

Detection of Waste Sites in Vietnam using Satellite Imagery

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Summary of Work:

Global Plastic Watch is a tool that detects waste sites in satellite imagery. In this work, the system was run in a high-sensitivity configuration to identify waste sites in Vietnam. Following detection, relevant metadata about the geographic and physical setting is collected. The model was run across all of Vietnam and detected 198 waste sites that could be confirmed using high-resolution satellite imagery. Of these sites, 80 are located within a buffered boundary of ten territories of interest to WWF. For each of the waste site locations, we evaluated the metadata and high-resolution imagery to identify 17 locations that are of highest risk for leakage of waste into rivers and oceans.

Summary of Methods:

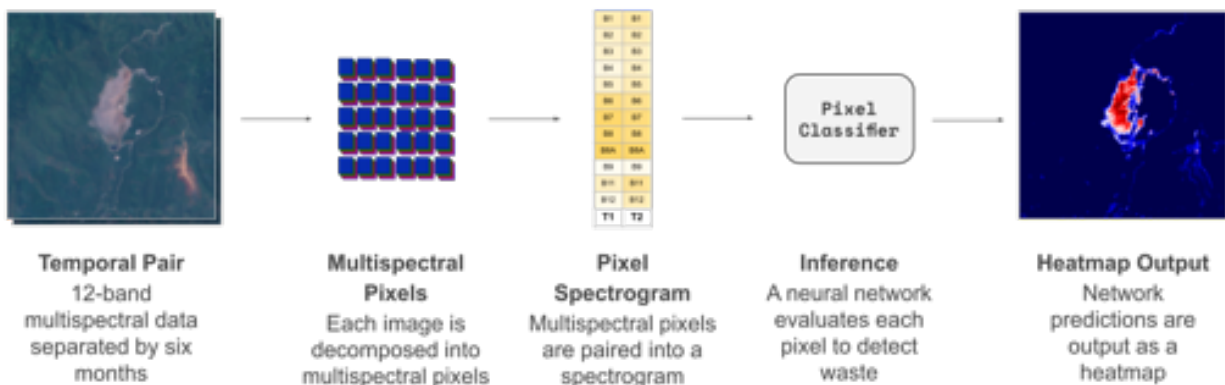
We have developed a system that analyzes satellite data to detect aggregations of waste. To our knowledge, no operational monitoring system for municipal solid waste exists. On land, the spectral diversity of waste and land cover makes it challenging to devise spectral indices that can effectively discriminate waste.

This system was developed for the Global Plastic Watch platform, which targets the identification of plastic and municipal waste. With remote detection of waste aggregations, one can measure rather than model waste distributions and monitor waste site development through time, through a globally consistent and comprehensive dataset. The outputs of the tool can be seen at globalplasticwatch.org.

In brief, our waste detection tool is composed of two convolutional neural networks that analyze and combine spectral, spatial, and temporal signals from data collected by the Sentinel-2 satellite. This data has 12 spectral bands, which capture visible and infrared light. The resolution of the data is 10 meters per pixel. This is substantially lower than high-resolution aerial imagery that typically covers 30 cm per pixel, but the Sentinel 2 data is refreshed much more frequently. Having recent multispectral data is essential for waste site identification. A waste site in high-resolution imagery can be seen outlined in red at left, and the same location in the Sentinel-2 data is seen on the right.



The detection system first evaluates each pixel in the region of interest to classify whether it contains waste. For each pixel, the network analyzes all 12 bands of spectral information at two time points to make a determination of whether waste is detected. These pixel predictions are then combined into a heatmap. The pipeline is seen in the following diagram.



The resulting heatmap of predictions for the full region of interest is processed to identify hot spots of waste-positive predictions. Each of these locations is then evaluated by a secondary neural network classifier that incorporates spatial information to make a final determination of whether the region is a waste site.

Full details of the system are detailed in the technical paper, currently under review in [PLOS ONE](#), and available as a [preprint on arXiv.org](#).

Validation of results

Points that are positively classified by both networks are denoted as "candidate sites." To confirm the accuracy of the identifications, these candidates are evaluated by a curator using publicly-available data. Predominantly, validation is done through analysis of very-high resolution satellite data hosted on the Google Earth and Mapbox platforms. This imagery is a composite collected from multiple sensing platforms, but Very-High-Resolution imagery (ranging from under 60 cm and up to 5 m in resolution) is available in most cases. At this

resolution, one can identify characteristic traits that are frequently seen in waste sites. These may include a high frequency texture, pale gray or brown coloration, roads and paths leading to active dumping areas, machinery for moving or dumping waste, or plumes from burning.

Depending on availability, sites may also be verified using other data sources. In Google Street View imagery, reviewers can clearly see the individual waste items as well as the aggregation as a whole. In other cases, data from Planet Planetscope and OpenStreetMap can be used as additional sources of information for site confirmation.

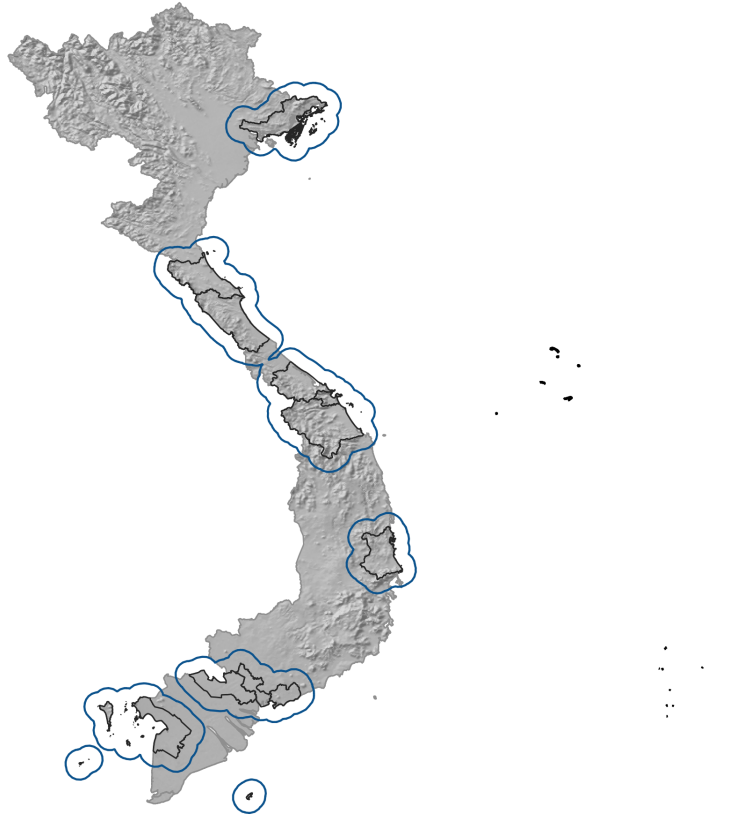
This process has the benefit of limiting the number of false positives. However, it is imperfect. The high-resolution data is frequently older than the data used for detection. Thus, a candidate waste site might be rejected if it is newly created. Additionally, waste aggregations are not always obvious to identify even in the high resolution images. If there is any uncertainty regarding whether a candidate is a waste site, the site is rejected. Additionally, waste aggregations are not always obvious to identify even in the high resolution images. Thus, some sites are labeled as "uncertain" if the validator needs additional information.

Analysis and Results:

Region of Interest and Algorithm Parameters

In this analysis, we evaluated every $10 \times 10\text{m}$ Sentinel-2 pixel captured in all of Vietnam ($3.30 \times 10^5 \text{ km}^2$) at nine time steps between January, 2019 and March, 2021. This produced 39.6 billion predictions at the pixel level and 110 million classifications of patches. To reduce variance, we average the time-step outputs to arrive at a final assessment of the presence of waste.

We ran the system across all of Vietnam, though the client's area of interest falls within the provinces of Thừa Thiên Huế, Quảng Ninh, Quảng Nam, Quảng Bình, Phú Yên, Kiên Giang, Hồ Chí Minh, Hà Tĩnh, Đà Nẵng, Bà Rịa-Vũng Tàu. Waste pollution is frequently transported by rivers, thus a waste site located outside of the study region may still contribute plastic pollution to the target area of interest. Additionally, waste generated in one province may be transported to a site in another. Thus, we buffer the provinces of interest by 0.25° to create the boundaries seen in fig 1.



*Figure 1: Study provinces of interest shown outlined in black.
Buffered regions shown in blue.*

Detection can be run in different sensitivity configurations. The sensitivity parameters balance the algorithm's confidence that a given pixel contains plastic, whether the location has spatial characteristics of a waste site, and the size of a waste site. We ran the system in a high sensitivity configuration. This produces more false positive results, but is also most likely to identify waste.

Site Metadata

For each site that is detected, we create a metadata profile capturing geophysical and environmental parameters. The parameters include soil type information (clay and sand percentage, soil bulk density, and soil great group identity (OpenLandMap), site elevation and slope (SRTM), landform type (Global ALOS Landforms), nearby population (WorldPop), average wind speed (Global Wind Atlas), and distance to nearest water bodies computed from data available through OpenStreetMap. The proximity of a site to a waterway is one of the most important risk factors for the sites

In prior work, we developed risk score metrics for each confirmed municipal waste site. The risk index is a composite of site area (smaller is better), distance to waterway (further is better),

population within 5 km (fewer is better), soil clay percentage (higher is better to avoid groundwater contamination).

The z-score (how far the variable strays from average) is calculated for each variable at every site using the population of all waste sites detected globally. Because all variables other than clay % follow a log normal distribution, the log of the value is taken before computing the z score. Distances to waterways are offset by +10 meters in order to avoid taking a log of 0.

Mathematically, the z-score is expressed as:

$$z_{variable}(x) = \frac{\mu_{variable} - x}{\sigma_{variable}}$$

Where μ represents the mean of the variable, and σ represents the standard deviation of that variable. More simply, the z-score captures whether a parameter is anomalously high or low relative to the values seen in other waste sites worldwide. The z-score values are then multiplied by a scaling factor according to the methodology developed in Widyarsana et al., 2019¹. This is done in order to account for the fact that a waste site that is near to a waterway is a much greater risk than a waste site located near to a populated area. A subset of Widyarsana's variables are included in this risk score which is computed using the following formula:

$$risk(x) = \frac{69 * z_{\log(water_dist)}(\log(x + 10)) + 41 * z_{clay}(x) - 61 * z_{\log(area)}(\log(x)) - 21 * z_{\log(population)}(\log(x))}{69 + 61 + 41 + 21}$$

For this work, we determined whether a site was of substantial risk manually instead of using a risk score. A manual review is most comprehensive, and also surfaces factors that may not be revealed through a formulaic calculation. Though a manual review of sites would not scale to cover the globe, it was manageable to review the sites detected in this analysis.

Results

Following manual candidate validation using high-resolution imagery, we confirmed the identification of 198 waste sites across the country of Vietnam. 17 industrial waste sites were also found. Industrial waste sites are those containing waste from construction, mining, factories, or other related activities. 16 sites were identified that could not be confirmed as containing waste and could benefit from alternate forms of validation. 31 of the detected waste sites fall within the target provinces, and 80 sites are within the buffered regions of interest (fig 2).

¹ Widyarsana, I. Made Wahyu, et al. "Risk assessment and rehabilitation potential of municipal solid waste landfills in Bali Province, Indonesia." *GEOMATE Journal* 17.63 (2019): 164-171.

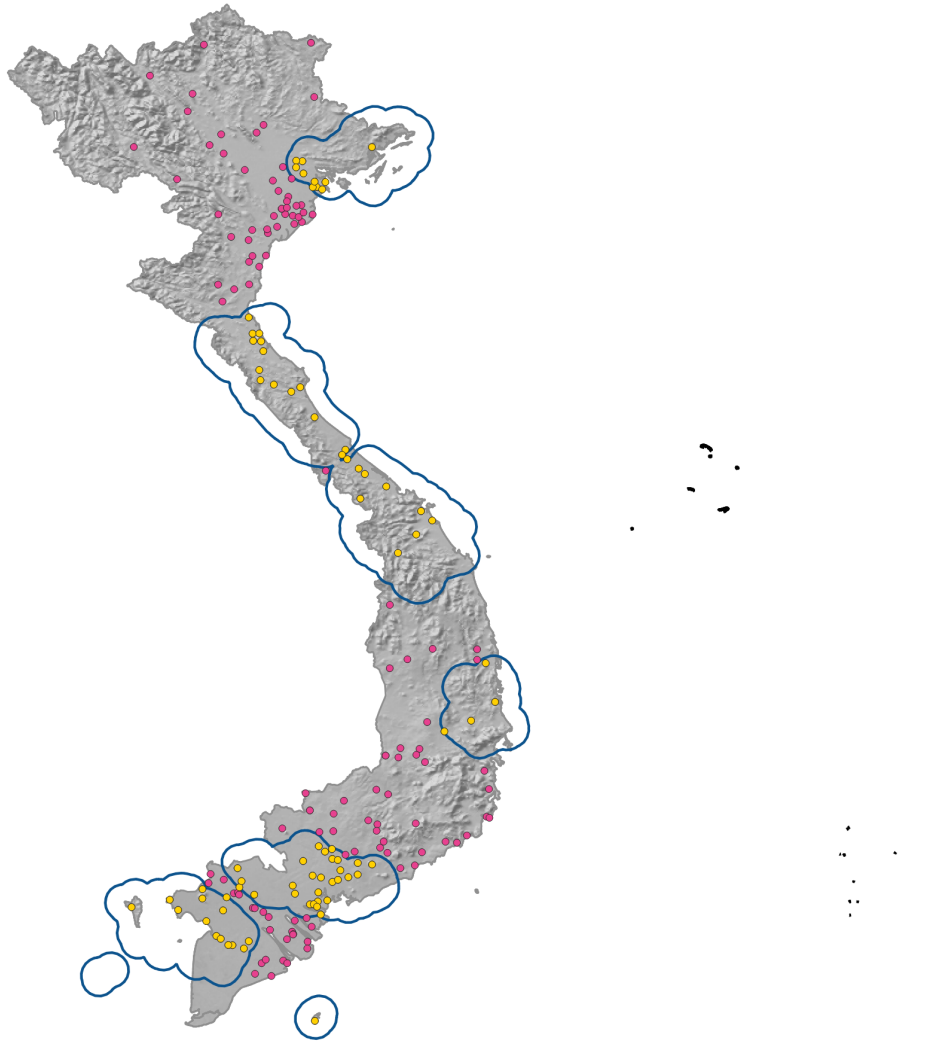


Figure 2. All identified waste sites in Vietnam. Sites within the buffered provinces of interest are shown in yellow.

