Evolutionary Assembly of Vegetation in Saline Habitats: A Southern Hemisphere Perspective Ladislav Mucina Gudrun Kadereit, Simone Steffen, Kelly Shepherd, Michael Moody, Margaret Byrne & Grant Wardell-Johnson

Curtin University of Technology, Perth Johannes Guttenberg University, Mainz, Germany Department of Environment & Conservation, Perth The University of Western Australia, Perth

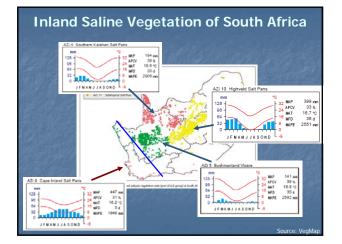
Menu

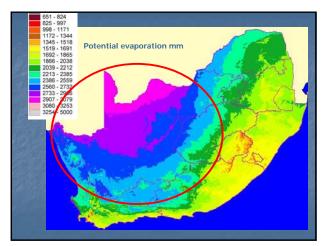
 diversity of types of saline vegetation in South Africa

- sources of halophyte diversity in SA
- crossing Indian Ocen to Australia (link between SA and AU)
- known molecular phylogenetic patterns in Australian halophytes
- ideas about their origins









Genera of Halophytes in Saline Vegetation of South Africa Two-level CLUSTER results (ISS, Chord distance)																							
Genus	Salicomia	Sarcocomia	Atriplex	Chenolea	Suaeda	Bassia	Salsola	Amaranthus	Prionanthium	Puccinellia	Stenotaphrum	Sporobokus	Stipagrostis	Panicum	Odyssea	Cenchrus	Chloris	Paspalum	Enneapogon	Eragrostis	Cynodon	Echinochloa	CLUSTER
Family	Chen	Chen	Chen	Chen	Chen	Chen	Chen	Amar	Poa	Poa	Роа	Роа	Роа	Poa	Poa	Роа	Роа	Poa	Роа	Роа	Poa	Poa	
AZe 1 Arid Estuarine Salt Marshes	Х	Х					Х					Х											1
AZi 2 Namagualand Salt Pans	х	х	х				х					х			х				х				1
AZe 2 Cape Estuarine Salt Marshes	х	х	х	х	х		х			х	х	х											1
AZe 3 Subtropical Estuarine Salt Marshes	х	х	х	х							х	х											1
AZi 8 Muscadel Riviere		х	х		х	х	х			х		х											1
AZi 9 Cape Inland Salt Pans	х	х	х		х				х	х		х											1
AZi 1 Namagualand Riviere		х			х		х						х		х						х		1
AZi 7 Tanqua Wash Riviere		х					x						х										1
AZi 10 Highveld Salt Pans			х		х		х	х				Х		Х			Х		Х	Х	Х	Х	2
AZi 11 Subtropical Salt Pans								х				х		х			х	х		х	х	х	2
AZi 3 Southern Kalahari Mekgacha							х	х				х	х	х	х	х	х		х	х	х		2
AZi 5 Bushmanland Vloere							х	х				х	х						х	х	х		2
AZi 4 Southern Kalahari Salt Pans							х					х	х	х					х	х			2
AZi 6 Southern Karoo Riviere						х	х			х		х	х			х				х	Х		2

Observations/Deductions/Questions (1) Two basic groups of saline vegetation units reflecting mega-climatic patterns (winter vs. summer rainfall) >> reflection of evolution of contrasting climatic systems? (2) High similarity of estuarine units (regardless the biome link) >> Strong habitat filters and effective dispersal corridors along the coasts allow for assembly of taxonomically similar communities Temperate estuarine (Cape) flora feeding subtropical estuarine vegetation ?

Where does this high diversity come from?

