Sustainability

Internship Project Report

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Sustainability

Table of Contents

Acknowledgments 1
Executive Summary 2
1. Background 3
1.1. Sustainable Development 3
1.2. Measuring Sustainability 4
1.3. Education for Sustainability 5
1.4. The United States Environmental Protection Agency 6
1.4.1. Responsibilities and Goals 6
1.4.2. Sustainability Framework 7
1.4.3. Environmental and Sustainability Education 8
2. Internship Project Objectives 8
2.1. Sustainability Indicators 8
2.2. EcoLearn 9
3. Internship Project Approach and Activities 10
3.1. Sustainability Indicators 10
3.2. EcoLearn 11
3.2.1. Standards Alignment 11
3.2.2. Revision 12
3.2.3. Cross-Grade Level Theme Summary 12
3.2.4. Theme backgrounds 12
4. Internship Project Outcomes and Findings 13
4.1. Sustainability Indicators 13
4.2. EcoLearn 16
4.2.1. Standards Alignment 16
4.2.2. Revision 17
4.2.3. Cross-Grade Level Theme Summary 17
4.2.4. Theme backgrounds 17
5. Conclusion 18
6. Appendixes 19
Figure I: U.S. E.P.A. Organization Chart 19
Figure II: E.P.A.'s Region 9 Organization Chart and Functions 23
Figure III: E.P.A.'s Region 9 Programs 24
Figure IV: Sustainability Measurement Tools 26
Figure V: National Sustainable Development Frameworks 29
Power Point Presentation I: World Climate 38
Figure VI: Sustainability Indicator Development Process 41
Figure VII: Standards Alignment 43
Power Point Presentation II: Water Pollution through Images 46
Figure VIII: Cross-Grade Level Theme Summary 51
Figure IX: Background for Third Grade "Animals" 53

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Executive Summary

The following report draws upon my overall internship experience at the U.S. Environmental Protection Agency Region 9 over the period between June 2015 and May 2016. It reflects on literature review, analysis, listening, observation, conversation, and practice. The original purpose of the project was to aid my EPA Learning Project Mentors in the process of creating a tool for measuring the internal organizational sustainability performance of EPA Region 9. Subsequently, the internship shifted toward helping EPA Region 9 and EPA Region 10 improve their environmental and sustainability education pilot project, EcoLearn. The internship provided me with an invaluable learning experience and helped me build transferable skills.

BACKGROUND

Sustainable Development

When we hear the word *sustainability* we think about the ability to endure, sustain, maintain, support, or restrain over time.[1] Though, the concept of sustainability can have different interpretations and dimensions. Since the publication of the Brundtland Report in 1987, the concept of sustainable development has gained broad public attention. The United Nations World Commission on Environment and Development (the Brundtland Commission) defined *sustainable development* as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[2] The underlying belief of the Commission was that economic growth and industrialization could be achieved without environmental damage and social inequality between and within generations. In 1992, the Rio Declaration on Environment and Development, Agenda 21, outlined the steps for fighting global poverty and unwise use of natural resources through sustainable consumption, financial assistance, free trade and investment expansion, to name a few. The Agenda urged counters to implement the concept of sustainable development into states' policies and programs at all levels and to develop indicators of sustainable development that can assist countries in their decision-making.[3] In 2015, the 2030 Agenda for sustainable development updated the goals and targets of the United Nations for transforming the world. It embraced the triple bottom line approach – People, Prosperity and Planet – as a means for eliminating extreme poverty and hunger and creating shared prosperity for all by 2030.[4] While the ambiguity of Brundtland Commission definition of sustainable development allows different interpretations, it clearly recognizes the need for a balance between three dimensions: social, economic and environmental. *Social sustainability* is "the ability of a social system, such as a country, family, or organization, to function at a defined level of social well-being and harmony indefinitely."[5] *Environmental sustainability* is "the ability of the environment to support a defined level of environmental quality and natural resource extraction rates indefinitely."[6] *Economic*

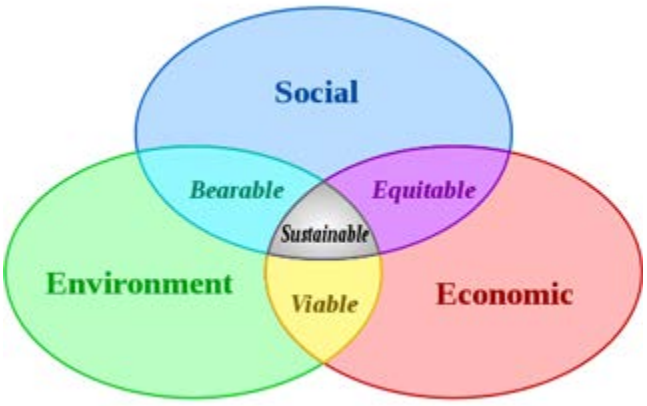


Image: thwink.org

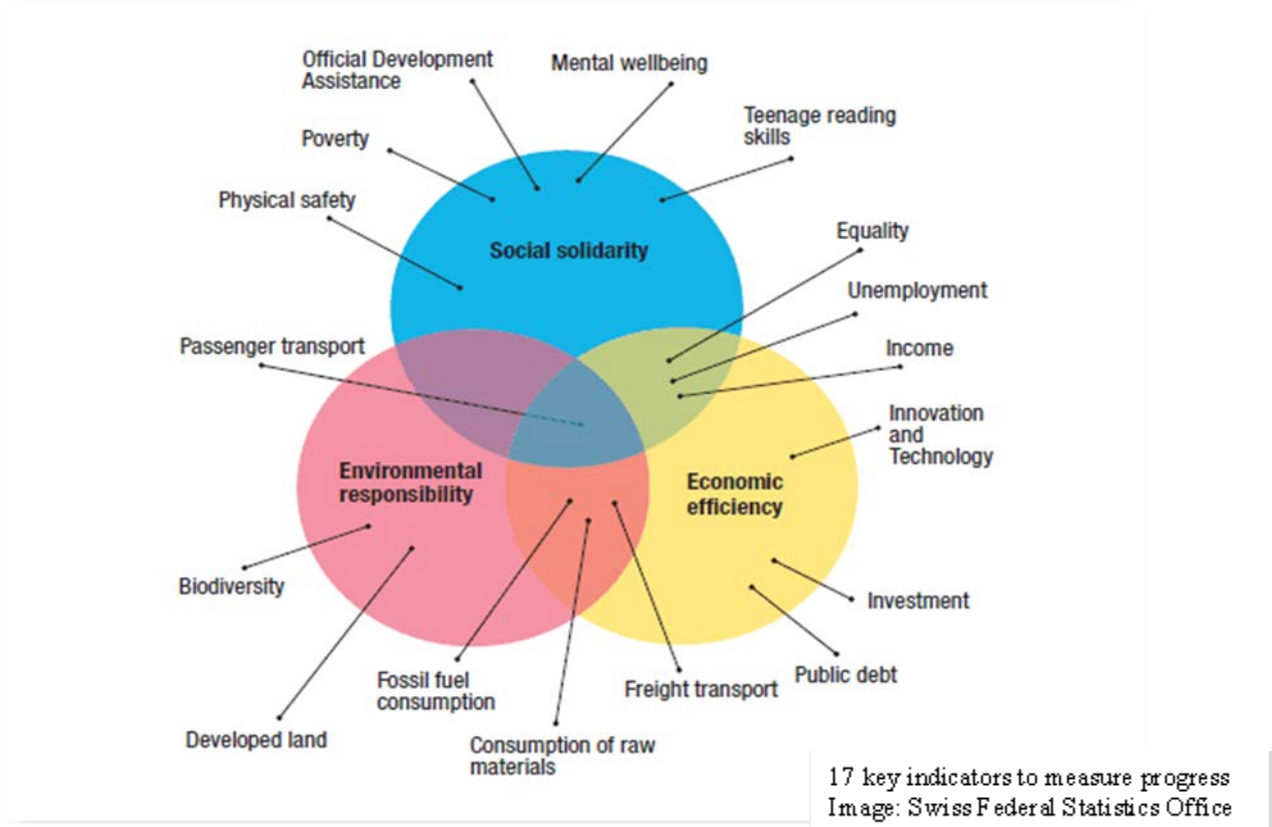
[1] "sustainability." *Dictionary.com*. Online Etymology Dictionary. Douglas Harper, Historian. http://dictionary.reference.com/browse/sustainability
[2] Brundtland Commission, "Our common future: Towards sustainable development." *United Nation* (1987).
[3] UN, "Indicators of Sustainable Development: Guidelines and Methodologies" http://www.un.org/esa/sustdev/natlinfo/indicators/guidelines.pdf page 5
[4] "Transforming our world: the 2030 Agenda for Sustainable Development." *United Nations* https://sustainabledevelopment.un.org/post2015/transformingourworld
[5] http://www.thwink.org/sustain/glossary/ThreePillarsOfSustainability.htm
[6] http://www.thwink.org/sustain/glossary/ThreePillarsOfSustainability.htm

sustainability is "the ability of an economy to support a defined level of economic production indefinitely."[7]

While these parts of sustainability are interconnected, interwoven and interdependent, organizations, businesses and communities in various fields have different notion of how to balance them. Although they have different understanding of how to measure and monitor progress toward their sustainability goals, both the public and private sectors have been responsive to the call of the United Nations to consider sustainability seriously.[8]

Measuring Sustainability

Measuring sustainability is tracking how each of the three pillars of sustainable development is progressing over time. The aim of this process is to ensure that the resources inherited by future generations allow for the same (or greater) levels of wellbeing as enjoyed by current generations. Measuring sustainability utilizes various metrics, indicators, indexes, benchmarks, and assessments to describe characteristics and quantify performance - how effectively an organization or company is achieving its sustainability objectives.[9] A



17 key indicators to measure progress
Image: Swiss Federal Statistics Office

[7] http://www.thwink.org/sustain/glossary/ThreePillarsOfSustainability.htm
[8] IUCN, "The Future of Sustainability" http://cmsdata.iucn.org/downloads/iucn_future_of_sustanability.pdf page 2
[9] Earth Institute, "The Growth of Sustainability Metrics" http://spm.ei.columbia.edu/files/2015/06/SPM_Metrics_WhitePaper_1.pdf

sustainability indicator is perceived to represents "a measurable aspect of environmental, economic, or social systems that is useful for monitoring changes in system characteristics relevant to the continuation of human and environmental wellbeing."[10] The effectiveness of scientifically constructed indicators depends on "trade-offs between scientific soundness and rigor, political effectiveness and democratic legitimacy."[11] Sustainability indicators inform decision-makers, government officials, and the public; they can be a powerful tool to foster sustainability.

The process of assessing the progress toward achieving predetermined goals, including evaluating (i) "information on the efficiency with which resources are transformed into goods and services (outputs)", (ii) "the quality of those outputs … and outcomes (the results of a program activity compared to its intended purpose)", and (iii) "the e effectiveness of government operations in terms of their specific contributions to program objectives"[12] refers to *performance measurement*. The performance of an organization in all dimensions of sustainability and for all drivers of organizational sustainability refers to *organizational sustainability performance*.[13] Measuring the internal organizational sustainability performance provides a reliable method to determine the level of integration of sustainability into daily operations and to suggest effective ways for cultural change in the organization.

Education for Sustainability

Education for sustainability "seeks a transformative role for education, in which people are engaged in a new way of seeing, thinking, learning and working. People are not only able to explore the relationships between their lives, the environment, social systems and institutions, but also to become active participants and decision-makers in the change process."[14] Education for sustainability helps students develop skills such as envisioning, critical thinking and reflection, dialogue and negotiation, collaboration and building of partnerships. [15] The urgent need for individuals and communities to understand the concepts of sustainability has motivated government and non-government organizations to spread sustainability education worldwide. The United Nations Educational, Scientific and Cultural Organization (UNESCO) is serving as the lead agency for education for sustainability project, and nations are being encouraged to establish their own sustainability education initiatives.[16]In the United States, the U.S. Partnership for Education for Sustainable Development is serving as a community-building "convener,

[10] Joseph Fiksel, Tarsha Eason and Herbert Frederickson. "A Framework for Sustainability Indicators at EPA." U.S. Environmental Protection Agency, October 2012. http://www.epa.gov/sustainability/docs/framework-for-sustainability-indicators-at-epa.pdf

[11] Paul-Marie Boulanger, "Sustainable development indicators: a scientific challenge, a democratic issue" http://sapiens.revues.org/166

[12] EPA, "BALANCED SCORECARD: Performance Measurement and Management Program Guide" https://www.epa.gov/sites/production/files/2014-06/documents/framework.pdf

[13] Stefan Schaltegger and Marcus Wagner, "Integrative management of sustainability performance, measurement and reporting", *International Journal of Accounting, Auditing and Performance Evaluation* 3, no. 1 (2006): 1-19..

[14] Daniella Tilbury and David Wortman, "Engaging People in Sustainability." Commission on Education and Communication, IUCN, Switzerland (2004): 9

[15] Daniella Tilbury and David Wortman, 9

[16] UNESCO, "Education for Sustainable Development" http://en.unesco.org/themes/education-sustainable-development

catalyst and communicator for sustainability education.[17] The role of the U.S. Environmental Protection Agency has been central for encouraging industry and the public to integrate sustainability thinking and sustainable practices into everyday life.

The United States Environmental Protection Agency

Responsibilities and Goals

On December 2, 1970, the United States Environmental Protection Agency (EPA) was born with the mission "To protect human health and the environment."[18] Concerns over human and environmental health pushed the Nixon Administration (1969–1974) to merge key antipollution programs into a new, independent agency. Environmental duties from the Department of the Interior; Department of Agriculture; Department of Health, Education and Welfare; Atomic Energy Commission; Federal Radiation Council; and Council on Environmental Quality were transferred to the newly formed EPA.[19] Although the President's Advisory Council on Executive Organization "recommended organizing EPA according to functional categories (e.g., monitoring, research, standard-setting, enforcement, assistance) rather than along media lines (e.g., air, water, land)" to better address the interrelated nature of pollution problems, fears of "frictions and chaos" left intact each of the current media programs.[20] The current organizational structure of EPA is a hybrid structure that incorporates twelve headquarters media and functional-based offices and ten regional offices. Each EPA regional office is responsible for the implementation of the EPA's programs within the states it operates. (Appendix: Figure I summarizes the U.S. EPA offices.) The Agency occupies 175 offices and laboratories and employs over 18,000 scientists, lawyers, policy analysts, and engineers nationwide[21,22]

Key responsibilities of U.S. EPA include (i) developing and enforcing regulations that implement environmental laws enacted by Congress; (ii) financially supporting environmental projects through grants; (iii) studying and solving current and future environmental issues; (iv) sponsoring voluntary partnerships and programs with businesses and organizations; (v) further environmental education and consciousness; and (vi) publishing information to inform the public about the activities of the agency.[23] EPA supports international partners in promoting sustainable development, protecting vulnerable populations, building democracy, and facilitating commerce globally.[24] EPA's international priorities include (i) strong environmental institutions, (ii) climate

[17] U.S. Partnership for Education for Sustainable Development http://uspartnership.org/view_archive_path/1
[18] Environmental Protection Agency, "About EPA" http://www2.epa.gov/aboutepa/our-mission-and-what-we-do
[19] Eric Lewis et al, "Studies Addressing EPA's Organizational Structure." EPA Office of Inspector General, Report No. 2006-P-00029. August 16, 2006. http://www.epa.gov/oig/reports/2006/20060816-2006-P-00029.pdf
[20] Eric Lewis et al, "Studies Addressing EPA's Organizational Structure." EPA Office of Inspector General, Report No. 2006-P-00029. August 16, 2006. http://www.epa.gov/oig/reports/2006/20060816-2006-P-00029.pdf page 2
[21] "Greening EPA." EPA http://www.epa.gov/greeningepa/facilities/
[22] Steven G. Gilbert, "Environmental Protection Agency." Toxipedia, Jun 09, 2014 http://www.toxipedia.org/display/toxipedia/Environmental+Protection+Agency#EnvironmentalProtectionAgency-AboutEPA
[23] EPA, "About EPA" http://www2.epa.gov/aboutepa/our-mission-and-what-we-do
[24] EPA, "EPA's International Cooperation" https://www.epa.gov/international-cooperation/basic-information-about-epas-international-cooperation

change, (iii) air quality, (iv) clean water, (v) toxic chemicals, and (vi) electronic waste. EPA operations have helped dramatically improve the air, water and land quality of the United States.

