ONGOING AND PROPOSED ELOHA RELATED PROJECTS, UPDATED APRIL 2011

Location, Date	Project Title	Science	Policy	Staff	Purpose	Objectives	Methods / Databases	Funding	Progress	Monitoring	Documents	Date up-dated
Arizona (Verde River). Phase I completed Jan 2008. Phase II Oct 2007-Jan 2009 data will be integrated into Phase III: a basin-wide study with USGS	Verde River Ecological Flows Study Phase III: Science to Support Sustainable Water Management	X		Jeanmarie Haney, Dale Turner, Dan Campbell, TNC-AZ; Anne Brasher USGS biology; Steve Wiele USGS hydrology.	Provide a scientific foundation for ecologically sustainable water management: Improve flow alteration-ecologic response science for a semi-arid watershed; develop quantified relationships; develop techniques and methods that can be applied more widely across the Southwest	Phase III: • Establish baseline flow conditions for the Verde River Watershed at gaged sites • Assess flow alteration (diversions, GW pumping, etc.) • Estimate actual (altered) flow vs. unmodified flow • Develop tools to estimate flow at ungaged sites • Monitor shallow groundwater near the river • Determine seasonal variations in agricultural return flows • Incorporate geomorphological and watershed characteristics • Develop watershed model incorporating surface water/groundwater components • Determine flow-ecology relationships	Hydrologic analyses of streamflow (regression; HIT/HAT/streamstats); integrated sw-gw modeling; geomorphology and instream habitat characteristics; flow-ecology models (hydrologic indicators/multi-variate analyses);	Phase 3A (first 2-year USGS contract): $350,000 (two years of USGS funding); Phase 3B (second 2-year USGS contract) has not yet been scoped.	On track for completion of Phase IIIA end of 2012.	See "Methods/Databases". Study sites will be permanently marked for repeat measurements		Mar-11
Colorado - Fraser River watershed, April 2006 - Dec 2007	A preliminary flow template for high-gradient, subalpine streams in the Fraser Watershed	X		John Sanderson (TNC). Workshop: Tom Iseman, Tim Sullivan David Harrison (TNC); LeRoy Poff (CSU), Steve Dougherty (ERO - riparian veg), Denver Water	Help Denver Water reduce ecological impacts of multiple diversions from Fraser River tributaries	Table of 4 levels of ecological condition and 7 associated flow parameters, as hypotheses for further investigation. Jan 2008 mtg concluded template development, discussed spring 2008 pilot implementation.	Natural and current flow data for 6 sites: Denver Water's PACSIM model. Flow alteration: IHA. Flow-ecology relations: Denver Water/TNC workshop 7/06/06. John calc'd monthly flow surpluses, deficits for each site for each level of ecological condition.	Private donation to TNC	Used flow assessment tool as basis for spring 2008 spill recommendations, but don't know whether Denver Water actually changed water management.	Not specified.		2008

Colorado Watershed Flow Evaluation Tool 1/15/2008 - 12/31/2008. W & E slope pilots, ~3750 km2 ea.	Environmen-tal flows char-acterization for the non-consumptive needs assessment	X	X	John Sanderson, coordinator; Tom Iseman (TNC) LeRoy Poff, Brian Bledsoe (CSU), Charles Wilding (CSU grad student), Nicole Rowan (CDM), Bill Miller (FET [Flow Evaluation Tool] consultant)	Provide a means for assessing flow status for specific attributes (e.g., native fish, cottonwood forests) within a stream type	Use existing data and expert opinion to develop flow-ecology curves. Develop a hydrologic foundation of daily natural and altered flows. Assign risk status for specific ecological attributes at a reach or sub-basin scale.	20-yr baseline and current flows for gaged and ungaged sites: existing Colo. River Decision Support System (CDSS) StateMod. Stream classification: TBD. 1-2 day peer-review workshop. Will calc flow alteration throughout study area at 1:100K (preferred) or larger scale.	~$70K + ~ $30K in-kind for pilots. CO Water Conservation Board hired CDM, which sub-contracted Bledsoe & Poff as part of state-wide water avai-lability study. Additional $ for western slope.	Pilot projects completed (CDM et al, 2009). Next: extend to entire west slope (where hydro foundation exists). Provide to basin roundtables for nonconsumptive needs assessmt.	Not specified.		2009
