

Overview of EANET monitoring system

The Acid Deposition Monitoring Network in East Asia (EANET) was established as an initiative for regional cooperation among the participating countries, creation of a common understanding on the state of acid deposition problems and for providing useful inputs to policy makers at various levels.

Monitoring activities started during the preparatory phase activities of EANET from March 1998 to December 2000. Regular monitoring of acid deposition started from January 2001 with the participation of 10 countries, namely China, Indonesia, Japan, Malaysia, Mongolia, Philippines, Republic of Korea, Russia, Thailand, and Vietnam. Cambodia, Lao PDR and Myanmar joined EANET in 2001, 2002 and 2005, respectively. There are currently 13 countries participating in EANET activities.

Acid deposition monitoring of EANET covers five environmental items – wet deposition, dry deposition (air concentration), soil and vegetation, inland aquatic environment, and catchment-scale monitoring. Monitoring of wet and dry deposition was implemented in order to measure atmospheric concentrations and to evaluate fluxes of acidic substances to the land surface, while monitoring for soil/vegetation, inland aquatic environment and catchment-scale has been carried out to assess adverse impacts on terrestrial and aquatic ecosystems. The monitoring data were used to evaluate the state of acid deposition as well as impacts on ecosystems.

For wet deposition monitoring, each participating country was required to carry out acid deposition monitoring using common methodologies as specified in the “Guidelines for Acid Deposition Monitoring in East Asia”, “Technical Manual for Wet Deposition Monitoring in East Asia” in 2010 and related QA/QC documents.

For dry deposition monitoring, manual and automatic monitoring methods were used based on the “Strategy Paper on Future Direction of Monitoring for Dry Deposition of EANET (2016-2020)”. For manual monitoring, the filter pack method was used to determine gaseous substances (SO_2 , HNO_3 , HCl and NH_3) and particulate matter components (SO_4^{2-} , NO_3^- , Cl^- , NH_4^+ , Na^+ , K^+ , Mg^{2+} and Ca^{2+}). The passive sampler method was used to determine the gaseous species of SO_2 , O_3 and NO_2 . In addition, some priority chemical species, SO_2 , NO , NO_2 (urban), NO_x , O_3 , PM_{10} and $\text{PM}_{2.5}$, were measured by automatic monitoring methods. The common methodology and quality assurance and quality control (QA/QC) for automatic monitoring were described in the “Technical Manual for Air Concentration Monitoring in East Asia” in 2013.

Soil and vegetation monitoring and the monitoring of inland aquatic environments were conducted in 11 countries as of 2017. Since the survey interval is every 3-5 years for soil and vegetation monitoring, the actual number of the data in each year are different. Most of the ecological monitoring sites corresponded to the deposition monitoring sites. Moreover, both soil and vegetation monitoring and monitoring of the inland aquatic environments were conducted in the vicinity of four deposition monitoring sites in China, two sites in Japan, two sites in the Philippines, two sites in Russia, one site in Thailand, and one site in Viet Nam. It was expected that the deposition data collected at the nearest monitoring sites would be used for interpretation of the data on ecological monitoring at these sites. The common methodologies of soil and vegetation monitoring and the monitoring of inland aquatic environments as specified in the “Technical Manual for Soil and Vegetation Monitoring in East Asia” in 2000 and “Technical Manual for Inland Aquatic Environment Monitoring in East Asia” in 2010, respectively.

Catchment scale monitoring was implemented at only one site in Japan, and a new site in the Philippines was being prepared. The methodology for catchment scale monitoring were described in the “Guideline for Catchment-scale Monitoring in East Asia” in 2010.

More detailed information of monitoring procedures and items are presented the annual data report, and information of the EANET monitoring sites are presented in Site Information of EANET Web page.