Of the 80 sites identified within the study area, 18 (23%) were found to be located within 250 meters of a waterway, and five (6.2%) are located within 100 meters of a waterway. The most frequent nearest water type to an identified site is a river (35% of sites). See figure 3.

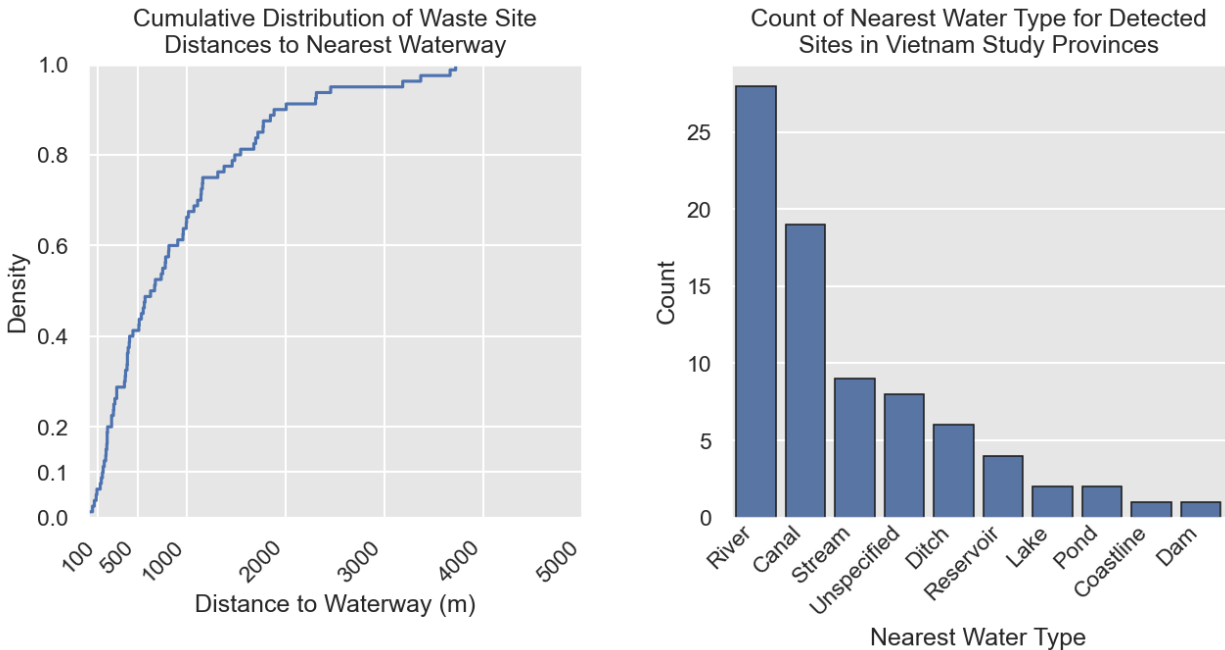


Figure 3. Cumulative distribution showing the proportion of waste sites within the study provinces as a function distance to the nearest waterway or water body at left. Nearest water type, as listed on OpenStreetMap, is shown at right.

Outputs

All data and assets are in a public Github repository located at <https://github.com/earthrise-media/vietnam-waste>.

Detected waste sites are shown in figure 2, listed in appendix table 1, and are presented in an interactive web map at <https://earthrise-media.github.io/vietnam-waste/vietnam-v1.0>. The raw data containing the locations and metadata may be downloaded [as a geojson](#), [as a csv](#), and as an [excel spreadsheet](#). Sites within the study area can be downloaded [as a geojson](#) and [as a csv](#).

For each site, we generated a display of high resolution imagery for each site location. Each high-resolution tile is shown with 30cm Mapbox imagery, and links to the corresponding location in Google maps for inspection of surrounding areas. This may be viewed at <https://earthrise-media.github.io/vietnam-waste/vietnam-chips-v1.0>

Sites Assessed to be of High Risk

Based on the evaluation of imagery and available metadata, we have made a rough determination of the sites most likely to cause environmental harm within the buffered provinces of interest. These sites are not listed in order of risk.

8f415c80648b89c, #53

Coordinates: 21.117914219535077, 106.4193505210995

Site is flowing directly into a river. Site is active and appears to be expanding.



<https://www.google.com/maps/@21.1181853,106.4189095,309m/data=!3m1!1e3>

8f65a441edac840, #125

Coordinates: 8.645, 106.601

Site is located very close to the ocean.



<https://www.google.com/maps/@8.6451916,106.5998301,474m/data=!3m1!1e3>

8f415c80abadc4b, #54

Coordinates: 21.12580836123202, 106.33025426738622

This site needs on-the-ground validation. It could be construction rubble used to prop up a dam. If confirmed as a waste site, this location seems to be flowing directly into a reservoir. Waste would likely stay within the reservoir.



<https://www.google.com/maps/@21.1260308,106.3299936,309m/data=!3m1!1e3>

8f65a36e6476c28, #120

Coordinates: 10.40231520720859, 104.49435269414005

Site is close to a major river and large. It seems to be managed, and is growing rapidly.



<https://www.google.com/maps/@10.4024023,104.4939334,154m/data=!3m1!1e3>

8f65a3574a16500, #119

Coordinates: 10.092008797442947, 105.02530840706682

There is a lot of waste in this complex. It is near many waterways. No active leakage is seen, but it is of risk. This may also be a private company's waste rather than a municipal waste site.



<https://www.google.com/maps/@10.090538,105.0272239,154m/data=!3m1!1e3>

8f65a3719320908, #121

Coordinates: 10.254714800896219, 104.6164666536214

Site is close to spilling into a small waterway and has spilled in the past. It is uncertain if the waterways lead to the ocean.



<https://www.google.com/maps/@10.2546328,104.6165655,309m/data=!3m1!1e3>

8f65b504d8cc340, #163

Coordinates: 10.393434346993242, 106.78123415682418

This is a very high risk site and is located right on the coast. It seems to be a formal waste site. Site seen to be leaking in March, 2022.



Street View from April 2022 also shows a risky scene.



<https://www.google.com/maps/@10.3936255,106.7812836,154m/data=!3m1!1e3>

8f65b530c792976, #167

Coordinates: 10.37745774018599, 106.64238613527534

Large site with multiple waterways nearby. Site is expanding and seems weakly managed (burning waste, etc).



<https://www.google.com/maps/@10.3772641,106.6423226,154m/data=!3m1!1e3>

8f41656ccd736a5, #74

Coordinates: 16.221814036511528, 107.26118201864537

Site is close to a large water body and is near to leaking.



<https://www.google.com/maps/@16.2215197,107.2611244,306m/data=!3m1!1e3>

8f65a2b4232a459, #112

Coordinates: 9.695618127889684, 105.57014418769243

Site is close to a waterway. And may possibly be actively leaking.



<https://www.google.com/maps/@9.6956223,105.5702147,309m/data=!3m1!1e3>

8f414276d9ae353, #14

Coordinates: 20.81500048583798, 106.75356812807027

There is a risk of leakage into the waterway on the eastern edge. A barrier may have been installed?



<https://www.google.com/maps/@20.8152359,106.7534296,1110m/data=!3m1!1e3>

8f41422a85b5172, #12

Coordinates: 20.82099538679052, 106.59659350831336

There seems to be an informal waste site here. The site is near water and has changed substantially through time.



<https://www.google.com/maps/@20.8209462,106.5964585,154m/data=!3m1!1e3?hl=en-US>

8f41422140ce59c, #10

Coordinates: 20.743888616800696, 106.62665419156276

The site can be seen leaking into a river along the northwestern edge.



<https://www.google.com/maps/@20.7438546,106.6264745,152m/data=!3m1!1e3?hl=en-US>

8f65b5odb691659, #164

Coordinates: 10.661934217441068, 106.85500464482438

Small site, but seen leaking into a waterway.



<https://www.google.com/maps/@10.6619879,106.8549521,154m/data=!3m1!1e3?hl=en-US>

8f65b52328b6984, #165

Coordinates: 10.510675566583732, 106.65076435845413

This site requires confirmation. Its proximity to major river makes for high leakage risk.



<https://www.google.com/maps/@10.5108044,106.6505164,309m/data=!3m1!1e3?hl=en-US>

8f65b529648e2d4, #166

Coordinates: 10.724864307086946, 106.68945574488897

This may only be a construction site. However, the proximity to a river makes for a high risk if confirmed.



<https://www.google.com/maps/@10.7249947,106.6895203,154m/data=!3m1!1e3?hl=en-US>

