

Sand Dune Stabilization Methods – A Global Tour

Desert Research Institute

**Great Basin Unified
Air Pollution Control District**

Keeler Dunes Meeting
August 24, 2011

Global Sand Dune Stabilization

–USA

–China

–Sahara

–Western Africa

–Australia

–New Zealand

–Great Britain

–Kuwait

–Pakistan

–India

–Madagascar

–Brazil

Stabilization Methods

- Sand fences
- Straw (checkerboard and bales)
- Mats and netting
- Chemical spray
- Brush
- Vegetation – preferred method worldwide



Vegetation

- PROS - most effective, least expensive, aesthetically pleasing, mimics a natural system, self-repairing
- CONS – irrigation needed, plant establishment phase critical, maintenance required until self-sustaining system is developed

Image © 2011 GeoEye

©2010 G

© 2011 Google

36°30'58.29" N 117°54'05.56" W elev 3666 ft



China



Google Earth Image of Shapotou, China

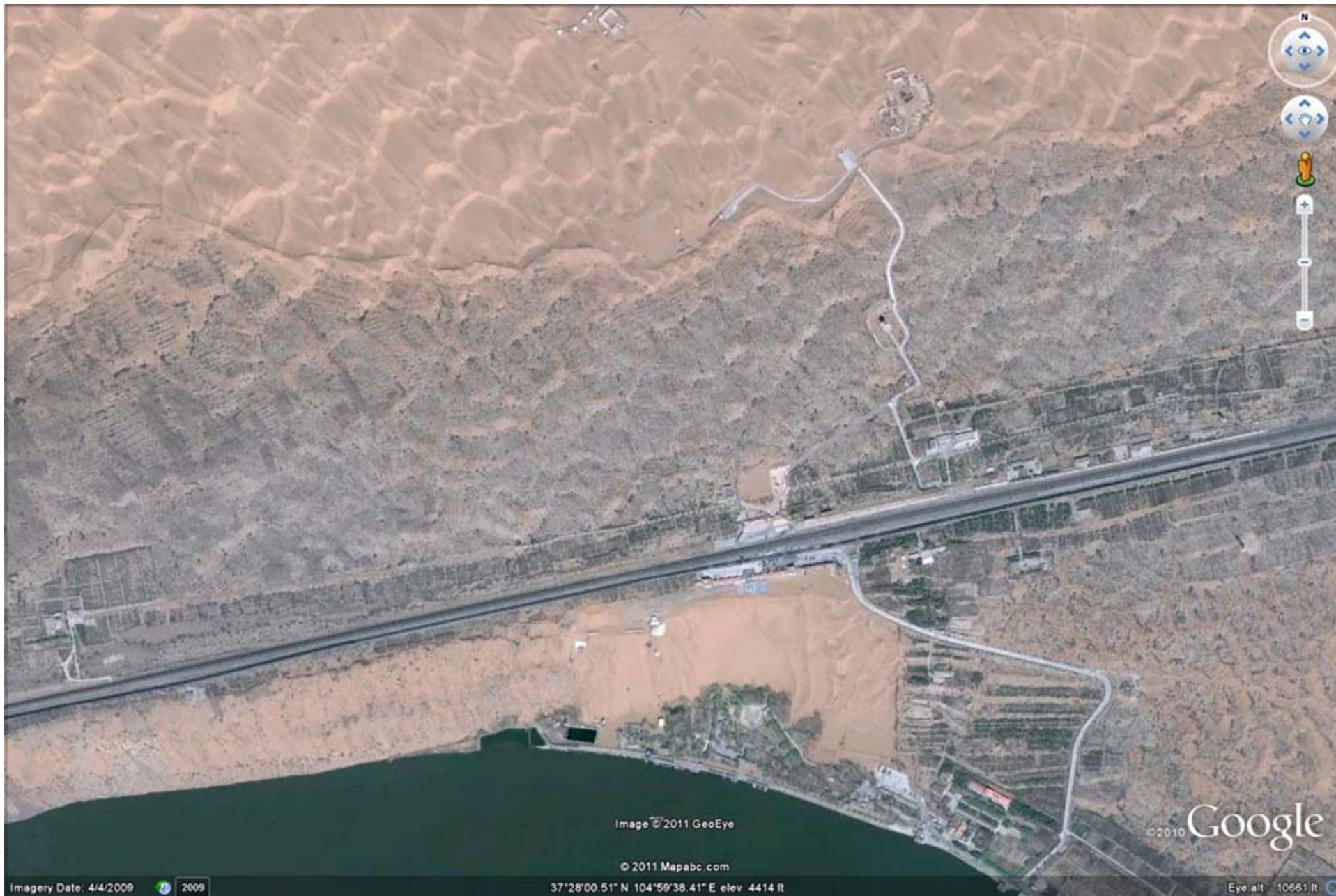


Image © 2011 GeoEye

© 2011 Mapabc.com

Imagery Date: 4/4/2009 2009

37°28'00.51" N 104°59'38.41" E elev. 4414 ft

© 2010 Google

Eye alt: 10661 ft

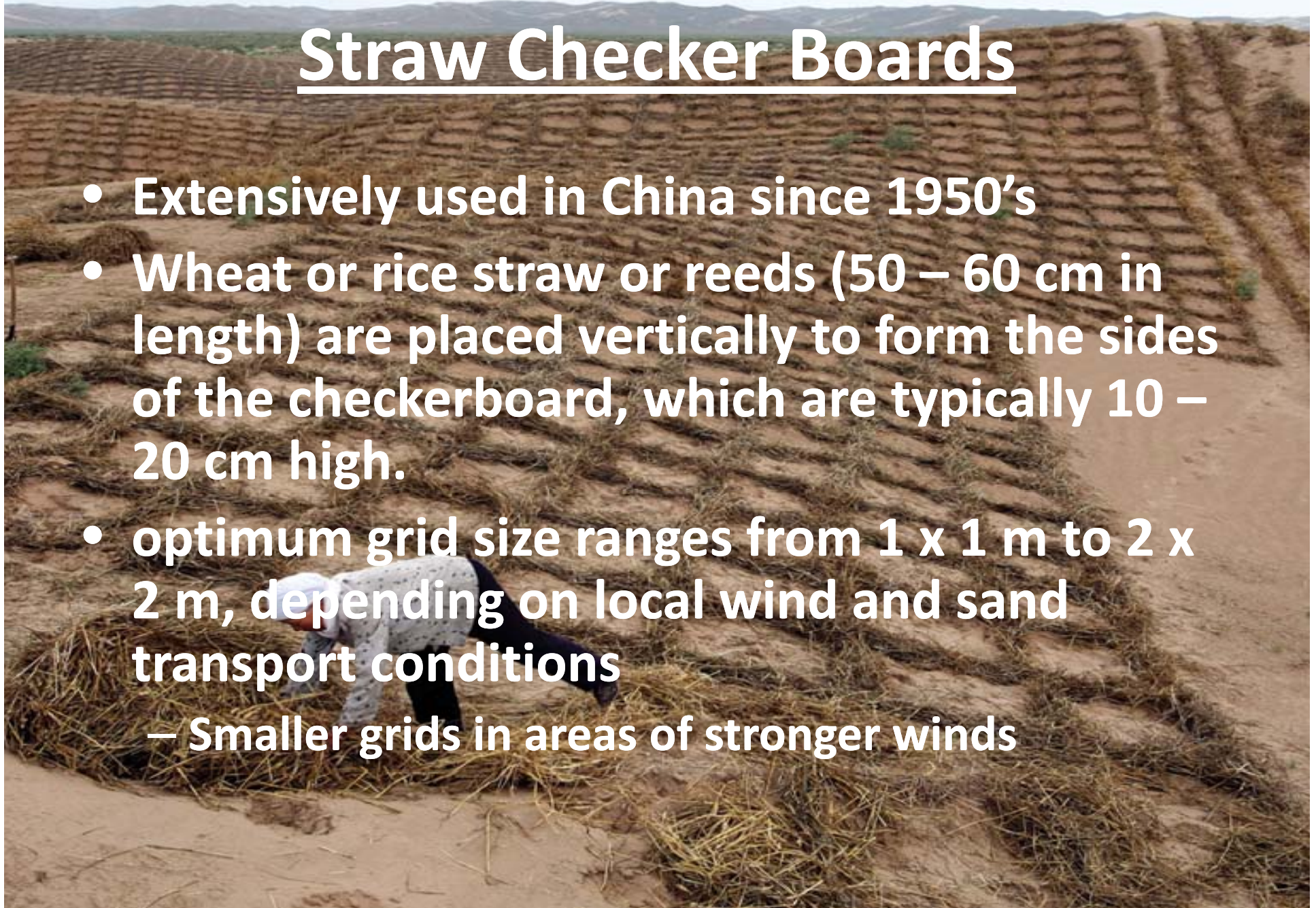
Zoom-in of Google Earth Image, Shapotou, China