Sustainability Framework

The United States had a sustainable development vision several years before the 1987 Brundtland Report. In 1969, the National Environmental Policy Act (NEPA) declared that the "continuing policy of the Federal Government" is to "create and maintain conditions, under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic, and other requirements of present and future generations."[25] That principle is what currently is described as sustainable development.

Image: EPA

Over the years, sustainability has experienced ups-and-downs under different Presidents, yet it remained an integrated part of the conceptual framework of U.S. EPA. In March 2015, President Barack Obama singed Executives Order (E.O.) 13693, titled "Planning for Federal Sustainability in the Next Decade," which revoked E.O. 13423 of 2007, E.O. 13514 of 2009 and several memoranda. The new Executive Order raises expectation of federal leadership and provides guidance for federal agencies to follow in implementing sustainability practices in the area of energy, climate change, water use, vehicle fleets, construction, and acquisition.[26]

The national 2014-2018 Strategic Plan of U.S. EPA sets forth five major goals[27] and four cross-cutting fundamental strategies.[28] It specifies the sustainability practices that U.S. EPA will incorporate across its facilities, purchases, and operations, including: (i) greenhouse gas emissions reductions; (ii) sustainable buildings; (iii) renewable energy; (iv) water conservation; (v) fleet management; (vi) sustainable acquisition; (vii) pollution prevention and waste reduction; (viii) energy performance contracts; (ix) electronics stewardship; (x) climate change resilience.[29] U.S. EPA's Report on the Environment (ROE) monitors how the condition of the environment and human health in the United States is changing over time by utilizing eighty-five indicators in five theme areas – Air, Water, Land, Human Exposure and Health, and Ecological Condition.[30] U.S. EPA has incorporated sustainable principles into sustainable products and purchasing, green infrastructure, sustainable materials, management, and energy efficiency,

[25] EPA, "Learn About Sustainability" http://www.epa.gov/sustainability/learn-about-sustainability#what
[26] "EO 13693." *FedCenter* https://www.fedcenter.gov/programs/eo13693/
[27] *Goal 1*: Addressing Climate Change and Improving Air Quality; *Goal 2*: Protecting America's Waters; *Goal 3:* Cleaning Up Communities and Advancing Sustainable Development; *Goal 4*: Ensuring the Safety of Chemicals and Preventing Pollution; and *Goal 5:* Protecting Human Health and the Environment by Enforcing Laws and Assuring Compliance http://www.epa.gov/planandbudget/strategicplan
[28] (i) Working Toward a Sustainable Future; (ii)Working to Make a Visible Difference in Communities; (iii)Launching a New Era of State, Tribal, Local, and (iv)International Partnerships; Embracing EPA as a High-Performing Organization to guide the Agency's work. http://www.epa.gov/planandbudget/strategicplan
[29] EPA Strategic Sustainability Plans, https://www.epa.gov/greeningepa/epa-strategic-sustainability-plans
[30] EPA's Report on the Environment (ROE) https://cfpub.epa.gov/roe/

sustainable principles and is yet to incorporate sustainability principles into various decisions, operations, facilities, partnership and sustainability measurement tools.[31]

Environmental and Sustainability Education

The National Environmental Education Act of 1990 "requires EPA to provide national leadership to increase environmental literacy." The U.S. EPA has established an Environmental Education and Training Program with the goal to "train educational professionals in the development and delivery of environmental education and training programs and studies." [32] The Environmental Education program of the Agency increases public awareness and knowledge about environmental issues and engage the public in problem solving, and action to improve the environment.[33] The U.S. EPA recognizes that the "key to resolving current challenges and preventing future ones lies in supporting an educated population that understands the interconnectedness of human and natural systems. In order to engineer solutions to these challenges, [EPA's] workforce needs to augment its capacity to think critically about environmental challenges, analyze potential actions, and work to create sustainable systems."[34]

In sum, the U.S. EPA has a variety of methods, tools, guidance and programs to promote sustainability. The Agency recognizes that incorporation of sustainability principles into its inter- and intra-agency coordination, collaboration and decision making can help increase the environmental, economic, and social benefits.

INTERNSHIP PROJECT OBJECTIVES

Sustainability Indicators

The Sustainability Indicators Project was meant to assist EPA Region 9 in designing a sustainability performance measurement tool that would help enhance the internal organizational sustainability performance via measuring progress toward established goals, informing the management in decision making, and raising understanding, awareness and involvement among EPA personnel.

EPA Region 9 Background

The U.S. Environmental Protection Agency - Pacific Southwest (Region 9) covers Arizona, California, Hawaii, Nevada, Hawaii, Samoa, Guam and 147 federally recognized tribes in the Pacific Southwest.[35] Its 1,088 personnel are divided in several offices and divisions to support the mission of EPA and serve the American environment and people. (Appendix: Figure II

[31] Sustainability and the ROE https://cfpub.epa.gov/roe/sustainability.cfm
[32] EPA, "National Environmental Education Act" https://www.epa.gov/education/national-environmental-education-act
[33] Environmental Education https://www.epa.gov/education
[34] https://www.epa.gov/sites/production/files/2015-10/documents/final2015neeacreport-08_7_2015_2.pdf page 1
[35] Region 9 Office https://www.epa.gov/greeningepa/region-9-office

sketches the organizational structure of EPA Region 9.) The programs of EPA Region 9 are grouped into 21 main themes focusing on environmental issues, vulnerable populations or geographic areas. (Appendix: Figure III lists main EPA Region 9's programs.) The Strategic Plan of EPA Region 9 adopts the national strategic goals of U.S. EPA and applies them to the specific for the Pacific Southwest environmental issues and solutions. EPA Region 9 strives to enforce effectively the new federal standards while employing "a multi-disciplinary approach to specific geographic sub-regions and populations."[36] Over the last several decades, EPA Region 9 has helped reduce smog, improve water quality, clean up hazardous waste and create sustainable, healthy communities. The 267,435 rentable square feet of the EPA Region 9 office in San Francisco (located in the Hawthorne Plaza) has received numerous distinctions for its limited environmental impacts, including the U.S. Green Building Council's LEED® Gold for Existing Buildings (version 2.0) certification in May 2009, LEED Platinum for Existing Buildings (version 2009) in August 2014, and the ENERGY STAR® annually since 2008.[37] EPA Region 9 is "committed to demonstrating the environmental, economic and social equity principles of sustainability in [its] internal operations and regulatory programs."[38] EPA Region 9 has quality indicators to evaluate progress of tackling environmental issues and now it is in the process of implementing a tool that will help the region measure and advance its internal organizational sustainability performance.

EcoLearn

The EcoLearn Project was meant to support EPA Region 9 and EPA Region 10 with improving forty-eight environmental and sustainability education lesson plans for students from kindergarten to fifth grade.

EcoLearn Background

Recognizing "the need and the overwhelming process of identifying effective curriculum to teach the concepts of environmental education in the classroom" and that "current standards focus environmental education on scientific discovery, not environmental protection and action," in addition to that "environmental education at the elementary level is an effective way of educating both the students and the parents about the opportunities and impacts of human action on the environment," the U.S. Environmental Protection Agency Region 9 and Region 10 offices have assembled a series of lesson plans, named EcoLearn.[39] EcoLearn entails three-year development process: the first year focuses on developing a curriculum, the second year – presenting lesson plans and collecting feedback, and the third year – improving further the curriculum. EcoLearn lesson plans include empirical modules that can be implemented by an external facilitator or classroom teacher; they can be used individually or as a set that build within the school year or between school years. EcoLearn comprises forty-eight lessons divided

[36] Region 9 Strategic Plan https://www3.epa.gov/region9/strategicplan/
[37] EPA, "Region 9 Office" https://www.epa.gov/greeningepa/region-9-office
[38] Sustainable Region 9 Policy https://www.epa.gov/sites/production/files/2015-07/documents/r9-ems-policy-statement_2010.pdf
[39] U.S. EPA Region 9 and 10, Letter to Schools & EcoLearn K-5 Curriculum Pilot, 2015, by Viccy Salazar

into eight themes per grade: Air, Animals, Climate change, Ecosystems, Energy, Food, Waste, and Water. *Air* included subthemes such as atmosphere structure, carbon cycle, greenhouse effects, acid rain, sources and impacts of air pollution, and reducing air pollution; *Animals* – animal diversity, food chain and food web, extinct, endangered and threatened animals, human impacts on animal diversity, fishing exploitation, reducing human impacts, and animal protection; *Climate change* – weather, climate, fossil fuels, causes and impacts of climate change, carbon footprint, and carbon footprint reduction; *Ecosystems* – levels of organization in an ecosystem, types of ecosystems, photosynthesis, energy flows through an ecosystem, and the role of top predators; *Energy* – forms of energy, sources of energy, non-renewable and renewable energy, electricity, energy units, energy consumption, energy efficiency, energy conservation, and pollution reduction; *Food* – food variety, food production, processing, distribution and consumption, food waste composting and recycling, sustainable food, healthy diet, consumer food choice, bee protection, hanger, and community gardens; *Waste* – natural resources, waste production, types of waste, waste disposal and pollution, and waste reduction; and *Water* – water sources, water scarcity, water cycle, water pollution, water consumption, water conservation, and water protection. EcoLearn lesson plans are STEM[40]-tied and designed for students from kindergarten to fifth grade. They are aligned to national and state education standards. Resources for the pilot project were developed with contributions from the U.S. Environmental Protection Agency, the Public Broadcasting Service, National Geographic, the National Aeronautics and Space Administration, and other educational institutions.[41] EcoLearn is developed to supports the mandate of EPA to make a visible difference in communities.

INTERNSHIP PROJECT APPROACH AND ACTIVITIES

Since I knew nothing about sustainability indicators and environmental and sustainability education before starting this internship, my first step was to obtain some understanding about those aspects of sustainability and then to think how to apply those knowledge.

Sustainability Indicators

The activities involved in the Sustainability Indicators Project included literature review, documentary analysis, observation, listening, reflection, and practice. Before being able to explore EPA's operations from sustainability perspectives, I needed to arm myself with a sustainability lens. I reviewed literature on (i) the history of sustainability and core sustainability concepts; (ii) national strategies for sustainable development and performance measurement,

[40] Science, Technology, Engineering and Mathematics are subjects collectively known as STEM
[41] U.S. EPA Region 9 and 10, Letter to Schools & EcoLearn K-5 Curriculum Pilot, 2015, by Viccy Salazar

particularly those of the United States, Germany, New Zealand and Canada; (iii) the sustainability frameworks of the U.S. Environmental Protection Agency, German Federal Environment Agency, New Zealand Environmental Protection Authority and Environment Canada; (iv) the sustainability indicator development processes; (v) organizational sustainability principles and performance reporting structures; (vi) the organizational structure of U.S. EPA; (vii) organizational challenges of implementing sustainability; and (viii) the Action Plan of U.S. EPA. Further, I analyzed EPA's documents, comprising (i) the Region 9 Sustainability Café Notes[42] and the Evaluation of Input from the Region 9 Sustainability Café and Proposed Next Steps[43]; (ii) EPA Region 10 Sustainability/Organizing principles and EPA Region 10 Section Supplement from the General S-CORE™ [44] Assessment; and (iii) U.S. EPA Principles for Greener Cleanups and the ASTM International Standard Guide for a Greener Clean-ups. Further, I gathered firsthand experience on sustainability operations during two EPA events. On July 23rd, I attended the U.S. Environmental Protection Agency sponsored workshop on Campus-Community Partnerships for Advancing Sustainability at San Francisco State University, and on August 6th, 2015, I attended the presentation of Viccy Salazar, U.S. EPA Region 10 Senior Sustainability Policy Advisor, on S-CORE™ at the EPA Office in San Francisco. I furthered my learning through drafting a sustainability indicator development process roadmap and creating a PowerPoint presentation on World Climate Exercise.[45] During our weekly meetings via conference calls, I shared information on accomplished tasks and asked questions that came over the course of the week. I emailed my notes on findings before each weekly meeting. I worked remotely and visited the office on several occasions.

EcoLearn

My EcoLearn work involved four major tasks: aligning forty eight lesson plans to four national and state educational standards; revising lesson plans; creating eight cross-grade level theme summary charts; updating and unifying forty eight theme background sections of lesson plans.

Image: CELF

Standards Alignment

Although EcoLearn lessons were created within the framework of sustainability learning standards, experiences, and instructional strategies, national and state corresponding learning standards were not specifically identified.

[42] Notes on Sustainability Café of April 9, 2014, systemized by Laura Bloch
[43] December 17, 2014 by Laura Bloch
[44] S-CORE™ (Sustainability--Competency, Opportunity, Reporting & Evaluation) is a multi-purpose sustainability assessment tool that was originally created in 2005 by Darcy Hitchcock and Marsha Willard of AXIS Performance Advisors in collaboration with the International Sustainable Development Foundation and the Zero Waste Alliance. https://www.sustainabilityprofessionals.org/resources/s-core-sustainability-assessment
[45] World Climate Exercise is a computer-simulation-based role-playing exercise, mimicking international climate change negotiations.

The process of aligning EcoLearn lesson plans to the national and state standards entailed several steps. First, I explored the websites of the learning standards: the Washington State K-12 Integrated Environmental and Sustainability Learning Standards, the California Education and the Environment Initiative, the Next Generation Science Standards, and the Common Core State Standards. I closely examined how they are grouped by discipline core, ideas and themes. Then, I read thoroughly each of the forty-eight EcoLearn lesson plans to determine what concepts were involved and what standards would be appropriate. After I selected standards for each lesson, I generated tables and organized the information into those tables.

Revision

During the first year of the EcoLearn project, student-interns, under the supervision of EPA Mentors, assembled environmental and sustainability lessons to support learning about the environment and sustainability. My task was to review these lessons and see whether they could be enhanced in terms of clarity, simplicity, source provision and effective key words. Some lesson plans had been already revised by an EPA employee and I made the proposed changes. There were a number of lessons that had not been revised and I needed to determine what improvements the lesson plans needed and then, to do them.

Cross-Grade Level Theme Summary

My next goal was to create summaries of EcoLearn lessons that would provide teachers and volunteers with an easy and quick access to the components and concepts of each lesson. I decided that charts containing key words would serve that purpose. I created charts, re-read lessons to extract strategic information, and organized that information under several categories.

Theme Backgrounds

Assuming that EcoLearn lessons will be used by volunteers with some basic subject matter background and minimal preparation time, I tried to amass such material that would make presenters confident when delivering the lessons. I identified the points that all six lessons under one theme differ and share, searched and selected pertinent information, and then I organized the information.

Our EcoLearn team communicated through weekly emails, conference calls and webinars. I saved my work in a shared Dropbox folder. Every week, I emailed to my Project Supervisors to provide them with an update on the progress of my work. During our conference calls, I learned about the work of the EcoLearn Members who were presenting EcoLearn lessons in class, including what obstacles or successes they had experienced, and how teachers and children reacted to the lessons. Further, I reflected on my work, received clarification on unclear aspects or new tasks.

INTERNSHIP ROJECT OUTCOMES AND FINDINGS

Sustainability Indicators

Prior to my Sustainability Indicators internship, I knew little about sustainability. I was unaware of sustainability frameworks, sustainability indicators, internal[46] and external[47] sustainability performance measurements. Although the U.S. EPA Region 9 office discontinued the Sustainability Indicators project in advance[48], meaning I was not able to finalize any potential set of sustainability indicators that could help EPA Region 9 office measure its organizational sustainability performance, I obtained immense valuable experience and knowledge.

A few important points

There is a need for a shared definition of sustainability**.** Based on perceptions of the importance of a particular sustainability aspect, definitions of sustainability can vary across frameworks and focus on social, economic, or ecological dimension. Though, establishing a clear definition of what sustainability means will help unify the framework of sustainability across sectors and regions. The unifying framework (tools, concepts and standards) will encourage leaders and organizations to look at sustainability through an integrated lens and set forth "holist, equitable and far-sighted" strategies for achieving it and assessing its progress collaboratively.[49]

Indicators represent desirable values and leverage points. As Donella Meadows puts it, "Indicators arise from values (we measure what we care about), and they create values (we care about what we measure). … Their presence or absence, accuracy or inaccuracy, use or non-use, can change the behavior of a system, for better or worse. In fact, changing indicators can be one of the most powerful and at the same time one of the easiest ways of making system changes — it does not require firing people, ripping up physical structures, inventing new technologies, or enforcing new regulations. It only requires delivering new information to new places.[50] There are hundreds of economic, social and environmental indicators that could demonstrate the state of sustainability for a particular place, activity, process or organization. The selection of indicators shows what is important.

