2012 INTECOL – International Wetlands Conference

Biogeomorphic feedbacks drive dynamics of vegetation–landform complex in a coastal riparian system

(Accepted by *Ecosphere*)

Daehyun Kim

Department of Geography

University of Kentucky

The Skallingen salt marsh in SW Denmark

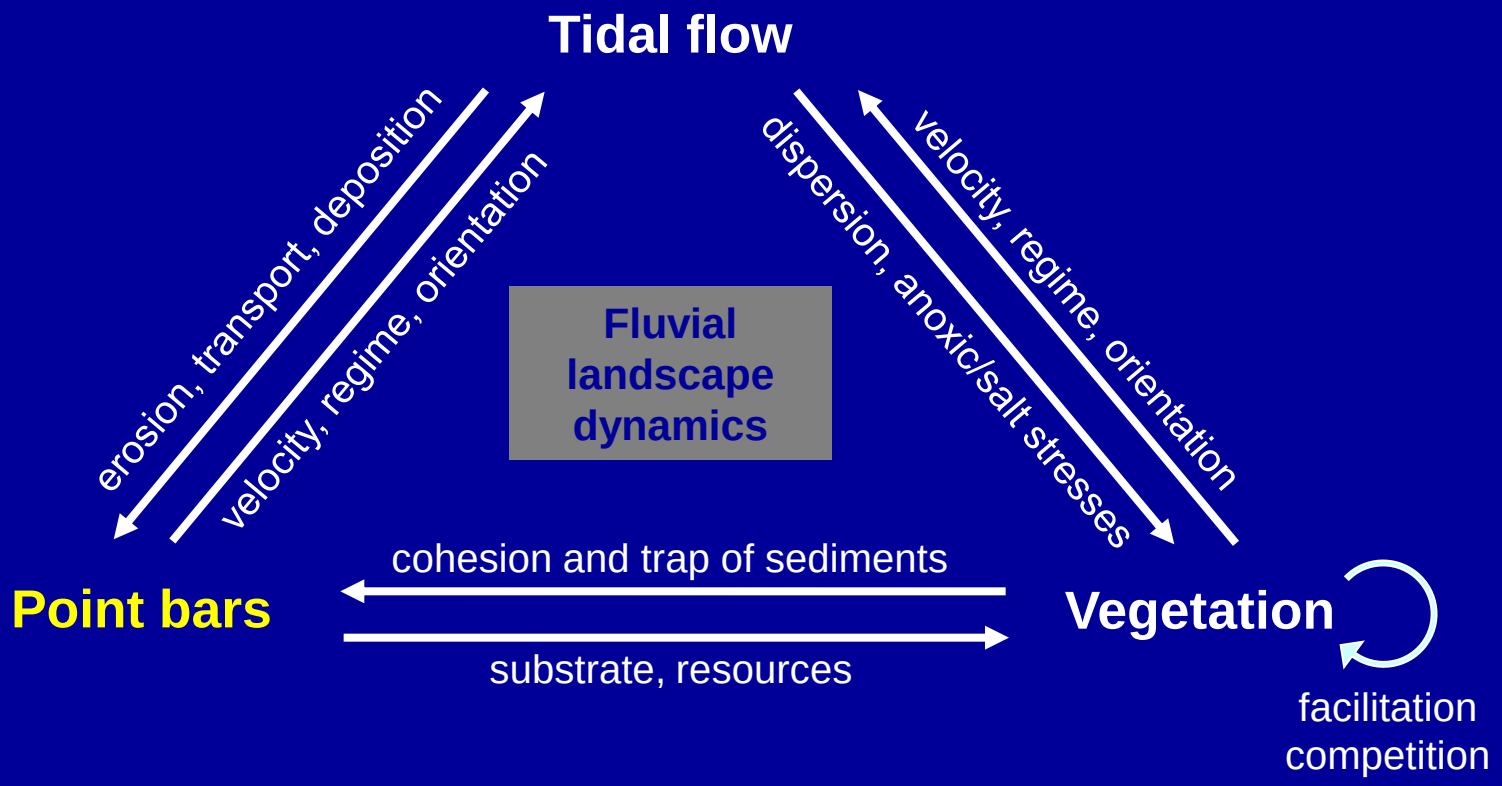
Dynamics of vegetation–landform complex

- bar: sedimentation / expansion of pioneer zone
- bank edge: erosion / retreat of vegetation

2006

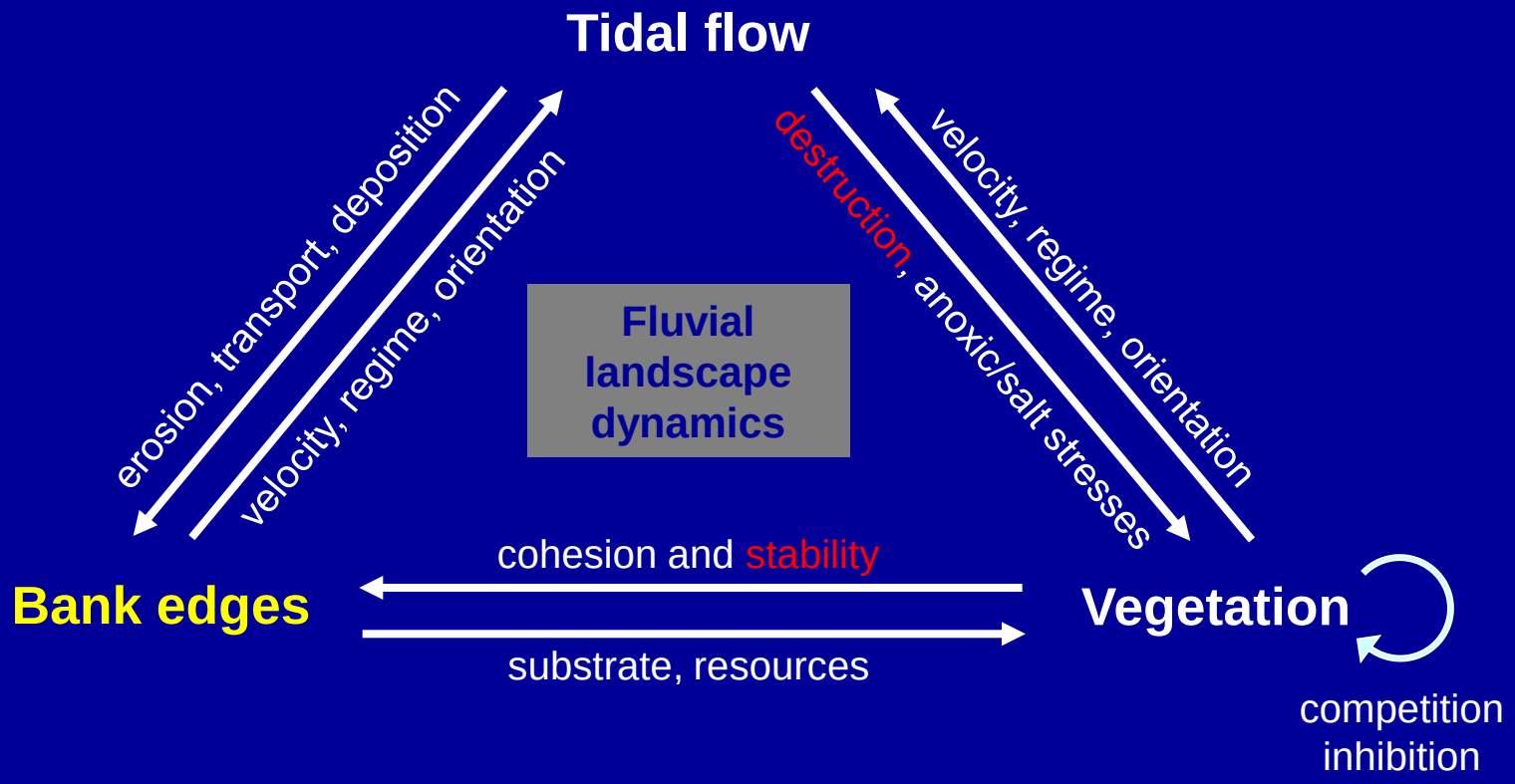
2011

Biogeomorphic Feedbacks in Tidal Creeks



Modified from and inspired by Corenblit et al. (2007)

