

World Forum on
Urban Forests
Mantova 2018

PS 3.3
Changing Environment

Plant Selection for Green Roof Rainfall Retention

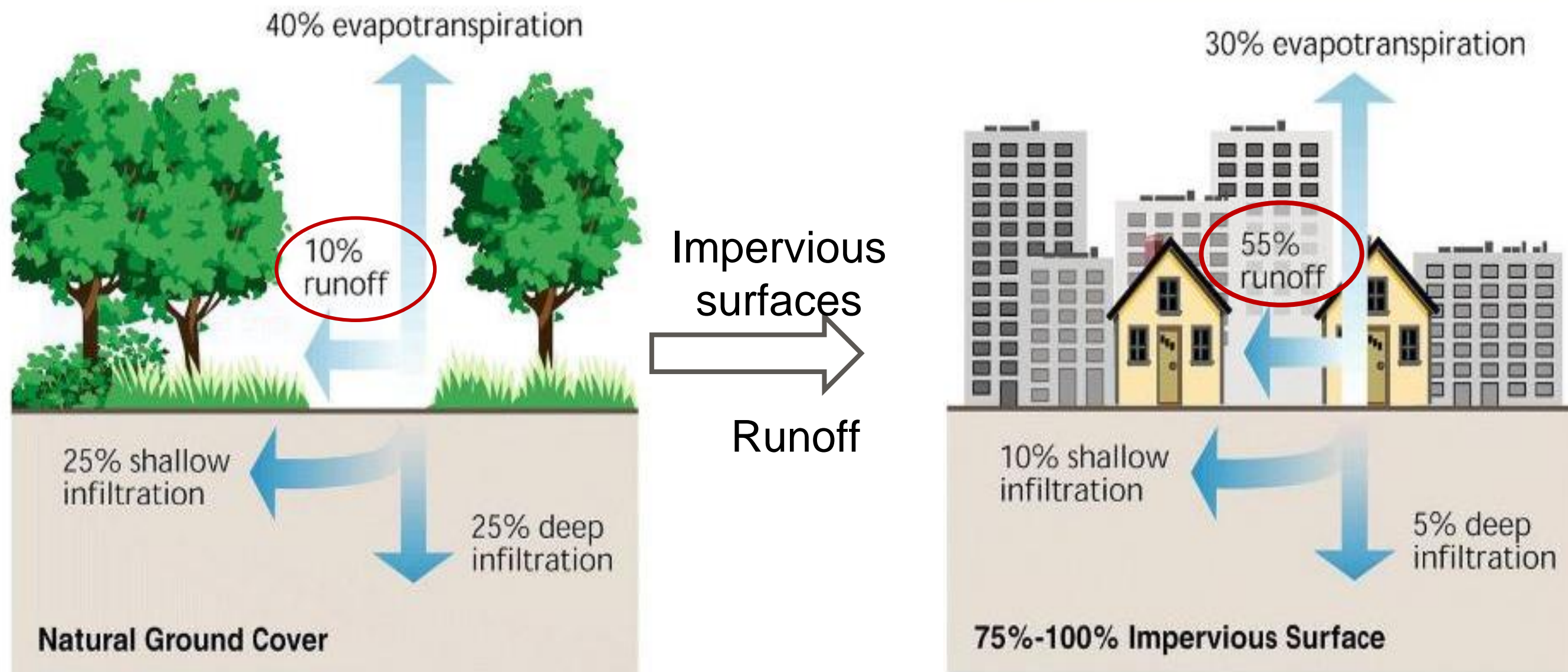
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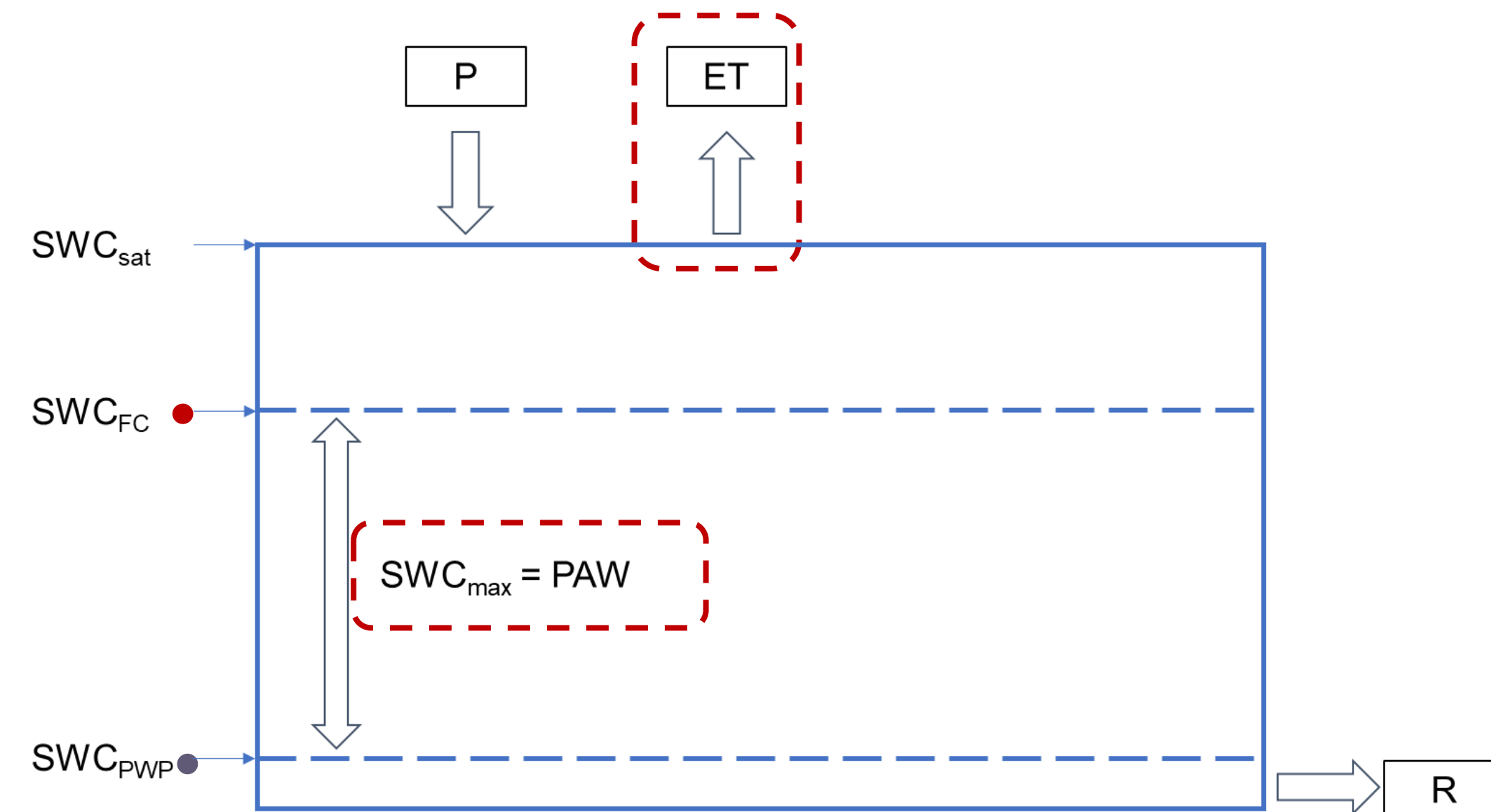
Sustainable stormwater management & Green roofs

