~~Nooksack-Abbotsford-Sumas Transboundary (NAST)~~ Nooksack-Fraser Transboundary Nitrogen (NFT-N): Project Overview

David Hooper, Dept. of Biology, WWU

Jill Baron, US Geological Service and Colorado State University

Shabtai Bittman, Agriculture and Agri-food Canada

George Boggs, Whatcom Conservation District

Jana Compton, EPA Region 10

Nichole Embertson, Whatcom Conservation District

Jiajia Lin, EPA Region 10

International Nitrogen Initiative

Towards the INMS International Nitrogen Management System www.inms.international

WESTERN WASHINGTON UNIVERSITY
COLLEGE OF SCIENCE AND ENGINEERING
Department of Biology

Talk overview

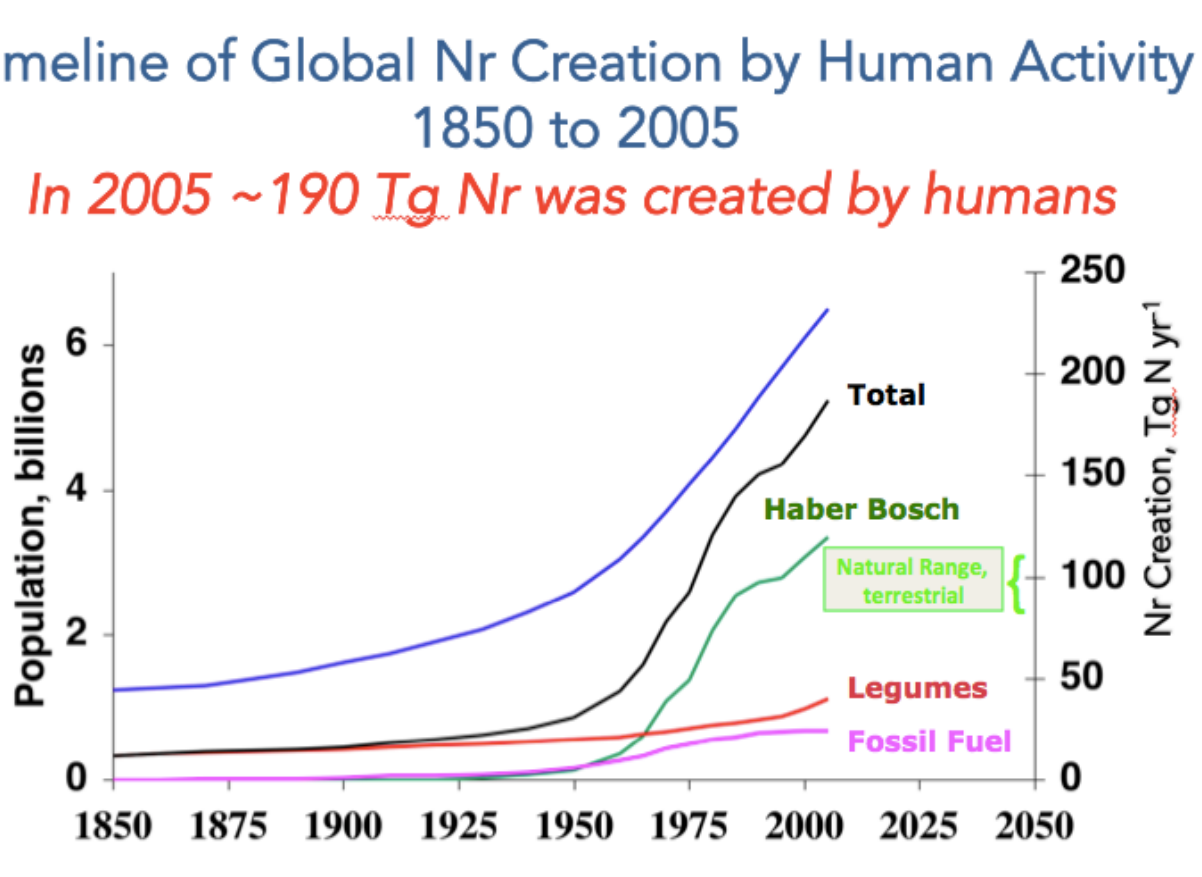
1. Summary of the nitrogen paradox
2. Scope and goals of the NFT-N Project
3. Preliminary N budget results
4. Key questions and future work

1. A question of balance: the Nitrogen paradox

N_2 is everywhere
Organisms need Nr (reactive nitrogen)
Excess Nr causes problems