Classification of Monitoring Sites

EANET monitoring sites are classified into two basic categories, namely acid deposition monitoring sites and ecological survey sites. Acid deposition monitoring sites are sites for the collection of fundamental data on the temporal and spatial distribution of acid deposition, and they are further classified into 3 sub-categories: remote sites, rural sites and urban sites for specific objectives of the monitoring. Ecological survey sites are those that provide basic data for assessing the effects of acidification on terrestrial ecosystems, and they are further classified into 2 sub-categories: survey sites and ecosystem analysis sites. Their classification of the monitoring sites is shown in Table 2.1.

Table 2.1 Classification of Monitoring Sites

Site Category	Site Classification	Main Purpose and Siting Criteria
Acid Deposition Monitoring Site for wet deposition and dry deposition monitoring	Urban Site	<ul style="list-style-type: none"> - Assessment of the state of acid deposition in urban areas - Urbanized and industrial areas, and the areas immediately outside the urban area - Data can be used for evaluation of acid deposition effect on buildings and historical monuments or human health
	Rural Site	<ul style="list-style-type: none"> - Assessment of the state of acid deposition in rural areas and/or hinterlands - Data can be used for the evaluation of acid deposition on agricultural crops, forests and etc. - More than 20km apart from large pollution sources like cities, power plants and highways
	Remote Site	<ul style="list-style-type: none"> - Assessment of the state of acid deposition in background areas - Data can be used for evaluation of long-range transport and deposition models - More than 50km apart from large pollution sources like cities, power plants and highways - More than 500m apart from main roads (less than 500 vehicles per day)
Ecological Survey Site for soil and vegetation monitoring and Inland aquatic monitoring	Basic survey site	<ul style="list-style-type: none"> - Accumulation of basic data on soil, forest, and inland aquatic environment and disclose trends in their properties - In the vicinity of the acid deposition monitoring site
	Ecosystem analysis site	<ul style="list-style-type: none"> - Assessment of acid deposition impacts on whole ecosystem through application of terrestrial ecosystem analysis and/or catchment analysis - Sensitive Areas to changes in atmospheric acidity and ecologically conserved area

Monitoring locations as of 2017

Thirteen EANET countries, namely, Cambodia, China, Indonesia, Japan, Lao PDR, Malaysia, Mongolia, Myanmar, Philippines, Republic of Korea, Russia, Thailand and Vietnam participated in monitoring of acid deposition in 2017. The data on deposition monitoring were submitted from a total of 62 monitoring sites, including 27 urban, 16 rural, and 19 remote sites. The map showing the location of these sites with the classification information is provided in Figure 2.1. The details on the location of the monitoring sites are presented in Table 2.2 and Table 2.3.



