- What is sand?
- Where does it come from?
- Waves and wave energy
- How global climate change will influence waves and wave transport
- Dune types and formation
- Natural dune communities
- Introduced beachgrass and influence on beach and dunes
- Surf zone and sand dwelling organisms and food web
- Snowy plover biology
- Oregon beach law
- Field trip

Dune types

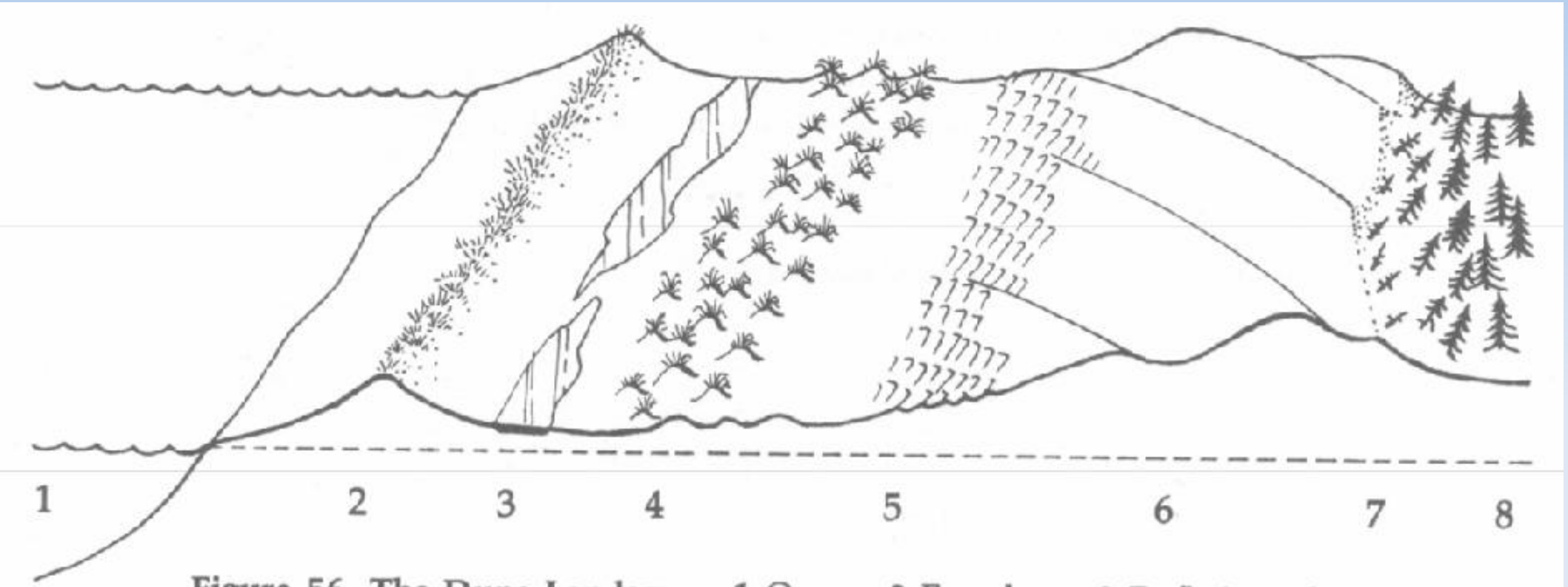


Figure 56. The Dune Landscape. 1 Ocean. 2 Foredune. 3 Deflation plain. 4 Beachgrass hummocks. 5 Transverse ridges. 6 Oblique dunes. 7 Retention ridge. 8 Forest. (Kellerman.)


3

Foredune

Photos: Andrea J. Pickart

Fig. 1. The native dune grasses *Leymus mollis* and *Poa macrantha* mix with forbs, including *Abronia latifolia* (yellow sand verbena) and *Lathyrus littoralis* (beach pea), on the foredune at the Lanphere Dunes Unit, Humboldt Bay National Wildlife Refuge.

Fig. 6b. The same location in July 2001, five years after restoration work was completed.

Pickart, 2008

Fig. 10. Restored foredune grassland at the Lanphere Dunes Unit, Humboldt Bay National Wildlife Refuge. Pickart, 2008