Nitrogen is essential

- Plant growth
  - Natural ecosystems
  - Crop growth
  - Landscaping
- Human and animal nutritior
- Meeting demands of increasing human populatio



A question of balance: the Nitrogen paradox

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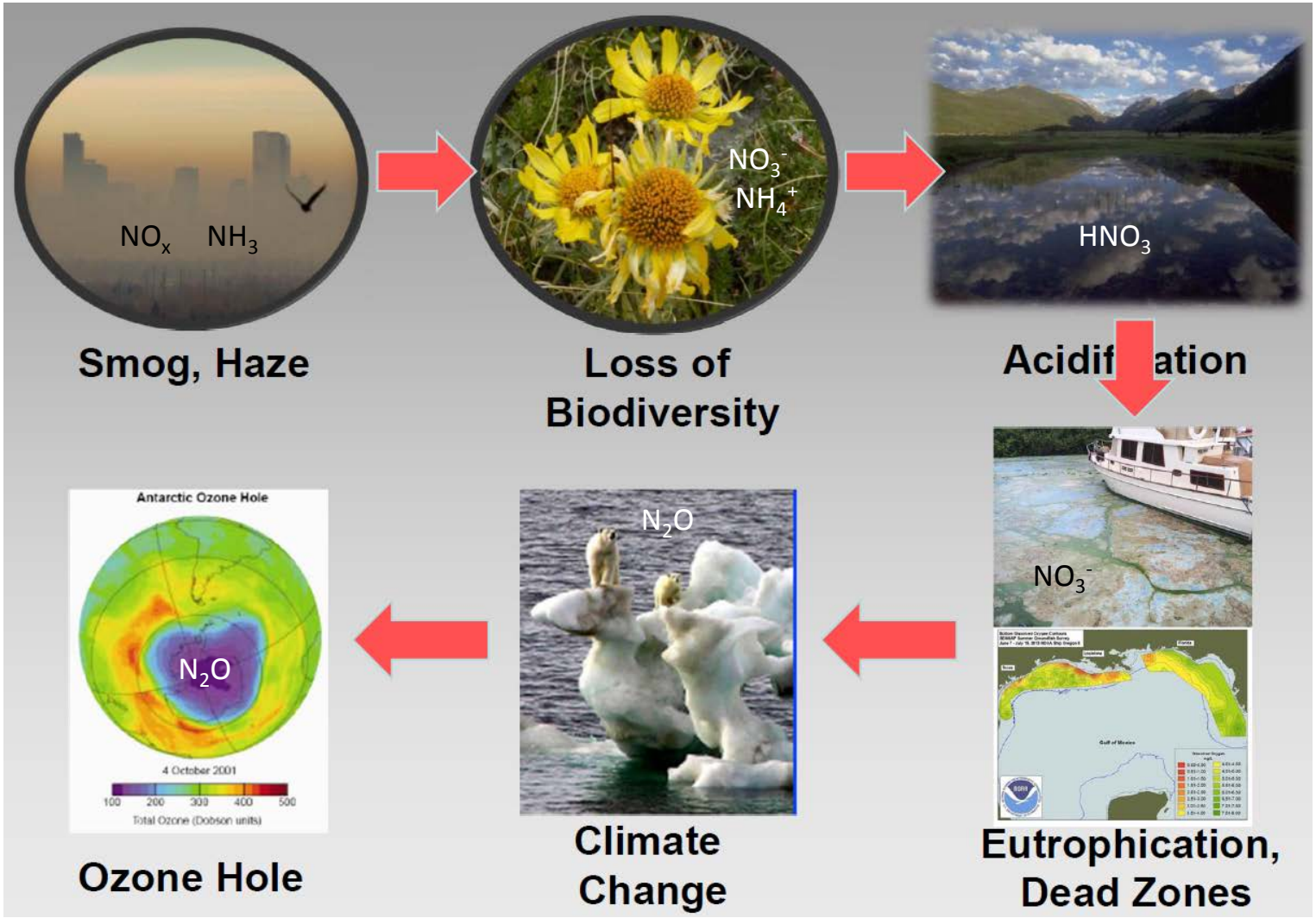

International Nitrogen Initiative

(Jill Baron, Director, INI North America Region)

"Optimizing nitrogen use in food and energy production, while minimizing the consequent harm to humans and the environment"

Demonstration projects of the International Nitrogen Management System

- Developing areas with too much N_r
  South Asia, East Asia, Latin America
- Developing areas with insufficient N_r: *East Africa*
- Regions with transition economies: *Eastern Europe*
- Developed areas with too much N_r: *West Europe, N. America*