Focus is a key element for success. Before undergoing sustainability performance measurements, it should be clarified first what is to be measured and how; what are the main

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[46] An *internal* sustainability performance measurement can include indicators that aim to measure internal conditions and performance, such as the extent of sustainability integrated into daily procedures and operations, employee behavior, and the impacts of these sustainability practices and behavior on organizational culture and operations.

[47] An *external* sustainability organizational performance measurement can include indicators that aim to measure the external impacts of organizational operations. In the case of EPA, this can be the ways EPA's regulatory and enforcement operations, trainings and partnership programs affect the regional, national, international, and global (social, economic, and environmental) sustainability.

[48] The U.S. EPA Region 10 office had developed an effective sustainability organizational performance system and EPA Region 9 decided to adopt it.

[49] Proposing a Unifying Framework for Sustainable Development, The Natural Step Network Contributions For Draft Zero United Nations Conference On Sustainable Development - Rio+20 page 1 http://www.uncsd2012.org/content/documents/319TNS_InputsforDraft%20Zero_Rio20_1Nov2011.pdf

[50] Donella Meadows, "Indicators and Information Systems for Sustainable Development: A Report to the Balatan Group. The Sustainability Institute, Hartland, VT. 1998, viii, 5

sustainability issues and goals of an organization; what activities should be integrated to forge a sustainability culture.[51] There is an old saw that says, "What gets measured gets important and gone." Regular measurement and monitoring keeps a focus on what is important in the long term. The aspects of organizational operations, activities, and resources that are measured tend to get improved while the aspects that are not measured tend to get ignored and often they can get even worse. Focusing on measuring and monitoring only one aspect of sustainability negatively reflects on the remaining aspects. As an agency that has the mission to protect the environment, the U.S. EPA has focused more on the state of the environment than on economic and social concerns. [52] Caution selection of multidimensional indicators could assist U.S. EPA foster improvement in all spheres of sustainability.

Integrating sustainability

The incorporation of sustainable development (the UN Agenda 21) is ongoing process, which varies across national development policies. A comparative analysis of the National Sustainable Development Strategy (NSDS), which is "essentially a *coordinated, participatory and iterative process* to achieve economic, environmental and social objectives in a balanced and integrated manner,"[53] of several countries demonstrates those differences. Appendix: Figure IV briefly summarizes aspects of NSDSs of the United States, Germany, New Zealand and Canada. It appears that the United States has inconsistent NSDS, influenced by political factors. Germany has a strong commitment to sustainable development and the institutional mechanisms of the United Nations. New Zealand has relatively good sustainable development policy integration, but incoherent NSDS; and Canada has coherence between NSDS and provincial and municipal activities, with a focus on environmental sustainability, and good practice in monitoring and evaluation.

Negotiating sustainability

The integration of sustainability within national strategies and practices depends also on international pressure and cooperation. For instance, climate change is a global challenge that jeopardizes sustainability. It requires a global solution, particularly greenhouse gas emissions reductions that will stabilize carbon dioxide levels at or below 450 parts per million and temperature increases at or below 2 °C above pre-industrial levels. However, it is not that easy a country to overcome national interests for global interests. I experienced it first hand during my one-day training of World Climate facilitators at Climate Interactive[54], a not-for-profit organization based in Washington DC. I then created a Power Point presentation (see Appendix: Power Point Presentation I) about World Climate in order to introduce the negotiation-simulation exercise to my EPA Mentors. The role-play is highly simplified version of actual UN meetings, where each participant plays the role of delegates from a particular country or group of countries and C-Learn -- a climate simulator tool – assessed the cumulative impact of the pledges of

[51] Joseph Fiksel et al., "Measuring Progress Towards Sustainability Principles, Process, and Best Practices" http://www.eco-nomics.com/images/Sustainability%20Measurement%20GIN.pdf
[52] Sustainability and the U.S. EPA (2011) page 149 http://www.nap.edu/openbook.php?record_id=13152&page=149
[53] https://sustainabledevelopment.un.org/content/documents/1380REPORT_final.pdf page 14
[54] Climate Interactive https://www.climateinteractive.org/about/

players into the future. Negotiating a viable solution to climate change has the potential to foster deep learning about climate change, sustainability, and the dynamics of international relations.[55] International climate change negotiations impact sustainability at local and global scales.

Measuring sustainability

For the reason that a universal set of sustainability performance measurement upon which most agrees has not been established, governments, businesses and communities have developed a number of diverse indicator sets to measure their sustainability performance. Currently, the Compendium of Sustainable Development Indicator Initiatives inclines 895 sustainability indicator sets.[56] Appendix: Figure V outlines 37 of the most popular sustainability measurement tools. The five most prized sustainability reporting frameworks are the Carbon Disclosure Project (CDP), the Dow Jones Sustainability Index (DJSI), the Global reporting Initiative (GRI), the Global Real Estate Sustainability Benchmark (GRESB) and the Sustainability Accounting Standards Board (SASB).[57,58] Yet putting sustainability into practice remains a challenge and measuring sustainability remains confusing.[59] Largely, U.S. companies lag behind E.U. companies in terms of sustainability disclosure. Principally, there is minimal emphasis on social and institutional dimensions of sustainability[60]

Developing a system of sustainability indicators

An effective sustainable indicator set results from a sustainable developing process. It requires time, effort and active participation. Based on literature review and reflection, I designed a roadmap for crafting an organizational sustainability indicators system, consisting of the following steps: (i) preliminary study; (ii) issue selection; (iii) objectives; (iv) conceptual framework; (v) indicator framework; (vi) initial pool of indicators; (vii) specialist advice; (viii) stakeholder and public consultation; (ix) data collection and processing; (x) indicators analysis; (xi) final selection; (xii) transparency and public information; (xiii) follow up. (Steps are listed and explained in Appendix: Figure VI) A sustainability indicators set can detect to what extent is taken into account the linkages between the social, environmental, and economic dimensions of sustainability, to what extent the measured dimensions are sensitive to stakeholder and managerial participation in the process; and to what extent collaboration, transparency, and accountability across place, activities, and time are demanded.[61]

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[55] "World Climate," Climate Interactive https://www.climateinteractive.org/programs/world-climate/

[56] International Institute for Sustainable Development, "Search the Compendium" http://www.iisd.org/measure/compendium/searchinitiatives.aspx

[57] http://www.globescan.com/component/edocman/?view=document&id=98&Itemid=591

[58] http://www.measurabl.com/wp-content/uploads/measurabl-top-5-sustainability-frameworks.pdf

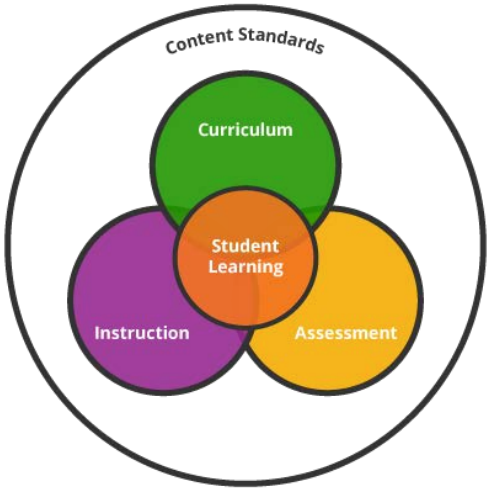
[59] Pamela Laughland and Tima Bansal, "The top ten reasons why businesses aren't more sustainable." Ivey Business Journal, January/February 2011 http://iveybusinessjournal.com/publication/the-top-ten-reasons-why-businesses-arent-more-sustainable/

[60] http://www.worldwatch.org/us-must-commit-sustainability-overcome-mounting-economic-and-ecological-strains

[61] FAO Fishery Resources Division , "Indicators for sustainable development of marine capture fisheries." *FAO Technical Guidelines for Responsible Fisheries.* No. 8. Rome, FAO. 1999 http://www.fao.org/3/contents/fe577ecd-224b-5dba-ac23-7c0d0d619266/x3307e00.htm

EcoLearn Project

"Education is the most powerful weapon which you can use to change the world."
– Nelson Mandela[62]



Standards Alignment

Learning standards describe what students should know and be able to do at each grade level. EcoLearn has eight themes – Air, Animals, Climate, Ecosystems, Energy, Food, Waste, and Water – for each of the six grade-levels. I aligned each of the forty eight lessons to relevant standards from the following four learning standards frameworks:

(i) The *Washington State K-12 Integrated Environmental and Sustainability Learning Standards* and their three areas: Standard 1: Ecological, Social, and Economic Systems; Standard 2: The Natural and Built Environment; and Standard 3: Sustainability and Civic Responsibility.[63]

(ii) The *California Education and the Environment Initiative* and there five principles: Principle I: People Depend on Natural Systems; Principle II: People Influence Natural Systems; Principle III: Natural Systems Change in Ways that People Benefit from and can Influence; Principle IV: There are no Permanent or Impermeable Boundaries that Prevent Matter from Flowing Between Systems; and Principle V: Decisions Affecting Resources and Natural Systems are Complex and Involve Many Factors.[64]

(iii) The *Next Generation Science Standards* and their three distinct and equally important dimensions to learning science: Dimension 1: Crosscutting Concepts – connections Physical Science, Life Science, Earth and Space Science, and Engineering Design; Dimension 2: Science and Engineering Practices – investigation of the natural world, design and building systems; and Dimension 3: Disciplinary Core Ideas – exploration of the key ideas in science.[65]

(iv) The *Common Core State Standards* and their academic standards in mathematics and English language arts/literacy.[66]

An example of standards alignment for one grade-level, particularly Third Grade: "Water," is represented in Appendix Figure VII: Appendix: Figure VII-a - the K-12 Integrated Environmental and Sustainability Learning Standards, Appendix: Figure VII-b - the California Education and the Environment Initiative, Appendix: Figure VII-c - the Next Generation Science Standards, and Appendix: Figure VII-d – the Common Core State Standards.

[62] Nelson Mandela in https://blog.usaid.gov/2013/04/education-the-most-powerful-weapon/
[63] http://www.k12.wa.us/EnvironmentSustainability/pubdocs/ESEStandards.pdf
[64] http://www.californiaeei.org/abouteei/whatistaught/epc/
[65] http://www.nextgenscience.org/
[66] http://www.corestandards.org/about-the-standards/

Revision

My part in the modification of EcoLearn lesson plans entailed: (i) making the suggested by an EPA staff member changes; (ii) ensuring the lessons are clear and organized; (iii) ensuring the credibility of cited sources; (iv) ensuring the provided/cited links work; (v) searching the original sources of activities and materials when citations and/or links were missing; (vi) ensuring each suggested set of key words was suitable for the particular lesson; adding or removing key words; (vii) searching for better images when present images were not clear; (viii) searching information and suitable images and creating PowerPoint slides and presentations to improve understanding of concepts; (ix) searching for and replacing activities when they appeared overly complex or unexciting; (x) searching for and replacing or adding video clips when it deemed to be helpful; and (xi) estimating the approximate duration of each activity and of the total duration of each lesson plan. Appendix: Power Point Presentation II provides an example of my revision work, particularly the Power Point Presentation for fifth grade Water Pollution through Images.

Cross-Grade Level Theme Summaries

The theme summaries are to enable potential EcoLearn presenters to experience EcoLearn lessons quickly. I created eight cross-grade level summary charts that both hint the content of each lesson and show how the particular theme gradually evolves from kindergarten to fifth grade levels. I divided the summary information into seven categories: learning objectives, key concepts, visuals, activities, homework, duration, and alighted to learning standards. In my perspective, that organization could allow the content of each lesson plan to be more visible in terms of strong and weak points, gaps and needs for potential improvements. Appendix: Figure VIII demonstrates a cross-grade level theme summary, specifically for K- Grade 5 “Food and Food Waste” lesson plans.

Theme Backgrounds

The background section is to arm the potential EcoLearn presenters with helpful information about a particular EcoLearn theme (assuming that EcoLearn volunteers/presenters may not be very familiar with the subject). I created new background sections by undergoing the following steps: (i) selecting key concepts that are unique for each lesson plan; (ii) identifying what all six lessons within each theme have in common; (iii) searching for, skimming over and selecting articles in order to gather all the information required; (iv) organizing the information in question-answer form; and (v) citing sources, and suggesting articles for further reading. Appendix: Figure IX is an example of a background section, particularly for fifth grade: “Animals.”

Artist: Yana Ilieva

CONCLUSION

Sustainability is a dynamic, multidimensional, complex, interdisciplinary, holistic and cooperative human approach to protect human and planetary health. The concept of sustainability is built on the assumption that social, economic, and environmental systems are in constant interaction and must be kept in harmony in order economies and cultures to continue to function and benefit from natural systems now and in the future. Implementing sustainability in all public and private aspects of activities is crucial for tackling current and future economic crisis, environmental degradation, poverty, and social inequality. Well-educated and sustainability literate individuals can help solve such issues. Education for sustainability can build lasting change towards a sustainable planet because the idea for sustainability grows and develops in the hearts and minds of learners. The U.S. Environmental Protection Agency strives to improve environmental and community health through the ways it operates and through the ways it makes people think and imagine.

The Sustainability Indicators Project and EcoLearn Project broaden my perspective and contribute to my personal development. Particularly they enhanced my in-depth understanding of: (i) the concept of sustainability; (ii) the characteristics of effective sustainability indicators; (iii) frameworks for measuring the internal organizational sustainability performance; (iv) the process of crafting lesson plans; (v) the process of connecting learning standards and lesson plans; (vi) the organizational structure and operations of the U.S. Environmental Protection Agency; and (vii) specific career paths. Further, the internship tasks enriched my research, analytical, critical thinking, editing, and creativity skills as well as solidified my team working, communication, time management, organizational, and self-reliance skills. While working remotely, from home, allowed me to enjoy maximal time flexibility, I wish I had asked my Mentors to attend more EPA sustainability events. That would have given me a broader perspective of the ways the Agency collaborates with other government agencies to solve sustainability issues as well as would have allowed me to investigate better my career interests. In short, my EPA internship was a rewarding, memorable life experience.

Appendixes

Back to *U.S. EPA Responsibilities and Goals*
Back to Table of Contents

Figure I: U.S. EPA Organization Chart[67]					
Administrator Acting Deputy Administrator					
Office of the Administrator (AO)					
Office of Civil Rights	Office of Children's Health Protection	Office of Civil Rights	Office of Congressional and Intergovernmental Relations	Office of Executive Services	Office of the Executive Secretariat
Office of Homeland Security	Office of Policy	Office of Public Affairs	Office of Public Engagement and Environmental Education	Office of Small Business Programs	Science Advisory Board
12 Headquarters Offices					
Functional Offices					
Office of Administration and Resources Management (OARM)					
Acting Assistant Administrator	Principal Deputy Assistant Administrator	Office of Policy and Resource Management -Director -Deputy Director	Office of Federal Sustainability -Federal Chief Sustainability Officer		
Environmental Appeals Board	Office of Administrative Law Judges	Office of Diversity, Advisory Committee Management and Outreach	Office of Human Resources	Office of Administration	Office of Acquisition Management
Office of Grants and Debarment	OARM – Research Triangle Park Office	OARM – Cincinnati Office			
Office of the Chief Financial Officer					
Chief Financial Officer	Deputy Chief Financial Officer	Acting Assistant Deputy Chief Financial Officer	Associate Chief Financial Officer		
Office of Budget	Office of Planning, Analysis and Accountability	Office of Financial Management	Office of Technology Solutions	Office of Financial Services	Office of Resource and Information Management

[67] "EPA Organization Chart." EPA http://www2.epa.gov/aboutepa/epa-organization-chart

Center for Environmental Finance					
Office of Enforcement and Compliance Assurance					
Principal Deputy Assistant Administrator	Deputy Assistant Administrator	Associate Assistant Administrator for Environmental Justice	Deputy Associate Administrator for Environmental Justice		
Office of Administration and Policy	Office of Civil Enforcement	Office of Criminal Enforcement, Forensics and Training	Office of Compliance	Office of Environmental Justice	Office of Federal Activities
Federal Facilities Enforcement Office	Office of Site Remediation Enforcement				
Office of Environmental Information					
Chief Information Officer	Acting Principal Deputy Assistant Administrator; Acting Deputy Chief Information Officer				
EPA Quality Management Program	Office of Information Collection	Office of Technology Operations and Planning	Office of Information Analysis and Access	Office of Program Management	
Office of General Counsel					
General Counsel	Principal Deputy General Counsel	Deputy General Counsel	Deputy General Counsel		
Air and Radiation Law Office	Alternative Dispute Resolution Law Office	Civil Rights and Finance Law Office	Cross-Cutting Issues Law Office	General Law Office	Pesticides and Toxic Substances Law Office
Resource Management Office	Solid Waste and Emergency Response Law Office	Water Law Office	Ethics Office		
Office of Inspector General (OIG)					
Inspector General	Deputy Inspector General				
Office of Audit	Office of Program Evaluation	Office of Investigations	Office of Mission Systems	Office of Counsel & Congressional and Public Affairs	Office of Chief of Staff
Office of International and Tribal Affairs (OITA)					
Assistant Administrator	Principal Deputy Assistant Administrator	Deputy Assistant Administrator			