Urbanization



Source: Relationship between impervious surface proportion and run-off (Ishimatsu et al., 2016)

Green roofs



Source: (Stovin et al., 2013)

Traditional stormwater management



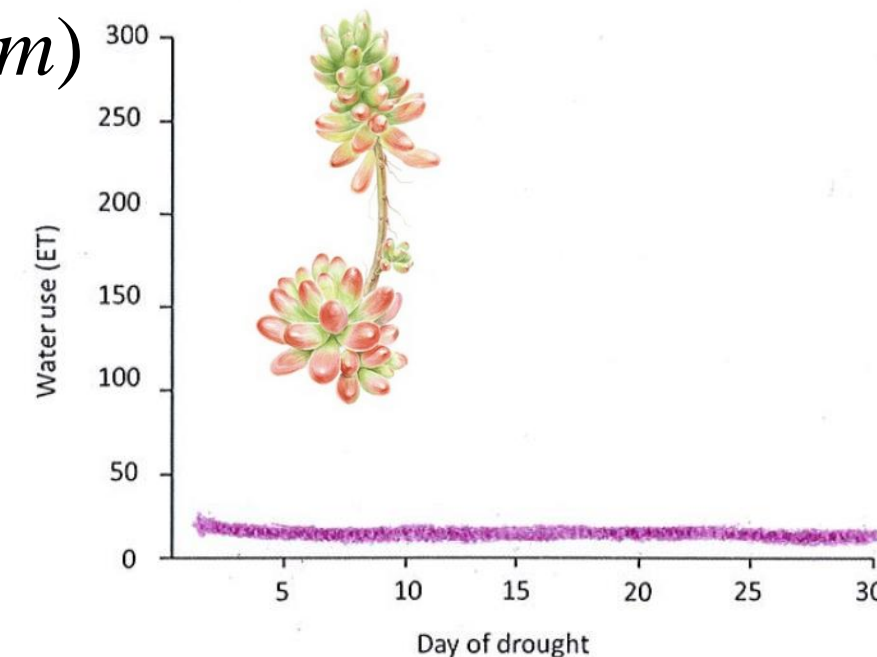


Problems of plant selection for green roofs

Sedum species

➤ Conservative water users- Succulents (*Sedum*)

- High tolerance for drought ← 😊
- Low efficiency of retention } 😞
- Sub-optimal delivery of stormwater benefit



➤ Monocultures (*Sedum* species)



- Lack of rainfall retention effectiveness
- Lack of diversity
- Lack of resilience: susceptible to climate extremes

Non-Succulents

Effect	Units	Succulent	Non-succulent	Reference
Runoff volume	ml	625	375	Nagase and Dunnett (2012)
Mean water loss in wet	g	1250	1300	Wolf and Lundholm (2008)
Mean water loss in dry		410	445	
Retention (<2mm)	%	88.9	98.2	Whittinghill et al. (2015)
Retention (2-10mm)		86.2	94.4	
Retention (>10mm)		74.8	92.4	

