HydroBio
Advanced Remote Sensing

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2009 Assessment of Dune Movement Near Keeler, California

Prepared by HydroBio for Great Basin Unified Air Pollution Control District

Abstract

Dune movement in the northeast corner of Owens Lake shoreline has given rise to a fugitive dust problem and concern for future encroachment on the town of Keeler. This report provides current 2009 data measurements of four dune transects selected in October 2008. These transects have continued the southeastern movement seen in the 2008 analysis.

1. Introduction

The sand dunes and sand deposit to the northwest of the community of Keeler, California are actively moving towards the community. To gain an understanding of the sand movement a preliminary assessment was initiated in 2008 to study the dune movement. This report is a continuation of that analysis named Preliminary Assessment of Dune Movement, and Factors Influencing Air Quality and Potential Mitigation Near Keeler, California. In that assessment five tasks were established, (1) determine a sand budget to understand where the sand is moving, (2) evaluate wind data to assess how wind has influenced dune movement, (3) determine the direction and rate of dune movement through the Keeler dune field, (4) determine the rate of movement and winnowing of the dune material to determine whether fine particulate releases are a temporary or long-term problem, and (5) determine how to mitigate this problem.

As part of the first task in the assessment, the dunes were visited with staff from the Great Basin Unified Air Pollution Control District during October 2008 and a series of transects were established in order to provide a benchmark for assessing sand budgets. These same sites were re-visited in October 2009 to identify any change within the dunes.

2. Field methods

There are four sites selected for the analysis in 2008. These transects were selected in various locations around the dune field (Figure 1). In 2008 the individual dunes appeared to be moving in different directions, so transects were constructed on different dunes located in various areas in order to understand the pieces that make up the dune field. This allows us to get the “big picture” of how the dunes interact with each other and the topography. These sites were revisited in 2009 during the same season and new measurements were collected.

2.1 Data Collection

Field data was collected using Global Positioning System (GPS) points to mark the beginning and end of each transect. Elevation data was calculated from measurements taken every 10 meters from a laser pointed at a stake on the opposite side of the dune. Field data was collected in October 2008 and then again in October 2009 to identify sand movement in and around the dunes. Both sets of elevation data were plotted for comparison.

Figure 2. Field data collection process

Along with elevation surveys, HydroBio has developed an aerial camera system that was used to capture high resolution imagery of the dune field in 2009. Two Nikon D90 digital SLR cameras were mounted on the belly of a Cessna 185. Each camera has 12.3 million effective pixels with the capability of capturing high spatial resolutions around 4.23 inches. One camera was modified to only pick up infrared wavelengths, while the other camera was left in its original condition. This method was developed so false color infrared imagery could be produced as well as natural color imagery. This capability is in the testing phase of our research, therefore only a high resolution natural color image was produced in this stage of the analysis of the Keeler Dunes. Images were captured in late October 2009 and were used in the analysis to identify changes since the 2008 Quickbird image.

3. Analysis

Transects B-E were intended to provide sufficient data to establish a sand budget within the dune field. In 2008 it was observed that the northern portions of the dune field had different characteristics than that found in the southerly areas. A series of hypotheses were formulated to be tested in 2009 when the transects would be resurveyed. These hypotheses were:

- The dunes in the northern portion of the field are deflating and have been transported onto the alluvial fan to the east.
- As the dunes deflate, the coarser particles are left behind leaving a “lag deposit” that is resistant to erosion.
- The formation of dunes is inhibited by the upwind location of thick greasewood growth.
- Dunes are formed through reworking by the wind, and in this process the fine particles giving rise to air pollution concerns.

Figure 1. Locations of dunes used in 2008 – 2009 fieldwork displayed on the 2008 Quickbird image.

