Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

COMPOST Matters In British Columbia
Compost Council Canada and EcoSafe-ZeroWaste
26-27 Feb. 2020, Abbotsford, BC

Whither Compost Nutrients in an Enriched Peri-Urban Context

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Agriculture and Agri-Food Canada, Agassiz, BC

Canada

Carbon Facts

- Carbon flows are an important aspect of the food cycle in the LFV
- Large amounts of local ‘food carbon’ is imported as feed and converted in the LFV. This is due to the limited land base
- Abundant carbon is interconnected with excess nutrients
- Uses of agricultural carbon for soil improvement and energy often leads to questions about associated nutrients,
- Using organic nutrients (manure) brings C with it.
- Amending carbon (compost, mulch) in soils is often associated with increased nutrients

Innovative systems are needed to improve the nutrient and carbon cycling in a double circular economy

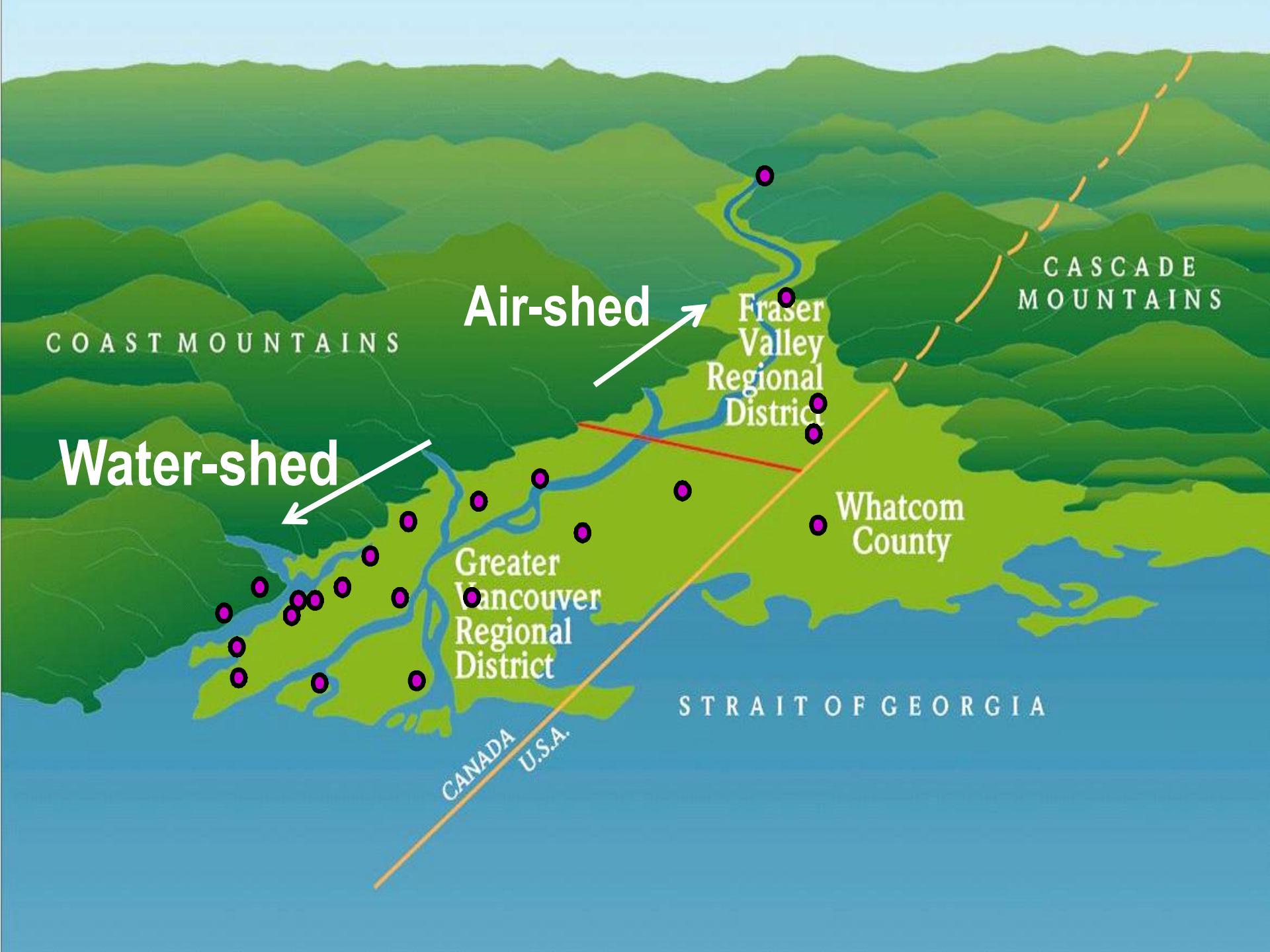
Good Agricultural Carbon

All agriculture is basically fixation of atmospheric carbon and conversion of fixed carbon to value added products like meat, eggs, milk and leather.

- **Molecular basis of all life**
- **Food for people**
- **Feed for wildlife**
- **Essential for soil quality**
  - **Crop residues**
  - **Raw manure**
  - **Compost**
  - **Biochar**
- **Soil Sequestration (very small land base in LFV)**
- **Energy substrate:**
  - **Combustion (heat)**
  - **Digestion (biogas)**
  - **Fermentation (alcohol)**
- **Root exudates, support rhizosphere**

Bad Agricultural Carbon

- **Emissions of CO_2 (GHG)**
- **Biological Oxygen Depletion (BOD) in waterways**
- **Mal-odours- composting, manure, mortalities, crop residues, silage effluent**
- **Host for vermin (grain, garbage, compost)**
- **Host for pests**
- **Carbon particles as air pollutant**
- **Carbon dust as carrier of chemical contaminants and zoonotic diseases.**
- **Black Carbon (from burning)- forcing climate change (albedo)**
- **Waste agricultural plastic**


Air-shed
Water-shed
COAST MOUNTAINS
CASCADE MOUNTAINS
Fraser Valley Regional District
Whatcom County
Greater Vancouver Regional District
STRAIT OF GEORGIA
CANADA
U.S.A.


