

Infrastructure of Dust Managing Particulate in the Borderland

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Airborne particulate in the US/Mexico border region indexes an emerging transnational security concern, enabling the proliferation of novel managerial infrastructures. Through an investigation of the *weaponized atmospheres* and *securocratic frontiers* of cross-border dust, the paper uncovers an invisible agent with the capacity to reshape bodies, buildings, cities, and territories in its image.

DUST AS TRANSNATIONAL SECURITY CONCERN

Dust surrounds us, saturating our atmosphere with a nearly imperceptible, but transcontinental airborne geology. Particulate matter disturbed from geologic strata, and the infinitesimal artifacts of anthropogenic intervention conspire to create an ever-present material ecology, suspended in our cities and streets, deposited in our homes. Microscopic *bits* of soil, sand, ash, and soot creep unnoticed through the everyday, vectors for the transmission of chemical, biological, and cultural *matériel*. The ability of dust to infiltrate boundaries, cross borders, and invade bodies has made it a primary security concern in the evolving transnational threat environment.

Dust, while often considered inert, is indeed a highly effective agent for transforming vast territories. The massive, intercontinental 'dust export' of the Saharan Desert that crosses the globe contributes to microbial growth and ice melt in Antarctica, sustains the health of ecosystems in the Amazon, and acts as the major life support system for the world's oceans, delivering vital trace elements like iron to nutrient-starved regions[1]. The dust-laden Saharan Air Layer (SAL), leaving in bursts from Western Africa every three to five days throughout the summer months, is said to both contribute to devastating algal blooms in the Gulf of Mexico, and to play a key role in diminishing the gathering force of tropical Atlantic storms[2].

New dust and sand sources are regularly created, discovered and exploited through a combination of natural and anthropogenic agents[4]. With desertification accelerating in an era of rapid climate change, existing sources of transnational dust flow are being naturally extracted, their boundaries expanding. Adding to the natural erosion of sand and dust sources, human agents and growing pressures

of urbanization are targeting and expanding dust sources for profit. Transnational criminal enterprises engage in *sand smuggling*[3] and other clandestine practices. This vast unregulated economy, dependent on the wholesale extraction of geologic material, is literally changing the map.

These vast migrations of dust carry with them a latent, but operative intelligence, clues to help us better understand our changing world. The first indications of shifting biospheres, emerging human and animal habitats, and criminal abuses are indeed encoded within the smallest of airborne particles. Geologists routinely investigate dust deposits, miles away from their source, searching for the unique

Figure 1: Aerosol Optical Depth [Showing Dust Export from Saharan Air Layer]
- Adapted from NASA Earth Observatory (NEO) May 2016



mineral and biological signatures which can help to pinpoint emerging origin sites and trace the development of known dust sources. Emerging cross-disciplinary fields map the future intersections of atmospheric material ecologies, criminal behaviors, global security, and the built environment. Experts in *environmental forensics* regularly deploy ‘chemical fingerprinting’ and image analysis techniques drawn from the toolkits of criminal investigations to investigate the spread of airborne contaminants and pollutants. Human rights organizations and military authorities investigate transgressions of *environmental security*, merging conflict studies with environmental justice[5]. Dust has become an important type of evidence in a range of emerging cross-territorial forensic investigations.

Within conflict zones, the dust particles can carry with them identifiable mineral, and therefore cultural markers, indexing the militant geologies of the anthropocene. Particulate on the beaches of Normandy contains evidence of the Allied D-Day invasion, with microphotography revealing granules reduced from shrapnel, artillery, and machinery created in combat[6]. This so-called *war sand* is one of many *conflict geologies*, born from the destruction of war. With modern conflicts engaging arid and equatorial climates, these conflict geologies are already expanding. The land-intensive activities of war, insurgency, and violent conflict are expected to increasingly contribute to dust transmission in desertified regions of Africa and West Asia in the coming decades[7].