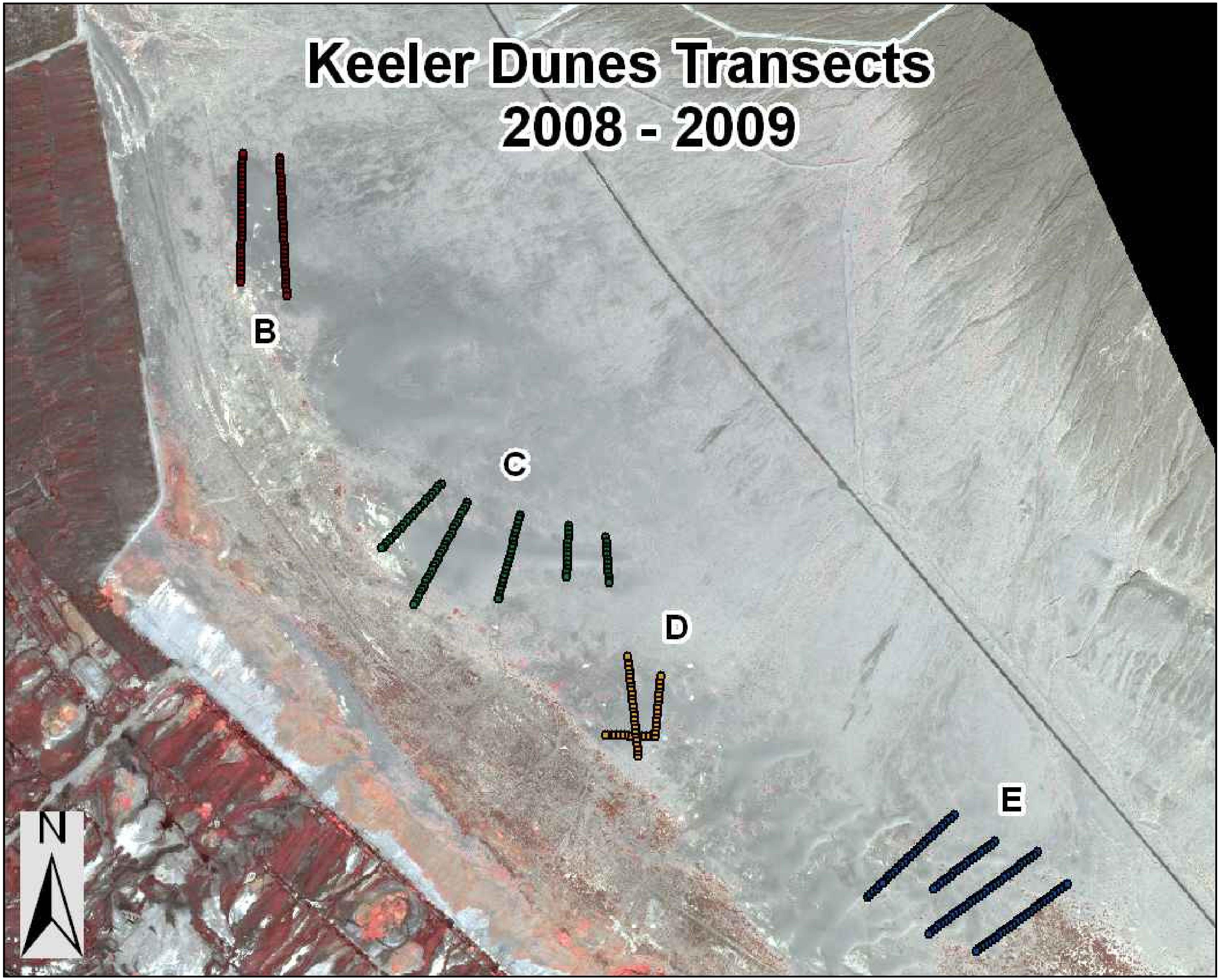


Figure 2. Transects from dune B data collected in October 2008 (left) and 2009 (right).

