

## Workshop Report

# Losses of foundation species and the consequences for ecosystem structure and function

Estes Park, Co., Saturday, 23 September 2006

**Workshop Organizers:** Brian Kloeppel - Coweeta, Aaron Ellison - Harvard Forest

**Workshop Format:** Five presentations followed by a discussion of foundation species in a broad range of biomes. Are there unifying questions or analyses?

### Presentations:

Introduction - Coweeta: Brian Kloeppel  
Ocean - Palmer: Robin Ross and Langdon Quetin  
Salt Marsh - Georgia Coastal: Meryll Alber  
Arctic - Toolik Lake: Donie Bret-Harte  
Eastern Forest - Harvard Forest: Aaron Ellison  
Grassland - Konza: Melinda Smith

### Running Notes:

Brian: introduction  
Brief history of foundation species workshops  
Summary points from Ellison et al. *Frontiers in Ecology and the Environment* paper

Ocean - Robin and Quetin:

Biology and description of ocean krill  
"long-lived" krill species of 5 to 7 years  
60-155 million metric tones of biomass  
Long-term decline (as much as 50%) since the 1970s - due to changes in water temperature and/or ice decline????  
Population of Adele populations have also been declining – the krill/penguin populations may be correlated, but not necessarily causal

Salt Marsh - Meryll Alber:

Introduction of salt marsh ecology and the ecosystems provided  
More marsh - more seafood  
Juncus / Spartina border changes over time (a change due to increases in salinity)  
2001 to 2002 dieback - 40 sites and over 800 hectares  
Long term impacts of salt marsh dieback resulting in soil erosion to further downstream and ocean systems  
Healthy vs. dieback sites: a summary of sediment losses  
Summary of ideas of potential causes...pollutant, drought, snail herbivory, (top down effects). Fungi (*Fusarium* \_\_\_)

Loss of foundation species, what's next????

Salt marsh dieback has been making splashes in the press

Arctic - Donie

Rapid climate change is occurring in the North (0.7 degrees C / decade)

Shrubs are expanding in the arctic (Alaska, Russia, and Canada)

Tussock tundra and deciduous shrubs

What are the limitations on production? Is warming resulting in increased decomposition and hence providing an indirect fertilization effect?

Plant removal experiments are investigation possible compensation responses

What happens when foundations are lost? ... changes in herbivore (large and small) food source

Eastern Deciduous Forest - Aaron

Hemlock removal experimental design

Grassland – Melinda

Plant community comparisons

Tallgrass prairie ecosystems

One species may contribute 80 to 90% of productivity

Plant diversity vs. plant productivity

Understanding the role of foundation species

Cross-site comparisons of outside treatments and influences

Fire: reduces diversity

Grazing: increases diversity

Removal experiments of dominant vs. low dominance / high diversity systems

Comparing removal impacts on plant diversity and productivity

Long-term (8 years later) there is still a 30 % reduction in big blue stem

Importance of long-term removal studies over time

Long-term rainfall manipulation plots initiated in 1998

Warming treatment added in 2001

Dominant species drive responses to climate change

ANPP declines and generates lower diversity

Dominant species responses

Discussion:

When a foundation species is changed or altered, an increase in species diversity often results

Ocean system influences include changes in health and status of predators and response to changes in ecosystems

Changes in altered resources and consumers...

How can we use existing data sets to identify the foundation species in these

Ocean systems ... foundation species are not primary species...

Top-down vs. bottom up effects: ocean krill are in the middle of the food web

Kelp forest ecosystems: dying has a large negative impact on the other forests

Management vs. ecological conflicts...

Scale of dominants versus “importance value”

When a dominant species is removed, is there a change to a new state of the system?

Threshold vs. continuum of species....

keystone species vs. foundation species (see Ellison et al. for definitions)

compensations by sub-dominants vs. exotic influences influencing diversity (it may likely depend upon the scale of measurements)

foundation species in temperate vs. tropical systems (e.g. mangrove forests are likely)

How do you think about which species are more likely to be characterized as foundation species? Where do you look for foundation species?

Coral reefs ...

### Participants List

<b>Last Name</b>	<b>First Name</b>	<b>Site or Research Location</b>
Adam	Tom	MCR
Alber	Merryl	GCE
Arkema	Katie	SBC
Baes	Salene	SEV
Barker-Plotkin	Audrey	HFR
Bret-Harte	Donie	ARC
Brooks	Andy	MCR
Corman	Jessica	NSF
Dugan	Jenny	SBC
Elliott	Katherine	CWT
Ellison	Aaron	HFR
Emery	Sarah	KBS
Foster	David	HFR
Fraser	Bill	PAL
Geta	Rishvoveanee	Romania
Guadine	Jenna	HBR
Hunt	Bill	MCM
Jarauca	Caroline	MCM
Jochum	Gera	NSF
Johnson	Peter	NTL / NWT
Kamarainen	AMY	NTL
Kloeppel	Brian	CWT
Kuhman	Tim	CWT
Lawson	Sarah	VCR
Lodge	Jean	LUQ
Maheigan	Mairead	MCR
Mahoney	Wendy	KBS
Marsh	Amanda	VCR
Martinson	Doug	PAL
Michaels	Rachel	VCR

Moore-Topinka	Hatalie	MCM
Morkeski	Kate	CWT
Mozdzer	Tom	VCR
Muldavin	Esteban	SEV
O'Keefe	John	HFR
Pate	Whitney	PIE
Pearson	Scott	CWT
Quetin	Langdon	PAL
Record	Sydne	HFR
Reed	Dan	SBC
Robertson	Mark	JOR
Ross	Robin	PAL
Rossweilier	Andrew	SBC
Schaefer	Sylvia	GCE
Smith	Melinda	KNZ
Smith	Rich	KBS
Spellman	Blaine	BNZ
Trexler	Joel	FCE
Turner	Monica	NTL / CWT
Vander Zander	Jake	NTL
Warne	Robin	SEV
Webster	Jack	CWT
Worel	Sheila	LUQ

Total = 53 participants