Waste Sites Detected in Study Provinces

ID	Number	Latitude	Longitude	High Risk	Risk Score	Area (m^2)	Soil Clay Fraction	Elevation	Drainage Direction	Upstream Drainage Area (km^2)	Height Above Nearest Drainage (m)	Landform Type	Soil Sand Fraction	Slope (degrees)	Fine Earth Density (kg / m^3)	Soil Great Group	Distance to Waterway (m)	Nearest Water Type	Population (1 km)	Population (5 km)	Population (10 km)	Wind Speed (m/s)	Place Name
8f4141951249875	8	18.852	105.641		0.36	1785	0.25	14	southeast	0.92314	0	Lower slope (warm)	0.49	1	116	1	1073	river	791	25,433	123,157	2.27	Nghi Lộc District, Nghệ An Province, Vietnam
8f41422140ce59c	10	20.744	106.627	Yes	0.28	2810	0.25	3	north	0.00800	1	Lower slope (flat)	0.43	1	121	0	3366	river	3,034	75,529	352,989	2.98	Xã Du Lễ, Huyện Kiến Thụy, Haiphong, Vietnam
8f414221c83508a	11	20.741	106.570		0.19	612	0.27	2	northeast	2.97761	0	Upper slope (flat)	0.38	0	112	0	560	river	3,319	69,042	339,120	3.15	Tiên Lãng, Haiphong, Thị trấn Tiên Lãng, Vietnam
8f41422a85b5172	12	20.821	106.597	Yes	0.10	67	-1.00	2	northeast	0.36000	0	Lower slope (flat)	-1.00	0	-1	-1	139	river	5,499	133,603	700,778	3.06	Vân Tràng 1, Trường Sơn, Haiphong, Xã Trường Sơn, 35999, Vietnam
8f41423aaa32171	13	20.708	106.707		0.34	711	0.26	3	northeast	0.00801	1	Lower slope (flat)	0.37	0	115	0	1772	river	2,510	58,956	216,158	3.25	Xã Đại Hạp, Huyện Kiến Thụy, Haiphong, Vietnam
8f414276d9ae353	14	20.815	106.754	Yes	0.33	6143	0.27	4	northwest	0.00800	0	Upper slope (flat)	0.42	0	110	1	520	river	2,239	74,870	595,672	3.34	Quận Hải An, Haiphong, Vietnam
8f4145229999c4b	40	18.504	105.820		0.30	1832	0.26	18	northwest	0.02434	2	Lower slope (warm)	0.40	3	140	1	377	dam	543	21,556	111,275	2.80	Lộc Hà District, Hà Tĩnh Province, Vietnam
8f414524556b899	41	18.511	105.705		0.25	1624	0.27	6	south	0.00811	0	Valley	0.40	1	120	0	1000	river	1,485	41,460	127,425	2.51	Hồng Lĩnh town, Hồng Lĩnh, Hà Tĩnh Province, 483700, Vietnam
8f414525a435730	42	18.617	105.696			0	0.28	5	southwest	0.00811	4	Lower slope (flat)	0.39	0	123	0	744	river	1,359	65,732	371,300	2.81	Petrolimex, Quốc lộ 1, Xuân An, Nghi Xuân District, Hà Tĩnh Province, 038, Vietnam
8f41452e464135e	43	18.619	105.794		0.27	1476	0.23	7	south	0.00811	1	Lower slope (flat)	0.44	0	124	1	1544	river	876	18,512	74,489	2.94	Linh Trung, Nghi Xuân District, Hà Tĩnh Province, 45506, Vietnam
8f4145360791a21	44	18.362	105.852		0.26	4874	0.26	5	southeast	0.06497	1	Lower slope (flat)	0.43	1	124	0	1485	water	2,287	57,999	170,786	2.49	Thạch Hà, Thạch Hà District, Hà Tĩnh Province, Vietnam
8f4151850b2a0d8	47	21.322	107.429			0	0.29	39	southwest	0.00797	50	Upper slope (warm)	0.40	9	121	0	456	water	908	15,839	32,967	2.43	Tiên Yên District, Quang Ninh Province, Vietnam
8f415c80648b89c	53	21.118	106.419	Yes		0	0.26	2	east	23.18360	0	Lower slope (flat)	0.44	1	124	48	786	river	2,811	67,777	159,766	3.48	Chí Linh, Hải Dương Province, Vietnam
8f415c80abadc4b	54	21.126	106.330	Yes	0.21	717	0.31	63	west	0.00798	7	Upper slope (warm)	0.40	6	116	1	186	water	1,588	43,830	182,088	3.85	Chí Linh, Hải Dương Province, Vietnam
8f415c95ac73742	55	21.028	106.328		0.40	3011	0.22	4	north	0.02397	1	Lower slope (flat)	0.45	0	118	1	150	ditch	1,506	55,212	298,038	3.19	Nam Sách District, Hải Dương Province, Vietnam
8f415c976836130	56	20.940	106.435		0.34	1951	0.28	5	north	0.02398	0	Lower slope (flat)	0.42	1	129	0	1720	river	3,587	67,533	290,867	2.74	Kim Cơn, Thanh Hà District, Hải Dương Province, Vietnam
8f4160a28b06865	65	16.398	107.637		0.25	1013	0.31	26	northeast	0.00821	9	Upper slope (warm)	0.43	4	126	1	243	stream	1,318	34,568	267,186	2.25	Hương Thủy, Thừa Thiên Huế Province, 530000, Vietnam
8f4161403cc021a	67	16.932	107.044	Yes		0	0.29	17	north	0.00818	7	Lower slope (warm)	0.43	4	132	0	198	stream	884	20,769	61,623	3.33	An Xá, Gio Linh District, Quang Trị province, Vietnam
8f4161429110913	68	16.858	106.996		0.36	2215	0.26	57	southwest	0.00819	32	Upper slope (warm)	0.47	3	125	1	1378	lake	294	10,285	55,357	3.89	Gio Linh District, Quang Trị province, Vietnam
8f416150935b336	69	16.794	107.071		0.36	737	0.29	34	west	0.04095	9	Lower slope (warm)	0.40	1	129	1	1145	river	1,653	63,361	125,048	3.37	Dong Ha City, Quang Trị province, Vietnam
8f4161c8c021cac	70	16.658	107.237		0.16	164	0.30	26	northeast	0.00820	15	Upper slope (warm)	0.42	1	116	2	1775	water	208	15,359	54,826	2.63	Tân Phước, Hải Lăng District, Quang Trị province, Vietnam
8f4161d8b58b95c	71	16.580	107.326		0.10	855	0.32	28	northwest	0.00820	11	Lower slope (warm)	0.37	2	117	0	424	reservoir	210	9,146	35,426	2.12	Phong Điền District, Thừa Thiên Huế Province, Vietnam
8f41642ed8258f4	72	16.041	108.142		0.05	6	0.29	35	north	0.03289	7	Lower slope (warm)	0.41	10	124	0	1159	pond	4,237	187,406	730,542	1.31	Hoàng Văn Thải, Liên Chiểu, Đà Nẵng, 556264, Vietnam
8f4164356625296	73	15.905	108.303		0.38	1532	0.27	10	west	0.00823	1	Upper slope (flat)	0.44	1	149	0	1696	ditch	3,647	96,686	254,527	2.85	Cẩm Hà, Hội An, Quang Nam Province, 560000, Vietnam
8f41656ccd736a5	74	16.222	107.261	Yes	0.40	4137	0.31	561	southeast	0.01643	4	Upper slope (warm)	0.41	4	118	1	259	canal	419	8,418	19,248	2.98	Phủ Vĩnh, A Lưới District, Thừa Thiên Huế Province, Vietnam
8f4165885b45518	75	15.435	107.807			0	0.33	362	southwest	0.00825	18	Upper slope (warm)	0.35	6	122	0	165	ditch	185	3,621	8,624	2.06	Khâm Đức, Phước Sơn District, Quang Nam Province, Vietnam
8f4165c108de1ab	76	15.701	108.072		0.25	3791	0.29	27	southwest	0.00823	16	Lower slope (warm)	0.37	1	118	0	517	stream	436	10,043	25,864	1.62	Nông Sơn District, Quang Nam Province, Vietnam
8f416ad30105974	77	18.089	105.793		0.38	4208	0.27	46	northeast	0.00813	24	Lower slope (warm)	0.44	3	116	3	180	water	276	4,993	19,453	2.82	Hồ Chí Minh Highway, Cây Trào, Hương Khê District, Hà Tĩnh Province, Vietnam
8f416e406223803	78	17.773	106.258		0.40	2106	0.28	64	southeast	0.00815	69	Upper slope (warm)	0.45	25	125	1	967	river	329	13,395	40,123	3.04	Tuyên Hóa District, Quang Bình province, 0084, Vietnam
8f416e59c34a56e	79	17.839	106.388		0.27	499	0.29	33	northeast	0.02443	11	Lower slope (warm)	0.46	2	127	1	543	reservoir	792	25,100	95,641	3.07	TL 22, Quảng Trạch District, Quang Bình province, Vietnam
8f416ee6aab3004b	80	17.941	105.811		0.41	1879	0.31	88	northeast	0.28490	7	Valley	0.35	13	110	7	1016	river	232	4,605	15,248	2.66	Tuyên Hóa District, Quang Bình province, Vietnam
8f416e7b36aa98e	81	17.876	106.005		0.36	5050	0.27	70	northwest	0.08143	11	Lower slope (warm)	0.41	8	82	1	1315	water	274	5,673	16,831	2.08	Dong Le Town, Tuyên Hóa District, Quang Bình province, Vietnam
8f416ed801b3434	82	17.403	106.596		0.14	457	0.31	26	northeast	0.01633	9	Lower slope (warm)	0.40	4	123	2	370	river	624	31,432	116,922	3.94	Quảng Ninh District, Quang Bình province, Vietnam
8f658492da5a500	86	10.438	105.319		0.34	4461	0.38	1	southwest	0.02523	1	Lower slope (flat)	0.28	2	74	3	199	canal	816	48,520	167,308	3.13	Cần Đăng, Châu Thành District, An Giang Province, Vietnam
8f6584b3170c834	88	10.557	104.969		0.21	2078	0.20	16	east	0.01681	11	Lower slope (flat)	0.54	1	140	0	3720	stream	584	17,627	103,029	3.20	Tịnh Biên District, An Giang Province, Vietnam
8f6584d4219c26c	89	10.861	105.479		0.23	773	0.40	7	north	0.05039	1	Upper slope (flat)	0.28	0	99	3	635	canal	1,768	26,739	83,979	3.00	Sa Rài, Tân Hồng District, Dong Thap Province, Vietnam
8f658586e4e04c9	90	10.295	103.939		0.34	3432	0.25	10	north	0.04206	4	Lower slope (flat)	0.51	1	136	0	399	river	594	10,320	34,565	2.48	Cửa Dương, Phú Quốc City, Kiên Giang Province, 922221, Vietnam
8f65a225c4cc8e5	100	10.248	105.268		0.28	8068	0.39	2	southwest	0.00841	1	Lower slope (flat)	0.32	2	92	1	157	canal	2,210	41,512	104,159	3.07	Núi Sập, Thoại Sơn District, An Giang Province, Vietnam
8f65a25167b3a43	101	10.490	106.312		0.26	4441	0.30	1	southwest	0.00841	0	Lower slope (flat)	0.39	0	119	1	1460	canal	606	41,695	190,380	2.58	Tân Phước District, Tien Giang province, Vietnam
8f65a258362e361	102	10.609	106.279		0.23	1862	0.39	1	south	77.54121	0	Lower slope (warm)	0.32	1	115	3	127	canal	202	6,789	43,495	2.00	Thanh Hóa District, Long An province, Vietnam

