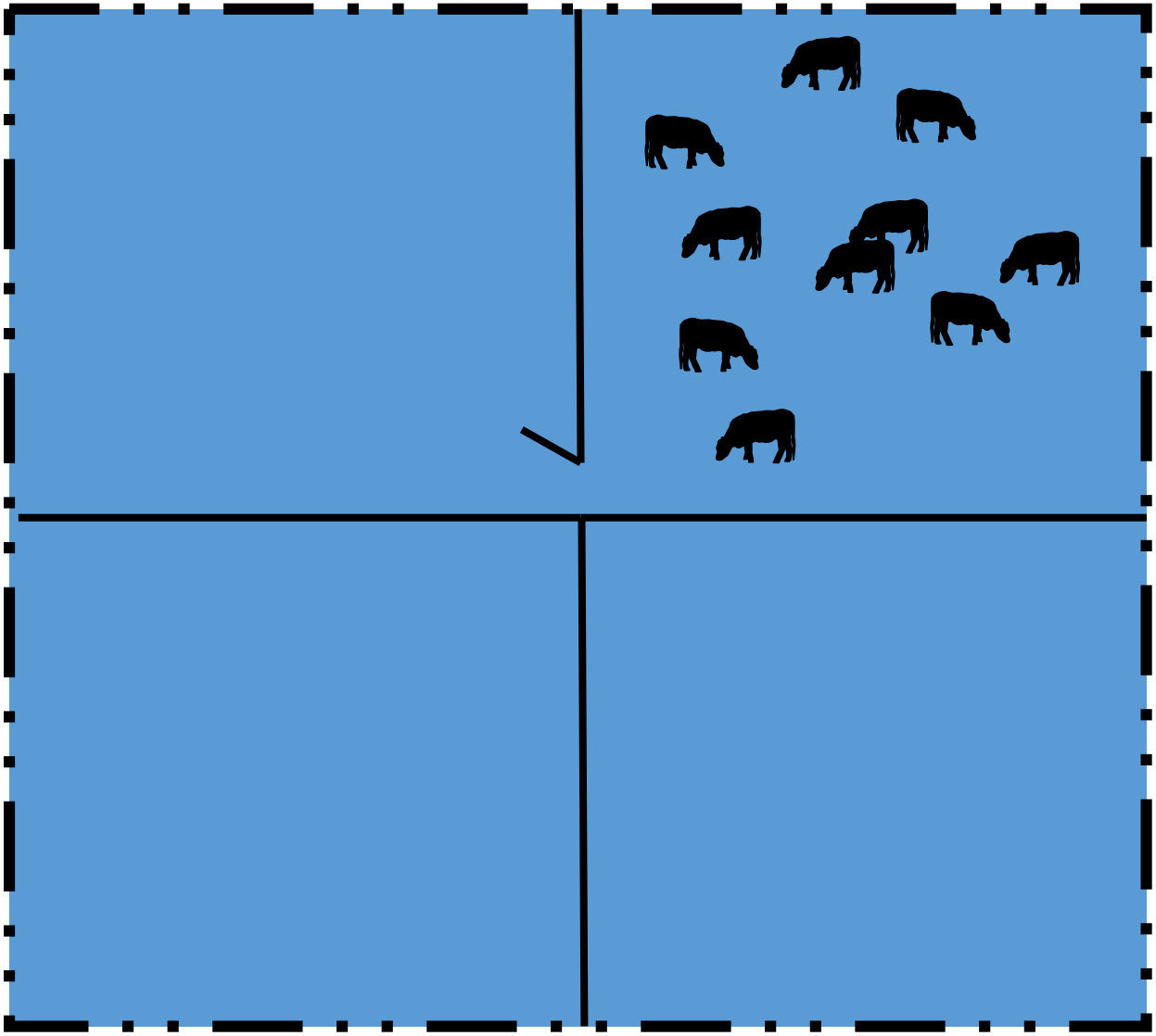

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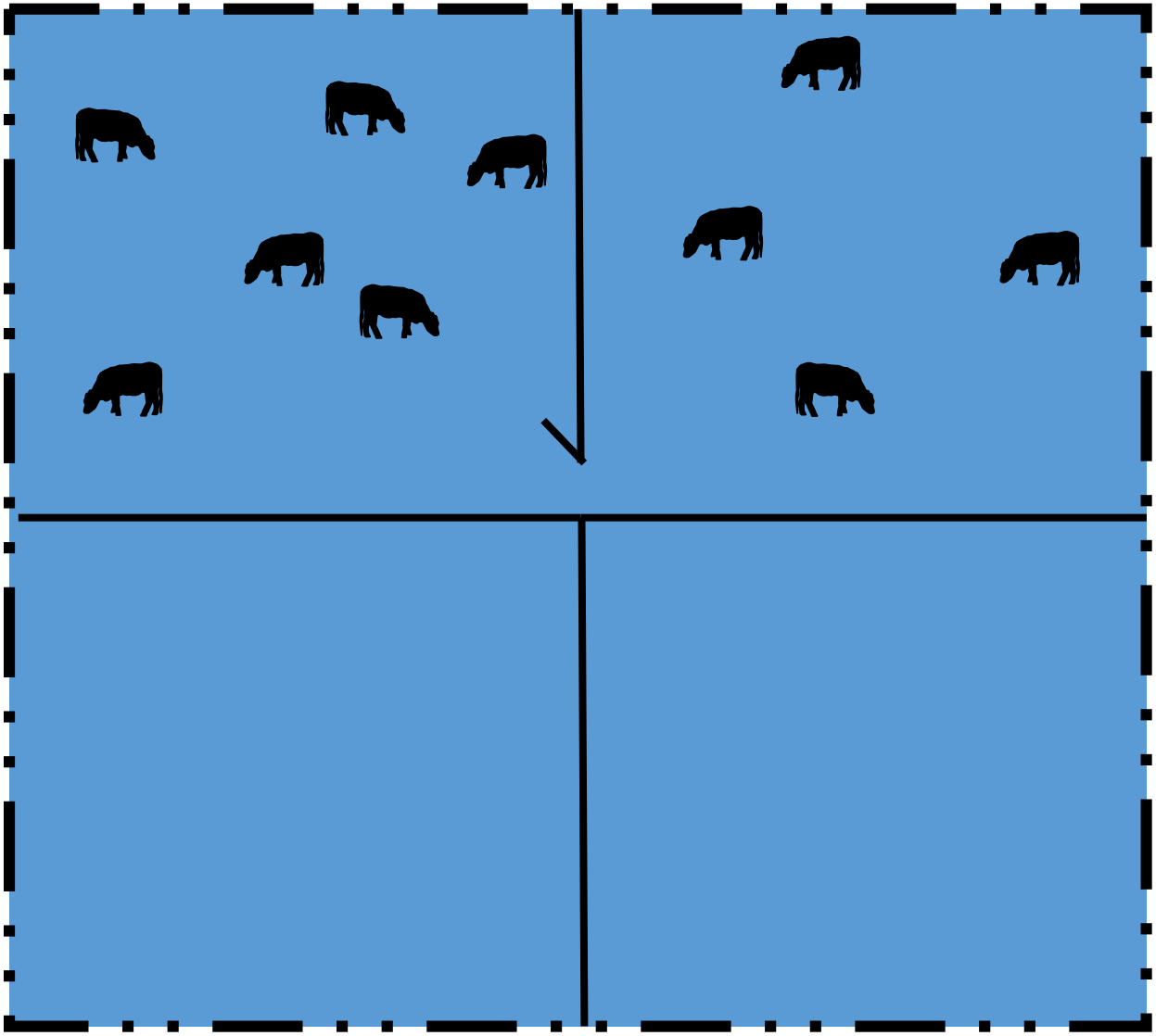