Generalized Water Supply Modeling including Connecticut Case Study, 2006-2010	Integrating Water Management and Ecological Flow Requirements (including a case study to support CT e-flow standard)	X	X	Mark P. Smith, Colin Apse (TNC); Richard M. Vogel (Tufts U.), Jack Sieber & Brian Joyce (SEI), Stacey A. Archfield (Tufts University/USGS)	Inform Connecticut instream flow regs to implement 2005 law requiring streamflow std based on natural flow variability.	Quantified tradeoffs btw different water mgmt objectives for storage releases from reservoirs, considering drought mgmt and conservation. Assisted the development of default reservoir release rule to protect aquatic resources statewide.	Generalized (not geographically based) WEAP model takes unregulated flow data and translates proposed environmental flow policies into regulated hydrographs and water availability indicators in relation to reservoir storage ratio.	Analysis using WEAP model and case studies funded by EPA Collaborative Sustainability Network grant $287,000.	Completed	N/A	See details & papers at: http://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/7546/report/0; obtain EPA Final Report & CT Case Study by request to Mark P. Smith mpsmith@tnc.org	Mar-11
Connecticut River Basin (VT, NH, MA, CT), began in 2008	Connecticut River Basin Sustainable Water Management modeling: includes unimpaired flow simulation and dam operations modeling	X		Kim Lutz, Julie Zimmerman, Colin Apse (TNC); Chris Hatfield, Townsend Barker, John Hickey, Woody Fields, (USACE), Ina Ferguson (Consensus Building Institute), Stacey Archfield (USGS)	Improve basin water management for multiple goals through re-operation of multiple dams. To be informed by flow-ecology relationships & target floodplain restoration sites.	Improve basin water management for multiple goals through re-operation of multiple dams. To be informed by flow-ecology relationships & target floodplain restoration sites.	Routing model (John Hickey). Flow synthesis: Modified QPPQ (See Massachusetts, below). Sediment (in selected locations): Dartmouth University NSF grant. Julie Zimmerman (TNC) modeled sub-daily flows to assess hydropower impacts, and constructed flow-ecology relationships using conceptual models and statistical methods.	Federal GI Study, $723,000 appropriation to the USACE as of FY10, awaiting FY11-12 appropriations, TNC has secured a $1.5 million private donation for the non-federal share	Stakeholder assessment complete (2009), simulation model for basin competed (2/2011) model calibration in progress, optimization model (LINGO) completed (3/2011), model calibration in progress, SYE model complete, web-based application in progress, Environmental Flow Workshop developed flow scenarios	Baseline data at 91 floodplain sites completed, baseline geomorphic study in two tributaries. Elevation, marked and ID'd tree spp along x-sects, soil, water levels, invasive spp, floodplain forest descriptions.	TNC-generaed documents on http://conserveonline.org/workspaces/ctriver	Mar-11

Magdalena River Basin, Colombia. (Jan 2010 - Dic 2010	ELOHA to prescribe environmental flows in the Magdalena River basin, Colombia	x		**From TNC:** Patricia Téllez, Tomas Walschburger, Rebecca Tharme, Paulo Petry, Jose Yunis , Juan Carlos González **Consultants:** Francisco Guerrero Angelica Ramírez, Cesar Cardona, Jaime Moreno, Federico González, Nelson Obregón, Eder Cárdenas Cárdenas, Cesar Garay, Juan Pablo Macías	Define citeria for flow regulations	Apply ELOHA framework in the Magdalena Basin. Identify pilot watershed to design and implement a monitoring plan; support the Enviromental Ministry to define criteria for implementing the environmental flow regulation law.	Hydrological Foundation: IHA, statistical analysis using MATLAP; river clasification by principal components analysis and clustering programing in MATLAP. Compiling ecological and hydrological databases. Next phase: Create decision support system using WEAP.	USD 250.000. : 159.000 from the Environmental Ministry and 92.000 from TNC. (Does not include WEAP modeling)	First phase allowed hydrologic characterization, river type classification (23 families of river types). Currently building hypotheses of flow- ecology relationships and "Ecological – flow curves" for each river type.	Not yet		Mar-11