International Nitrogen Initiative

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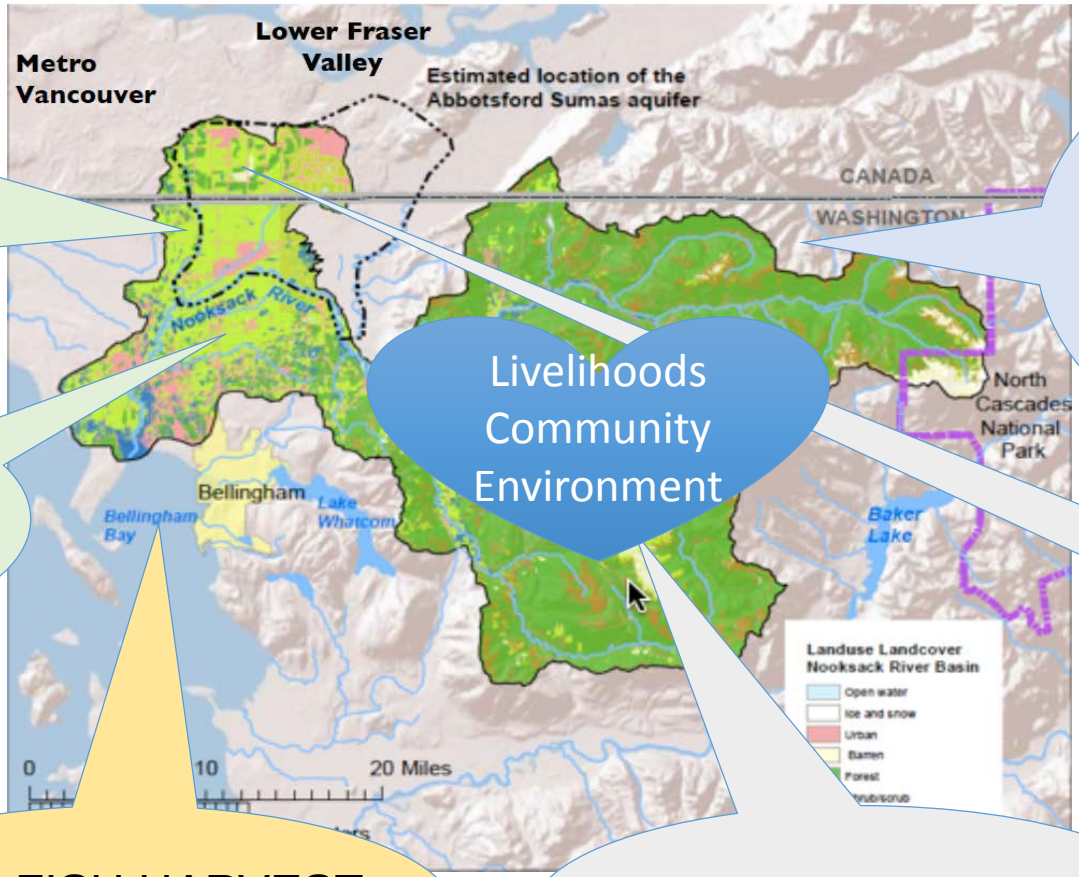
Nooksack-Lower Fraser Transboundary Region