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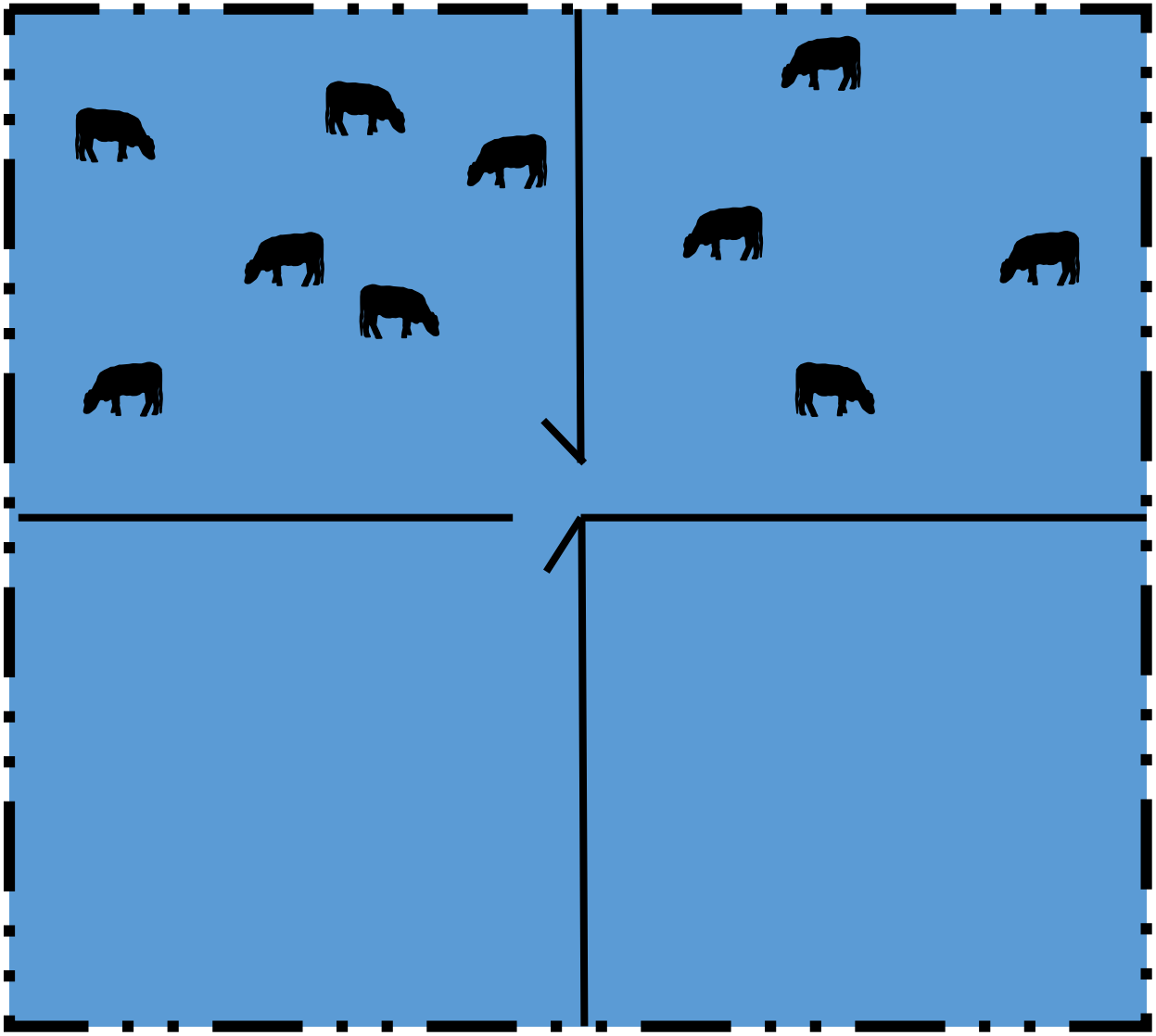