Biogeomorphic Feedbacks in Tidal Creeks



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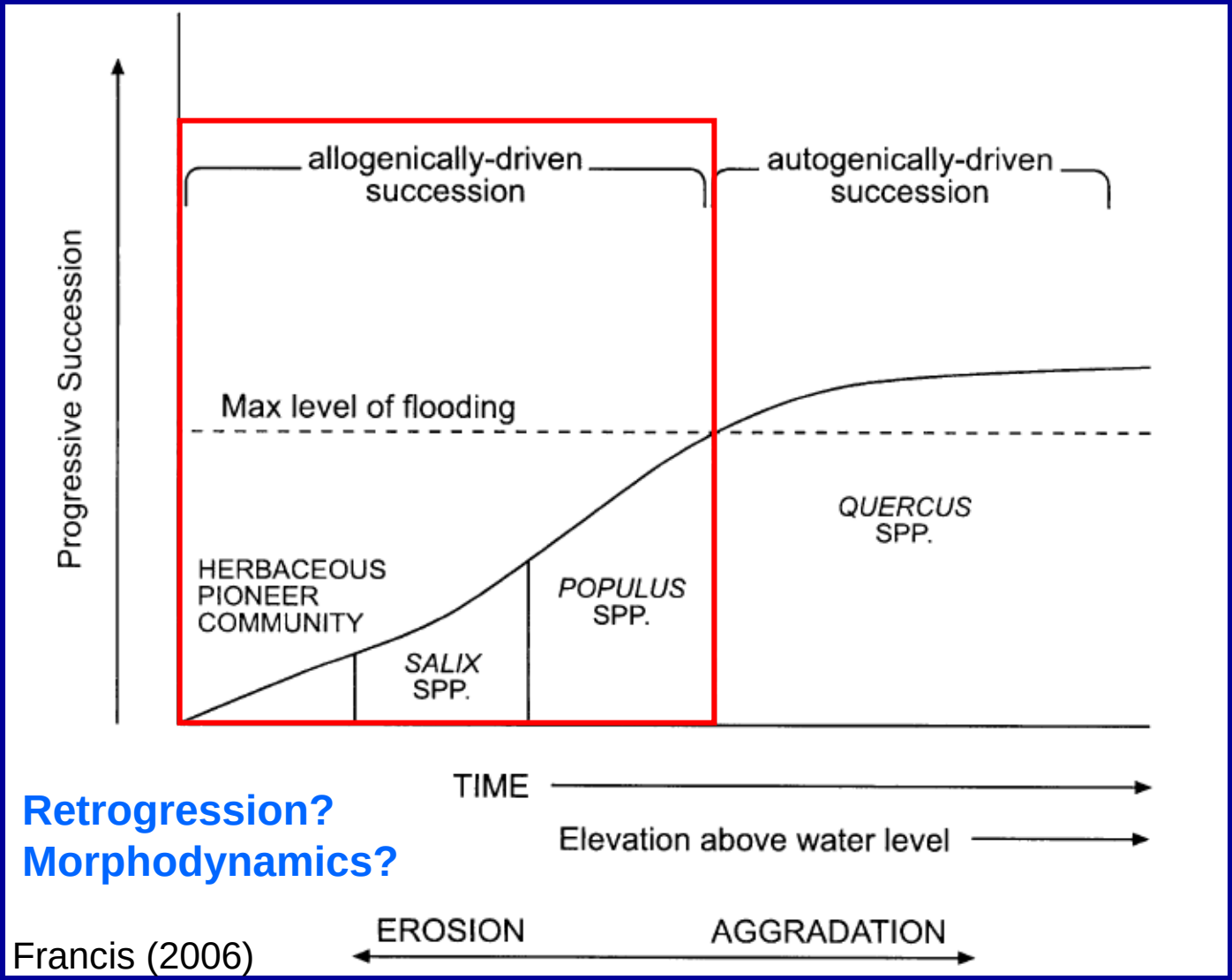
A Conventional Notion in Riparian Ecology



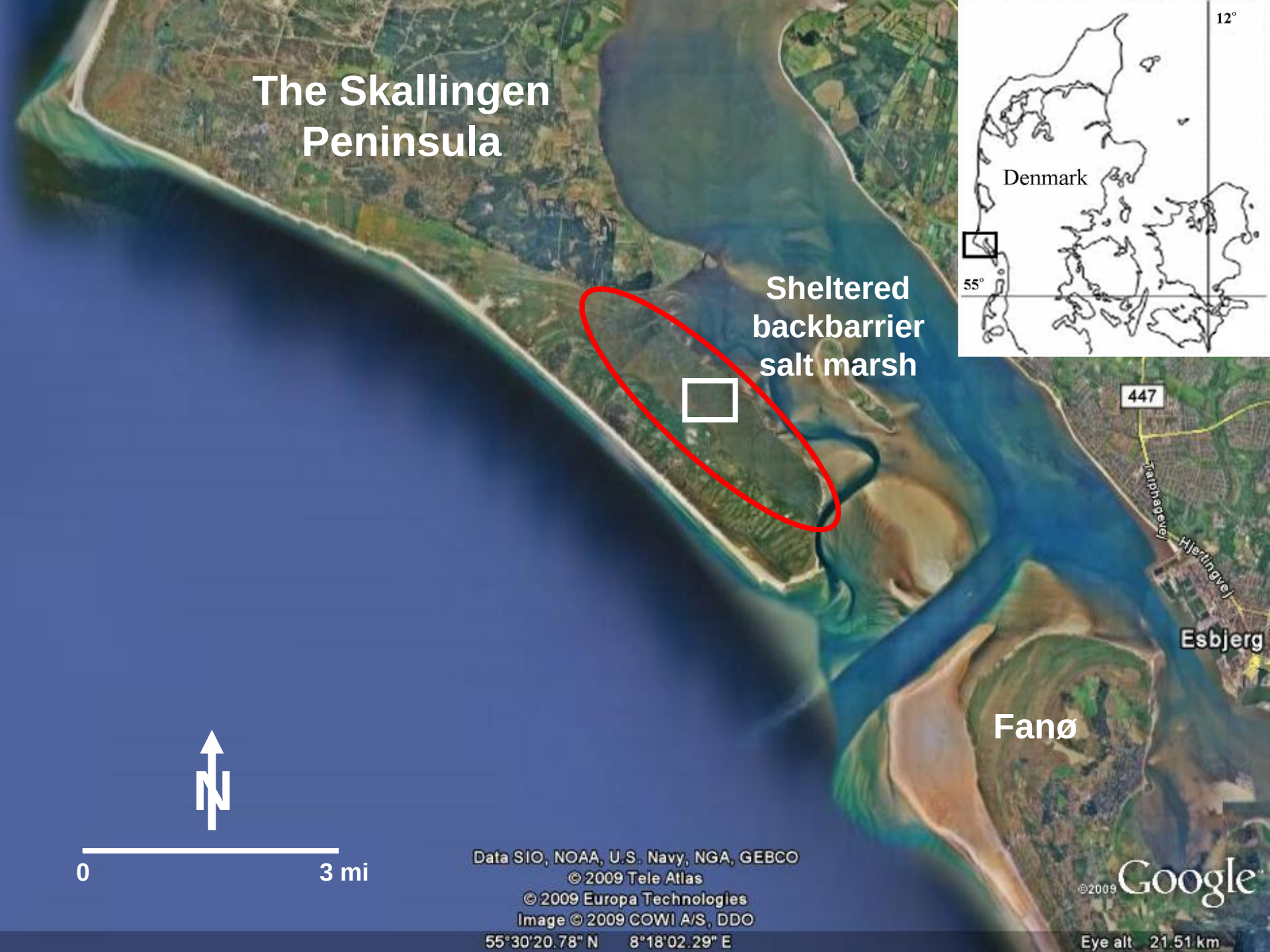
Retrogression?
Morphodynamics?