Office of Regional and Bilateral Affairs	Office of Global Affairs and Policy	Office of Management and International Services	American Indian Environmental Office		
Office of Research and Development (ORD)					
Principal Deputy Assistant Administrator for Management	Deputy Assistant Administrator for Science	Deputy Assistant Administrator; EPA Science Advisor	Acting Associate Assistant Administrator		
National Center for Computational Toxicology	National Center for Environmental Assessment	National Center for Environmental Research	National Exposure Research Laboratory	National Health and Environmental Effects Research Laboratory	National Homeland Security Research Center
National Risk Management Research Laboratory	Office of the Science Advisor	Office of Science Policy			
Media offices					
Office of Solid Waste and Emergency Response (OSWER)					
Assistant Administrator	Principal Deputy Assistant Administrator	Deputy Assistant Administrator			
Office of Superfund Remediation and Technology Innovation	Office of Resource Conservation and Recovery	Office of Underground Storage Tanks	Office of Brownfields and Land Revitalization	Office of Emergency Management	Federal Facilities Restoration and Reuse Office
Office of Water (OW)					
Assistant Administrator	Deputy Assistant Administrator				
Immediate Office of the Assistant Administrator for Water	Office of Ground Water and Drinking Water	Office of Science and Technology	Office of Wastewater Management	Office of Wetlands, Oceans and Watersheds	
Office of Air and Radiation (OAR)					
Federal Chief Sustainability Officer	Associate Assistant Administrator & Senior Counsel	Deputy Assistant Administrator	Senior Advisor for Congressional and International Affairs	Senior Policy Advisor	
Office of Air Quality Planning and Standards	Office of Atmospheric Programs	Office of Transportation and Air Quality	Office of Radiation and Indoor Air		
Office of Chemical Safety and Pollution Prevention (OCSPP)					
Assistant Administrator	Deputy Assistant Administrator	Associate Assistant Administrator for Management	Senior Policy Counsel		
Office of Pesticide Programs	Office of Pollution Prevention and Toxics	Office of Science Coordination and Policy			

10 Regional Offices
Region 1 (New England) -- Boston
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and 10 Tribal Nations
Region 2 -- New York
New Jersey, New York, Puerto Rico, the U.S. Virgin Islands and 8 Tribal Nations
Region 3 (Mid-Atlantic) -- Philadelphia
Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia
Region 4 (Southeast) -- Atlanta
Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and 6 Tribal Nations
Region 5 -- Chicago
Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin and 35 Tribal Nations
Region 6 (South Central) -- Dallas
Arkansas, Louisiana, New Mexico, Oklahoma, Texas and 66 Tribal Nations
Region 7 (Midwest) -- Kansas City
Iowa, Kansas, Missouri, Nebraska and 9 Tribal Nations
Region 8 (Mountains and Plains) -- Denver
Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations
Region 9 (Pacific Southwest) -- San Francisco
Arizona, California, Hawaii, Nevada, American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Marshall Islands, Republic of Palau, and 148 Tribal Nations
Region 10 (Pacific Northwest) -- Seattle
Alaska, Idaho, Oregon, Washington, and 271 Native Tribes

Back to *U.S. EPA Responsibilities and Goals*

Back to Table of Contents

Figure II: Organization Chart and Functions of EPA Region 9 Office[68]		
Office of the Regional Administrator *Regional Administrator*		*Deputy Regional Administrator*
Office of Public Affairs		*Office of Regional Counsel*
Press and Congressional Affairs Web and Freedom of Information Act Pacific Islands Contact Office (Honolulu, HI		Enforcement Ethics Legal Counseling
Air Division	*Land Division*	*Water Division*
Planning Permits Rules Air Toxics, Radiation & Indoor Air Air Quality Analysis Grants Clean Energy & Climate Change	Pacific Islands US Mexico Border Pesticides Toxics Children's Health Environmental Education Tribal Program Resource Conservation & Recovery Act RCRA & TSCA Corrective Action & Permits Underground Storage Tank Program Solid Waste and Municipal Landfills Sustainable Materials Management Pollution Prevention	Clean Water Act Safe Drinking Water Act Marine Protection, Research & Sanctuaries Act
Env. Mangmt Division	*Superfund Division*	*Enforcement Division*
Information Technology/Management Superfund Cost Accounting Science Policy Quality Assurance Budget, Finance, Contracts Human Resources Health & Safety/Facilities Strategic Planning Laboratory Grants Management	Site Cleanup Federal Facilities and Base Closures Emergency Response & Planning Community Involvement Site Assessment Oil Pollution Brownfields Partnerships, Land, Revitalization Cleanup	Compliance Inspection Case Development State Oversight Compliance Data Management & Analysis NEPA Environmental Justice

Back to *EPA Region 9 Background*

Back to Table of Contents

[68] "Organization Chart for EPA's Region 9 Office." EPA http://www.epa.gov/aboutepa/organization-chart-epas-region-9-office#ora

Figure III: EPA Region 9 Programs[69]
Agriculture Pesticides • Animal Waste Management
Air Actions • Clean Air Technology • Cleanup-Clean Air • Maps • Permitting Program • Radiation Program • State Implementation Plans for Air Quality • Today's Air Quality • Tribal Air • West Coast Diesel Exiting EPA
Biofuels Biodiesel • Waste to Biogas (locate producers)
Clean up Animal Waste Management • Brownfields • Emergencies and Spills • Environmental Justice • Land Revitalization • Superfund Sites • National Superfund Website • Site Evaluation and Cleanup Goals • Underground Storage Tanks
Climate Change Adaptation • Green Building • Energy Efficiency • Recycling • Sustainable Water Infrastructure
Compliance & Enforcement Criminal Investigation • Drinking Water Enforcement • Enforcement Action Public Notices • Hazardous Waste Enforcement • NPDES Compliance & Enforcement • Wetlands Compliance and Enforcement
Communities & Ecosystems Agriculture • Environmental Justice • Federal Facilities Compliance • Funding Sources for Communities • Tribal Program • Pacific Islands • U.S.-Mexico Border
Disasters & Emergency Response and Preparedness Disasters Home • Oil Spills • Cleanup Emergencies • Report a Spill or Environmental Violation
Environmental Impact National Environmental Policy Act (NEPA)
Federal Facilities Federal Green Challenge
Grants & Funding Available Grants • Applying for Grants • Requests for Proposals • Funding Sources for Communities
Green Building Build Green with Reused Materials
Health Children's Environmental Health • Indoor Air • Toxics
Outreach & Media Environmental Education • FOIA • Media Center • Press Contacts • Video Gallery
Pollutants/Toxics Animal Waste Management • Lead • Mercury • Naturally Occurring Asbestos (in California) • PCBs • Pollution Prevention • Toxic Release Inventory
Science and Research Library (Environmental Information) • Quality Assurance in Region 9 • Quality Management Plan • Region 9 Laboratory • Regional Science Council
Superfund Lead • Mercury • PCBs • Pesticides • National Superfund Website • Perchlorate • Toxics Release Inventory
Toxic Substances National Superfund Website • Brownfields • Oil Program • National Priorities List • Regional Screen Levels • Site Overviews
Tribal Regional Tribal Operations Committee (RTOC) • Newsletters • Tribal Air • Tribal Waste • Tribal Water
Waste Biodiesel • Databases & Reporting • EPA ID numbers (RCRA) • Hazardous Waste • Organics • Recycling • Pollution Prevention • Solid Waste Management • State & Local Partnerships • Tribal Waste • Underground Storage Tanks
Water

[69] "Programs and Resources," EPA http://www3.epa.gov/region9/programs-region9.html

Coastal Waters • Dredging Navigational Channels • Injection Wells (UIC) • Marine Debris • Permits (NPDES) • Polluted Runoff (Nonpoint Source Pollution) • Storm Water • Sustainable Water Infrastructure • Pollution Control Plans (TMDL) • San Francisco Bay Delta • Tribal Water Protection • Underground Injection Control • Wastewater Pretreatment (non-residential) • Water Recycling • Water Quality • Watersheds • Wetlands

Back to *EPA Region 9 Background*

Back to Table of Contents

Figure IV: National Sustainable Development Frameworks [table is unfinished]

The United States	Germany	New Zealand	Canada
The National Environmental Policy Act of 1970[70] "Government Performance Results Act" of 1993[71] President's Council on Sustainable Development (1993-1999)[72] Proposed 1997 Sustainable Development Indicators • 32 indicators[73]	"Perspectives for Germany – Our Strategy for Sustainable Development" (2002)[76,77] National Sustainability Strategy 2002 - 2014[78] Structures of sustainability policy[79] • all levels • German Council for Sustainable Development Specific initiatives	Resource Management Act 1991[82] Local Government Act 2002[83] Environment Strategy 2010 (1995)[84] Growing an Innovative New Zealand (2002) Key Government Goals to Guide the Public Sector in Achieving Sustainable Development (2002)	The Auditor General Act of 1995[89] Federal Sustainable Development Strategy (2008)[90] • "a commitment to minimizing the environmental impacts of its policies and operations as well as maximizing the efficient use of natural resources and other goods and services"[91] The FSDS Management Framework 2013–2016[92]

[70] The National Environmental Policy Act of 1970 requires federal agencies to integrate environmental principles into their decision-making processes http://www2.epa.gov/nepa/what-national-environmental-policy-act

[71] The Government Performance Results Act of 1993 requires strategic plans for all agencies containing long-term goals and objectives as well as performance indicators for all government programs https://www.whitehouse.gov/omb/mgmt-gpra/gplaw2m

[72] Created by the Clinton administration in 1993, ceased to operate under the Bush administration in 1999 http://clinton2.nara.gov/PCSD/

[73] http://www.hq.nasa.gov/iwgsdi/1997SDI.html

[76] http://www.nachhaltigkeitsrat.de/fileadmin/user_upload/English/pdf/Perspectives_for_Germany.pdf

[77] Ralf Tils, "The German sustainable development strategy: facing policy, management and political strategy assessments." *European Environment* 17, no. 3 (2007): 164-176.
http://www.politischestrategie.de/publikationen/Tils_2007_European%20Environment.pdf

[78] National Sustainability Strategy from 2002 to 2014 http://www.nachhaltigkeitsrat.de/en/the-council/strategie/?size=1%810%871%810%812%810%870%A1%A7blstr%3D0-1%20union%20select%200%2C1%2C2%2C3%2C4%2C5%2C6%2C7--

[79] https://www.bundesregierung.de/Content/EN/StatischeSeiten/Schwerpunkte/Nachhaltigkeit/nachhaltigkeit-2010-12-13-strukturen-der-nachhaltigkeitspolitik.html

[82] http://www.legislation.govt.nz/act/public/1991/0069/latest/DLM230265.html

[83] http://www.legislation.govt.nz/act/public/2002/0084/latest/DLM170873.html

[84] http://www.mcguinnessinstitute.org/Site/Projects/NSDS_national_strategy/Government_Strategies/environment_2010.aspx

89 The Auditor General Act requires 28 departments to submit to Parliament individual Sustainable Development Strategies

90 http://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1

91 https://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=892FBDA6-1#s1

92 https://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=A78BC4F7-1

"Towards a Sustainable America: Advancing Prosperity, Opportunity, and a Healthy Environment for the 21st Century" (1999)[74]
• 10 goals
  o Health and the Environment
  o Economic Prosperity
  o Equity
  o Conservation of Nature
  o Stewardship
  o Sustainable Communities
  o Civic Engagement
  o Population
  o International Responsibility
  o Education
 	
"2006 Sustainable Practices Toolbox for State and Local Governments"[75]
	• Energy Tax Reform: Pricing Energy for Jobs and Resource Conservation
	• Promoting Renewable Energy
	• Encouraging Green Infrastructure
	• Implementing Sustainable Transportation[80]
	• Voluntary Family Planning[81]
	• Phasing out of Nuclear Power
	• National Climate Protection Program
		Government's Approach to Sustainable Development (2002)[85]
		
		Sustainable Development for New Zealand Programme of Action (2003)[86]
		• Four priority areas
		  o Quality and allocation of freshwater
		  o Energy
		  o Sustainable cities
		  o Investing in child and youth development
		• Six goals[87]
		
		Making New Zealand Strong (2003) and Future Wellbeing: A Sustainability Stocktake of New Zealand (2006)[88]
			Departmental Sustainable Development Strategies[93]
			• Departments and agencies report on their sustainable development activities in annual Reports on Plans and Priorities and Departmental Performance Reports[94]
			• 17 FSDS targets and 26 indicators[95]
			
			Canada's Economic Action Plan: Responsible Resource Development[96]
			
			Canadian Environmental Assessment Act, 2012[97]

[74] http://clinton2.nara.gov/PCSD/Publications/tsa.pdf
[75] Oregon http://www.oregon.gov/gov/Documents/executive_orders/eo0602.pdf
[80] Ralph Buehler, Arne Jungjohann, Melissa Keeley, and Michael Mehling, "How Germany Became Europe's Green Leader: A Look at Four Decades of Sustainable Policymaking'." Solutions-For aa sustainable and desirable future (2011). http://www.thesolutionsjournal.com/node/981
[81] http://everywomaneverychild.org/commitments/all-commitments/germany
[85] http://www.beehive.govt.nz/node/14744
[86] http://www.mcguinnessinstitute.org/Site/Projects/NSDS_national_strategy/Government_Strategies/SDPOA.aspx
[87] (1) Strengthen national identity and uphold the principles of the Treaty of Waitangi; (2) Grow an inclusive, innovative economy for the benefit of all; (3) Maintain trust in government and provide strong social services; (4) Improve New Zealanders' skills; (5) Reduce inequalities in health, education, employment and housing; (6) Protect and enhance the environment
http://www.mcguinnessinstitute.org/Site/Projects/NSDS_national_strategy/Government_Strategies/SDPOA.aspx
88 http://nz.phase2.org/papers-and-presentations
[93] http://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=18846414-1
[94] http://www.tbs-sct.gc.ca/rpp/index-eng.asp
[95] https://www.ec.gc.ca/default.asp?lang=En&n=8684516C-1&offset=2&toc=show
[96] "*Responsible Resource Development* means opportunities for all Canadians, including Aboriginal communities. Our plan achieves the right balance to unleash the potential of our resource sectors to create high-value jobs across Canada while strengthening safety and environmental protection. *Responsible Resource Development* means jobs, long-term growth and prosperity for all Canadians — both today and for generations to come."
- See more at: http://actionplan.gc.ca/en/page/r2d-dr2/overview#sthash.NhCMiFEy.dpuf
http://actionplan.gc.ca/content/r2d-dr2
[97] http://laws-lois.justice.gc.ca/eng/acts/C-15.21/index.html

			Strategic Environmental Assessment[98] • interdependence between environmental sustainability and economic well-being[99]
National Sustainability Performance Monitoring/Measurement Frameworks			
National Environmental Monitoring Initiative[100] 2002 Research Strategy: Environmental Monitoring and Assessment Program[101]	Federal Government Management Concept for a Sustainable Development[102] • 10 management rules[103] • 21 key indicators with 38 goals[104] • Four categories: o Intergenerational Equality o Quality of Life o Social Cohesion	*"Monitoring Progress towards a Sustainable New Zealand" (2002)*[113] *founded the basis for* the "Measuring New Zealand's Progress Using a Sustainable Development Approach: 2008"[114] *"New Zealand's framework for measuring sustainable development"(2009)*[115]	Commissioner of the Environment and Sustainable Development[119] • assessing sustainable development performance Departmental Performance Reports[120] Performance Measurement[121]