128,000 cattle
(mostly high producing dairy cows)
16 million chickens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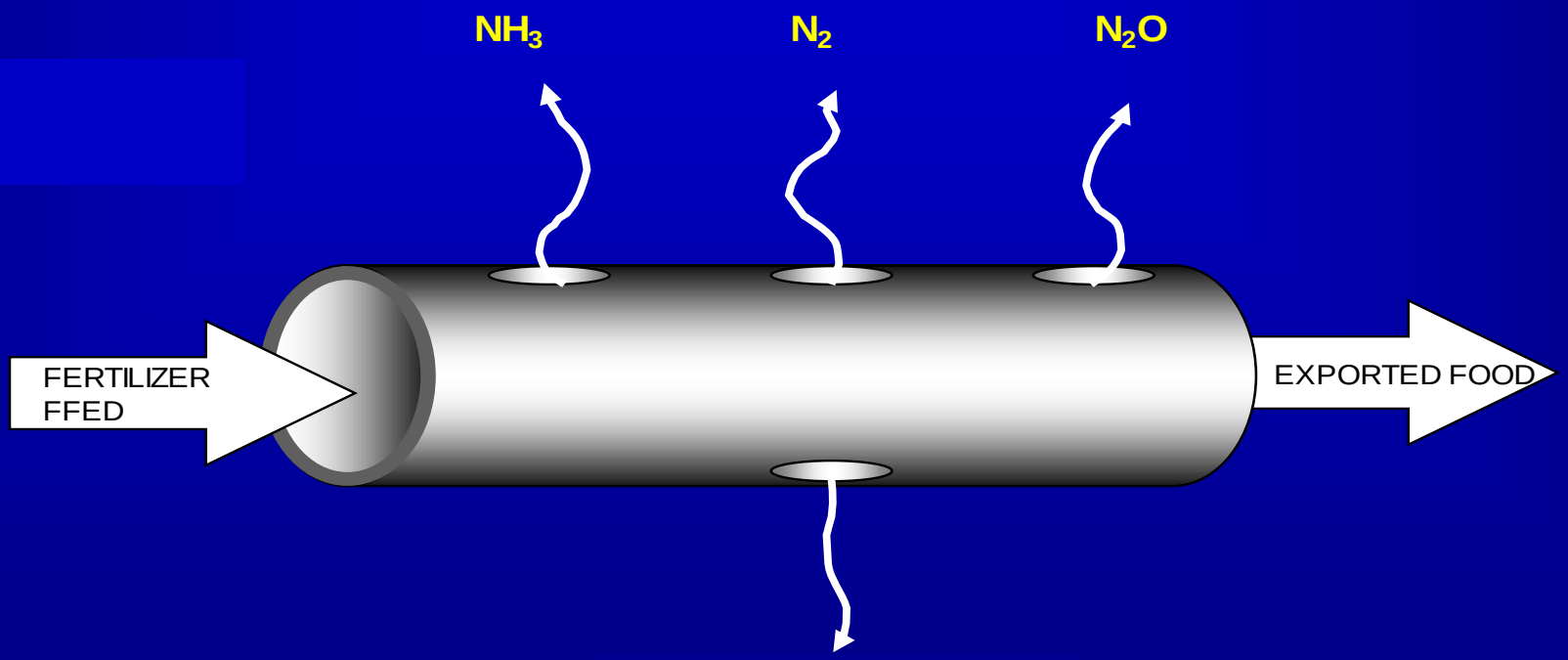
$1.6 billion farmgate revenue
>2.5 million people

….and wildlife!

Fraser River Delta:

- **Largest estuary on Canada's Pacific coast**
- **Major wintering habitat for waterfowl & raptors**
- ***Only* wintering habitat in Canada for migratory shorebirds**