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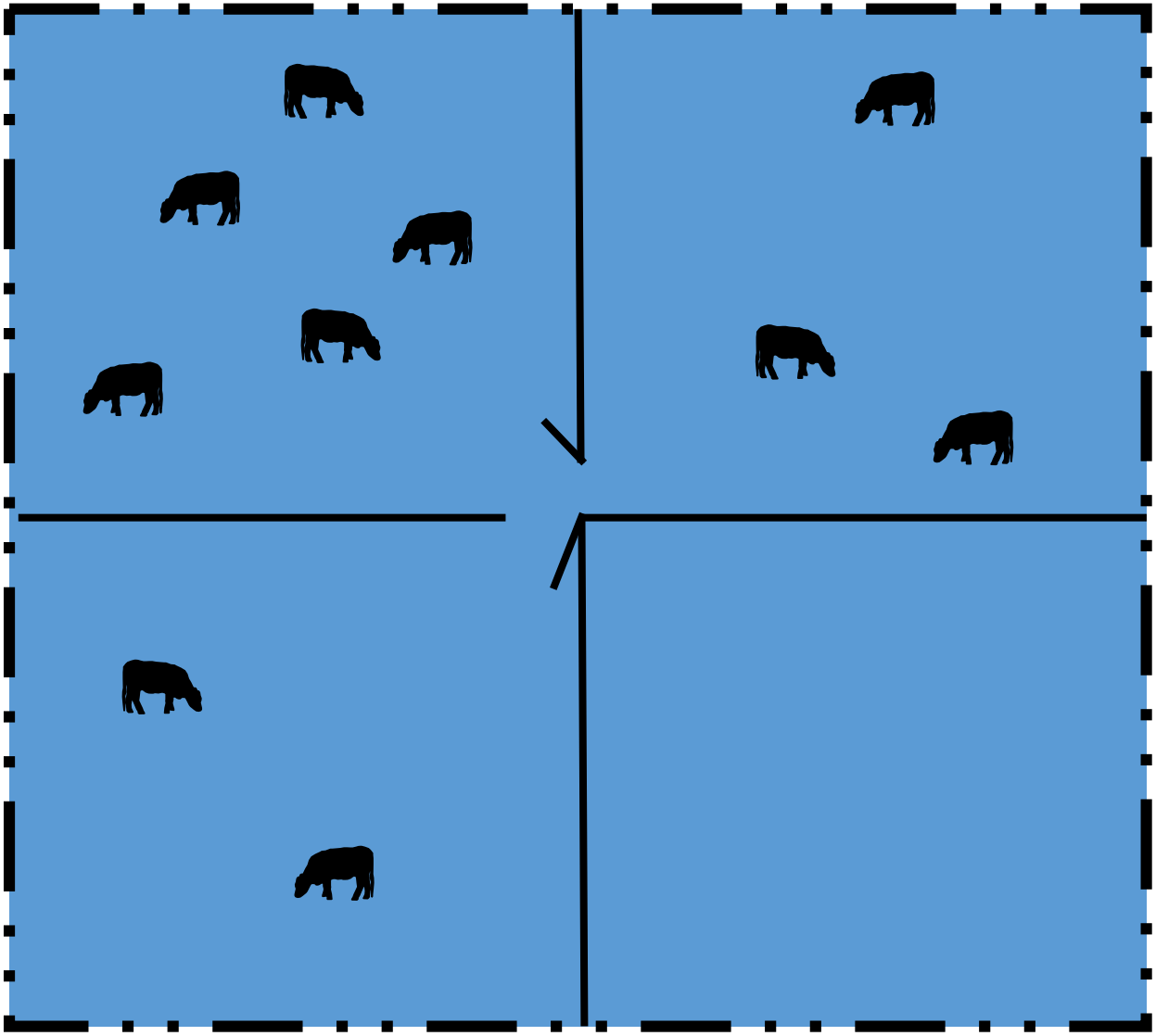

