Salton Sea Dust Control

Prioritizing cost-effective dust mitigation at the Salton Sea

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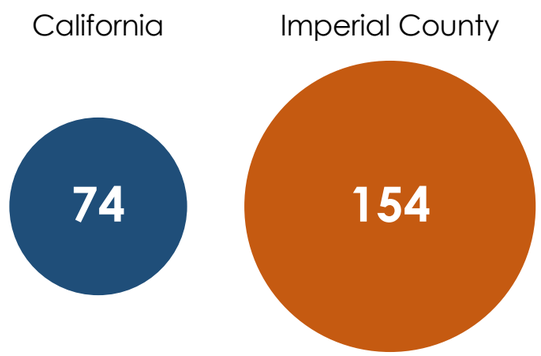
What is the Salton Sea?

The Salton Sea is the largest lake in California, located in both Imperial and Riverside counties. It was created accidentally when a flood caused the Colorado River to break through an irrigation canal and fill the Salton Basin.

The Sea is a terminal lake with no natural inflow, so lake levels have been highly dependent on the runoff from surrounding agricultural land. Outflow is solely from evaporation.

Problems arising from a shrinking sea

Asthma-related emergency room visits per 10,000 children

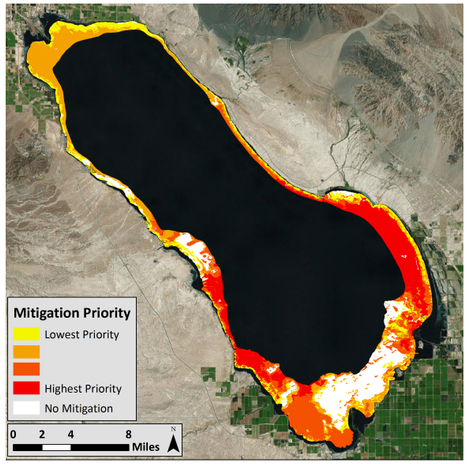


California Environmental Health Tracking Program, The Desert Sun (2017)

The lake level is declining rapidly because of water transfers that prevent the usual agricultural runoff from flowing into the Sea. This exposes the sediments of the dry seabed.

High winds in the area can create dust storms on exposed land, which is harmful for people to breathe, especially for children, the elderly, and those with respiratory problems. Dust also impacts the bird and fish populations at the Sea.

Priority areas to implement dust control



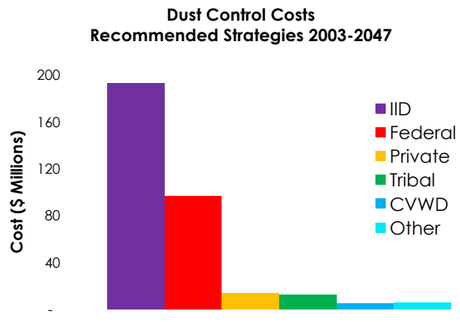
Based on our recommended dust control methods and their associated costs, as well as the results from our Dust Model, a cost-effectiveness score for each area was calculated to determine which parts of the Salton Sea should be prioritized for control.

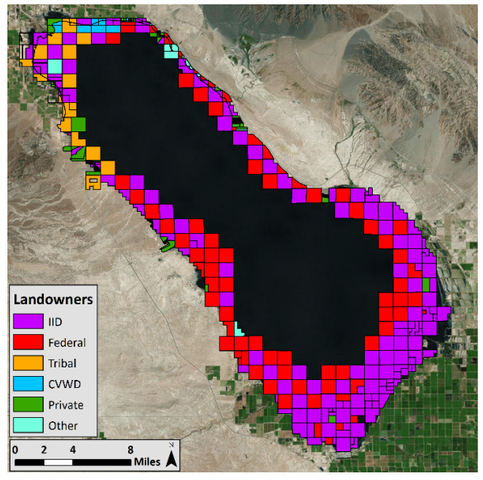
Soils with higher dust emission potential also have lower costs of mitigation should be given priority for control.

Because fine soils are more likely to generate dust as well as be the least costly to mitigate, we recommend that the fine soils in the windier southeastern portion of the sea be prioritized for control.

Dust control responsibility

Local regulations indicate that landowners could be responsible for dust control costs. The graph below outlines expected costs for landowners under this scenario.





Conclusions

We hope our results can better inform decision-makers to determine the best way to reduce the amount of airborne dust at the Sea, thereby decreasing the harm to surrounding residents in Imperial and Riverside counties.