Regional Nutrient Budgets
-Leaky Pipe Model-



Ammonia affects air quality

Abbotsford, BC

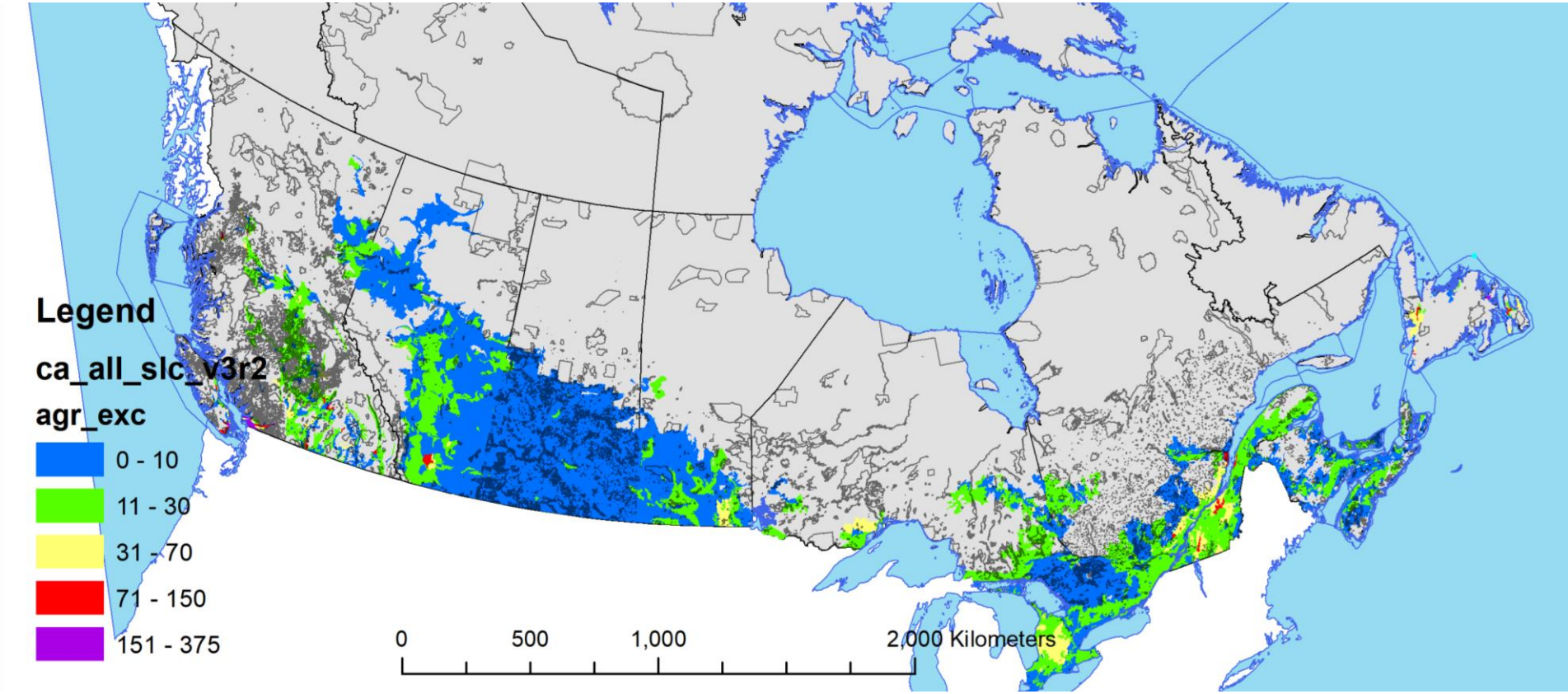
Winter

Mid- to late Summer

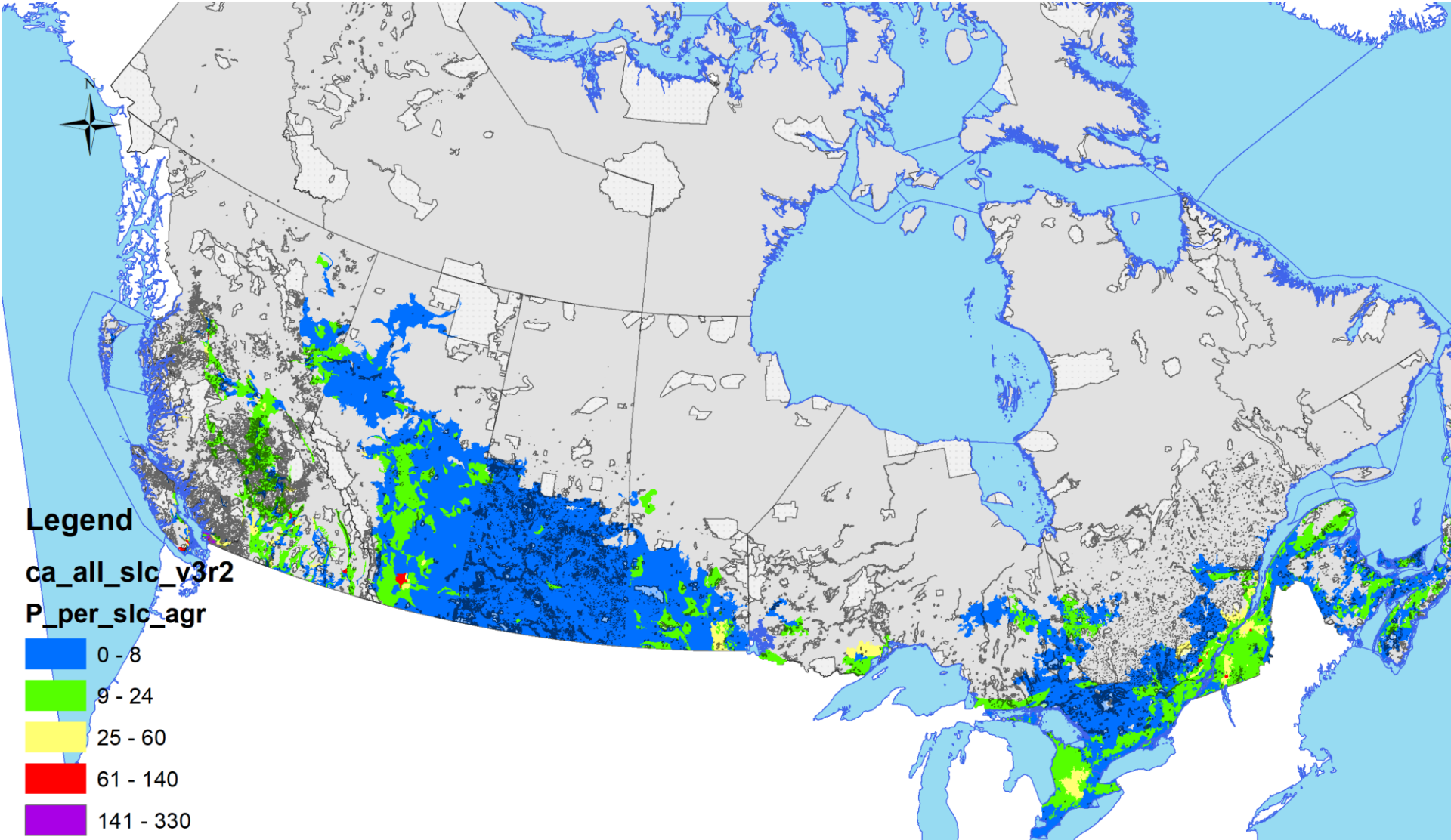
Gray haze in late summer due to ammonium nitrate particulates ($PM_{2.5}$); ammonia from agriculture and NO_x from vehicles--reduces visibility impacting scenic tourism and harming human health and $80 million in lost tourist revenue!

From: Bittman ,S. and Sheppard, S. 2014. Ammonia emissions in Canada. pp 29-46, In Van der Hoek, K.W. and N.P. Kozlova, (Eds.) Abating ammonia emissions in the UNECE and EECCA region.

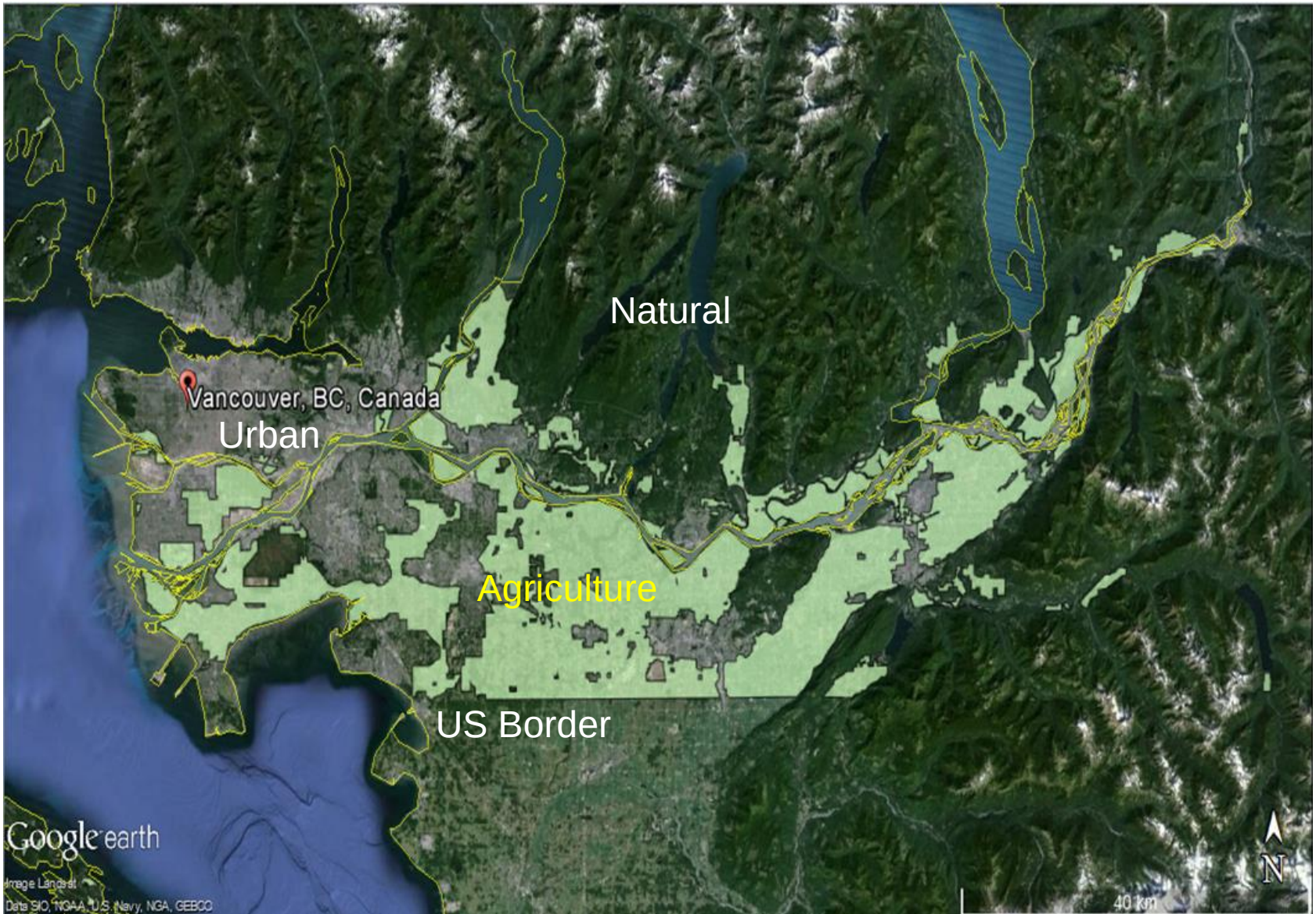
Nitrogen use on agricultural land in 2016 in kg/ha