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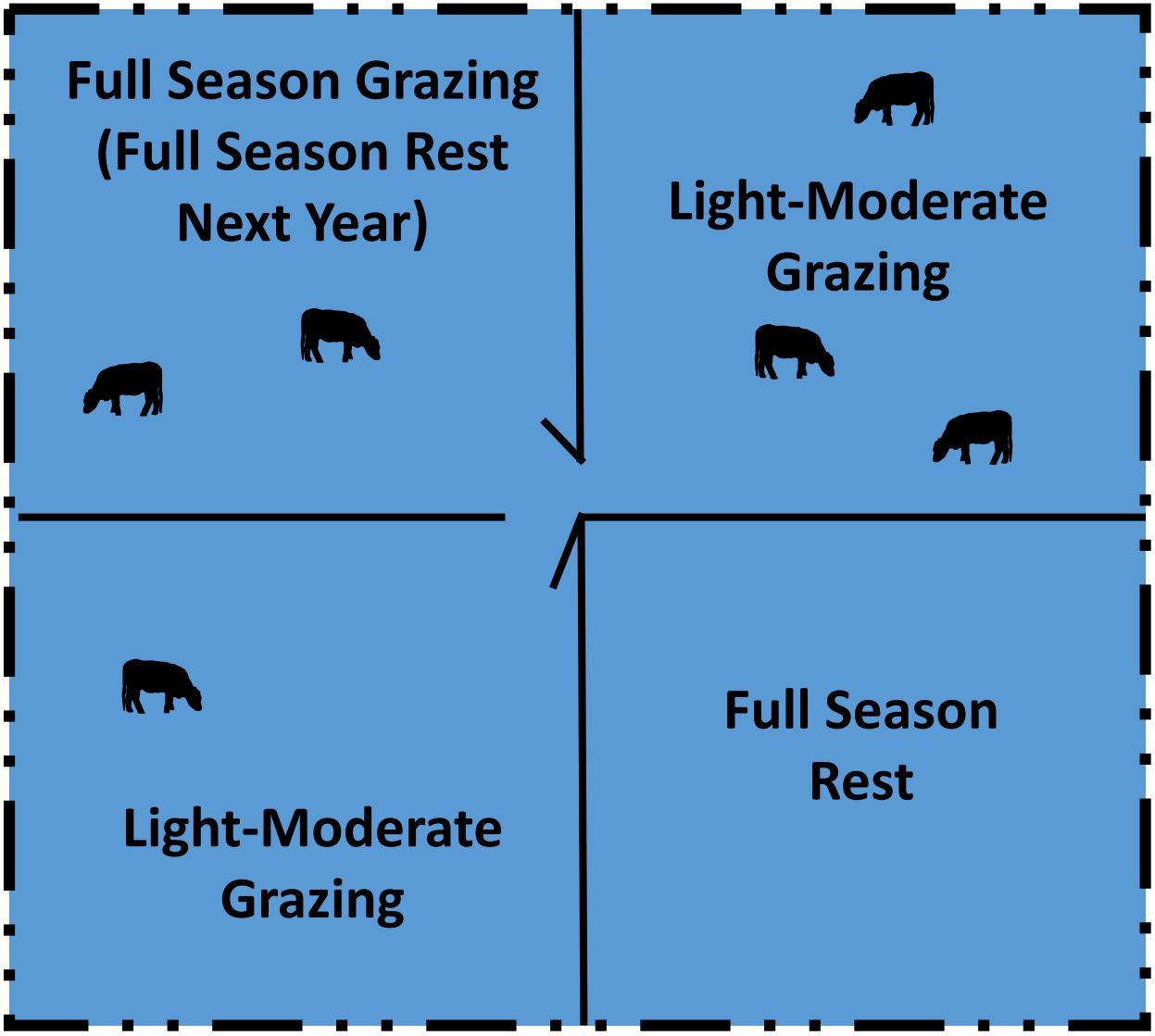