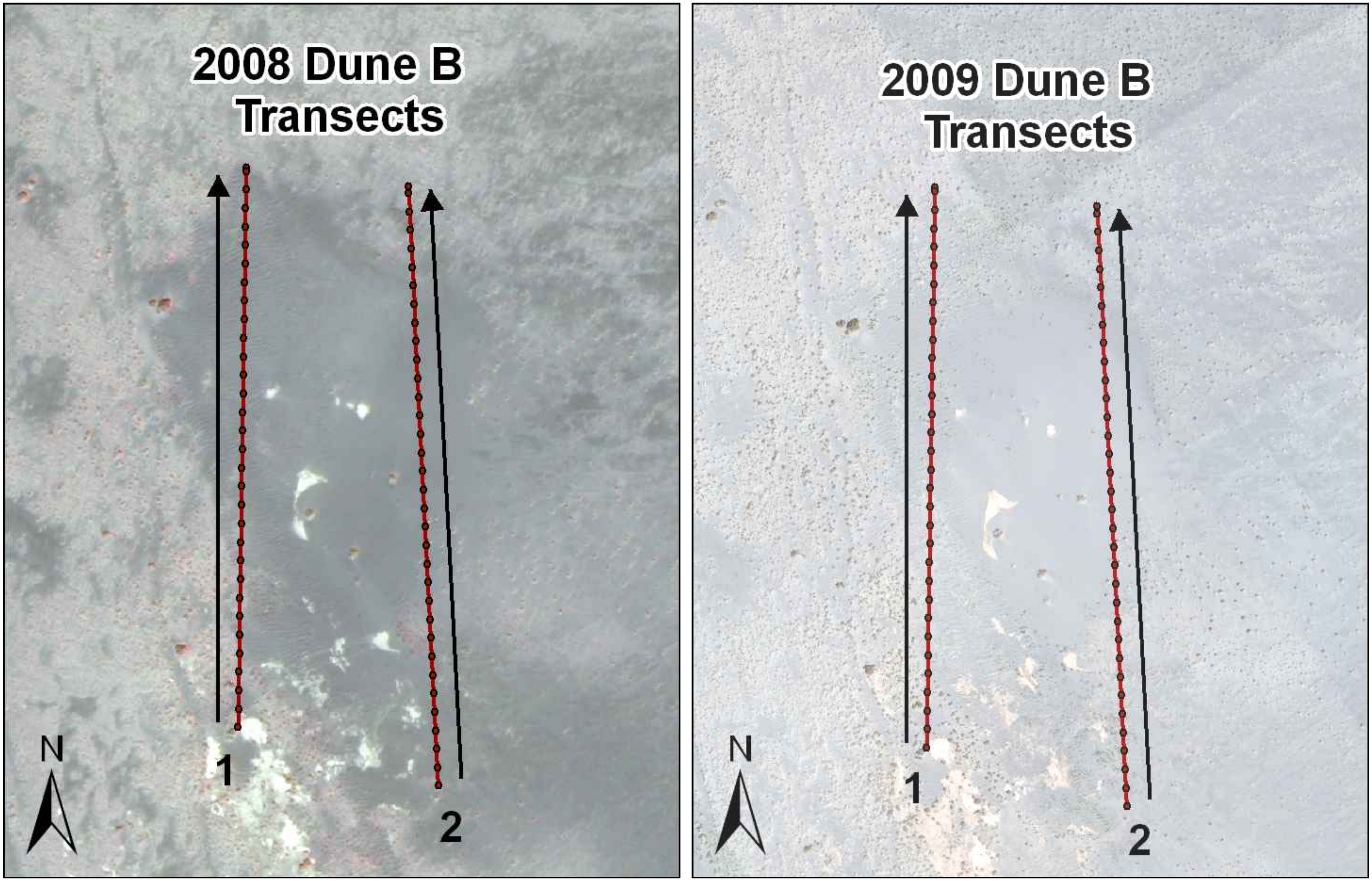


Figure 3. Transects from dune B data collected in October 2009.

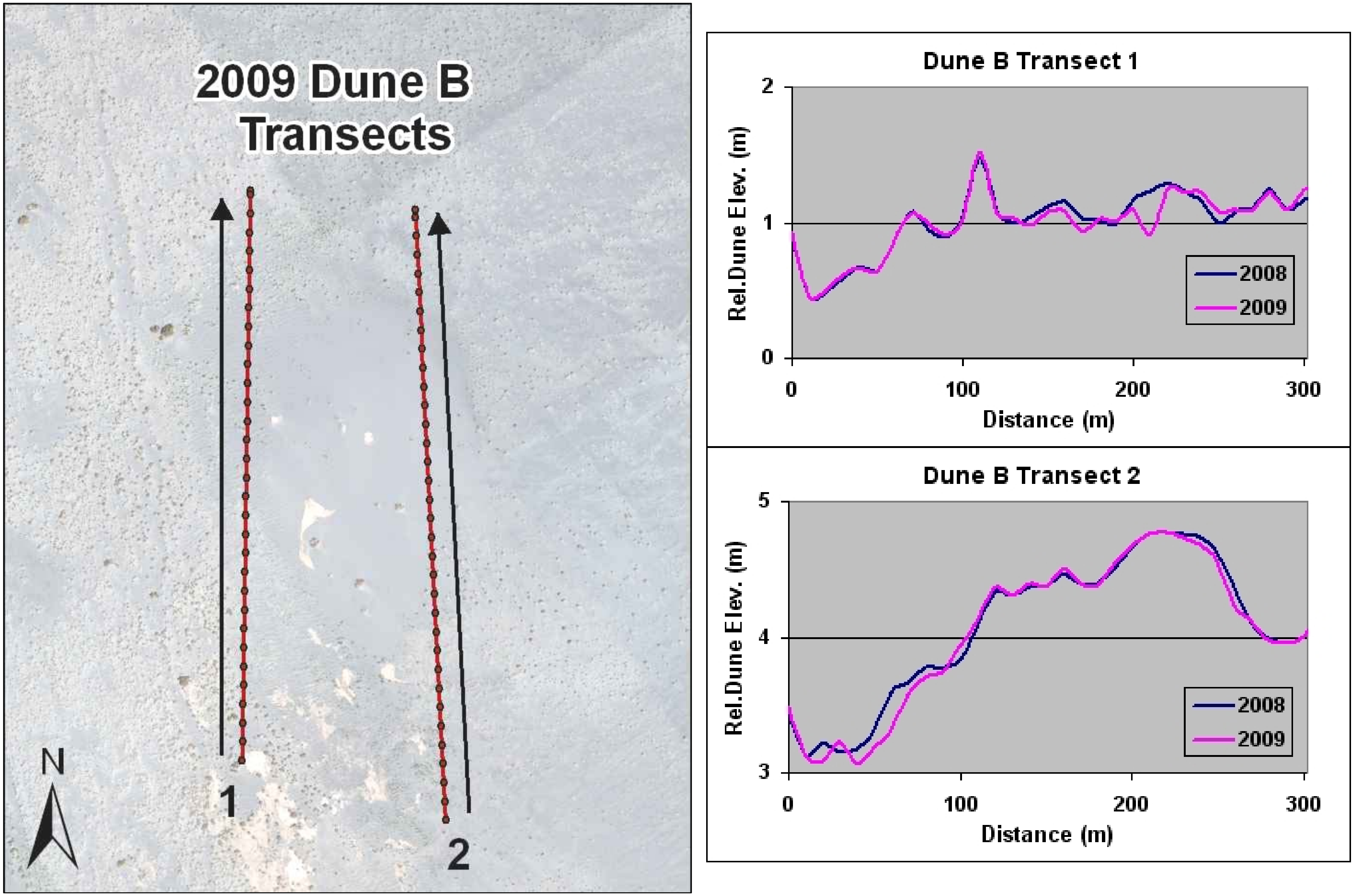


Figure 4. Examples of changes in dune B from 2008 - 2009. These images show the change in sand movement on dune B.