Massachusetts , 2006-2011	Several: incl Sustainable Yield Estimator, MA Index Streamflows Guidance, USGS flow-ecology projects	X	X	Colin Apse, Mark Smith, Alison Bowden (TNC); Stacey Archfield, Dave Armstrong (fish), Peter K. Weiskel (USGS); private, fed, state govt & legislature involved.	Tools to improve state water management; informing 2010-11 Sustainable Water Management Initiative, a state-led administrative process; legislation also filed to establish instream flow standard statute (Sustainable Water Resources Act)	USGS's Sustainable Yield Estimator (SYE) is a water management decision support tool that simulates existing and current hydrologic conditions at a daily time scale. Index Streamflows help identify stressed basins. Flow-ecology relations designed to inform water decision making	SYE = "hydrologic foundation." Flow data: Modified QPPQ plus water use information. Instream flow goals can be incorporated into SYE. Index streamflow guidance completed. Dave Armstrong (USGS) et al linked fish community data (fluvial fish relative abundance) to percent alteration of August median flow, categorized for watersheds statewide using biological condition gradient approach	Several MA state resource agencies funded USGS to develop the SYE software, ~$450,000. Other state funding for flow-ecology investigations and index streamflow guidance	SYE; "MA Water Indicators"; phase 1 of "fish and habitat study" (flow and impervious cover) completed 2010; phase 2 of "fish and habitat" (more variables including dams) underway	None specific to SWMI; MA DFW has extensive statewide database of fish sampling locations used as baseline, continued annual sampling of fish communities planned	Weiskel et al 2010, USGS SIR 2009–5272 (http://pubs.usgs.gov/sir/2009/5272/); Archfield et al 2010, USGS SIR 2009–5227 (http://pubs.usgs.gov/sir/2009/5227/); Armstrong et al 2010, USGS OFR 2010–1139 (http://pubs.usgs.gov/of/2010/1139/); see also http://www.mass.gov/?pageID=eoeeasubtopic&L=4&L0=Home&L1=Air%2c+Water+%26+Climate+Change&L2=Preserving+Water+Resources&L3=Sustainable+Water+Management&sid=Eoeea	Apr-11
Chiapas, Mexico	Environ-mental flows for Chiapas costal watersheds	X		Nélida Barajas, Alejandro Hernandez, Manuel Morales, Rebecca Tharme (TNC)	Demonstrate ELOHA in Mexico.	Propose at national level the use of ELOHA to estimate environmental flows, using Chiapas as pilot project	GIS-complete. Hydrological data compilation: obtained daily streamflow data for fifteen sites. Literature compiled	none	GIS developed and information compiled	None specified.		Apr-11

Michigan, 2/28/06 - 7/1/07	Water Withdrawal Assessment Process, Screening Tool, and Impact Assessment Model	X	X	Paul Seelback (MDNR); David Hamilton (MDEQ) James Nicholas (USGS); Groundwater Conservation Advisory Council of 17 voting stakeholders (see report p. 41); Rick Bowman (TNC)	Manage large water with-drawals using scientific basis for decision making as per legislative mandate and Annex 2001.	Withdrawal assessment tool to be used by person proposing large withdrawal to determine adverse impact on water resources. Council translated flow reduction - fish population curves for 11 stream types into screening rules.	Streamflow withdrawal (GW & SW), & fish community models linked thru GIS. 11,000 stream segments. "Index" (median August) flow at 132 long-term gages. Index flows for ungaged sites extrapolated from gaged flows and watershed characteristics. Long-term MDNR, UM, and USDA-FS fish-abundance data for ~1,700 sites.	$500,000 funded by state legislature.	6/08 law passed creating the nation's first eflows manage-ment system, which uses flow alteration-ecological response computer application for permitting water withdrawals.	Recommend ed 5-yr model updates; continue & expand flow gaging; begin statewide GW monitoring; measure 5 environment al, 3 economic, 3 social		