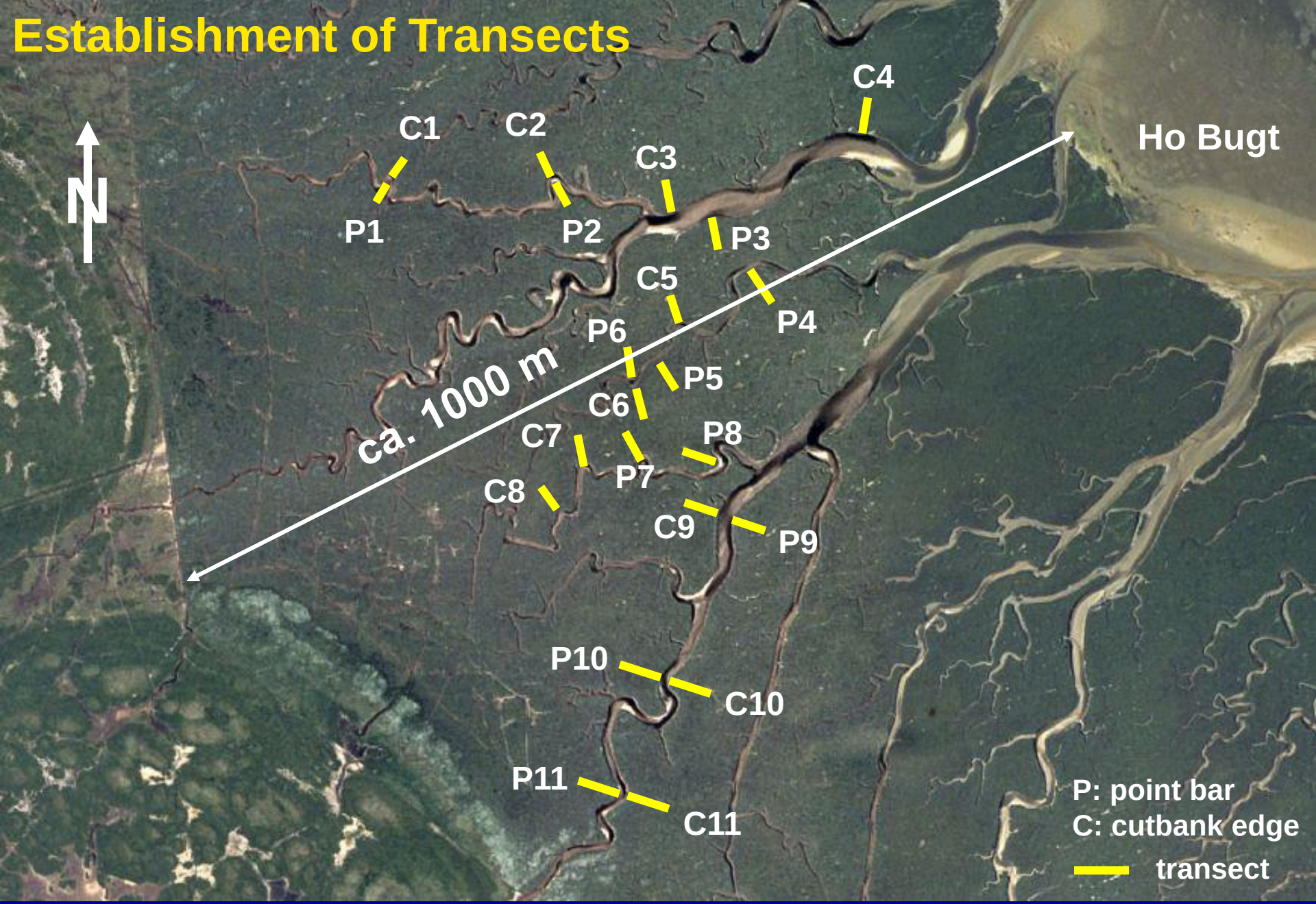
Francis (2006)

Hypothesized Gradient across Tidal Creeks

Away from the creek

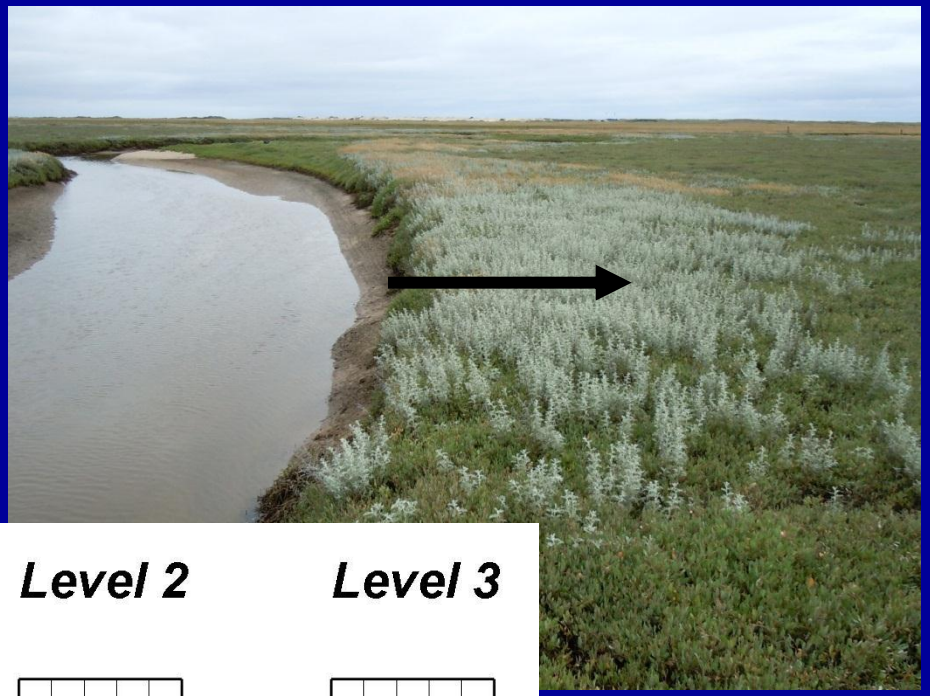
- Less dynamic changes in hydrogeomorphology
- Less changes in plant species composition

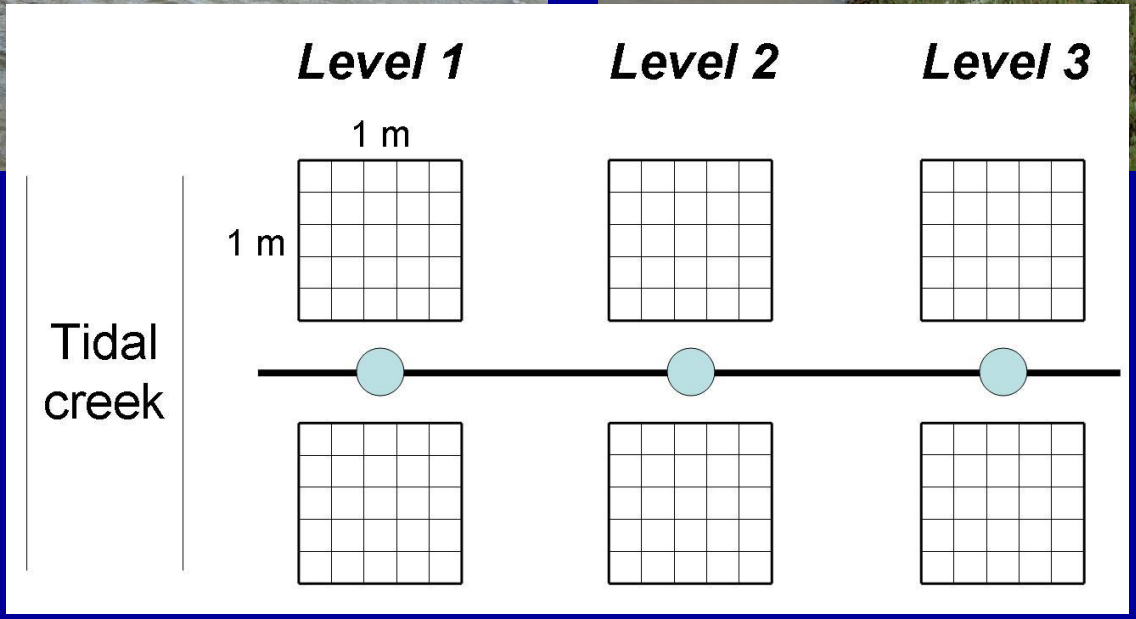

The Skallingen Peninsula
Sheltered backbarrier salt marsh
Denmark
12°
55°
447
Taphagevej
Hjertingvej
Esbjerg
Fanø
N
0
3 mi
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2009 Tele Atlas
© 2009 Europa Technologies
Image © 2009 COWI A/S, DDO
55°30'20.78" N 8°18'02.29" E
©2009 Google
Eye alt 21.51 km



Sampling sites in the study area (photo taken in 1995)