Waste Sites Detected in Study Provinces

ID	Number	Latitude	Longitude	High Risk	Risk Score	Area (m²)	Soil Clay Fraction	Elevation	Drainage Direction	Upstream Drainage Area (km²)	Height Above Nearest Drainage (m)	Landform Type	Soil Sand Fraction	Slope (degrees)	Fine Earth Density (kg / m³)	Soil Great Group	Distance to Waterway (m)	Nearest Water Type	Population (1 km)	Population (5 km)	Population (10 km)	Wind Speed (m/s)	Place Name
8f65a265d81ba74	103	10.583	105.505		0.17	238	0.44	5	northeast	0.00841	1	Lower slope (flat)	0.20	1	76	2	573	canal	1,279	43,019	145,620	3.12	843, Tân Mỹ, Thanh Bình District, Dong Thap Province, Vietnam
8f65a26eb9a90e2	106	10.673	105.536		0.32	1701	0.35	4	north	0.00840	0	Upper slope (warm)	0.33	2	103	1	420	river	1,568	29,099	71,610	3.07	Tam Nông District, Dong Thap Province, Vietnam
8f65a27093936d0	107	10.476	105.721		0.25	4680	0.42	3	south	0.05045	0	Lower slope (flat)	0.24	0	96	1	1112	canal	1,052	34,216	173,691	3.07	Cao Lanh District, Dong Thap Province, Vietnam
8f65a2a222e6a6c	110	9.802	105.641		0.23	1685	0.35	1	northwest	0.00843	1	Lower slope (flat)	0.33	0	85	2	911	canal	2,198	23,759	80,968	3.16	61, Hòa Quới, Phụng Hiệp District, Hậu Giang Province, Vietnam
8f65a2a69521581	111	9.743	105.404		0.27	2321	0.31	3	north	0.00843	1	Upper slope (flat)	0.35	0	99	1	1163	river	2,751	34,452	109,000	3.16	Quốc lộ 61, Vị Thanh, Hậu Giang Province, Vietnam
8f65a2b4232a459	112	9.696	105.570	Yes	0.37	3012	0.38	-1	north	0.00843	0	Lower slope (flat)	0.28	1	87	1	66	ditch	3,308	46,371	116,281	3.27	Phường Bình Thạnh, Long Mỹ Town, Hậu Giang Province, Vietnam
8f65a348daccda	118	10.420	104.968		0.43	1120	0.30	6	north	0.00841	3	Lower slope (flat)	0.39	0	122	3	675	river	1,466	33,515	88,685	3.07	Trị Tôn District, An Giang Province, Vietnam
8f65a3574a16500	119	10.092	105.025	Yes	0.32	1033	0.41	0	south	0.01684	0	Upper slope (flat)	0.22	0	102	3	195	water	839	19,146	76,483	3.33	Hon Dat District, Kien Giang Province, Vietnam
8f65a36e476c28	120	10.403	104.494	Yes	0.21	45	0.43	2	east	0.00841	2	Upper slope (flat)	0.25	1	83	2	294	canal	323	11,284	32,477	2.24	Ha Tien City, Kien Giang Province, KP1, Vietnam
8f65a3719320908	121	10.254	104.616	Yes	0.33	1145	0.43	3	southeast	0.00841	0	Lower slope (flat)	0.21	0	116	1	818	ditch	399	10,761	20,901	3.13	Kien Luong District, Kien Giang Province, Vietnam
8f65a3c00309571	122	9.878	105.171		0.15	91	0.32	3	south	0.00842	1	Lower slope (flat)	0.34	0	109	0	397	canal	1,651	43,828	160,547	3.06	Minh Lương, Châu Thành District, Kien Giang Province, Vietnam
8f65a3c264a8acb	123	9.837	105.234		0.33	120	0.36	-1	west	0.01685	0	Lower slope (warm)	0.24	1	101	0	241	canal	2,679	33,243	98,271	2.98	Giồng Riềng District, Kien Giang Province, Vietnam
8f65a3d31d88614	124	9.746	105.344		0.17	999	0.32	1	west	0.00843	1	Upper slope (flat)	0.32	1	95	2	86	canal	1,073	33,249	109,568	2.87	Quốc lộ 61, Gò Quao District, Kien Giang Province, Vietnam
8f65a441edac840	125	8.645	106.601	Yes	0.38	3150	0.31	10	southwest	0.04226	23	Lower slope (warm)	0.37	6	99	1	194	coastline	120	1,995	4,592	2.81	Prison Escape, Ha Huy Giap Street, Khu 5, Cồn Sơn, Cồn Dao, Cồn Đảo District, Ba Ria-Vung Tau Province, Vietnam
8f65b181069981b	146	10.965	106.430		0.45	1370	0.31	1	north	0.01679	1	Valley	0.41	1	133	2	409	river	1,878	52,045	245,318	2.17	Tam Tấn, Thái Mỹ Commune, Cù Chi District, Ho Chi Minh City, 82719, Vietnam
8f65b19350a008d	147	10.753	106.567		0.30	255	0.36	2	northwest	0.00840	1	Lower slope (flat)	0.29	2	119	0	92	stream	7,091	391,284	2,688,243	2.58	Tan Tao A Ward, Ho Chi Minh City, Vietnam
8f65b1d2ad6ecd	149	11.101	106.747		0.46	64	0.27	43	northwest	0.00839	6	Valley	0.49	2	126	2	4423	stream	1,280	54,286	276,164	2.25	Phường Hội Nghĩa, Tân Uyên Town, Binh Duong province, Vietnam
8f65b1d36665359	150	11.138	106.849		0.33	3372	0.31	56	southwest	0.04195	7	Valley	0.43	5	123	1	579	stream	1,914	27,658	98,811	2.01	Tân Thành, Bắc Tân Uyên District, Binh Duong province, Vietnam
8f65b1d52413376	151	11.179	106.657		0.33	1584	0.27	48	north	0.00839	2	Upper slope (warm)	0.51	0	127	2	2454	water	858	32,847	225,079	2.49	Chánh Phú Hòa, Ben Cat Town, Binh Duong province, Vietnam
8f65b504d8cc340	163	10.393	106.781	Yes	0.36	189	0.34	2	southwest	0.00841	1	Upper slope (flat)	0.35	2	93	1	1882	canal	1,254	24,652	73,448	3.50	Kiêng Phước, Gò Công Dong District, Tien Giang province, Vietnam
8f65b50db91659	164	10.662	106.855	Yes	0.19	1805	0.34	5	east	0.02521	1	Lower slope (flat)	0.36	2	100	0	264	river	593	24,714	118,268	2.39	Xã Phước Khánh, Nhơn Trạch District, Đồng Nai Province, 710000, Vietnam
8f65b52328b6984	165	10.510	106.651	Yes	0.26	390	0.40	5	northeast	0.00841	6	Upper slope (flat)	0.24	2	131	2	49	river	1,148	51,734	182,545	3.17	Xã Phước Đồng, Cầm Đức District, Long An province, Vietnam
8f65b529648e2d4	166	10.725	106.689	Yes	0.34	1699	0.42	3	northeast	0.04201	1	Upper slope (flat)	0.23	1	119	1	5	river	16,438	1,269,686	4,648,837	2.35	Đường số 1, Bình Hưng, Bình Chánh District, Ho Chi Minh City, 70000, Vietnam
8f65b530c792976	167	10.378	106.643	Yes	0.16	213	0.35	-2	west	0.00841	0	Upper slope (flat)	0.32	0	121	1	1845	canal	2,119	88,544	239,088	3.20	Long Chánh, Gò Công Town, Tien Giang province, Vietnam
8f65b53408d4b83	168	10.336	106.529		0.17	86	0.26	1	south	0.00841	0	Lower slope (flat)	0.42	1	124	1	757	canal	1,819	36,359	163,861	3.05	12A, Bình Đông, Gò Công Tây District, Tien Giang province, 0009, Vietnam
8f65b537076dcbb	169	10.338	106.584		0.31	3353	0.26	2	northeast	0.00841	1	Lower slope (flat)	0.43	0	127	0	682	canal	4,675	49,766	173,074	3.06	ĐT.827, Vĩnh Bình, Gò Công Tây District, Tien Giang province, 0009, Vietnam
8f65b542b883534	170	10.768	107.222		0.80	134	0.29	190	northwest	0.00840	11	Upper slope (warm)	0.46	3	120	1	961	stream	1,455	30,321	108,854	2.45	Xã Xuân Mỹ, Cẩm Mỹ District, Đồng Nai Province, 810000, Vietnam
8f65b546a934b41	171	10.730	107.086		0.32	6237	0.31	46	southwest	0.01680	5	Lower slope (warm)	0.42	2	122	2	2309	river	539	12,559	97,940	2.24	Bau Can, Long Thành District, Đồng Nai Province, Vietnam
8f65b54f2b8950a	172	10.937	107.223		0.31	463	0.31	213	east	0.00840	35	Upper slope (warm)	0.45	4	122	1	783	lake	3,406	101,419	220,086	2.83	Phường Suối Tre, Long Khánh City, Đồng Nai Province, Vietnam
8f65b559e7b22c4	173	10.914	107.431		0.14	612	0.31	172	southeast	0.05038	22	Upper slope (warm)	0.44	3	136	0	1148	reservoir	1,636	44,482	119,675	3.69	Xuân Lộc District, Đồng Nai Province, Vietnam
8f65b5681b61a53	174	10.995	106.853		0.21	232	0.28	37	north	0.05876	12	Upper slope (flat)	0.44	0	131	0	275	pond	9,001	280,670	859,741	2.04	Trảng Dài Ward, Biên Hòa City, Đồng Nai Province, 76913, Vietnam
8f65b56b5a998ca	175	10.980	106.933		0.46	23653	0.32	20	northeast	0.00839	4	Lower slope (warm)	0.41	0	131	1	997	stream	2,367	151,814	684,446	2.18	Hố Nai 3, Xã Hồ Nai 3, Trảng Bom District, Đồng Nai Province, Vietnam
8f65b572e461892	176	10.692	106.936		0.25	1365	0.26	24	southwest	0.06722	4	Upper slope (flat)	0.48	1	130	0	3185	river	2,413	52,805	177,718	1.95	Nguyễn Văn Cừ, Xã Phước An, Nhơn Trạch District, Đồng Nai Province, Vietnam
8f65b57ac60164a	177	10.831	106.971		0.20	1842	0.29	33	south	0.02520	2	Upper slope (flat)	0.47	2	129	0	821	reservoir	1,356	58,444	217,091	2.34	An Phuoc, Long Thành District, Đồng Nai Province, 8464, Vietnam
8f65b5adacb16b0	179	10.302	106.632		0.25	1363	0.29	2	northwest	0.12619	1	Upper slope (warm)	0.40	1	127	1	292	canal	3,493	35,068	202,787	3.28	Hòa Phú, Gò Công Tây District, Tien Giang province, Vietnam
8f65b5af5351094	180	10.189	106.686		0.22	4297	0.38	-3	south	0.49652	0	Upper slope (flat)	0.26	2	124	0	1773	canal	5,213	36,939	95,720	3.30	Bình Đại, Bình Đại District, Bến Tre Province, Vietnam
8f69300b306ccf5	189	13.835	109.080		0.17	52	0.26	48	north	0.01661	7	Valley	0.50	6	136	3	2303	river	1,674	44,649	223,809	1.82	An Nhơn, An Nhơn District, Bình Định Province, 5800, Vietnam
8f693215ec11085	192	13.001	108.868		0.27	386	0.33	211	east	0.00833	39	Upper slope (warm)	0.40	3	139	0	1677	river	292	6,171	21,756	3.68	Buôn Bàu, Sông Hinh District, Phu Yen province, Vietnam

Waste Sites Detected in Study Provinces

ID	Number	Latitude	Longitude	High Risk	Risk Score	Area (m^2)	Soil Clay Fraction	Elevation	Drainage Direction	Upstream Drainage Area (km^2)	Height Above Nearest Drainage (m)	Landform Type	Soil Sand Fraction	Slope (degrees)	Fine Earth Density (kg / m^3)	Soil Great Group	Distance to Waterway (m)	Nearest Water Type	Population (1 km)	Population (5 km)	Population (10 km)	Wind Speed (m/s)	Place Name
8f6932a464a14c2	193	13.273	109.217		0.25	456	0.33	45	northeast	0.05827	9	Valley	0.39	4	127	2	3664	river	479	24,834	90,300	3.45	Chi Thanh Town, Tuy An District, Phu Yen province, Vietnam
8f6932cc4486855	194	12.845	108.481		0.23	5249	0.29	451	southeast	0.00834	17	Upper slope (warm)	0.45	2	138	0	400	river	381	21,422	79,949	4.14	Ea Kar District, Đắk Lắk province, Vietnam