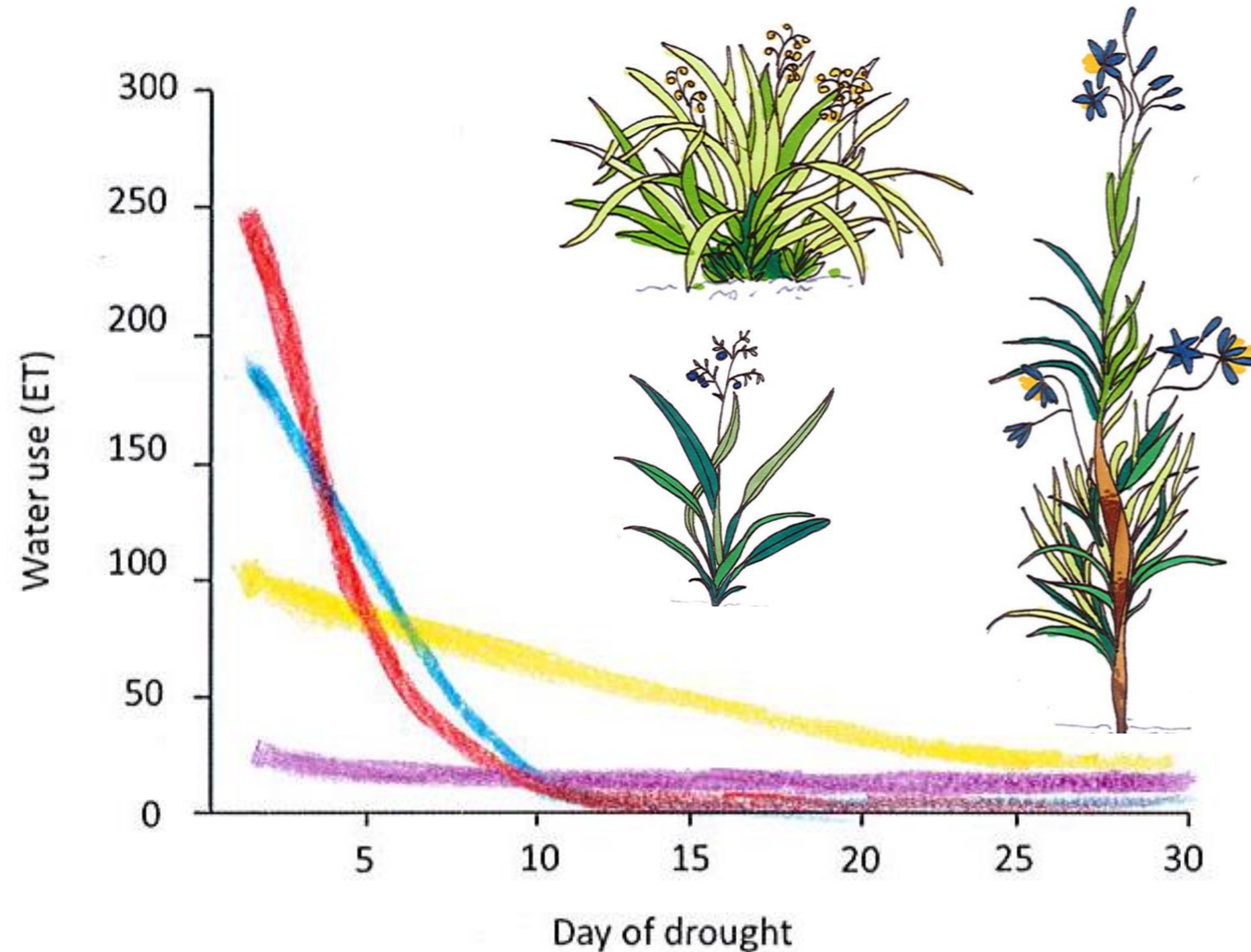
- **Higher transpiration rate** 😊

- **Vulnerable to Water Limitations** 😞



If and how to evaluate a trade-off?

➤ Plant water use strategy



Water use plasticity

- Use more when water are available
- Reduce use when water deficit occurs

Source: Farrell et al. (2013)

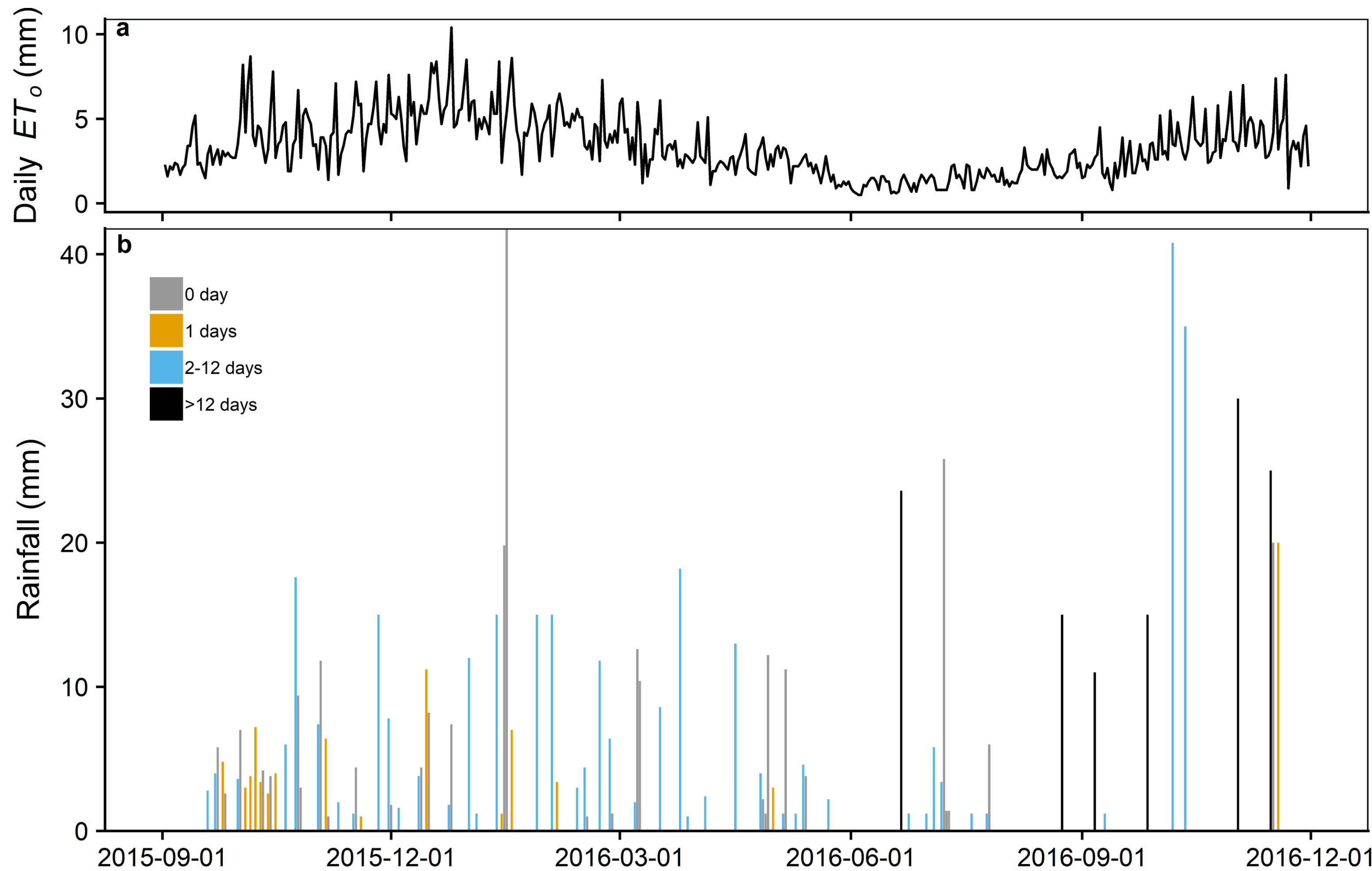
- Plastic water-using species will perform better than conservative water-using species
- ET

