



- ▼ Overview of the study

Study Basis - Manning et al (2016)

- EPA and ORNL report on hierarchal selection process of biota modeling in the Preliminary Remediation Goal (PRG) and Dose Compliance Concentration Calculators (DCC).
 - Intake Rate Derivation
 - Transfer Factor Compilation
 - Mass Loading Factor Sources
- This report updated the accuracy of risk assessment modeling for the consumption of produce and animal products sourced from contaminated land and/or land irrigated with contaminated water

ORNL/TM-2016/328

Biota Modeling in EPA's Preliminary Remediation Goal and Dose Compliance Concentration Calculators for Use in EPA Superfund Risk Assessment: Explanation of Intake Rate Derivation, Transfer Factor Compilation, and Mass Loading Factor Sources



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Karessa L. Manning
Fredrick G. Dolislager
Michael B. Bellamy

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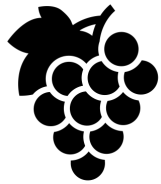
OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE US DEPARTMENT OF ENERGY

▼ Summary of New Study



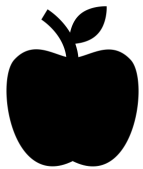
- Goal:

Supplement the Manning et al (2016) report by incorporating produce items that have been found in Native American diets.



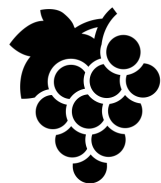
- Components of Study

- Plant specific mass loading factors (MLF)
- Transfer factors (TF) of radionuclides to produce
- Source hierarchies for TFs and MLFs
- Ingestion rates

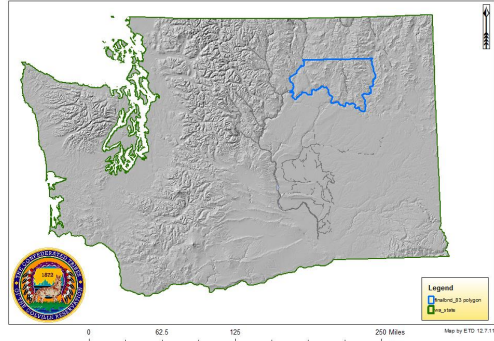


▼ Ingestion Rates

- New data adds 30 produce items
- Produce items are based on food consumption surveys and reports
 - Environment International Ltd. for the Confederated Tribes of the Colville Reservation (2012)
 - Harper and Ranco in conjunction with five federally recognized Tribal Nations in Maine for the EPA (2009)
 - New York State Energy and Development Administration (2015)
 - CB&I Federal Services LLC for the EPA (2017)
- Provides general guidelines for produce types that may be incorporated
- Presents a range of methodology that creates some inconsistencies
- This limited set of data may not adequately represent all tribes. If you know of any more studies, please share!



Boundary and Position of the Colville Indian Reservation in Washington State



Source: [EPA](#)

Food Questionnaire Data Report: Upper Columbia River Resources Survey (2012)

By Environment International Ltd.

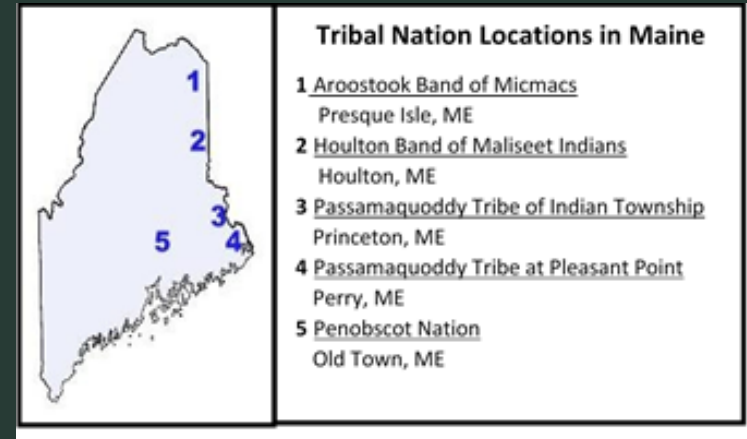
- Prepared for the Confederated Tribes of the Colville Reservation
- Located in Washington State
- Uses food consumption questionnaires and interviews of reservation residents
- Provides the most detailed produce item list of all the sources found