Waste Sites Detected in Vietnam

ID	Number	Latitude	Longitude	Risk Score	Area (m^2)	Soil Clay Fraction	Elevation	Drainage Direction	Upstream Drainage Area (km^2)	Height Above Nearest Drainage (m)	Landform Type	Soil Sand Fraction	Slope (degrees)	Fine Earth Density (kg / m^3)	Soil Great Group	Distance to Waterway (m)	Nearest Water Type	Population (1 km)	Population (5 km)	Population (10 km)	Wind Speed (m/s)	Place Name
8f4141158152699	1	19.260	105.429	0.28	1515	0.26	67	northwest	0.00808	19	Upper slope (warm)	0.43	3	126	0	877	river	762	24,220	97,040	2.50	Thái Hòa, Nghệ An Province, Vietnam
8f41411ac7414c3	2	19.331	105.646	0.14	514	0.26	61	southwest	0.00807	13	Lower slope (warm)	0.49	2	129	2	2152	pond	337	11,206	69,370	2.21	Hoàng Mai, Quỳnh Lưu District, Nghệ An Province, Vietnam
8f414131560db1d	3	19.327	105.196	0.29	697	0.31	93	south	0.00808	13	Lower slope (warm)	0.34	10	127	6	432	river	1,926	20,249	51,586	1.96	Quốc lộ 48C, Quý Hợp, Quý Hợp District, Nghệ An Province, 470000, Vietnam
8f4141471088620	4	19.657	105.645	0.41	10473	0.22	10	northwest	0.00806	2	Lower slope (warm)	0.55	4	129	1	670	river	1,302	37,459	141,415	3.22	Nông Cống, Thanh Hoa province, Vietnam
8f41414e4ab164d	5	19.742	105.694	0.43	5397	0.26	7	southwest	0.51549	0	Valley	0.44	2	123	2	325	river	1,748	59,488	251,221	3.07	Đồng Sơn, Thanh Hoa province, Vietnam
8f41415569348a0	6	19.587	105.793	0.36	531	0.23	5	west	0.02419	0	Lower slope (flat)	0.45	0	120	1	255	river	2,169	35,349	100,680	3.45	Nghi Sơn, Thanh Hoa province, Vietnam
8f414158e2816e1	7	19.748	105.890	0.32	3489	0.28	3	southwest	0.00805	2	Lower slope (flat)	0.36	0	125	1	1184	Sông Đơ	6,464	79,294	193,501	3.24	Đường Trần Hưng Đạo, Sầm Sơn, Thanh Hoa province, Vietnam
8f4141951249875	8	18.852	105.641	0.33	6143	0.25	14	southeast	0.92314	0	Lower slope (warm)	0.49	1	116	1	1073	river	791	25,433	123,157	2.27	Nghi Lộc District, Nghệ An Province, Vietnam
8f4141a13150409	9	19.081	105.260	0.21	1775	0.31	54	north	0.02426	1	Valley	0.40	1	121	1	1584	river	463	16,500	60,193	2.58	Tân Lập, Tân Kỳ District, Nghệ An Province, Vietnam
8f41422140ce59c	10	20.744	106.627		0	0.25	3	north	0.00800	1	Lower slope (flat)	0.43	1	121	0	3366	river	3,034	75,529	352,989	2.98	Xã Du Lễ, Huyện Kiến Thụy, Haiphong, Vietnam
8f414221c83508a	11	20.741	106.570	0.34	1951	0.27	2	northeast	2.97761	0	Upper slope (flat)	0.38	0	112	0	560	river	3,319	69,042	339,120	3.15	Tiên Lãng, Haiphong, Thị trấn Tiên Lãng, Vietnam
8f41422a85b5172	12	20.821	106.597	0.80	134	-1.00	2	northeast	0.36000	0	Lower slope (flat)	-1.00	0	-1	-1	139	river	5,499	133,603	700,778	3.06	Vân Tráng 1, Trường Sơn, Haiphong, Xã Trường Sơn, 35999, Vietnam
8f41423aaa32171	13	20.708	106.707	0.31	463	0.26	3	northeast	0.00801	1	Lower slope (flat)	0.37	0	115	0	1772	river	2,510	58,956	216,158	3.25	Xã Đại Hợp, Huyện Kiến Thụy, Haiphong, Vietnam
8f414276d9ae353	14	20.815	106.754	0.27	386	0.27	4	northwest	0.00800	0	Upper slope (flat)	0.42	0	110	1	520	river	2,239	74,870	595,672	3.34	Quận Hải An, Haiphong, Vietnam
8f4142a580b6ad1	15	20.344	106.568	0.20	292	0.25	3	southeast	0.00802	0	Lower slope (flat)	0.42	1	124	1	1244	coastline	2,387	38,447	147,241	3.56	Tiền Hải District, Thái Bình province, Vietnam
8f41431065a246a	16	20.323	106.006	0.28	482	0.24	1	northwest	0.03210	1	Upper slope (flat)	0.45	1	123	0	771	canal	5,826	74,278	308,872	3.03	Lâm, Ý Yên District, Nam Định province, Vietnam
8f41434ae8616d0	17	20.837	105.991	0.19	167	0.24	5	northwest	0.00800	0	Lower slope (flat)	0.43	2	128	1	1229	river	4,442	105,967	385,838	3.13	Khôi Châu, Khôi Châu District, Hưng Yên Province, Vietnam
8f414352e361298	18	20.601	106.215	0.30	873	0.29	1	south	0.14420	0	Lower slope (flat)	0.40	1	118	0	575	river	3,881	80,061	288,122	3.06	Hưng Hà, Hưng Hà District, Thái Bình province, Vietnam
8f414355e4eb6c4	19	20.686	106.072	0.45	2251	0.25	5	southeast	0.01601	0	Valley	0.44	2	122	0	186	water	4,876	122,616	314,960	3.05	An Tảo, Phường An Tảo, Hưng Yên City, Hưng Yên Province, Vietnam
8f41435987aa59a	20	20.865	106.263	0.28	764	0.29	2	southeast	4.12658	0	Valley	0.38	0	120	0	636	river	1,922	69,337	361,614	3.13	Gia Lộc, Gia Lộc District, Hải Dương Province, Vietnam
8f41436d0af6123	21	20.991	105.583	0.23	134	0.23	9	north	0.00799	1	Upper slope (flat)	0.40	1	123	1	731	river	6,054	109,400	425,103	2.68	Quốc Oai District, Hanoi, Vietnam
8f414385202182a	22	20.074	105.918	0.29	1932	0.27	12	southwest	0.14468	13	Lower slope (warm)	0.43	3	126	1	834	canal	965	25,768	173,500	3.00	Đường Lê Thế Sơn, Bím Sơn, Thanh Hoa province, Vietnam
8f41438aa383af6	23	20.166	106.052	0.32	331	0.30	3	northwest	0.00803	0	Valley	0.38	0	120	0	232	river	2,424	76,456	277,475	3.08	Yên Ninh, Yên Khánh District, Ninh Bình province, 0303, Vietnam
8f41438c5ae58dd	24	20.131	105.908	0.24	7126	0.29	85	east	0.00804	32	Upper slope (warm)	0.40	4	122	1	2704	reservoir	852	44,757	165,931	2.96	Tam Điệp, Ninh Bình province, 433420, Vietnam
8f4143a6842bad6	25	20.020	105.385	0.10	845	0.30	76	northeast	0.03216	17	Lower slope (warm)	0.42	5	126	1	4093	river	496	17,110	75,429	1.80	Ngọc Lặc District, Thanh Hoa province, Vietnam
8f4143b08b1244e	26	19.974	105.638	0.25	691	0.26	10	northeast	0.00804	0	Valley	0.40	0	133	1	1009	water	2,885	49,725	193,357	2.66	Đường Đồng Cổ, Quán Lào, Yên Định District, Thanh Hoa province, Vietnam
8f4143b8d5ae1ad	27	20.120	105.691		0	0.25	20	southwest	0.00804	11	Lower slope (flat)	0.45	3	133	1	1566	water	1,008	27,204	92,297	2.42	Kim Tân, Thạch Thành District, Thanh Hoa province, Vietnam
8f4143c28ca50a6	28	20.327	106.280	0.30	74	0.28	3	northwest	0.02408	2	Lower slope (flat)	0.38	0	109	2	139	river	2,986	89,838	327,780	3.31	Cổ Lễ, Trục Ninh District, Nam Định province, Vietnam
8f4143c46cce6cb	29	20.350	106.170	0.33	887	0.26	3	east	0.00802	0	Valley	0.41	0	107	1	442	river	2,678	73,842	407,938	3.11	Nam Giang, Nam Trực District, Nam Định province, 41000, Vietnam
8f4143c5a72b449	30	20.426	106.118	0.29	3219	0.28	2	southwest	0.00802	1	Upper slope (flat)	0.40	1	121	0	1209	river	1,885	121,092	395,513	3.10	Mỹ Lộc, Mỹ Lộc District, Nam Định province, 400000, Vietnam
8f4143c5a7aa913	31	20.429	106.120	0.29	2452	0.28	0	southeast	0.00802	0	Valley	0.41	0	117	0	1052	river	2,054	126,578	395,690	3.00	Nam Định, Nam Định province, 42000, Vietnam
8f4143ca675622d	32	20.481	106.404	1.00	5531	-1.00	4	north	0.02405	2	Upper slope (flat)	-1.00	1	-1	-1	69	river	1,618	62,023	359,655	3.25	Thái Bình, Kiến Xương District, Thái Bình province, Vietnam
8f4143cac61e92a	33	20.471	106.332	0.38	2041	0.30	1	southwest	0.00802	2	Lower slope (flat)	0.39	1	123	0	378	river	5,954	167,263	419,675	2.52	Cầu Nhân, Thái Bình, Thái Bình province, 0363, Vietnam
8f4143cd1ad9385	34	20.536	106.195	0.21	631	0.28	1	northeast	0.02404	0	Lower slope (flat)	0.39	1	114	0	1519	river	3,370	75,596	304,405	3.11	Hưng Hà District, Thái Bình province, Vietnam
8f4143ce1458c18	35	20.442	106.194	0.26	63	0.27	5	south	7.21709	0	Valley	0.44	1	118	0	297	river	12,569	211,714	457,919	2.36	Trần Nhân Tông, Nam Định, Mỹ Lộc District, Nam Định province, 42000, Vietnam
8f4143d053960c9	36	20.235	106.413	0.24	359	0.28	1	north	3.61353	0	Lower slope (flat)	0.39	1	104	4	712	water	2,627	63,510	238,409	2.81	Giao Thủy District, Nam Định province, Vietnam
8f4143d1921801b	37	20.308	106.364	0.21	687	0.27	2	northeast	0.00803	0	Valley	0.39	0	112	1	1604	canal	3,288	90,253	341,866	3.05	Xuân Trường District, Nam Định province, 123, Vietnam
8f4143d71110d30	38	20.208	106.301	0.36	2178	0.24	5	north	1.15654	0	Lower slope (flat)	0.45	1	122	2	641	canal	5,998	94,823	300,109	3.08	Yên Định, Hải Hậu District, Nam Định province, Vietnam
8f4143daaa506e9	39	20.373	106.435	0.15	88	0.24	2	north	0.02407	0	Lower slope (flat)	0.43	0	112	1	1183	river	2,469	77,077	287,142	3.17	Kiến Xương, Kiến Xương District, Thái Bình province, Vietnam
8f414522999c4b	40	18.504	105.820	0.32	1033	0.26	18	northwest	0.02434	2	Lower slope (warm)	0.40	3	140	1	377	dam	543	21,556	111,275	2.80	Lộc Hà District, Hà Tĩnh Province, Vietnam
8f414524556d899	41	18.511	105.705	0.27	1476	0.27	6	south	0.00811	0	Valley	0.40	1	120	0	1000	river	1,485	41,460	127,425	2.51	Hồng Lĩnh town, Hồng Lĩnh, Hà Tĩnh Province, 483700, Vietnam
8f414525a435730	42	18.617	105.696		0	0.28	5	southwest	0.00811	4	Lower slope (flat)	0.39	0	123	0	744	river	1,359	65,732	371,300	2.81	Petrolimex, Quốc lộ 1, Xuân An, Nghi Xuân District, Hà Tĩnh Province, 038, Vietnam

Waste Sites Detected in Vietnam

ID	Number	Latitude	Longitude	Risk Score	Area (m^2)	Soil Clay Fraction	Elevation	Drainage Direction	Upstream Drainage Area (km^2)	Height Above Nearest Drainage (m)	Landform Type	Soil Sand Fraction	Slope (degrees)	Fine Earth Density (kg / m^3)	Soil Great Group	Distance to Waterway (m)	Nearest Water Type	Population (1 km)	Population (5 km)	Population (10 km)	Wind Speed (m/s)	Place Name
8f41452e464135e	43	18.619	105.794	0.25	1624	0.23	7	south	0.00811	1	Lower slope (flat)	0.44	0	124	1	1544	river	876	18,512	74,489	2.94	Linh Trung, Nghi Xuân District, Ha Tinh Province, 45506, Vietnam
8f4145360791a21	44	18.362	105.852	0.25	1363	0.26	5	southeast	0.06497	1	Lower slope (flat)	0.43	1	124	0	1485	water	2,287	57,999	170,786	2.49	Thach Ha, Thạch Hà District, Ha Tinh Province, Vietnam
8f414a4627010db	45	21.324	103.972		1272	0.34	714	west	0.01595	35	Lower slope (warm)	0.39	20	129	5	-1	-1	840	31,838	102,067	3.01	Son La, Son La province, Vietnam
8f414ec911ac51d	46	20.347	105.200			0.29	67	southeast	0.01605	19	Lower slope (warm)	0.39	5	145	2	348	river	503	13,115	39,990	0.83	Cảnh Nang, Bá Thước District, Thanh Hoa province, Vietnam
8f4151850b2a0d8	47	21.322	107.429	0.27	499	0.29	39	southwest	0.00797	50	Upper slope (warm)	0.40	9	121	0	456	water	908	15,839	32,967	2.43	Tiên Yên District, Quang Ninh Province, Vietnam
8f4159734c6a774	48	22.358	104.207	0.12	1685	0.29	126	northeast	0.09500	10	Lower slope (warm)	0.39	9	130	1	4760	river	320	11,078	48,467	2.59	Bao Thang District, Lao Cai province, Vietnam
8f4159d8050c499	49	22.096	104.825	0.23	747	0.30	85	south	0.19828	8	Valley	0.40	13	119	3	802	river	615	13,122	43,337	1.77	Lục Yên District, Yen Bai Province, Vietnam
8f415b9b612da65	50	22.807	104.990	0.29	1348	0.30	182	northwest	0.05524	40	Lower slope (warm)	0.35	12	126	3	709	river	2,501	45,516	72,430	1.27	Minh Khai, Hà Giang, Hà Giang Province, 311000, Vietnam
8f415c205c36074	51	21.532	105.755	0.20	562	0.28	73	northwest	0.33441	2	Valley	0.41	12	121	4	1049	river	534	14,365	153,083	2.41	Thai Nguyen City, Pho Yen City, Thai Nguyen province, Vietnam
8f415c2a6950788	52	21.645	105.855	0.29	412	0.28	62	northwest	0.01591	21	Upper slope (warm)	0.48	10	129	0	393	river	1,848	47,070	279,579	2.86	Hóa Trung Commune, Đồng Hỷ District, Thai Nguyen province, Vietnam
8f415c80648b89c	53	21.118	106.419	0.34	3432	0.26	2	east	23.18360	0	Lower slope (flat)	0.44	1	124	1	786	river	2,811	67,777	159,766	3.48	Chi Linh, Hải Dương Province, Vietnam
8f415c80abadc4b	54	21.126	106.330	0.36	737	0.31	63	west	0.00798	7	Upper slope (warm)	0.40	6	116	1	186	water	1,588	43,830	182,088	3.85	Chi Linh, Hải Dương Province, Vietnam
8f415c95ac73742	55	21.028	106.328	0.33	120	0.22	4	north	0.02397	1	Lower slope (flat)	0.45	0	118	1	150	ditch	1,506	55,512	298,038	3.19	Nam Sách District, Hải Dương Province, Vietnam
8f415c976836130	56	20.940	106.435	0.10	67	0.28	5	north	0.02398	0	Lower slope (flat)	0.42	1	129	0	1720	river	3,587	67,533	290,867	2.74	Kim Can, Thanh Hà District, Hải Dương Province, Vietnam
8f415cb36ad5aa4	57	21.034	106.136	0.20	2480	0.22	3	southeast	0.00799	1	Lower slope (flat)	0.45	4	111	2	4146	ditch	1,882	82,440	287,874	3.26	Gia Binh District, Bac Ninh province, Vietnam
8f415d012468c4a	58	21.351	105.073		1033	0.31	88	west	0.00797	38	Valley	0.39	5	128	2	-1	-1	328	8,189	35,354	1.60	Yên Lập, Yên Lập District, Phu Tho Province, 000, Vietnam
8f415d55c41e6c4	59	21.507	105.240	0.07	950	0.32	52	north	0.00796	20	Upper slope (warm)	0.42	4	129	3	5011	river	265	7,727	47,870	2.44	Phù Ninh District, Phu Tho Province, Vietnam
8f415d6d0701a74	60	21.841	104.754	0.18	674	0.31	66	north	0.11124	6	Lower slope (warm)	0.36	8	123	3	1390	river	448	11,456	40,905	1.60	Đường tỉnh 151, Tran Yen District, Yen Bai Province, Vietnam
8f415da63941718	61	20.856	104.600	0.17	727	0.32	807	northwest	0.01600	49	Lower slope (warm)	0.35	2	127	0	1822	stream	987	10,577	32,689	2.25	Mọc Châu, Mọc Châu District, Son La province, Vietnam
8f415dc5d62c58a	62	21.229	105.275	0.14	350	0.31	38	northwest	0.00798	15	Upper slope (warm)	0.41	3	125	1	1504	stream	565	17,121	126,247	2.63	Thanh Thủy District, Phu Tho Province, Vietnam
8f415e7334ad588	63	22.835	106.545	0.11	560	0.31	569	east	0.03156	32	Lower slope (warm)	0.31	19	121	0	3291	river	1,311	17,670	33,117	2.64	Trùng Khánh, Trùng Khánh District, Cao Bằng Province, Vietnam
8f415e86514d6ce	64	22.049	106.591	0.20	824	0.29	226	southeast	0.00793	28	Valley	0.42	3	130	1	1205	river	372	10,503	27,405	3.00	Pò Lầu, Văn Lãng, Lạng Sơn Province, Vietnam
8f4160a28b0e865	65	16.398	107.637	0.40	3011	0.31	26	northeast	0.00821	9	Upper slope (warm)	0.43	4	126	1	243	stream	1,318	34,568	267,186	2.25	Hương Thủy, Thừa Thiên Huế Province, 530000, Vietnam
8f4161018059d2b	66	16.626	106.759	0.25	1003	0.32	426	northeast	0.00820	223	Upper slope (warm)	0.36	7	118	2	676	stream	385	8,665	20,362	5.38	Khe Sanh, Hướng Hóa District, Quang Tri province, Vietnam
8f4161403cc021a	67	16.932	107.044	0.40	2106	0.29	17	north	0.00818	7	Lower slope (warm)	0.43	4	132	0	198	stream	884	20,769	61,623	3.33	An Xá, Gio Linh District, Quang Tri province, Vietnam
8f4161429110913	68	16.858	106.996	0.23	1862	0.26	57	southwest	0.00819	32	Upper slope (warm)	0.47	3	125	1	1378	lake	294	10,285	55,357	3.89	Gio Linh District, Quang Tri province, Vietnam
8f416150935b336	69	16.794	107.071	0.32	6237	0.29	34	west	0.04095	9	Lower slope (warm)	0.40	1	129	1	1145	river	1,653	63,361	125,048	3.37	Dong Ha City, Quang Tri province, Vietnam
8f4161c8c021cac	70	16.658	107.237	0.19	1805	0.30	26	northeast	0.00820	15	Upper slope (warm)	0.42	1	116	2	1775	water	208	15,359	54,826	2.63	Tân Phước, Hải Lăng District, Quang Tri province, Vietnam
8f4161d8b58b95c	71	16.580	107.326	0.34	4461	0.32	28	northwest	0.00820	11	Lower slope (warm)	0.37	2	117	0	424	reservoir	210	9,146	35,426	2.12	Phong Điền District, Thừa Thiên Huế Province, Vietnam
8f41642ed8258f4	72	16.041	108.142	0.31	3353	0.29	35	north	0.03289	7	Lower slope (warm)	0.41	10	124	0	1159	pond	4,237	187,406	730,542	1.31	Hoàng Văn Thái, Liên Chiêu, Da Nang, 556264, Vietnam
8f4164356625296	73	15.905	108.303	0.21	717	0.27	10	west	0.00823	1	Upper slope (flat)	0.44	1	149	0	1696	ditch	3,647	96,686	254,527	2.85	Cầm Hà, Hội An, Quang Nam Province, 560000, Vietnam
8f41656ccd736a5	74	16.222	107.261	0.33	1145	0.31	561	southeast	0.01643	4	Upper slope (warm)	0.41	4	118	1	259	canal	419	8,418	19,248	2.98	Phú Vinh, A Lưới District, Thừa Thiên Huế Province, Vietnam
8f4165885b45518	75	15.435	107.807		0	0.33	362	southwest	0.00825	18	Upper slope (warm)	0.35	6	122	0	165	ditch	185	3,621	8,624	2.06	Khâm Đức, Phước Sơn District, Quang Nam Province, Vietnam
8f4165c108de1ab	76	15.701	108.072	0.21	232	0.29	27	southwest	0.00823	16	Lower slope (warm)	0.37	1	118	0	517	stream	436	10,043	25,864	1.62	Nông Sơn District, Quang Nam Province, Vietnam
8f416ad30105974	77	18.089	105.793	0.30	255	0.27	46	northeast	0.00813	24	Lower slope (warm)	0.44	3	116	3	180	water	276	4,993	19,453	2.82	Ho Chi Minh Highway, Cây Trào, Hương Khê District, Ha Tinh Province, Vietnam
8f416e406223803	78	17.773	106.258	0.16	213	0.28	64	southeast	0.00815	69	Upper slope (warm)	0.45	25	125	1	967	river	329	13,395	40,123	3.04	Tuyên Hóa District, Quang Binh province, 0084, Vietnam
8f416e59c34a56e	79	17.839	106.388	0.36	5050	0.29	33	northeast	0.02443	11	Lower slope (warm)	0.46	2	127	1	543	reservoir	792	25,100	95,641	3.07	TL 22, Quảng Trạch District, Quang Binh province, Vietnam
8f416e6aab3004b	80	17.941	105.811	0.19	612	0.31	88	northeast	0.28490	7	Valley	0.35	13	110	7	1016	river	232	4,605	15,248	2.66	Tuyên Hóa District, Quang Binh province, Vietnam
8f416e7b36aa98e	81	17.876	106.005	0.23	1685	0.27	70	northwest	0.08143	11	Lower slope (warm)	0.41	8	82	1	1315	water	274	5,673	16,831	2.08	Dong Le Town, Tuyên Hóa District, Quang Binh province, Vietnam
8f416ed801b3434	82	17.403	106.596	0.33	1584	0.31	26	northeast	0.01633	9	Lower slope (warm)	0.40	4	123	2	370	river	624	31,432	116,922	3.94	Quảng Ninh District, Quang Binh province, Vietnam
8f65848114a0058	83	10.694	105.278	0.28	3121	0.39	3	northwest	0.00840	2	Lower slope (flat)	0.30	1	89	0	707	river	802	34,603	171,351	3.06	Phủ Thành, Phú Tân District, An Giang Province, Vietnam