Figure 2.1 Locations of EANET deposition monitoring sites in 2017

Table 2.2 Locations of EANET deposition monitoring sites

Country	Site	Code	Classification	Latitude* ¹	Longitude* ¹	Altitude* ¹ /m
Cambodia	Phnom Penh	<i>KHA001</i>	Urban	11°33'18"N	104°56'20"E	12
China	Chongqing - Haifu	<i>CNA003</i>	Urban	29°37'30"N	106°30'34"E	300
	- Jinyunshan	<i>CNA004</i>	Rural	29°49'42"N	106°22'43"E	403
	Xi'an - Shizhan	<i>CNA005</i>	Urban	34°14'33"N	108°57'10"E	419
	- Jiwozi	<i>CNA007</i>	Remote	33°51'06"N	108°48'52"E	2,198
	Xiamen - Hongwen	<i>CNA008</i>	Urban	24°28'47"N	118°09'47"E	39
	- Xiaoping	<i>CNA009</i>	Remote	24°51'23"N	118°02'55"E	530
	Zhuhai - Xiang Zhou	<i>CNA010</i>	Urban	22°16'22"N	113°31'46"E	40
	- Zhuxiandong	<i>CNA011</i>	Urban	22°12'24"N	113°30'60"E	50
	- Haibin-Park	<i>CNA012</i>	Urban	22°15'40"N	113°34'25"E	30
Indonesia	Jakarta * ²	<i>IDA001</i>	Urban	06°09'22"S	106°50'32"E	7
	Serpong	<i>IDA002</i>	Rural	06°21'02"S	109°40'04"E	64
	Kototabang	<i>IDA003</i>	Remote	00°12'08"S	100°19'05"E	845
	Bandung	<i>IDA004</i>	Urban	06°53'41"S	107°35'11"E	753
	Maros	<i>IDA005</i>	Rural	04°59'50"S	119°34'17"E	1
Japan	Rishiri	<i>JPA001</i>	Remote	45°07'30"N	141°14'30"E	40
	Ochiishi	<i>JPA002</i>	Remote	43°09'43"N	145°29'50"E	49
	Tappi	<i>JPA003</i>	Remote	41°15'06"N	140°21'01"E	106
	Sado-seki	<i>JPA004</i>	Remote	38°15'02"N	138°24'01"E	129
	Happo	<i>JPA005</i>	Remote	36°41'48"N	137°47'53"E	1,850
	Ijira	<i>JPA006</i>	Rural	35°34'14"N	136°41'51"E	140
	Oki	<i>JPA007</i>	Remote	36°17'19"N	133°11'06"E	90
	Banryu	<i>JPA008</i>	Urban	34°40'54"N	131°47'59"E	53
	Yusuhara	<i>JPA009</i>	Remote	33°22'46"N	132°56'06"E	790
	Hedo	<i>JPA010</i>	Remote	26°51'58"N	128°14'55"E	60
	Ogasawara	<i>JPA011</i>	Remote	27°05'32"N	142°13'02"E	212
	Tokyo	<i>JPA012</i>	Urban	35°41'30"N	139°45'10"E	26
Lao PDR	Vientiane * ³	<i>LAA001</i>	Urban	17°59'88"N	102°34'93"E	175
Malaysia	Petaling Jaya	<i>MYA001</i>	Urban	03°06'07"N	101°38'42"E	51
	Tanah Rata	<i>MYA002</i>	Rural	04°29'03"N	101°22'17"E	1,545
	Danum Valley	<i>MYA003</i>	Remote	04°58'53"N	117°50'37"E	438
	Kuching	<i>MYA004</i>	Urban	01°29'25"N	110°21'09"E	20
Mongolia	Ulaanbaatar	<i>MNA001</i>	Urban	47°55'13"N	106°54'43"E	1,303
	Terelj	<i>MNA002</i>	Remote	47°58'59"N	107°27'04"E	1,557
Myanmar	Yangon	<i>MMA001</i>	Urban	16°51'53"N	96°09'13"E	21
	Mandalay * ⁴	<i>MMA002</i>	Urban	21°54'46"N	96°03'51"E	70
Philippines	Metro Manila	<i>PHA001</i>	Urban	14°38'09"N	121°04'43"E	55
	Los Baños	<i>PHA002</i>	Rural	14°09'53"N	121°15'00"E	25
	Mt. Sto. Tomas	<i>PHA003</i>	Remote	16°25' N	120°36' E	1,500
Republic of Korea	Kanghwa	<i>KRA001</i>	Rural	37°42'32"N	126°16'26"E	60
	Cheju (Kosan)	<i>KRA002</i>	Remote	33°17'32"N	126°09'43"E	37
	Imsil	<i>KRA003</i>	Rural	35°36'09"N	127°10'53"E	217

Table 2.2 Locations of EANET deposition monitoring sites (continued)