Deflation plain

Beachgrass hummocks

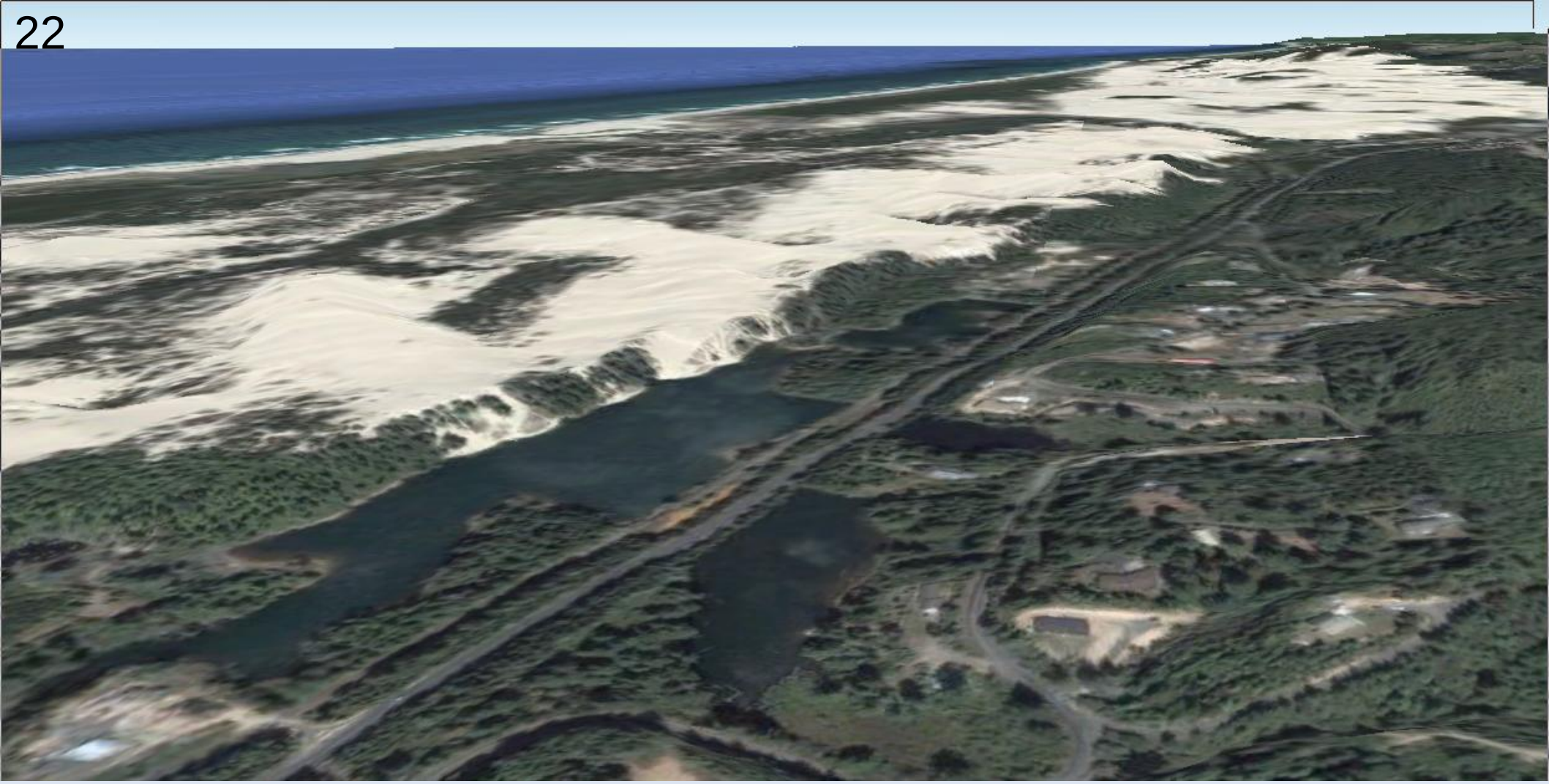
Transverse dune


Dune trend 80°
Wind direction and dune migration 170°

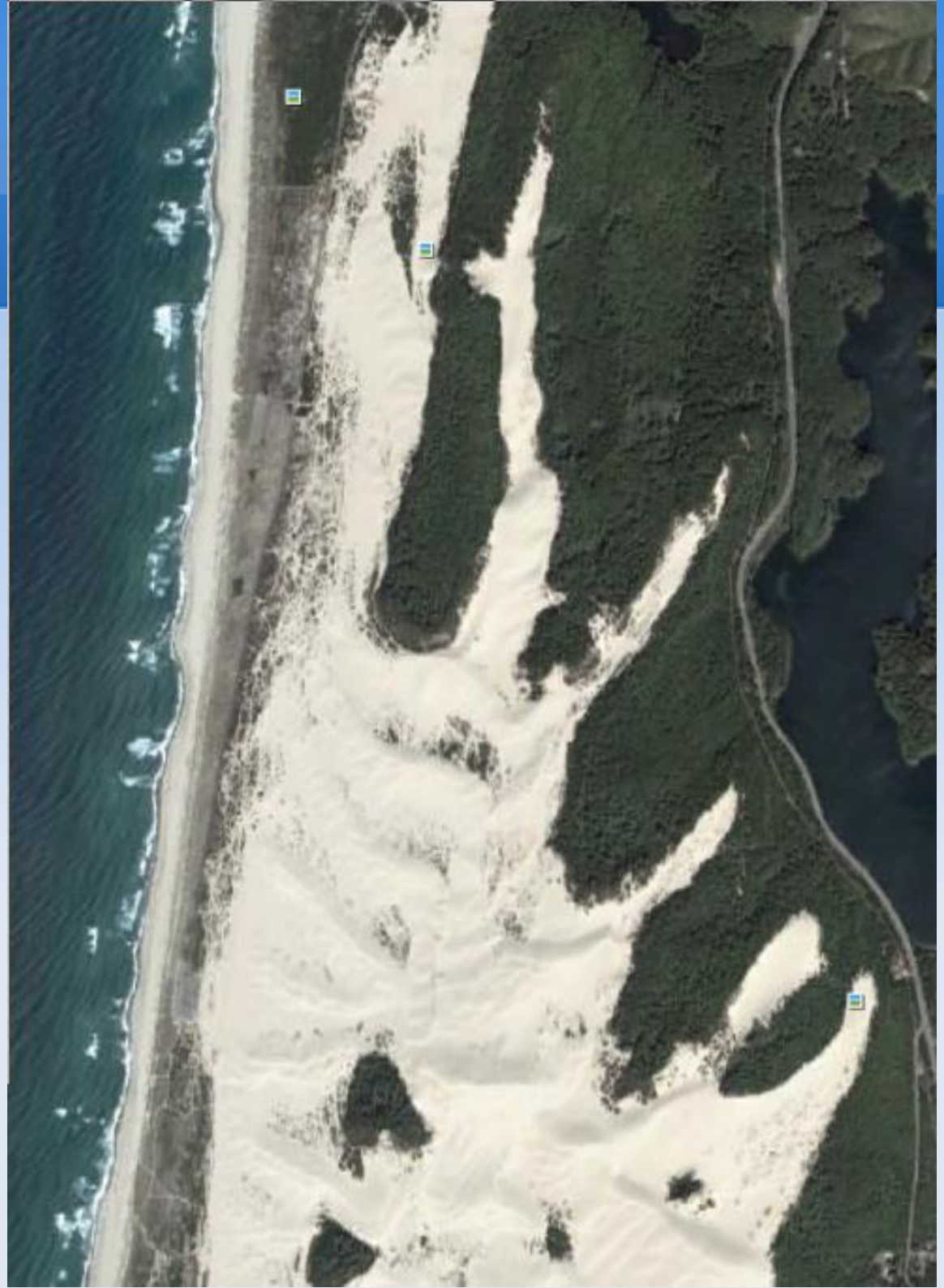
Oblique dune


26°
45°
Dune advance
Resultant sand transport
trend
116°
Resultant winter wind

Retention ridge