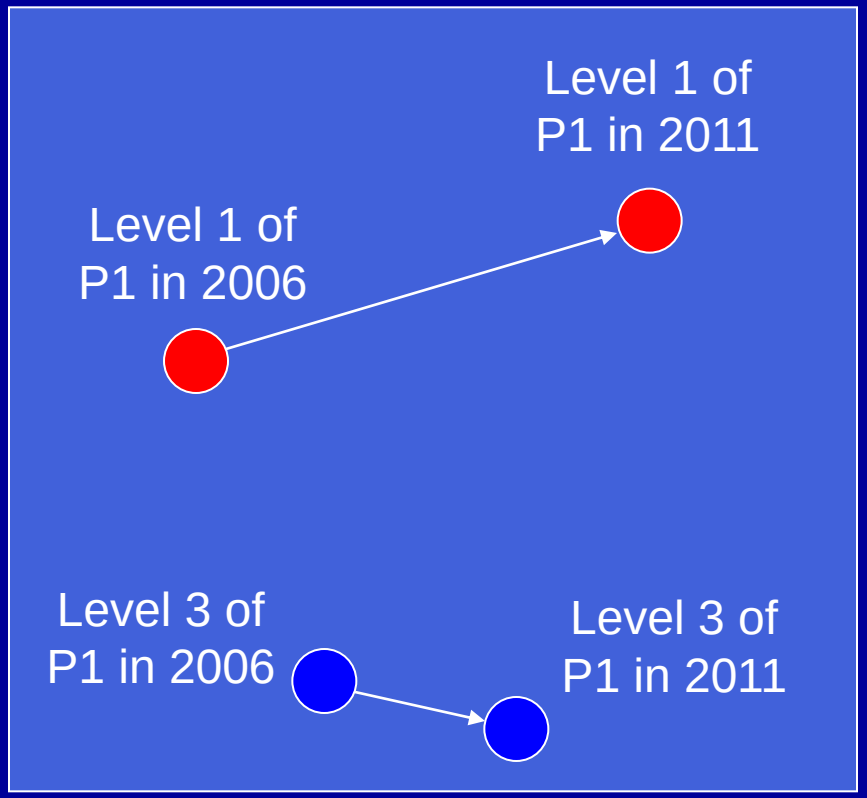
Sampling Design





Estimation of Succession Rate

e.g. point bar part



2-dimensional space of non-metric multidimensional scaling

Average Euclidean distance in Level 1

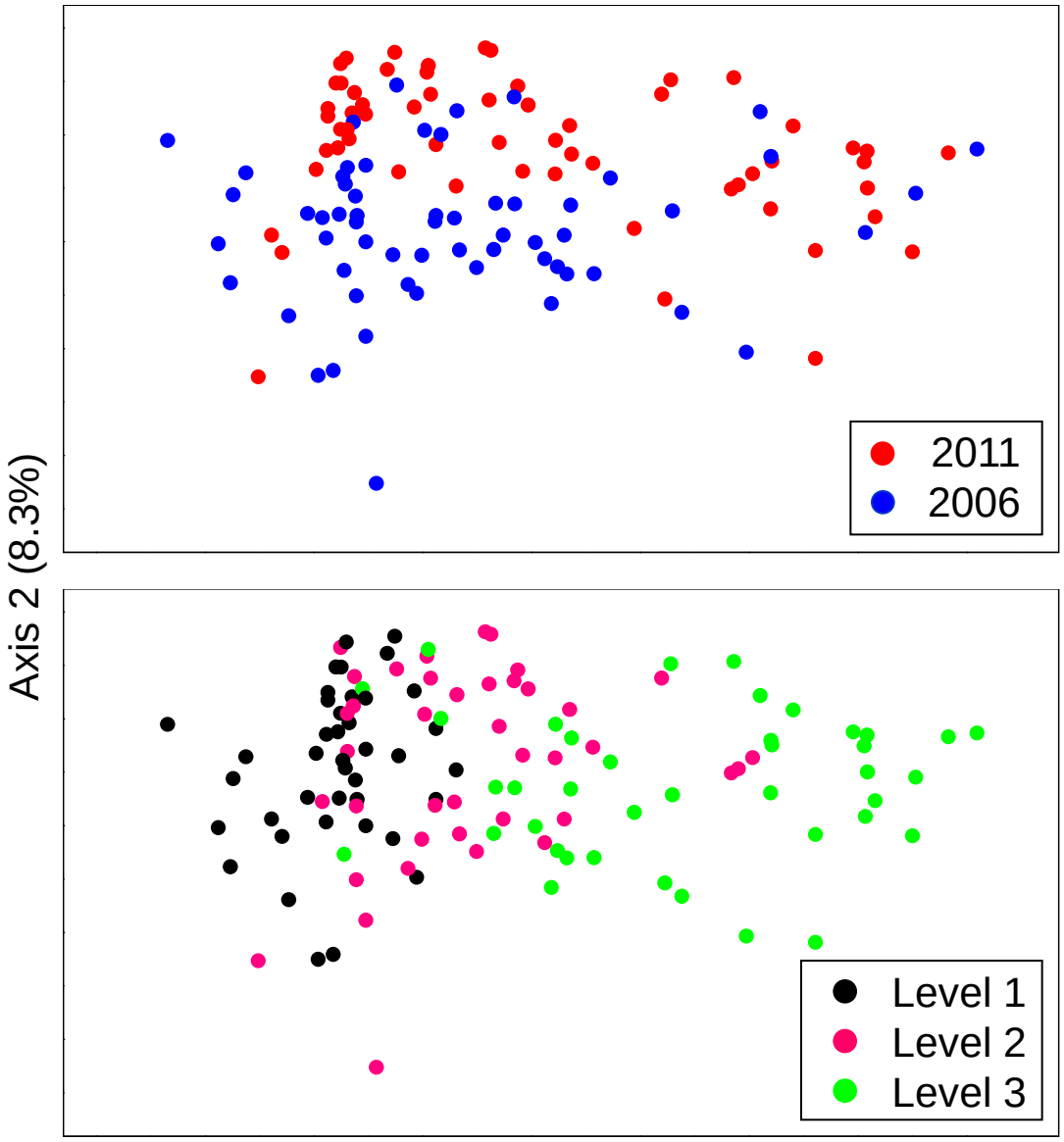
vs.

Average Euclidean distance in Level 2

vs.

