

Gap and Thin Spot Analysis

Climate Literacy and Energy Awareness Network (CLEAN, cleanet.org)

This gap and thin spot analysis of educational resources in the CLEAN collection (cleanet.org) is based on key terms and topical vocabularies that outline the breadth of climate science and energy awareness. The list of topics was developed, tested and refined by CLEAN team members in collaboration with the NOAA climate office.

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*Total number of educational resources in the CLEAN collection addressing the listed topics listed in **bold**. In parenthesis the number of resources at different grade levels (middle school, high school, college level).*

Topic level	Subtopic level	Subsubtopic level	Total	Activity	Visualizati on	Video	
Climate System			256 (175,220,145)	111 (60,83,57)	62 (45,59,42)	79 (67,75,45)	
	Global Energy Balance		25 (14,20,13)	18 (8,13,9)	2 (2,2,0)	5 (4,5,4)	
	Orbital Cycles		25 (17,19,11)	13 (7,8,4)	9 (8,8,6)	3 (2,3,1)	
		Long-term Cycles	6 (3,4,6)	1 (0,0,1)	4 (3,4,4)	1 (0,1,1)	ok
		Seasons	17 (12,13,5)	12 (7,8,3)	4 (4,4,2)	1 (1,1,0)	
	Solar Radiation		34 (22,27,10)	22 (12,15,6)	6 (6,6,1)	7 (5,7,3)	

Topic level	Subtopic level	Subsubtopic level	Total	Activity	Visualizati on	Video	
	Atmospheric Composition		37 (22,31,27)	21 (11,17,15)	6 (2,6,6)	10 (9,8,6)	
		Greenhouse Gases	26 (16,21,18)	15 (8,12,11)	3 (1,3,3)	8 (7,6,4)	
		Aerosols	8 (5,8,6)	4 (2,4,3)	2 (1,2,2)	2 (2,2,1)	ok
		Evolution of Atmosphere	0	0	0	0	? if we have time
	Greenhouse Effect		34 (24,30,20)	13 (5,11,10)	8 (7,8,4)	13 (12,11,6)	
	Atmospheric Circulation		6 (3,5,2)	5 (2,4,2)	1 (1,1,0)	1 (1,1,0)	Ok
		Hadley Cells	0	0	0	0	Ok
		Coreolis Effect	1 (1,1,0)	1 (1,1,0)	0	0	ok
	Ocean and Climate		57 (40,52,28)	27 (13,23,13)	8 (7,8,6)	20 (18,20,10)	
		Heat Capacity of Water	4 (2,3,2)	4 (2,3,2)	0	0	Ok
		Thermohaline Circulation	14 (7,13,8)	8 (2,7,5)	2 (2,2,1)	4 (3,4,2)	
		Thermal Expansion	5 (5,3,1)	2 (2,1,0)	1 (1,1,0)	1 (1,1,1)	ok
	Climate Feedbacks		65 (46,60,38)	29 (14,24,17)	10 (9,10,6)	26 (23,26,15)	
		Albedo	34 (26,31,18)	15 (8,12,8)	3 (3,3,1)	16 (15,16,9)	

Topic level	Subtopic level	Subsubtopic level	Total	Activity	Visualization	Video	
		Deforestation	4 (4,4,3)	0	2 (2,2,2)	2 (2,2,1)	Gap
	Water Cycle		8 (6,7,2)	4 (3,3,0)	1 (1,1,0)	3 (2,3,2)	
	Carbon Cycle		67 (40,56,40)	26 (12,18,16)	21 (12,19,13)	15 (12,14,9)	
		Biogeochemical Processes	25 (16,23,15)	7 (4,6,5)	12 (8,11,6)	4 (2,4,3)	
		Sources and Sinks	32 (22,27,15)	9 (5,6,5)	16 (10,14,8)	4 (4,4,1)	
	Regional Climates		25 (14,21,13)	19 (10,15,9)	3 (1,3,3)	3 (3,3,1)	
	Climate Compared to Weather		13 (12,11,5)	5 (5,4,0)	0	8 (7,7,5)	

