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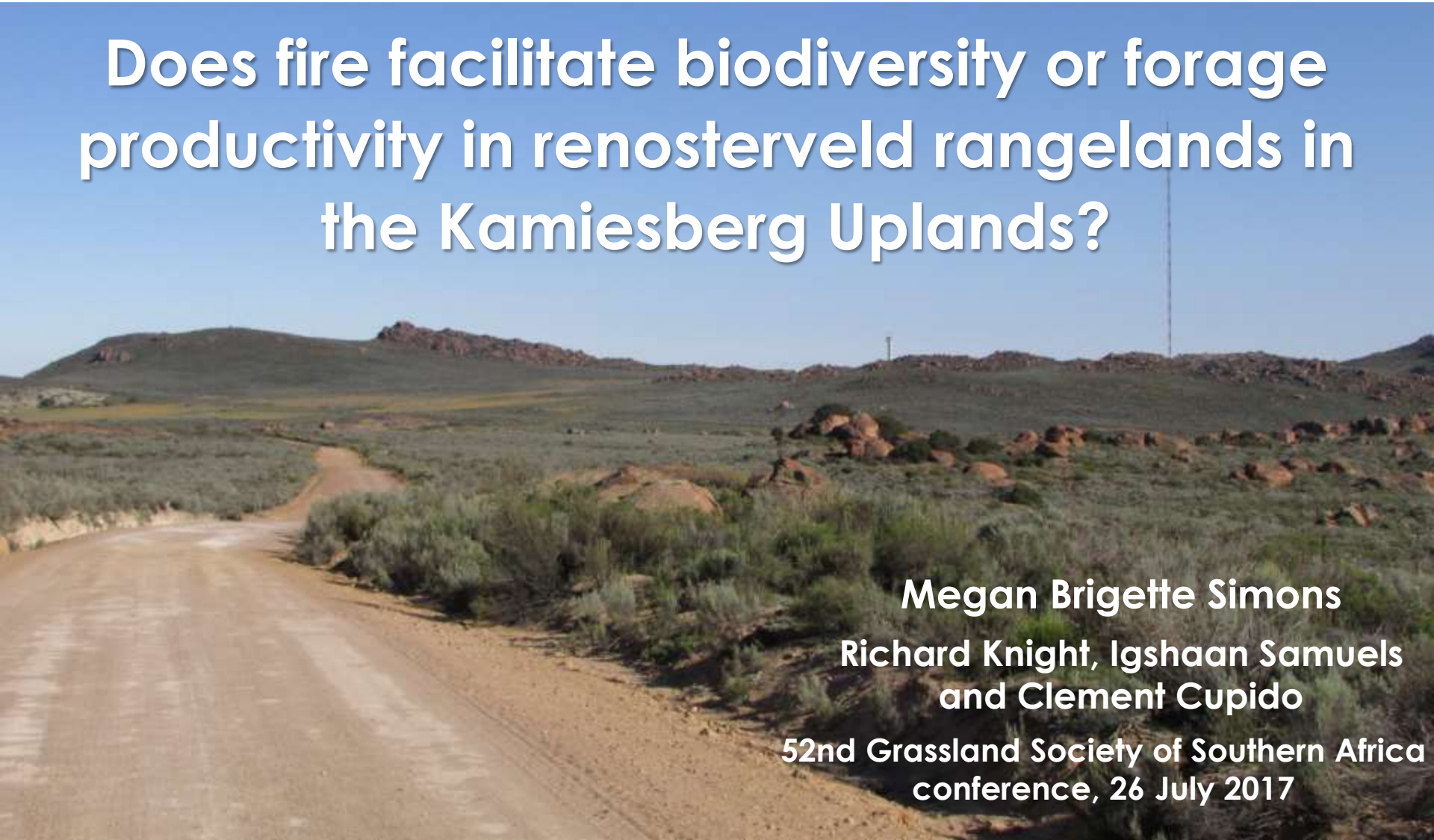
Does fire facilitate biodiversity or forage productivity in renosterveld rangelands in the Kamiesberg Uplands?