Phosphorous use on agricultural land in 2016 in kg/ha



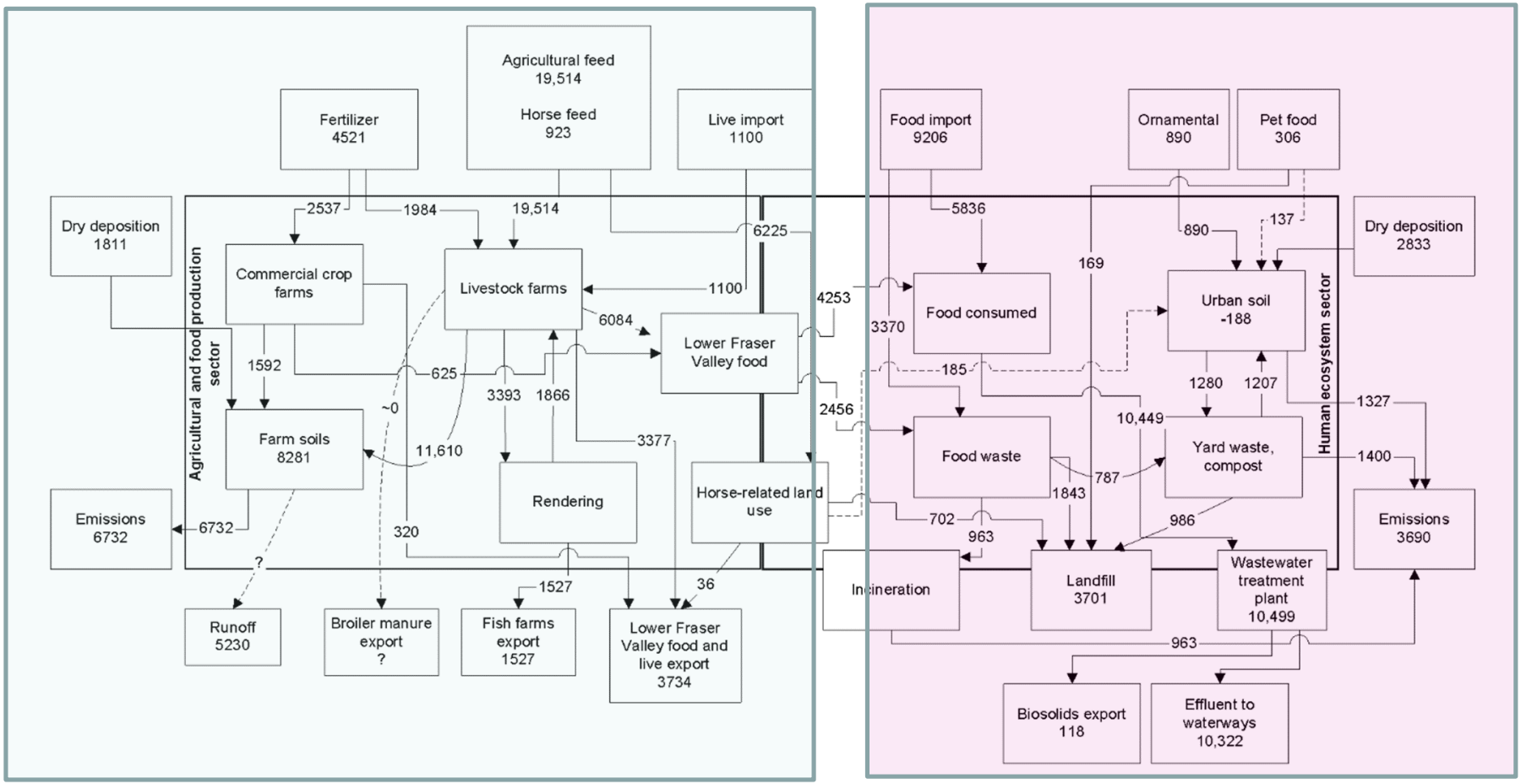
Lower Fraser Valley- agricultural and urban ecosystems- is a peri-urban nutrient sink