The latent information embedded in transnational dust flows also includes insight into our changing climates and microclimate. An analysis of various contaminants or changing ratios of minerals and

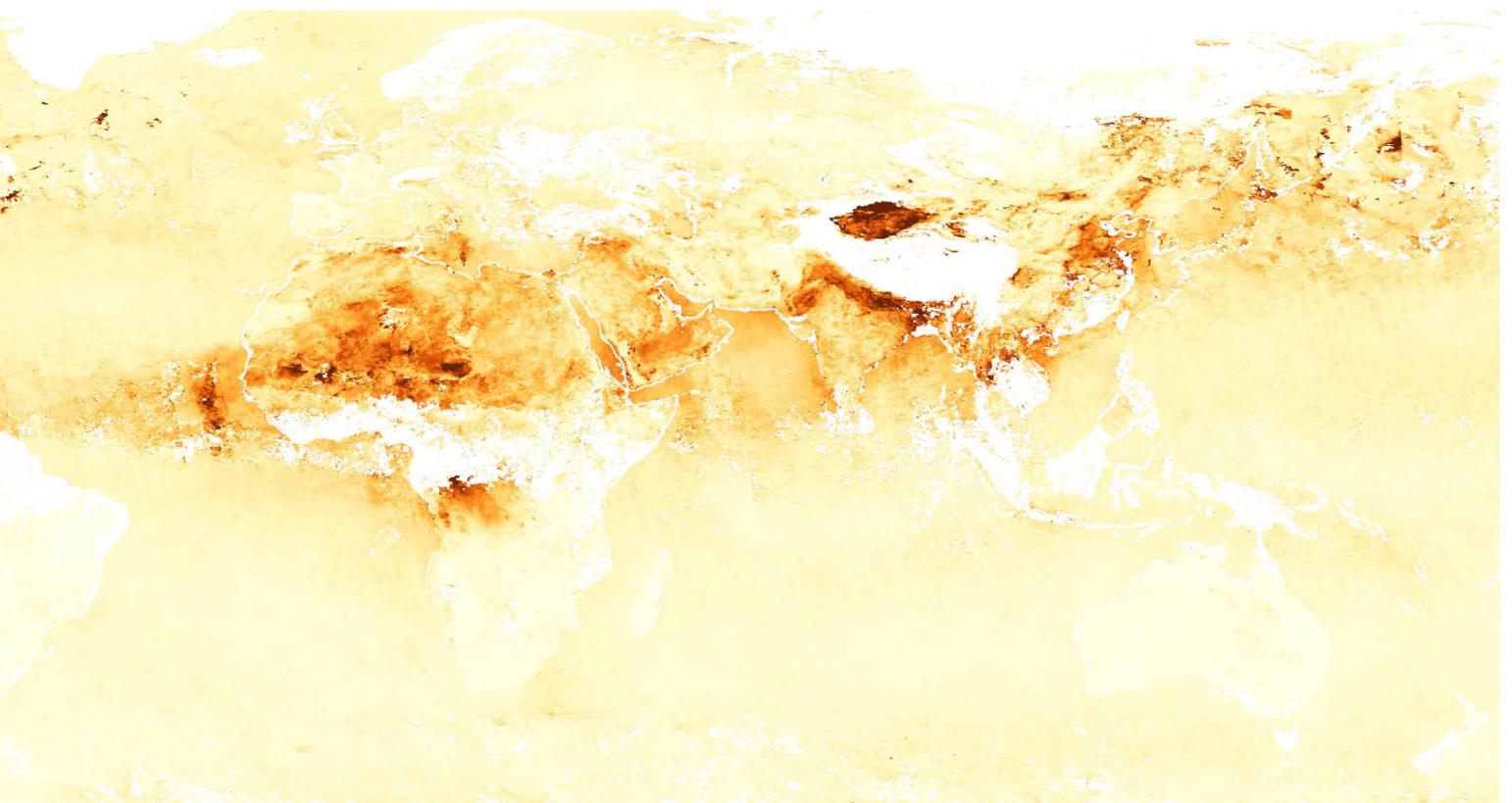
plant life carried on the wind can be an early indicator of cross border migrations, airborne pollutants[8], allergens, pathogens and disease. As dust crosses borders it is a target of concern for global security.

WEAPONIZED ATMOSPHERES

Climate and weather control fantasies involving dust and security emerge with what James Rodger Fleming calls the ‘weather warriors’, those captains of science and industry who sought to instill world order, and disrupt sovereignty by virtue of planetary-scale environmental modifications. The desire to shape the weather for geostrategic advantage, either to prevent the desiccation of crops to secure domestic food supply, or to hinder the advance and supply lines of a targeted enemy, has concerned military researchers for decades. With a renewed interest in *weaponized atmospheres* emerging across a range of security interests, dust and airborne particulate is poised to take on new roles.