➤ Plant diversity (of water use plasticity)

- Mixtures will perform better than monocultures
- ET



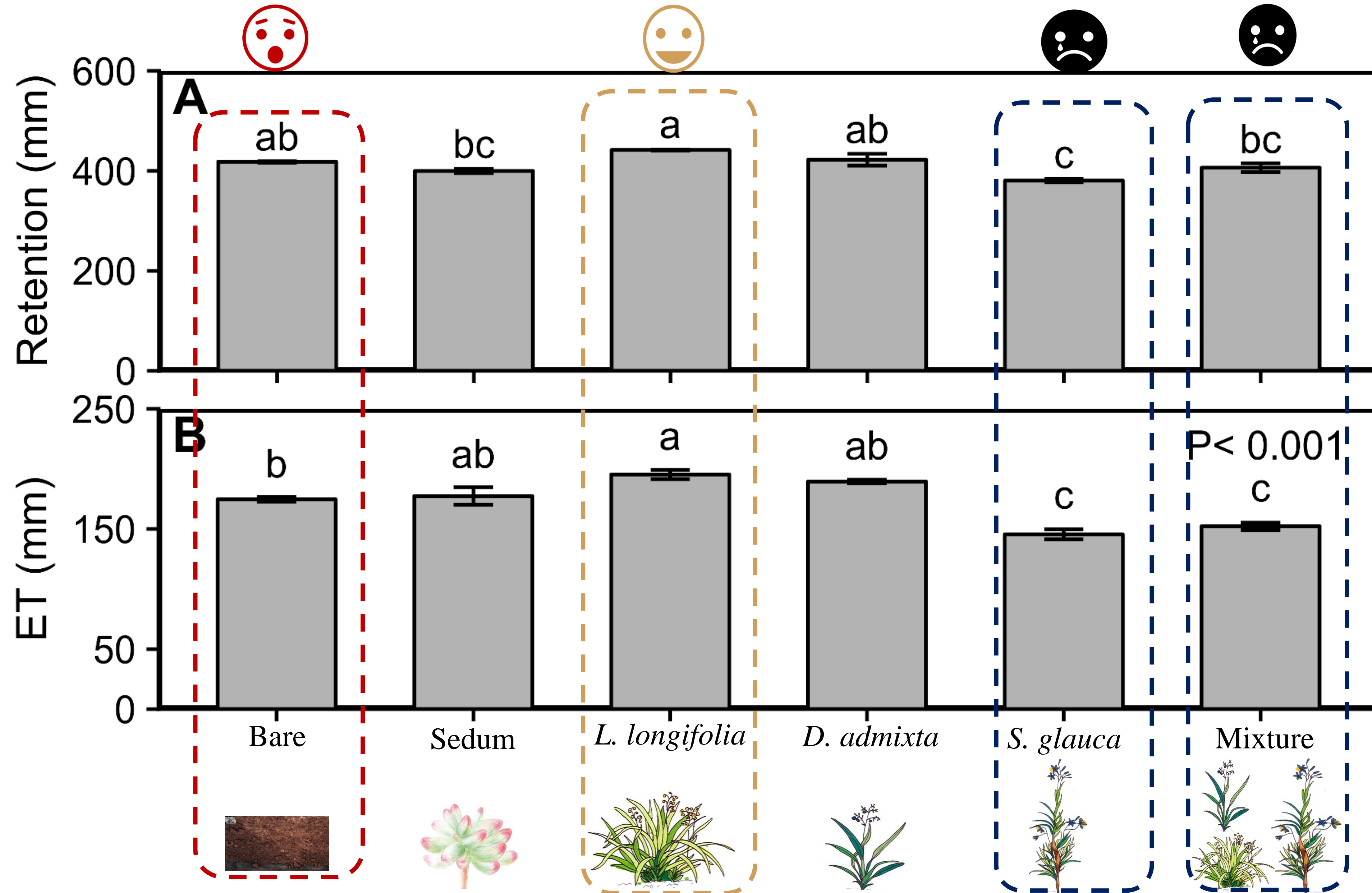
Experimental Design



- 92 events
- 'typical' year simulated long-term rainfall (1965-2015)

