



eFlowNews - Volume 6 Issue 3

September 2009

eFlowNet and partners convene seminar on environmental flows and sustainable development at World Water Week 2009



A half-day seminar was convened at World Water Week on August 16th by the Global Environmental Flows Network (eFlowNet) and partners on environmental flows and sustainable development which includes meeting environmental flow requirements, weigh trade-offs, and maximise economic and social welfare.

Environmental Flows have emerged as a conceptual framework and management tool to seek a sustainable balance between river regulation, extractive use, and ecosystem conservation. This seminar aimed to highlight different aspects of environmental flows and brought together a multidisciplinary panel of experts working at the forefront of these issues to explore the latest approaches to meet environmental flow requirements, weigh trade-offs, and sustain biodiversity while maximising economic and social welfare.

Conveners of the seminar included eFlowNet, USAID Global Water for Sustainability Program (GLOWS), Conservation International, Deltares, International Union for Conservation of Nature (IUCN), Swedish Water House (SWH), The Nature Conservancy (TNC), UNEP-DHI Centre for Water and Environment (UDC) and World Wide Fund for Nature (WWF).

Summary of presentations and discussion

An environmental flow regime sustains ecological functions and ecosystem services important for human well being. For example fisheries and recession agriculture feed over 2 billion people worldwide. Extraction of water for agriculture, regulation for hydropower and climate change is altering the flow regime causing the loss of ecosystems and ecosystem services. Implementation of environmental flows can help mitigate negative downstream impacts from hydropower plants. Several guidelines exist for sustainable hydropower; still many projects that are implemented have little consideration of environmental flows. Intensive agriculture is causing a decline in water availability for humans and people, and worldwide 1/3 of the world's population lives in river basins that have to deal with water scarcity. In Pakistan over 90 % of water use is diverted for agriculture and the per capita availability has dropped as well as the annual discharge from Kotri barrage. One litre of water produces on average one calorie of food. There has been a steady increase in global nutritional status during the last decades but large differences exist between regions and between developed and developing countries. The need to feed the world's growing population will put increased pressure on the world's water resources, and in a worst case scenario the water use will double by 2050. However future scenarios improve with more effective water use, such as the introduction of BMP (Best Management Practices) in the Indus basin, upgrading rain fed agriculture and reforming institutions.

Implementing and recognising environmental flows is an important step to ensure future water security. Environmental Flow Assessments have evolved from single target species to more robust models addressing whole ecosystems. Indicator specie, such as Yellowfish in South Africa, can be helpful to better understand the link between different flow scenarios and ecosystem impacts and to gain buyin from stakeholders. In the Savanna River TNC has been working with the Army Corps of Engineers to operate the dams to protect ecological health of the river while addressing the growing needs of people for drinking water and other water uses. Climate change is expected to alter the flow regime and cause changes to the environment, but the specific changes are difficult to predict. Ecosystem management will need to adapt to these rapid changes and this will be made easier by utilizing the natural adaptability of freshwater ecosystems maintained by environmental flows.

The key views and recommendations that emerged from the seminar included:

- 1) Environmental flows are part of the solution to water resource problems and are a fundamental component of sustainable water resources management. Environmental flows result in a wide variety of benefits which improve human well-being. Potential entry points for incorporating environmental flows into existing legal frameworks are Clean Development Mechanism (CDM) projects and environmental impact assessment (EIA) regulation.
- 2) Social aspects should be integrated with scientific knowledge in a more holistic manner in environmental flows. This is important to both upscale successful implementation and increase buy-in of environmental flow approaches by policy-makers. Areas of integration include land management, water integrity, and modern and traditional perceptions of water resource management.
- 3) Environmental flow assessments must consider climate change predictions. There is also a risk of over-simplifying environmental flows requirements with key performance indicators, whereas a range of mechanisms may be needed to capture

the complexity society-ecosystem interactions.