Topic level	Subtopic level	Subsubtopic level	Total	Activity	Visualization	Video	
Causes of Climate Change			140 (99,127,88)	52 (22,41,30)	36 (29,36,29)	51 (48,29,48)	
	Cyclical and Natural Changes		54 (36,48,34)	26 (10,21,14)	14 (3,14,13)	14 (13,13,7)	
		El Nino, La Nina, ENSO	10 (6,10,6)	6 (2,6,4)	1 (1,1,1)	3 (3,3,1)	
		Other Oscillations	0	0	0	0	Gap - PDO, AO etc

Topic level	Subtopic level	Subsubtopic level	Total	Activity	Visualizati on	Video	
		Volcanic Eruptions	2 (2,0,0)	1 (1,0,0)	0	1 (1,0,0)	Check tag – otherwise gap
		Solar Output Variability	2 (2,0,0)	1 (1,0,0)	0	1 (1,0,0)	gap
		Seasonal Variability	14 (9,12,6)	10 (5,8,3)	3 (3,3,2)	1 (1,1,1)	
		Long-term Variability (Such as Milankovitch cycles, Snowball Earth)	3 (2,3,2)	1 (1,1,0)	1 (1,1,1)	1 (0,1,1)	Thin spot or tagging error
	Anthropogenic Changes		90 (69,82,56)	25 (12,19,14)	27 (21,27,21)	37 (36,35,20)	
		Greenhouse Gas Emissions	42 (7,36,32)	16 (6,12,11)	9 (6,9,9)	16 (15,14,11)	
		Land Use Changes	11 (7,10,5)	5 (3,4,2)	4 (2,4,2)	2 (2,2,1)	

Topic level	Subtopic level	Subsubtopic level	Total	Activity	Visualizati on	Video	
Measuring and Modeling Climate			288 (204,264,196)	101 (51,81,59)	79 (59,78,71)	108 (94,105,67)	
	Climate Data		235 (174,216,155)	83 (47,67,46)	54 (41,53,49)	98 (86,96,61)	
		Measurements and Observations	175 (141,163,110)	52 (30,42,27)	38 (34,38,34)	85 (77,83,50)	
		Proxy Data	32 (22,28,22)	13 (7,10,8)	5 (4,4,4)	14 (11,14,10)	

Topic level	Subtopic level	Subsubtopic level	Total	Activity	Visualizati on	Video	
		Paleoclimate Records	34 (22,30,24)	14 (8,11,10)	8 (6,7,6)	12 (8,12,8)	
	Global Climate Modeling		59 (26,52,52)	24 (4,17,20)	26 (17,26,24)	9 (5,9,8)	
		Climate Projections	15 (4,14,14)	7 (0,6,6)	8 (4,8,8)	0	
		Climate Reconstructions	4 (1,4,4)	4 (1,4,4)	0	0	ok
		Scenario Development	11 (5,11,11)	4 (0,4,4)	7 (5,7,7)	0	

Topic level	Subtopic level	Subsubtopic level	Total	Activity	Visualizati on	Video	
Impacts of Climate Change			241 (185,224,140)	71 (37,59,27)	55 (44,55,46)	115 (103,110,68)	
	Sea Level Rise		50 (40,46,37)	11 (8,8,3)	20 (18,20,18)	19 (14,18,16)	
	Extreme Weather		33 (22,28,19)	10 (3,8,5)	5 (4,5,4)	18 (15,15,10)	
		Heavy Precipitation/Floods	2 (1,1,1)	0	0	2 (1,1,1)	Gap
		Heat Waves	4 (4,3,3)	0	1 (1,1,1)	3 (3,2,2)	gap
		Drought	7 (6,6,2)	1 (0,1,1)	1 (1,1,1)	5 (5,4,0)	gap
		Hurricanes	8 (3,6,3)	7 (2,5,3)	0	1 (1,1,0)	Gap
	Ecosystem Changes		69 (61,61,28)	21 (15,15,3)	8 (7,8,5)	40 (39,38,20)	

Topic level	Subtopic level	Subsubtopic level	Total	Activity	Visualization	Video	
	Plants and Animals		69 (60,63,26)	24 (17,19,3)	7 (6,7,5)	38 (37,37,18)	
	Melting Ice and Permafrost		69 (56,65,41)	22 (14,19,8)	14 (13,14,12)	33 (29,32,21)	
	Ocean Warming / Acidification		29 (22,27,11)	13 (8,11,3)	5 (3,5,4)	10 (10,10,4)	
	Availability of Water Resources		19 (16,18,10)	2 (0,2,2)	6 (5,6,4)	11 (11,10,4)	
	Agricultural Changes / Food Security		11 (9,11,5)	4 (2,4,2)	3 (3,3,2)	4 (4,4,1)	
	National Security		4 (4,4,3)	1 (1,1,0)	1 (1,1,1)	2 (2,2,2)	ok
	Public Health		13 (8,12,8)	5 (2,4,2)	2 (1,2,1)	7 (5,7,6)	
	Economic Impacts		9 (7,9,6)	4 (2,4,2)	0	5 (5,5,4)	Gap - viz (e.g. billion dollar disaster NOAA)