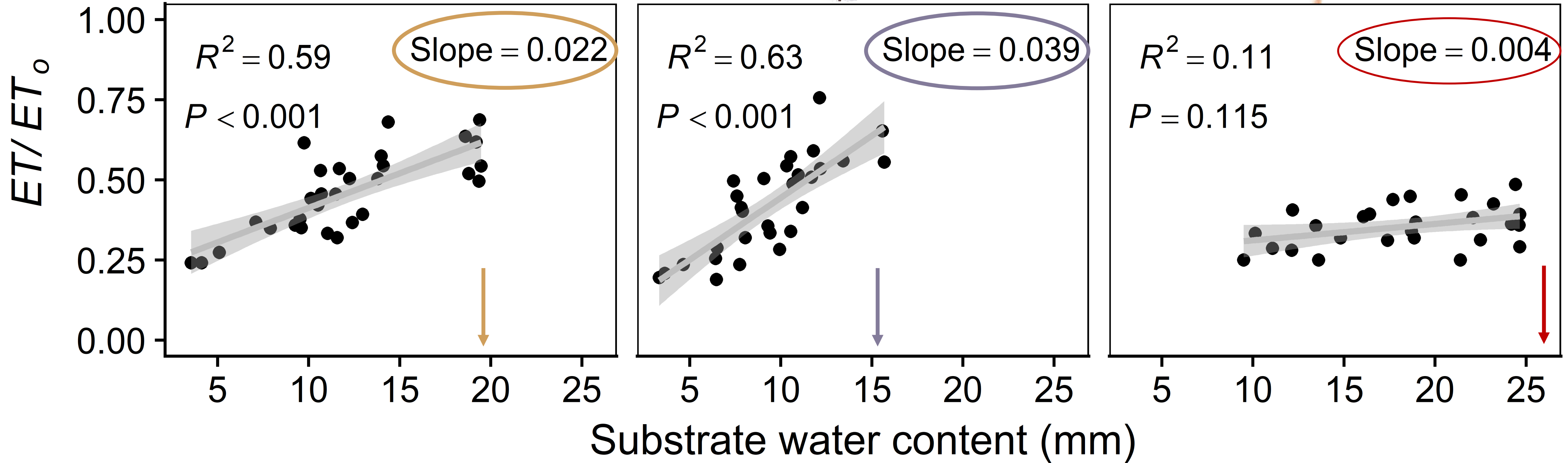


Retention performance



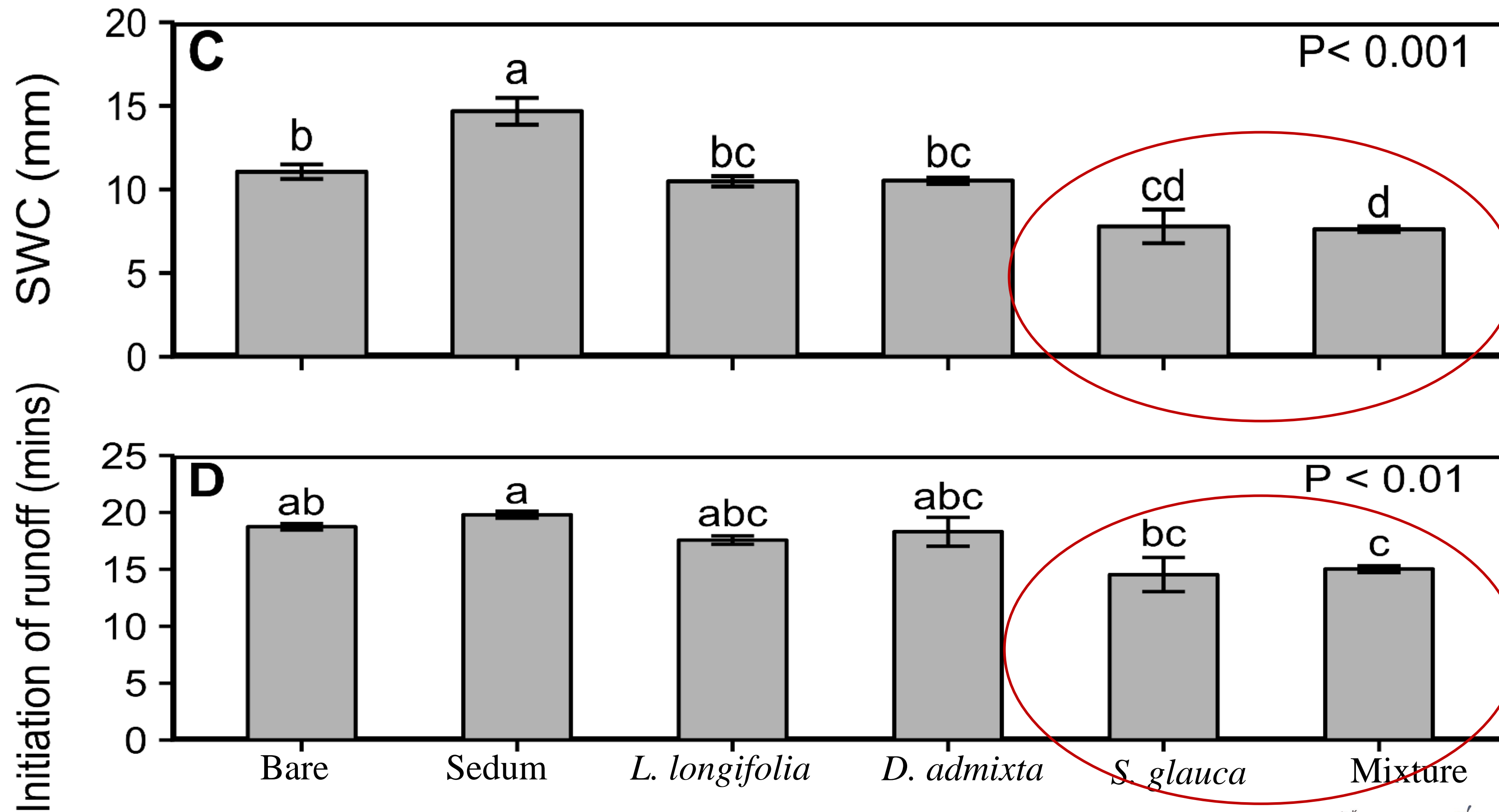