Seminar Programme

Co-chairs: Michael McClain, UNESCO Institute for Water Education (UNESCO-IHE) and Anna Forslund, World Wide Fund for Nature/Swedish Water House

14:00 Welcome and Introduction. Michael McClain, UNESCO-IHE

14:05 **Environmental Flows as a Tool for Hydropower Sustainability. Peter Bergsten, Vattenfall Power Consultant, Sweden**

14:20 **Promoting Best Management Practices in Thirsty Crops – A Solution to Stop Indus Running Dry. Hammad Naqi Khan, WWF Pakistan**

14:35 **Food and Environmental Flows: Strange Bedfellows? David Molden, Deputy Director General, International Water Management Institute (IWMI)**

14:50 **The Importance of Environmental Flows to Biodiversity and Ecosystem Services. Ian Harrison, Conservation International/IUCN & Brian Richter, TNC**

15:05 **The Red Queen is Treading Water: The Problem of Climate Change, Shifting Flow Regimes, and Environmental Flows. John Matthews, WWF**

15:20 Summary. Anna Forslund, WWF/Swedish Water House

15:30 Coffee Break

16:00 Open discussion initiated and motivated by a panel of discussants, including, James Dalton, IUCN, Brian Richter, TNC, and Veronica Strang, University of Auckland.

17:20 Closing. Michael McClain, UNESCO-IHE

17:30 Close of Seminar

Environmental flows and human well-being report launched at World Water Week 2009



"Securing Water for Ecosystems and Human Well-being: The Importance of Environmental Flows" is a joint publication which highlights the service role played by healthy ecosystems in helping water managers meet their goal of maximising the economic and social welfare of all water users in an equitable manner.

Healthy ecosystems simultaneously serve multiple aspects of human well-being, especially among poor communities living close to the land-water interface. Ecosystem services have real economic value today and special importance in mitigating future problems and economic losses related to climate change. To preserve and benefit from these services, the water manager must ensure that an environmental flow regime is maintained in rivers and wetlands.

The goal of the report is to illuminate the role of environmental flows to simultaneously improve human well-being and sustain vital ecosystems. We hope that the reader will come to understand environmental flows as essential to meeting the water management challenges we face today and into the future, including adaptation to climate change.

The report is a joint collaboration between member organisations of The Global Environmental Flows Network (eFlowNet). This includes Swedish Water House (SWH), World Wide Fund for Nature (WWF), Umeå University, International Union for Conservation of Nature (IUCN), The Nature Conservancy (TNC), Conservation International (CI), UNEP-DHI Center for Water and Environment (UDC); UNESCO Institute for Water Education (UNESCO-IHE) and Deltares.

The launch was accompanied by a **press release** and a press event which included a short presentation highlighting key messages.

A pdf of the report can be found **here**.

Paper on the Ecological Limits Of Hydrologic Alteration (ELOHA) published in Freshwater Biology



Leading international river scientists have recently published an article on the Ecological Limits Of

Hydrologic Alteration (ELOHA), where they provide the rationale and practical guidelines for its application.

Ecological Limits of Hydrologic Alteration (ELOHA) is a scientifically robust and flexible framework for assessing and managing environmental flows across large regions, when lack of time and resources preclude evaluating individual rivers. ELOHA systematically translates understanding of the ecological ramifications of human-induced streamflow alterations from rivers that have been studied to rivers that have not, without requiring detailed site-specific information for each river.

N. Leroy Poff, Brian D. Richter, Angela H. Arthington, Stuart E. Bunn, Robert J. Naiman, Eloise Kendy, Mike Acreman, Colin Apse, Brian P. Bledsoe, Mary C. Freeman, James Henriksen, Robert B. Jacobson, Jonathan G. Kennen, David M. Merritt, Jay H. O'keeffe, Julian D. Olden, Kevin Rogers, Rebecca E. Tharme, Andrew Warner. **The ecological limits of hydrologic alteration (ELOHA): a new framework for developing regional environmental flow standards.** *Freshwater Biology* (2009) doi:10.1111/j.1365-2427.2009.02204.x

Abstract

1. The flow regime is a primary determinant of the structure and function of aquatic and riparian ecosystems for streams and rivers. Hydrologic alteration has impaired riverine ecosystems on a global scale, and the pace and intensity of human development greatly exceeds the ability of scientists to assess the effects on a river-by-river basis. Current scientific understanding of hydrologic controls on riverine ecosystems and experience gained from individual river studies support development of environmental flow standards at the regional scale.

