

Development Plan 2017-2020

Executive summary, introduction and scope

This is an excerpt of Eawag's Development Plan 2017-2020. The excerpt includes the executive summary and preamble as well as two introductory chapters. These chapters provide the rationale for Eawag's research, teaching and outreach and describe its vision, scope and mandate.

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Executive Summary

Eawag is recognized world-wide as a leading institute for research, education, and consulting in aquatic science and technology. Eawag takes an **integrated view** of the water environment, a view that encompasses the continuum from relatively unperturbed aquatic ecosystems to fully engineered water and wastewater management systems. Eawag focuses on **high-impact research**, that is, on basic research that will lead to fundamental advances in the aquatic sciences and on applied research that addresses important societal needs. Eawag also plays a unique role in working with practitioners to maintain the **bridge between theory and practice** that is needed to implement novel concepts within society.

Eawag's mandate encompasses research, education, and expert consulting. Each of these activities is pursued in collaboration with national partners, particularly the other institutions of the ETH Domain, Cantonal Universities and Universities of Applied Sciences as well as international partners. Key national partners in applied and transdisciplinary research and in expert consulting include the Federal Offices, Cantonal agencies, municipal utilities, consulting firms, and industry. The balance of these interactions reflects Eawag's focus on public, rather than economic, goods.

In the planning period 2017-2020, Eawag will pursue the following goals:

- Sustain and further develop its world-class research program, which integrates across fundamental and applied research questions in a broadly-interdisciplinary manner.
- Bring the experience of this inter- and transdisciplinary research program to support activities in both tertiary and continuing education and in knowledge and technology transfer.
- Maintain and strengthen its existing national and international collaborations in research and education and build strategic partnerships to facilitate the uptake of research into practice.
- Sustain and further develop its collaboration with stakeholders and provide scientific input for decision making in the water sector.
- Maintain the strength of its research staff with particular attention to key appointments of research needed to pursue initiatives on targeted topics.
- Pursue initiatives on targeted topics relating to Eawag's three strategic themes. Within the theme **water for human welfare**, the focus in the next planning period will be on *sustainable urbanization*. Within the theme **water for ecosystem function**, Eawag will expand its capacity for *integrated field experiments and observations* as a means to improve mechanistic, process-based understanding across spatial and temporal scales. To support its activities in the area of **strategies for making trade-offs and resolving competing demands**, Eawag will continue to strengthen its capacity in the social sciences and plans to establish a Center for the synthesis and integration of scientific and technical knowledge relevant to socio-environmental-technological systems (SETS), which will be developed in cooperation with the other ETH Domain institutions.
- Continue to support national tasks, including the activities of the Swiss Center of Applied Ecotoxicology (Ecotox Center).

Preamble

The ETH Domain comprises six autonomous institutions, which share a common mandate in education, research, and service. Within the ETH Domain, there are two different types of institutions – the ETHs (ETH Zurich and EPFL) and the Research Institutes (PSI, Empa, Eawag, and WSL).

The ETHs, as the only degree-granting institutions within the ETH Domain, bear the fundamental responsibility for tertiary education. Since the Research Institutes (RIs) cannot grant academic degrees, their educational mandate can only be fulfilled in partnership with the ETHs or other degree-granting institutions.

Unlike the RIs, the scope of the activities of the ETHs in science and engineering is not subject to any thematic constraints. Thus, the ETHs must maintain the capacity to meet the needs of education, research, and service in a broad range of fields. The RIs, however, are legally constrained in the thematic scope of their activities. These thematic constraints reflect political decisions regarding the importance of certain thematic areas to Switzerland.

Eawag is legally responsible for the following thematic areas¹:

- Chemistry, physics, biology and microbiology of water
- Ecology of aquatic systems
- Drinking water and wastewater treatment technologies
- Sustainable management of water supply and resources and of the water environment

Together, the ETHs and the RIs share the responsibility to fulfill the mandate of the ETH Domain in education, research, and service. The ETHs and RIs are the operational units of the ETH Domain. As autonomous institutions, the ETHs and RIs develop strategies for each individual institution; they also participate in and support the development of the shared strategy of the ETH Domain.

¹ According to the Verordnung des ETH-Rates über die Forschungsanstalten des ETH-Bereichs (414.161), these areas are: Chemie Physik, Biologie und Mikrobiologie des Wassers; Ökologie aquatischer Systeme; Wasser- und Abwassertechnologie; Beziehungen zwischen Wasser, Gesellschaft und Natur; nachhaltige Bewirtschaftung des Wassers und der Gewässer. The German text is definitive.

1. Water: Direct Human Needs and Ecosystem Function

Water is a basic necessity of life and also underpins a wide variety of human activities, from food production, energy generation, and transportation to advanced industrial manufacturing. In addition, water is a critical component of the ecosystems that provide direct and indirect services to society – in the form of fish habitat, recreational venues, climate moderation, and assimilation of wastes including the carbon dioxide released by fossil fuel combustion.

Water resources are subject to stress in many regions of the world. This stress is anticipated to increase as a result of increasing population pressures, urbanization, and energy demand and changes in dietary consumption patterns, land-use and global climate. Historical practices in water use, water resource management, and water infrastructure development have often exacerbated this problem, but at the same time, leave ample opportunity for improvement.

The issues of water availability and quality must be addressed at multiple scales – local demand, regional climatic patterns, migration of invasive species via trans-boundary waters and international trade, and the global implications for economic development and food supply all represent different facets of sustainable water management. There is an urgent need to strengthen the scientific basis for decision making such that competing demands and pressures on the water environment can be balanced and mitigated.

