

1-1-2009

Salt Flat Basin's contribution to regional dust production and potential influence on dry deposition in the Guadalupe Mountains (Texas, USA)

Adriana E. Perez

Department of Geological Sciences, University of Texas, El Paso

Thomas E. Gill

Department of Geological Sciences, University of Texas, El Paso

Follow this and additional works at: <http://digitalcommons.usu.edu/nrei>

Recommended Citation

Perez, Adriana E. and Gill, Thomas E. (2009) "Salt Flat Basin's contribution to regional dust production and potential influence on dry deposition in the Guadalupe Mountains (Texas, USA)," *Natural Resources and Environmental Issues*: Vol. 15, Article 20.
Available at: <http://digitalcommons.usu.edu/nrei/vol15/iss1/20>

This Article is brought to you for free and open access by the Quinney Natural Resources Research Library, S.J. and Jessie E. at DigitalCommons@USU. It has been accepted for inclusion in Natural Resources and Environmental Issues by an authorized administrator of DigitalCommons@USU. For more information, please contact becky.thoms@usu.edu.



Salt Flat Basin's Contribution to Regional Dust Production and Potential Influence on Dry Deposition in the Guadalupe Mountains (Texas, USA)

Adriana E. Perez¹ & Thomas E. Gill¹

¹Department of Geological Sciences, University of Texas at El Paso, 500 West University Avenue, El Paso, Texas 79968, USA;

Corresponding author:

Thomas E. Gill

University of Texas, El Paso, 500 West University Avenue, Texas 79968, USA

E-mail: tegill@utep.edu

Saline lake and playa basins are amongst the most potent sources of mineral aerosols (dust) on Earth. The mineralogy and particle size of wind-erodible surface sediments in such basins are major controls of the nature of aerosols mobilized into remote areas downwind. This investigation evaluates the characteristics of dust emitted from the Salt Flat Basin of far western Texas (USA) (Figure 1). The Salt Flat Basin contains several ephemeral lakes and playas which, when dry, are major dust emitters. Aeolian sediment traps of different designs were deployed from mid-2005 through mid-2007 at 0.5, 1 and 1.5 m above the ground at three sites in the basin, two of which had been identified from satellite imagery as dust sources, and also at the crest of the Guadalupe/Delaware Mountains to the east (site of a National Park and an aerosol sampler in the IMPROVE nationwide air monitoring network) (Figure 1). Dust samples were collected twice a year (spring and fall accumulation). The particle size and chemistry of samples were evaluated by laser granulometry, proton-induced X-ray emission, ion chromatography, and X-ray diffraction. Dust flux in the Salt Flat Basin was highly variable with season and location, ranging from $10 \text{ g m}^{-2} \text{ yr}^{-1}$ (summer 2005) to

$150 \text{ g m}^{-2} \text{ yr}^{-1}$ (spring 2007), with an overall average of $50 \text{ g m}^{-2} \text{ yr}^{-1}$ for 32 total samples collected, consistent with seasonal dust storm frequency and similar to what has been measured at other locations in the southwestern USA (Table 1). Dust emitted from the Salt Flat Basin is rich in fine silt and clay-sized particles, potentially contributing to long-distance ($> 100 \text{ km}$) transport, especially during the spring windy season. The chemical composition of the dust was consistent with the known composition of the playa surfaces and surrounding lithology, but showed a geochemical fractionation with height and mode of transport (emission vs. deposition). Saltating particles near the ground were comprised primarily of gypsum and other sulfate and potash minerals, while suspended and falling dust was comprised primarily of silicate minerals including kaolinite and potassium feldspar. For the duration of the study the Salt Flat Basin did not appear to be a major source of aerosols at the Guadalupe Mountains IMPROVE site (GUMO), suggesting that GUMO is a valid regional sampling site not unduly influenced by dust emissions from the Salt Flat Basin located $\sim 20 \text{ km}$ upwind.

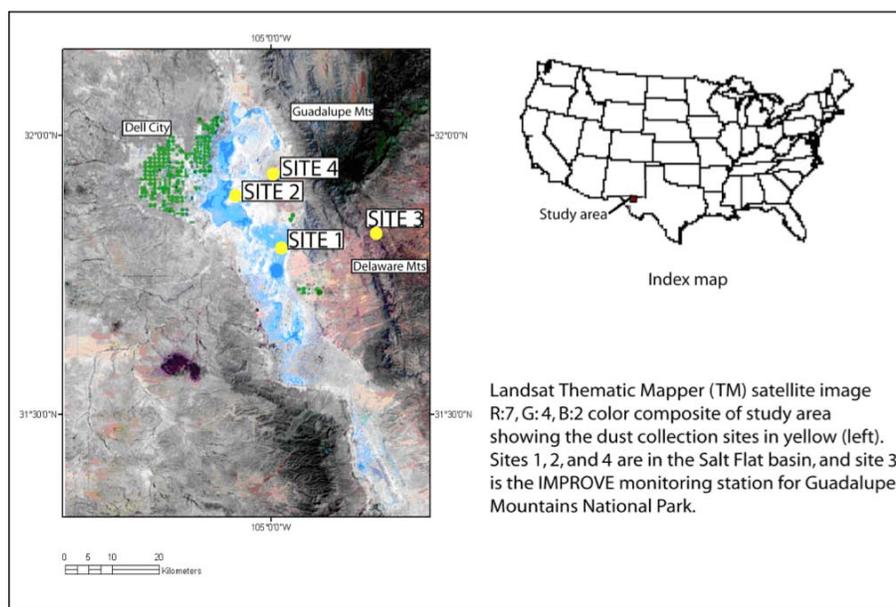


Figure 1—Location of Salt Flat basin and sampling sites.

Table 1–Dust flux measured at various locations (after Perez, A.E. 2008. Application of integrated remote sensing and GIS technologies to geoenvironmental issues in far west Texas and southern New Mexico, Ph.D. dissertation, University of Texas at El Paso, and Crabtree, G.W. 2004. Dustfall on the southern high plains of Texas. M.Sc. thesis, Texas Tech University).

Location	Dust Flux (g m ⁻² yr ⁻¹)	Trap Height (m)
Salt Flat Basin, Texas (this study)	50 (range 10-150)	1.5
Southern California	4.3-33.9	2.0
Central Arizona	48.0	3-5
Las Cruces, New Mexico	7.6-28.1	0.9
Texas Panhandle	13.0-27.0	1.4
Edwards Plateau, Texas	10.8-13.7	1.5
Bighorn Basin, Wyoming	4.6-12.3	2.0
Great Plains, USA	20.2-90.8	0.6
Negev Desert, Israel	156.0-240.0	0-5
Israel (Mediterranean coast)	57.0-102.0	2.0
Israel (semiarid)	89.0-217.0	2.0
Lubbock, Texas	102.0	10.0
Big Spring, Texas	77.0	10.0
Lake Lahontan, Nevada	81.0	0.0