[98] http://www.ec.gc.ca/ee-ea/default.asp?lang=En&n=A01CABBD-1
[99] http://www.ec.gc.ca/default.asp?lang=En&n=A1A87CE4-1#Chapter1.1
[100] http://www.wcc.nrcs.usda.gov/publications/Briefing-Book/bb24.html
101 http://www.epa.gov/emap/html/pubs/docs/resdocs/EMAP_Research_Strategy.pdf
102 Sustainability: the strategy http://www.bundesregierung.de/Content/EN/StatischeSeiten/Schwerpunkte/Nachhaltigkeit/nachhaltigkeit-2006-07-27-die-nationale-nachhaltigkeitsstrategie.html
[103] The ten management rules https://www.bundesregierung.de/Content/EN/StatischeSeiten/Schwerpunkte/Nachhaltigkeit/nachhaltigkeit-2007-04-13-die-10-managementregeln-der-nachhaltigkeit.html
[104] The Monitoring: the indicatorshttps://www.bundesregierung.de/Content/EN/StatischeSeiten/Schwerpunkte/Nachhaltigkeit/en-nachhaltigkeit-2007-04-13-erfolgskontrolle:-die-21-indikatoren.html?nn=709674
[113] Monitoring Progress Towards a Sustainable New Zealand (2002) http://www.stats.govt.nz/browse_for_stats/snapshots-of-nz/Measuring-NZ-progress-sustainable-dev-%20approach/monitoring-progress-towards-sustainable-nz.aspx
[114] Measuring New Zealand's Progress Using a Sustainable Development Approach: 2008 http://www.stats.govt.nz/browse_for_stats/snapshots-of-nz/Measuring-NZ-progress-sustainable-dev-%20approach/sustainable-development.aspx
[115] http://www.stats.govt.nz/browse_for_stats/snapshots-of-nz/Measuring-NZ-progress-sustainable-dev-%20approach/framework-measuring-sustainable-development.aspx
http://www.stats.govt.nz/browse_for_stats/snapshots-of-nz/Measuring-NZ-progress-sustainable-dev-%20approach/key-findings/progress-towards-sustainable-development.aspx#
119 The Commissioner of the Environment and Sustainable Development (CESD) in the Office of the Auditor General is responsible for reporting to Parliament on the extent to which departments are implementing and achieving the objectives laid out in their sustainable development strategies http://www.oag-bvg.gc.ca/internet/English/cesd_fs_e_921.html
120 http://www.ec.gc.ca/default.asp?lang=En&n=31D9FF32-1
121 https://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=6B103348-1

	○ International Responsibility Sustainable Indicator Reports[105, 106] • every two years, released by the German Federal Statistical Office – Destatis Progress Reports[107] • every four years, released by the Federal Government German Sustainability Code (2014)[108, 109] • Twenty qualitative Sustainability Code criteria, plus 28 GRI[110] and 16 EFFAS[111] performance indicators • Four areas: ○ Strategy ○ Process management, ○ Environment	"Key Findings on New Zealand's Progress Using a Sustainable Development Approach: 2010"[116] measures New Zealand's environmental, economic, and social progress using • 16 key indicators • Four dimensions: ○ Meeting needs – how well do we live? ○ Fairness – how well are resources distributed? ○ Efficiency – how efficiently are we using our resources?	Reporting Strategy[122] Canadian Environmental Sustainability Indicators[123] • Theme I. Addressing Climate Change and Air Quality[124] • Theme II. Maintaining Water Quality and Availability[125] • Theme III. Protecting Nature and Canadians[126] Indicators Supporting the Federal Sustainable Development Strategy[127]

[105]https://www.destatis.de/EN/Publications/Specialized/EnvironmentalEconomicAccounting/Indicators2014.pdf?__blob=publicationFile
[106] Michael Kuhn and Regina Hoffmann-Müller, "Sustainable Development Indicators in Germany and Linkages to Stiglitz/Sen." *Federal Statistical Office of Germany*, 30 September 2010 http://www.nsi.bg/sites/default/files/files/pages/dgins/dgins_papers/DGINS-NH20100916-e1.pdf
[107] http://www.bundesregierung.de/Content/DE/_Anlagen/Nachhaltigkeit-wiederhergestellt/2012-06-07-fortschrittsbericht-2012-englisch-barrierefrei.pdf?__blob=publicationFile
[108] The German Sustainability Code http://www.nachhaltigkeitsrat.de/uploads/media/RNE_The_German_Sustainability_Code_GSC_text_No_41_January_2012.pdf
[109] Guideline for the Sustainability Code http://www.nachhaltigkeitsrat.de/uploads/media/The_Sustainability_Code_SME_Guideline.pdf
[110] GRI Index http://www.munich-airport.de/media/download/general/publikationen/en/gri-index.pdf
[111] EFFAS indicators, pages 18-20 http://www.effas-esg.com/wp-content/uploads/2011/07/KPIs_for_ESG_3_0_Final.pdf
[116] http://www.stats.govt.nz/browse_for_stats/snapshots-of-nz/Measuring-NZ-progress-sustainable-dev-%20approach/key-findings-2010.aspx#
122 https://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=62458E04-1
123 http://www.ec.gc.ca/indicateurs-indicators/
124 Air and Climate Indicators http://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=03603FB3-1
[125] Water indicators http://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=13307B2E-1
[126] Nature Indicators http://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=DC4B459E-1
[127] http://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=31D0F52A-1

	o Society[112]	o Preserving resources – what are we leaving behind for our children?[117, 118]	
Government Environmental Agencies			
Environmental Protection Agency of the United States[128] • December 2, 1970 • 17,000 employees, 12 Headquarters and 10 Regional offices[129]	**Federal Environment Agency of Germany**[130] • July 22, 1974	**Environmental Protection Authority of New Zealand**[132] • July 1, 2011[133]	**Environment Canada** • June 11, 1971 • 6800 employees, 5 regions[134]

[112] German Sustainability Code Criteria : *Strategy:* (i) Strategic analysis and action, (ii) Materiality, (iii) Objectives, and (iv) Depth of the value chain. *Process Management*: (i) Responsibility, (ii) Rules and processes, (iii) Control, (iv) Incentive systems, (v) Stakeholder engagement, and (vi) Innovation and product management. *Environment*: (i) Usage of natural resources**,** (ii) Resource management**,** and (iii) Climate-relevant emissions. *Society***:** (i) Employment rights and Diversity**,** (ii) Equal opportunities, (iii) Qualifications**,** (iv) Human rights, (v) Corporate citizenship, (vi) Political influence, and (vii) Corruption/Conduct that complies with the law and policy.
http://www.deutscher-nachhaltigkeitskodex.de/fileadmin/user_upload/dnk/dok/leitfaden/The_Sustainability_Code_Guideline_for_SMEs.pdf

[117] http://www.stats.govt.nz/browse_for_stats/snapshots-of-nz/Measuring-NZ-progress-sustainable-dev-%20approach/key-findings-2010.aspx

[118] NZ progress indicators Tupuranga Aotearoa, Key Findings on New Zealand's Progress Using a Sustainable Development Approach: 2008
Meeting needs – how well do we live? (i) Unemployment rate, (ii) Disposable income, (iii) Health expectancy, and (iv) Physical safety. *Fairness – how well are resources distributed?* (i) Access early childhood education, (ii) Income inequality, and (iii) Economic hardship. *Efficiency – how efficiently are we using our resources?* (i) Greenhouse gas intensity, (ii) Energy intensity, and (iii) Labor productivity. *Preserving resources – what are we leaving behind for our children* (i) Distribution of selected native species, (ii) Greenhouse gas emissions, (iii) Nitrogen in rivers, (iv) Adult education attainment, (v) Assets and infrastructure, and (vi) Speakers of te reo Māori

128 Total area: 9,826,675 sq km (land: 9,161,966 sq km and water: 664,709 sq km)
*includes only the 50 states and District of Columbia, no overseas territories
Population:318,892,103 (July 2014 est.); GDP (purchasing power parity): $17.46 trillion (2014 est.); GDP - real growth rate: 2.4% (2014 est.); GDP - per capita (PPP): $54,800 (2014 est.) https://www.cia.gov/library/publications/the-world-factbook/geos/us.html

[129] http://publicaccess.supportportal.com/link/portal/23002/23012/ArticleFolder/2132/About-EPA-General-FAQs

[130] Total Area: 357,022 sq km (land: 348,672 sq km and water: 8,350 sq km); Population: 80,996,685 (July 2014 est.); GDP (purchasing power parity): $3.613 trillion (2014 est.); GDP - real growth rate:1.6% (2014 est.); GDP - per capita (PPP):$44,700 (2014 est.) https://www.cia.gov/library/publications/the-world-factbook/geos/gm.html

[132] Total area: 267,710 sq km (land: 267,710 sq km and water: NA) *includes Antipodes Islands, Auckland Islands, Bounty Islands, Campbell Island, Chatham Islands, and Kermadec Islands; Population: 4,401,916 (July 2014 est.); GDP (purchasing power parity): $158.7 billion (2014 est.); GDP - real growth rate: 3.6% (2014 est.); GDP - per capita (PPP): $35,000 (2014 est.) https://www.cia.gov/library/publications/the-world-factbook/geos/nz.html

[133] "The Environmental Protection Authority (EPA) came into being on 1 July 2011 to assist in the management of New Zealand's environment by providing a consistent regulatory approach to a broad range of environmental issues. The new organisation was created by bringing together functions and staff from the Environmental Risk Management Authority, the Ministry for the Environment and the Ministry of Economic Development."
http://www.epa.govt.nz/Publications/EPA%20SOI%202011-14.pdf

[134] https://ec.gc.ca/default.asp?lang=En&n=BD3CE17D-1

	• 1,500 employees, 5 divisions, 13 sites[131]		

Objectives of Environmental Agencies			
• to protect human health and the environment Through • Making a Visible Difference in Communities across the Country • Addressing Climate Change and Improving Air Quality • Taking Action on Toxics and Chemical Safety • Protecting Water: A Precious, Limited Resource • Launching a New Era of State, Tribal and Local Partnerships • Embracing EPA as a High Performing Organization • Working Toward a Sustainable Future[135]	• to protect and nurture the natural basis for life now and for future generations, • to work to promote sustainable development, • to encourage everyone to consider environmental protection as a matter of course in all their thoughts and deeds[136, 137]	• to protect people and the environment	• to protect and restore Canada's natural environment • to conserve the country's natural heritage • to equip Canadians to make informed decisions on weather, water and climate conditions • to minimize threats to Canadians and their environment from pollution[138]
Key Responsibilities of Environmental Agencies			
• Develop and enforce regulations • Give grants • Study environmental issues • Sponsor partnerships	• Gather environmental data, investigate the relevant interrelationships and making projections	• Provide advice and administrative assistance to a person or group of people appointed by the Minister	• Preserve and enhance the quality of the natural environment, including water, air, soil, flora and fauna;

[131] http://www.umweltbundesamt.de/en/the-uba/about-us
[135] http://www2.epa.gov/aboutepa/epas-themes-meeting-challenge-ahead
[136] https://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/3122.pdf
[137] http://epanet.pbe.eea.europa.eu/european_epas/countries/de
[138] http://www.ec.gc.ca/default.asp?lang=En&n=A1A87CE4-1#Chapter1.1

• Teach people about the environment • Publish information[139]	• Make our knowledge and experience available to a national and international public; advise other national, regional and private bodies. • Provide the general public with clear information and answers • Cooperate in international committees and conferences on the continued development of international environmental protection • Implement environmental law[140, 141]	• Administering applications for major infrastructure projects • Regulating the use of hazardous substances and new organisms • Provides businesses with certification, qualifications and licenses for managing hazardous substances • Administering New Zealand's Emissions Trading Scheme • Managing the environmental effects in New Zealand's Exclusive Economic Zone • Contribute to and co-operate with international forums and carry out international obligations related to its functions under an environmental Act[142]	• Conserve Canada's renewable resources; • Conserve and protect Canada's water resources; • Forecast daily weather conditions and warnings, and provide detailed meteorological information • Enforce rules relating to boundary waters • Coordinate environmental policies and programs for the federal government[143]
Key Topics of Environmental Agencies			
o Air o Water o Health o Climate change o Substances and Toxics o Land, Waste and Cleanup Science o Pesticides o Ecosystems o Sustainable practices	o Air o Water o Health o Climate | Energy o Chemicals o Waste | Resources o Soil | Agriculture o Economy | Consumption o Sustainability | Strategies | International matters o Traffic | Noise	o Legislation and regulations o Nationally significant proposals o Hazardous substances o New organisms o Emissions Trading Scheme o Exclusive Economic Zone o Resource Management	o Air o Water o Nature o Pollution and Waste o Weather o Climate change o Environmental Emergencies o Science and Technology o Sustainable Development o Enforcement

[139] http://www2.epa.gov/aboutepa/our-mission-and-what-we-do
[140] http://www.umweltbundesamt.de/en/the-uba/about-us
[141] http://www.umweltbundesamt.de/en/the-uba/about-us/mission-statement
[142] Statement of Intent For the years 2011– 2014, page 9 http://www.epa.govt.nz/Publications/EPA%20SOI%202011-14.pdf
[143] https://www.ec.gc.ca/default.asp?lang=En&n=BD3CE17D-1

Key Issues of Environmental Agencies			
o Air o Water o Health and Safety o Climate Change o Waste o Chemicals and Toxics o Land and Cleanup o Emergencies o Greener Living o Pesticides[144]			o Air o Biodiversity o Chemicals and Waste Management o Climate Change o Enforcement o Trade and Environment o Water[145]
Environmental Agency Sustainability Frameworks			
"EPA Strategic Plan 2009-2014"[146] • Planning, Budget, and Results[147] • "National Program Manager Guidances"[148]	• Sustainability integrated in all programs and activities • Environmental Law: installations, environmental media and substances (pollution control law, water law, soil		

[144] http://www2.epa.gov/learn-issues
[145] https://ec.gc.ca/international/default.asp?lang=En&n=B054DBA2-1
[146] http://itepsrv1.itep.nau.edu/itep_course_downloads/AdvMgmt_Resources/2009StratPlanChangeDoc.pdf
[147] http://www2.epa.gov/planandbudget
[148] http://www2.epa.gov/planandbudget/national-program-manager-guidances

"EPA for State and Local Governments"[149]	protection law, waste law, chemicals law)[150] • European Institutional Law: the Treaty on European Union and the Treaty on the Functioning of the European Union; the Treaty of Lisbon • Information as an instrument • International cooperation • Antarctic • Cooperation with the countries of Central and Eastern Europe, the Caucasus, Central Asia, and other countries neighboring the EU[151]		
Environmental Agency Organizational Sustainability Measurement Frameworks			
The Report on the Environment • 85 indicators • Six themes o Air o Water o Land o Human Exposure and Health o Ecological Condition o Sustainability[152] Recommendation "adoption of sustainability indicators for purposes of problem definition, goal setting, measurement of progress, evaluation of performance,	• Certified to the standards of the European eco-management and audit scheme[155, 156] • Environmental guidelines "we are consistently engaged in implementing the measures that we recommend to others in an effort to achieve lasting, environmentally acceptable development…We regularly carry out environmental audits, publish the results and the subsequent measures in an environmental declaration, and engage in public discussions about them"[157]		Reports on Plans and Priorities Departmental Performance Reports

[149] http://www.epa.gov/epahome/statelocal.htm
[150] http://www.umweltbundesamt.de/en/topics/sustainability-strategies-international/environmental-law
[151] http://www.umweltbundesamt.de/en/topics/sustainability-strategies-international-matters
[152] http://cfpub.epa.gov/roe/indicators.cfm
155 EMAS' distinctive key elements are performance, credibility and transparency http://ec.europa.eu/environment/emas/about/summary_en.htm
156 http://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/4006.pdf
157 Page 44, https://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/3122.pdf

communication with stakeholders, and public reporting"[153] • New indicators that do not focus only on the environment o economic and social indicators o environmental justice indicators[154]			

Back to *SI Project Outcomes and Findings*
Back to Table of Contents

[153] Fiksel, Joseph, Tarsha Eason and Herbert Frederickson. "A Framework for Sustainability Indicators at EPA." U.S. Environmental Protection Agency, October 2012. http://www.epa.gov/sustainability/docs/framework-for-sustainability-indicators-at-epa.pdf
154 Sustainability and the U.S. EPA (2011) page 149 http://www.nap.edu/openbook.php?record_id=13152&page=149