Average Euclidean distance in Level 3

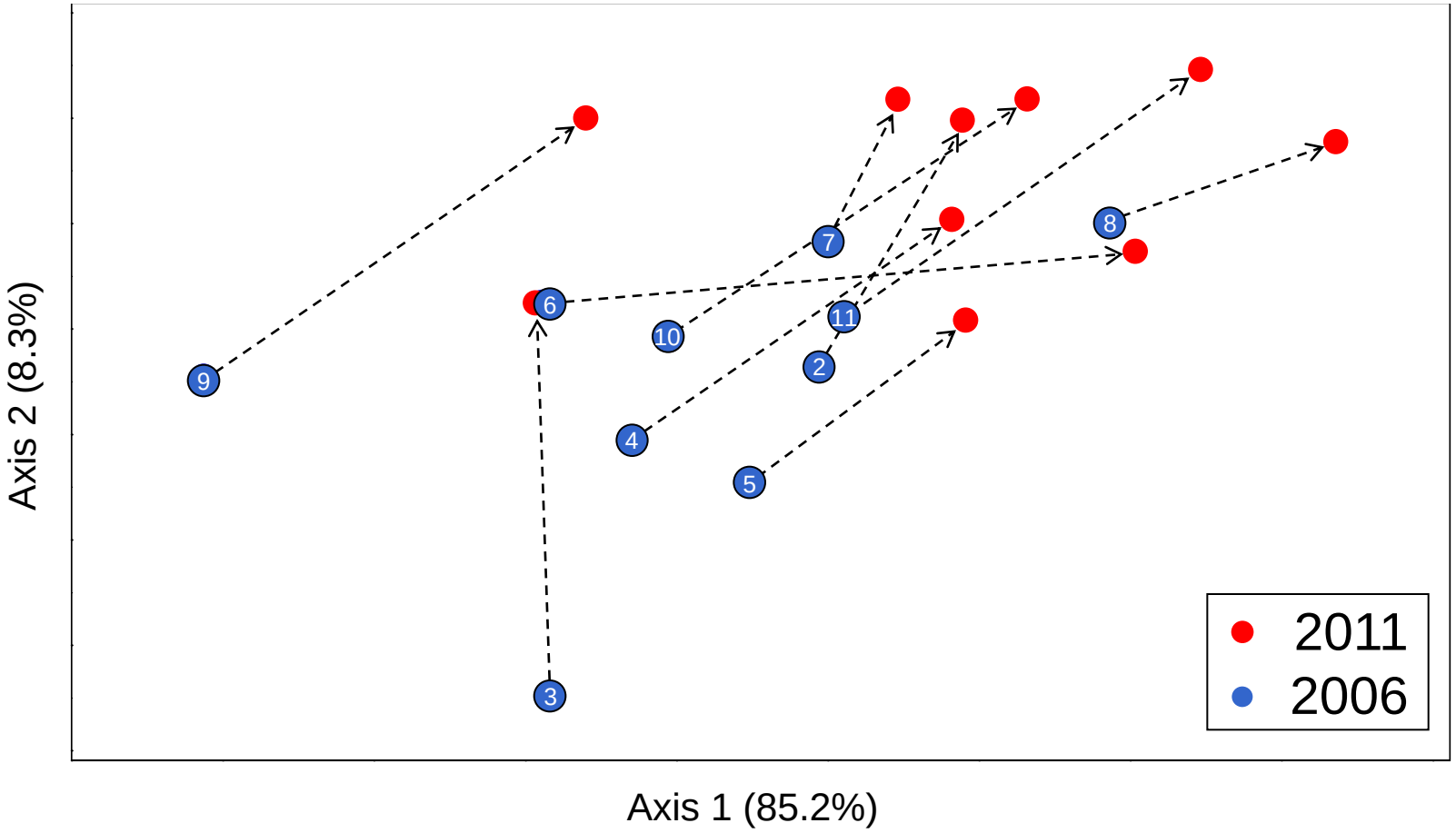
Dynamics in Point Bars



Paired samples test
t = -0.81, p < 0.001

ANOVA
F = 81.34, p < 0.001

Dynamics in Point Bars

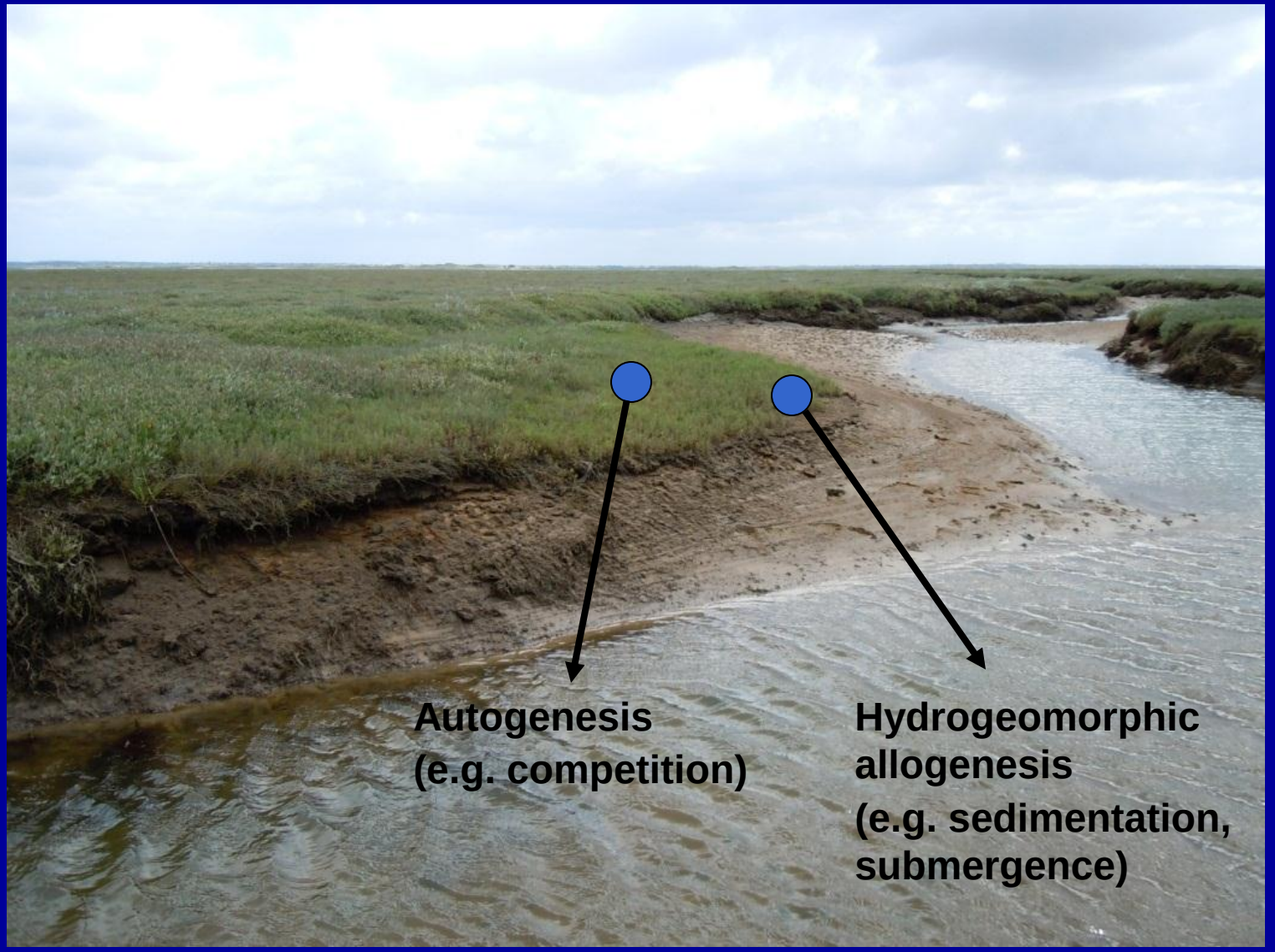


Kim (In press) *Ecosphere*

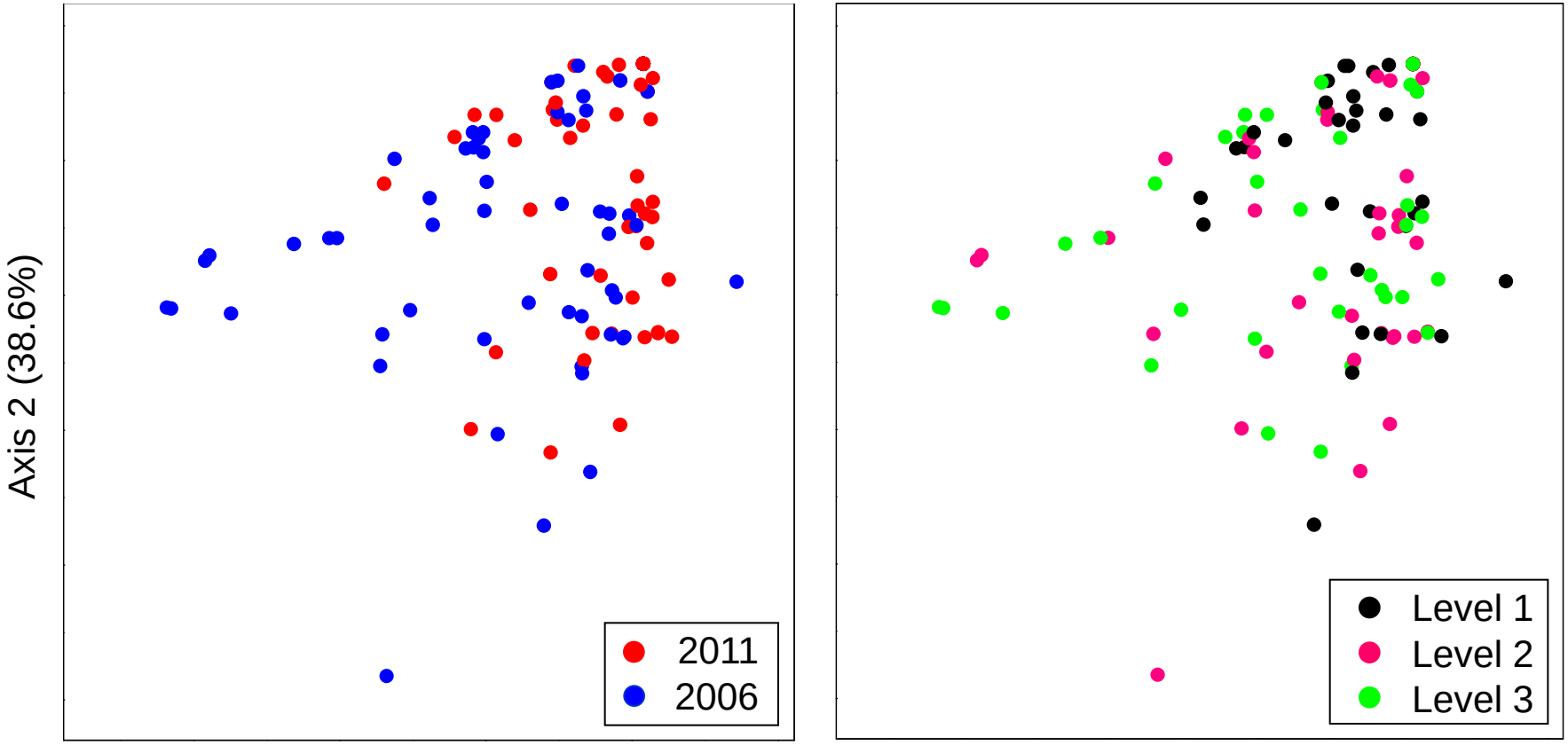
Dynamics in Point Bars

Kim (In press) *Ecosphere*

Dominant Processes in Point Bars



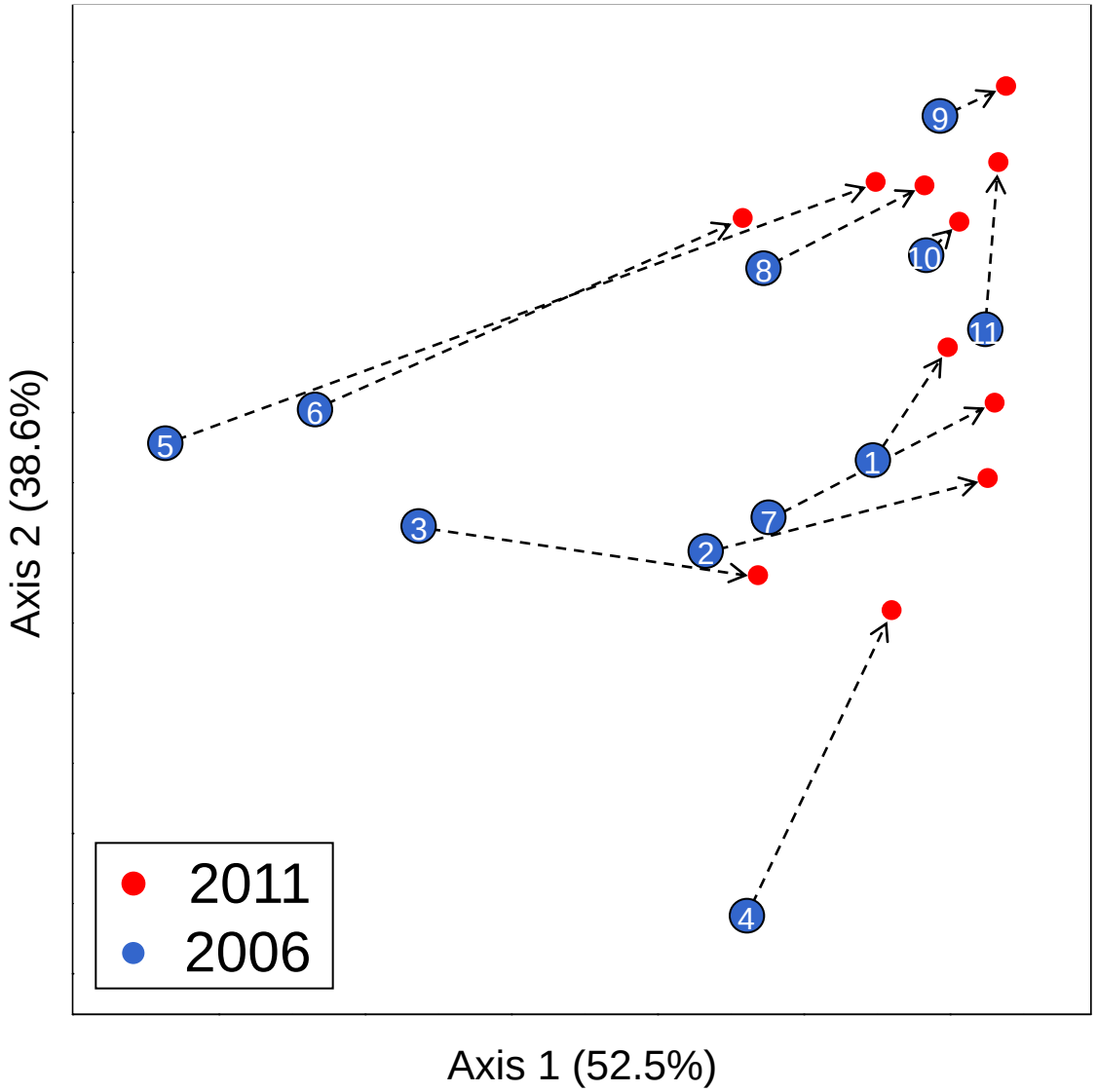