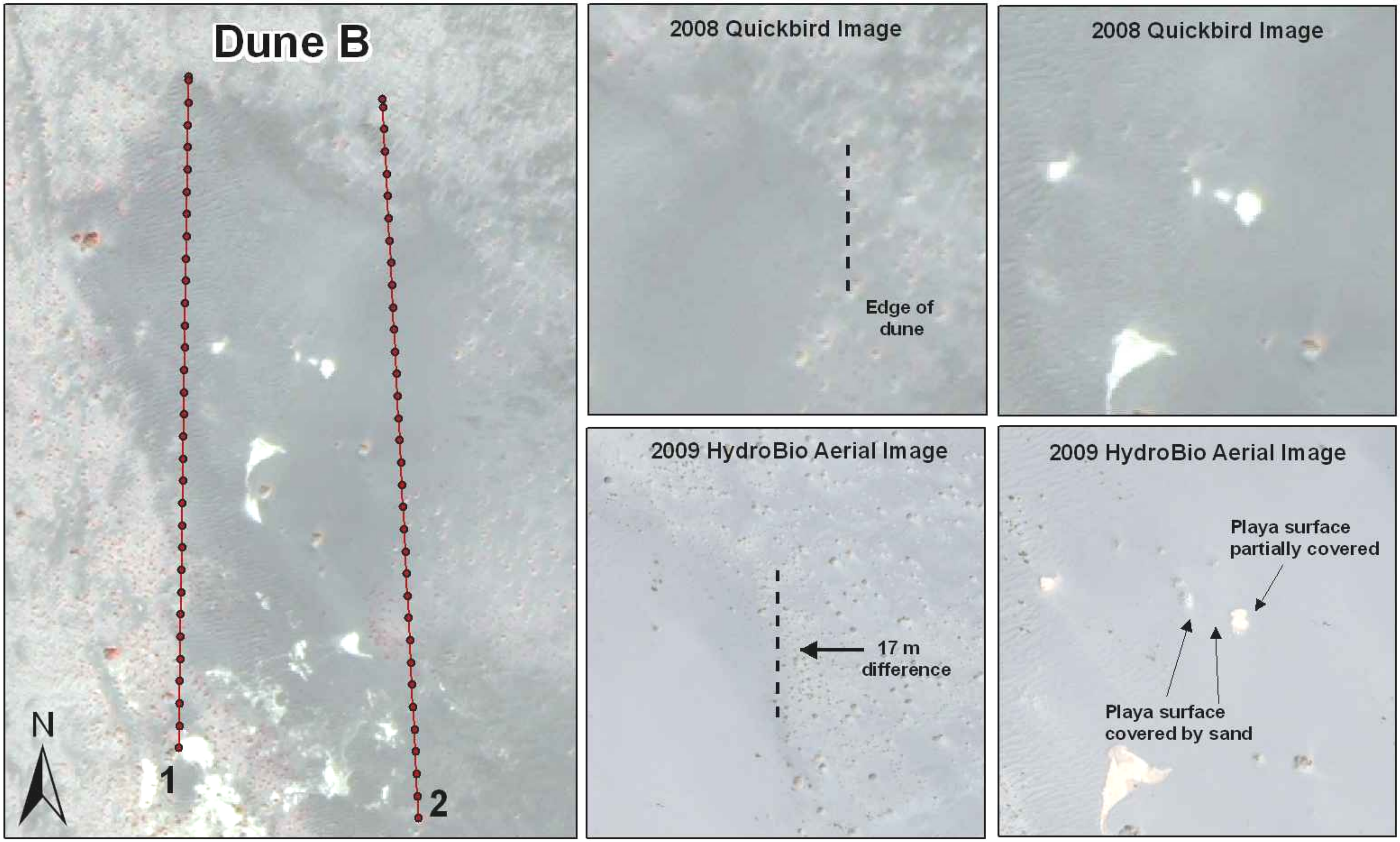


Figure 5. Comparison of the Quickbird 2008 imagery (top) to the 2009 Aerial imagery (bottom).

