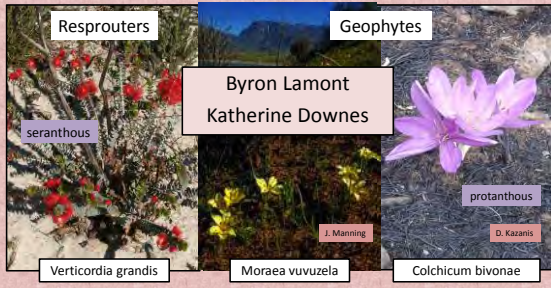
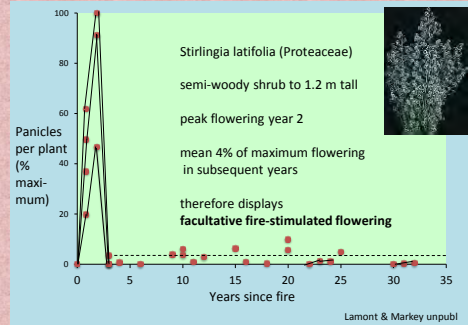


Fire-stimulated flowering Australia, South Africa



1. **Obligate fsf** – flowering is restricted to the first 1–2 years after fire.
2. **Facultative fsf** – flowering peaks 1–2 years after fire but continues at a low rate.

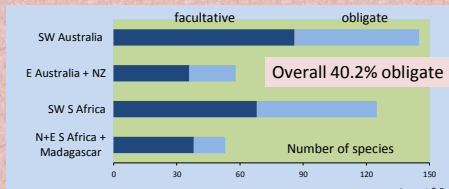
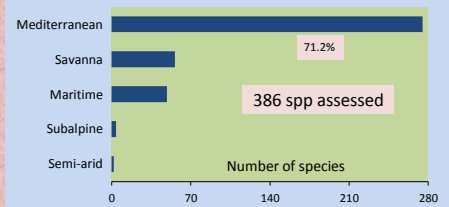


We have data for 550 species including distribution, family, growth form, obligate or facultative, time of peak flowering, methods of seed dispersal and where stored, germination time, fire interval, seasonality and data sources:

- Australia 203+*
 - South Africa 173*
 - North America 92*
 - South America 21
 - Europe 14*
 - New Zealand 5
 - Madagascar 5
 - Central America 4
- *include mediterranean climates



Sternbergia sicula (Colchicaceae)
Greece (D. Kazanis pers. comm.)



Lamont & Downes submitted

Family with fsf (+ aceae)	No. spp	
Orchid	174	45.1%
Xanthorrhoeae (includes Asphortel)	42	
Irid	23	
Aster	16	
Prote	16	
Haemodor	16	
Fab (Faboidae)	14	
Amaryllid	9	
Dryas	9	
Po	7	
Dasyopogon	7	
Zami	6	
Myrt	6	
Campanul	5	
Asparag	3	
Apocyn	3	
Colchic	3	
	2	
	1	