Dynamics in Cutbank Edges



Paired samples test
$t = 6.34$, $p < 0.001$

No significant differentiation

Dynamics in Cutbank Edges



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Dynamics in Cutbank Edges

	Overall	Level 1	Level 2	Level 3
Pioneers	-			
Competitors	+ / -			
General pathway	Progress-ive			

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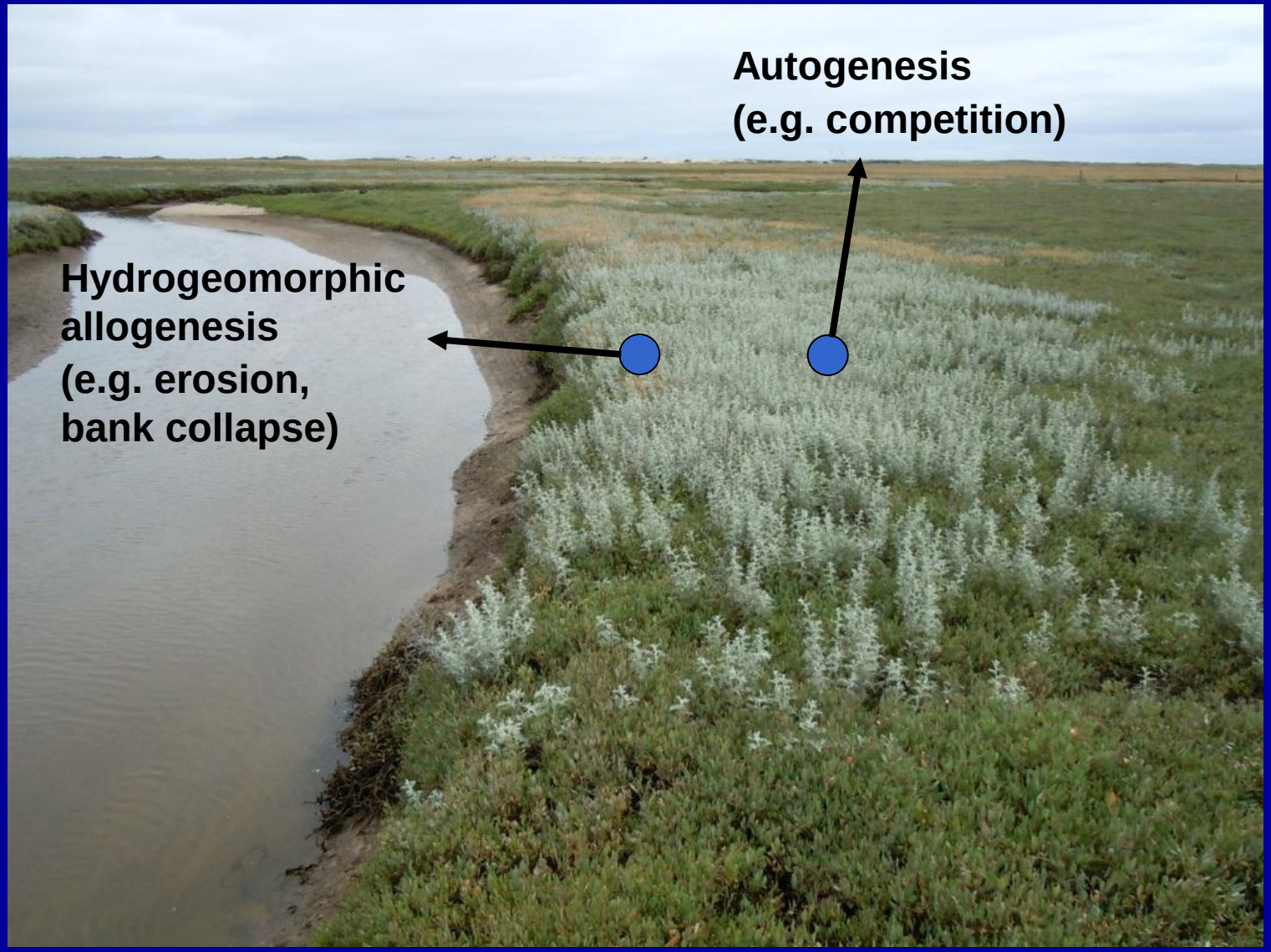
Dominant Processes in Cutbank Edges