Megan Brigette Simons

Richard Knight, Igshaan Samuels and Clement Cupido

52nd Grassland Society of Southern Africa conference, 26 July 2017

Introduction

- Arid regions are characterized by event-driven changes in species composition
- Fire is an important driver of biodiversity in many ecosystems
- Livestock grazing can have various impacts on rangelands:
    - plant species composition, reduce vegetation cover and accelerate erosion
- Contribute to a reduction in rangeland conditions
- Understand and consider the effects of fire and grazing for rangeland management

Distribution of Renosterveld

Introduction

- Fire-prone shrubland of Fynbos Biome
- Divided into two types based on geographic distribution
    - Westcoast Lowland Renosterveld
    - **Mountain Upland Renosterveld**
- Only 20% MU renosterveld has been transformed
- Renosterveld vegetation can be described by:
    - vegetation height, cover, species richness, soils and palatability
- Attributes are relevant to grazing use and conservation
- Understand the dynamic behaviour of arid shrublands
    - sustain animal production and species conservation

Ecological status of renosterveld plant species

Decreasers: species which predominate in good rangeland condition but declines in abundance once the rangelands are over- or underused

e.g. *Ehrharta calycina, Ficinia indica* and *Leobordea digitata*

Increasers: species which increase in abundance in poor rangeland conditions and thrive in disturbed areas

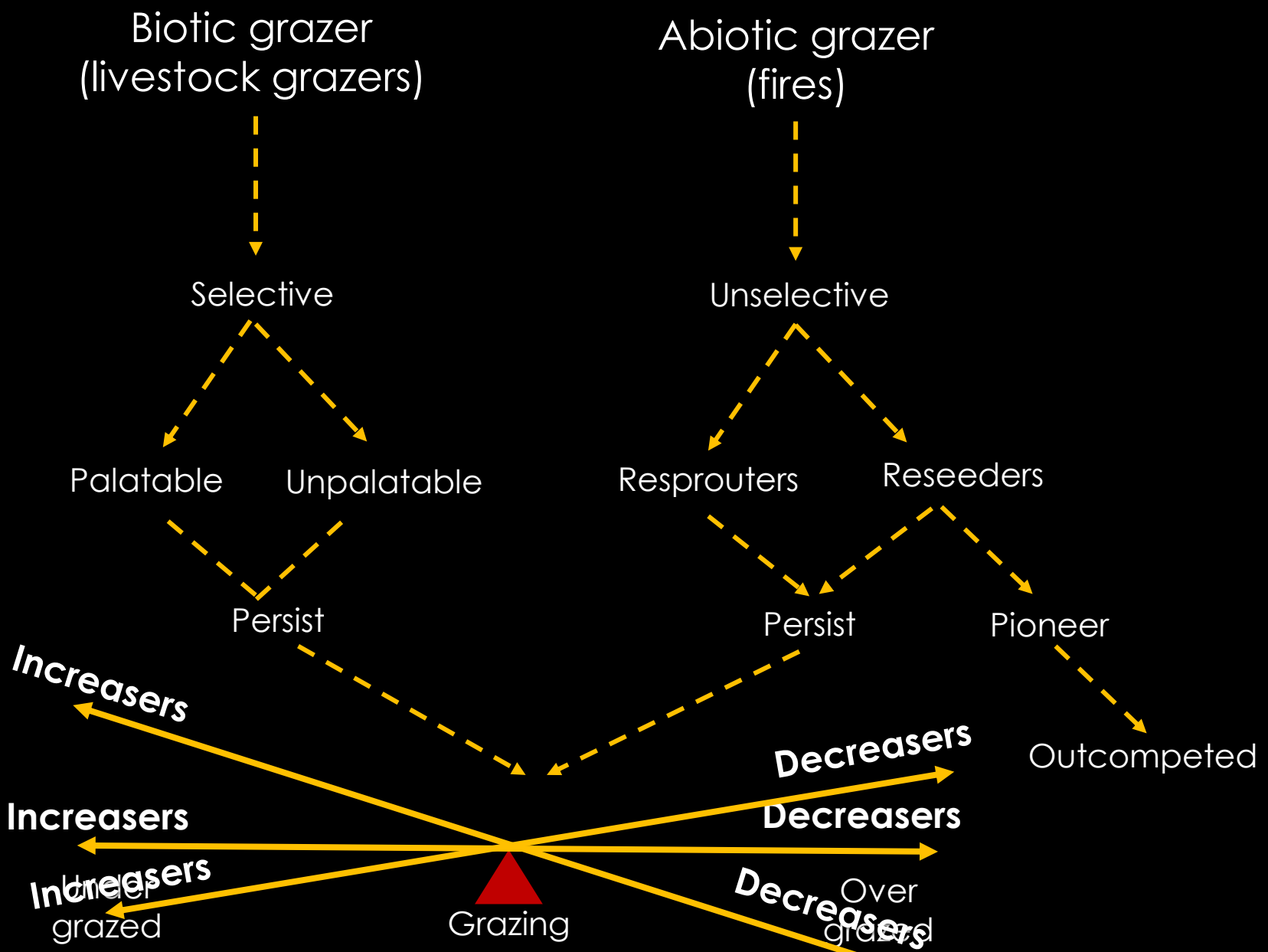
e.g. *Anisodontea bryoniifolia, Chrysocoma ciliata* and *Elytropappus rhinocerotis*