Parabola dune



Parallel ridges

(1) Columbia River south jetty to Tillamook Head; 26 km

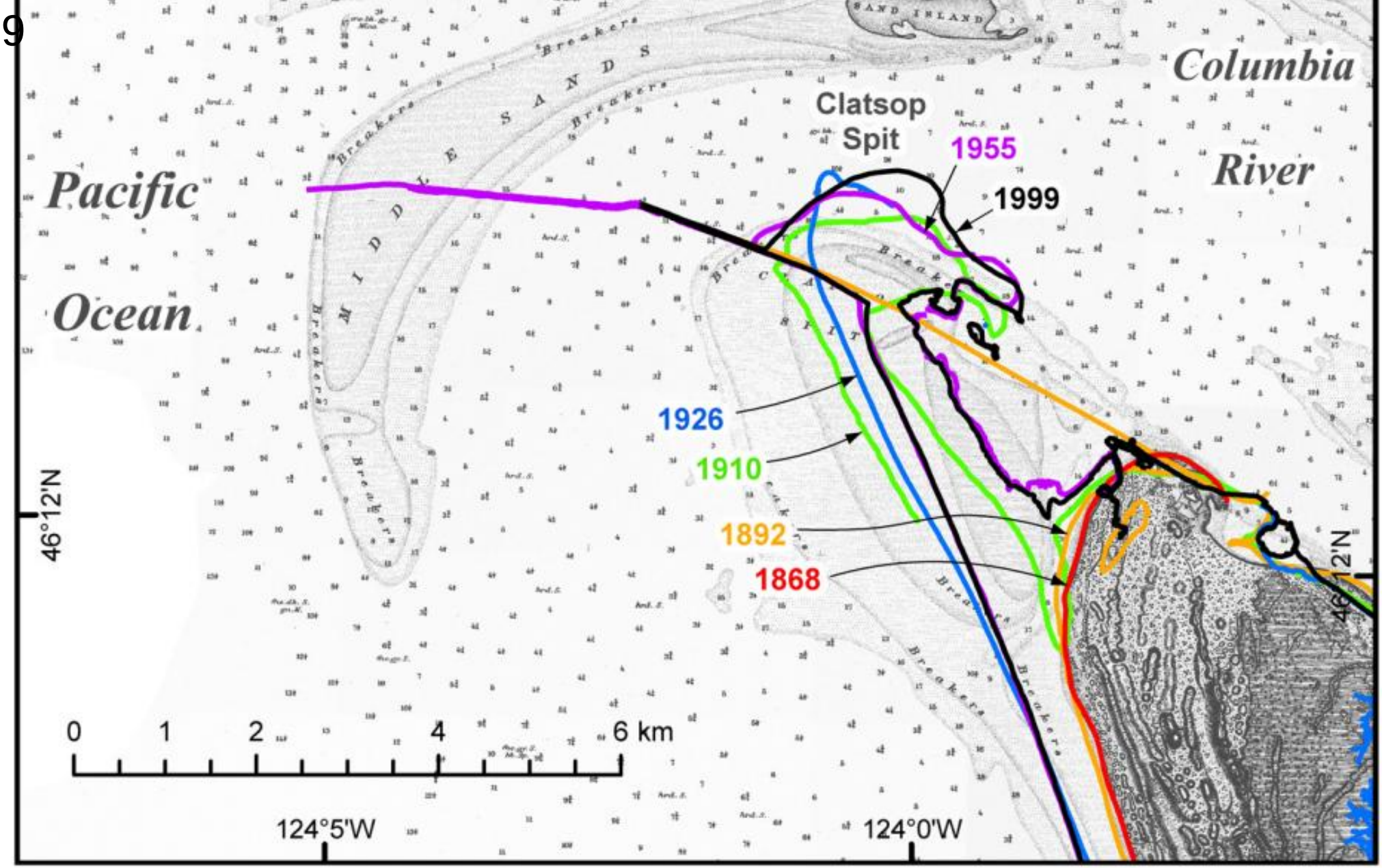
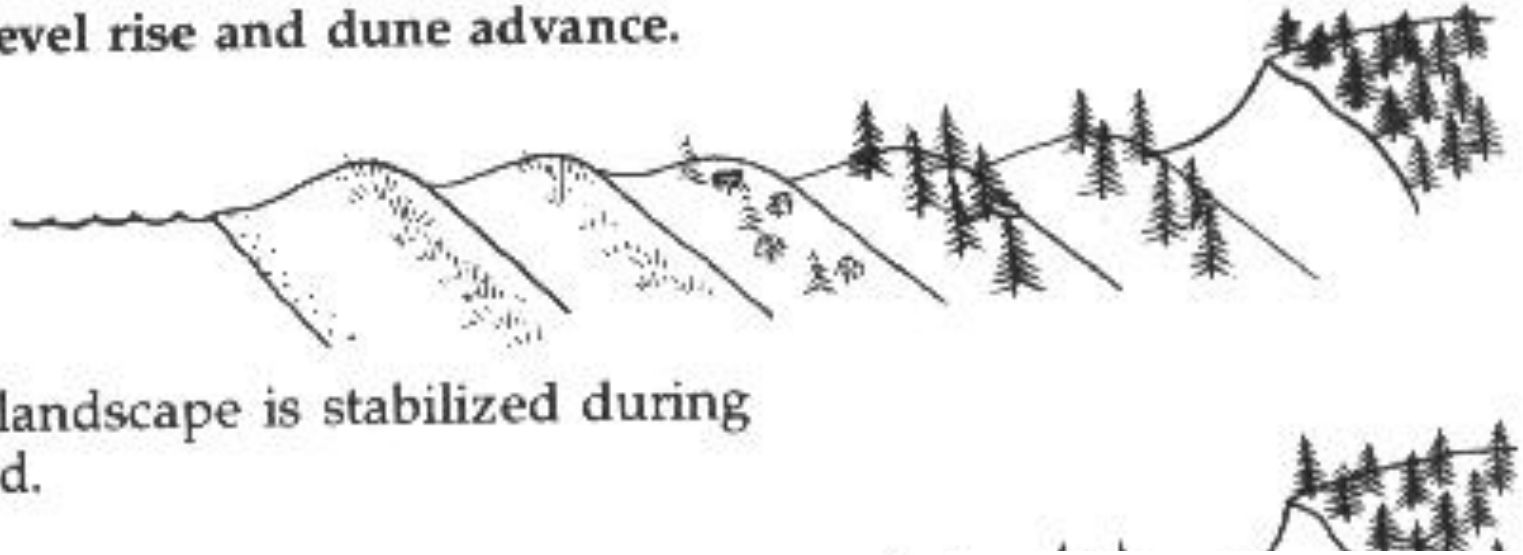


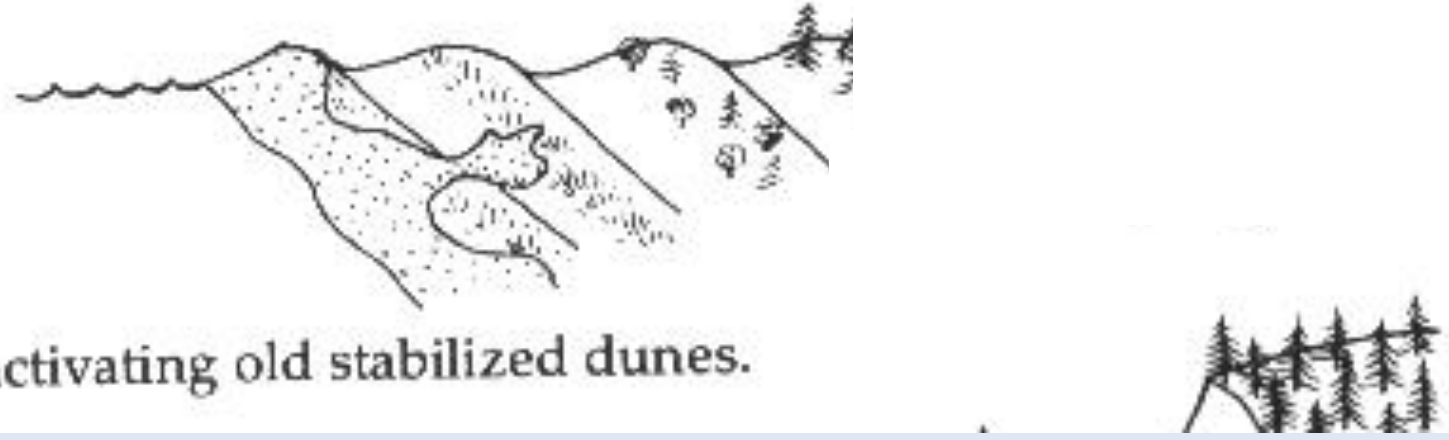
Fig. 6. 1870 U.S. Coast and Geodetic Survey — Mouth of the Columbia River, with historical shorelines.