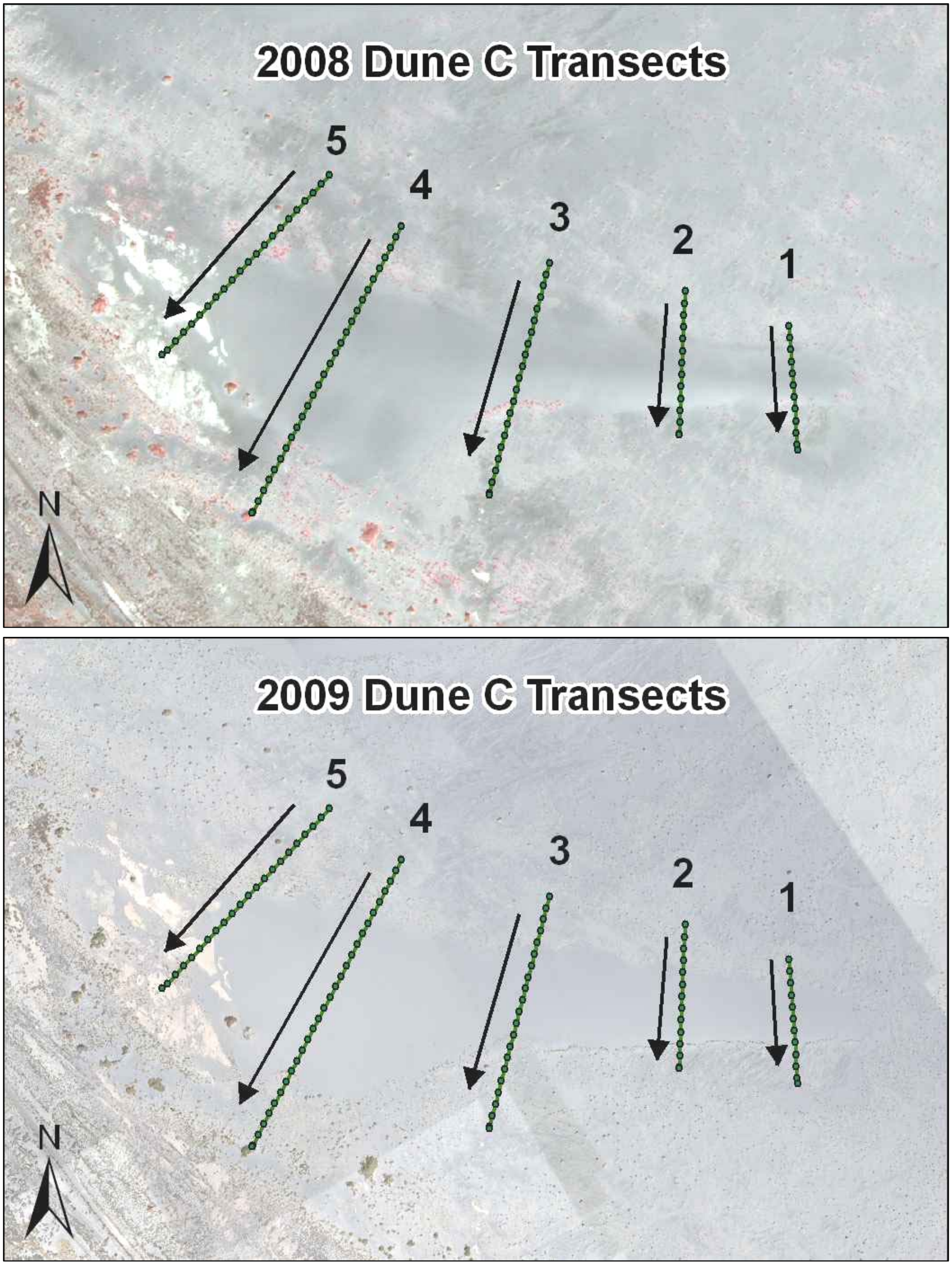


Figure 6. Transects collected for dune C in 2009.