34 families with fsf

In top 10 with fsf but not 10 largest families

Among 10 largest families

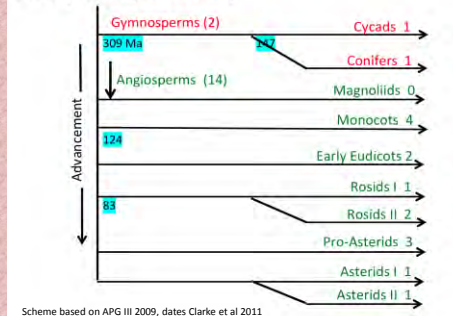
Xanthorrhoea australis

Satyrrium carneum Cape orchid

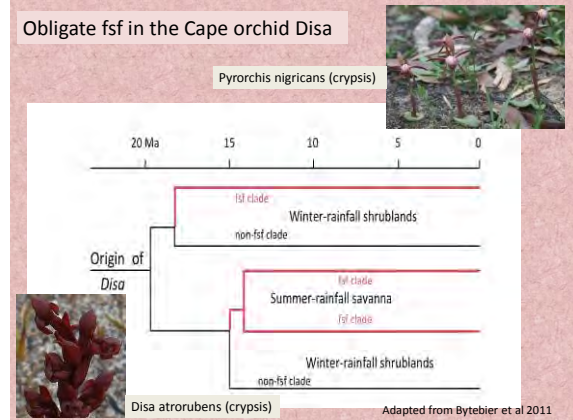
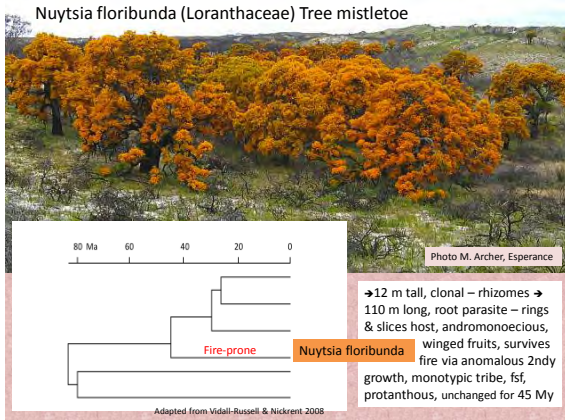
Blandfordi, Lami, Stylidi, Cyper, Santal, Ranuncul, Loranth, Combret, Doryanthae, Podocarp, Goodeni, Verben, Scrophulari, Malv, Eric, Byblid, Phylidrell

Lamont & Downes submitted


Seed plants (16 orders)




Lamont & Downes subm



Additional fsf evolutionary examples




Protea lorea
10.6 Ma




Conospermum
lineage 35 Ma

Three independent origins in Protea: one at 10.6 Ma (5 spp), one at 8.6 Ma, one at 1.2 Ma. Fsf poorly documented (chronogram of Valente et al 2010).

Proteaceae: *Stirlingia*-*Conospermum*-*Synaphea* clade strong fsf, fire-prone to 71.2 Ma, but how do you deal with fire-killed species? (chronogram of Sauquet et al 2009).



Drosera binata 28 Ma (chronogram of Yesson and Culham 2006)




Haemodorum
clade 48 Ma

Haemodoraceae: *Haemodorum* clade 48 Ma, *Dilatris* – stem 42 Ma (chronogram of Hopper et al. 2009).

- ### Fitness benefits
- Fsf optimizes the fitness benefits of sexual reproduction without sacrificing vegetative growth, ie there are no trade-offs (resource matching rather than resource switching):
1. Resources (light, nutrients, water, warmth, space) optimal
 2. Competition minimal: resources, pollinators (flowering enhanced, synchronized and hastened)
 3. Avoids reproductive failure should it coincide with fire
 4. Overwhelms specialist florivores and granivores
 5. Germination of new seeds/recruitment favoured (suboptimal)
 6. Ensures time for vegetative buildup before next fire – clonal
 7. Increase in maternal output of dioecious and andromonoecious spp – resource effect
 8. Wind dispersal promoted (suboptimal – serotiny a better solution)

Conclusions

1. Fire-stimulated flowering present in all regions subject to frequent fire, especially mediterranean Australia & South Africa (& savannas).
2. The 155 spp (40%) with obligate fsf in Australia and South Africa stand as proof of the role of ancestral fire in directing the evolution of traits in fire-prone regions.
3. A case can be made for considering the remaining 230 spp with facultative fsf as fire-adaptations as well.
4. Fsf has a long and ongoing association with seed plants: A. With a 300 My history and the ability to survive fire, *Cycads* provide the greatest promise for exploring the origin of fire on earth and the onset of fire-driven trait evolution among plants. B. As the largest group with fsf among all fire-prone floras, *terrestrial orchids* hold most promise for revealing the more recent spread of fire and fire-driven trait evolution.



Orchidoideae

Most of this material is now in press as:

Lamont, B. B and Downes, K.S. (2011) Fire-stimulated flowering among resprouters and geophytes in Australia and South Africa. *Plant Ecology* (special issue on Resprouting)