MUNICIPAL, SEPTIC, DEPOSITION, NATURAL SOURCES

AG PRODUCTION, SOURCES

Livelihoods
Community
Environment

AIR QUALITY EFFECTS ON HUMAN HEALTH, BIODIVERSITY

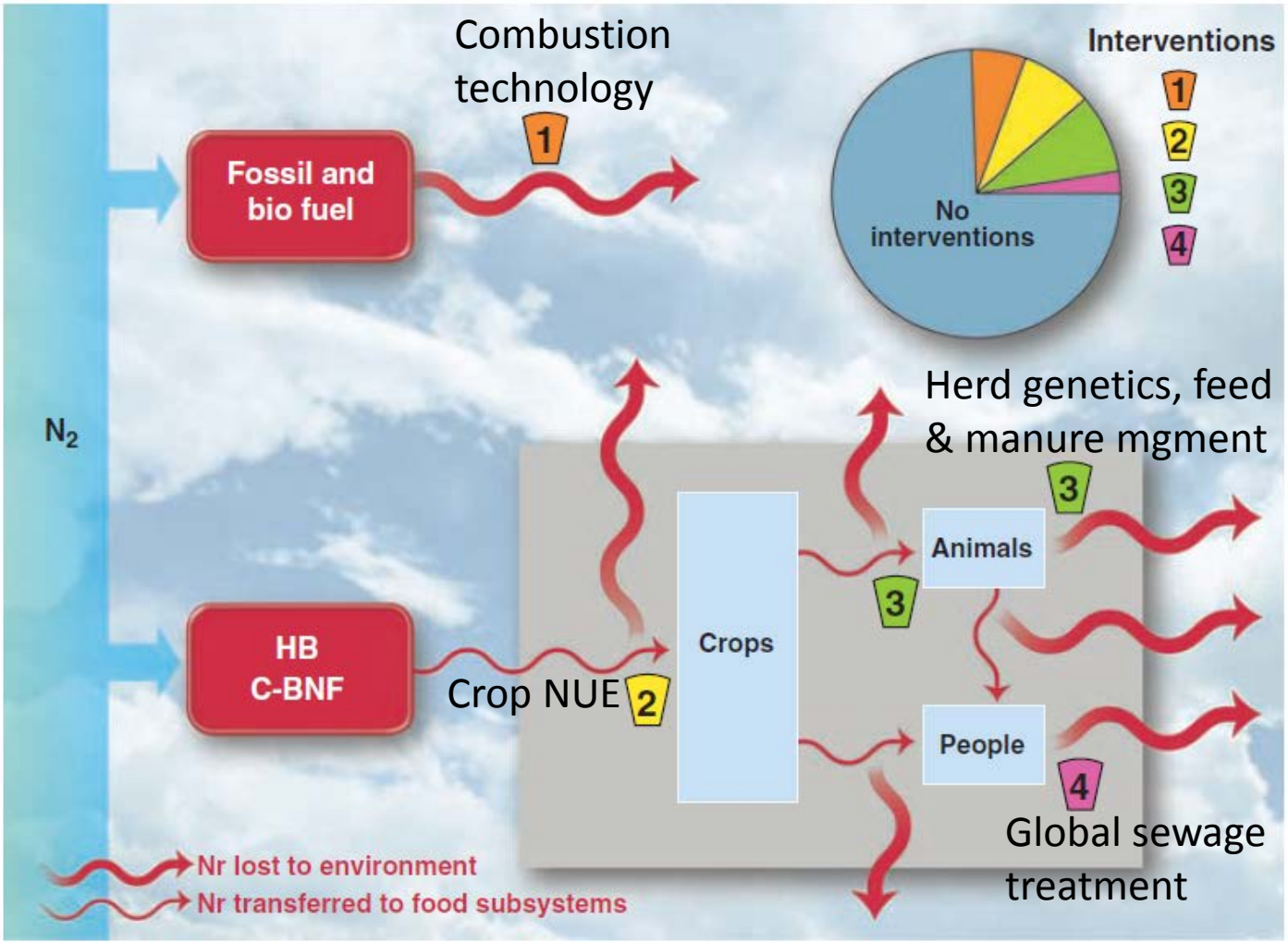
HIGH GROUNDWATER [N]

SHELLFISH HARVEST CLOSURES

SURFACE WATER [N]