Allow All Plants to Bloom

- Periodic complete exclosure of livestock is needed for some plant species.

Why is Plant Diversity Important?

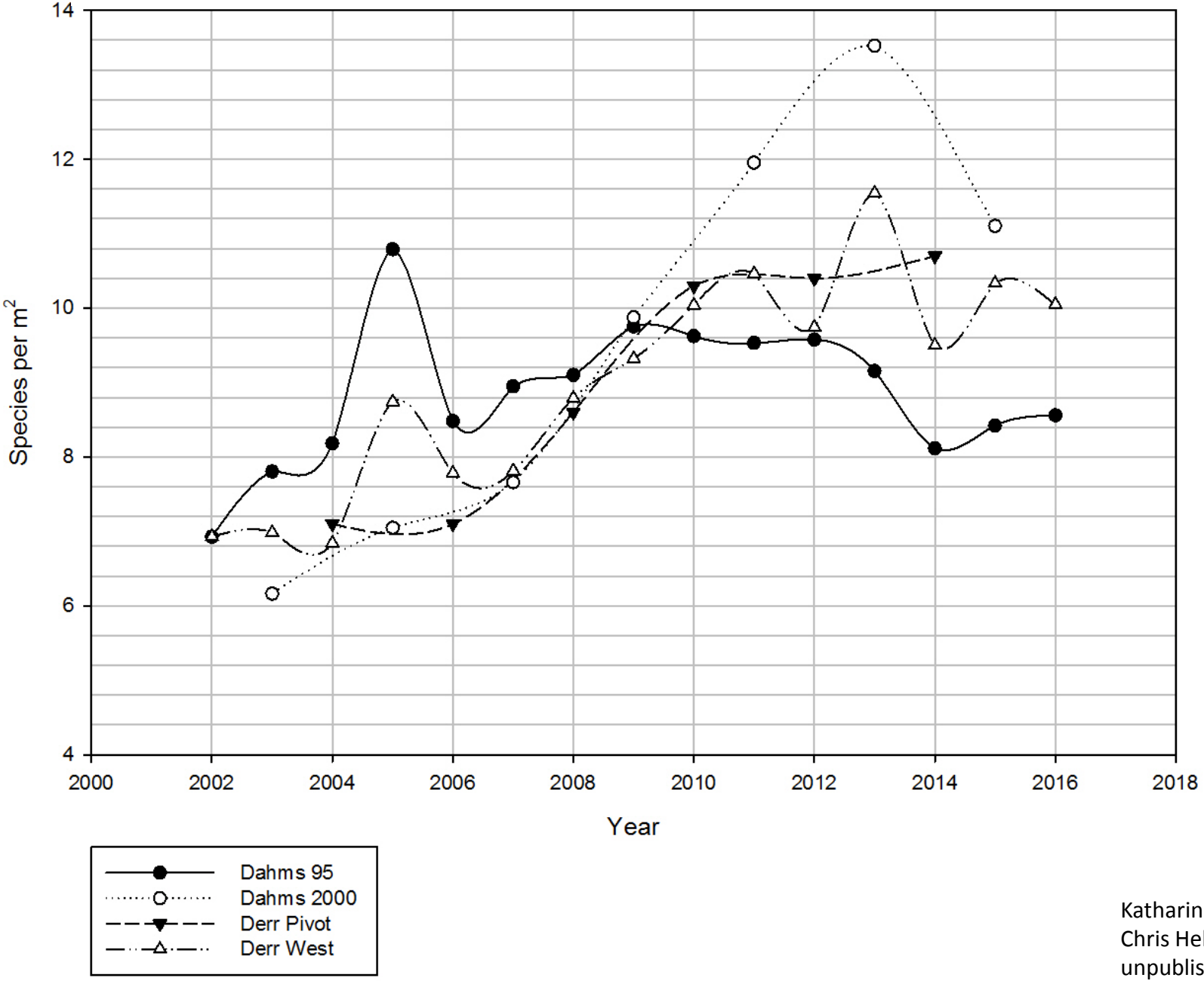
Facilitates invertebrate diversity (and their functional roles) (KSU study)