Figure V: Sustainability Measurement Tools [table is unfinished]		
1.	Ecological Footprint Analysis (EFA) --1992, William Rees	measures human demand on nature -- amount of land and water area a human population would hypothetically need in order to provide the resources required to support itself and to absorb its wastes, given prevailing technology
2.	Carbon Footprint	measures the total carbon dioxide (and sometimes methane) emissions of an individual, industry, activity, or political unit
3.	Life-Cycle Analysis or Assessment (LCA)	is a cradle-to-grave analysis that measures all aspects of an item's history
4.	Energy Return on Investment (EROI)	is the ratio of the amount of usable energy acquired from a particular energy source versus the amount of energy expended to obtain that energy source
5.	I=PAT	Impact (I) on the environment is produced by the combination of population (P), affluence (A), and technology (T) of a given society I=PAT later replaced by STIRPAT (an acronym that refers to a statistical model for assessing environmental impacts at virtually any scale and to a research program in structural human ecology)
6.	UN Human Development Index (HDI) UN Human Poverty Index (HPI)	measures the social wellbeing of a country, including life expectancy, education, and per capita income levels to rate the relative development of a country measures life expectancy, literacy, and basic standard of leaving around the world; supplements the HDI
7.	UN Millennium Development Goals (MDGs)	Goal 1: Eradicate Extreme Hunger and Poverty Goal 2: Achieve Universal Primary Education Goal 3: Promote Gender Equality and Empower Women Goal 4: Reduce Child Mortality Goal 5: Improve Maternal Health Goal 6: Combat HIV/AIDS, Malaria and other diseases Goal 7: Ensure Environmental Sustainability Goal 8: Develop a Global Partnership for Development
8.	The Index of Social Health	measures the social wellbeing of society (mainly applied to the U.S.)
9.	The Genuine Progress Indicator (GPI)	an alternative to GDP; measures in monetary term, but does not simply measure the "busyness" of an economy – takes GDP information and adjust for factors such as income distribution, crime, pollution, long-term environmental damage, and dependence on foreign assets
10.	The Genuine Wealth	an alternative to GDP; measures the physical and qualitative conditions of well-being
11.	The Happy Planet Index (HPI) and Gross Domestic Happiness (GDH)	alternatives to GDP; rate the average human happiness in countries

12.	The Triple Bottom Line (TBL)[158]	rates three aspects of sustainability: financial, social, and environmental; the three Ps: people, planet and profits
13.	The Leadership in Energy and Environmental Design (LEED Certification)	is used to measure, rate, and promote green building
14.	The Sustainability Tracking, Assessment, and Rating System (STARS)	is a transparent, self-reporting framework for colleges and universities to gauge relative progress toward sustainability
15.	The Ecosystem-Based Fishery Management (EBFM)	Holistic approach that seeks a scientific rather than a maximized yield (maximum sustained yield method)
16.	Eco-label: Certified Organic	is administrated by departments of agriculture or other bodies legally entitled to certify organic
17.	Eco-label: Fair Trade	Ensures that products were produces in a socially and environmentally responsible ways
18.	Eco-label: Food Miles	refers to the distance that a food item travels, beginning with where it is grown or processed and ending with where it is purchased or consumed
19.	Eco-label: Forest Stewardship Council	promotes sustainable use of forests and helps consumers make informed decisions
20.	Eco-label: Marine Stewardship Council and Ocean Wise[159]	recognizes and rewards sustainable fishing
21.	The Environmental Sustainability Index (ESI) and the Environmental Performance Index (EPI)[160]	measure overall progress towards environmental sustainability
22.	Framework for Strategic Sustainable Development (FSSD)[161], also known as The Natural Step Framework	Is a process of incorporating various sustainability methods, tools, and concepts
23.	International Organization for Standardization[162]	ISO 26000 provides guidance for social responsibility ISO 14031 framework for Environmental Performance Evaluation
24.	The United Nations Global Compact[163]	works with businesses, agencies, labor, civil society and governments to advance collaboration and ten universal principles in the areas of human rights, labor, environment and anti-corruption
25.	Organisation for Economic Co-operation and Development (OECD) [164]	promotes policies that will improve the economic and social well-being of people around the world
26.	The European Management and Adult Scheme Regulation (EMAS)[165]	is developed by the European Commission for companies and other organizations to evaluate, report, and improve their environmental performance.

[158] http://www.ibrc.indiana.edu/ibr/2011/spring/article2.html
[159] From 1 to 20, adopted from Jeremy L. Caradonna: *Sustainability: A history*. Oxford University Press, 2014.
[160] http://epi.yale.edu/
[161] http://www.alliance-ssd.org/framework-for-strategic-sustainable-development-fssd/
[162] http://www.iso.org/iso/home/standards/iso26000.htm
[163] https://www.unglobalcompact.org/
[164] http://www.oecd.org/about/
[165] http://ec.europa.eu/environment/emas/index_en.htm

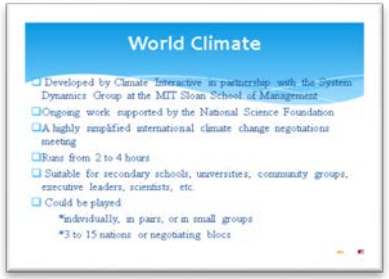
27.	The Global Reporting Initiative[166] GRI's Sustainability Disclosure Database[167]	G4 is the current version of GRI's original Sustainability Reporting Guidelines[168,169]
28.	Sustainalytics[170]	is a global leader in sustainability research and analysis, serving investors and financial institutions around the world
29.	Ethical Investment Research Services (EIRIS)[171]	is a leading global provider of environmental, social and governance (ESG) research, empowering responsible investors with independent analysis and the tools to incorporate this information into investment decisions
30.	The Sustainability Accounting Standards Board (SASB)[172]	
31.	Carbon Disclosure Project (CDP)[173]	
32.	The Dow Jones Sustainability Index (DJSI)[174]	
33.	The *Global Real Estate Sustainability Benchmark* (*GRESB*)[175]	
34.	Ceres and the Tellus Institute's Global Initiative for Sustainability Ratings (GISR)[176]	guides business and other organizations worldwide to expand and accelerate their contribution to sustainable development
35.	Kaplan and Norton's Balanced Scorecard[177]	
36.	AccountAbility[178]	AA1000 Series of Standards
37.	SustainAbility[179]	

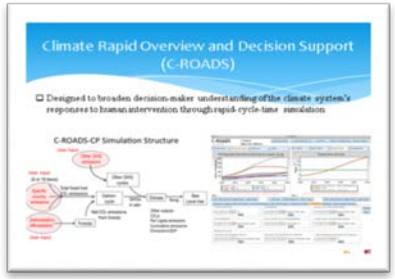
Back to *Measuring Sustainability*

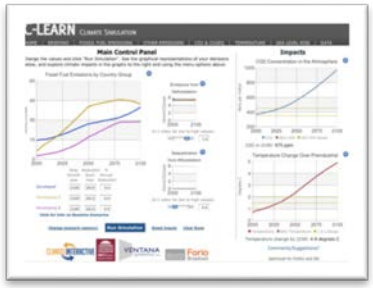
Back to Table of Contents

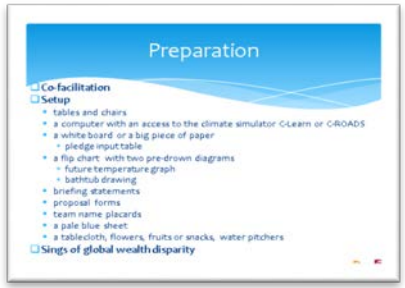
[166] https://www.globalreporting.org/Information/about-gri/Pages/default.aspx
[167] http://database.globalreporting.org/
[168] https://www.globalreporting.org/standards/Pages/default.aspx
[169] https://www.globalreporting.org/resourcelibrary/GRIG4-Part2-Implementation-Manual.pdf
[170] http://www.sustainalytics.com/about-us
[171] http://www.eiris.org/about-us/
[172] http://www.sasb.org/
[173] https://www.cdp.net/en-US/Pages/About-Us.aspx
[174] http://www.sustainability-indices.com/
[175] https://www.gresb.com/about/
[176] http://ratesustainability.org/about/
[177] http://balancedscorecard.org/Resources/About-the-Balanced-Scorecard
[178] http://www.accountability.org/standards/
[179] http://www.sustainability.com/services

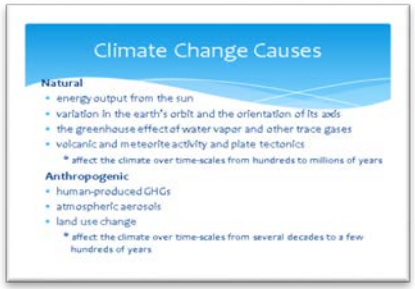
Power Point Presentation I: World Climate Exercise

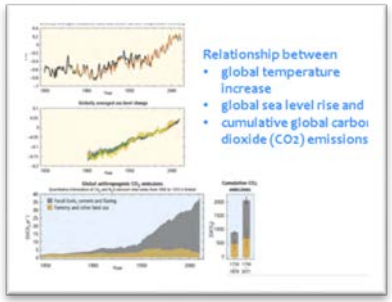


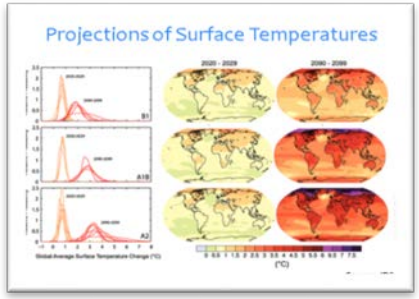


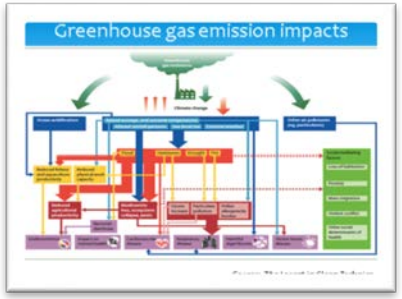


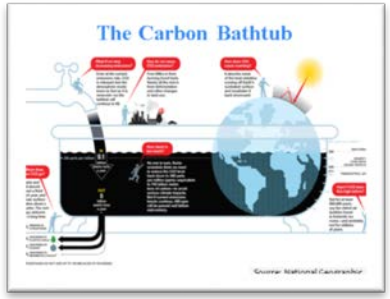












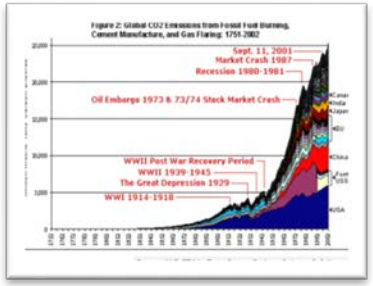
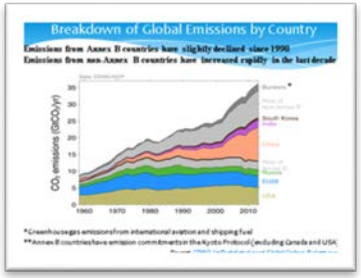
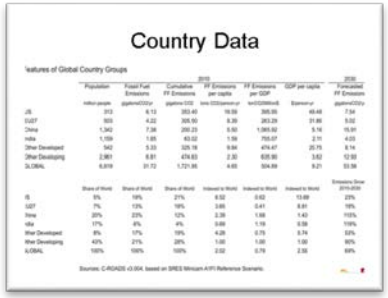


Figure 2: Global CO2 Emissions from Fossil Fuel Burning, Cement Manufacture, and Gas Flaring: 1751-2002
Sept. 11, 2001
Market Crash 1987
Recession 1980-1981
Oil Embargo 1973 & 73/74 Stock Market Crash
WWII Post War Recovery Period
WWII 1939-1945
The Great Depression 1929
WWI 1914-1918


Breakdown of Global Emissions by Country
Emissions from Annex B countries have slightly declined since 1990
Emissions from non-Annex B countries have increased rapidly in the last decade
CO2 emissions (GtCO2/yr)
1960
1970
1980
1990
2000
2010


Country Data

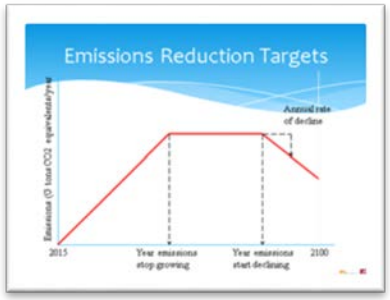
Head of State Meeting, Copenhagen, December 2009
"If there is no sense of mutuality in this process, it's going to be difficult for us to ever move forward in significant way."
—President Barack Obama
"I say this with all due respect and in all friendship… With all due respect to China. [The developed countries have pledged to reduce greenhouse gas emissions by 80 percent.] And in return, China, which will soon be the biggest economic power in the world, says to the world: 'Commitments apply to you, but not to us.' This is utterly unacceptable! This is about the essentials, and one has to react to this hypocrisy!"
—President Nicolas Sarkozy
"Thank you for all these suggestions. We have said very clearly that we must not accept the 50 percent reductions. We cannot accept it."
—Hu Yaobi

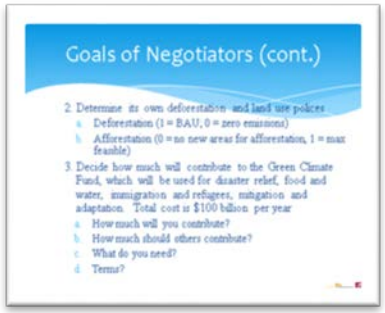
United Nations
Framework Convention or
Climate Change
Twenty climate change negotiations sessions, but no effective agreement over reduction in greenhouse gas emissions

World Climate Players
Meeting Leads
UN Secretary-General
Ban Ki-moon
UNFCCC Executive Secretary
Christiana Figueres
Negotiating Blocs
U.S.
EU
Other Develop Countries
China
India
Other Developing Countries
Lobbyists
Activists
Advisors
C-Learn or C-ROADS

Welcome Delegates
UN Climate Summit

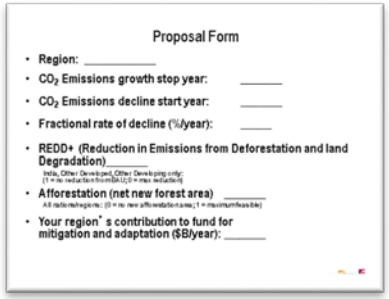
Goals of Negotiators
Achieve emissions reduction commitments to stabilize GHG levels by 2100 at a level that limits global warming to no more than 2 °C above preindustrial levels
Make decisions to address three tasks:
1. Set its own fossil fuel emission targets
a. In what year GHG emissions will stop growing
b. In what year GHG emissions will begin to decline
c. at what rate GHG emissions will decline

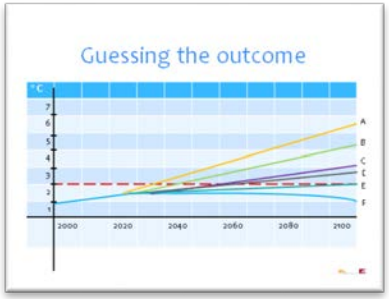

Emissions Reduction Targets
Annual rate of decline
2015
Year emissions stop growing
Year emissions start declining
2100

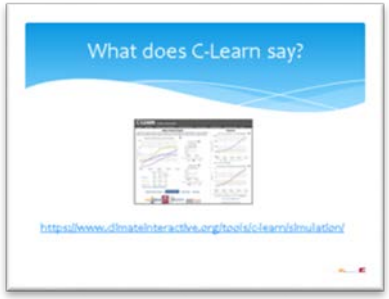

Goals of Negotiators (cont.)
2. Determine its own deforestation and land use policies
a. Deforestation (1 = BAU, 0 = zero emissions)
b. Afforestation (0 = no new areas for afforestation, 1 = max feasible)
3. Decide how much will contribute to the Green Climate Fund, which will be used for disaster relief, food and water, immigration and refugees, mitigation and adaptation. Total cost is $100 billion per year
a. How much will you contribute?
b. How much should others contribute?
c. What do you need?
d. Terms?