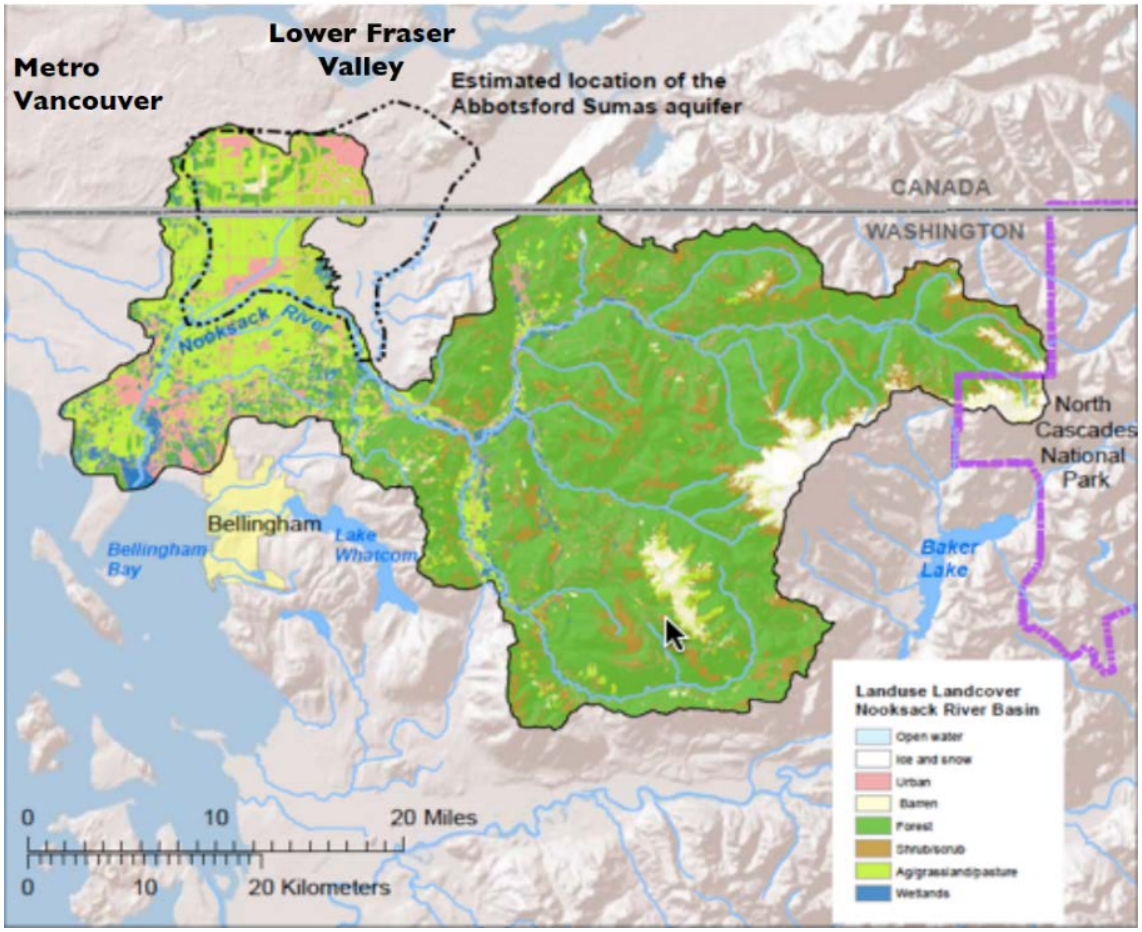
2. Scope and Goals of NFT - N

Nitrogen budgeting: a global example



Galloway et al. 2009

Geographic scope



1. Transboundary watershed, air-shed and aquifer
2. Policy issues: CA, US, First Nations
3. Variety of land use within basin
4. “Downstream” effects are local
5. Past and current efforts, data availability