Minnesota 2010-11	Developing Ecological Criteria to Support Environ-mental Flow Protections in Minnesota	X	X	Kristen Blann and Phil Gerla (TNC)	Define flow ecology relationships to support existing policy and develop tools for assessing cumulative impacts	Phase I: Literature review, flow-ecology hypotheses; research proposals. Phase II: (a) Quantitative flow-ecology analysis; (b) Development of online water withdrawal screening tool; (c) development of integrated land use-water use management tool for pilot watershed/priority landscapes (e) development of white paper on ELOHA for integrated river, lake and wetland systems (lentic ELOHA)	MPCA biological assessment (IBI) database, USGS and MN DNR hydrologic data; plus site-based studies published in literature	$100K	Consensus on need established among partners, almost all elements moving forward very slowly for proposing future work.	To be combined with statewide biological assessment data	All available online at http://conserveonl ine.org/workspac es/mn-ecohydro/ (click on "files and pages")	Mar-11
New York Great Lakes drainage. (Jan. 15, 2011 - Dec. 31, 2012)	Instream flow recommen-dations for the Great Lakes Basin of New York and Pennsylvania.	X	X	David Klein, George Schuler, Colin Apse (TNC); Mark Woythal (DEC); Bill Fisher (NY Cooperative Fish and Wildlife Research Unit, Cornell U.); hydroecologist to be hired	Develop an objective process for evaluating ecological impacts of new withdrawals of water from tribs of Lakes Erie and Ontario, and the upper St. Lawrence, with flow recommen-dations	Stream classification, flow requirements and hypotheses of response to flow alteration based on expert judgment, test hypotheses of flow alteration with existing databases and data from gaged streams, formulate flow recommendations for each stream type, based on expert judgement, final report to DEC	Stream classification using HIP, literature review and expert judgment to formulate conceptual models of flow requirements, assess degree to which most-disturbed streams differ from least-disturbed using USGS simulations of monthly mean flows, test hypotheses of flow alteration response with state fish and macroinvert databases, formulate flow recommendations for each type of stream based on expert input	RCN grant $100,000, foundation grants totaling $80,000 to date, additional foundation grant of $100,000 supports USGS Streamflow Estimator Tool (SET) work	Completing contract with Cornell, searching for hydroecologist to be based at Cornell, preparing for first expert workshop, USGS Great Lakes Center is completing monthly simulations, USGS-NY preparing to begin statewide SET			Mar-11

Ohio Lake Erie Basin Streams. Science completed 2010. Report near completion.	Great Lakes (GL) Compact Implemen-tation - Ohio Lake Erie (LE) Streams	X	X	John Stark, Anthony Sasson, Adrienne Dziak (TNC), Midwest Biodiversity (Contractors)	Protect low streamflows in the Lake Erie basin as demonstration project for statewide flow protection.	1) Ensure science- based low-flow protections for Lake Erie Basin, 2) ODNR adoption of hybrid ELOHA Tool, 3) Eventual expansion to Ohio R Basin	Tiered segment classification using state ALU classes and upstream catchment area. Baseline hydrology from USGS gages and regression models to ungaged sites. Fish, mussel, and invertebrate sens. species loss curves from quantile regression using 3,100+ paired ecological collections during 1977-2009.	$120,000 total (80,000 TNC, 40,000 Smith Foundation)	Modeling completed, Report in Progress. State workgroup deadlocked on "sensitive" stream protections	Project design and modeling selected to utilize existing state ecological collections (5 yr intervals)	2010
Oklahoma, Multi-year proposal	Instream flow management for people and nature: a proposal to the Oklahoma Water Resources Board	X	X	Mike Fuhr, Ellen Tejan (TNC), Rachel Esralew (USGS), Jerry Brabander (USFWS), Bill Fisher (OSU). OWRB contracted USACE, which contracted CDM consultants to update the water mgmt plan.	Integrate environmental flow protection into ongoing update to statewide comprehensive water mgmt plan	Stream prioritization for eflow prescriptions; stream classification; flow-ecology relns by class; proposed limits of hydrologic alteration; hydrologic foundation; site-specific eflows for 1-2 rivers; eflow recom-mendations; eflows method decision tree.	Prioritization: TNC Stream Conservation database. Stream classes: HIP, using gaged "baseline" sites only, combined with fish data. Methods and data for other steps not specified.	$200,000 private donation for river prioriti-zation. $75K? from Oklahoma Water Research Resources Institute to Bill Fisher for HIP.	Bill Fisher is doing HIP. Ellen Tejan left TNC in May or June 2008. Her replacement will prioritize rivers for site-specific eflows assessments.	None specified.	