Cooper's paradigm of dune development

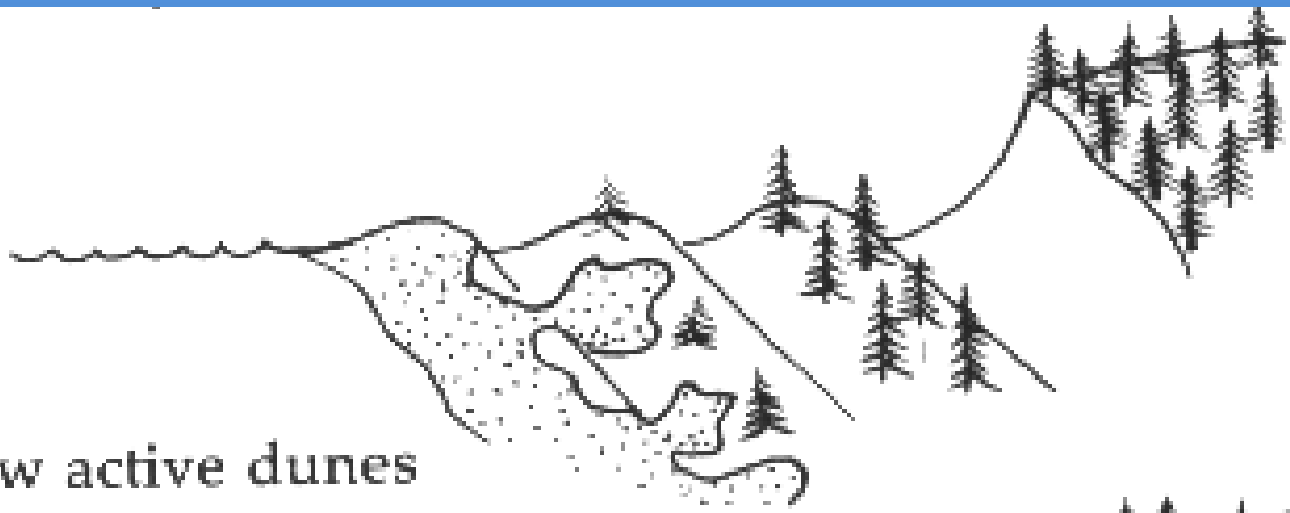
Figure 55. Sea level rise and dune advance. (Kellerman.)



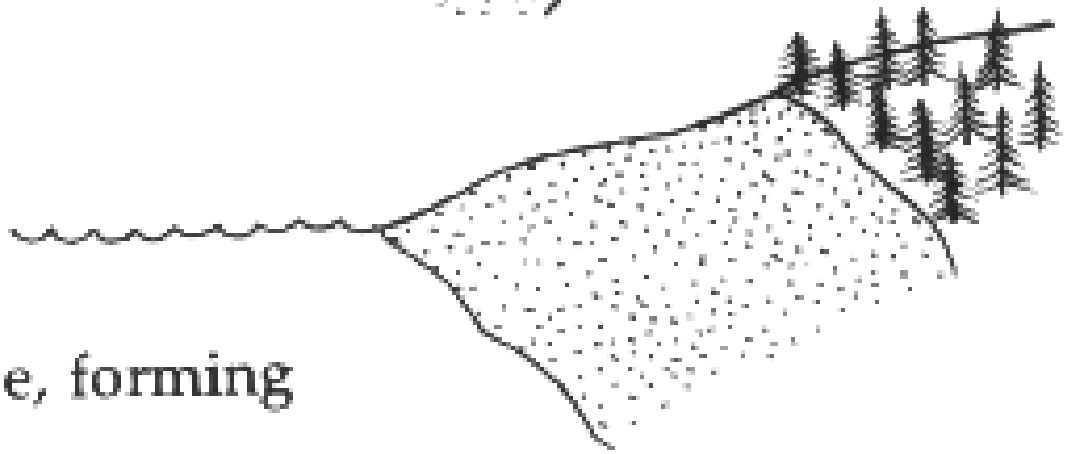
Previous dune landscape is stabilized during quiescent period.



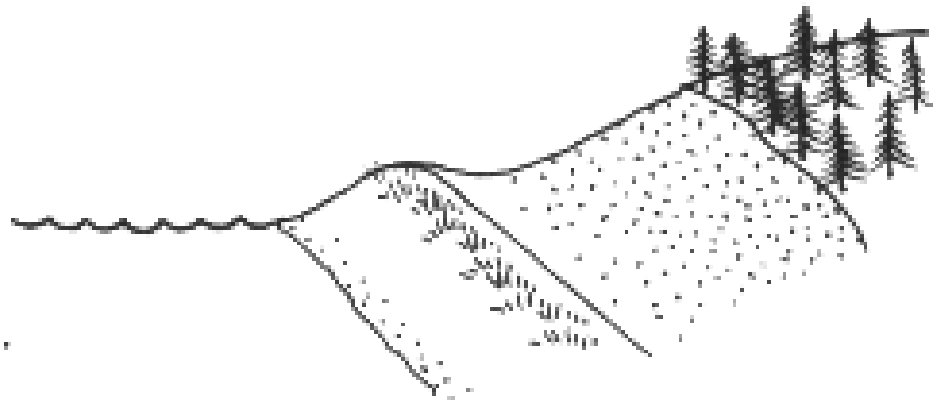
Sea level rises, re-activating old stabilized dunes.



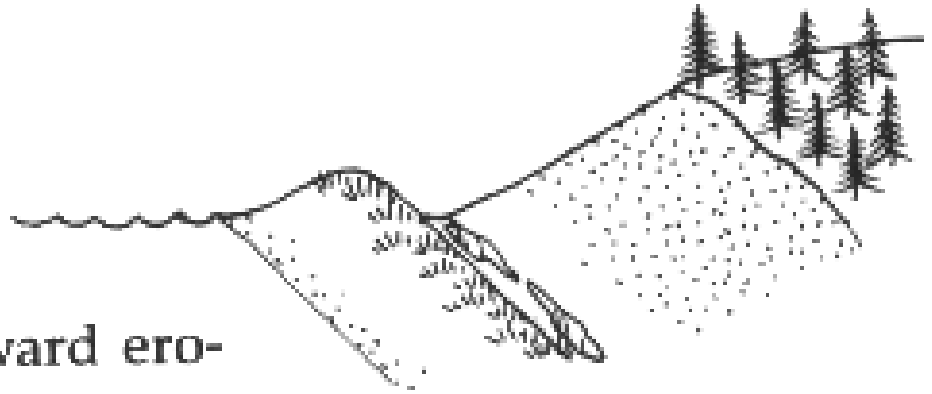
Sea continues to rise, and new active dunes spread inland.