Ecological status of renosterveld plant species

Appendix 2: List of perennial species and their ecological status in the Kamiesberg. Asterisks reflect in which sites species were found: B= Burnt area, U=unburnt area, C= found in burnt and unburnt areas.

Ecological status	Burnt	Unburnt	Both
Decreaser species			
Perennial graminoids			
Chaetobromus involucratus			*
Ehrharta calycina			*
Ficinia indica			*
Ficinia nigrescence			*
Fingerhuthia africana	*		
Schismus schismoides			*
Stipagrostis ciliata			*
Perennial shrubs			
Agathosma capensis	*		
Anthospermum spathulatum			*
Arctotis fastuosa			*
Aspalathus Spinosa			*
Chrysanthemoides monilifera	*		
			*

Disturbance regimes



Research questions

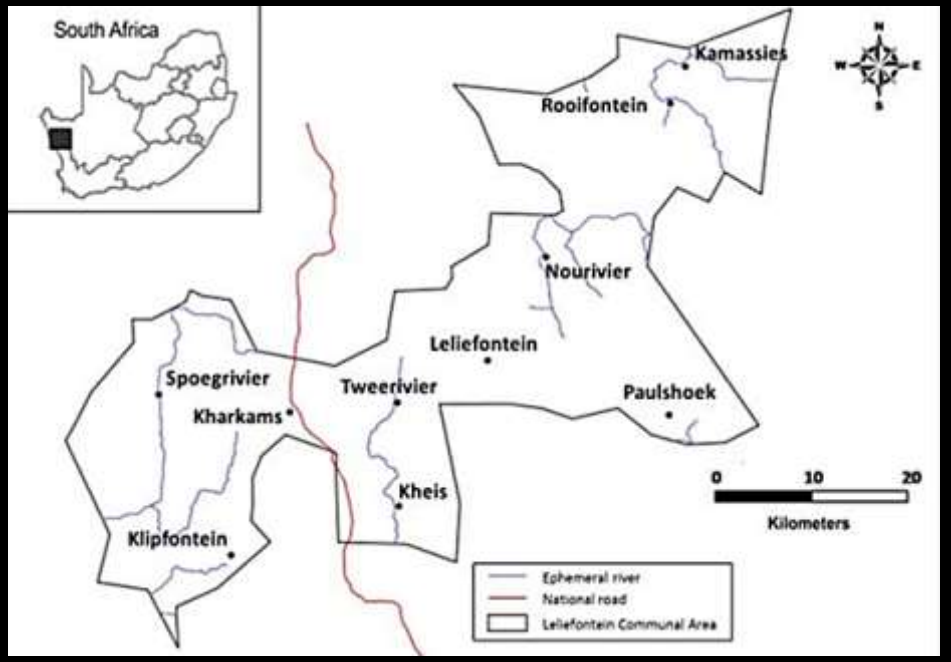
- Is there a change in species richness over time?
- How does fire affect biodiversity and forage productivity over a temporal scale?





Study area

- Leliefontein Communal area comprising about 192 000 hectares in size
- Annual rainfall 392 mm
- Livestock farming is one of the most extensive land uses in the area
- The communal area has nine different vegetation types