Topic level	Subtopic level	Subsubtopic level	Total	Activity	Visualization	Video	
Human Responses to Climate Change			110 (80,100,61)	51 (24,44,29)	14 (12,14,7)	45 (44,42,25)	

Topic level	Subtopic level	Subsubtopic level	Total	Activity	Visualization	Video	
	Mitigation Strategies		73 (56,67,35)	35 (20,31,17)	11 (9,11,5)	27 (27,25,13)	
		Emissions Reduction	37 (30,33,14)	22 (16,19,8)	5 (4,5,2)	10 (10,9,4)	
		Carbon-free Energy	11 (9,11,4)	4 (2,4,1)	2 (2,2,0)	5 (5,5,3)	
		Land Use Changes	6 (5,6,4)	3 (2,3,2)	1 (1,1,0)	2 (2,2,2)	thin
		Carbon Capture and Storage	3 (2,3,1)	1 (0,1,1)	1 (1,1,0)	1 (1,1,0)	thin
	Adaptation Strategies		15 (11,14,9)	5 (1,5,3)	2 (2,2,1)	8 (8,7,5)	Thin
		Retrofitting Infrastructure	1 (1,0,0)	0	0	1 (1,0,0)	Not right subtopics?
		New Infrastructure	2 (2,1,1)	0	1 (1,1,1)	1 (1,0,0)	Not right subtopics?
		Social Innovation	3 (3,2,2)	0	1 (1,1,1)	2 (2,1,1)	Not right subtopics?
	Risk Management		4 (2,4,4)	2 (0,2,2)	1 (1,1,1)	1 (1,1,1)	College level concept - discuss in future iteration
	Personal Responsibility		27 (23,25,9)	14 (11,12,6)	5 (4,5,2)	8 (8,8,1)	

Topic level	Subtopic level	Subsubtopic level	Total	Activity	Visualization	Video	
Nature of Climate Science			41 (26,36,31)	19 (8,14,14)	4 (3,4,3)	17 (14,17,14)	
	Process of Science		31 (22,26,23)	15 (7,10,11)	0	15 (14,15,12)	
	Common Misconceptions		2 (0,2,2)	2 (0,2,2)	0	0	Create catalog record for teaching about pages

Topic level	Subtopic level	Subsubtopic level	Total	Activity	Visualization	Video	
Energy Use			161 (116,145,88)	72 (45,58,35)	27 (18,27,19)	56 (50,54,30)	
	Fossil Fuels		46 (30,37,26)	26 (18,17,10)	7 (2,7,7)	12 (10,12,8)	
	Nuclear Energy		13 (8,13,8)	6 (5,6,2)	5 (1,5,5)	2 (2,2,1)	
	Solar Energy		36 (25,35,17)	18 (12,17,7)	6 (2,6,5)	11 (10,11,5)	
	Wind Energy		29 (21,26,17)	13 (10,11,7)	9 (5,9,7)	7 (6,6,3)	
	Other Alternatives		50 (34,47,26)	17 (10,14,7)	10 (6,10,8)	18 (16,18,7)	
	Efficiency and Conservation		53 (42,49,24)	32 (23,28,14)	5 (4,5,2)	15 (14,15,8)	
	Carbon Capture and Storage		3 (1,3,1)	2 (0,2,1)	0	1 (1,1,0)	

Topic level	Subtopic level	Subsubtopic level	Total	Activity	Visualizati on	Video	
	Usage Trends		20 (10,19,15)	10 (6,9,6)	8 (2,8,8)	2 (2,2,1)	
	Energy Policy		5 (0,4,4)	4 (0,3,3)	0	1 (0,1,1)	
	Energy Infrastructure		14 (12,13,11)	8 (8,7,5)	3 (2,3,3)	3 (2,3,3)	