Suppresses invasive species
- Smooth brome, Canada thistle, poison hemlock, etc. (UNL/TNC studies)

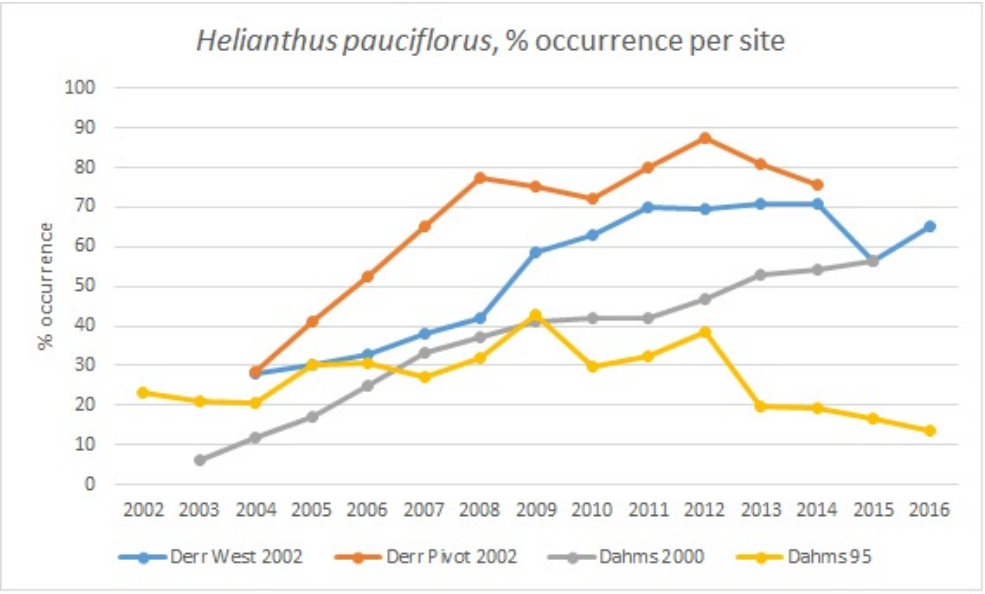
Higher rates of soil respiration (microbial activity) (UNL study)