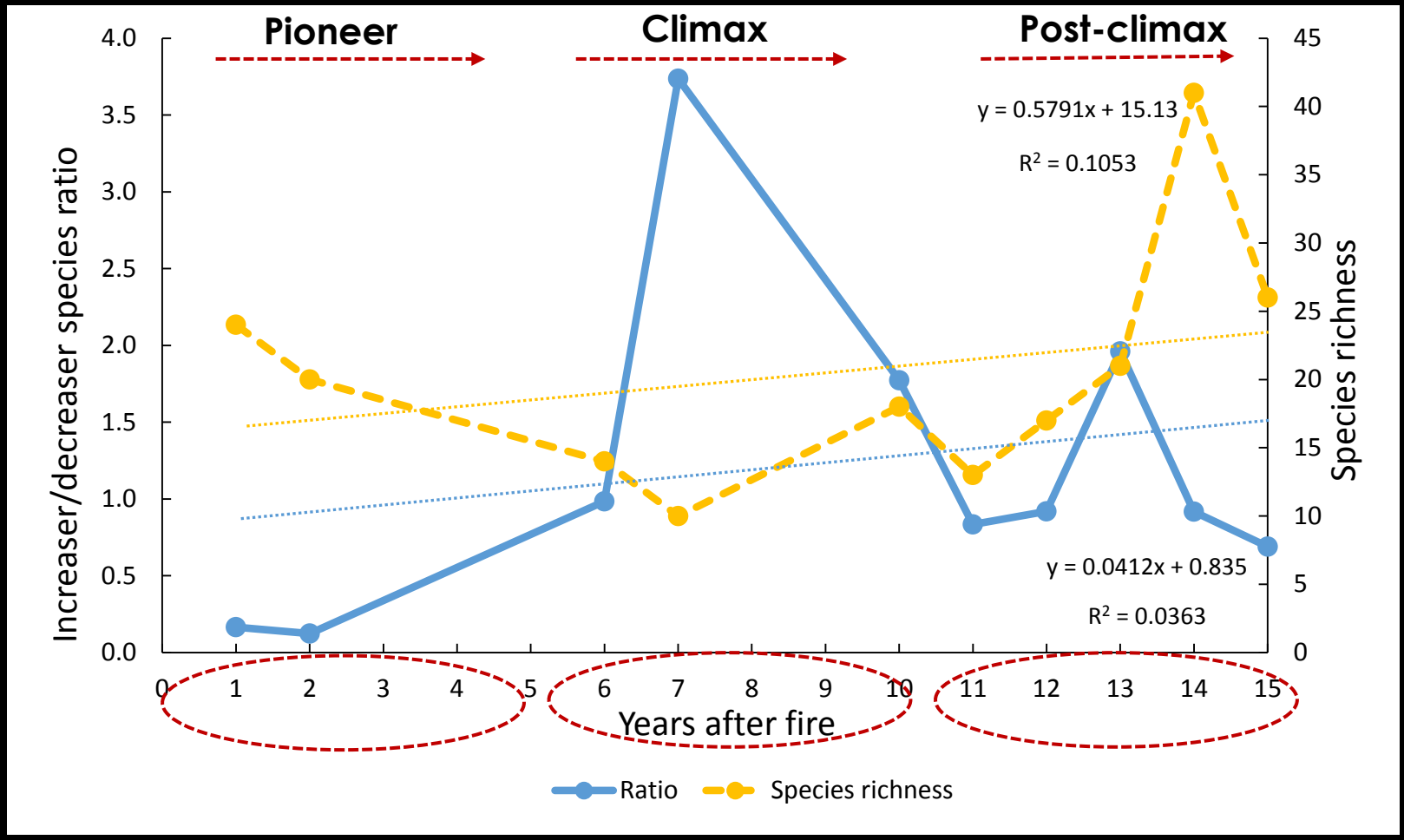
The location of Leliefontein communal area in Namaqualand (Samuels 2013)