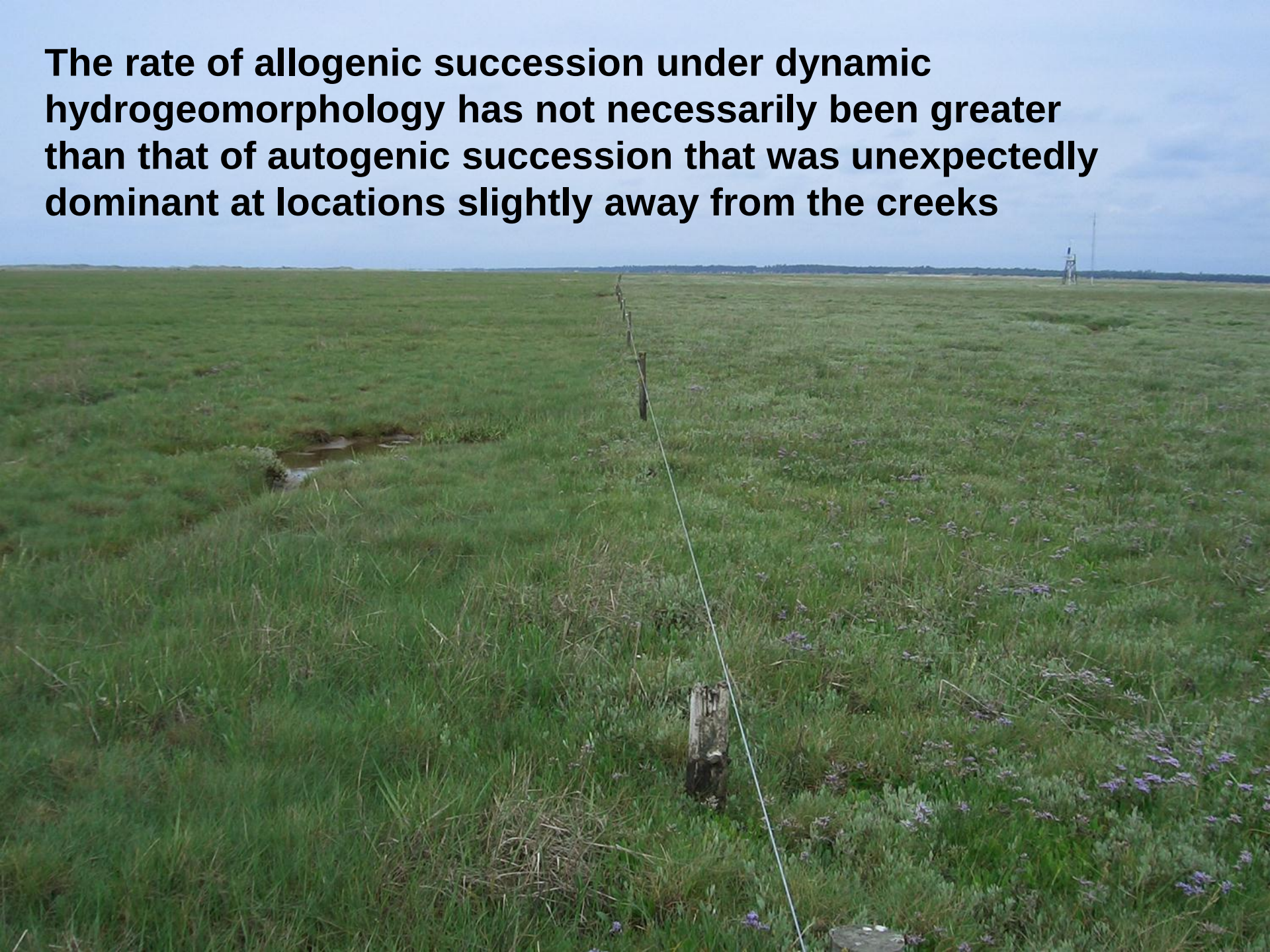
Hypothesized Gradient across Tidal Creeks

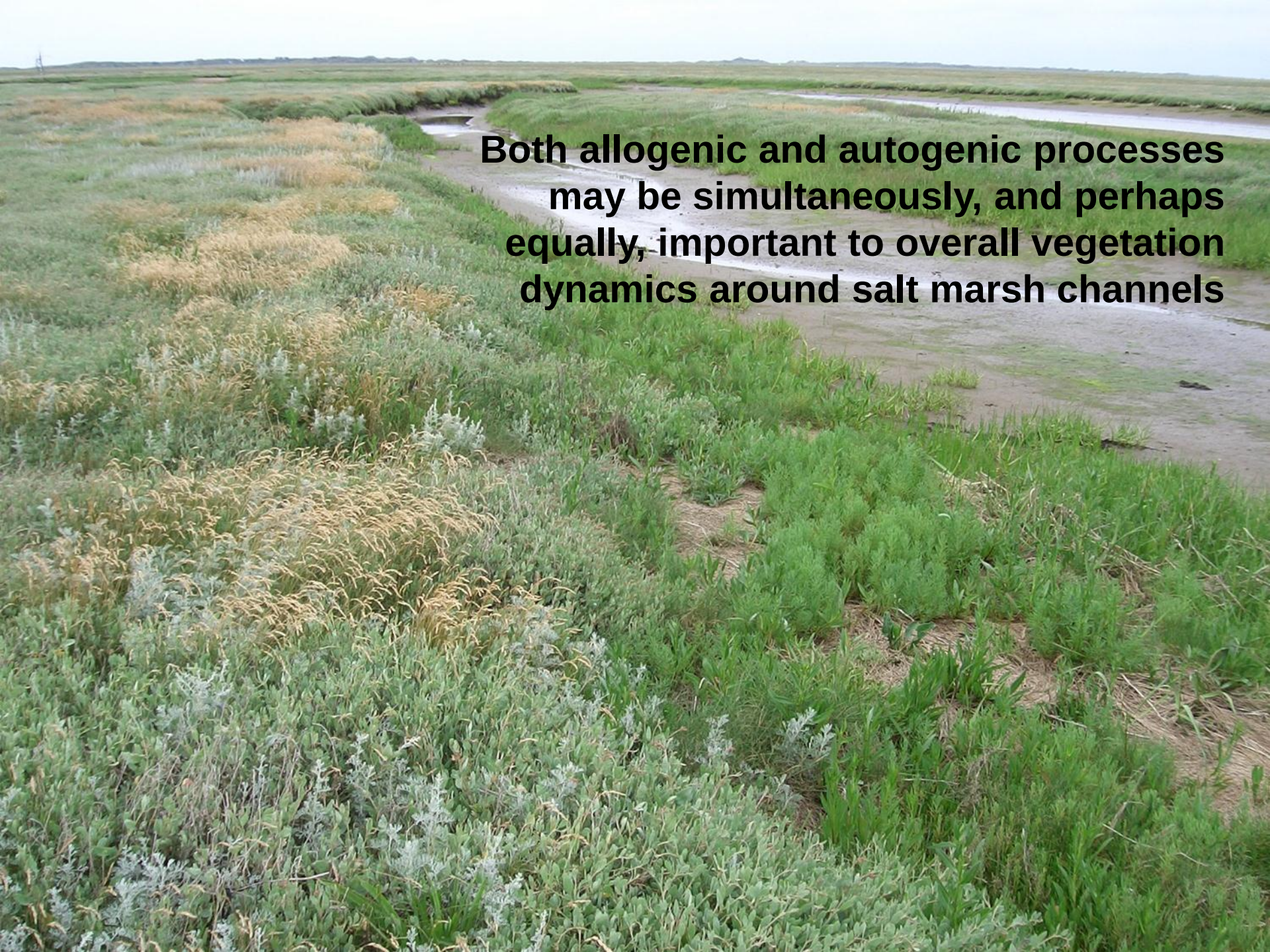
Away from the creek

- Less dynamic changes in hydrogeomorphology
- Less changes in plant species composition