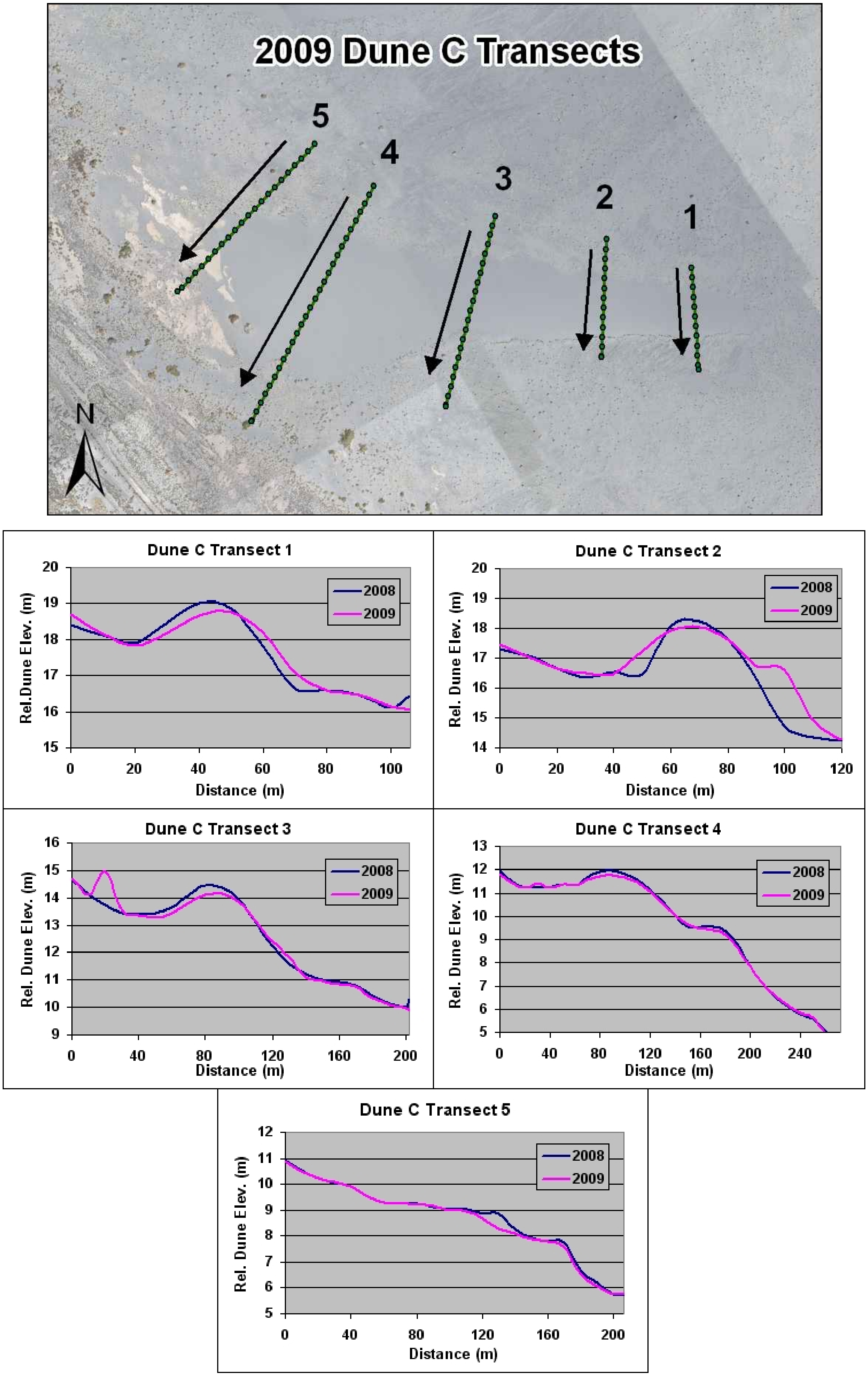


Figure 7. Comparison of the Quickbird 2008 imagery (left) to the 2009 Aerial imagery (right).

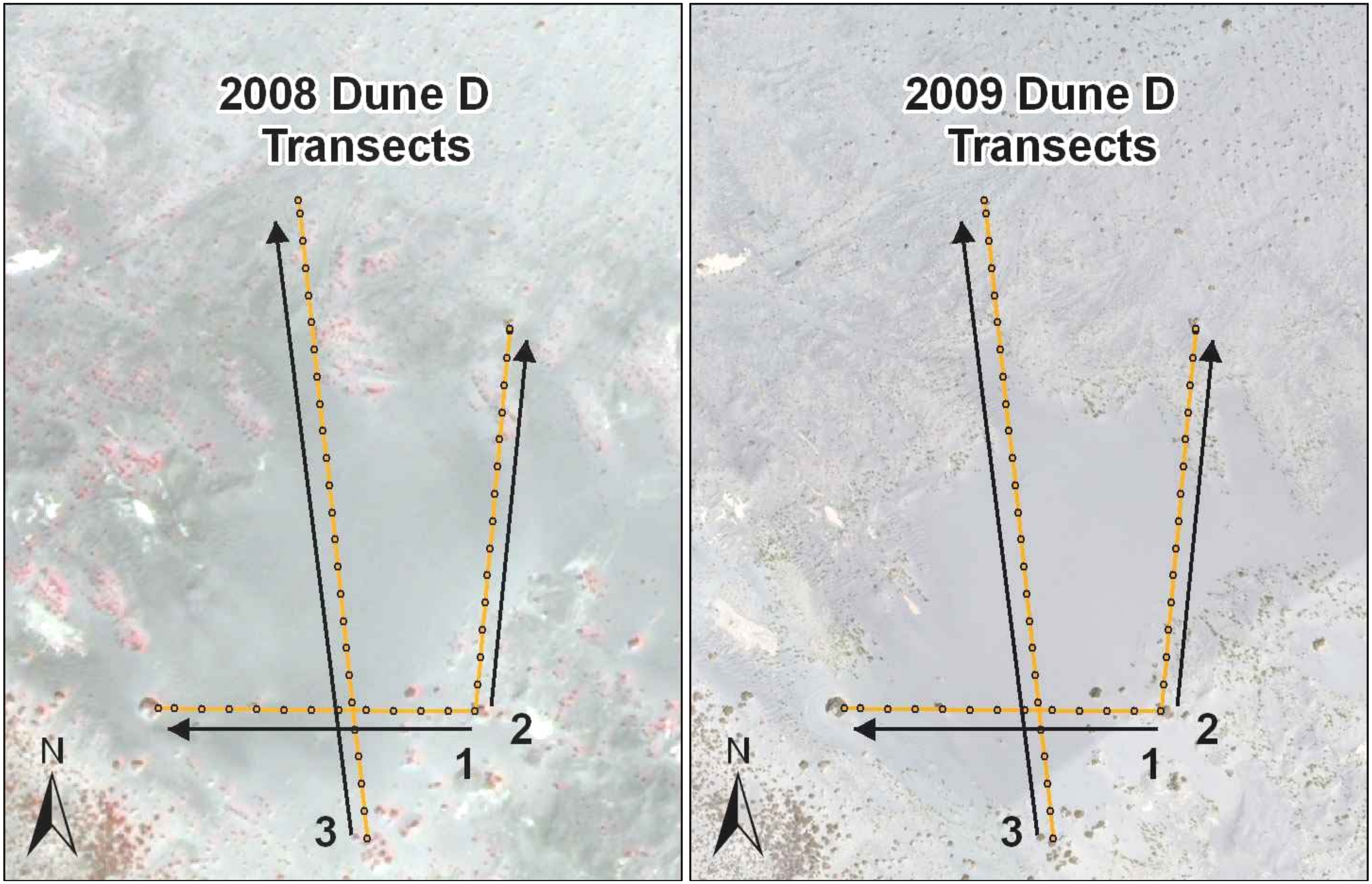


Figure 8. Field data transects for dune D collected in October 2009.