Active dunes reach maximum advance, forming oblique ridges.

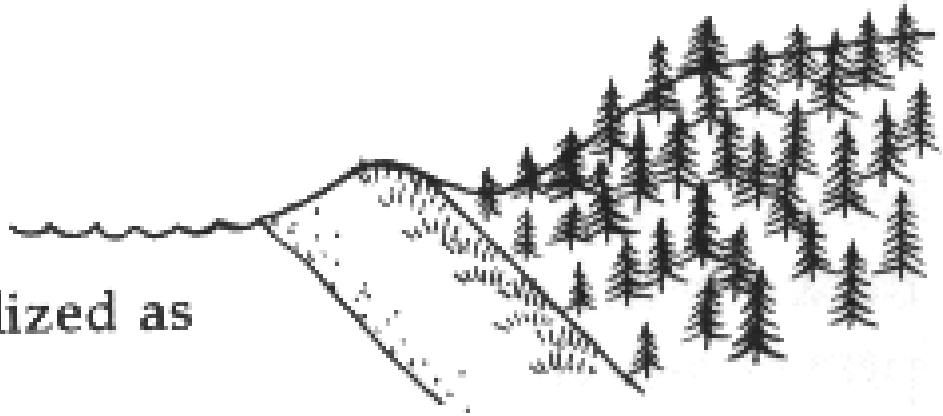


Sea level stabilizes, foredune is created.