Plant selection for green roofs



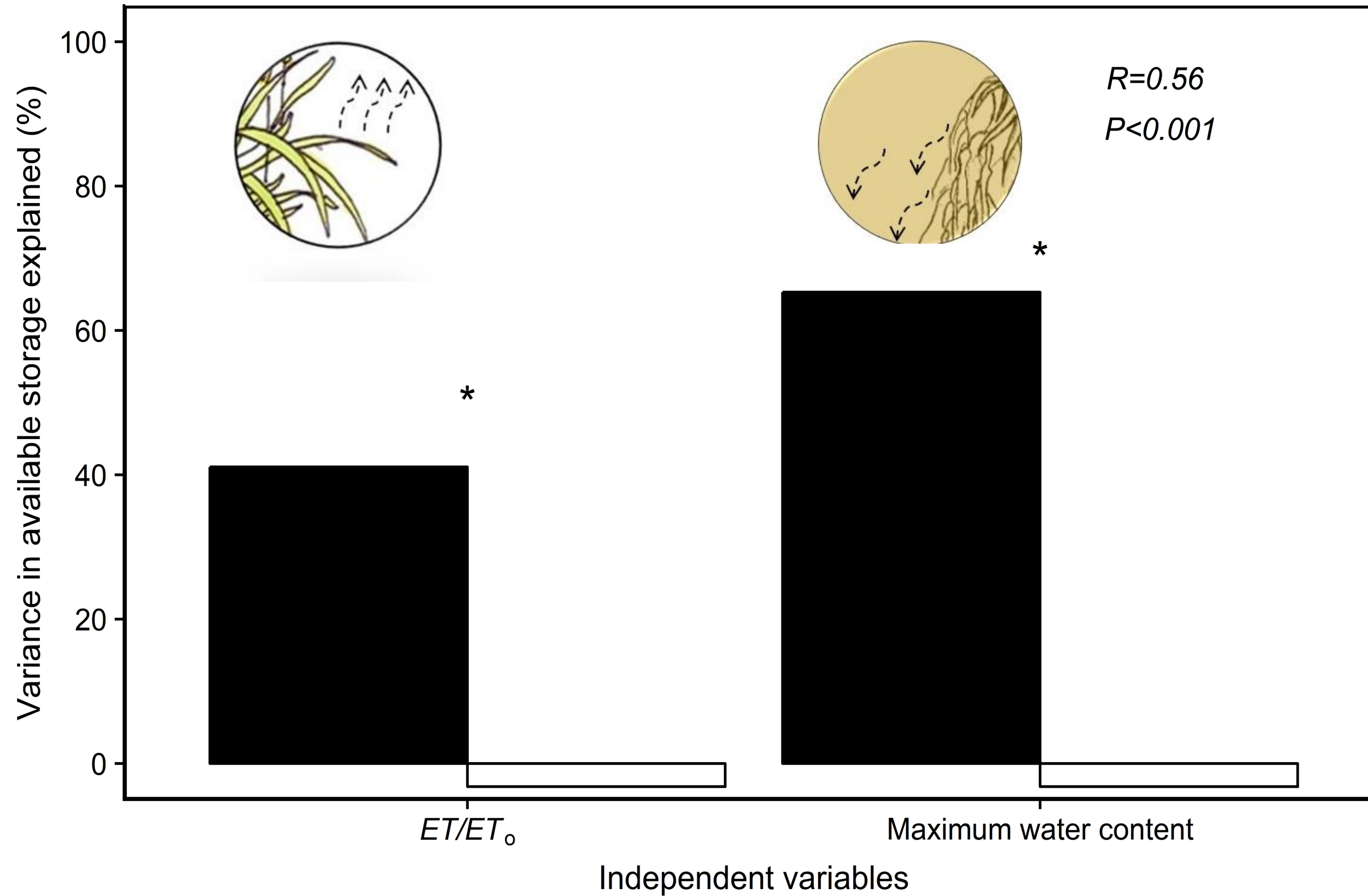


Plant-induced