Since ancient times, it was thought that the atmospheric residue of large battles conspired to change the weather, causing rainfall in the days immediately after the disturbance. In the 20th Century, *cloud-seeding* experiments, first developed privately by researchers at General Electric and later transferred to the military domain after World War II, sought to use chemical particulates to weaponize the weather[9].

The Cold War saw an exuberance of proposals and direct military actions, using *weaponized atmospheres* to push the limits of possibility while raising ethical question. The Soviet Union entered the scene with ambitious - if not entirely possible - predictions for an emerging



planetary particulate regime. Rusin and Flit show in their “upbeat” propagandist pamphlet, *Man vs. Climate*, several radical proposals for re-engineering the planet at the service of Soviet interests. Citing *dust storms* as a significant detriment to domestic security and a challenge to overcome in the projection of power abroad, the authors herald a brave new world of atmospheric control in the service of the Soviet state. Included in the pamphlet is a proposal by Gorodsky and Cherenkov which advocates for surrounding the Earth in a ring of dust, “similar to the ring around Saturn,” in order to block the effects of solar radiation and limit the volatility of seasonal temperature differentials[10].

The US, meanwhile, was using theaters of operation as testing grounds for *weather warfare*. Operation POPEYE, an intensive, classified cloud-seeding operation bombarded Vietnamese airspace with lead and silver iodide in an attempt to extend the monsoon season and hinder supply chains. After the operation was made public, the US Senate and United Nations each passed resolutions against the use of such wartime environmental modification techniques[11], setting a precedent for a juridical *autonomy of atmosphere* predicated on the nation-state, coincident with national sovereignty but dependent on mutualist planetary regulation.

While a great deal of skepticism, along with ethical and scientific uncertainty surrounds such large-scale experiments, the scientific community is returning to proposals for geo-engineering with renewed vigor. Buoyed by a speculative report[12] from the US Department of Defense on the possible national security impacts of global warming for US military and strategic interests, techno-futurist scientific endeavor has shifted to investigate macro-engineering techniques which privilege an image of the planet increasingly subject to arid, windblown, dusty landscapes. The Pentagon’s mandate to “explore geo-engineering options that control the climate” found an inspiration and ready recruit in the prevalent migrations of global dust.

A 2003 study advocated for *stratospheric dust injections* to combat the detrimental effects of ozone layer depletion in sensitive areas[13]. More recent, and more earnest proposals from geo-engineering specialists suggest new futures for dust, accelerating the effects of natural dust deposits and enlisting them in the battle for planetary atmospheric stability. Drawing on the historic ability of dust to fertilize the planet’s nutrient-rich oceans and encourage algal blooms, one proposal from 2008 suggests targeted artificial fertilization. The resulting algal territories would, the authors suggest, act as a carbon sink and limit the effects of global warming[14].

Adapting to the UN mandate for a drawdown on *weaponized atmospheres*, the military has shifted its target from the weather itself to the sensors and systems which help an enemy to understand its impact and forecast its behavior. A recent proposal from the US Air Force for next-gen weaponized atmospheres suggests “clouds of microscopic computer particles that could block an enemy’s optical sensors or guide smart weapons to their targets”[15].

