Data Report 2018 (draft) Chapter 7: Catchment-scale Monitoring

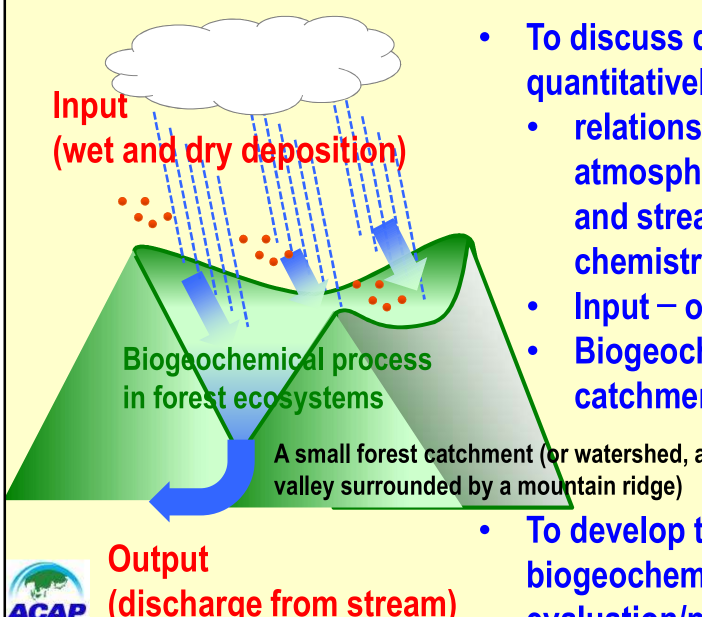
Network Center for EANET

ACAP

1

1

Catchment-scale analysis may allow us …



- To discuss qualitatively quantitatively
  - relationship between atmospheric deposition and stream water chemistry
  - Input – output budget
  - Biogeochemistry in the catchment
- To develop the biogeochemical model for evaluation/projection

ACAP

2

2

Field operation:

Table 7.1 Methods and frequency of major monitoring

Items to be monitored		Recommended methods	Proposed frequency
Input (total deposition)	Precipitation amount	Rain gauge	Continuously or daily
	Wet deposition*1	Wet-only sampling	Daily or weekly
		Bulk sampling (when electricity is not available)	Weekly or biweekly
	Dry deposition*1	Inferential method: based on Filter pack data and Meteorological data	Weekly (for filter pack method)
		Automatic monitors (alternative for air concentration)	Continuously
	Total deposition	Wet + Dry	Biweekly or monthly
		Throughfall–Stemflow method (when electricity is not available)	Biweekly

Note. *1, The relevant EANET data can be referred.

3

3

Field operation: Table 7.1 (continued)

Output (discharge from the stream)	Water discharge	Weir	Continuously or biweekly
		H-Q curve method (when a weir is not available)	
	Stream water chemistry	Periodical collection of stream water	Weekly or biweekly
		Intensive sampling	During heavy-rain or snow-melting events
	Chemical discharge	Calculation based on the water flux and the chemical concentration	Biweekly, monthly or annual
Soil	Soil chemistry*1	Collection from the permanent plots	Once for several years
Vegetation	Plant growth*1	Measurement of tree size (diameter at breast height, height of tree and name of species)	Once for several years

Note. *1, The relevant EANET data can be referred.

4

4

Laboratory operation:

Table 7.2 Chemical parameters for the respective items

Items	Parameters to be measured
Rainwater samples	Mandatory: SO_4^{2-}, NO_3^-, Cl^-, NH_4^+, Ca^{2+}, Mg^{2+}, Na^+, K^+, Electric conductivity (EC), and pH Optional: Total organic nitrogen (TON), Total organic carbon (TOC)
Stream water samples	Mandatory: SO_4^{2-}, NO_3^-, Cl^-, NH_4^+, Ca^{2+}, Mg^{2+}, Na^+, K^+, Electric conductivity (EC), pH, and Alkalinity (Gran's ANC and/or pH 4.8 endpoint) Optional: SiO_2, TON, TOC, Total dissolved Al
Air concentrations (by filter pack method)	Cations: NH_4^+, Ca^{2+}, Mg^{2+}, Na^+, and K^+, Anions: SO_4^{2-}, NO_3^-, and Cl^-, Gasses: SO_2, HNO_3, HCl, and NH_3
Soil chemistry	pH (H_2O), pH (KCl), Exchangeable Base Cations (Ca, Mg, K and Na), Exchangeable Acidity, Al and H, Effective Cation Exchangeable Capacity

The existing EANET technical documents can also be referred for the laboratory operation!