Country	Site	Code	Classification	Latitude* ¹	Longitude* ¹	Altitude* ¹ /m
Russia	Mondy	<i>RUA001</i>	Remote	51°37'18"N	100°55'10"E	1,996
	Listvyanka	<i>RUA002</i>	Rural	51°50'47"N	104°53'34"E	646
	Irkutsk	<i>RUA003</i>	Urban	52°14'53"N	104°15'33"E	495
	Primorskaya	<i>RUA004</i>	Rural	43°37'45"N	132°14'13"E	85
Thailand	Bangkok	<i>THA001</i>	Urban	13°47'04"N	100°32'22"E	5
	Samutprakarn	<i>THA002</i>	Urban	13°39'58"N	100°36'21"E	4
	Pathumthani	<i>THA003</i>	Rural	14°02'46"N	100°42'43"E	6
	Khanchanaburi (Vachiralongkorn Dam)	<i>THA004</i>	Remote	14°47'05"N	98°36'05"E	130
	Chiang Mai					
	- Mae Hia	<i>THA005</i>	Rural	18°45'40"N	98°55'54"E	349
	- Chang Phueak	<i>THA006</i>	Urban	18°50'26"N	98°58'11"E	329
	- Si Phum	<i>THA007</i>	Urban	18°47'27"N	98°59'24"E	313
	Nakhon Ratchasima					
- Sakaerat	<i>THA008</i>	Rural	14°28'04"N	101°54'05"E	409	
- Nai Mueang	<i>THA009</i>	Urban	14°58'46"N	102°05'53"E	184	
Vietnam	Hanoi	<i>VNA001</i>	Urban	21°03'24"N	105°43'36"E	6
	Hoa Binh	<i>VNA002</i>	Rural	20°50'12"N	105°20'32"E	23
	Cuc Phuong	<i>VNA003</i>	Remote	20°18'01"N	105°41'38"E	155
	Da Nang	<i>VNA004</i>	Urban	16°02'35"N	108°12'24"E	5
	Can Tho	<i>VNA005</i>	Rural	10°05'18"N	105°41'45"E	2
	Ho Chi Minh	<i>VNA006</i>	Urban	10°47'04"N	106°42'00"E	5
	Yen Bai	<i>VNA007</i>	Rural	21°42'28"N	104°52'29"E	56

*1 The latitude and longitude are shown according to the World Geodetic System. The latitude, longitude and altitude of each site indicate the deposition monitoring site.

*2 Jakarta site was relocated in 2016.

*3 The wet only sampler and filter pack system were moved to Natural Resources and Environment Research Institute (NRERI) on October 2017.

*4 The classification of Mandalay site was changed from rural site to urban site in 2017.

The current situation on basic survey sites for ecological monitoring and their nearest deposition monitoring sites are shown in Table 2.3. Soil and vegetation monitoring and monitoring on inland aquatic environment are conducted at 31 plots in 10 countries and 19 lakes/ rivers in 11 countries, respectively. Most of the ecological monitoring sites are corresponded to the deposition monitoring sites. Moreover, both soil and vegetation monitoring and monitoring on inland aquatic environment are conducted in the vicinity of 4 deposition monitoring sites in China, 2 sites in Japan, 2 sites in Philippines, 2 sites in Russia, 1 site in Thailand, and 1 site in Vietnam. It is expected that the deposition data collected in their nearest monitoring sites will be used for interpretation of the data on ecological monitoring in these sites.

Table 2.3 Basic survey sites for ecological monitoring and their nearest deposition sites

Country	Site for deposition monitoring	Plot for soil and vegetation monitoring	Code for soil and vegetation monitoring	Site for monitoring on inland aquatic environment	Code for monitoring on inland aquatic environment
Cambodia	-	-	-	Sras Srang Lake	<i>KHI002</i>
China	Chongqing - Jinyunshan	Jinyunshan	<i>CNS004</i>	Jinyunshan Lake	<i>CNI004</i>
	Xi'an - Jiwozi	Dabagou	<i>CNS007</i>	Jiwozi River	<i>CNI007</i>
	Xiamen - Xiaoping	Xiaoping	<i>CNS009</i>	Xiaoping Dam	<i>CNI209</i>
	Zhuhai - Zhuxiandong	Zhuxiandong	<i>CNS011</i>	Zhuxiandong Stream	<i>CNI111</i>
Indonesia	Serpong	Bogor Research Forest (Dramaga Experimental Forest)	<i>IDS002</i>	-	-
	Bandung	-	-	Patengang Lake	<i>IDI004</i>
	-	-	-	Gunung Lake	<i>IDI006</i>
Japan	Ijira	Ijira	<i>JPS006</i>	Ijira Lake	<i>JPI006</i>
		Yamato	<i>JPS106</i>		
	Banryu	Banryu-2 ^{*1}	<i>JPS008</i>	Banryu Lake	<i>JPI008</i>
		Iwami "rinku" Factory Park ^{*1}	<i>JPS108</i>		
Lao PDR	Vientiane	-		Nam Hum Lake	<i>LAI001</i>