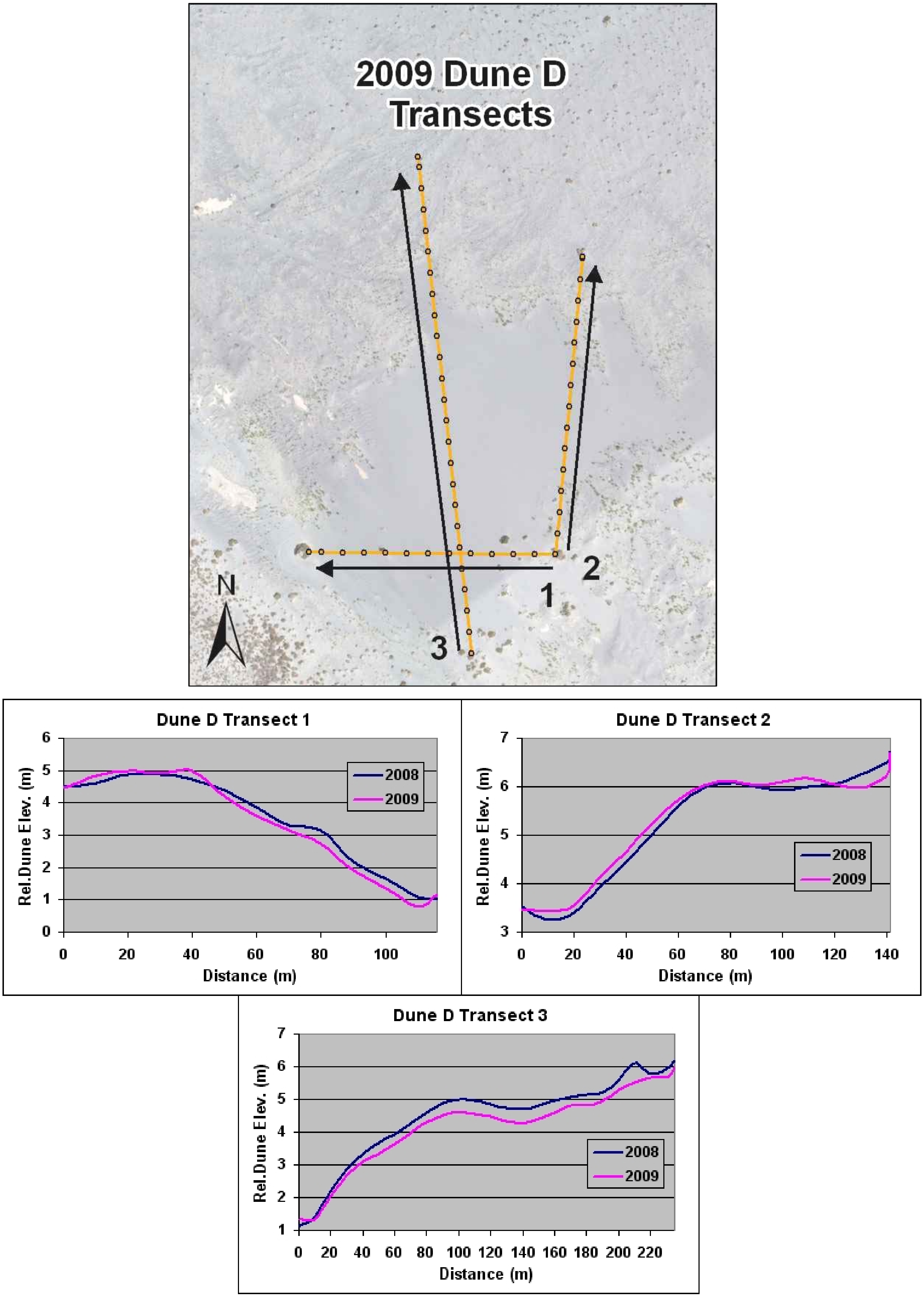
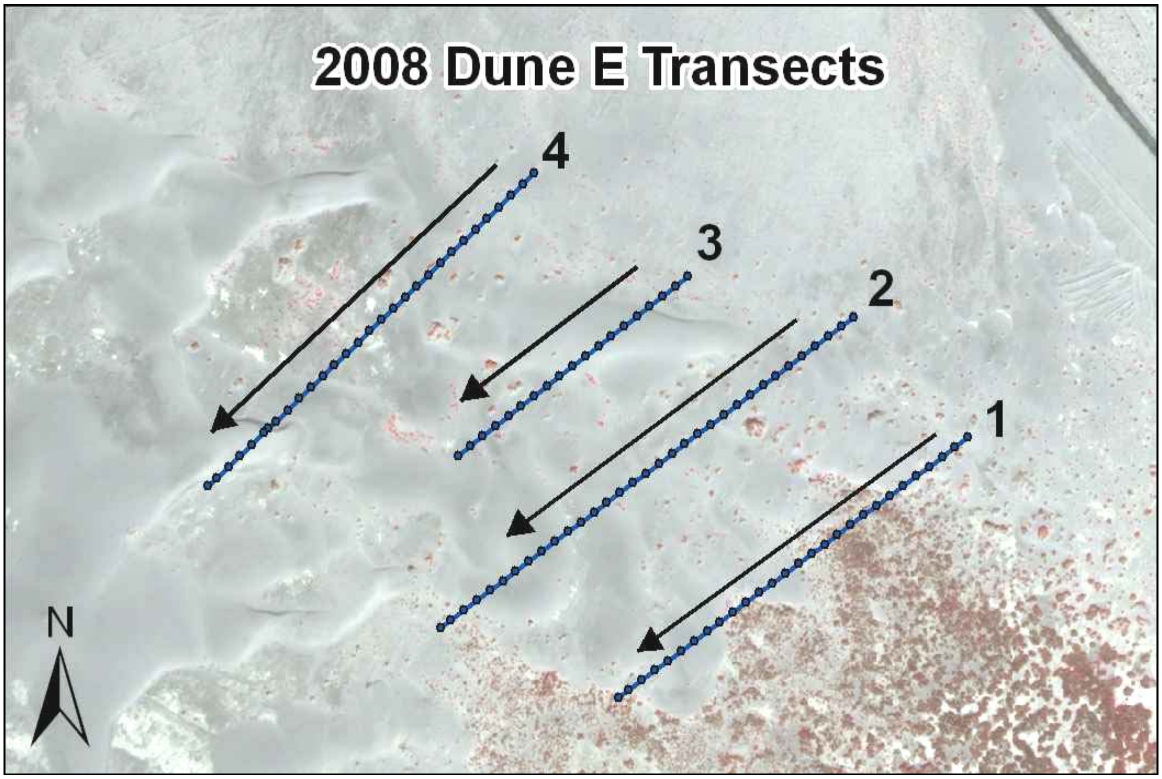