Waste Sites Detected in Vietnam

ID	Number	Latitude	Longitude	Risk Score	Area (m^2)	Soil Clay Fraction	Elevation	Drainage Direction	Upstream Drainage Area (km^2)	Height Above Nearest Drainage (m)	Landform Type	Soil Sand Fraction	Slope (degrees)	Fine Earth Density (kg / m^3)	Soil Great Group	Distance to Waterway (m)	Nearest Water Type	Population (1 km)	Population (5 km)	Population (10 km)	Wind Speed (m/s)	Place Name
8f658485d60199c	84	10.644	105.057	0.36	2433	0.41	2	south	0.00840	0	Lower slope (warm)	0.25	0	62	5	194	canal	727	27,958	119,729	3.12	Xã Vĩnh Tế, Chau Doc City, An Giang Province, Vietnam
8f65848c84a55b4	85	10.777	105.086	0.42	659	0.40	3	southwest	0.05880	1	Upper slope (flat)	0.26	0	127	2	52	river	1,706	46,905	175,227	3.05	957, An Phú, An Phú District, An Giang Province, 89888, Vietnam
8f658492da5a500	86	10.438	105.319	0.36	1785	0.38	1	southwest	0.02523	1	Lower slope (flat)	0.28	2	74	3	199	canal	816	48,520	167,308	3.13	Cần Đăng, Châu Thành District, An Giang Province, Vietnam
8f65849356042d8	87	10.496	105.425	0.17	149	0.30	1	west	0.00841	1	Lower slope (flat)	0.35	1	115	2	881	canal	1,653	56,913	282,263	3.14	Nhon Hiệp, Chợ Mới District, An Giang Province, Vietnam
8f6584b3170c834	88	10.557	104.969	0.23	5249	0.20	16	east	0.01681	11	Lower slope (flat)	0.54	1	140	0	3720	stream	584	17,627	103,029	3.20	Tịnh Biên District, An Giang Province, Vietnam
8f6584d4219c26c	89	10.861	105.479	0.23	773	0.40	7	north	0.05039	1	Upper slope (flat)	0.28	0	99	3	635	canal	1,768	26,739	83,979	3.00	Sa Rài, Tân Hồng District, Dong Thap Province, Vietnam
8f658586e4e04c9	90	10.295	103.939	0.37	3012	0.25	10	north	0.04206	4	Lower slope (flat)	0.51	1	136	0	399	river	594	10,320	34,565	2.48	Cửa Dương, Phu Quoc City, Kien Giang Province, 922221, Vietnam
8f6596cab9a3a96	91	14.681	107.689	0.17	1134	0.30	667	east	0.00827	39	Upper slope (warm)	0.42	8	131	0	2481	water	964	19,439	37,033	2.80	Quốc lộ 14C, Hòa Bình, Ngoc Hoi District, Kon Tum province, Vietnam
8f65a0410319b9c	92	9.482	105.828	0.22	3529	0.28	4	north	0.00843	1	Valley	0.46	1	124	1	2675	river	1,258	27,070	87,966	3.22	Quốc lộ 1, Thanh Phú, Mỹ Xuyên District, Soc Trang province, Vietnam
8f65a04a6ae88b1	93	9.534	105.887	0.30	5903	0.30	2	west	17.04899	0	Lower slope (flat)	0.38	1	119	3	1413	canal	1,548	38,552	130,856	3.36	Mỹ Tú District, Soc Trang province, Vietnam
8f65a0530a05726	94	9.297	105.969	0.25	1677	0.48	2	west	0.00844	2	Upper slope (flat)	0.21	1	103	4	478	canal	801	38,484	75,167	3.81	Lê Lai, Hải Ngừ, Xã Vĩnh Trach Đông, Vĩnh Châu Town, Soc Trang province, Vietnam
8f65a0558c7294c	95	9.328	105.732	0.49	8657	0.25	-1	south	0.02531	0	Lower slope (flat)	0.49	1	123	3	201	canal	1,773	100,504	217,806	3.31	Châu Hưng, Vĩnh Lợi District, Bac Lieu province, 97000, Vietnam
8f65a201dc09a20	96	10.224	105.852	0.36	1615	0.29	3	east	0.00841	0	Upper slope (flat)	0.44	2	93	1	345	river	1,968	51,344	205,254	3.12	854, Châu Thành District, Dong Thap Province, 870000, Vietnam
8f65a2035b03aed	97	10.152	105.930	0.32	7347	0.39	1	west	0.01683	0	Valley	0.28	1	84	2	977	river	3,910	53,684	179,785	3.10	Phủ Hưng, Long Hồ District, Vinh Long province, Vietnam
8f65a20cd92d172	98	10.284	105.699	0.40	1697	0.39	3	northwest	0.00841	1	Valley	0.24	1	97	2	140	canal	2,183	51,448	235,498	3.12	Xã Hòa Thành, Lai Vung District, Dong Thap Province, Vietnam
8f65a20eaf2c92	99	10.280	105.728	0.39	3466	0.42	6	north	0.03365	0	Valley	0.22	1	105	1	198	river	2,769	95,503	244,422	3.10	Sa Đéc City, Dong Thap Province, 81800, Vietnam
8f65a225c4cc8e5	100	10.248	105.268	0.38	1532	0.39	2	southwest	0.00841	1	Lower slope (flat)	0.32	2	92	1	157	canal	2,210	41,512	104,159	3.07	Núi Sập, Thoại Sơn District, An Giang Province, Vietnam
8f65a25167b3a43	101	10.490	106.312	0.26	4441	0.30	1	southwest	0.00841	0	Lower slope (flat)	0.39	0	119	1	1460	canal	606	41,695	190,380	2.58	Tân Phước District, Tien Giang province, Vietnam
8f65a258362e361	102	10.609	106.279	0.40	4137	0.39	1	south	77.54121	0	Lower slope (warm)	0.32	1	115	3	127	canal	202	6,789	43,495	2.00	Thanh Hóa District, Long An province, Vietnam
8f65a265d81ba74	103	10.583	105.505	0.17	238	0.44	5	northeast	0.00841	1	Lower slope (flat)	0.20	1	76	2	573	canal	1,279	43,019	145,620	3.12	843, Tân Mỹ, Thanh Bình District, Dong Thap Province, Vietnam
8f65a26695b3c50	104	10.508	105.484	0.41	243	0.30	4	northeast	0.00841	3	Upper slope (flat)	0.40	1	121	2	75	canal	7,827	71,042	245,629	2.93	Mỹ Lương, Chợ Mới District, An Giang Province, Vietnam
8f65a266dd60448	105	10.477	105.500	0.22	108	0.27	8	northwest	0.00841	1	Valley	0.42	0	124	2	478	canal	2,993	68,034	255,902	3.10	Mỹ Lương, Chợ Mới District, An Giang Province, Vietnam
8f65a26eb9a90e2	106	10.673	105.536	0.32	1701	0.35	4	north	0.00840	0	Upper slope (warm)	0.33	2	103	1	420	river	1,568	29,099	71,610	3.07	Tam Nông District, Dong Thap Province, Vietnam
8f65a27093936d0	107	10.476	105.721	0.25	4680	0.42	3	south	0.05045	0	Lower slope (flat)	0.24	0	96	1	1112	canal	1,052	34,216	173,691	3.07	Cao Lãnh District, Dong Thap Province, Vietnam
8f65a28de994316	108	9.966	105.949	0.26	612	0.30	2	south	1.33057	0	Upper slope (flat)	0.41	1	109	1	719	canal	2,835	48,742	138,277	3.22	Mỹ Hòa, Trà Ôn District, Vinh Long province, Vietnam
8f65a29817862ce	109	9.830	106.196	0.13	209	0.27	2	south	1.32270	0	Lower slope (flat)	0.45	1	115	0	2286	canal	2,853	47,184	114,871	3.28	Tiểu Cần, Tiểu Cần District, Tra Vinh province, Vietnam
8f65a2a222e6a6c	110	9.802	105.641	0.25	1365	0.35	1	northwest	0.00843	1	Lower slope (flat)	0.33	0	85	2	911	canal	2,198	23,759	80,968	3.16	61, Hòa Quới, Phụng Hiệp District, Hậu Giang Province, Vietnam
8f65a2a69521581	111	9.743	105.404	0.28	2810	0.31	3	north	0.00843	1	Upper slope (flat)	0.35	0	99	1	1163	river	2,751	34,452	109,000	3.16	Quốc lộ 61, Vị Thanh, Hậu Giang Province, Vietnam
8f65a2b4232a459	112	9.696	105.570	0.45	1370	0.38	-1	north	0.00843	0	Lower slope (flat)	0.28	1	87	1	66	ditch	3,308	46,371	116,281	3.27	Phường Bình Thạnh, Long Mỹ Town, Hậu Giang Province, Vietnam
8f65a2c2ecc5932	113	10.100	106.309	0.30	421	0.29	3	northeast	0.27779	0	Valley	0.38	1	122	1	388	canal	3,955	79,250	169,693	2.96	Mô Cày Nam District, Bến Tre Province, Vietnam
8f65a2d63af39ad	114	9.941	106.270	0.24	563	0.33	2	north	0.70745	0	Lower slope (flat)	0.38	0	118	1	839	river	6,117	61,086	224,320	3.18	Càng Long District, Tra Vinh province, Vietnam
8f65a2d65034925	115	9.905	106.288	0.28	436	0.30	0	northwest	0.00842	0	Valley	0.36	0	118	1	398	ditch	1,781	65,195	223,661	3.23	Quốc lộ 60, Bình La, Châu Thành District, Tra Vinh province, Vietnam
8f65a2d65babdb0	116	9.898	106.283	0.50	1362	0.31	1	northeast	0.03369	0	Valley	0.38	1	124	1	36	ditch	1,190	56,183	218,307	3.29	Quốc lộ 60, Bình La, Châu Thành District, Tra Vinh province, Vietnam
8f65a2da3af30e9	117	10.137	106.481	0.14	166	0.28	2	east	0.00842	1	Valley	0.41	1	114	1	1355	river	1,376	43,890	118,105	2.81	Tân Hòa, Giồng Trôm District, Bến Tre Province, Vietnam
8f65a348daccda	118	10.420	104.968	0.33	3372	0.30	6	north	0.00841	3	Lower slope (flat)	0.39	0	122	3	675	river	1,466	33,515	88,685	3.07	Trị Tôn District, An Giang Province, Vietnam
8f65a3574a16500	119	10.092	105.025	0.36	2215	0.41	0	south	0.01684	0	Upper slope (flat)	0.22	0	102	3	195	water	839	19,146	76,483	3.33	Hon Dat District, Kien Giang Province, Vietnam
8f65a36e476c28	120	10.403	104.494	0.30	1832	0.43	2	east	0.00841	2	Upper slope (flat)	0.25	1	83	2	294	canal	323	11,284	32,477	2.24	Ha Tien City, Kien Giang Province, KP1, Vietnam
8f65a3719320908	121	10.254	104.616	0.28	8068	0.43	3	southeast	0.00841	0	Lower slope (flat)	0.21	0	116	1	818	ditch	399	10,761	20,901	3.13	Kien Luong District, Kien Giang Province, Vietnam
8f65a3c00309571	122	9.878	105.171	0.34	1699	0.32	3	south	0.00842	1	Lower slope (flat)	0.34	0	109	0	397	canal	1,651	43,828	160,547	3.06	Minh Lương, Châu Thành District, Kien Giang Province, Vietnam
8f65a3c264a8acb	123	9.837	105.234	0.21	45	0.36	-1	west	0.01685	0	Lower slope (warm)	0.24	1	101	0	241	canal	2,679	33,243	98,271	2.98	Giồng Riềng District, Kien Giang Province, Vietnam