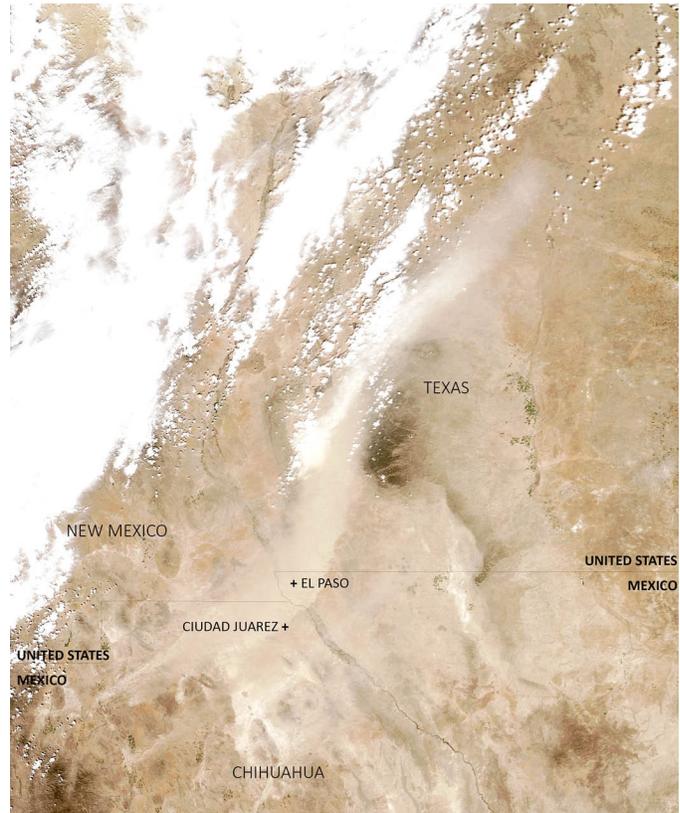


Figure 2: Transnational Dust Storm over El Paso / Ciudad Juarez
-Adapted from NASA Earth Observatory April 2012

SECUROCRATIC DUST FRONTIERS

In parallel with this macro-scale research in *weaponized atmospheres*, military strategists have developed and appropriated physical, terrestrial territories to augment weaponized particulate experimentation. Trajectories for the possible impact of dust and other airborne particulate on global security are embedded in a series of *securocratic* territories, managerial militarized landscapes which deploy infrastructural technologies to privilege the reading of dust as contaminant, weapon, and threat. A series of landscape-scale and urban environment simulations speckled across the US domestic interior demonstrate an ongoing military commitment to the defense and tactical deployment of particulate management.

Dugway Proving Ground is host to one of the earliest such installations, dedicated from its creation in 1942 to managing the effects of weaponized airborne threats from chemical, biological, and nuclear material. The collection of simulated German and Japanese villages act as a kind of physical computer for airborne particulate, an urban laboratory for testing response and attack. The site itself required extensive particulate management strategies to maintain the integrity of the future experiments, creating a kind of neutral atmosphere and control scenario against which future atmospheric incursions could be measured. The first order of business was to control the amount of blowing sand on site by importing massive amounts of gravel, setting the stage for future experiments[16], creating the control condition against which future airborne incursions could be measured.

Also in Utah, the Deseret Test Center at Fort Douglas used chemical and biological *simulants* to test region-scale affects of airborne contaminants, leading to the long-term modification of neighboring landscapes and ecosystems, adversely affecting public and animal health. This feedback between a designed, controlled, and localized intervention and its unpredictable territorial reach would be a consistent feature and design problem for particulate simulation facilities to overcome.

While purpose-built constructions like those at Dugway are valuable in simulating complex interactions of built form and airborne particulate, the military also appropriates existing urban forms and infrastructures to conduct its tests. Beginning in 1953, the US Army Chemical Corps staged mock chemical attacks on real cities, including St. Louis, Minneapolis, and Winnipeg[17]. The Large Area Concept experiments, begun in 1957, extended this experimental territory, requiring the complicit coordination of multiple jurisdictions. The experiments included analyses of downwind effects across multiple states, infusing the atmosphere with simulants which allow researchers to trace the range of the foreign agent.

The simulants used in such tests, which themselves pose a range of threats, still line these urban landscapes and trans-jurisdictional domestic territories. In St. Louis, predominantly African American neighborhoods, replete with high-density modernist public housing complexes, were chosen for similar tests based on their resemblance to the Soviet urban fabric then a primary target for operations. This insidious history of particulate contamination has only recently been revealed with renewed government interest in the redevelopment of the ill-fated Pruitt-Igoe site. Environmental assessments support speculation that chemical contaminants and radioactive tracers may have been deployed[18].

Recognizing that transmission of particulate occurs not only within the fabric but through the systems of the city, the infrastructural spaces of the city are recast as future sites of invisible airborne assaults as well. US Senator Orrin Hatch has reportedly advocated for the construction

of a dedicated particulate testing facility, including a mock subway system, drawing on the complex and contested legacies of Utah's simulated urban landscapes[19]. More recent experiments managed by the Department of Homeland Security have used the New York subway system itself as a ready-made test site, speculating on the use of the passing trains as efficient aerosol dispersal mechanisms and testing their assumptions in real time. Unsuspecting commuters contribute to the reality of the simulation[20]. Similar studies used transit infrastructures in Boston and Washington, D.C. in recent years.