Food category	percent of population consuming	Average consumption frequency (times per year)	Consumers sourcing from local area
Huckleberries	75.0%	16	86.00%
Wild Strawberries	27.0%	9	89.00%
Camas	23.0%	14	74.00%
Wild Raspberries	22.0%	10	90.00%
Bitterroot	21.0%	11	83.00%
Wild Blackberries	19.0%	15	78.00%
Wild Mushrooms	17.0%	11	92.00%
Sarvisberries	16.0%	14	89.00%
Chokecherries	14.0%	17	87.00%
Lomatiums	14.0%	14	89.00%
Spring Beauty	14.0%	13	84.00%
Indian Carrot	12.0%	12	88.00%
Wild Thimbleberries	11.0%	8	89.00%
Wild Rose	10.0%	21	87.00%
Hazelnuts	10.0%	32	36.00%
Balsamroot	9.0%	22	95.00%
Pine Nuts	8.0%	14	37.00%
Soapberries	8.0%	18	84.00%
Blue Elderberries	7.0%	17	89.00%
Sage	7.0%	37	65.00%
Lichen (Moss)	7.0%	10	78.00%
Oregon Grape	3.0%	9	95.00%
Walnuts	3.0%	53	100.00%
Red or Black Hawthorn	2.0%	21	100.00%
Valerian	1.0%	44	84.00%
Cattail	1.0%	19	100.00%
Huss Huss	1.0%	12	100.00%
Buckbrush	1.0%	8	86.00%
Bunchberries	<1%	6	57.00%

Wabanaki Cultural Lifeways Exposure Scenario (2009)

By the Harper and Ranco

- Coordinated effort among the five federally recognized Tribal Nations in Maine and the US EPA
- Report describes traditional uses, not contemporary uses
- Uses historical and anthropological information



Source: [MIT CEHS](#)

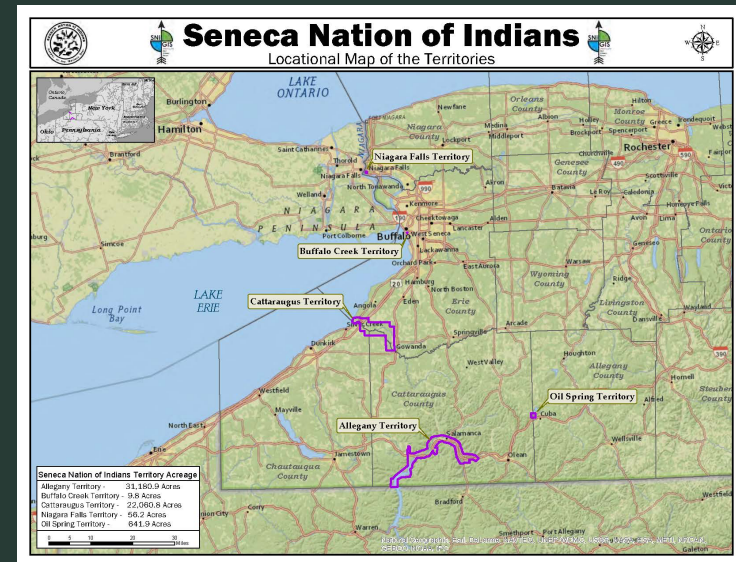
Food category	% of 2000 kcal	Equiv. kcal day	Rep kcal/ 100g	Grams per day
Bulbs	2	40	30	133
Berries, Fruits	2	40	100	40
Other vegetables	2	40	100	40
Greens, Tea	2	40	30	133
Honey, Maple Syrup, Other	2	40	275	15
Seeds, Nuts, Grain	6	120	500	24
Roots, Bulbs, Tubers	2	40	100	40

Land Use Survey (2015)

By *NYSERDA*

- Seneca Nation Territory
- Effort by NYSERDA to determine potential health impacts from radioactive contamination
- Responses are estimates made by technical team without comment from Seneca community

Food Category	Quantity consumed (g/day)	
	Adults	Children
Fruit, grains, and non-leafy vegetation	453.59	194.40
Leafy vegetation	323.99	129.60



Source: [eSpatially New York](http://www.espatially.com)

Carson River Human Health Risk Assessment (2017)

By CB&I Federal Services LLC for the EPA

- Evaluates risks associated with the Carson River Mercury Site in Nevada
- Traditional tribal food intake exposure factors from EPA (2007) and Harper (2005)
- Fallon Paiute-Shoshone Tribe



Source: [EPA](http://www.epa.gov)