preferential flow



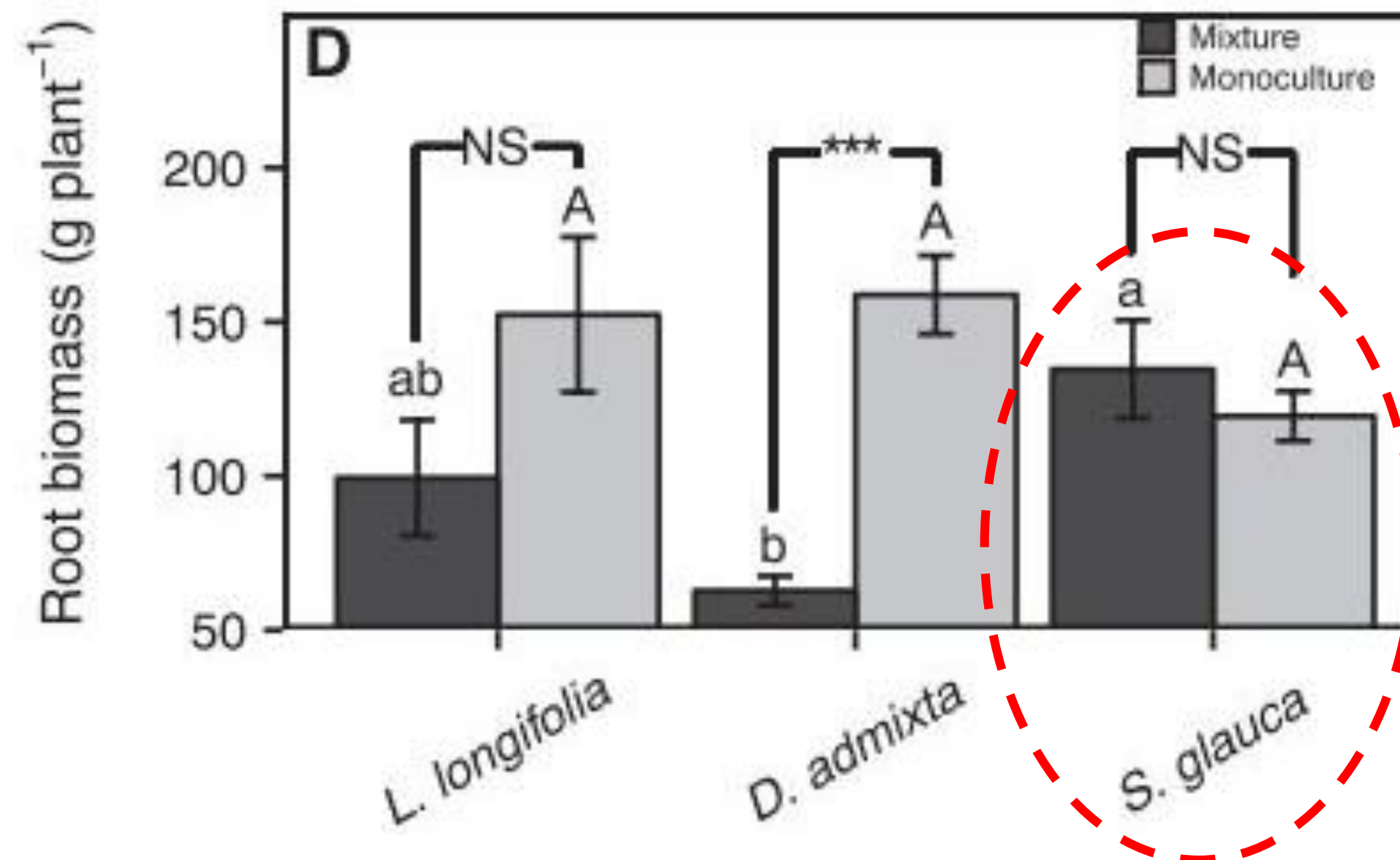
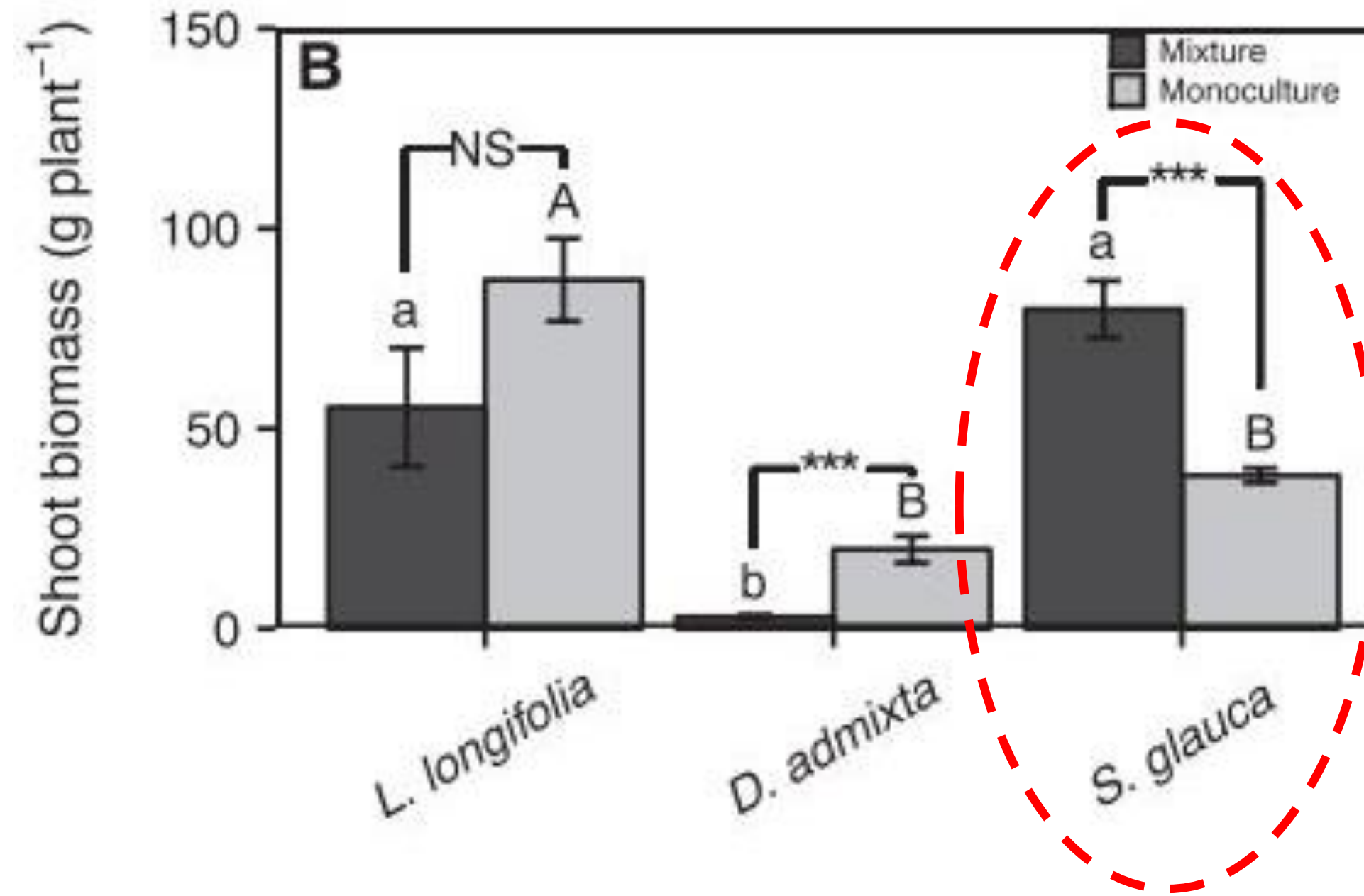