Nitrogen flows in the Lower Fraser Valley BC
t N/yr

Agriculture Ecosystem

Urban Ecosystem



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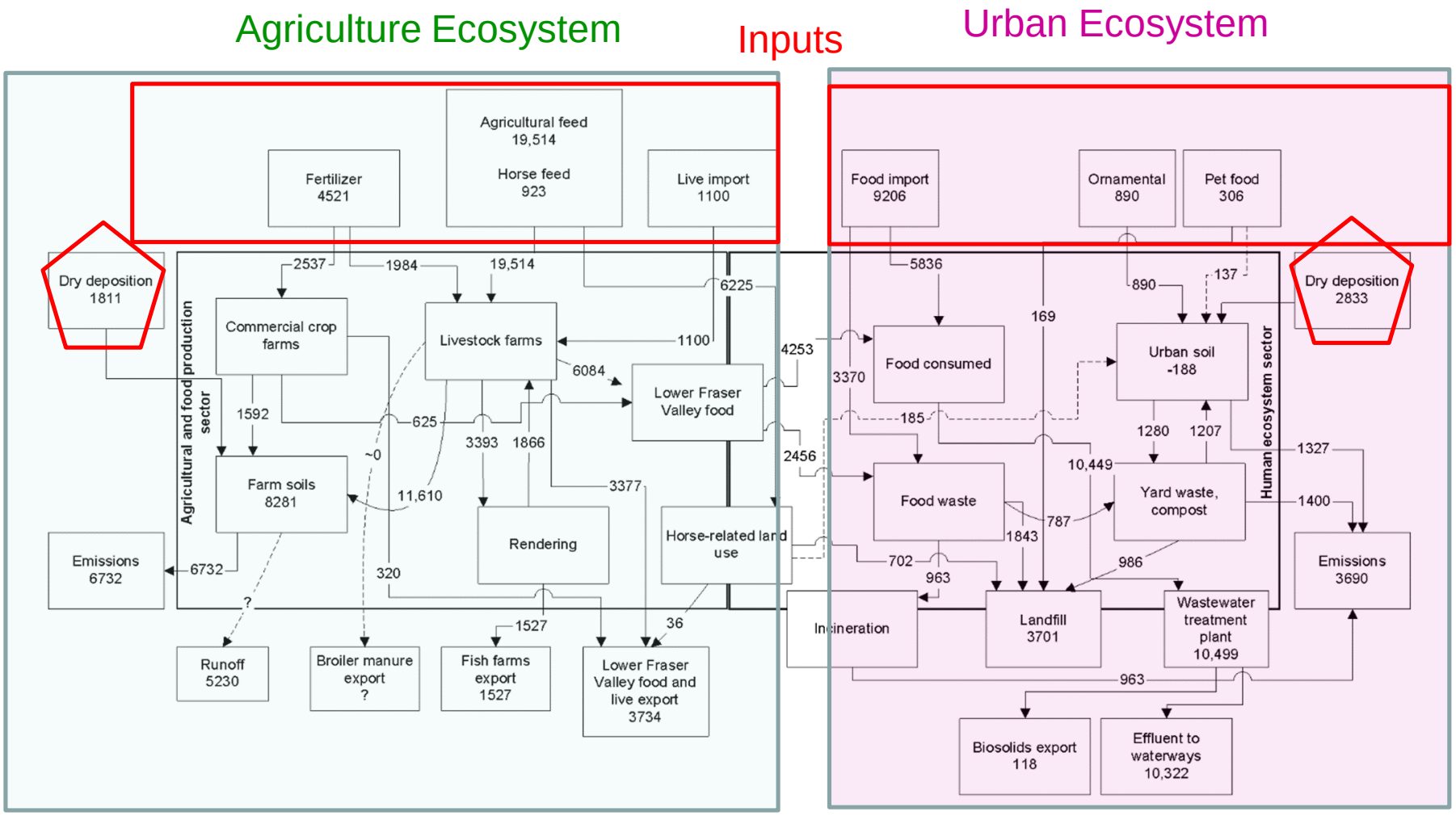

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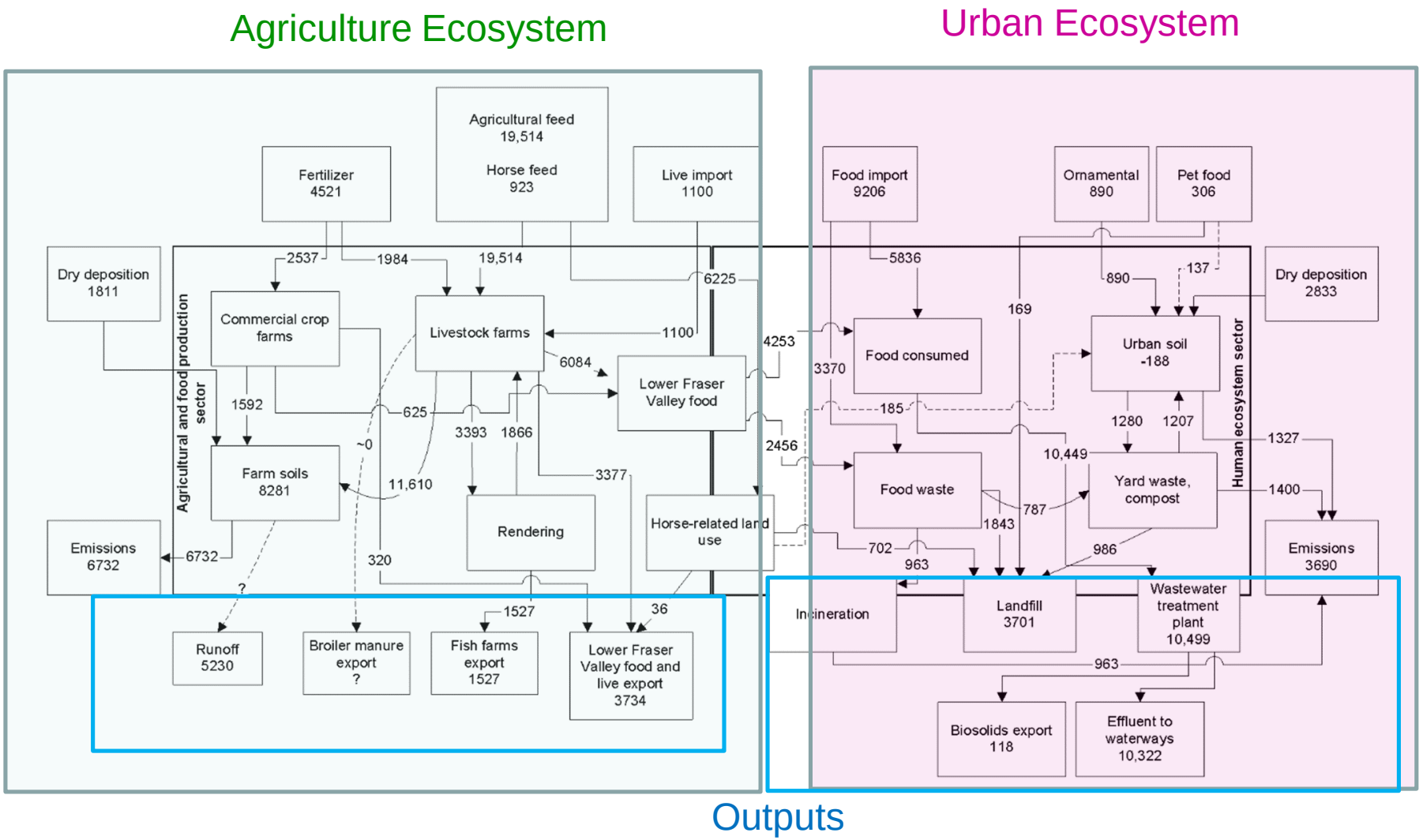