Pennsylvania (with Susque-hanna River basin pilot project). Report finished June 2008.	"Developing instream flow criteria to support ecologically sustainable water resource planning and management"	X	X	Michele DePhilip, Colin Apse, Mark Smith, Julie Zimmerman, Ron Ramsey (TNC). USGS- Ft. Collins. Sponsor: PA DEP and PA Instream Flow Technical Advisory Committee (TAC)	Review methods and costs for statewide flow management. Recommend tools, models, and approaches to improve PA's instream flow protection	Statewide database of index gages and hydrologic classification of streams statewide. Flow alteration - ecological response curves for Susquehanna macroinverts. Major report with reviews, case studies, costs, recommendations. Developed in collabor-ative process w/ state, fed agencies; basin commis-sions (TAC)	Literature review by TNC staff with partner assistance. Stream classification & flow stat selection via HIP w/ USGS (including EFCs) and spatial transfer of classification to ungaged sites by TNC. Statewide withdrawal data and flow statistics from USGS and DEP used to calculate withdrawal index (percent of 7Q10) linked to macroinverts. Macroinvert data from Susquehanna Basin Commission.	Pennsylvania Growing Greener Environmental Stewardship and Watershed Protection Grant $109K. SRBC will likely fund ecological flow recommendations for sub-basins.	Report completed 6/30/08. Five stream types defined, based on 71 hydro stats for 136 relatively unimpaired gage sites. Linear relationships identified between aquatic inverte-brate metrics and withdrawal index for 298 sites.	None specified.	

Pennsylvania, **PROPOSAL**	Development of Baseline Hydrologic Conditions in Pennsylvania for Sustainable Water Planning and Management	X	X	Michele DePhilip, Colin Apse, Ron Ramsey (TNC); Curtiss Schreffler, Ed Koerkle (USGS); Susquehanna River Basin Commission.	Develop and implement an approach to synthesizing baseline hydrologic conditions at a daily time scale across Penn.	Identify index gages and method for translating to ungaged sites; implement statewide baseline hydrologic condition estimator; At least 20 years of synthesized daily flow data	Daily unimpaired flow at ungaged sites: probably modified QPPQ. Susquehanna has OASIS and HSPF models.	UPDATE		None specified.		