Plants influences via *ET* and *Non-ET*





Dominant species in the mixture



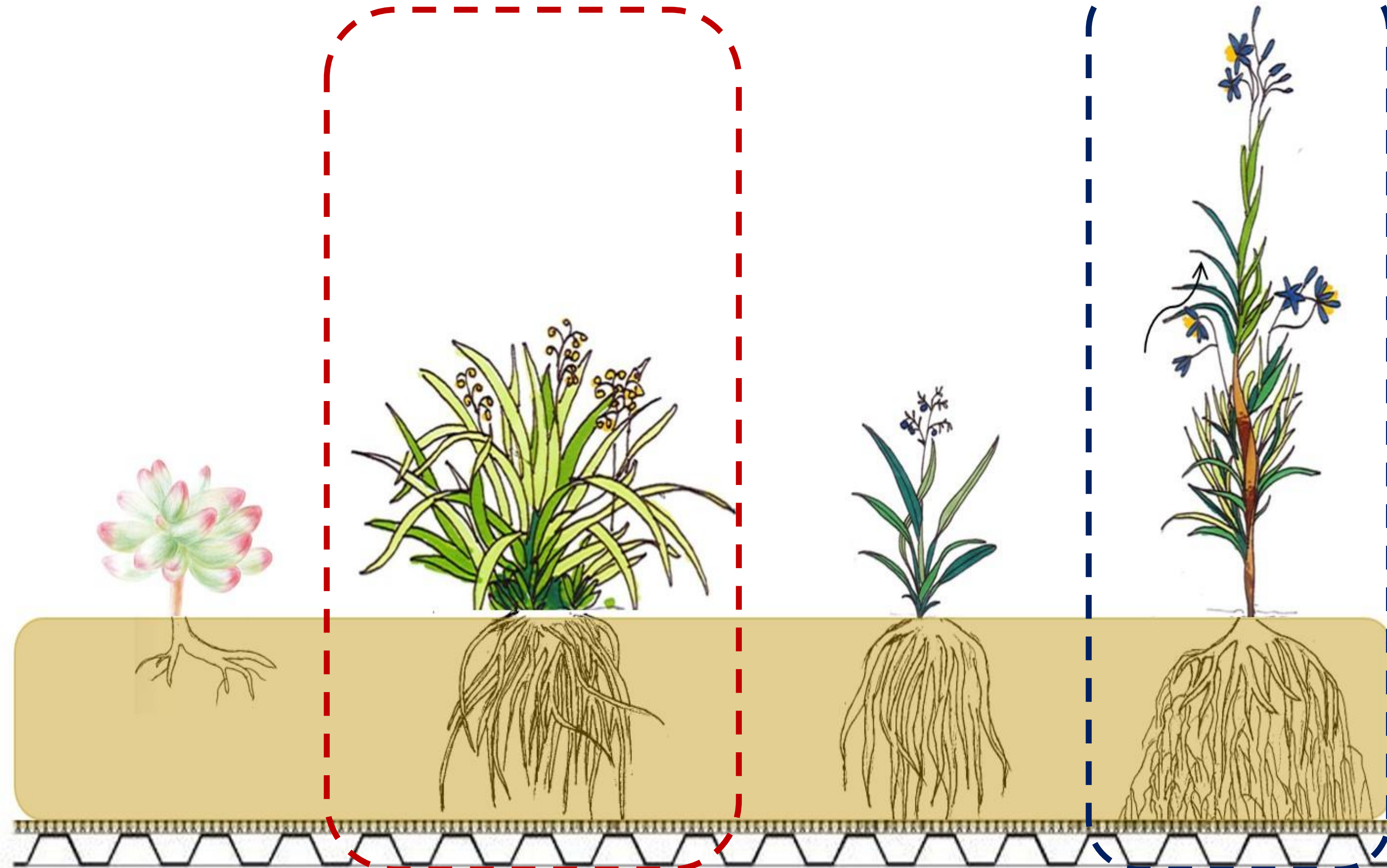


Take-home Message

Retention

Water use

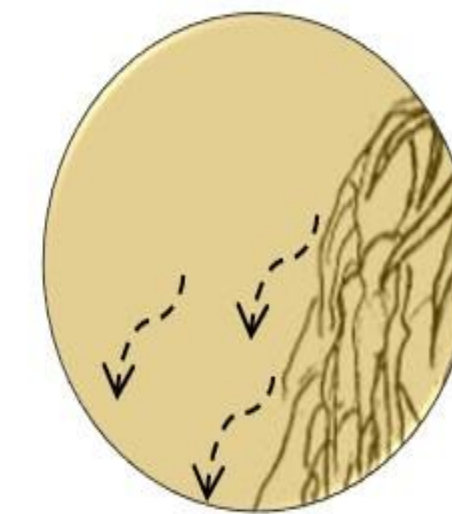
Preferential flow



ET

➤ **Plant selection**

- ET- water use strategies



Flow pathway
(non-ET)

➤ **Plant selection**

- Preferential flow- roots



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