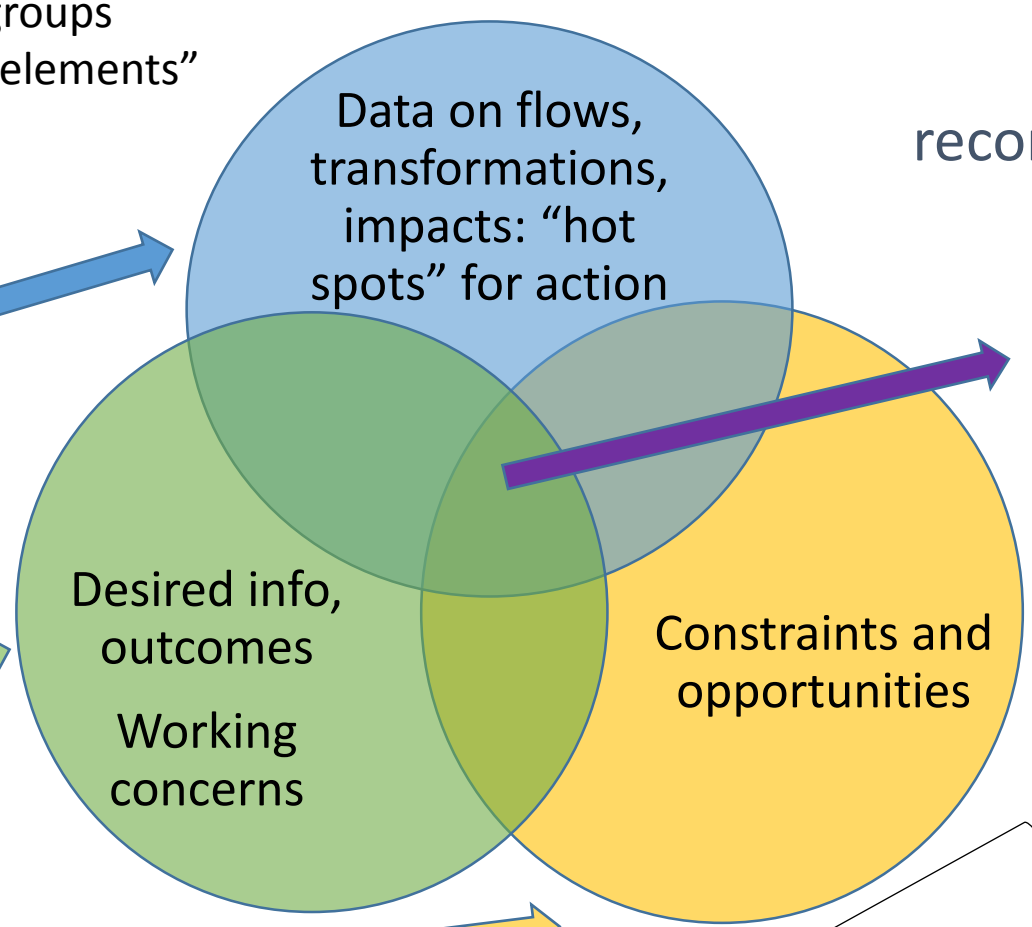
Approach

Locally (project area) collaborative, internationally relevant
Multi-perspective
Data-driven, locally validated, comprehensive (N sources, effects, etc.)
Accounts for tradeoffs & synergies
- other working groups
- other "reactive elements"