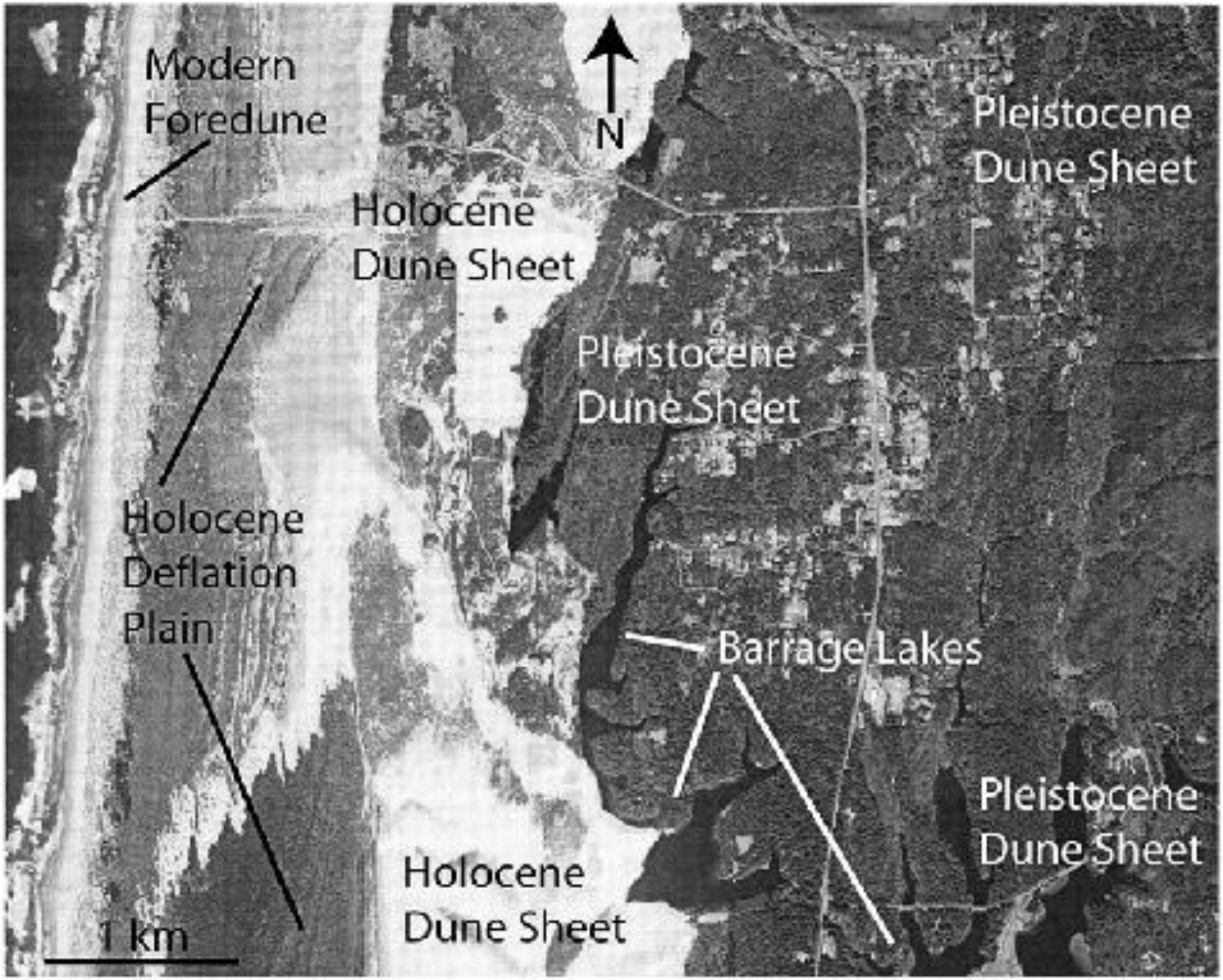


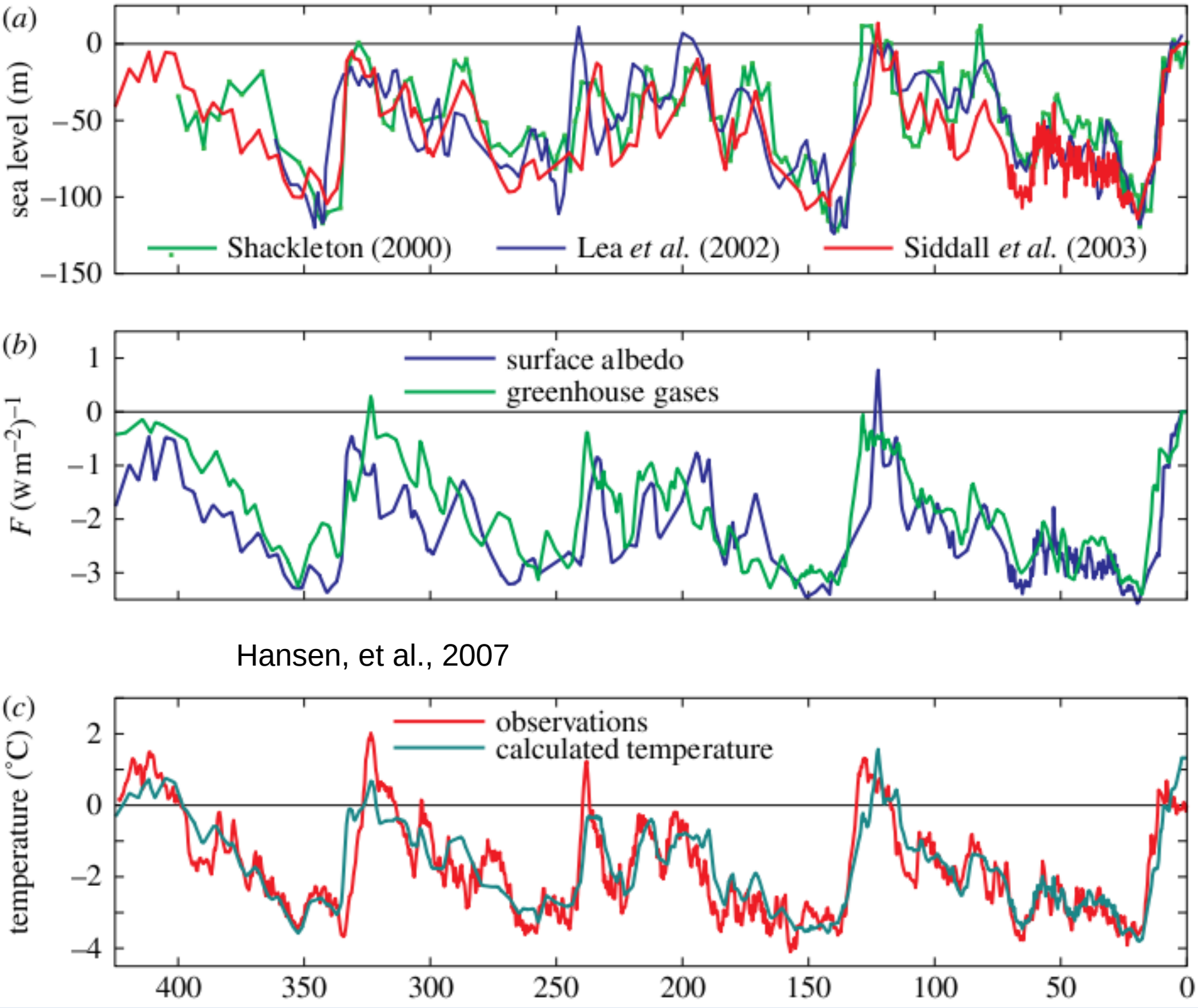
Foredune traps beach sand, allows leeward erosion to water table, creating deflation areas.

Deflation areas colonized by vegetation.