5

5

Data management

- Units to be used:
  - Water flux (precipitation amount and stream water discharge): mm
  - Chemical concentration: $mol_c\ L^{-1}$ ($\mu mol_c\ L^{-1}$ or $mmol_c\ L^{-1}$)
  - Ion flux (deposition, discharge or soil/vegetation flux): $mol_c\ ha^{-1}$ or $mol_c\ m^{-2}$
  - Elemental flux for N and S: $kg\ ha^{-1}\ y^{-1}$ or $g\ m^{-2}\ y^{-1}$
- Water balance on a catchment-scale
- Material/elemental balance on a catchment-scale

ACAP

6

Monitoring sites:

Table 7.3 Site for the catchment-scale monitoring

Country	Site name (and name of river/stream)	Catchment area (km^2)	Geology and soil type	Coverage of forest (%) and major species	Start year
Japan	Lake Ijira Catchment (Kamagatani River)	2.98	Chert Cambisols (brown forest soils)	99.6%, Japanese cedar (*Cryptomeria japonica),* Japanese cypress (*Chamaecyparis obtusa),* and Japanese red pine (*Pinus densiflora)*	November 2007 (the water year here: from November to the next October)

ACAP

7

Monitoring sites:

Table 7.4 Survey outline for the catchment-scale monitoring

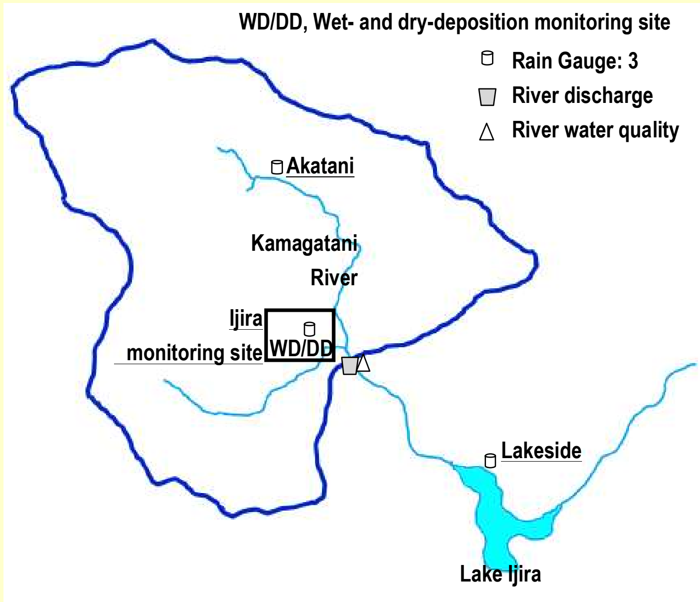
Site	Items	Detailed items
Lake Ijira Catchment	Input (total deposition)	1. Precipitation amount (at 3 points)*1 2. Wet deposition*1 3. Dry deposition (Air concentration measurement for Inferential method)*1 4. Total deposition (calculated as wet+dry)
	Output (chemical discharge from the stream)	1. Water discharge (by H-Q curve method) 2. Stream water chemistry: biweekly 3. Chemical discharge
	Soil*2	Soil chemical properties
	Vegetation*2	1. Plant growth (field measurement) 2. Species composition (field measurement)

Note: *1, The EANET data collected at the Ijira deposition monitoring site will be used; *2, The EANET data collected in the Lake Ijira soil and vegetation monitoring plots will be referred.

ACAP

8

Sampling design at Lake Ijira



9

9

Results of monitoring:

Table 7.5 List of the dataset submitted for Data Report 2017

Site	Items	Detailed items	Water years
Lake Ijira Catchment	Input (total deposition)	1. Precipitation amount (at 3 points) *Calculation of total deposition is under discussion for precise estimation.*	2016-2017
	Output (chemical discharge from the stream)	1. Water discharge 2. Stream water chemistry: biweekly 3. Chemical discharge	2016-2017

Note.

•The data of wet deposition and dry deposition (air concentration) in the Ijira deposition monitoring site for the period can be found in Data Reports 2016 and 2017

•The water year: from November to October in the following year.

•Soil chemical properties, plant growth and understory-species composition are surveyed in 2016 as a part of soil and vegetation monitoring.

10

Table 7.6 Water balance in the catchment: Lake Ijira Catchment

Fluxes[*1]	Points	Water year[*2] 2017-2018
Input by precipitation, mm y^{-1}	Akatani (260 m)	3,774
	Ijira monitoring site (140 m)	3,588
	Lakeside (110 m)	3,427
	Mean	3,596
Output by the stream, mm y^{-1}	Outlet of Kamagatani River	2,818
Runoff rate, %		78

Note. [*1], Fluxes were calculated based on the catchment area, 2.98 km^{-2}, at the outlet of Kamagatani River; [*2], The water year: from November to the next October.

Table 7.7: Stream water chemistry (biweekly data)

Table 7.8: Periodic chemical discharges from the stream (biweekly data)

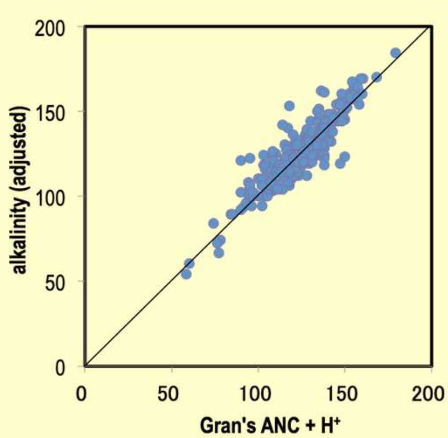
Table 7.8: Annual chemical discharges from the stream