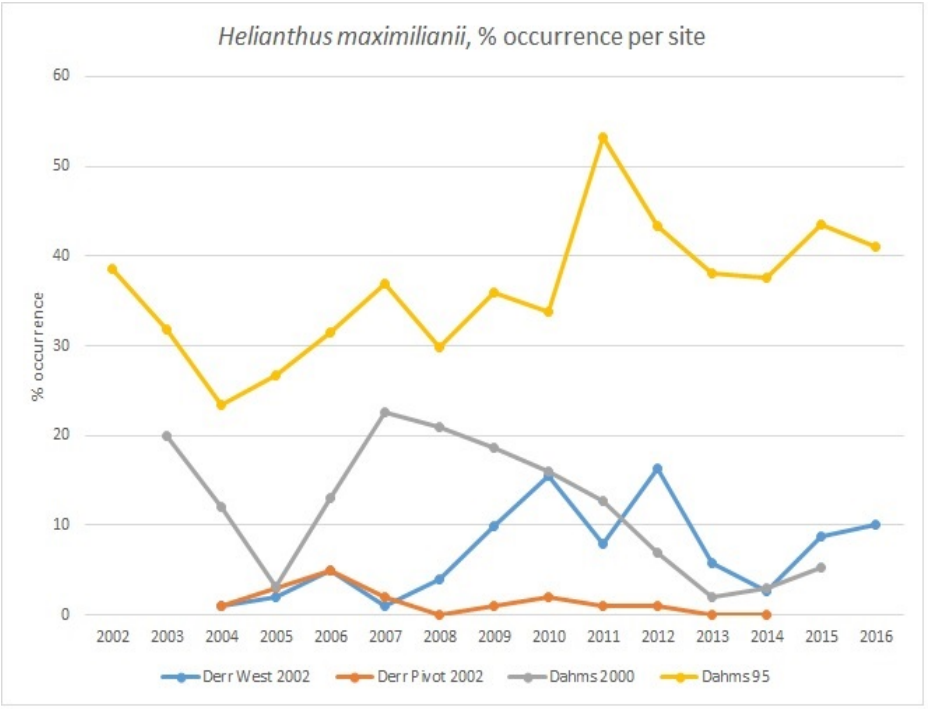
→ **Ecological Resilience**

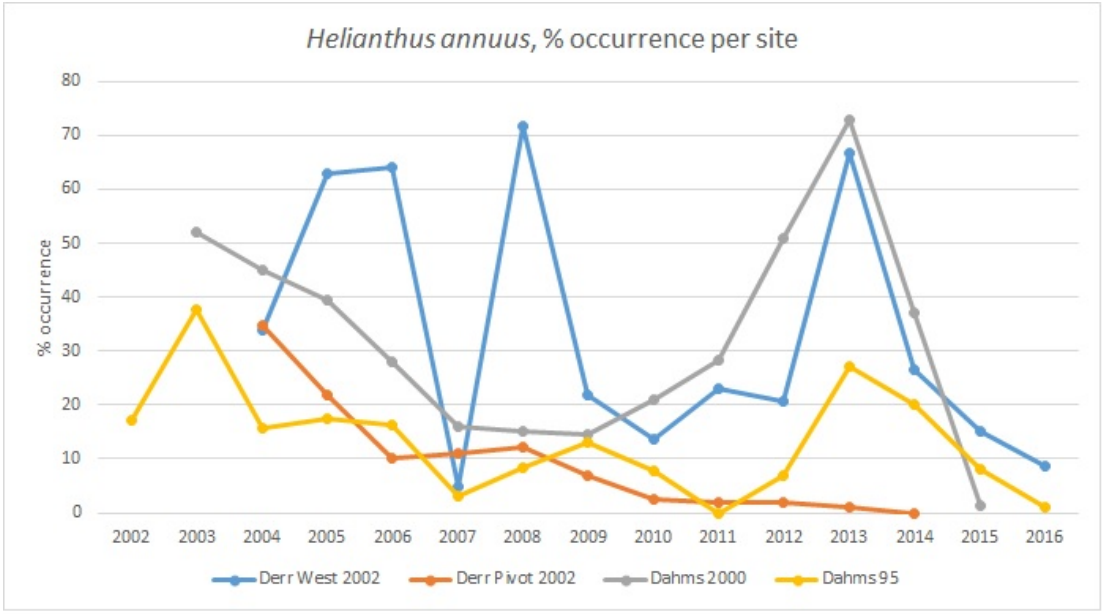
Plant Species per Square Meter – Four Restored Prairies managed with variations of patch-burn grazing



Katharine Hogan and Chris Helzer, unpublished data







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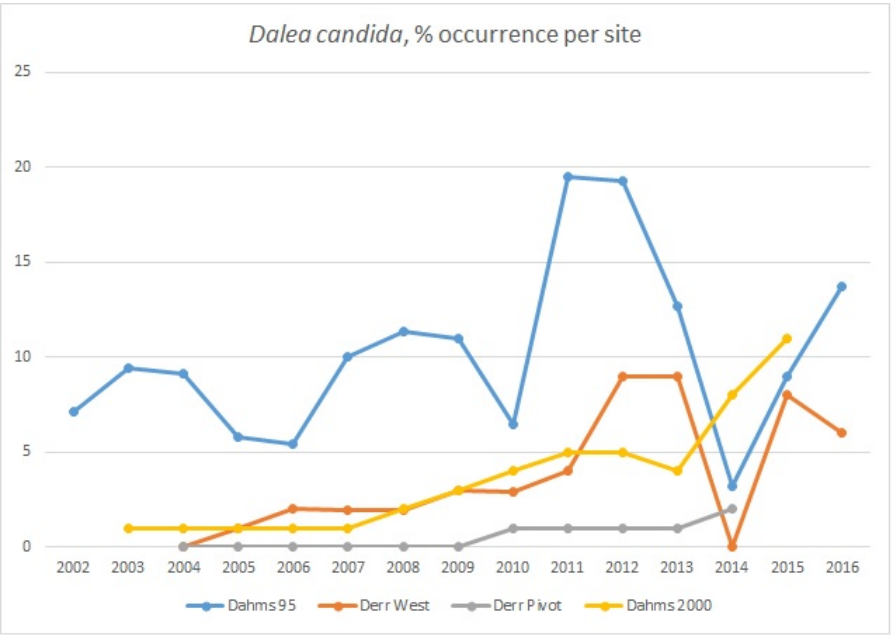