Back at Dugway, a new *securocratic frontier* is being sketched. Test facilities once dedicated to military use are now used in a 'global challenge', open to foreign agencies and private companies to test their defenses against airborne chemical or biological simulants. *Point detectors* can register presence of agents on site, while *standoff detectors* use lasers to detect agents at a distance. The *Active Standoff Chamber* and *Ambient Breeze Tunnel* provide two different environments for response teams to test their tech within controlled airflow environments. Tests can be expanded to an outdoor "massive test grid" which allows for natural airflow to affect the simulant[21]. Operators of the facility provide only the infrastructure, and do not themselves collect any data on the capabilities, technologies, experiments, or readings of the 'customers' allowed to test. This confirms a trend, documented in the 'Copies of Copies: Simulated Cities From Security to Logistics' essay by Ersela Kripa in this issue, where military training facilities are increasingly sharing space and resources with the private sector. Competing national security systems for the dispersal, collection, and detection strategies of airborne contaminants briefly and democratically inhabit this neutral test zone in the name of scientific advancement, only later to be deployed for geopolitical and military advantage.

Figure 3: Haboob, Ransom Canyon Texas - Wikimedia User Leaflet, Creative Commons



FOREIGN SOIL

With the increased technological ability to monitor airborne contamination across juridical and sovereign boundaries, dust has become a suspect transnational and potentially criminal entity, and vector for geopolitical strategy. In practice, US border regulators are giving new credence to the term *foreign soil*.

Security agencies are increasingly concerned with foreign particle contaminants within the domestic interior, including the unintentional transmission of foreign biogenetic material through soil-borne organisms, and risks from *agro-terrorism* - the intentional introduction of harmful foreign materials to a nation's agriculture or food supply[22].

Federal regulators thus consider the interstate transmission of soil to be an "extremely high risk activity," requiring special permits for imported soil, especially when deliberately transmitted in large quantities[23]. The buildup of foreign soil and windblown dust on farm equipment, in shipping containers and vehicles, as well as military *materiel* demands immediate response[24]. While some material, like low quantities of decorative beach sand - so-called *pure sand* - does not constitute a significant threat, other sources are subject to more intense scrutiny, necessitating heat and pressure sterilization procedures at designated ports of entry[25]. NAFTA provisions require extensive verifications to ensure an accountable origin and travel path for goods shipped under the agreement. These specifically allow for dust accumulated during shipment to be removed as part of normal operations.

With domestic agriculture seen as a vast economic engine and 'soft' target post-9/11, security efforts to detect and respond to airborne contaminants have increased. While there have been only twelve

documented cases of agro-terrorism in the past century[26], and none involving the use of aerosol dispersants targeting soil composition, investigators speculate on the terrorist use of chemical contaminants and poisons like *ricin* in such scenarios[27]. *Dust generators* and *dust fraction collector assemblies* are used to gauge the transfer of dust from contaminated sites through wind, human, and machinic vectors[28]. These studies anticipate future acts of *agro-terrorism*, which can include the introduction of chemical irritants through the aerosol dispersal mechanisms of *highly modified crop dusters*[29] and the spreading of low levels of radioactive materials in agricultural soil. Despite these attempts to maintain the integrity of domestic soil, dust migrates and transgresses these boundaries constantly.

CHIHUAHUA DESERT AS SITUATED CREATIVE MACHINE

Within this context, the El Paso/Ciudad Juárez border metroplex can be seen as a particularly vital *situated creative machine*. The binational metropolis, while separated by national security infrastructures, is joined by the geologic and climatological anomalies of the stark and rapidly changing Chihuahuan Desert.

The desert defines a transnational territory with unique geomorphological characteristics and a vocabulary all its own. Dry lake beds - or *playas* - throughout the desert funnel dust indiscriminately across the international boundary. The dust forges a new territory of shared particulates - ingested by buildings, landscapes, machinery, and citizens alike. *Dust devils*, *haboobs*, and *dust storms* reshape the experience of the city and landform. *Microbursts*, and *dust plumes* appear locally as ephemeral manifestations of a shifting landscape. These all reduce visibility and cause threats to human health, safety, and life.