11

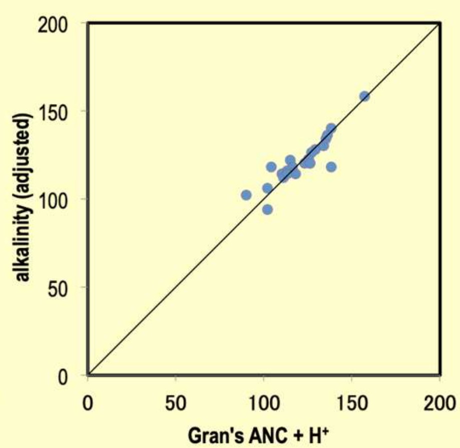
11

Analytical precision of alkalinity at Lake Ijira

All the data since 2007



The data in 2018



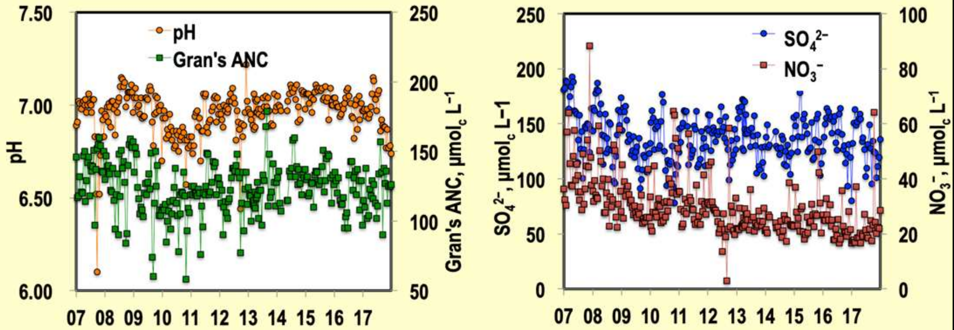
- Analytical precisions of Gran's ANC and pH4.8 alkalinity were fairly good.

ACAP

12

12

Recovery from acidification/nitrogen saturation?

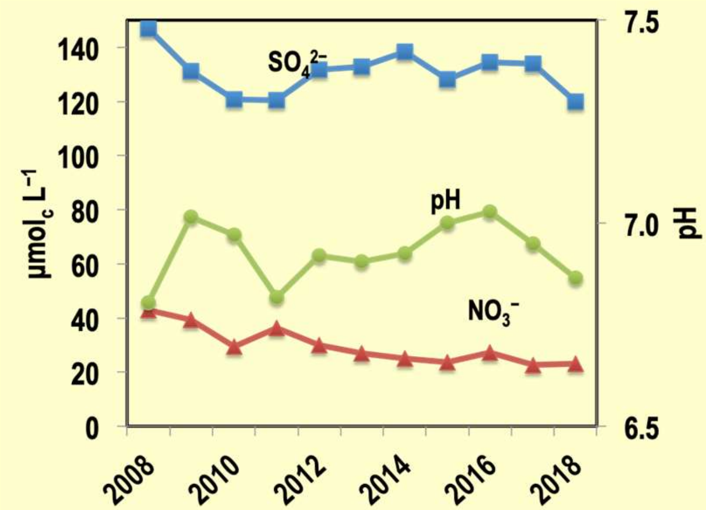


- In the mid-1990s, acidification and nitrogen saturation were suggested (Nakahara et al. 2010, *Biogeochemistry*).
- pH and ANC are relatively stable or rather increasing especially for the last several years. Concentrations of SO_4^{2-} and NO_3^- have been declining.
- Recent recovery is suggested (Sase et al. 2019, *Biogeochemistry*).

13

13

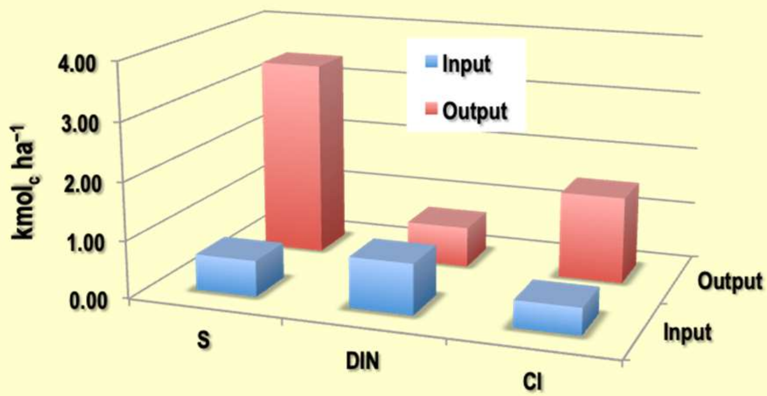
Weighted mean of the stream water chemistry



Declining trend of NO_3^- concentrations is clear.

14

Comparison with the inputs (wet + dry)
WY 2015-2016 (based on Data Report 2016 and 2017)



- S output exceeded the input due to contribution of geology (rock S) (Sase et al. 2019).
- N output is still relatively large. 6.5% of the atmospheric nitrate is exported to the stream directly without processes in the ecosystem (Nakagawa et al. 2018, *Biogeosciences*).

15

15

Thank you for your attention

16