Figure 9. Comparison of the Quickbird 2008 imagery (top) to the 2009 Aerial imagery (bottom).



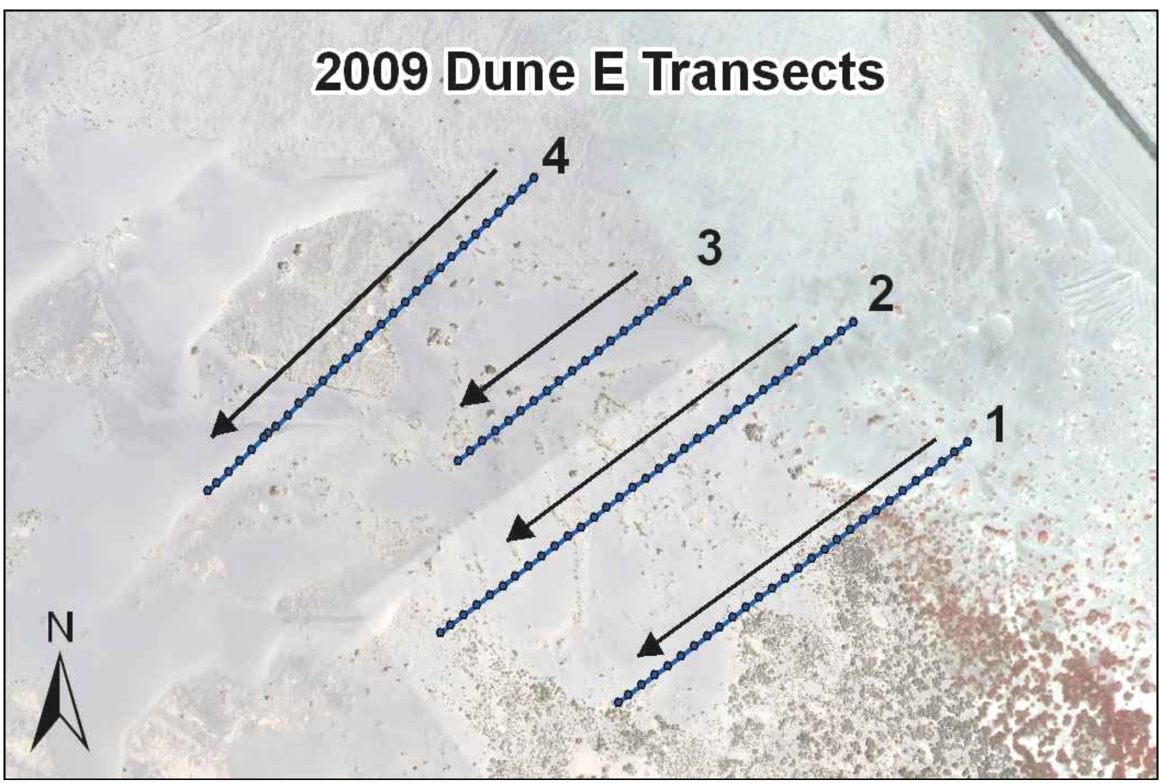


Figure 10. Transects for dune E collected in October 2009.