Table 2.3 Basic survey sites for ecological monitoring and their nearest deposition sites (continued)

Country	Site for deposition monitoring	Plot for soil and vegetation monitoring	Code for soil and vegetation monitoring	Site for monitoring on inland aquatic environment	Code for monitoring on inland aquatic environment
Malaysia	Petaling Jaya	Pasoh Reserve Forest1	<i>MYS001</i>	Semenyih Dam	<i>MYI001</i>
		Pasoh Reserve Forest2	<i>MYS101</i>		
	-	UPMKB Rehabilitated Forest Planted in 1991	<i>MYS005</i>		
		UPMKB Rehabilitated Forest Planted in 2008	<i>MYS105</i>		
	Danum Valley	-	-	Tembaling River	<i>MYI003</i>
Mongolia	Ulaanbaatar	Bogdkhan Mountain	<i>MNS001</i>	-	-
	Terelj	Terelj Mountain	<i>MNS002</i>	Terelj River	<i>MNI002</i>
Philippines	Los Banos	Mt. Makiling	<i>PHS002</i>	Pandin Lake	<i>PHI102</i>
		UP Quezon, Land Grant	<i>PHS102</i>		
	Metro Manila	La Mesa Watershed	<i>PHS001</i>	-	-
	Mt. Sto Tomas	Boneco Long Term Ecological Research Site	<i>PHS003</i>	Ambulalakaw Lake	<i>PHI003</i>
Republic of Korea	Imsil	Mt. Naejang	<i>KRS003</i>	-	-
Russia	Irkutsk	Irkutsk	<i>RUS003</i>	-	-
	Listvyanka	Bolshie Koty	<i>RUS002</i>	Pereemnaya River	<i>RUI102</i>
		Pereemnaya river catchment	<i>RUS102</i>		
	Mondy	Ilchir Lake	<i>RUS001</i>	-	-
		Okinskoe Lake	<i>RUS101</i>		
Solar Observatory		<i>RUS201</i>			
Primorskaya	Primorskaya	<i>RUS004</i>	Komarovka River	<i>RUI004</i>	

Table 2.3 Basic survey sites for ecological monitoring and their nearest deposition sites (continued)

Country	Site for deposition monitoring	Plot for soil and vegetation monitoring	Code for soil and vegetation monitoring	Site for monitoring on inland aquatic environment	Code for monitoring on inland aquatic environment
Thailand	Khanchanaburi (Vachiralongkorn Dam)	Vachiralongkorn Dam	<i>THS004</i>	Vachiralongkorn Dam	<i>THI004</i>
		Vachiralongkorn Puye	<i>THS104</i>		
Vietnam	Hoa Binh	Cave of Heaven	<i>VNS002</i>	Hoa Binh Reservoir	<i>VNI002</i>
		Thang Ranh	<i>VNS102</i>		

*1 The sites around Banryu deposition site were relocated in 2001.

Table 2.4 shows the sites for catchment-scale monitoring, and this table contains the site information which is under preparation at this moment.

Table 2.4 Site for catchment-scale monitoring

Country	Site	Code	Note
Japan	Lake Ijira catchment	<i>JPC006</i>	
Philippines	La Mesa Watershed	<i>PHC001</i>	Under preparation