Scotland's Net Zero? Operationalizing **Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism (MuSIASEM) in the UK**

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The James Hutton Institute

Net Zero & MuSIASEM

- Self-intro - Fellowship in land use and societal metabolism
- Work in progress
- Scotland (our policy audience, but contextualized by UK) has a goal for net zero by 2045
  - How will this happen? Talk? and the walk?
  - Net zero means offsetting... & mention of afforestation (peatlands too) and carbon capture technologies
  - But not my critique at this point

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- It would be nice to compare Scotland to other places, but even Scotland is not consistent within itself
- We want multi-year too, but one step at a time
- The focal scale: start where we can (the data) and define where we end – much is data determined
- And go global?
- Grammars
- Why does all this matter? Let's see…

Net Zero & MuSIASEM

- What is this? MuSIASEM? Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism
- Think: Russian dolls…
  - Successive embeddedness (vertical & horizontal)
  - Spatial/regional/national, sectoral, temporal (always ‘multi’) -
  - Holon: everything has parts and is part of something else
  - The black box… and ‘unblackboxing’

UK 2019 MuSIASEM

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		2019 UK - Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism (MuSIASEM)																	
		Total Hours of Human Activity	Energy Metabolic Rate				Economic Job Produc-tivity (GVA/Hr)	Energy Flow				Gross Value Added (£2019)	Energy intensity of £	PW All Income (est)	GVA intensity of PW	GHG	Coupling		
																	GHG Intensity of Hour	GHG Intensity of Energy	GHG Intensity of £
		(Mhr)	Total (ktoe/h)	Elec (ktoe/h)	Heat (ktoe/h)	Fuels (ktoe/h)	(£/h)	Total (ktoe)	Elec (ktoe)	Heat (ktoe)	Fuels (ktoe)	(M£)	(toe/£)	(M£)	(£/£)	ktCO2e	ktCO2e/ Mh	tCO2e/ toe	(ktoe/M£)
Level 1	**All Society**	585,140	0.26	0.05	0.10	0.11	3.4	154,509	29,573	57,677	67,259	2,017,344	77	688,517	2.9	447,877	0.8	2.9	0.22
Level 2 (HH vs PW)	**HH Sector**	539,179	0.07	0.02	0.05	0.00	-	38,334	8,918	26,940	2,476	-	-	-	-	132,948	0.25	3.5	-
	Paid Work Sector	45,961	2.53	0.45	0.67	1.41	43.9	116,175	20,655	30,737	64,783	2,017,344	58	688,415	2.9	310,909	7	2.7	0.15
	PW Intensity vs HH	0.1	35.6	27.2	13.4	306.9	-	30	2.3	1.1	26.2	-	-	-	-	2.3	27.4	0.1	-
Level 3 (Paid work breakdown)	**Agriculture**	271	5.37	1.34	0.80	3.23	50.9	1,456	362	218	876	13,802	105	2,598	5.3	47,352	175	32.5	3.43
	Transportation	1,185	47.73	0.40	1.51	45.82	36.8	56,556	478	1,790	54,288	43,618	1,297	16,223	2.7	24,960	21	0.4	0.57
	Energy/Fuel Prod	436	34.29	9.50	15.34	9.45	119.3	14,945	4,142	6,684	4,119	51,984	287	9,405	5.5	85,619	196	5.7	1.65
	Industry	7,359	3.16	1.08	1.72	0.36	48.0	23,221	7,928	12,626	2,667	353,544	66	114,182	3.1	109,826	15	4.7	0.31
	Commercial	20,449	0.65	0.30	0.26	0.08	54.4	13,226	6,209	5,369	1,648	1,113,378	12	313,739	3.5	28,940	1.4	2.2	0.03
	Public Admin	14,635	0.38	0.10	0.22	0.05	25.3	5,493	1,536	3,221	736	369,748	15	211,596	1.7	12,260	0.8	2.2	0.03
	Misc	1,613	0.79	0.00	0.51	0.28	44.2	1,278	0	829	449	71,270	18	20,672	3.4	1,954	1.2	1.5	0.03

- Land, Water, natural capitals, health measures?
- Borders? Input/outputs. Embeddedness/Sudoku

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- Differential impacts of sectors and qualitatively different from each other

Discussion

- What about Scotland? The detail is not in the data.
- We can glean proportions from UK, but we know it's different, ie, AG and grazing land are different
- AG – low value, low employment, large area, small energy sector and might be small but it's a different policy environment than say commercial
- So, yes, metabolics is hard: need hold multiple pieces of information in head at same time. Multi-sector, multi-unit, non-equivalent items
- Kahneman's Systems 2 thinking – not easy, but more representative of socioecological systems

Discussion

- Systems in government are not set up for metabolic analysis; they're set up for economic analysis, and generally everything gets reduced to pounds – this is not working
- This universal currency gives us sloppy grammars
- In the end, we cant externalize, climate change is witness to that.
- Problem shifting (sweep under rug); EU can't feed itself, externalizing emissions, China gets blamed
- Metabolic can analysis tracks all this…

Thanks for listening…

- Please comment/critique (and got data?)
- Can we collaborate?
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