Waste Sites Detected in Vietnam

ID	Number	Latitude	Longitude	Risk Score	Area (m^2)	Soil Clay Fraction	Elevation	Drainage Direction	Upstream Drainage Area (km^2)	Height Above Nearest Drainage (m)	Landform Type	Soil Sand Fraction	Slope (degrees)	Fine Earth Density (kg / m^3)	Soil Great Group	Distance to Waterway (m)	Nearest Water Type	Population (1 km)	Population (5 km)	Population (10 km)	Wind Speed (m/s)	Place Name
8f65a3d31d88614	124	9.746	105.344	0.43	1120	0.32	1	west	0.00843	1	Upper slope (flat)	0.32	1	95	2	86	canal	1,073	33,249	109,568	2.87	Quốc lộ 61, Gò Quao District, Kien Giang Province, Vietnam
8f65a441edac840	125	8.645	106.601	0.38	3150	0.31	10	southwest	0.04226	23	Lower slope (warm)	0.37	6	99	1	194	coastline	120	1,995	4,592	2.81	Prison Escape, Ha Huy Giap Street, Khu 5, Côn Sơn, Côn Dao, Côn Đảo District, Ba Ria-Vung Tau Province, Vietnam
8f65a62c6628b2a	126	9.520	106.141	0.41	864	0.28	-3	southwest	0.05059	0	Valley	0.37	1	121	2	105	canal	738	31,647	121,466	3.42	ĐH.28, Lịch Hội Thượng, Trần Đề District, Soc Trang province, Vietnam
8f65a62f4159661	127	9.482	106.199	0.29	219	0.42	0	northwest	0.00843	1	Upper slope (flat)	0.22	2	104	0	154	river	2,068	32,366	88,209	3.58	Nhà Thờ, Xã Trung Bình, Trần Đề District, Soc Trang province, Vietnam
8f65a661e9510e4	128	9.795	106.495	0.32	689	0.30	1	west	0.00843	0	Lower slope (flat)	0.38	1	127	1	320	drain	1,499	33,501	89,661	3.42	Mỹ Long, Cầu Ngang District, Tra Vinh province, Vietnam
8f65a662eda92d0	129	9.696	106.491	0.44	445	0.40	-1	southwest	0.18542	0	Lower slope (flat)	0.21	0	127	2	30	canal	1,741	30,710	94,334	3.40	Long Huu, Duyen Hai Town, Tra Vinh province, Vietnam
8f65b0006868969	130	11.555	107.376	0.41	310	0.34	159	northeast	0.00838	13	Lower slope (warm)	0.35	1	118	1	53	river	2,320	29,768	57,714	2.03	Đường tỉnh 721, Cát Tiên, Cát Tiên District, Lâm Đồng Province, Vietnam
8f65b01104a9b6e	131	11.497	107.508	0.31	1077	0.34	161	east	0.03352	1	Lower slope (warm)	0.35	16	128	2	338	reservoir	668	22,012	45,366	1.33	Đà Têh, Đà Têh District, Lâm Đồng Province, Vietnam
8f65b012200ea00	132	11.403	107.497	0.22	1153	0.31	171	south	0.03353	11	Lower slope (warm)	0.39	10	120	2	1112	stream	692	21,395	58,426	1.49	Đà Huoi District, Lâm Đồng Province, 814690, Vietnam
8f65b0219901481	133	11.651	106.873	0.39	1708	0.26	72	west	0.01675	15	Valley	0.48	4	113	0	208	stream	561	22,050	55,029	1.82	Phủ Riêng, Phú Riêng District, Bình Phước Province, Vietnam
8f65b0292db5492	134	11.840	107.022	0.30	1595	0.29	209	southwest	0.00837	36	Upper slope (warm)	0.44	6	112	0	663	dam	1,212	35,506	88,441	2.86	Phước Sơn, Đức Hạnh, Bù Gia Mập District, Bình Phước Province, Vietnam
8f65b036178a899	135	11.398	106.868	0.22	944	0.29	81	southeast	0.00838	17	Lower slope (warm)	0.48	8	119	1	1045	stream	502	20,086	66,692	2.16	Đồng Phú District, Bình Phước Province, Vietnam
8f65b04334880db	136	11.932	107.664	0.22	1455	0.35	599	southeast	0.00837	67	Peak/ridge (warm)	0.36	9	121	2	857	dam	213	7,062	58,901	2.51	Lê Thánh Tông, Gia Nghĩa, Đắk Nông Province, Vietnam
8f65b04ee490c01	137	12.000	107.493	0.23	1667	0.35	703	southwest	0.00836	103	Upper slope (warm)	0.38	13	115	1	1168	water	1,201	26,341	54,815	2.83	Kien Duc, Đắk R'Lấp District, Tuy Đức District, Đắk Nông Province, Vietnam
8f65b0806aac220	138	11.158	107.548	0.16	1903	0.28	141	northwest	0.01678	7	Upper slope (warm)	0.50	4	132	2	3537	ditch	545	39,416	94,014	1.44	Đức Linh District, Bình Thuận province, 803700, Vietnam
8f65b08a54dd351	139	11.247	107.599	0.09	199	0.32	140	southeast	0.00839	30	Upper slope (warm)	0.37	4	130	0	2001	water	692	16,248	64,673	1.95	Đức Linh District, Bình Thuận province, Vietnam
8f65b09110d5b88	140	11.084	107.654	0.07	358	0.31	133	northwest	0.02517	8	Lower slope (flat)	0.41	1	133	4	3313	river	400	19,688	51,878	1.73	Gia An, Tân Linh District, Bình Thuận province, Vietnam
8f65b0b0ec92710	141	11.102	107.178	0.46	1170	0.30	102	north	0.15943	10	Lower slope (warm)	0.45	6	120	0	2629	pond	1,215	40,748	115,975	2.13	Phủ Cường, Xã Phú Cường, Định Quán District, Đồng Nai Province, Vietnam
8f65b0b40449750	142	11.056	107.045	0.18	1283	0.32	66	northeast	0.00839	7	Lower slope (warm)	0.37	1	130	0	2082	pond	959	30,166	81,854	2.19	Xã Cây Gáo, Trảng Bom District, Đồng Nai Province, Vietnam
8f65b10c644e260	143	11.438	106.128	0.35	7034	0.21	22	south	0.00838	7	Upper slope (warm)	0.56	2	139	2	952	canal	542	16,779	59,512	2.60	Tân Châu District, Tây Ninh province, Vietnam
8f65b1414604946	144	11.699	106.528	0.16	1000	0.25	56	northeast	0.05024	0	Upper slope (warm)	0.52	1	132	1	2643	river	400	11,244	64,207	2.22	Hơn Quán District, Bình Phước Province, Vietnam
8f65b1414620472	145	11.699	106.528	0.18	1500	0.25	56	north	0.00837	1	Lower slope (warm)	0.52	1	132	1	2696	river	400	11,263	64,963	2.22	Hơn Quán District, Bình Phước Province, Vietnam
8f65b181069981b	146	10.965	106.430	0.46	23653	0.31	1	north	0.01679	1	Valley	0.41	1	133	2	409	river	1,878	52,045	245,318	2.17	Tam Tân, Thái Mỹ Commune, Củ Chi District, Ho Chi Minh City, 82719, Vietnam
8f65b19350a008d	147	10.753	106.567	0.36	189	0.36	2	northwest	0.00840	1	Lower slope (flat)	0.29	2	119	0	92	stream	7,091	391,284	2,688,243	2.58	Tan Tao A Ward, Ho Chi Minh City, Vietnam
8f65b1caa30b8da	148	11.386	106.667	0.11	201	0.25	48	northeast	0.24311	8	Lower slope (warm)	0.53	2	128	0	1903	canal	219	14,429	82,229	2.35	Chon Thành, Chon Thành District, Bình Phước Province, 112, Vietnam
8f65b1d2ad6ecdd	149	11.101	106.747	0	0	0.27	43	northwest	0.00839	6	Valley	0.49	2	126	2	4423	stream	1,280	54,286	276,164	2.25	Phường Hội Nghĩa, Tân Uyên Town, Bình Duong province, Vietnam
8f65b1d36665359	150	11.138	106.849	0.25	456	0.31	56	southwest	0.04195	7	Valley	0.43	5	123	1	579	stream	1,914	27,658	98,811	2.01	Tân Thành, Bắc Tân Uyên District, Bình Duong province, Vietnam
8f65b1d52413376	151	11.179	106.657	0.20	1842	0.27	48	north	0.00839	2	Upper slope (warm)	0.51	0	127	2	2454	water	858	32,847	225,079	2.49	Chánh Phú Hòa, Ben Cat Town, Bình Duong province, Vietnam
8f65b21106a9d94	152	12.602	107.843	0.13	786	0.30	369	east	0.01669	26	Upper slope (warm)	0.42	6	134	0	3053	water	881	25,080	97,663	2.43	Đắk Rông, Cư Jút District, Đắk Nông Province, Vietnam
8f65b212196a805	153	12.467	107.813	0.06	249	0.32	488	south	0.00835	74	Upper slope (warm)	0.37	6	127	2	2710	river	242	9,328	39,971	2.72	Krông Nô District, Đắk Nông Province, Vietnam
8f65b2141818998	154	12.494	107.627	0	2639	0.34	607	northwest	0.00835	52	Upper slope (warm)	0.39	3	125	1	-1	-1	253	15,519	78,202	3.21	Quốc lộ 14C, Đắk Mil, Đắk Mil District, Đắk Nông Province, 641970, Vietnam
8f65b214181cc86	155	12.494	107.628	0	1693	0.34	612	northwest	0.00835	52	Upper slope (warm)	0.39	2	125	1	-1	-1	256	15,784	78,486	3.21	Quốc lộ 14C, Đắk Mil, Đắk Mil District, Đắk Nông Province, 641970, Vietnam
8f65b2c05383cea	156	12.591	108.119	0.20	1536	0.36	498	southwest	0.02504	12	Lower slope (warm)	0.37	9	132	0	1660	water	1,466	40,391	123,804	7.74	Cư Kuin District, Đắk Lắk province, 02623, Vietnam
8f65b2d5c6b6b24	157	12.506	108.073	0.11	655	0.38	461	southeast	0.00835	19	Lower slope (warm)	0.37	4	138	0	2335	water	648	31,968	86,855	3.56	Buôn Trấp, Krông Ana District, Đắk Lắk province, Vietnam
8f65b3b33c098b4	158	11.948	106.466	0.00	73	0.25	73	east	0.00837	2	Upper slope (flat)	0.49	2	130	1	3655	stream	148	3,803	23,192	1.72	Lộc Ninh District, Bình Phước Province, Vietnam
8f65b40d3558a09	159	10.902	108.052	0.32	11807	0.23	82	northwest	0.17633	23	Lower slope (warm)	0.51	1	140	2	1966	river	1,280	38,239	154,400	3.73	Phan Thiết City, Hàm Thuận Nam District, Bình Thuận province, Vietnam
8f65b439ab6e9e6	160	10.861	107.842	0.20	2942	0.27	37	northeast	0.00840	2	Lower slope (flat)	0.45	2	137	1	2745	river	416	13,493	33,937	2.80	Hàm Thuận Nam District, Bình Thuận province, Vietnam