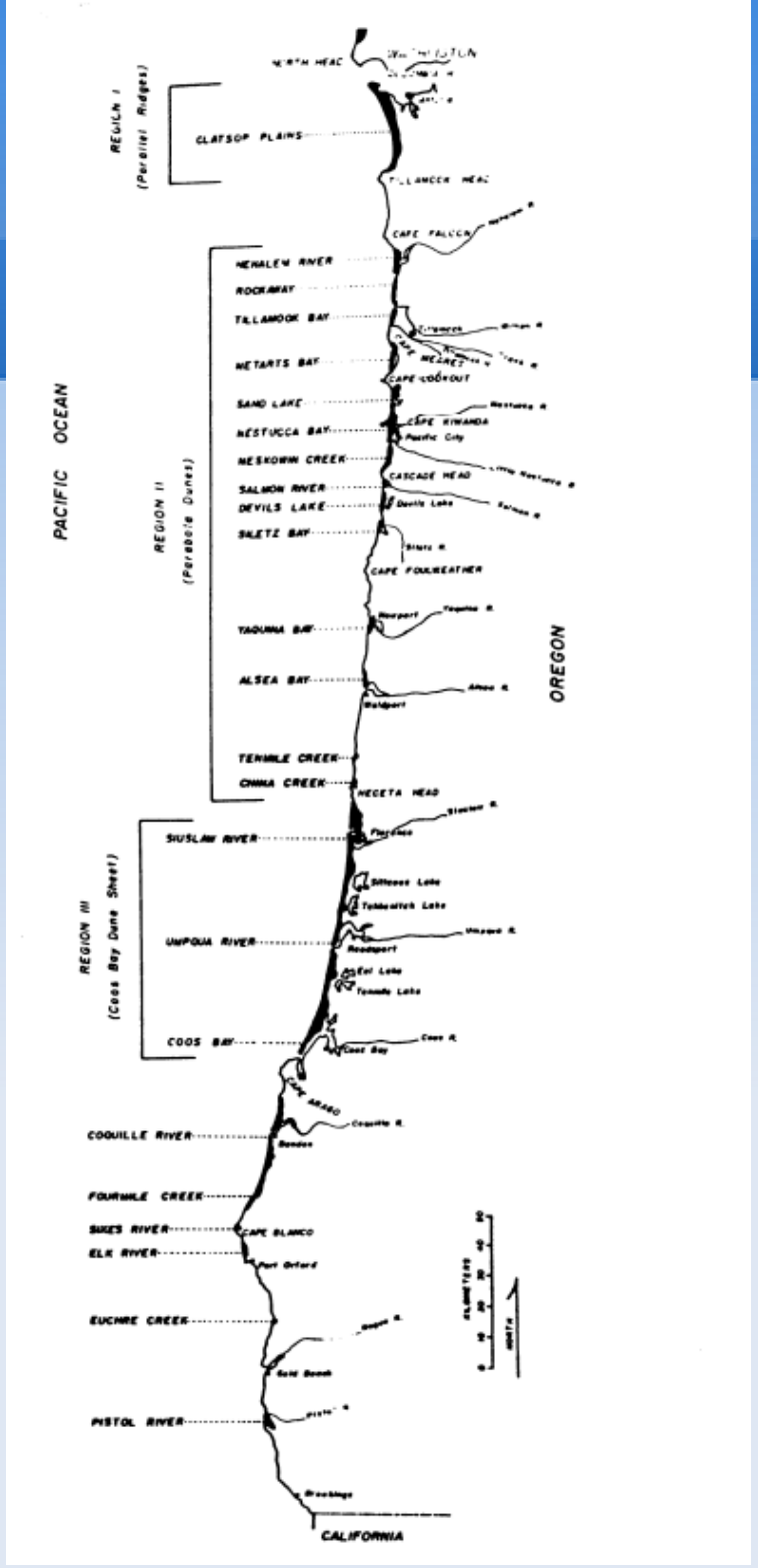


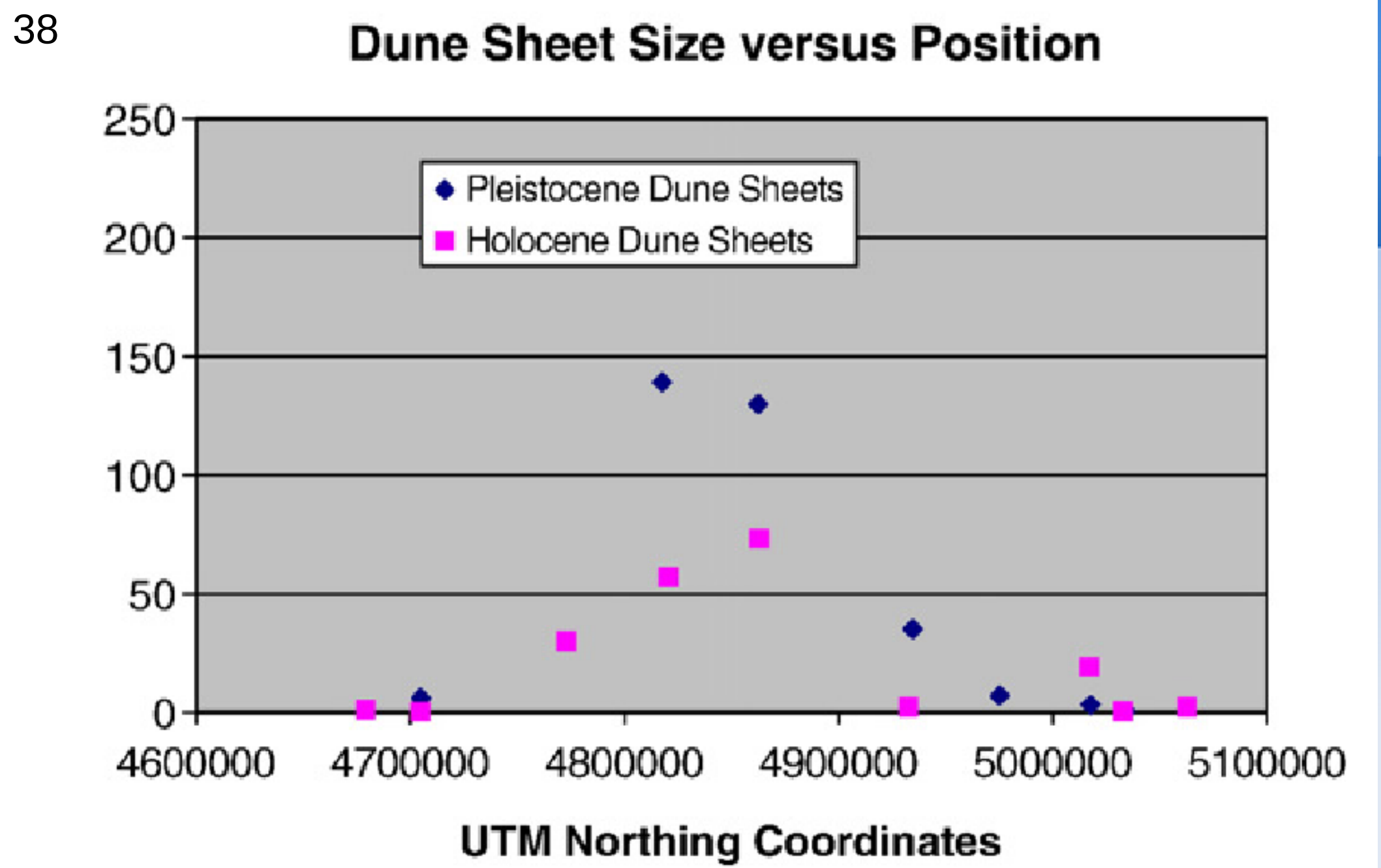
Eventually previous active sand is stabilized as succession pregresses to forest.


Modern
Foredune
N
Pleistocene
Dune Sheet
Holocene
Dune Sheet
Pleistocene
Dune Sheet
Holocene
Deflation
Plain
Barrage Lakes
Pleistocene
Dune Sheet
Holocene
Dune Sheet
1 km



Hansen, et al., 2007


PACIFIC OCEAN
OREGON
REGION I
(Parallel Ridges)
CLATSOP PLAINS
TILLAMOOK HEAD
CAPE FALCON
REGION II
(Parabolic Dunes)
NEHALEM RIVER
ROCKAWAY
TILLAMOOK BAY
NETARTS BAY
CAPE LOOKOUT
SAND LAKE
NESTUCCA BAY
CAPE KIWANDA
NESKOWIN CREEK
CASCADE HEAD
SALMON RIVER
DEVILS LAKE
SILETZ BAY
CAPE FOULWEATHER
YAQUINA BAY
ALSEA BAY
TENMILE CREEK
CHINA CREEK
HECETA HEAD
REGION III
(Coos Bay Dune Sheet)
SIUSLAW RIVER
UMPQUA RIVER
COOS BAY
COQUILLE RIVER
FOURMILE CREEK
SIXES RIVER
CAPE BLANCO
ELK RIVER
EUCHRE CREEK
PISTOL RIVER
CALIFORNIA