**Aerial Image of Shapatou area in 1956 with railroad line (A-B) engulfed in sand.
(From Mitchell et. al.)**

Straw Checker Boards

- Extensively used in China since 1950's
- Wheat or rice straw or reeds (50 – 60 cm in length) are placed vertically to form the sides of the checkerboard, which are typically 10 – 20 cm high.
- optimum grid size ranges from 1 x 1 m to 2 x 2 m, depending on local wind and sand transport conditions
 - Smaller grids in areas of stronger winds





**Straw Checkerboards
Shapotou, China**



Dune stabilized in 1981 with lines of trees and shrubs and straw checkerboard.

**Belt of straw checkerboard
across dune in China.**





Installing straw checkerboard in stabilized belt of dune, Tengger Desert, China



Installing straw checkerboard, Tenggar Desert, China

Boardwalk across stabilized area, Shapotou, China



Fence checkerboards, China



Madagascar





Dune stabilization project by Rio Tinto Mining Company, Madagascar





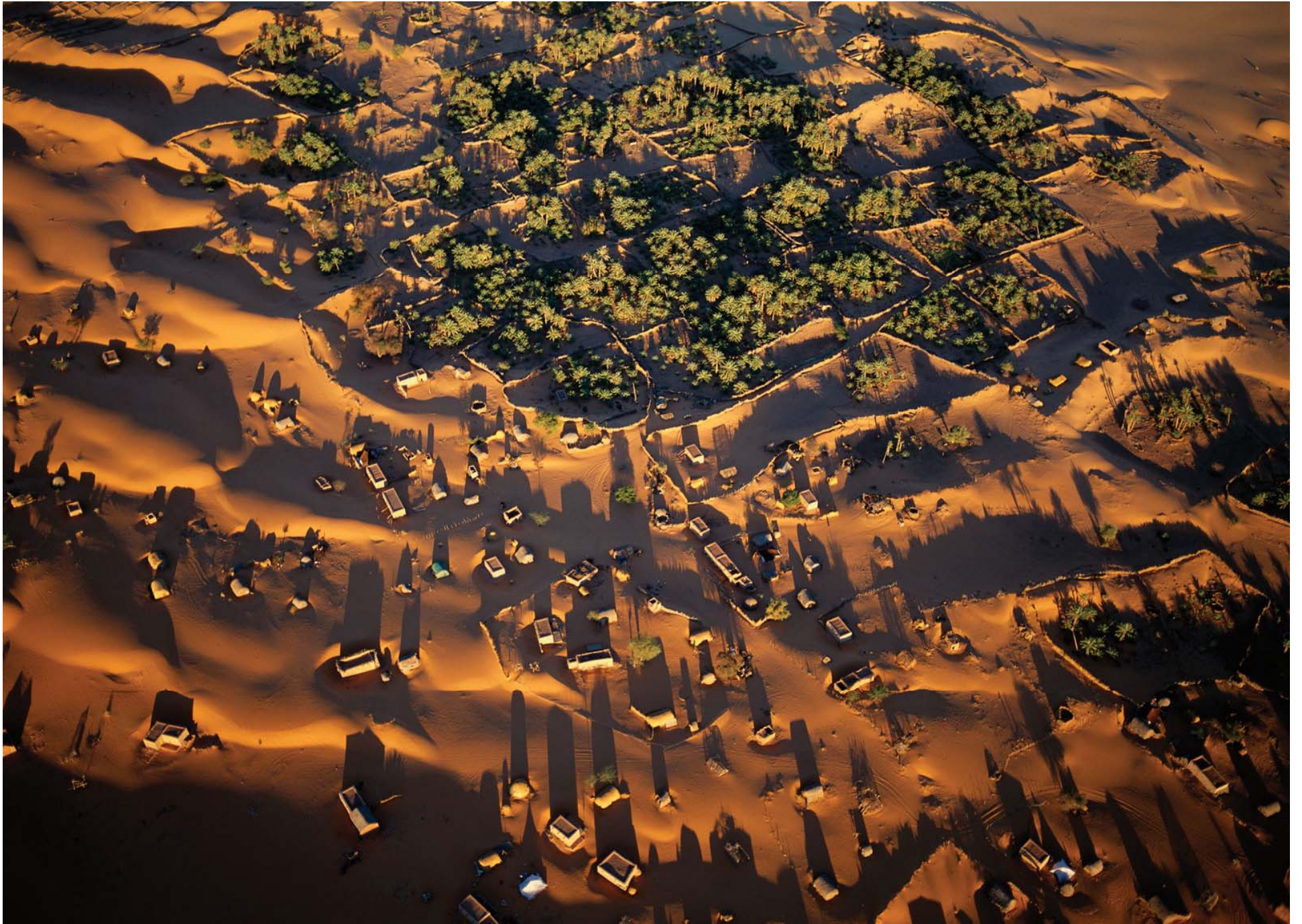
Dune stabilization with fences and grass, Madagascar.