Waste Sites Detected in Vietnam

ID	Number	Latitude	Longitude	Risk Score	Area (m^2)	Soil Clay Fraction	Elevation	Drainage Direction	Upstream Drainage Area (km^2)	Height Above Nearest Drainage (m)	Landform Type	Soil Sand Fraction	Slope (degrees)	Fine Earth Density (kg / m^3)	Soil Great Group	Distance to Waterway (m)	Nearest Water Type	Population (1 km)	Population (5 km)	Population (10 km)	Wind Speed (m/s)	Place Name
8f65b449414c9ab	161	11.245	108.497	0.20	746	0.30	12	southwest	0.02516	5	Lower slope (flat)	0.40	1	149	0	1299	stream	1,138	22,228	52,505	2.61	Hải Xuân, Bắc Bình District, Bình Thuận province, Vietnam
8f65b47a0552a54	162	11.092	108.155	0.14	350	0.28	39	northwest	0.00839	10	Lower slope (warm)	0.40	1	142	0	1760	river	679	26,742	75,949	2.28	Ma Lâm, Hàm Thuận Bắc District, Bình Thuận province, Vietnam
8f65b504d8cc340	163	10.393	106.781	0.17	999	0.34	2	southwest	0.00841	1	Upper slope (flat)	0.35	2	93	1	1882	canal	1,254	24,652	73,448	3.50	Kiến Phước, Gò Công Đông District, Tiền Giang province, Vietnam
8f65b50db691659	164	10.661	106.855	0.38	4208	0.34	5	east	0.02521	1	Lower slope (flat)	0.36	2	100	0	264	river	593	24,714	118,268	2.39	Xã Phước Khánh, Nhơn Trạch District, Đồng Nai Province, 710000, Vietnam
8f65b52328b6984	165	10.510	106.651		0	0.40	5	northeast	0.00841	6	Upper slope (flat)	0.24	2	131	2	49	river	1,148	51,734	182,545	3.17	Xã Phước Đồng, Cần Đức District, Long An province, Vietnam
8f65b529648e2d4	166	10.725	106.689	0.46	64	0.42	3	northeast	0.04201	1	Upper slope (flat)	0.23	1	119	1	5	river	16,438	1,269,686	4,648,837	2.35	Đường số 1, Bình Hưng, Bình Chánh District, Ho Chi Minh City, 70000, Vietnam
8f65b530c792976	167	10.378	106.643	0.21	2078	0.35	-2	west	0.00841	0	Upper slope (flat)	0.32	0	121	1	1845	canal	2,119	88,544	239,088	3.20	Long Chánh, Gò Công Town, Tiền Giang province, Vietnam
8f65b53408d4b83	168	10.336	106.529	0.17	86	0.26	1	south	0.00841	0	Lower slope (flat)	0.42	1	124	1	757	canal	1,819	36,359	163,861	3.05	12A, Bình Đông, Gò Công Tây District, Tiền Giang province, 0009, Vietnam
8f65b537076dc6b	169	10.338	106.584	0.17	52	0.26	2	northeast	0.00841	1	Lower slope (flat)	0.43	0	127	0	682	canal	4,675	49,766	173,074	3.06	ĐT.827, Vĩnh Bình, Gò Công Tây District, Tiền Giang province, 0009, Vietnam
8f65b542b883534	170	10.768	107.222	0.25	1013	0.29	190	northwest	0.00840	11	Upper slope (warm)	0.46	3	120	1	961	stream	1,455	30,321	108,854	2.45	Xã Xuân Mỹ, Cẩm Mỹ District, Đồng Nai Province, 810000, Vietnam
8f65b546a934b41	171	10.730	107.086	0.22	4297	0.31	46	southwest	0.01680	5	Lower slope (warm)	0.42	2	122	2	2309	river	539	12,559	97,940	2.24	Bau Can, Long Thành District, Đồng Nai Province, Vietnam
8f65b54f2b8950a	172	10.937	107.223	0.05	6	0.31	213	east	0.00840	35	Upper slope (warm)	0.45	4	122	1	783	lake	3,406	101,419	220,086	2.83	Phường Suối Tre, Long Khánh City, Đồng Nai Province, Vietnam
8f65b559e7b22c4	173	10.914	107.431	0.27	2321	0.31	172	southeast	0.05038	22	Upper slope (warm)	0.44	3	136	0	1148	reservoir	1,636	44,482	119,675	3.69	Xuân Lộc District, Đồng Nai Province, Vietnam
8f65b5681b61a53	174	10.995	106.853	0.41	1879	0.28	37	north	0.05876	12	Upper slope (flat)	0.44	0	131	0	275	pond	9,001	280,670	859,741	2.04	Trảng Dài Ward, Biên Hòa City, Đồng Nai Province, 76913, Vietnam
8f65b56b5a998ca	175	10.980	106.933	0.16	164	0.32	20	northeast	0.00839	4	Lower slope (warm)	0.41	0	131	1	997	stream	2,367	151,814	684,446	2.18	Hồ Nai 3, Xã Hồ Nai 3, Trảng Bom District, Đồng Nai Province, Vietnam
8f65b572e461892	176	10.692	106.936	0.14	457	0.26	24	southwest	0.06722	4	Upper slope (flat)	0.48	1	130	0	3185	river	2,413	52,805	177,718	1.95	Nguyễn Văn Cừ, Xã Phước An, Nhơn Trạch District, Đồng Nai Province, Vietnam
8f65b57ac60164a	177	10.831	106.971	0.15	91	0.29	33	south	0.02520	2	Upper slope (flat)	0.47	2	129	0	821	reservoir	1,356	58,444	217,091	2.34	An Phước, Long Thành District, Đồng Nai Province, 8464, Vietnam
8f65b5a6801acd3	178	10.011	106.554	0.90	2962	-1.00	-1	east	0.00842	1	Lower slope (flat)	-1.00	0	-1	-1	164	river	882	26,475	138,563	3.87	Ấp Chín, Ba Tri District, Bến Tre Province, Vietnam
8f65b5adacb16b0	179	10.302	106.632	0.34	711	0.29	2	northwest	0.12619	1	Upper slope (warm)	0.40	1	127	1	292	canal	3,493	35,068	202,787	3.28	Hòa Phú, Gò Công Tây District, Tiền Giang province, Vietnam
8f65b5af5351094	180	10.189	106.686	0.26	4874	0.38	-3	south	0.49652	0	Upper slope (flat)	0.26	2	124	0	1773	canal	5,213	36,939	95,720	3.30	Bình Đại, Bình Đại District, Bến Tre Province, Vietnam
8f65b66de50961b	181	12.400	108.199	0.08	249	0.33	448	northeast	0.00835	29	Upper slope (warm)	0.39	4	133	2	2440	river	576	14,414	33,326	3.39	Liên Sơn, Lắc District, Đắk Lắk province, Vietnam
8f65b69101a1b18	182	11.336	108.807	0.18	700	0.27	33	southeast	0.01677	10	Lower slope (warm)	0.42	2	164	0	1836	coastline	757	13,821	42,616	2.17	Tuy Phong District, Bình Thuận province, Vietnam
8f65b69757b44e1	183	11.230	108.663	0.27	3982	0.22	78	south	0.15097	1	Lower slope (warm)	0.47	9	142	0	1746	ditch	552	17,827	76,844	3.92	Phú Điền, Tuy Phong District, Bình Thuận province, Vietnam
8f65b6aed0ea526	184	11.511	108.064	0.16	1334	0.36	972	northwest	0.00838	40	Upper slope (warm)	0.37	19	113	0	1814	stream	259	7,201	55,574	2.66	Quốc lộ 28, Di Linh District, Lâm Đồng Province, Vietnam
8f65b6d343754e2	185	11.608	109.094	0.15	377	0.24	18	west	0.05863	4	Lower slope (warm)	0.43	6	144	0	2315	coastline	1,119	24,933	98,026	3.66	Mỹ Tường, Ninh Hải District, Ninh Thuận province, Vietnam
8f69145925a9ba5	186	11.592	109.134	0.28	754	0.26	18	southwest	0.01675	8	Lower slope (warm)	0.42	2	147	0	715	coastline	2,172	18,320	38,329	5.17	Tỉnh lộ 702, Mỹ Tường, Ninh Hải District, Ninh Thuận province, Vietnam
8f6914ca138e425	187	12.009	109.128	0.15	3027	0.29	43	southeast	0.00836	15	Lower slope (flat)	0.43	1	145	1	4700	water	525	13,070	96,857	3.34	Liên Thôn 2, Cam Lâm District, Khánh Hòa Province, Vietnam
8f6914d23aebc4d	188	12.273	109.061	0.26	1057	0.34	24	northwest	0.05014	20	Lower slope (warm)	0.36	6	143	0	765	river	1,963	55,020	146,372	1.38	Tỉnh Lo 8, Diên Khánh, Diên Khánh District, Khánh Hòa Province, 650000, Vietnam
8f69300b306ccf5	189	13.835	109.080	0.25	3791	0.26	48	north	0.01661	7	Valley	0.50	6	136	3	2303	river	1,674	44,649	223,809	1.82	An Nhơn, An Nhơn District, Bình Định Province, 5800, Vietnam
8f69305652d9955	190	13.885	108.956	0.25	3922	0.28	38	northeast	0.04982	9	Lower slope (warm)	0.49	3	142	1	1905	stream	842	28,014	90,429	2.61	Gạch ngói Phú An, Phú An, Tây Sơn District, Bình Định Province, Vietnam
8f6930c59309619	191	14.036	108.956	0.10	1553	0.34	74	southeast	0.01659	25	Lower slope (warm)	0.36	3	143	1	4074	water	231	8,328	42,330	3.67	Tùng Chánh, Phú Cát District, Bình Định Province, Vietnam
8f693215ec11085	192	13.001	108.868	0.14	612	0.33	211	east	0.00833	39	Upper slope (warm)	0.40	3	139	0	1677	river	292	6,171	21,756	3.68	Buôn Bàu, Sông Hinh District, Phu Yen province, Vietnam
8f6932a464a14c2	193	13.273	109.217	0.10	855	0.33	45	northeast	0.05827	9	Valley	0.39	4	127	2	3664	river	479	24,834	90,300	3.45	Chi Thanh Town, Tuy An District, Phu Yen province, Vietnam
8f6932cc4486855	194	12.845	108.481	0.26	390	0.29	451	southeast	0.00834	17	Upper slope (warm)	0.45	2	138	0	400	river	381	21,422	79,949	4.14	Ea Kar District, Đắk Lắk province, Vietnam
8f6932da1718223	195	12.961	108.231	0.15	1874	0.32	778	northwest	0.00833	88	Upper slope (warm)	0.40	5	121	0	4302	water	1,616	25,160	97,404	5.56	Krông Buk District, Đắk Lắk province, Vietnam
8f6936101c72d58	196	13.891	107.944	0.17	6521	0.33	714	southwest	0.02491	40	Lower slope (warm)	0.35	4	126	1	4569	water	329	13,045	83,719	2.87	Pleiku, Gia Lai Province, Vietnam
8f6936a1e294934	197	14.043	108.310	0.12	799	0.33	743	northeast	0.00830	54	Upper slope (warm)	0.40	1	121	0	2635	river	314	11,662	34,822	4.37	Mang Yang District, Gia Lai Province, Vietnam
8f6936ce0951586	198	13.761	107.688		0	0.29	335	southeast	0.02492	35	Lower slope (warm)	0.45	3	128	1	3641	water	260	12,844	36,928	2.38	Chu Ty, Đức Cơ District, Gia Lai Province, Vietnam