2. This paper presents a consensus view from a group of international scientists on a new framework for assessing environmental flow needs for many streams and rivers simultaneously to foster development and implementation of environmental flow standards at the regional scale. This framework, the ecological limits of hydrologic alteration (ELOHA), is a synthesis of a number of existing hydrologic techniques and environmental flow methods that are currently being used to various degrees and that can support comprehensive regional flow management. The flexible approach allows scientists, water-resource managers and stakeholders to analyse and synthesise available scientific information into ecologically based and socially acceptable goals and standards for management of environmental flows.

3. The ELOHA framework includes the synthesis of existing hydrologic and ecological databases from many rivers within a user-defined region to develop scientifically defensible and empirically testable relationships between flow alteration and ecological responses. These relationships serve as the basis for the societally driven process of developing regional flow standards. This is to be achieved by first using hydrologic modelling to build a 'hydrologic foundation' of baseline and current hydrographs for stream and river segments throughout the region. Second, using a set of ecologically relevant flow variables, river segments within the region are classified into a few distinctive flow regime types that are expected to have different ecological characteristics. These river types can be further subclassified according to important geomorphic features that define hydraulic habitat features. Third, the deviation of current-condition flows from baseline-condition flow is determined. Fourth, flow alteration-ecological response relationships are developed for each river type, based on a combination of existing hydroecological literature, expert knowledge and field studies across gradients of hydrologic alteration.

4. Scientific uncertainty will exist in the flow alteration-ecological response relationships, in part because of the confounding of hydrologic alteration with other important environmental determinants of river ecosystem condition (e.g. temperature). Application of the ELOHA framework should therefore occur in a consensus context where stakeholders and decision-makers explicitly evaluate acceptable risk as a balance between the perceived value of the ecological goals, the economic costs involved and the scientific uncertainties in functional relationships between ecological responses and flow alteration.

5. The ELOHA framework also should proceed in an adaptive management context, where collection of monitoring data or targeted field sampling data allows for testing of the proposed flow alteration-ecological response relationships. This empirical validation process allows for a fine-tuning of environmental flow management targets. The ELOHA framework can be used both to guide basic research in hydroecology and to further implementation of more comprehensive environmental flow management of freshwater sustainability on a global scale.

Keywords: environmental flows, hydroecology, hydrologic modelling, river management, streamflow classification

More information on the authors, references, and purchasing details can be found at

<http://www3.interscience.wiley.com/journal/122588390/abstract>

The Colorado Water Conservation Board releases report on the application of ELOHA in Colorado



Water managers, policy makers, stakeholders, and scientists with diverse expertise in Colorado are using Ecological Limits Of Hydrologic Alteration (ELOHA) to accelerate the integration of environmental flows into regional water resource planning and management.

The Colorado Water Conservation Board have produced a report which compares two pilot studies that used statewide flow-ecology curves to estimate ecological risk at individual sites. One pilot watershed (Roaring Fork) is data-rich and has a hydrologic foundation, while the other (Fountain Creek) is data-poor and has only gauged streamflow data. The flow-ecology curves are embedded in a Watershed

Flow Evaluation Tool (WFET), which is a specific application under the broader framework known as the Ecological Limits of

Hydrologic Alteration (ELOHA). According to The Nature Conservancy's Environmental Flows Program Director Eloise Kendy "this is the first documentation of a full-scale ELOHA (mostly) as envisioned by its developers.... within the constraints of a highly charged political context."

The Watershed Flow Evaluation Tool (WFET) helps basin stakeholders assess non-consumptive flow needs by associating flow status with ecological response by stream type. The three major steps in the development of the WFET are: 1) use existing data and expert opinion to develop flow-ecology relationships, 2) develop a hydrologic foundation of daily natural and altered flows, and 3) combine flow-ecology relationships and the hydrologic foundation to assign risk status for specific attributes across entire watersheds at a reach or sub-basin scale.

In this report, the WFET is used to answer two questions:

- How have flows changed from baseline to existing conditions?
- How do these flow changes relate to ecological changes or risk?

Camp Dresser & McKee Inc., Bledsoe B. D., Miller W. J., Poff N. L., Sanderson J. S. & Wilding T. K. (2009) *Watershed Flow Evaluation Tool (WFET) Pilot Study for Roaring Fork and Fountain Creek watersheds and site-specific quantification pilot study for Roaring Fork watershed (draft)*. Colorado Water Conservation Board, Denver, CO. Available at <http://cwcb.state.co.us/IWMD/COsWaterSupplyFuture/>

For more information on **ELOHA** in Colorado, consult the **ELOHA** case study [database](#).