Study area

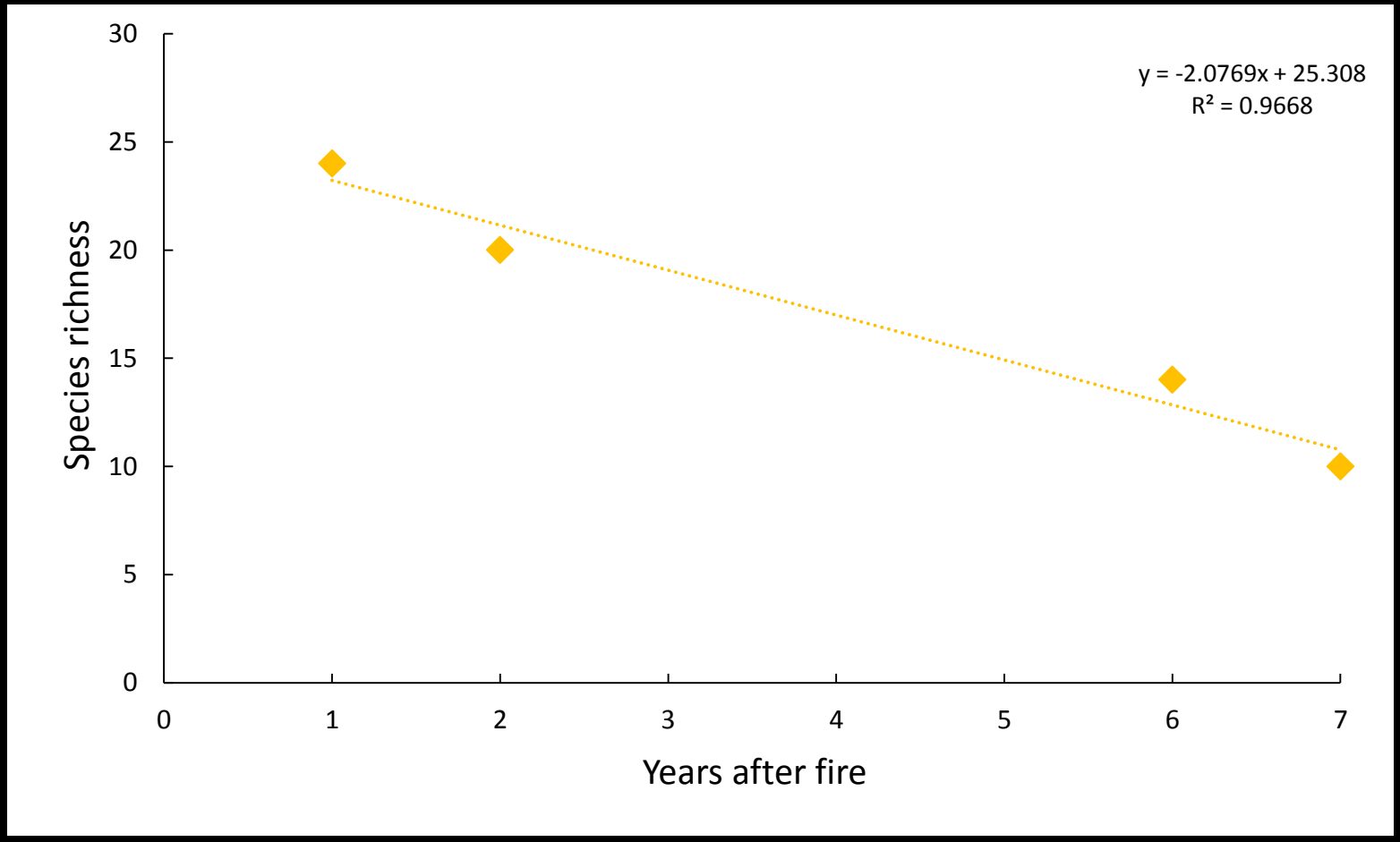

South Africa
Kamassies
Rooifontein
Nourivier
Hoorngat
Klipnoek
Leliefontein
Tanngberg
Skaapkuier
Populierskloof
Die Wiak
Kharras 2
Groenkloof
Paulshoek
Spoegrivier
Tweerivier
Kharkams
Kheis
Klipfontein
Image Landsat / Copernicus
Google Earth
Earth Point
Imagery Date: 12/31/2013