Food Category	Quantity consumed (grams per day)
Pine nuts	80
Roots, Tubers	300
Bulbs	300
Berries, fruit, and garden vegetables	333
Greens	833
Seed and grain	50
Honey, tea, etc.	40
Total plant intake	1936

Produce List

Roots

- Balsamroot
- Bitterroot
- Burdock root
- Camas
- Cattail root
- Chicory root
- Dandelion root
- Huss huss
- Indian carrot
- Leek
- Lomatium root

- Spring beauty

- Valerian

Fruits

- Oregon grape
- Chokecherries

Other vegetables

- Beans
- Buckbrush
- Cattail shoot
- Peas
- Squash
- Wild rose

Greens

- Watercress
- Fiddleheads
- Lichen
- Sage

Seeds and Nuts

- Tree Nuts
- Sunflower
- Chia seeds

Other

- Maple syrup
- Wild mushrooms

Plant-Specific Mass Loading Factors (Appendix A)

- MLF Sources:

- Hinton (1992)
- Environment Agency (EA) (2009)
- Pinder and Mcleod (1989)

- Moisture content conversion factor sources:

- EA (2009)
- Stuckel & Low (1996)
- Ixtaina (2008)
- International Atomic Energy Agency (IAEA) (2010)
- IAEA (2014)
- Soil Screening Guidance (EPA)

- Other table components:

- Initial MLF
- Units
- Unit conversion (to obtain g dry soil/kg plant)
- Moisture content conversion factor

Plant-Specific Mass Loading Factors (Appendix A)

Example:

Produce	Initial MLF	Initial MLF units	Initial MLF source	Unit conversion	Units after conversion	Moisture content conversion factor	Moisture content conversion factor sources	MLF	Final MLF units
Root Vegetables									
Balsamroot	0.001	g dry soil / g dry plant	EA (2009)	None	g dry soil / g dry plant	0.103	EA (2009)	1.03E-04	g dry soil / g fresh plant

Transfer Factor Source Hierarchy (Appendix B)

Transfer factors model radionuclide transfer to produce before human consumption

Table components

- Primary, secondary, and tertiary transfer factor categories
- Sources
- Number and list of transfer factors

Example:

Produce	Primary Transfer Factor Category	Primary Transfer Factor Source	Number of Transfer Factors from Primary Source	Secondary Transfer Factor Category	Secondary Transfer Factor Source	Number of Transfer Factors from Secondary Source	Tertiary Transfer Factor Category	Tertiary Transfer Factor Source
Bulbs and roots								
Balsamroot	Root	IAEA TRS 472	34-Ag, Am, Ba, Ce, Cl, Cm, Co, Cr, Cs, Fe, I, La, Mn, Mo, Na, Nb, Np, P, Pb, Pm, Po, Pr, Pu, Ra, Rb, Ru, Sb, Sr, Tc, Th, U, Y, Zr	Root Vegetable	EA	15- Au, Br, Ca, Er, Eu, Ga, In, Lu, Ni, S, Sc, Sm, Tl, V, Zn	None	NCRP-123, RADSSL, RESRAD, Baes paper



Transfer Factor Source Hierarchy (Appendix B)

1. IAEA Technical Report Series no. 472
 - Handbook of parameter values for the prediction of radionuclide transfer in terrestrial and freshwater environments
2. EA
 - Initial radiology assessment methodology
3. NCRP-123
 - National Council on Radiation Protection and Measurements
 - Screening models for releases of radionuclides to atmosphere, surface water, and ground Vol I and II
4. RADSSL
 - EPA Radionuclide Soil Screening Users Guide
5. RESRAD
 - US Dept of Energy
 - User's Manual for RESRAD Versi
6. Baes
 - Oak Ridge National Laboratory
 - Review and Analysis of Parameters Assessing Transport of Environment Released Radionuclides through Agriculture

Next Steps

- Find more sources on tribal ingestion rates and produce items
- Create a report on animal ingestion related to fishing and hunting patterns



Grace Maley

Middlebury College Class of 2021

Environmental Studies and Economics

*Prepared for the US Environmental Protection Agency (EPA).
The project aims to supplement EPA risk assessment models for the consumption of biota by incorporating produce items that are found in Native American diets. The goal is to create more comprehensive and inclusive risk assessment models.*

EPA Contacts:

*Stuart Walker - Office of Superfund Remediation and
Technology Innovation (OSRTI)*

*Michele Burgess - Office of Superfund Remediation and
Technology Innovation (OSRTI)*

Jon Richards – Region 4