The impacts of human activities on the environment are so extensive and pervasive that the traditional distinction of “natural” versus “engineered” is no longer meaningful. Rather, it is necessary to adopt an integrated view of the water environment that encompasses various levels of control, impact, and function as a basis for informed management decisions. The major challenge for the future will be to meet direct human needs for water while preserving the capacity of the water environment to provide ecosystem services.

Over the period 2017-2020, Eawag will pursue major initiatives in three strategic areas:

- Water for Human Welfare. Eawag will prioritize activities relating to **sustainable urbanization**, specifically through research on the urban water cycle that links water management to other issues including energy and resource recovery. Research in the Swiss context will benefit from collaboration with Empa (and other ETH Domain institutions) on the modular experimental building NEST (Next Evolution in Sustainable Building Technologies). Eawag is initiating a new strategic program (see section 4.1) that will link activities in NEST with research on decentralized technologies in industrialized and low- and middle-income countries.
- Water for Ecosystem Function. In the period 2013-2016, Eawag invested in new mesocosm facilities that provide an important link between laboratory and field studies of ecosystem structure and function and also initiated an internal Strategic Program (EcolImpact) to study the effects of micropollutants in complex ecosystems. Eawag will continue these activities and further expand its capacities for **integrated field experiments and observations**. This effort will be fostered by the anticipated appointment of a joint professor in Remote Sensing of Water Systems with the University of Zurich. These activities will provide rich data sources that Eawag will exploit through model-based analysis.
- Strategies for Making Trade-offs and Resolving Competing Demands. Eawag's continued development of its Department of Environmental Social Sciences (ESS) is a key component of activities in this area. In addition, Eawag plans to complement its traditionally strong focus on discovery by establishing a Center for the synthesis and

integration of scientific and technical knowledge relevant to socio-environmental-technological systems (SETS).

These priorities will guide Eawag's activities and provide a strategic basis for the allocation of its resources over the next planning period.

2. Vision, Scope and Mandate

Eawag's efforts are based on the vision of a sustainable balance between meeting direct human needs for water and preserving the capacity of the water environment to provide ecosystem services. Because of its strengths in aquatic science and technology and expertise in transdisciplinary research, Eawag is uniquely suited to provide leadership in the solution of problems related to the water environment. The challenge for Eawag is to direct its efforts most productively, that is, to focus its scientific research on questions that will lead to fundamental advances in the aquatic sciences, to focus its engineering on important societal needs, and to maintain the bridge between theory and practice that is needed to implement novel concepts within society.

Eawag espouses an integrated view of the water environment, which is hereby taken to encompass the continuum from relatively unperturbed aquatic ecosystems to fully engineered water and wastewater management systems. Eawag's focus is on the chemical, biological and physical integrity (i.e., quality) of water and their impacts on aquatic ecosystems and human health, recognizing the inherent links between water quality and quantity. Eawag affirms the principle of sustainable development in the management of the water environment and recognizes that this can only be achieved through national and international partnerships between researchers in the natural and social sciences and engineering and the broader society. Furthermore, Eawag recognizes and responds to the need for innovative research in aquatic science and technology to support the sustainable management of the water environment in industrialized, emerging and developing countries.

In the domain of water science and technology, Eawag has a mandate with three major facets – research, education and expert consulting. In the first of these three areas, Eawag pursues high-impact research, i. e. basic research leading to fundamental advances in theory, and applied research introducing radical innovations in practice and addressing the critical needs of society. Eawag's research is international in scope, but a key component of its research portfolio addresses issues of immediate concern within Switzerland, as determined in cooperation with the Swiss Federal and Cantonal agencies.

In its educational activities, Eawag supports the Federal Institutes of Technology, Cantonal Universities and Universities of Applied Sciences in formal course instruction and the supervision of student research. In particular, Eawag offers students at the Masters and Doctoral levels an opportunity to participate in large-scale, multi-investigator projects with strong connections to application and practice. Eawag also supports activities in continuing education that are directed to professionals and practitioners and has a strong tradition of training for capacity development in low- and middle-income countries.

In its expert consulting activities, Eawag provides support and guidance for stakeholders, practitioners, industry, government and politics through projects that address practical problems and implement solutions, as well as through continuing education for practitioners and service on expert committees and advisory boards. In addition, Eawag hosts several platforms (see section 3.3.1) to inform and advise stakeholders and to foster dialogue.

The results of research conducted at Eawag, including the development of novel concepts, methods, and technologies, are disseminated by various means, such as technical publications and presentations and teaching. Consulting and expert services also provide a venue for knowledge transfer, particularly to professionals and practitioners. This is also accomplished through participation of Eawag researchers in core activities (including conferences, continuing education programs, and development of guidelines) of the Swiss urban water and environmental associations. Employment of former members of Eawag's research staff (including former Ph.D. students) in non-academic positions is also very important as a means of transferring knowledge and directly influencing decision making.

Outreach to the public and to its representatives in politics and a better public understanding of the science conducted at Eawag is achieved through active and attractive communication of its research projects. Eawag disseminates results and findings through its print publications (e.g. the annual report and factsheets), electronic newsletter, recently-upgraded website and also through the direct engagement of its researchers with stakeholders and members of the public. Eawag also works closely with media representatives who cover science and technology. In addition, Eawag seeks to engage the public in a dialogue on socially relevant topics through the participation of Eawag researchers in events such as the annual "Infotag" and through the involvement of stakeholders in transdisciplinary projects.