Research Method

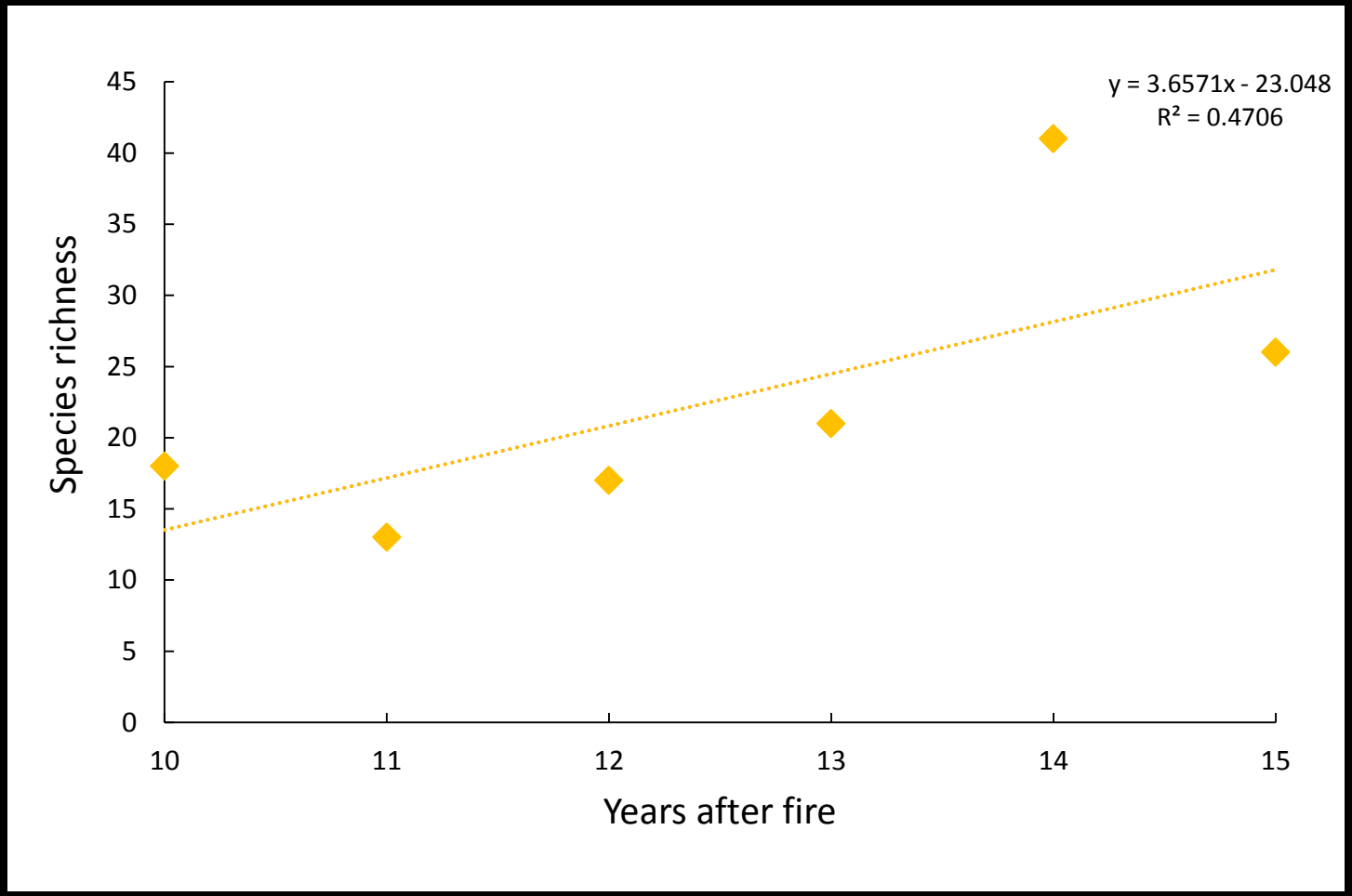
Results


Pioneer
Climax
Post-climax
y = 0.5791x + 15.13
R² = 0.1053
y = 0.0412x + 0.835
R² = 0.0363
Increaser/decreaser species ratio
Species richness
Years after fire
Ratio
Species richness

Results: pioneer ⟶ climax stage



Results: climax ⟶ post-climax stage



Discussion:

Is there a change in species richness over time?

- Species richness in Namaqualand Granite Renosterveld will remain constant overtime
    - does not decline in older renosterveld over 15 years
- Different grazing intensities increased and maintained species richness
- Overgrazing coupled with exclusion of fire reduced the perennial grass component in shrublands
    - dominated by unpalatable shrubs
- The number of species present are not of much importance, but rather the type of species

Discussion:

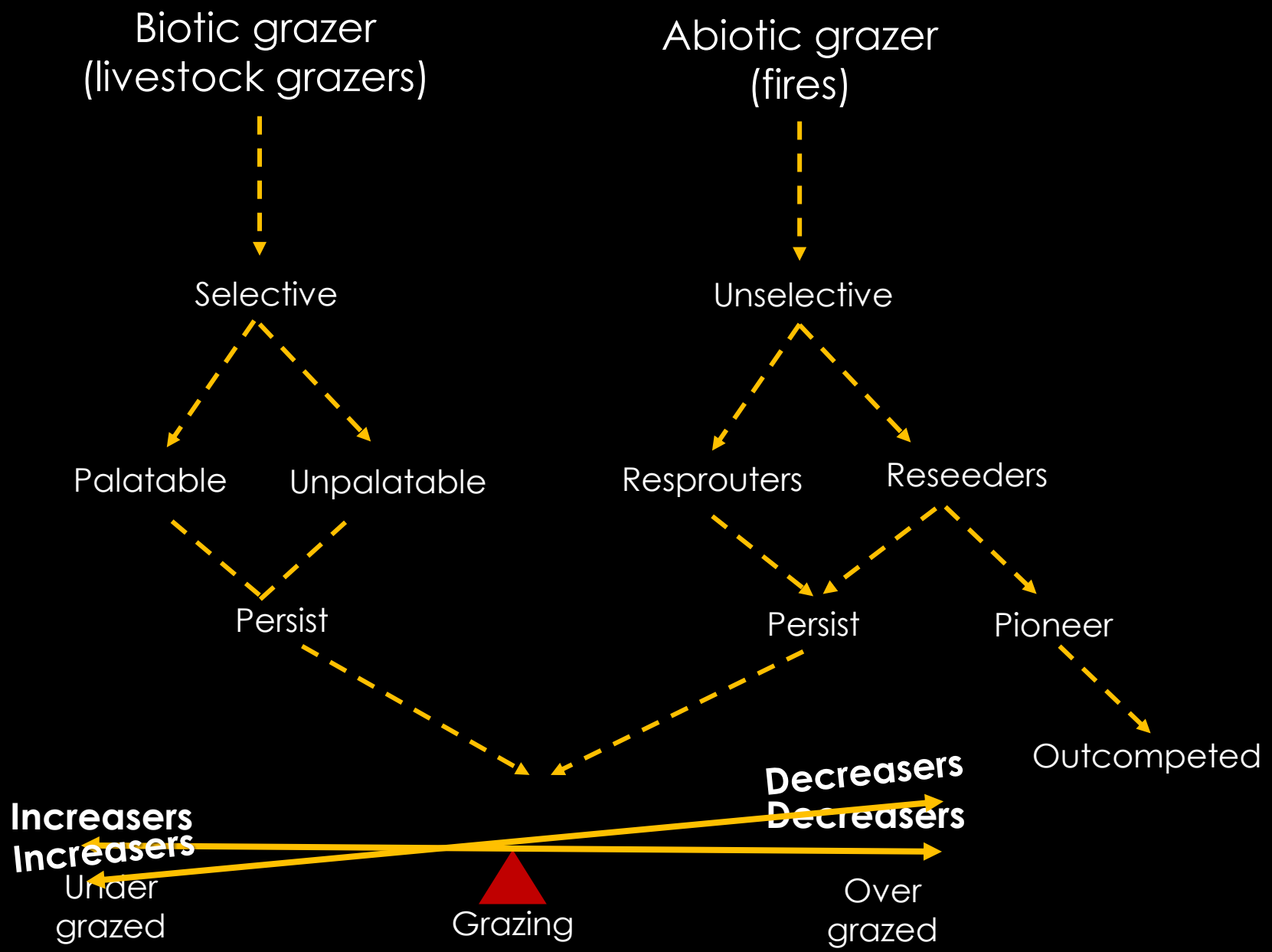
How does fire affect biodiversity and forage productivity over a temporal scale?

- Disturbances opened space for decreaser species to re-colonise
- Fire restores rangeland heterogeneity and alter grazing patterns in such a way that it enhances local biodiversity
- Namaqualand Granite Renosterveld should not be **burnt** sooner than **seven years**
    - increase forage productivity
    - eliminate or reduce increaser species
- All these species are of least concerned and are therefore not species of conservation concern

Fire Return Interval for Renosterveld

Authors	Year	Fire return period
Cowling and Holmes	1992	3-5 years
Jacobs and Jangle	2008	
Kraaij and van Wilgen	2014	
Cape Nature	2013	3-10 years
Rebelo	1992	3-10 (up to 40) years
Kraaij and Kruger	2010	5.5 years
Kraaij	2010	5.8 years
Pooley	2015	5-10 years
Forsyth *et al*.	2010	5-20 years
Simons	2017	7 years (in progress)
Jacobs and Jangle	2008	10-15 years
Helme and Rebelo	2005	
Bond	1997	10-20 years
Forsyth and van Wilgen	2008	17.7-37.4 years