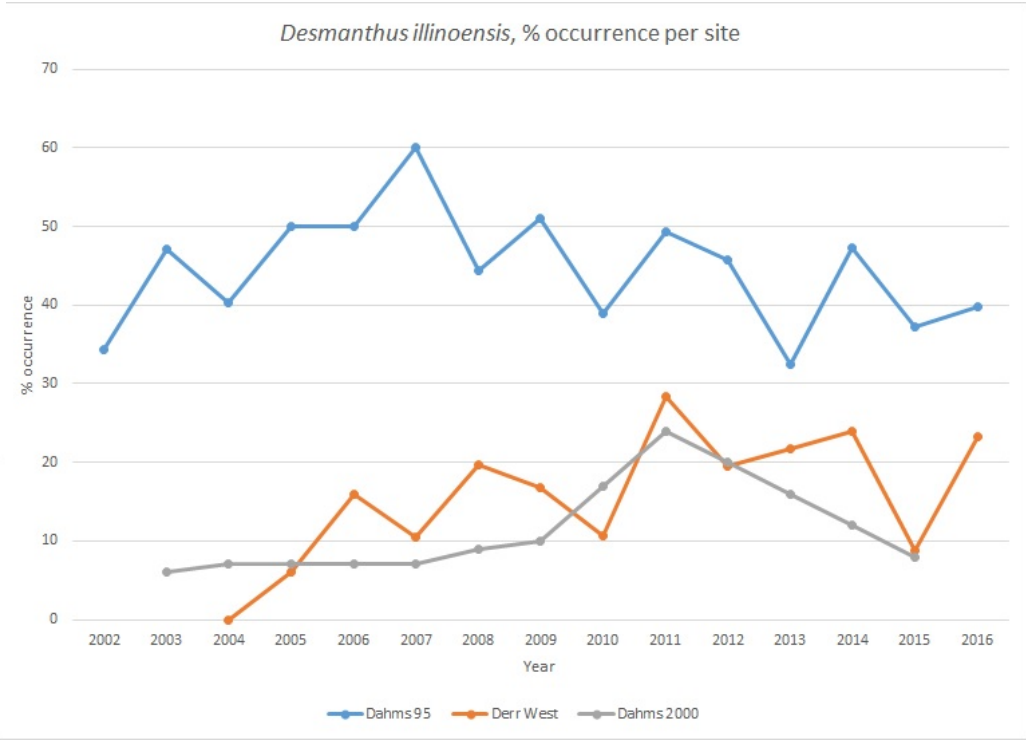

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Measuring Success

Ideally:

Plant composition

- High species richness
- Good distribution of flowering times
- Good representation by functional groups

Vegetation Structure

- Wide spread of types represented (short, tall, patchy, etc.)
- Multiple examples of each type present in “neighborhood”
- Shifting locations of each patch type over time

Measuring Success

Ideally:

- Pollinator abundance/diversity
- Diversity/Abundance of other inverts
- Prevalence of invasive plants
- Etc.

Plant composition

- High species richness
- Good distribution of flowering times
- Good representation by functional groups

Vegetation Structure

- Wide spread of types represented (short, tall, patchy, etc.)
- Multiple examples of each type present in “neighborhood”
- Shifting locations of each patch type over time

- Grassland bird abundance/diversity
- Other wildlife species/Invertebrates

Measuring Success

Surrogate Measures:

<u>Grassland birds</u>

Can help indicate habitat size/structure availability

Not sensitive to plant diversity

Not a good indicator of ecological resilience (on their own)

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Managing Prairies for Biodiversity and Ecological Resilience

Chris Helzer
chelzer@tnc.org
https://prairieecologist.com/

The Nature Conservancy