Water users in Michigan access new tool to see impacts of withdrawals



Since July 2009, prospective water users in Michigan State, USA can access an online decision support system known as the Water Withdrawal Assessment Tool (WWAT) to determine whether their proposed withdrawals, combined with the cumulative impacts of all upstream water uses, will degrade fish communities in excess of the allowable amount.

WWAT is designed to estimate the likely impact of a water withdrawal on nearby streams and rivers. Use of this tool is required of anyone proposing to make a new or increased large quantity withdrawal from the waters of the state, including all groundwater and surface water sources, prior to beginning the withdrawal. WWAT is linked to a ground water and surface water model, which is in turn linked to flow-ecology curves. Scientists developed the curves, and stakeholders decided how much ecological degradation to allow. For more information on WWAT, please consult <http://www.miwwat.org/> or the ELOHA case study [database](#).

Update on the Jordan River Rehabilitation Project



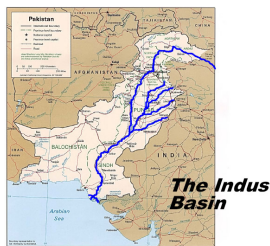
As part of Friends of the Earth Middle East's (FoEME) Jordan River Rehabilitation Project, FoEME has partnered Israeli, Jordanian and Palestinian experts in a study which aims to propose a range of environmental flows necessary to rehabilitate the Lower Jordan River.

The Environmental Flows Study is undertaking hydrological, botanical and biological sampling in five zones over two seasons (winter and summer) comparing the findings to historic data. This study is detailing both the quantity and quality of water flows required to maintain a healthy river and nurture fauna and flora along the banks and flood plain of the Jordan River Valley.

The **project** conducted a second round of biological, hydrological and botanical sampling of the Lower Jordan River as part of the project's **Environmental Flow Study**. The team of Jordanian, Palestinian and Israeli experts visited five rarely accessed locations between the Sea of Galilee and the Dead Sea uncovering a river in critical condition **measuring a mere 30 cm deep** in its southern sections and raising fears that the Jordan River will cease to flow in the remaining summer months. To see pictures from the study tour, please visit the [Jordan River Environmental Flows Photo Album](#).

Visit the [Jordan River press coverage page](#) for recent articles from Reuters, Swiss News World Wide, Bester News and EbioAnt.

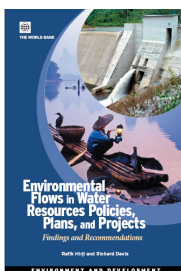
The Jordan River Rehabilitation Project is supported by USAID, the Richard and Rhoda Goldman Fund, the Green Environment Fund and the Global Nature Fund/ Ursula Merz Foundation. This project provides a concrete step towards building support among decision makers in Jordan, Palestine and Israel to rehabilitate the Lower Jordan River. FoEME understands that a regional approach which brings all sides to act together, is a pre-requisite for gaining the political support for returning fresh water flows to the Lower Jordan River. For more information on this study please visit Friends of the Earth Middle East's website at www.foeme.org.



WWF Pakistan, in cooperation with WWF UK, is currently working on the development and refinement of water policy reform objectives for the Indus Basin in Pakistan.

This includes a range of water policy areas, including: the national and provincial water resources management policy and institutional framework; policies relating to allocation of water, in particular in the agricultural sector; water infrastructure management policy; and environmental flows policy. **Saafconsult**, a Dutch consultancy firm specialised in water resource management work, has been tasked by WWF UK to assist with the development of these objectives. Drawing from the many publications of lessons learned and international case studies, mainly from the **Global Environmental Flows Network**, proposals are being developed on how to include environmental flows into national policy and practical applications.

World Bank reports on environmental flow policy, plans and projects are now available



Two publications on environmental flow policy, plans and projects produced by the World Bank have been launched to address a fundamental shortcoming in most water resource investments as well as planning and policy reforms to date, particularly, the inadequate protection of environmental flow conditions in rivers, lakes, wetlands, estuaries and groundwater systems.

Adequate considerations of freshwater ecosystems and integration of environmental flows are also glaringly absent in most ongoing global and regional debates on and adaptation responses to climate change in water resources planning and management.