Ongoing implementation, analysis and communication

Develop recommendations

Evaluate potential solutions



N inventory

Citizen input and information

Policy analysis

Funding

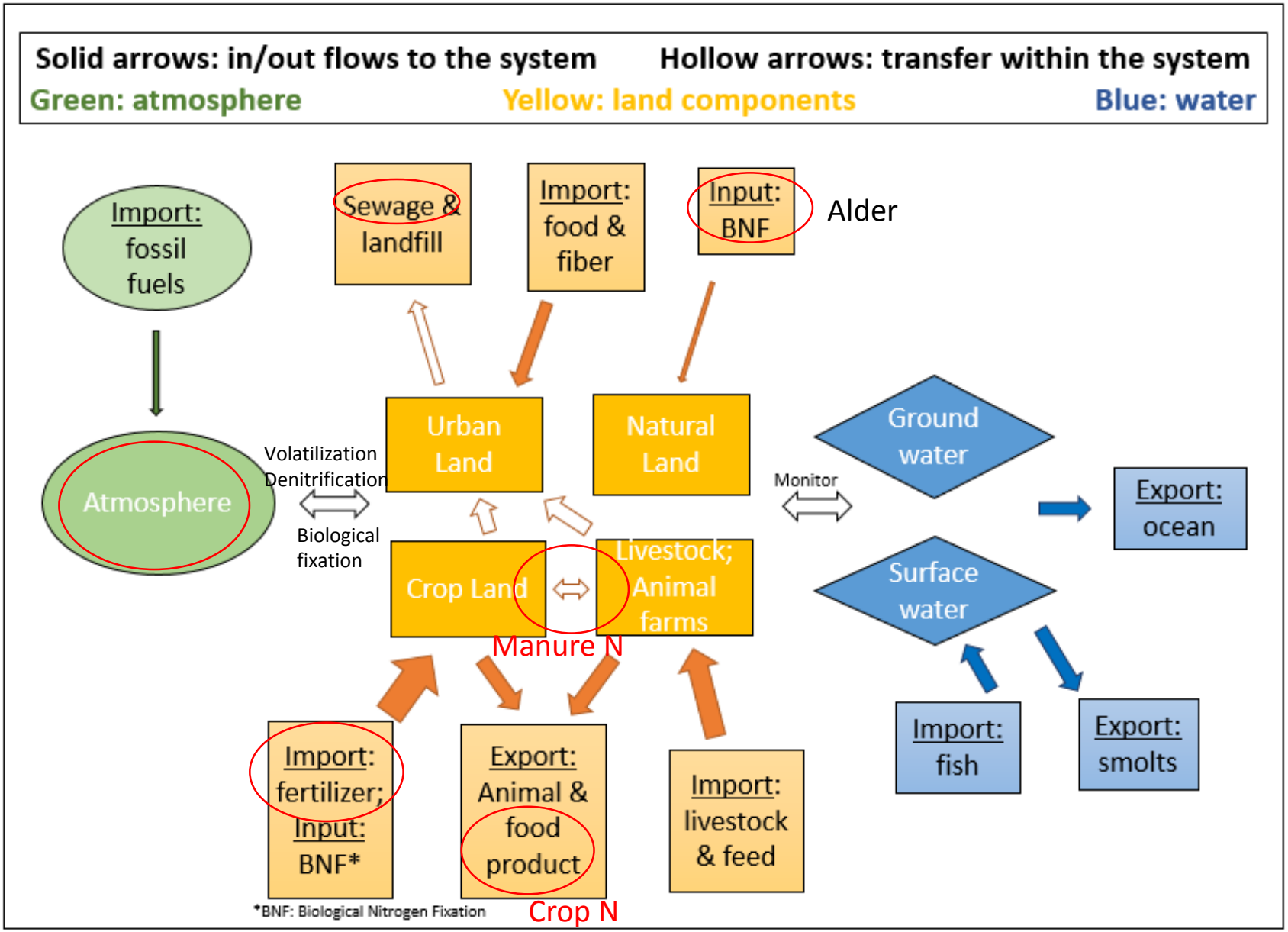
Activities so far

- Workshops
  - Initial, at WWU, Oct. 24-26, 2016
    - Funded by NSF grant to Eric Davidson, U MD
    - Participants – Diverse academic & agency scientists (see handout)
    - Outcomes
      - Plan for data gathering, N budget preparation
      - Pursue funding opportunities
      - Field trip of Whatcom County research, farms and streams
  - Recent, at Bellewood Acres, Sept. 14-16, 2017
    - Funded by WWU (CSE, Biology Dept.)
    - Participants
      - Scientists (agency & academic; social & biophysical)
      - Citizen representatives (Ag, environmental, local planning)
    - Outcomes
      - Charter: working principles, scope of project, goals – in process
      - Outline work plan – in process
      - Develop plans for future outreach – in process

Activities so far, con't

- N Budget work – Jiajia Lin, Jana Compton (EPA, Corvallis)
- Air transport modeling (CMAQ) – Donna Schwede (EPA, NC)
  - Fine scale: 4 km x 4 km grid
  - Budget
  - Air quality
- Monthly phone meetings – growing list of interested parties
  - N budget updates
  - Planning
- Funding pursued
  - EPA RARE Grant – Jana Compton, lead
  - National Socio-Environmental Synthesis Center (SESYNC) – Jill Baron, lead

3. N budget (so far) – Jiajia Lin, Jana Compton



Preliminary results

	Source	Amount (metric ton N/yr)	Amount (US ton N/yr)	Data source	Uncertainty
I	Point sources in the watershed	355	391	SPARROW, 2002	Small; will be updated using more current and local data
I	Alder fixation in the watershed	6.6	7.5	OSU LEMMA Species map, 2002	Small
I	Deposition in the watershed	532	586	CMAQ, 2008	Small; will be updated using new model output for 2014
I	Ag. Fert. N recommended, whole w'shed	3762	4147	NASS; extension; local knowledge; USDA 2014	Medium; need more input on crop yield and fertilization rate
C	All animal excretion N in the county	6918	7626	NASS, 2012; NRCS, Canadian Nutrient Model	High; also need to account for N loss during storage, transportation, and application; no poultry manure applied
O	Crop N	1972-2922	2174-3221	NASS; USDA; IPNI	Total plant growth, soil N, manure application