Mauritania, Africa





Fences on dunes in Mauritania



Fences used to protect settlement in Mauritania.



Planting wind blocks on dunes in Mauritania



**Dune Stabilization along the
Road of Hope.
Mauritania, Africa
(1986-1997)**

From: A.M. Jensen and M.S. Hajej (2001)



New Zealand





**Hand planting rows of marram grass in New Zealand in 1973.
(From S. Jamieson, 2010)**

Sand Fences

- Widely used in coastal areas
- Most effective configuration
 - single linear fence perpendicular to the predominant sand transport direction
 - Fences 1.2 m (4') high, with a vertical arrangement of 3.8 cm (1.5 inch)-wide wooden slats with a gap of 2.5 cm (1 inch), giving a porosity of 50% are the most effective.



Louisiana coast



Mauritania



06/09/2005

Sand Fences

Khalil, S.M., 2008. The use of sand fences in barrier island restoration: experience on the Louisiana Coast. ERDC TN-SWWRP-08-4. US Army Corps of Engineers, pp. 22.

Sahara Desert



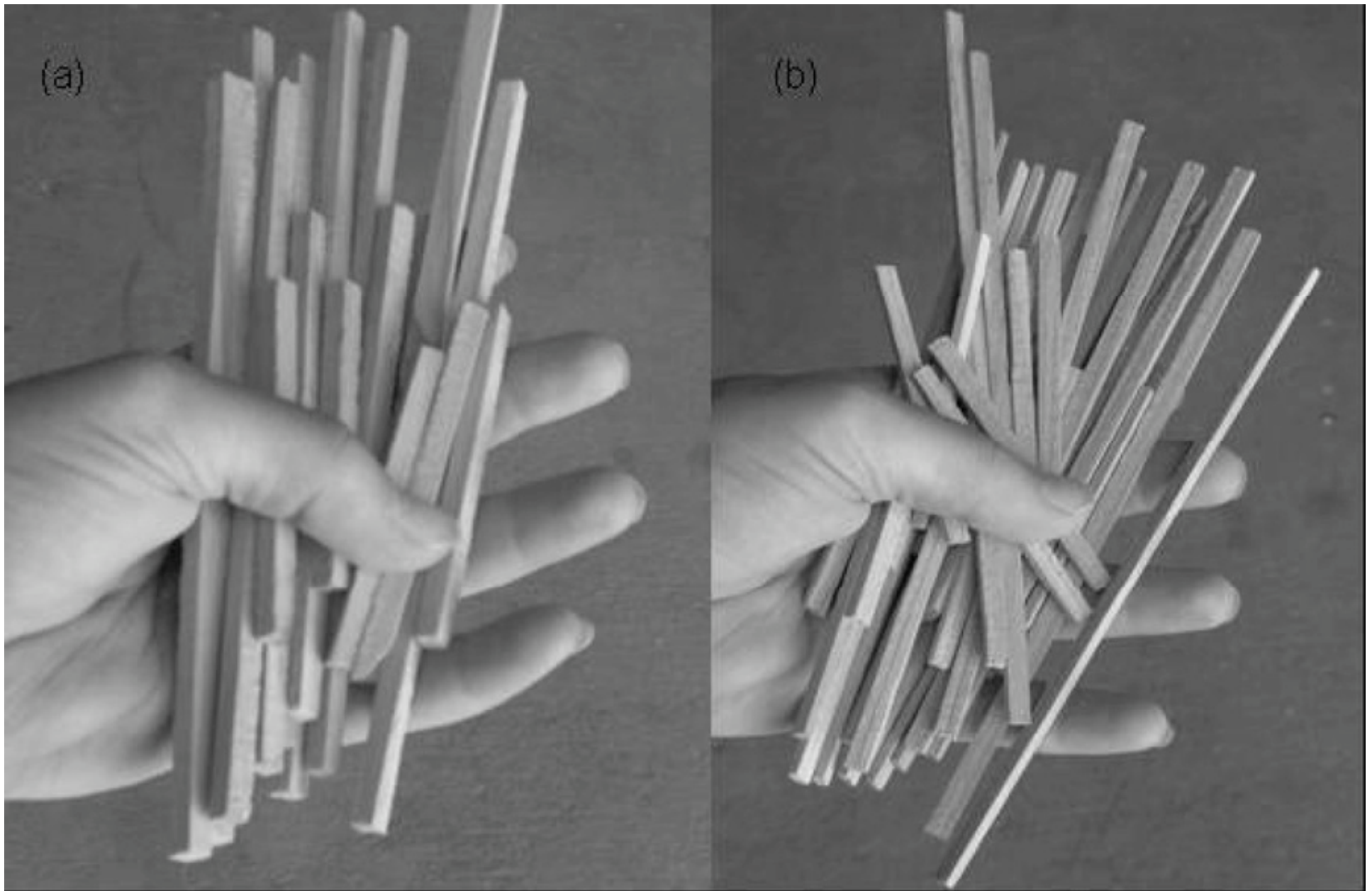
Sand Fences



Coastal dune area, USA.

Surface cover

- **Wood chips, agricultural straw and other materials spread on surface**
 - Widely used in the control of wind erosion from agricultural areas
- **Agricultural straw is problematic in an area of high winds and sand flux rates, unless it is anchored or crimped to the surface**
- **Wood strand material**
 - stable to wind speeds of 18 m/sec (40 mph),
 - wheat straw stable to only 6.5 m/s (14.5 mph).
 - PM10 emission reductions of 90% compared to bare soil were observed in these experiments (*Copeland et al., 2009*).