Acknowledgements

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Approach

Our team took 4 steps to work toward resolving this environmental challenge:

Research cost-effective dust control methods that can be implemented at the Salton Sea

Develop a Dust Model to forecast areas that are the most prone to dust storms

Determine the most cost-effective way to reduce dust at the Sea

Review relevant regulations to determine potential dust control responsibility

Dust control methods and costs

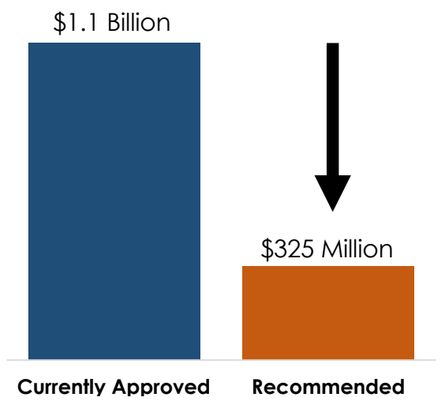
Surface Roughening

Vegetation

Surface roughening and vegetation enhancement were found to be the best techniques for controlling dust at the Sea. They stabilize the soils and reduce surface wind speeds, while being water-efficient and cost-effective.

If these recommended methods are used, dust control costs will be roughly one-third of the cost of using currently approved techniques. The map to the left shows where recommended strategies should be used.

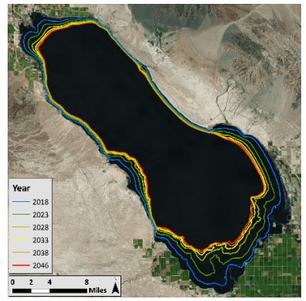
Dust Control Costs



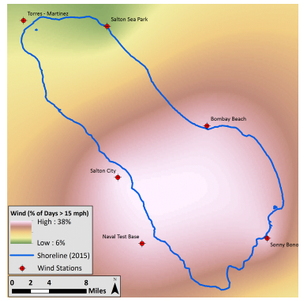
Dust Model

By using modeling software and looking at the future shoreline, wind data, and soil types of the Salton Sea, we were able to predict the areas that would be the least and most likely to produce dust storms.

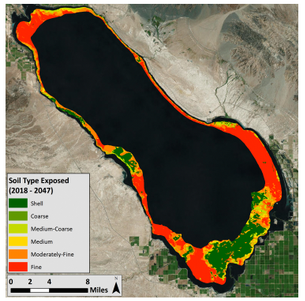
Future Shoreline



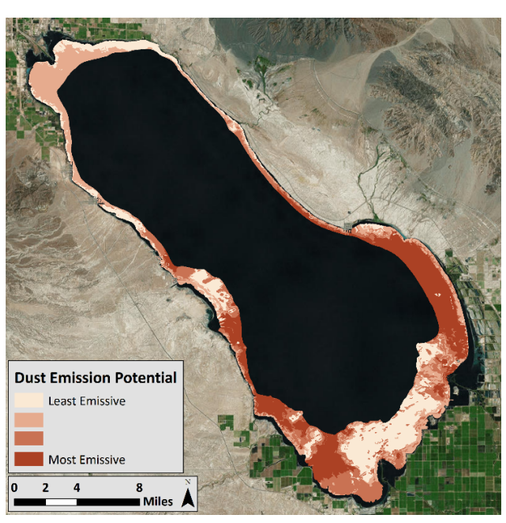
Wind Frequency



Soil Type



- First, modeling software was used to predict what water levels the Sea would drop to in the future. Then, mapping software was used to overlay underwater elevation profiles with future sea elevations to predict future shorelines and new exposed beaches.
- Next, the frequency of windy days was predicted across the Salton Sea, based on five years of historical weather data from six monitoring stations.
- Finally, soil types were added. The soil map shows the relative potential of each soil type to produce airborne dust during windy conditions. This was combined with the frequency of wind events to predict how often dust storms might occur at exposed seabed.



The model result on the left shows that the southern and eastern shores of the Salton Sea have the highest dust emission potential. These soils generally contain the finest sediments and experience the highest wind speeds.

While fine soils exist at the northern end of the sea, the lower frequency of high wind speeds in the north indicate that this area will not generate as many dust storms.

Additionally, there is a large area of hard-packed shell beds in the south, which is predicted to not produce any dust.