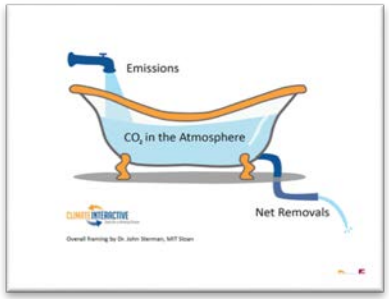
Possibilities for the Global Climate Deal
Global CO2e Emissions
2100 Values
150
100
50
0
2000
2020
2040
2060
2080
2100
CLIMATE INTERACTIVE

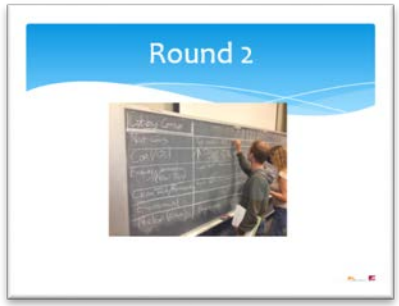
Round 1

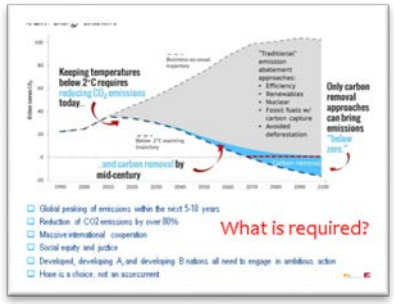


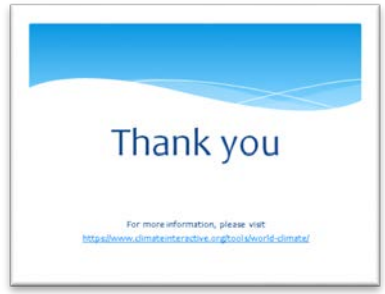












Back to *SI Project Outcomes and Findings*
Back to Table of Contents

Figure VI: External Organizational Sustainability Indicator System Development Process
Step 1: Preliminary study
• A small working group explores (i) the broad conceptual framework of sustainability, (ii) the sustainability performance measurement and monitoring frameworks, *including* the characteristic of sustainability indicator systems, criteria for *effective sustainability indicators, and methods for organizing sustainability indicators;* and (iii) whether a standard set of sustainability indicators could be utilized or adapted
Step 2: Issue selection
• The working group (i) creates a list of EPA Region 9 priority issues; (ii) reviews and condenses the list; and (iii) defines each issue/field of action clearly
Step 3: Objectives
• The working group identifies and clarifies the overall EPA Region 9 sustainability goals and objectives and their scope and scale
Step 4: Conceptual framework
• The working group (i) adopts a definition of sustainability; and (ii) identifies EPA Region 9 sustainability themes (and subthemes), including elements necessary for sustainability
Step 5: Indicator framework
• The working group (i) adopts a definition of *sustainability*; and (ii) identifies EPA Region 9 sustainability themes (and subthemes), including elements necessary for sustainability
Step 6: Initial pool of indicators
• The working group (i) generates an initial set of sustainability indicators that relates to elements necessary for EPA Region 9 sustainability goals/objectives; (ii) reevaluates/removes duplication and refines the list; (iii) divides indicators in several dominant sustainability themes (and subthemes); and (iv) provides a basic definition, applicable unit of measurement and period covered for each indicator
Step 7: Specialist advice
• The working group (i) discusses EPA Region 9 issues/goals/objectives, key principles and criteria for selecting indicators and the initial set of indicators with EPA regional/departmental specialists (via e-mail/phone, in person, or group meeting/Sustainability Indicators Café); (ii) compiles experts' comments and suggestions; and (iii) updates the set of indicators
Step 8: Stakeholder and public consultation
• The working group (i) organizes and conducts a participatory session with key stakeholders and members of civil society/community to discuss EPA Region 9 sustainability goals/objectives and sustainability performance measurement framework, including principles and criteria for selecting indicators, and the set of candidate indicators; and (ii) updates the list of indicators
Step 9: Data collection and processing
• The working group (i) pares down the list of indicators based on its knowledge of available data sources (the group could identify and contact certain primary or alternative data holders); and (ii) refines the list of indicators, if needed
Step 10: Indicators analysis
• The working group applies EPA Region 9 indicator criteria to test the relevance-strength of each indicator; and (ii) narrows down the indicator list
Step 11: Final selection
• The working group (i) identifies the final set of sustainability indicators; and (ii) checks again whether each indicator is clearly defined, covers strategic goals and has a proper unit of measurement and period covered
Step 12: Transparency and public information
• The working group ensures that (i) EPA Region 9 indicator system is publicized and easily accessible to the public; (ii) information is easily understandable ; (iii) and a channel for public input on indicators is available
Step 13: Follow up
• The indicator set is periodically evaluated, reviewed, optimized and updated
References
• ACT Rochester, "About ACT Rochester," http://www.actrochester.org/frequently-asked-questions

- László Pintér et al., “Developing a system of sustainability indicators for the Lake Balaton region” International Institute for Sustainable Development, 2008 https://www.iisd.org/pdf/2010/developing_sustainability_indicators_balaton.pdf
- Denise Brown, “Good Practice Guidelines for Indicator Development and Reporting,”2009 http://www.oecd.org/site/progresskorea/43586563.pdf
- Sustainable Measures, "Sustainability Indicators 101: Indicators of Sustainability." *Sustainable Measures* http://www.sustainablemeasures.com/indicators
- Amy Lynch et al., “Sustainable Urban Development Indicators For The United States.” Report to the Office of International and Philanthropic Innovation, 2011 http://penniur.upenn.edu/uploads/media/sustainable-urban-development-indicators-for-the-united-states.pdf
- Ravi Prabhu et al., Testing and Developing Criteria and Indicators for Sustainable Forest Management in Cameroon: The Kribi Test.” *Center for International Forestry Research*, 1998 http://www.cifor.org/publications/pdf_files/books/spubs/sp-kribi.pdf

Back to *Sustainability Indicators Project Outcomes and Findings*

Back to Table of Contents

Figure VII-a: the K-12 Integrated Environmental and Sustainability Learning Standards[180]
Standard 1: Ecological, Social, and Economic Systems
• Students develop knowledge of the interconnections and interdependency of ecological, social and economic systems. They demonstrate understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, and global levels.
Standard 2: The Natural and Build Environment
• Students engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments.
Standard 3: Sustainability and Civic Responsibility
• Students develop and apply the knowledge, perspective, vision, skills, and habits of mind necessary to make personal and collective decisions and take actions that promote sustainability.

Figure VII-b: the California Education and the Environment Initiative[181]		
Principle I: People Depend on Natural Systems		
• The continuation and health of individual human lives and of human communities and societies depend on the health of the natural systems that provide essential goods and ecosystem services.		
Concept B: Students need to know that the ecosystem services provided by natural systems are essential to human life and to the functioning of our economies and cultures.		
Principle III: Natural Systems Change in Ways that People Benefit from and can Influence		
• Natural systems proceed through cycles that humans depend upon, benefit from, and can alter.		
Concept A: Students need to know that natural systems proceed through cycles and processes that are required for their functioning.	*Concept B:* Students need to know that human practices depend upon and benefit from the cycles and processes that operate within natural systems.	*Concept C*: Students need to know that human practices can alter the cycles and processes that operate within natural systems.

Figure VII-c: the Next Generation Science Standards[182]		
From Molecules to Organisms: Structures and Processes		
• 5-LS1-1: Support an argument that plants get the materials they need for growth chiefly from air and water.		
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Engaging in Argument from Evidence: Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Support an argument with evidence, data, or a model.	*LS1.C: Organization for Matter and Energy Flow in Organisms*: Plants acquire their material for growth chiefly from air and water.	*Energy and Matter:* Matter is transported into, out of, and within systems.
Earth's Systems		
• 5-ESS2-2: Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.		
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts

[180] http://www.k12.wa.us/environmentSustainability/Standards/default.aspx
[181] http://www.californiaeei.org/abouteei/whatistaught/epc/
[182] http://www.nextgenscience.org/search-standards

Using Mathematics and Computational Thinking: Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. Describe and graph quantities such as area and volume to address scientific questions.	*ESS2.C: The Roles of Water in Earth's Surface Processes:* Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.	*Scale, Proportion, and Quantity:* Standard units are used to measure and describe physical quantities such as weight and volume.
Earth and Human Activity		
• 5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.		
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information: Obtain and combine information from books and other reliable media to explain phenomena.	*ESS3.C: Human Impacts on Earth Systems:* Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.	*Systems and System Models*: A system can be described in terms of its components and their interactions. *Connections to Nature of Science*: Science findings are limited to questions that can be answered with empirical evidence.
Earth's Systems		
• 2-ESS2-3: Obtain information to identify where water is found on Earth and that it can be solid or liquid.		
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information: Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information. Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question.	*ESS2.C: The Roles of Water in Earth's Surface Processes:* Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.	*Patterns*: Patterns in the natural world can be observed.

Figure VII-d: the Common Core State Standards[183]
Mathematics
Mathematical Practices
Reason abstractly and quantitatively
• CCSS.Math.Practice.MP2: Mathematically proficient students make sense of quantities and their relationships in problem situations.
Model with mathematics

[183] http://www.corestandards.org/read-the-standards/

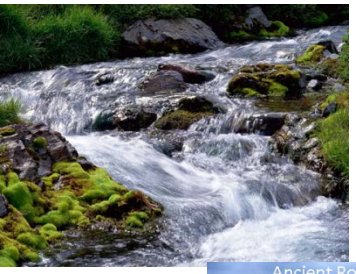
• CCSS.Math.Practice.MP4: Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace.
English Language Arts
Reading: Informational Text
Integration of Knowledge and Ideas • CCSS.ELA-Literacy.RI.3.7: Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).
Writing
Research to Build and Present Knowledge • CCSS.ELA-Literacy.W.3.8: Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.
Speaking and Listening
Comprehension and Collaboration • CCSS.ELA-Literacy.SL.3.3: Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.
Presentation of Knowledge and Ideas • CCSS.ELA-Literacy.SL.3.6: Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification.

Back to *EcoLearn Outcomes and Findings*: Standards Alignment

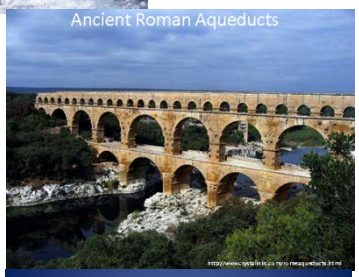
Back to Table of Contents

Power Point Presentation II: Fifth Grade: "Water Pollution through Images"

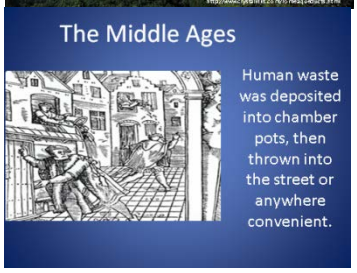
Slide 1:
Water pollution comes from both natural and human-made sources. Water pollution refers to "any change or modification in the physical, chemical and biological properties of water that will have a detrimental consequence on living things."[184]



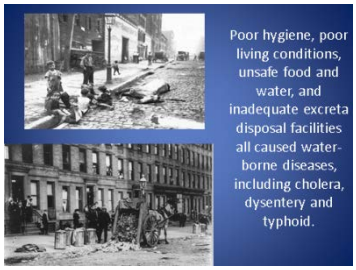
Slide 2:
In ancient times, humans would drink fresh water from streams, lakes, ponds and rain.
As human populations took on agriculture and formed permanent settlements the risk of water contamination and disease increased as human and animal waste were often dumped into the closest river or stream.



Slide 3:
The Romans constructed aqueducts to bring a constant flow of water from distant sources into cities and towns, supplying public baths, latrines, fountains and private households. Waste water, primarily rainwater from roofs and pavements, was removed by the sewage systems and released into nearby bodies of water.[185]



Slide 4:
During the Middle Ages in Europe, water borne diseases such as Typhoid Fever and Cholera broke out with regularity because people often disposed of their wastes in the street or in bodies of water that were also used as a drinking source.[186]



Slide 5:
By the 1800s, people began to understand that unsanitary living conditions and water contamination contributed to disease epidemics.[187] Toilets were installed in houses in the early 19th century, but they were usually connected to cesspools, not to sewers. In densely populated areas, local conditions soon became intolerable because the cesspools were seldom emptied and frequently overflowed.[188]

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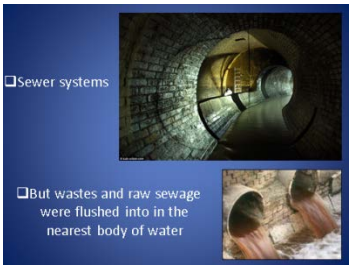
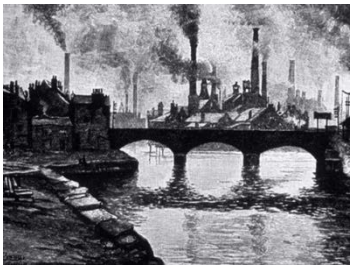
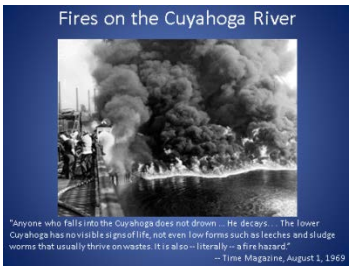
[184] http://eschooltoday.com/pollution/water-pollution/what-is-water-pollution.html
[185] http://www.engr.mun.ca/~jsharp/6101/6101.html
[186] Steven Solomon, *The Epic Struggle for Wealth, Power, and Civilization.* New York: Harper Perennial, 2011.
[187] Steven Solomon, *The Epic Struggle for Wealth, Power, and Civilization.* New York: Harper Perennial, 2011.
[188] http://www.engr.mun.ca/~jsharp/6101/6101.html



Slide 6:
Many cities install sewer systems but wastes and raw sewage were flushed into oceans, lakes, and rivers.



Slide 7:
As cities became more populated towards the end of the 19th century, industrialized cities across Europe and the United States were experiencing a new kind of pollution: waste from industries and factories.[189]

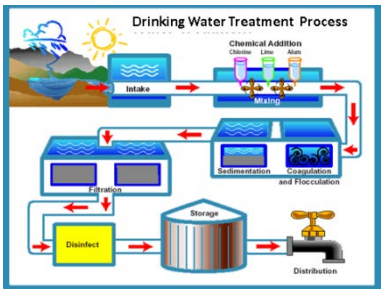


Side 8:
Water and air pollution in U.S. urban areas continued to increase well into the 20th century. The Cuyahoga River in Cleveland, Ohio became so polluted that the water erupted into flames! The first fire occurred in 1936, when a spark from a blowtorch ignited floating debris and oils. Over the next 30 years, the river caught fire several more times. In 1969, another major fire erupted. This time, with the help of news and magazine coverage, the fire prompted the nation to take immediate action against water pollution. The public response to this event helped create the Federal Water Pollution Control Act (1972), commonly called the Clean Water Act.[190]

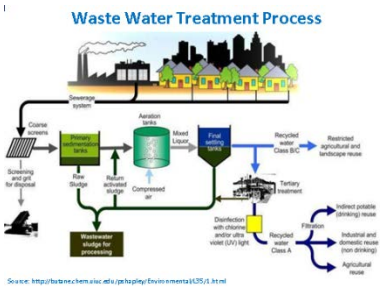
Slide 9:
The Santa Barbara oil spill of 1969 spewed an estimated 3-million gallons of crude oil into the ocean, creating an oil slick 35 miles long along California's coast and killing thousands of birds, fish and sea mammals. The spill became a flashpoint for the founding of the environmental movement. The Earth Day—April 22—marks the anniversary of the birth of the modern environmental movement in 1970. The first Earth Day had led to the creation of the United States Environmental Protection Agency and the passage of the Clean Air, Clean Water, and Endangered Species Acts.[191]

Slide 10:
The U.S. Environmental Protection Agency enforces federal clean water and safe drinking water laws, provides support for municipal wastewater treatment plants, and takes part in pollution prevention efforts aimed at protecting watersheds and sources of drinking water.[192]

[189] http://oceanservice.noaa.gov/education/kits/pollution/02history.html
[190] http://oceanservice.noaa.gov/education/kits/pollution/02history.html
[191] http://www.earthday.org/about/the-history-of-earth-day/
[192] http://www.epa.gov/regulatory-information-topic/regulatory-information-topic-water

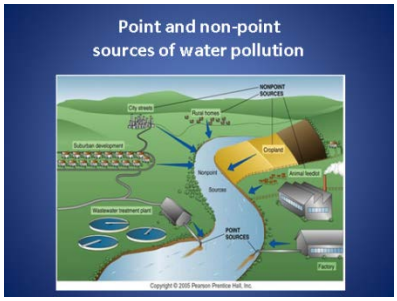


Slide 11:
Drinking water treatment process removes contaminants and ensures water quality.



Slide 12:
Wastewater treatment process ensures that the sewage generated from domestic, commercial, and industrial waste is properly treated and disinfected before it is discharged to a water body.

Slide 13:
While water pollution has been reduced with the enactment of the Clean Water Act and the Safe Drinking Water Act, there is still much work to be done. Water pollution can result from several sources, including "waste water that runs through city sewers, waste water produced by industrial processes, water runoff from farmers, urban areas, mining, forestry, and construction, and the dredging and filling of waterways which churns up bottom sediment and other pollutants."[193]



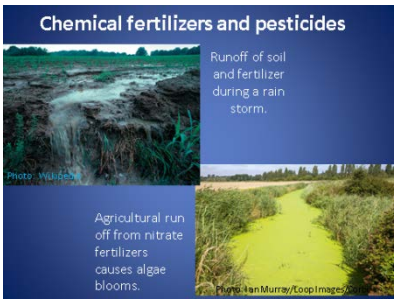
Slide 14:
The causes of water pollution can be divided into two different groups based on their origin.
Point Source: Point source of pollution is generated from a definite identifiable source like the discharge pipe of domestic or industrial sewage to a water body. *Nonpoint Source:* Nonpoint source of pollution does not have one specific source that is easily identifiable. Example of nonpoint source pollutants are fertilizer, pesticide, oils spilled from cars etc.[194]

Slide 15:
Here are some examples of non-point source pollution. Water pollution from mines is a major concern.