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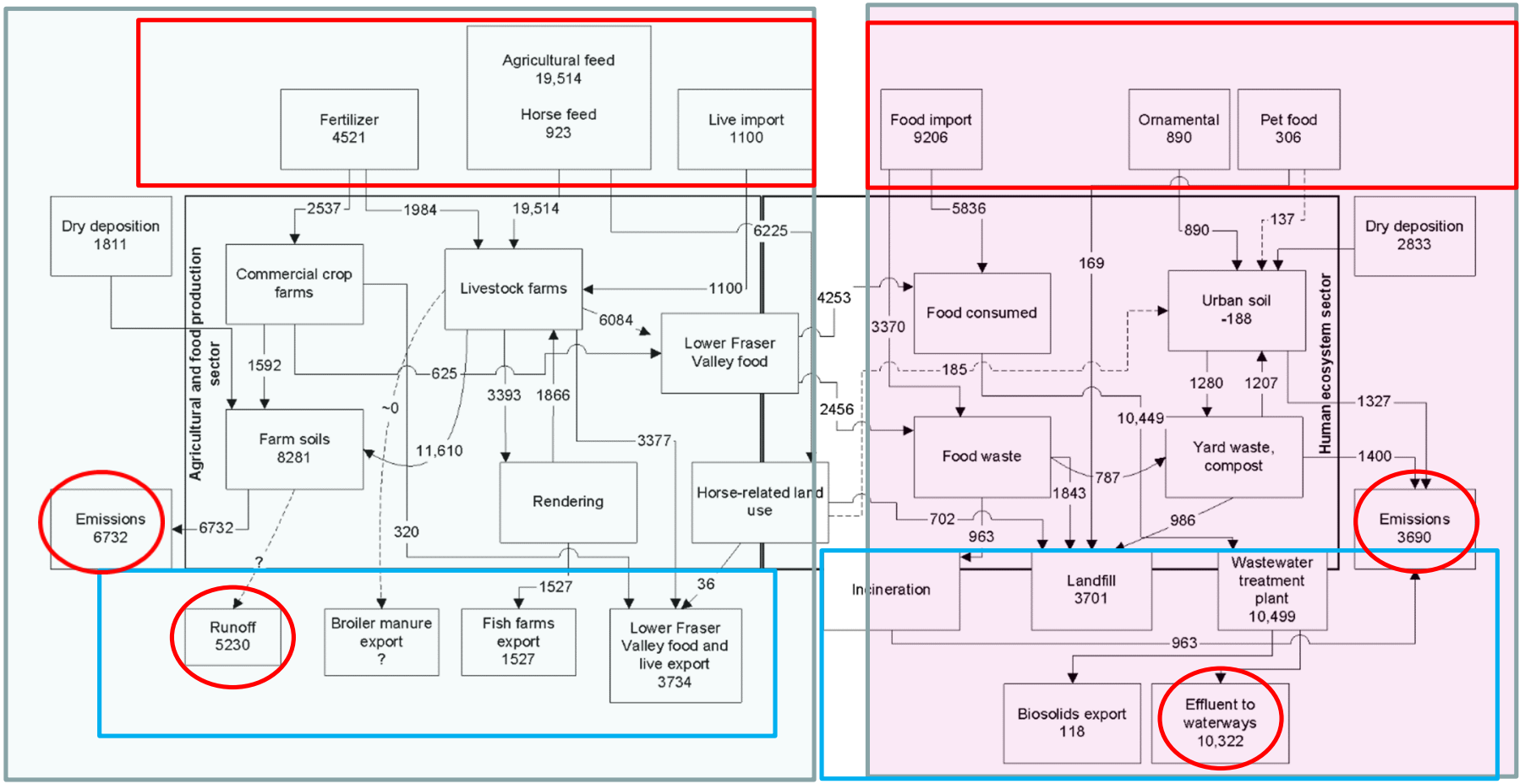

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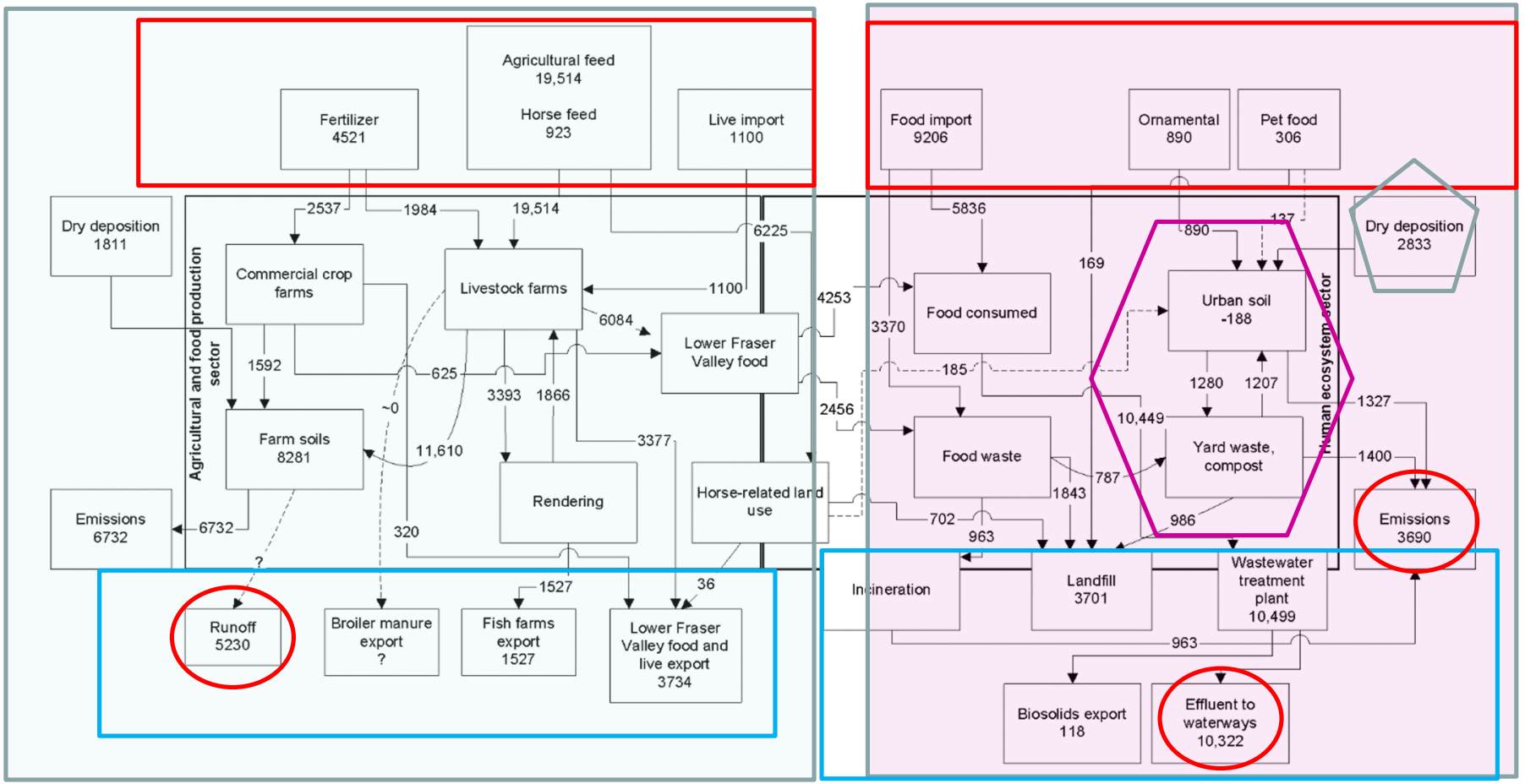