Budget summary and future work

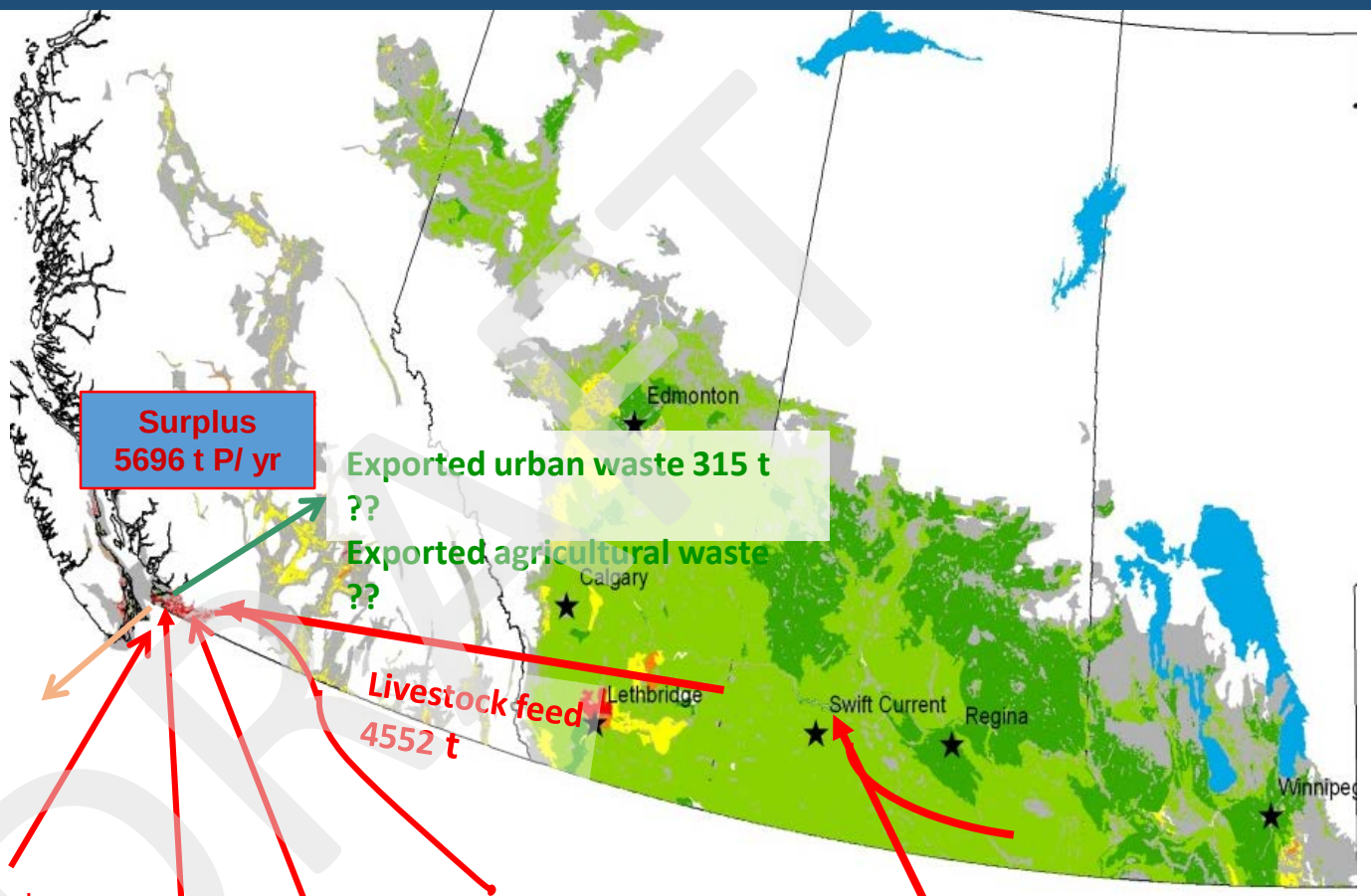
- Budget is not yet completed, for both agricultural and non-agricultural sectors;
  - Add more inputs, internal transformations, exports
  - Improve & validate results with local knowledge and more up-to-date data; fill in the gaps->reduce uncertainty;
- Refine the results to consistent scales
  - Nooksack River Transboundary Watershed
  - Lower Fraser + Whatcom County
- Merge with Canadian N budget; analyze imbalances

Nitrogen flows in the Lower Fraser Valley - Shabtai Bittman

Agriculture

Urban

Imports and exports of phosphorous (tonne P/ year) (Draft – Shabtai Bittman)



Local food production 437 t

Surplus 5696 t P/ yr

Exported urban waste 315 t

??

Exported agricultural waste

??

WWTP effluent 1433 t

Livestock feed 4552 t

Soaps, pet food, horse feed 841 t

Imported Food 1022 t

Mined fertilizer applied 1554 t

Total mined fertilizer for feed and food >7000 t

4. Questions and Future Work

1. Scope
    1. Nitrogen linked to other issues: phosphorus, fecal coliform
2. What outcomes most useful to participants (citizen outreach)?
3. Funding for key project pieces
    1. Outreach
    2. Solution & scenario evaluation
    3. Developing recommendations
4. How to best complement other efforts
    1. Avoid repeating work
    2. Build on each others' networks
    3. Avoid "stakeholder burnout"

Complementing other efforts

BC/WA Water Quality Task Group – fecal coliform focus, ~1 yr

Puget Sound Partnership

Puget Sound Natural Resource Alliance

BC Agriculture Nutrient and Air Working Group

ECY Puget Sound Nutrient Source Reduction Project

ECY BMP Review

WRIA 1 Planning Unit

Citizen Caucuses

Portage Bay Partnership

Thanks!