Wood-Strand Material for Wind Erosion Control

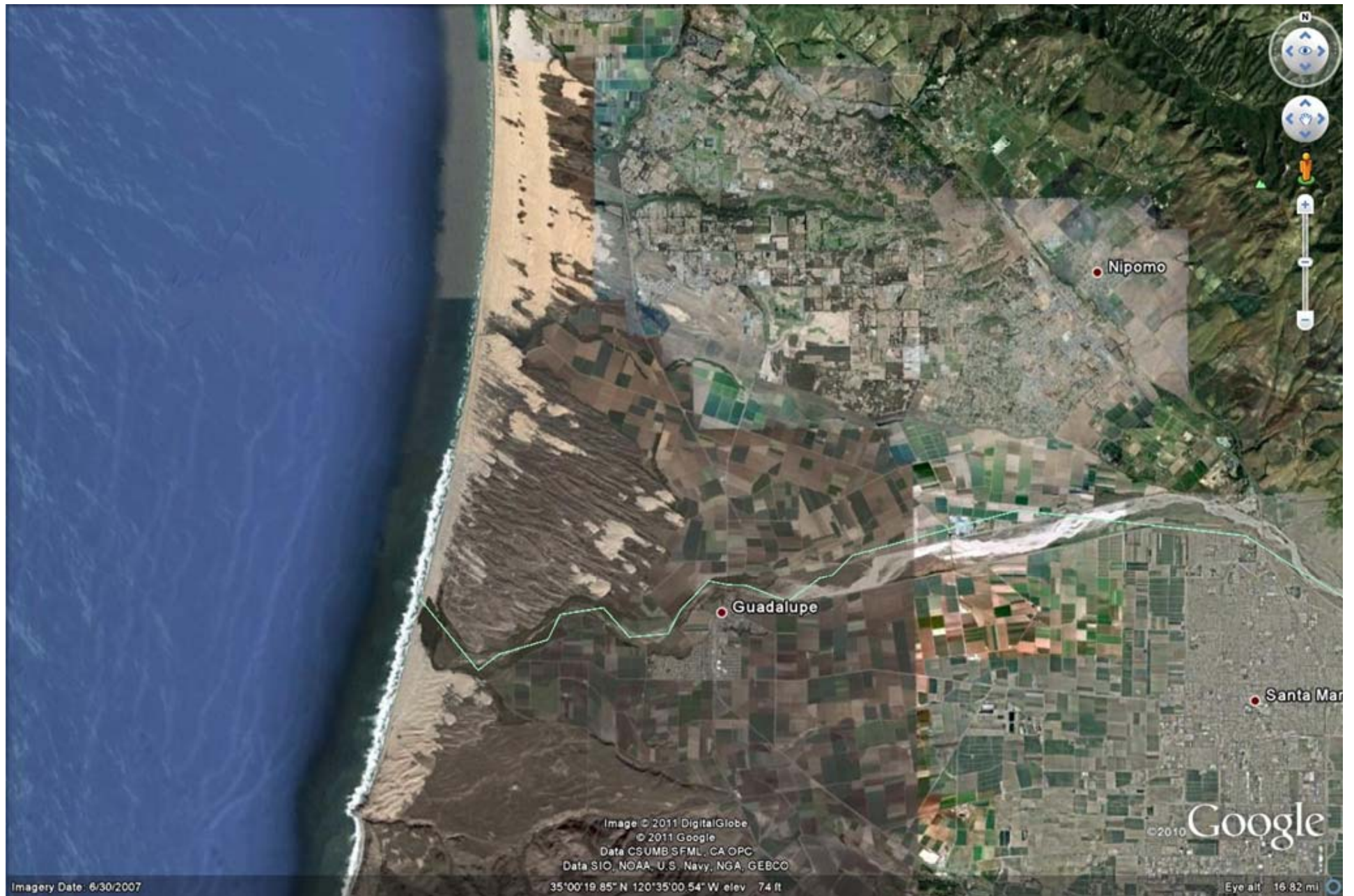
Copeland, N.S., Sharratt, B.S., Wu, J.Q., Foltz, R.B., Dooley, J.H., 2009. Journal of Environmental Quality 38, 139-148.



Straw blanket covering portion of dunes.

Oceano Dunes

An aerial photograph of the Oceano Dunes. The foreground shows the ocean with white-capped waves breaking onto a sandy beach. The middle ground is dominated by vast, rolling sand dunes. Numerous cars and people are scattered across the dunes, indicating a popular recreational area. In the background, there are green hills and a small blue pond or stream.



Google Earth image of Oceano-Pismo Beach dunes.

Oblique aerial photo of portion of Oceano Dunes.