Disturbance regimes



Conclusion

- Farmers in Leliefontein can maintain a relatively high stocking rate due to different burnt areas
    - Different heterogeneity
    - Different forage quality
- Biodiversity is maintained by resting the veld
    - Recently burnt veld = 6-12 months
    - Yearly = 5-6 months
- **“What’s best for biodiversity is not for productivity”**

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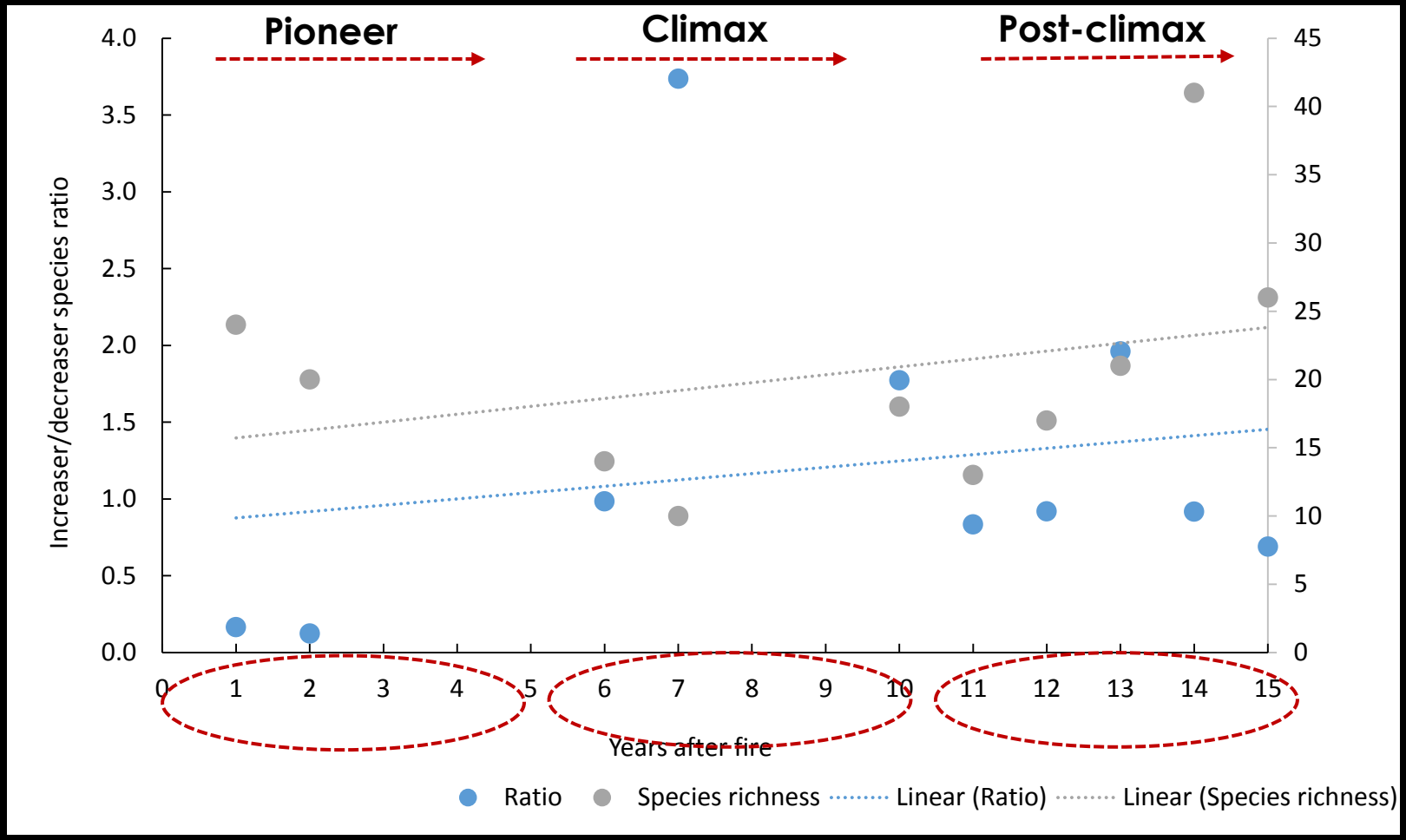
Thank you

Results


Pioneer
Climax
Post-climax
Increaser/decreaser species ratio
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
45
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Years after fire
Ratio
Species richness
Linear (Ratio)
Linear (Species richness)