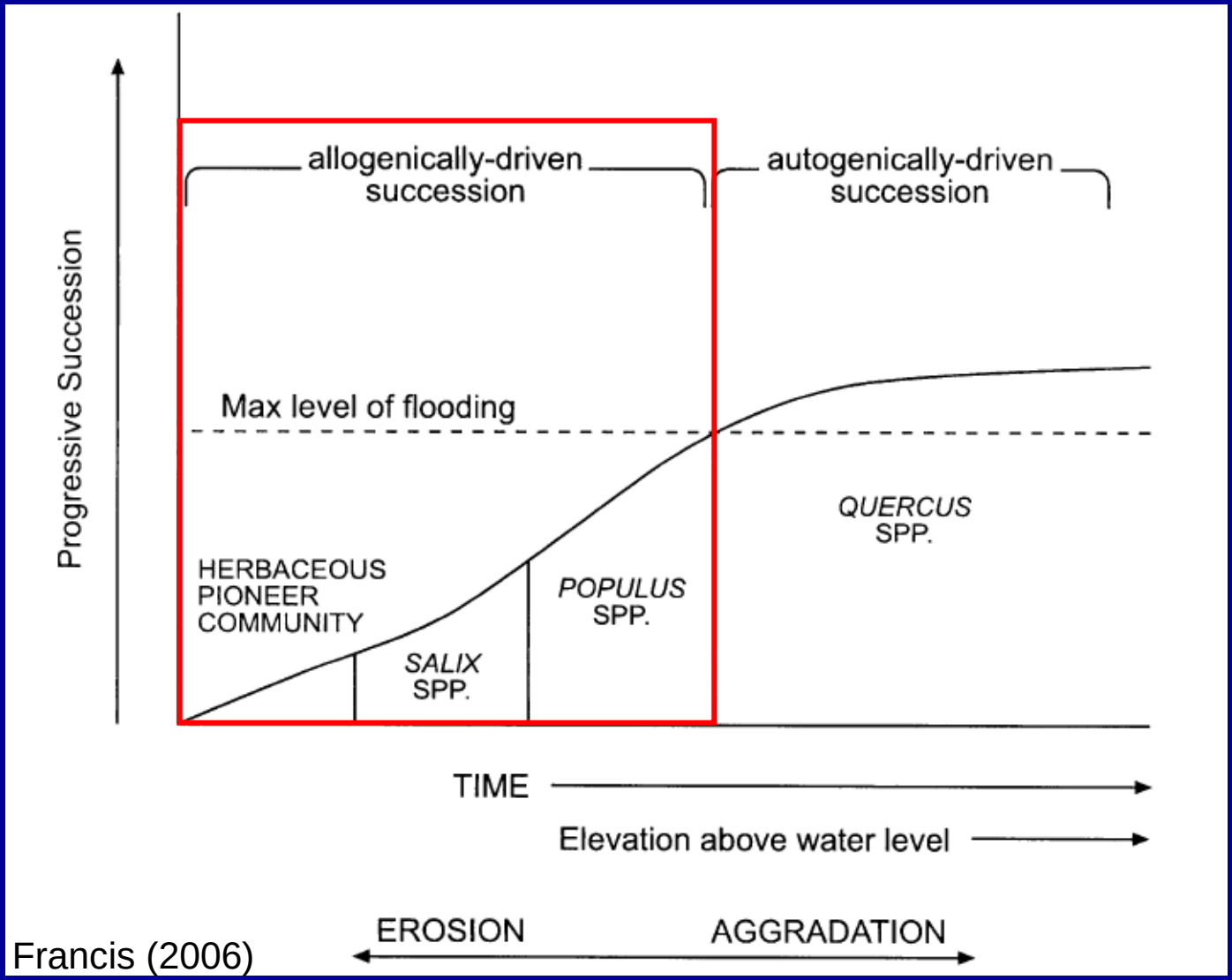
Rejected

The rate of allogenic succession under dynamic hydrogeomorphology has not necessarily been greater than that of autogenic succession that was unexpectedly dominant at locations slightly away from the creeks



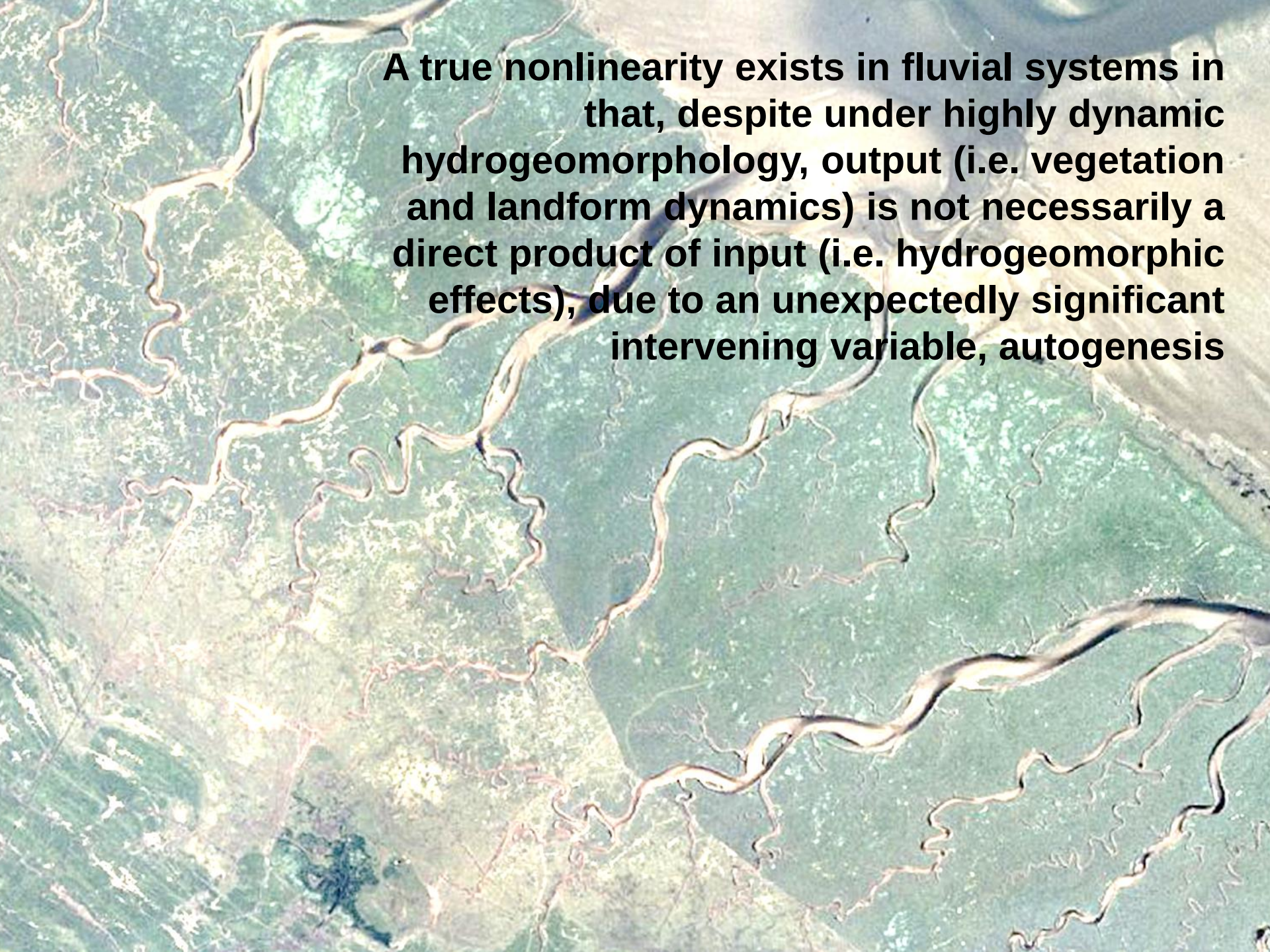

Both allogenic and autogenic processes may be simultaneously, and perhaps equally, important to overall vegetation dynamics around salt marsh channels

A Conventional Notion in Riparian Ecology



Francis (2006)


This view is in disagreement with the conventional belief in fluvial ecology, calling for a more explicit inclusion of autogenic processes in modeling the evolution of vegetation–landform complexes in the riparian zone



A true nonlinearity exists in fluvial systems in that, despite under highly dynamic hydrogeomorphology, output (i.e. vegetation and landform dynamics) is not necessarily a direct product of input (i.e. hydrogeomorphic effects), due to an unexpectedly significant intervening variable, autogenesis

Acknowledgments

- Research Grants
  - Society of Wetland Scientists
  - NSF Doctoral Dissertation Research Grant
  - European Union Center of Excellence
  - Association of American Geographers

Advance of pioneer zone
by 2.8 m in P10

Retreat of bank edge
by 2.3 m in C3