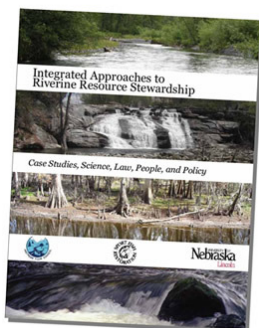
The first publication '**Environmental flows in water resources policies, plans and projects: findings and recommendations**' advances the understanding and integration in operational terms of environmental flows (water allocation) into integrated water resources management (IWRM). It draws heavily from an in-depth analysis of 17 global - Bank and non Bank supported - case studies from Northern Aral Sea (restoration project), Australia (Water Reforms and Pioneer catchment), Canada (Bridge River Water Use Plan), China (Tarim Basin), European Union (Water Framework Directive), Florida (Water Management Policy), India (restoration of Chilika Lagoon), Lesotho (LHWP), Mekong River Basin, Senegal River Basin, South Africa (Water Policy, Kruger Catchment, and Berg Dam), and Tanzania (Water Policy, Pangani Basin and Lower Kihansi Hydropower Dam).

Based on the 17 global water policy, plan, and project case studies, the book addresses the highly contested complexities of environmentally responsible water resources development, broadens the global perspectives on "equitable sharing" and "sustainable use" of water resources, and expands the definitions of "benefits sharing" in high-risk water resources development. Hardcopies are available from the **World Bank bookstore** or from **Barnes and Noble** or **Amazon**.

The second Bank publication, '**Environmental flows in water resources policies, plans and projects: case studies**' is an Environment Department Paper (No. 117) under ENV's Natural Resources Management series. A hardcopy of the case study report can be obtained by sending an email to Ibampadde@worldbank.org.

Both publications are joint products of the Sustainable Development Network's Environment Department and Energy, Transport and Water Department. Their preparation was supported by many individuals from the World Bank and many institutions worldwide listed in the acknowledgments.

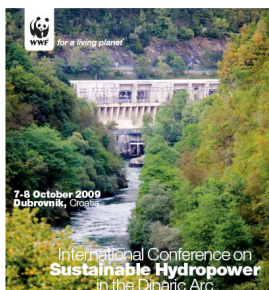
Riverine Resource Stewardship publication launched by the Instream Flow Council (IFC)



"*Integrated Approaches to Riverine Resource Stewardship – Case Studies, Science, Law, People and Policy*" (Locke, et al, 2009) explores IFC's recommended "eight ecosystem components" for instream flow work, as applied in eight case studies from the U.S. and Canada.

The newly released publication responds to the broad call for "examples" of how to plan and conduct instream flow decision-making by detailing the processes, tools, and lessons from flow projects on the Campbell (BC), Cedar (WA), Dungeness (WA), Housatonic (CT), Peace (FL), Platte (NE), Terror (AK), and Trinity (CA) rivers.

In addition to the case studies, legal experts will find an extensive treatment of instream flow laws across the US and Canada, managers and researchers will find ideas for monitoring, training and research, and the "Advancing the State of the Practice" chapter should be valuable to even the most seasoned instream flow experts. See www.instreamflowcouncil.org to order, and please pass this information along to your colleagues in agencies, universities, the private sector, and stakeholder groups that could benefit from this book. Whether you're an instream flow practitioner, water manager, attorney, conservation advocate, project proponent, or citizen stakeholder, portions of this book will help you better understand and effectively participate in water management decision-making.



A conference on sustainable hydropower in the Balkans is being organized by WWF with the support of World Bank, IHA and GWP from the 7-8 October in Dubrovnik, Croatia.

The conference will gather key stakeholders in dam development and operation in the region. Participants will discuss the potential of enhancing the sustainability of hydropower schemes through the adoption of environmental standards, including the concept of environmental flow. Examples of sustainable hydropower and innovative approaches from around the world will be presented with a view to supporting informed and science-based choices and achieving sustainable solutions for the region.

Click the following to find the **conference announcement**, a **provisional agenda**, a **registration form** as well as **practical information** for more details. Accommodation, all conference sessions and most meals will be in Hotel Lapad. Further information on practical details is available on the **conference webpage**. Do not hesitate to contact **WWF MedPO** offices (conference@wwfmedpo.org), for any further enquiry.

No energy without water security, IUCN tells hydropower congress



When looking at the links between hydropower and climate change, it is essential that any infrastructure - whether man-made or natural - is made more sustainable and therefore resilient.