El Paso and Ciudad Juárez together form a critical node in the regional geology of dust. Recurring dust events sweep through the region on a

Figure 4: Spring Dust Storm, El Paso [Franklin Mountains Not Visible in Background] - Hadley Paul Garland, Creative Commons





Figure 3: Joint Ambient Breeze Tunnel, Dugway - US Army / Public Domain

seasonal basis, enacting shared infrastructures of security, control and response. A distributed dust infrastructure is growing, including a constellation of monitoring stations, desert research facilities, broadcast sites, and emergency response facilities. At the scale of the binational region, air quality monitoring stations are stationed to measure airborne particulate and serve as early indicators of impending events. Water trucks are mobilized to construction sites to weigh the dust with moisture, inhibiting travel of so-called *fugitive dust* [30]. *Track-out control devices* on work sites ensure dust is not carried away by machinery, vehicles or other equipment, each granule either deposited close to site of origin or forced off the machines with pressurized water.

Other examples of *soft dust infrastructure* emerge to capture and control the spread. Regular customs and border screenings are conducted to inhibit the free travel of pathogens, biological or agricultural material either purposefully or accidentally concealed, grafted within the network of logistics infrastructure-rail cars, shipping containers, and tractor trailers. *Sweeps* for dust can involve high tech sensing equipment and sensitive microscope or low-tech solutions, including customs agents with sturdy brooms.

The dust provides both cover and a signal for illicit activity. *Dust trails* from moving vehicles in the desert landscape routinely map the workings of narcotraffickers, accelerating the work of Customs and Border Patrol (CBP) agents. Recently agents in Nogales, AZ were led by a dust trail to an abandoned truck near the border, where more than 1,000 pounds of marijuana[31] were discovered unattended. A similar incident led agents in McAllen, TX to another 1,027 pound seizure, this time from an abandoned Chevy Tahoe[32].

The technologies of dust storm detection and human detection collapse on the border, with sequential imaging, infrared technologies, and radar common tools for both. In one instance the CBP newsroom

applauds the agents' use of infrared technology to continue drug seizures despite significant dust storms [33]. The new VADER imaging technology deployed by the CBP began as a mobile vehicle-mounted radar and is now installed in overhead drones to produce overhead imagery. VADER is celebrated for its ability to locate undocumented migrants through the visual fog of dust storms and atmospheric haze[34], extending the gaze of the security state. Mobile radar units are similarly deployed in the civilian sector in order to observe bodies and movements which are unintelligible to stationary observers, improving *haboob* prediction algorithms[35].

These types of negotiations between sensing infrastructures and dusty landscape leads to a kind of *infrastructural arms race* over the control and manipulation of the cross border geology. Traffickers exploit geologic contingencies to locate cross border smuggling tunnels in easy-to-dig, but easy-to-retain areas of sandy soil, building them quickly and without additional reinforcement. These areas also happen to make it very difficult for tunnels to be discovered, as advanced electromagnetic imaging sees the geology, tunnel and water table equally as 'noise' [36]. Security forces and traffickers both adapt their vehicles to the dusty terrain, deploying All-Terrain Vehicles (ATVs) —also called *dune buggies* or *sand rails* - to navigate the desert terrain. Narcotraffickers use the sand to bury their stash[37].

The atmospheric effects of cross-border dust have also inhibited operations and endangered lives. Dust has been cited as a factor in agent deaths during vehicle chases on dusty roads [38]. Human traffickers have used shipments of sand to conceal their clandestine cargo, which on delivery has forced aliens to be nearly suffocated and 'cough up sand'[39].

The forensic attitude of dust control agents is not only passively measuring but also actively affecting the territory. Geoscientists deploy *tracers*, chemical compounds and identifiable isotopes distributed across an origin landscape to act as transmitted chemical signatures[40], making the origin site identifiable when the dust transmission is complete. Recent advances in aerosol tracking technologies seek to minimize the impact of this airborne micro-geology as it enters and leaves the bodies it inevitably encounters. A proprietary system named DNATrax embeds a unique artificial DNA signature within inert aerosol sugars, a *particulate barcode* which ties the particle back to its place of origin.

Transnational dust can be seen as a primary vector, an *abstract machine*, which connects and organizes disparate political economies, transmits cultural and geologic material across different regimes of urban inhabitation, and acts as an engine for geopolitical engineering from the technologic to the planetary scale.

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