Urban Composting

N budget (kt N/yr) for Lower Fraser Valley showing influx and efflux for the agricultural and urban ecosystems

Influx		Efflux	
Agriculture			
Fertilizer	4.52	Food and animal export	3.73
Feedstuffs	19.5	Fish farms	1.52
Live animals	1.10	Emissions (NH_3)	6.73
Deposition (NH_4 and NO_x)	1.81	Surplus (leach. and denitrific.)	8.28
		(LFV food to urban ecosystem)	6.71*
Total	**26.91**		**20.26**
Urban			
Imported food	9.21	Effluent from WWTP**	10.33
Fertilizer	0.89	Landfill	3.70
Pet food	0.31	Incineration	0.96
Horse feed	0.92	Emissions (NH_3)	2.73
Deposition (NH_4 and NO_x)	2.88	Export	0.12
Total	**14.21**		**17.84**
Lower Fraser Valley Region			
Total ***	**41.1**		**38.1**
Total (kg per capita)	**15.9**		**14.7**

*internal flow from agriculture to urban, not included in total efflux
** WWTP Waste Water Treatment Plant
***except fuel

Waste Recycling in the LFV

- Manure reuse
- Manure export
- Animal feed
- Waste to energy Incineration
- Waste to energy AD
- Composting
- Others?

Exporting Carbon as (Poultry) Manure

- This is intended to export nutrients – carbon is coincidental
- Dairy and pig manure cannot be exported due to high moisture
- Exporting poultry (broiler) litter which has a low moisture content is possible
- Is moving poultry litter to low production farmland or rangeland really a disposal measure -as there is very limited food value gained.
- Energy cost due to distance

Carbon recycled as poultry feed

- Rendering waste is a major supplement for poultry feed
- Excellent recycling of nutrients- replaces imported mineral P and protein
- Public concern?

Agricultural Carbon (manure) for energy- biogas

- C form livestock manure is converted to biogas for use as fuel
- All original nutrients (N and P) remain and are expensive to transport to original farms
- More profitable if urban waste is mixed, but this leaves more nutrients on land.

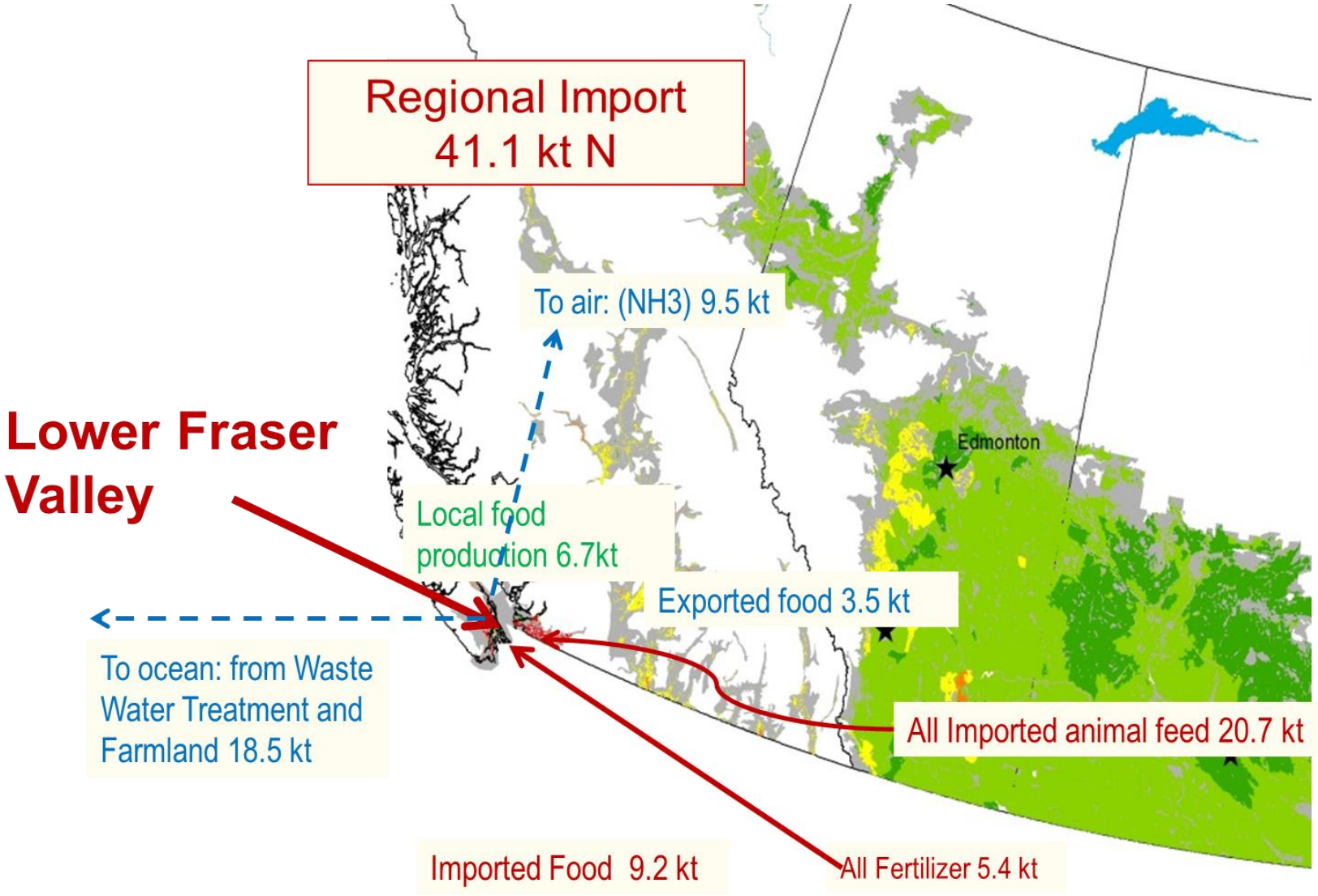
City carbon (food and yard waste) for energy- waste to energy

- C for energy from urban waste
- Reduces C and volume; nutrients collected ash and stored in landfills (not necessarily bad!)
- A large amount of P is imported for stabilizing the fly ash and this P is also stored in landfill.