Potomac River basin ESWM-ELOHA hybrid, non-Coastal Plain Potomac watershed, April 2009 - Feb 2012	Middle Potomac River Watershed Assessment: Potomac River Sustainable Flow and Water Resources Analysis	X	X	Stephanie Flack (TNC), Carlton Haywood (Interstate Commission on the Potomac River Basin), Claire O'Neill (USACE-Baltimore District), Rob Burgholzer (VADEQ)	To protect and restore natural, seasonally variable flow regime in the mainstem Potomac and its tributary streams through a basin-wide environmental flows assessment.	Develop empirical flow alteration-ecological response relationships for smaller streams and gather expert input and best judgement towards defining more quantitative large river flow needs for two large tributaries and three large river segments (from Shenandoah confluence through tidal freshwater Potomac).	Hydrologic foundation -- modification of Chesapeake Bay program v.5 HSPF model, calibrated and refined to model baseline (relatively intact), current, and projected future flows for 719 sub-watersheds with biological datapoints. Biological dataset --- Database of water quality, habitat conditions and biometrics originally used to develop the Chesapeake Basin-wide Index of Biotic Integrity ("Chessie B-IBI"). IHA and HIT packages used to determine hydro alteration statistics. Apr. - Oct. 2011 interactive webinar series will explain analytical building blocks and engage jurisdictions in review pf and input on methodology, technical advisory group to be convened to review and advise on curves, and	Corps-TNC-ICPRB WRDA Sec. 729 Watershed Assessment, with 3:1 fed/non-fed cost-share, and TNC as non-fed cost-share partner. Additional non-Federal cost-share being provided by states in basin including VA, and ICPRB CO-OP section on water supply for the DC metro region.	As of 4/11, literature review for large river flow needs completed, and flow alteration-ecological response relationships (curves) beginning to be developed, for expert review and assessment at Nov. 2011 social process workshop.	Project builds on existing federal and state level monitoring of flow and benthic macro-invertebrates. As smaller stream flow recs are developed based on social part of ELOHA, biological indicators can continue to be monitored to assess impacts of flow alteration from water and/or land use change. Plan is to develop a large river flow needs monitoring	See http://potomacriver.org/sustainableflows for all publicly available project documents, including overarching Corps Project Management Plan, large river flow needs report, archived past webinars on project methodology and findings, workshop summaries and agendas, etc.	Mar-11

Tennessee River Valley (106,200 km2), Sept 2006-2010 (4 years)	Regional Determina-tion of Hydrologic Require-ments of Aquatic Ecosystems of Water-sheds in Tennessee	X	X	Rodney Knight, Brian Gregory, USGS; Sally Palmer (science) and Marie Stringer (govt relns), TNC; Technical Advisory Committee	Develop a tool to estimate fish community health at unmonitored locations throughout the Tennessee River Valley	Conceptual flow-ecology models. Regional prediction model in FORTRAN. Framework for using regional predictor for decision support. Hoping to inform basin-scale water management planning.	HIP used to select 12 hydro variables based on 41 gaged sites statewide. Ecol. Variables = fish IBI + their component measurements fromTVA. Later, inverts for Cumberland Plateau, which lacks fish data. Correlation analysis of hydrological and ecological datasets. Region-of-influence statistical modeling. (OASIS model of Duck River basin)	$719,813 funded by TNC and TN with 50/50 USGS match	Found relns betw flow constancy, moderate floods, & recession rates and insectivorous fish community health & struc-ture. Next: develop and test tool to predict flow stats at ungaged sites.	None specified.	Knight, R. R., Gregory, M. B., and Wales, A. K. 2008. Relating streamflow characteristics to specialized insectivores in the Tennessee River Valley: a regional approach. Ecohydrology 1:394-407, doi: 10.1002/eco.32.	2009