- In evolutionary terms: high species diversity is a result of high speciation & low extinction rates
- **High speciation rates**
 - Recurrent disturbance (new habitats, new open niches) Recurring isolation (genetic divergence) and re-union (facilitating hybridization)
- Low extinction rates
- Overall regional stability (resistance to climate change)
- Sorting along ecological gradients (reduction of competition: limiting similarity?)
- Large population sizes (reduction of chance of stochastic disasters)

Question

Which regions in southern Africa would show the highest regional species diversity in saline habitats?

Prediction

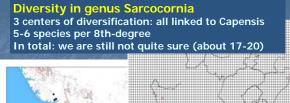
The highest species diversity in saline habitats will be found in estuarine salt marshes of the winter-rainfall Cape flora.

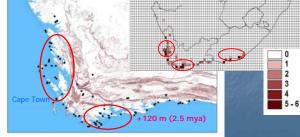
Why?

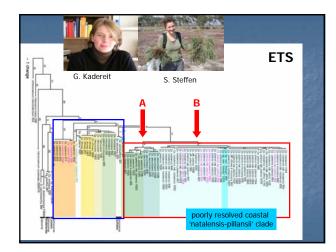
1) The estuaries of the Cape have been exposed to recurrent marine transgressions resulting in repeated fragmentation and rejuvenation of coastal habitats creating substrate for adaptive radiations.

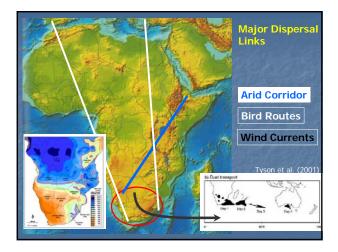
2) The fine-tuned sorting along environmental gradients (evolution of beta-niche traits) is controlling the local-scale coexistence of congeneric flora and creates steep beta-diversity clines.

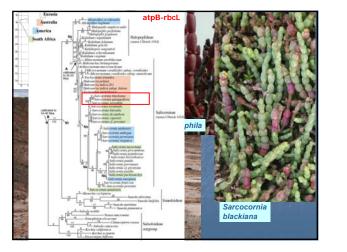
3) The winter-rainfall of the Cape is a region of high resistance to drastic climate change - slowing-down of extinction rates.

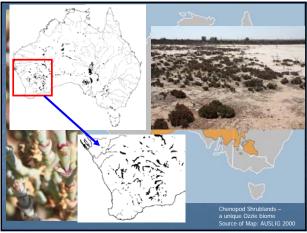








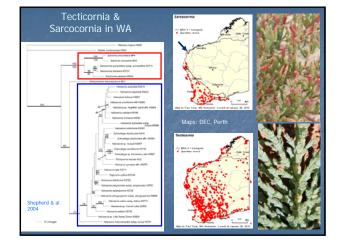


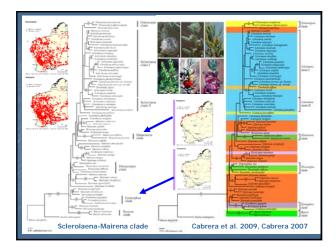


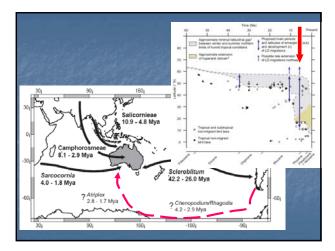
Australia:

The southern headquarters of chenopods

- no endemic subfamilies or tribes
- 28 native genera (many endemic, but...)
- ≈ 400 species (*Tecticornia* ≈ 80)
- biome dominated by chenopods (Chenopod Shrublands)
- Why? The driest and the longest dry continent of the World ?







Origins Australian Halophytes

- (1) Number of recent dispersal events (almost all younger that mid-Miocene)
- (2) in situ speciation (at least Tecticornia shows "rapid recent" pattern)
- (3) One taxon (Scleroblitum: tribe Chenopodiae) presumed to have arrived earlier (Oligocene?)
- (4) How old is the halophyte flora of Australia anyway?

<image>

Thanks you !

Image: State of the state of t

haft (German