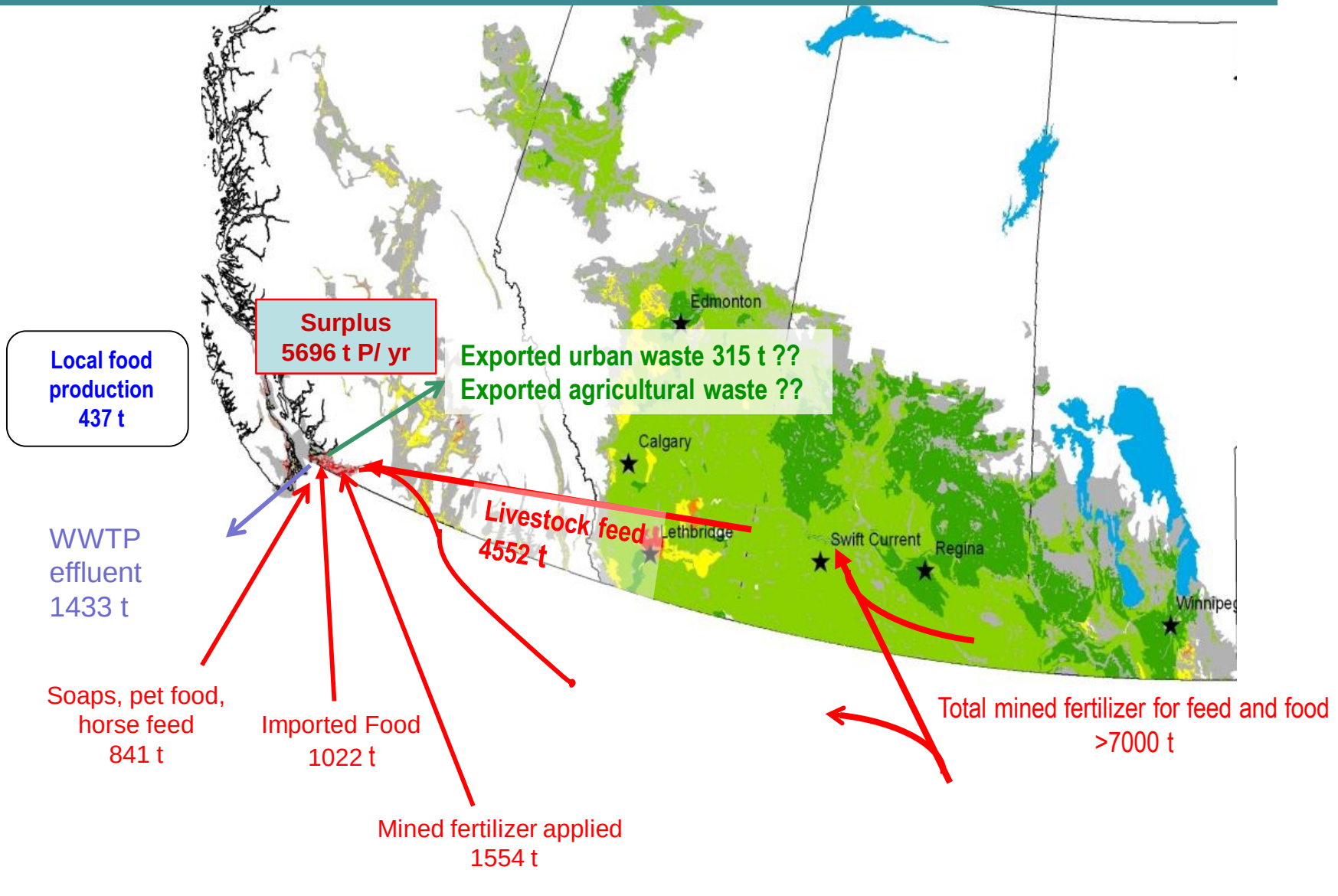
City Carbon (Food and yard waste) for urban soil

- Food wastes are collected, composted
- Constant compost supply, does it match demand?
- Composting depletes available nitrogen
- Compost is used as soil amendment for its stable carbon but can lead to accumulation of P in urban soils.

Imports and exports of Nitrogen to the Lower Fraser Valley and Metro Vancouver (tonne N/ year)



Imports and exports of phosphorous to the Lower Fraser Valley and Metro Vancouver (tonne P/ year)

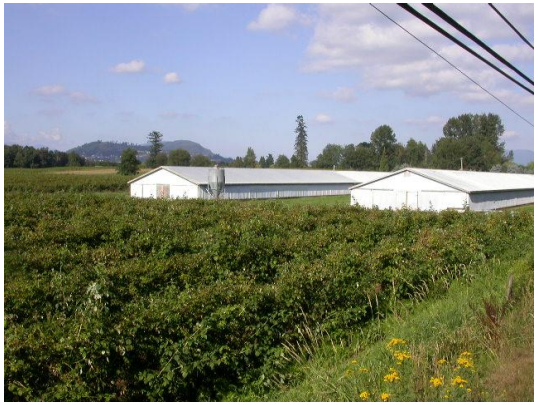


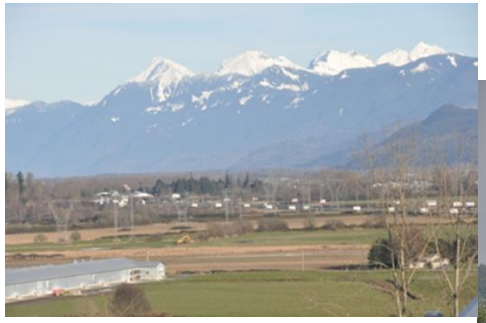
Tackling the nutrient surplus in the Lower Fraser Valley

1. Micro scale; real time N modelling and management
2. Field scale: Dual manure stream
3. Farm scale: Feed crop optimization
4. Regional scale: Regional strategies

No one approach is sufficient

Our Goal: Tackling the nutrient surplus in the Lower Fraser Valley





Water quality

Air Quality

No approach in isolation

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Thank you

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Photo from Delta Wildlife Trust website

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