Vietnam, 8/1/08-7/31/09	Design of National Environ-mental Flows Framework	X	X	Eloise Kendy, Rebecca Tharme, Brian Richter (TNC); Viet Hoang, Trine Goan (WWF); Dr. Lai and his 3 Vietnamese consultants (Vietnam Ministry of Natural Resources and Environment (MoNRE))	Design a national framework to determine eflow needs and integrate them into river basin planning and management	Recommend tools, models, experts, methodologies, legal reforms, pilot basins for eflow determination and management	Interviews, database research, expert workshop	$80K from Danida; TNC salary is in-kind contribution. Entire amount was not spent.	Project completed 2009. Lacking a proof-of-concept demonstration project, MoNRE rejected the holistic approach we recommended.	None.	Draft report available upon request from Eloise Kendy, ekendy@tnc.org. See also Richter, B. D. 2009. Re-thinking environmental flows: from allocations and reserves to sustainability boundaries. River Research and Applications 22(8):1052-63.	Apr-11
Virginia, (Proposal partially funded 12/2010-12/2011)	Development of a systems-based approach to integrated watershed monitoring, assessment, protection,a nd conservation.	X	X	Judy Dunscomb, (TNC) Robert Burgholzer and Scott Kudlas (VDEQ), Don Orth, (VPI) Scott Simon (VDGIF),	Development of transparent, in-stream flow requirements to maximize success in meeting off-stream needs while preserving healthy watersheds	Assess hydrologic alteration, flow-ecology relations by stream class, determine acceptable degree of flow alteration. EPA grant products: flow-ecology hypotheses, and recommendations for streamflows needed to maintain stream health.	VA WOOOMM Model is hydrologic foundation; INSTAR, DGIF, and Heritage Databases provide starting points for biological data. WOOOMM is an integrated web-based hydro modeling and DSS; it can intergrate with HSPF and dynamically link to data from a variety of web sources, including USGS NWIS and NOAA Gridded Precip	12/2010 $107k directed to EPA-approved contractor (Tetra Tech) to work with VDEQ and TNC to assemble database and derive ecology flow relationships	Unified biological data base under assembly.	None yet specified.		Apr-11

Washington State) (12/01/07-11/30/09)	Ecologically sustainable water mgmt in WA State: Developing flow mgmt tools for watershed planning	X	Julian Olden (UW); Cathy Reidy Liermann; Chris Konrad (TNC/USGS), Tim Beechie (NOAA). Intended users = WA Dept of Ecology, watershed groups.	Develop new analytical tools that support scientifically-credible, regional flow guidelines for stream protection and restoration as an alternative to IFIM	Stream classification; flow alternation - ecological response relations; state map of flow alteration; environmental flow standards based on flow-ecology relations by stream type. Detailed assessment of one river per class.	Hydrologic classification using Bayesian clustering; spatial extrapolation using a statistical classifier, present-day and predicted future flow classes under scenarios of climate change; geomorphic classifcation. Biological data: EPA/USGS chinook salmon abundance or survival per life stage, salmon productivity, native fish abundance and diversity, insect and riparian plant biodiversity, and riparian forest regeneration.	NOAA ($200K); seeking additional funding; legislative earmark unsuccessful	Hydrogeomorphic classification of WA rivers completed. Ecological data compiled.	None specified.	Beechie et al 2010 Bioscience 60:209-22; Olden and Naiman 2010 Freshwater Biology 55:86-107; Gao et al 2009 J. Hydrology 374:136-147; Reidy Liermann et al in press.	Apr-11
Western United States (Jan 1, 2008 - Dec 31, 2011)	Predicting relative risk of invasion by saltcedar and mud snails in river networks under differ-ent scenarios of climate change and dam opera-tions in the western US	X	LeRoy Poff, Brian Bledsoe, Denis Dean (CSU); David Purkey (SEI), Jonathan Friedman, Greg Auble, Pat Shafroth (USGS); David Merritt (USDA-FS); David Raff (BuRec); David Lytle (OSU)	Create a framework for evaluating the relative risk of invasive species spread and dominance due to local-scale habitat dynamics in rivers.	Model to predict saltcedar, mudsnail distribution; dams + downscaled GCM (12x12km) to predict future daily streamflow; model future saltcedar, mudsnail distribution under climate change. 25,000-mi2 pilot basins.	Excellent existing saltcedar (FS?) and mudsnail data (MSU). Purkey will apply WEAP for Poff, and then take the flow data down to 100s of meters with an artificial intelligence program (ANN) to create hydro foundation under climate change.	EPA Star Grant EPA-A-G2007-STAR-H1 $599,748	Year 1: Collect GIS data for species occurrence and WEAP model; acquire GCM data, downscale to western US; identify WEAP model region.			2008