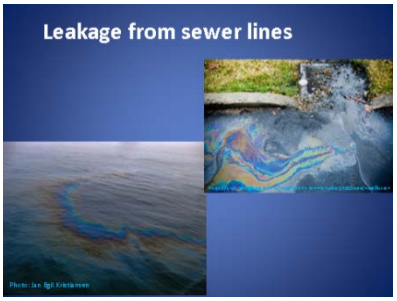
Back to *EcoLearn Outcomes and Findings*: Revision
Back to Table of Contents

[193] http://www1.american.edu/ted/projects/tedcross/xseap17.htm
[194] http://www.theecoambassador.com/Causesofwaterpollution.html#sthash.2aQoTjF2.dpuf

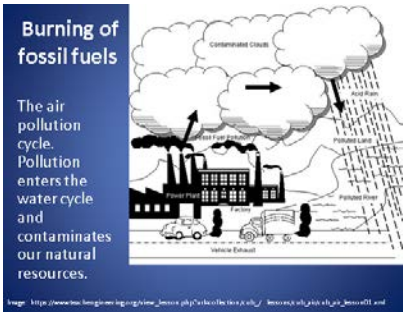
Slide 16:
Oil spill pose a huge concern as large amount of oil enters into the sea and does not dissolve with water; there by opens problem for local marine wildlife such as fish, birds and sea otters.[195]



Slide 17:
Water pollution associated with fertilizers usually occurs because of adding more nutrients to the soil than can be taken up by the crop. These materials travel from fields to ground water or surface water.[196]



Slide 18:
A small leakage from the sewer lines can contaminate the underground water and make it unfit for the people to drink.[197]

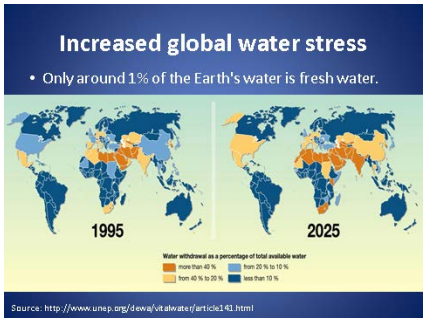


Slide 19:
Fossil fuels like coal and oil when burnt produce substantial amount of ash in the atmosphere. The particles which contain toxic chemicals when mixed with water vapor result in acid rain. [198]

Back to *EcoLearn Outcomes and Findings*: Revision
Back to Table of Contents

[195] http://www.conserve-energy-future.com/sources-and-causes-of-water-pollution.php
[196]http://macd.org/ME/Resource%20Material/Aquatic%20Ecology/Pesticide%20Characteristics%20that%20Affect%20Water%20Quality.pdf
[197] http://www.conserve-energy-future.com/sources-and-causes-of-water-pollution.php
[198] http://www.conserve-energy-future.com/sources-and-causes-of-water-pollution.php

Slide 20:
Garbage dumping



Slide 21:
Water pollution adds enormously to existing problems of water scarcity by contaminating large volumes of available water, thus making it unsuitable for use.

Slide 22:
Currently more than one-third of the world's population experiences serious water problems and polluted water sickens more than 1 billion people each year. Water pollution is worst in developing countries, where human health is gravely damaged by accelerating contamination of water supplies.[199]

Slide 23:
Our water is our responsibility.

Back to *EcoLearn Outcomes and Findings*: Revision

Back to Table of Contents

[199] http://www.environment.nsw.gov.au/stormwater/HSIEteachguide/WaterPoln.htm

Figure VIII: Cross-Grade Level Theme Summary for Food and Food Waste Lesson Plans					
Kindergarten	1st Grade	2nd Grade	3rd Grade	4st Grade	5st Grade
Learning objectives: students will learn					
What food is	What food waste is	Where food comes from	How food works as fuel	What pollination is	What food system is
Where food comes from	Why reducing food waste is important	What the impacts of wasting food are	What energy and transportation resources are involved in food production	Why plants need pollination	What steps are involved in getting food from a farm to our plate
How food relates to our environment	What we can do to prevent food waste	What we can do to reduce food waste	How to keep ourselves and our environment healthy by eating sustainably	Body parts of a honey bee	How far way our food is grown
				Body parts of a flower	
			How our healthier consumption patterns can help our community	Why bees are very important to the foods we eat	What resources are used in the production of our food
					What the connection between personal food choice and food systems is
Key concepts					
Food	Food	Food	Food	Food	Food
Food variety	Trash	Food variety	Food variety	Food variety	Food variety
Food production	Food waste	Origins of food	Food source	Pollen	Agriculture
Food ingredients	Compost	Food waste	Food production	Pollination	Food production
Farm	Landfill	Food waste impacts	Food transportation	Honeybee anatomy	Food processing
Soil	Biodegradable	Food waste reduction	Consumption	Flower anatomy	Food distribution
	Pollution from food waste	Food transportation	Healthy food/diet	Decline in bee population	Food consumption
			Sustainable food	Protecting bees	Food waste composting
			Eating local		Food waste recycling
			Community gardens		Consumer food choice
			Hunger		
Visuals					
Food PowerPoint	Food waste PowerPoint	Real fruits	Community gardens images (PowerPoint)	Fruits and vegetables images (PowerPoint)	Real spinach or other vegetable
Real fruits and vegetables	Real apples	World map	Food groups	Bee and flower body parts images (PowerPoint)	Food Production PowerPoint
		Food wastage footprint YouTube video	Healthy eating tips	Why do we Need Bees YouTube video	
Activities					

Your Favorite Meal drawing	Apple activity	Your breakfast drawing and discussion	Sustainable Eating, Healthy Foods, and Community Gardens	Food dependent on pollination from honeybees	Farm to Plate Game
Where Does our Food Come From? discussion	Food Waste imagination discussion	Buying Food From Around the World	Human Footprint interactive	What's the Buzz on Bees?	
What Does a Plant Need to Grow? discussion	Food Waste visualization and discussion	Why food waste is a problem discussion	Choose MyPlate	Bee anatomy worksheet	
Tactile Food discussion	Reflective writing	How to reduce food waste discussion and writing		Flower anatomy worksheet	
The Little Red Hen reading/listening					
Homework					
Ask family members where the food came from	Discuss with family members responsible food practices	Discuss with family members how they can reduce food waste	Share an article with family members	Keep a food journal for a week	Investigate food labels
			Write a pledge	Research pollinated by bees foods	
Duration (in minutes)					
50-60	50-60	50-60	65-75	55-65	55-65
Aligned to standards					
Washington K-12 Integrated Environmental and Sustainability Learning Standards	Washington K-12 Integrated Environmental and Sustainability Learning Standards	Washington K-12 Integrated Environmental and Sustainability Learning Standards	Washington K-12 Integrated Environmental and Sustainability Learning Standards	Washington K-12 Integrated Environmental and Sustainability Learning Standards	Washington K-12 Integrated Environmental and Sustainability Learning Standards
California Education and the Environment Initiative	California Education and the Environment Initiative	California Education and the Environment Initiative	California Education and the Environment Initiative	California Education and the Environment Initiative	California Education and the Environment Initiative
Next Generation Science Standards	Next Generation Science Standards	Next Generation Science Standards	Next Generation Science Standards	Next Generation Science Standards	Next Generation Science Standards
Common Core State Standards	Common Core State Standards	Common Core State Standards	Common Core State Standards	Common Core State Standards	Common Core State Standards

Back to *EcoLearn Outcomes and Findings:* Theme Summary

Back to Table of Contents

Figure IX: Background for Third Grade "Animals" lesson

Background[200] - What does the teacher need to know before teaching this lesson?

What is an animal?[201,202]

All life is divided into six kingdoms:

- Bacteria, Archaea, Protista, Plantae, Fungi, and Animalia.

Animals are a group of organisms in the family Animalia. There are over 8 million animal species on our planet! Animals can be

- *Arthropods*: any animals that have more than four, jointed legs, such as insects, spiders and crustaceans, scorpions, etc.
- *Amphibians*: born in water and breathe with gills like a fish, but when grow up, they develop lungs and can live on land.
- *Fish*: Live in water and have gills, scales, fins, and most importantly, a spine.
- R*eptiles*: animals with scaly skin. They are born on land and are cold blooded. Snakes, lizards, crocodiles, alligators, turtles, etc.
- *Birds*: lay and hatch out of eggs. Rather than hair they have feathers, and are the only animals that do so. Not all animals can fly, but all do use their feathers for some sort of navigation (flying, running).
- *Mammals*: drink milk as babies and have hair on their bodies, such as dogs, cats, horses, duckbill platypuses, kangaroos, dolphins and whales, etc.

In agriculture, animals are raised for food, fiber, and fuel. These animals are known as livestock. Companion animals are what we call dogs, cats and other animals that provide companionship to humans.

What do animals need to survive?[203]

All animals need air, food, water, shelter, and space to survive.

What is a food chain?[204,205,206]

All living things need to feed to get energy to grow, move and reproduce. But what do these living things feed on? Smaller insects feed on green plants, and bigger animals feed on smaller ones and so on. This feeding relationship in an ecosystem is called a food chain.

- Green plants make their own food. They use the energy from the sun to make their own food. Some of this food is used, and some is stored in the roots, stems, and leaves. Plants are producers – they make/produce their own food by photosynthesis.
- Animals cannot make their own food. Animals get their energy and biomass by consuming/eating other organisms. All animals are consumers – they consume/eat. Animals that eat only plants are called herbivores (or primary consumers). Animals that eat other animals are called carnivores. Carnivores that eat herbivores are called secondary consumers, and carnivores that eat other carnivores are called tertiary consumers. Animals that eats both plants and animal are called omnivores.
- Predators are organisms that eat another organism. Preys are the organism which the predators eat.

A food chain always starts with a green plant (a producer), which is eaten by an animal (a consumer). A food chain ends with a predator – the predator is at the top of the food chain. The sun is very important for all living things – without the sun the plants would not grow, without plants there would be no animals.

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[200] Answers contain excerpts from cited articles. For more information, follow the links.
[201] https://articles.extension.org/pages/64594/what-is-an-animal
[202] http://www.kidzone.ws/animals/animal_classes.htm
[203] http://ecosystems.psu.edu/youth/sftrc/lesson-plan-pdfs/habitat
[204] http://eschooltoday.com/ecosystems/what-is-a-foodchain.html
[205] http://resources.woodlands-junior.kent.sch.uk/homework/fooodchains.htm
[206] http://mpalalive.org/classroom/lesson/food-chains-kenya#sthash.poHFPaN1.dpuf

What is a food web?
A food web consists of many food chains.

What is the difference between a food web and a food chain?[207]
A food chain only follows just one path as animals find food.

- A hawk eats a snake, which has eaten a frog, which has eaten a grasshopper, which has eaten grass.

A food web shows the many different paths plants and animals are connected.

- A hawk might also eat a mouse, a squirrel, a frog or some other animal. The snake may eat a beetle, a caterpillar, or some other animal. And so on for all the other animals in the food chain.

A food web is several food chains connected together.

What is extinction?[208]
Extinction of a particular animal or plant species occurs when there are no more individuals of that species alive anywhere in the world - the species has died out. This is a natural part of evolution. But sometimes extinctions happen at a much faster rate than usual. For example, at the end of the Cretaceous period 65 million years ago, a mass extinction caused the death of many different types of animals and plants, including the dinosaurs. Today human intervention is also causing rapid extinction. Hunting, habitat destruction and the over exploitation of wildlife means that many different types of plants and animals are being pushed to the edge of extinction.

What are endangered and threatened species?[209]
Endangered species are those plants and animals that have become so rare they are in danger of becoming extinct. Threatened species are plants and animals that are likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Why do species become endangered?[210]
Every day between 50 and 150 plant and animal species become extinct for a variety of reasons:

- Habitat loss. Habitat refers to the place where an animal or plant species lives. This habitat consists of five elements: food, water, shelter, space and an appropriate mixture of these elements. All species must have adequate habitat in order to survive.
- Introduced species. When non-native plants or animals are introduced into an area, they may disturb the natural balance of the ecosystem. Introduced species may over populate an area, compete for food, carry diseases for which native species may have no immunity, drive out other species and cause numerous other problems. They may prey on native species that have no defenses again the invader.
- Pollution. Pollution from pesticides, burning coal, oil and gas, industrial plants and automobile emissions all impact wildlife populations.
- Population. It took the entire history of humankind for the population to reach 1 billion around 1810. By 1930, this doubled to 2 billion people. Today there are over 7 billion people.
- Over-consumption. Because of over-consumption of the earth's resources, the world is losing wild places and species as the demand for food, minerals, lumber, and other resources increase.

Why protect endangered and threatened species?[211, 212]
The Endangered Species Act of 1973 recognizes that endangered and threatened species of wildlife and plants "are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people."

We all depend upon plants and wildlife. From studying them, we have learned new ways of growing food, making clothing, and building houses. Scientists have discovered how to use certain plants and animals as

[207] http://resources.woodlands-junior.kent.sch.uk/homework/fooodchains.htm
[208] http://www.oum.ox.ac.uk/thezone/animals/extinct/define.htm
[209] https://www.epa.gov/endangered-species/learn-more-about-threatened-and-endangered-species
[210] http://www.rollinghillswildlife.com/get_involved/conserv_endang.html#habitat
[211] https://www.fws.gov/nativeamerican/pdf/why-save-endangered-species.pdf
[212] https://www.epa.gov/endangered-species/learn-more-about-threatened-and-endangered-species

medicine. If we fail to protect threatened or endangered species, we will never know how they might have improved our lives.

What can we do to help save endangered species?[213]

- Learn about endangered species in your area. Teach your friends and family about the wonderful wildlife, birds, fish and plants that live near you.
- Get involved by volunteering at your local nature center or wildlife refuge. The best way to protect endangered species is to protect the places where they live, such as national wildlife refuges, parks or other open spaces.
- Make your home wildlife friendly. Feed pets indoors and lock pet doors at night to avoid attracting wild animals into your home. Reduce your use of water in your home and garden so that animals that live in or near water can have a better chance of survival. Place decals on windows to deter bird collisions.
- Plant native plants. Native plants provide food and shelter for native wildlife. Attracting native insects like bees and butterflies can help pollinate your plants.
- Avoid using herbicides and pesticides. Many herbicides and pesticides take a long time to degrade and build up in the soils or throughout the food chain. Predators such as hawks, owls and coyotes can be harmed if they eat poisoned animals.
- Slow down when driving. Many animals live in developed areas and this means they must navigate a landscape full of human hazards.. Roads divide habitat and present a constant hazard to any animal attempting to cross from one side to the other.
- Recycle and buy sustainable products. Buy recycled paper, sustainable products like bamboo and Forest Stewardship Council wood products to protect forest species. Recycle your cell phones, because a mineral used in cell phones and other electronics is mined in gorilla habitat.
- Never purchase products made from threatened or endangered species. Avoid supporting the market in illegal wildlife including: tortoise-shell, ivory, coral.
- Do not participate in shooting, trapping, or forcing a threatened or endangered animal into captivity, and report it as soon as you see it to your local state or federal wildlife enforcement office.
- Protect wildlife habitat so that wildlife have places to find food, shelter and raise their young. Support the minimization of logging, oil and gas drilling, over-grazing and development all result habitat destruction.

Further reading

Animals http://animals.nationalgeographic.com/animals/
Animal Diversity web: https://www.google.com/search?q=Animal+diversity+&ie=utf-8&oe=utf-8
Threats To Global Biodiversity:
http://www.globalchange.umich.edu/globalchange2/current/lectures/biodiversity/biodiversity.html
Extinction: http://paleobiology.si.edu/geotime/main/foundation_life4.html
The extinction crisis:
http://www.biologicaldiversity.org/programs/biodiversity/elements_of_biodiversity/extinction_crisis/
Endangered Species http://www.fws.gov/endangered/
The IUCN Red List of Threatened Species http://www.iucnredlist.org/

Back to *EcoLearn Outcomes and Findings:* Theme Backgrounds

Back to Table of Contents

[213] http://www.endangered.org/10-easy-things-you-can-do-to-save-endangered-species/