Mark Smith, Head of IUCN's Water Programme, also described the Water and Nature Initiative (WANI) and the development of a global network on environmental flows (**eFlowNet**), encouraging the participation of the hydropower industry. He stressed that energy and water security are interdependent, and that basins must be managed to ensure resilience to climate change.

For more information on IUCN's work on the water-energy nexus, you can read the brief note **Knowing the wealth of water before the well is dry: Learning from the environmental world on water-energy links**.

For more information on this event: <http://www.iisd.ca/yimb/hydro/iha2009/> and <http://www.ihacongress.org/>

Proceedings of the Workshop 'Nuts & Bolts of Flow Re-Allocation' at the International Environmental Water Allocation Conference



A pre-conference workshop "Nuts & Bolts of Flow Re-Allocation" sponsored by IUCN, The Nature Conservancy and WWF was held on Feb 22nd to kick off the International Environmental Water Allocation conference held in Port Elizabeth in February 2009.

International Environmental Water Allocation conference

A number of interactive discussions, panelists and workshop participants addressed how reallocating water to the environment means there is a need to change existing patterns of water use and management. Different approaches were presented ranging from the use of water markets to decisions made by the regulatory authority.

A summary of the workshop discussion is provided below and click here to read the **full document [pdf]**.

Summary

Environmental flows have gained increasing recognition in water-stressed regions where the limits to hydrologic alteration and extraction have been recognized often only after they have been exceeded. The concept of basin closure describes the process of reaching or surpassing these limits; as a basin closes, shifting values and demands for water must be addressed by reallocating water from existing uses to protect other water users from involuntary losses and to preserve or enhance environmental flows. Flow reallocation is an approach to implement environmental flows by reallocating water from existing users when overallocation produces a temporary or permanent deficit in environmental flows.

Workshop panels generated a set of key findings and conclusions about

- (a) frameworks for flow reallocation and
- (b) lessons learned from efforts to design and implement flow reallocation programs.

The *framework session* concluded that flow reallocation is unlikely to occur at the necessary scale without wider water governance reforms. Reforms should address institutional shortcomings, define environmental flow requirements, and incorporate appropriate collaborative and market-based institutions to reallocate water for environmental flows.

- Institutional barriers to flow reallocation – unclear property rights, high political and economic costs, and weak institutional capacity – reinforce the need to generate political resolve to address environmental flows as part of wider water governance reform.
- Quantifying environmental flow requirements enables assessment and implementation at multiple scales and requires substantial financial, stakeholder, and scientific resources. Holistic methods for assessment support an iterative and adaptive approach to quantify environmental flow needs with limited resources.

The session on *implemented cases* surveyed experience with flow reallocation in the Columbia Basin, U.S-Mexico border, and Australia. Although these cases are at different stages of reform and involve different blends of collaborative and market-based mechanisms for reallocation, a set of shared lessons and key differences clarify constraints and opportunities for flow reallocation.

- Collaborative governance is a common feature of all cases and has proven integral to the: recognition and specification of environmental flow needs, establishment of caps on water extraction, reform of water rights regimes to limit access to freshwater and legitimize the environment as a water use, development of authority and capacity to transfer reliable water rights for environmental purposes, and commitment to avoid or offset negative impacts to communities and other water users.

Requesting information on the impacts of fish due to dam operations



One of the issues associated with flow regulation is the incremental mortality associated with fish stranding as a result of dam operations. We are interested in the experience of others with this issue with particular interest in data obtained quantifying impacts on populations of fish and measurements of the effectiveness of changing operations, such as ramping rates, on reducing impacts and the resulting effect on fish survival or abundance.

Any additional methods at mitigation or avoidance of stranding would also be of interest. Information sources can be from published or grey literature, or summary of ongoing investigations. Please contact Dr. Dana Schmidt at dschmidt@golder.com with any information that may be pertinent.

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Contribute to the next eFlow News update - November



We want to get your input for the next eFlow news update. Please send us your information by October 21.

We want to share more information on what you are doing on environmental flows, including:

- summaries from past events
- upcoming events
- announcements of projects, partnerships
- highlights of new reports, tools, projects
- proposed discussions

Please send all information to Stefano Barchiesi at StefanoBarchiesi@eflownet.org.

We look forward to hearing from you!

eFlowNet team