Peterson et al., 2007

Peterson et al., 2007

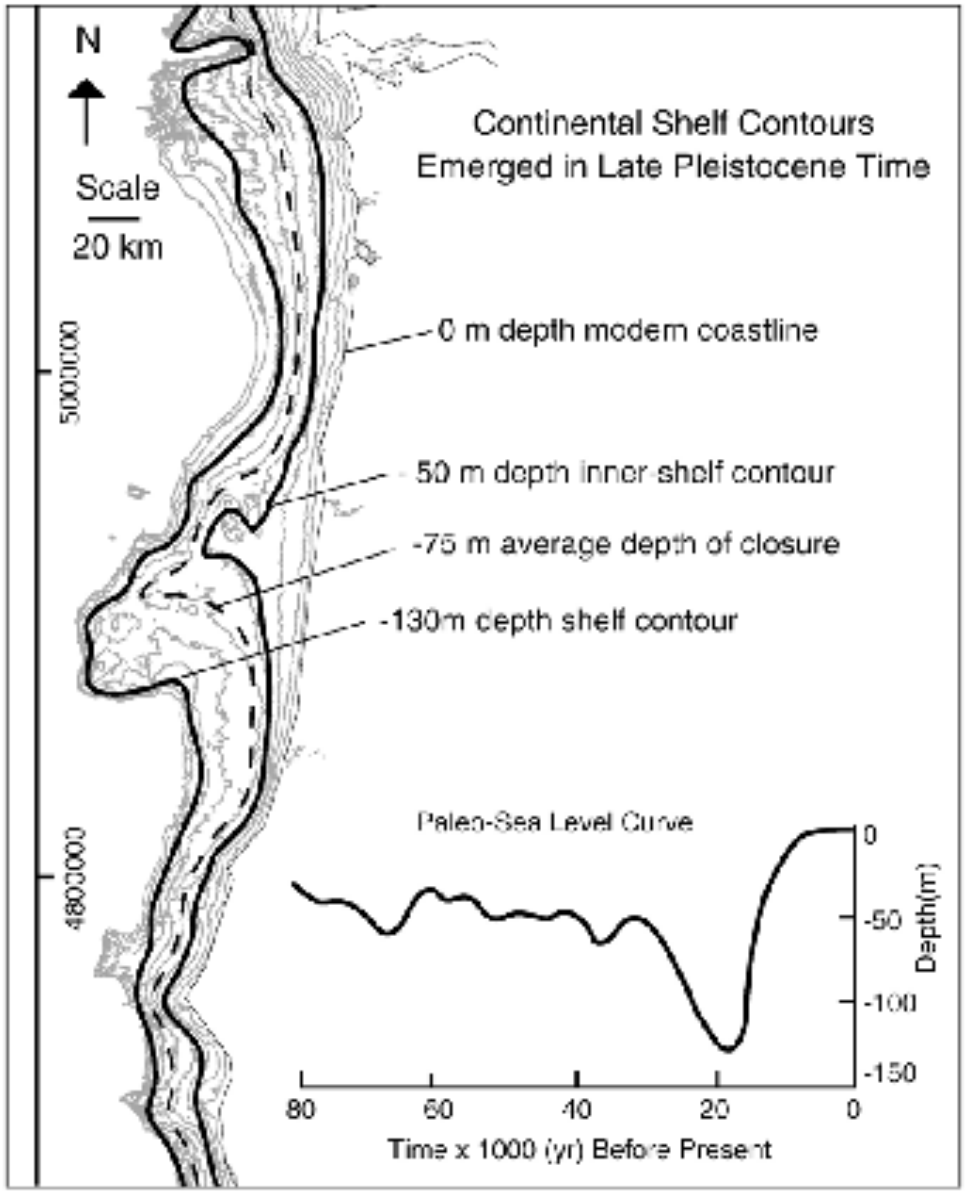
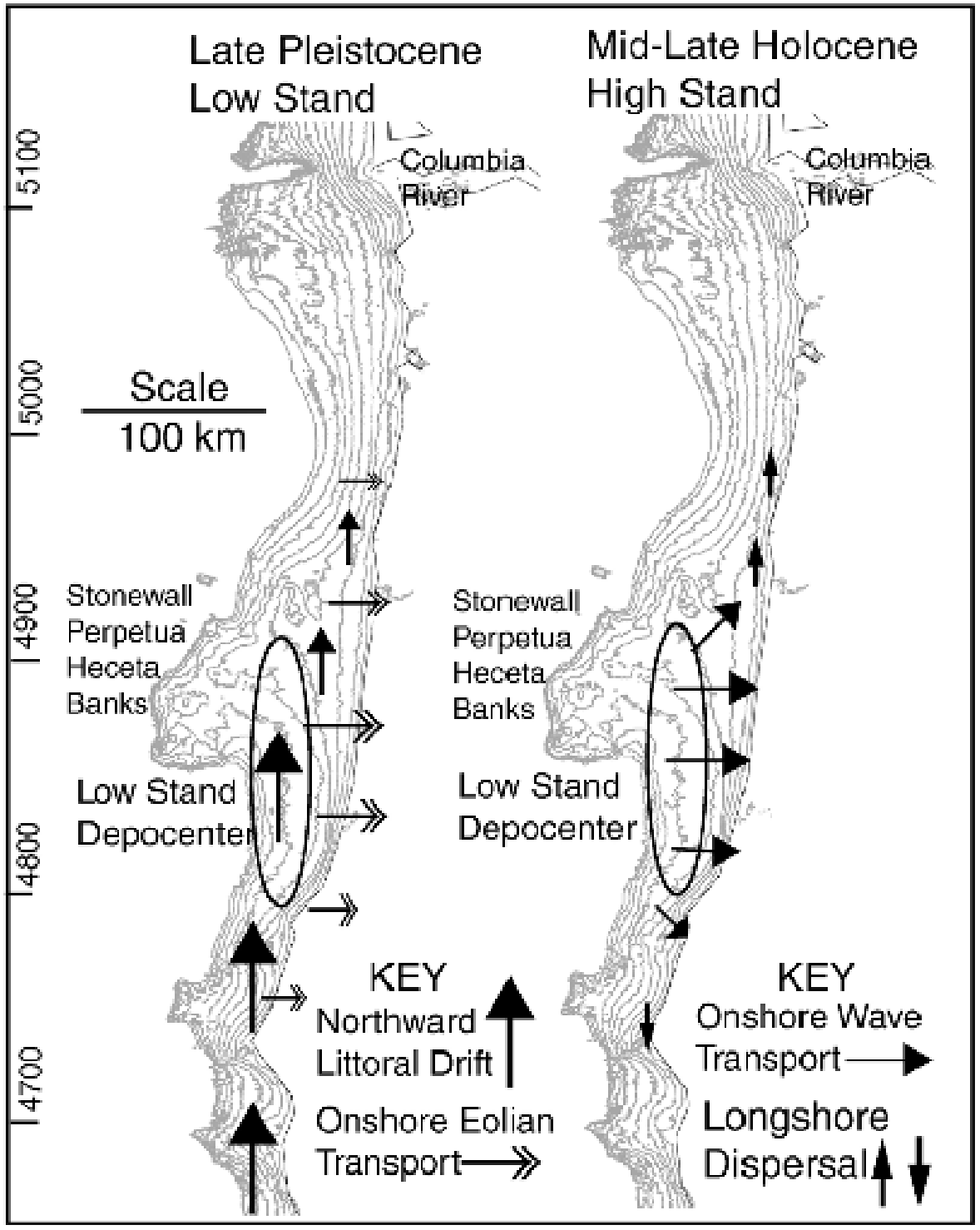


Fig. 4. Map of Oregon continental shelf showing paleo-sea levels (solid lines) at −50 m and −130 m isobaths. A eustatic, sea-level curve is shown for the last 80,000 years (figure redrafted from Pirazzoli, 1993, sea-level curve from Chappell and Shacklelton, 1986). The major period of Late-Pleistocene dune emplacement (30–70 ka) is dominated by sea levels of about 50 m below present sea level. The average depth of closure, e.g., limit of littoral transport (dashed line at −75 m contour), for the late Pleistocene is assumed to have been about 25 m below the average sea level for that period. Sea level during the last glacial maximum (21–18 ka) briefly decreased to 130 m below present sea level.


Late Pleistocene
Low Stand
Mid-Late Holocene
High Stand
Columbia
River
Columbia
River
5100
5000
4900
4800
4700
Scale
100 km
Stonewall
Perpetua
Heceta
Banks
Low Stand
Depocenter
Stonewall
Perpetua
Heceta
Banks
Low Stand
Depocenter
KEY
Northward
Littoral Drift
Onshore Eolian
Transport
KEY
Onshore Wave
Transport
Longshore
Dispersal

Dune formation

- Most dunefields are from the Pleistocene, 50 kya
- Sea level not rapidly rising then, and sea at around 50 m depth line
- No dunes older than around 80 kya, not known why
- Climate was cooler 50 kya, and might have been drier, but not known. Maybe weaker stabilization?

References

Pickart, A.J. 2008. Restoring the grasslands of northern California's coastal dune. Grasslands 17(1): 3-9.

Peterson, C.D. et al. 2007. Ages, distributions, and origins of upland coastal dune sheets in Oregon, USA. Geomorphology 91(1-2): 80-102.