

INTEGRATING ENVIRONMENT AND HUMAN HEALTH

7TH NATIONAL CONFERENCE ON SCIENCE, POLICY AND THE ENVIRONMENT

PRELIMINARY DRAFT RECOMMENDATIONS PROVIDED BY BREAKOUT SESSION PARTICIPANTS (SUBJECT TO REVIEW AND EDITING)

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The National Council for Science and the Environment (NCSE) thanks the participants for their thoughtful contributions.

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DECISION-MAKING IN THE REAL WORLD

BREAKOUT SESSION 1: INTEGRATING ENVIRONMENT, CULTURE, AND HUMAN WELL-BEING

Decision-makers should meet with people from diverse cultures and moral views to discuss specific health and environment health goals

- United Nations 10 Millennium Goals
- Decision-makers should set goals that are concrete, short-term, and long-term goals to promote sustainability
- Policymakers should develop economic incentives, fiscal realignment toward science-based goals
 - Example, tax codes should reflect ‘green development’
- Funding agencies should require a health assessment impact to all environmental assessment/research
- Educators of children and youth (kindergarten to grade 12) should create ecosystem health curriculums to increase justice, transdisciplinary approaches and equity
- Researchers and scientists should make science, environmental health issues more understandable
- Scientists should accept a protocol on intercultural communication recognizing the need for common language to discuss environmental goals among different cultures. This could be accomplished by developing alternate credentials so discussions can occur on an equal footing
- NEA should resource 25% of funding to arts and the environment
- Universities should promote environmental justice

BREAKOUT SESSION 2: RISK AND DECISIONMAKING

Methods and Models

1. EPA and other government agencies should do situation-oriented risk assessments (process oriented and tied to primary prevention)
2. Improve methods for cumulative risk assessment to think more holistically about causes and effect
3. NAS should provide advice about what probabilistic risk metrics would be most useful to making which social choices
4. Reg. agencies should use knowledge management practices to capture, share, and link the wealth of existing information for used in data management
5. NAS should look at the substances and produces to which people are most exposed (don’t assume volume relates to exposure) and assess our knowledge and management capability in relation to exposure/draw on CPSC human factors
6. Decisionmakers/risk assessment should draw on existing data from large, landscape scale environmental monitoring (e.g. NEON, etc.) as point of holistic, ecological risk assessment
7. Congress should amend TSCA to correct the current situation in which there is insufficient toxicology information on both new and existing chemicals should mandate similar information on substances and products
8. Mutually developed indicators should be used to support decision-making and as a measure by which decision makers stakeholders public can communicate and assess, risk, and judge
9. Regulatory agencies should routinely collect and publish stakeholder risk concern comments drawing on extension agents and community-based staff

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10. NAS should provide advices about best mix of environmental monitoring and biomonitoring, given fixed resources
11. Life-cycle assessment risk and sustainability factors should be integrated in developing indicators for decision-making
12. In order to reduce risk, communication, and decisionmaking congress should mandate reg. agencies to revisit major reg. decisions on a periodic basis (<10 years) to make risk assessment and management be done on an iterative basis
13. Funding agencies should set priorities for research based on reducing uncertainty and on addressing public concerns
14. Policy makers should engage regulated entities, scientist and the public should engage in a dialogue at the beginning of a risk assessment process to help from a process of shared learning and decision making (including defining appropriate roles).

BREAKOUT SESSION 3: POPULATION, GENDER, JUSTICE, AND HEALTH

- 1) The scientific and policy communities should encourage empirical research on environmental vulnerability and vulnerable populations. (Move analytic research into the field.)
- 2) Governments and multilateral institutions and donors should promote and fund environmental impact assessments that are independent and transparent (i.e. made available to the public in all cases), and that take into account affects on human health, gender and justice.
- 3) Researchers should pay particular attention to the impacts of environmental change in migration processes and to the differentiated and special needs and vulnerabilities of migrant populations – not only in terms of environmental hazards but in migrants’ relative lack of access to legal, social and other institutional protection.
- 4) Governments and private and public funders should promote trans-disciplinary research on the interactions of population, gender, environmental change, justice and health.
- 5) Congress should consider and enact a statute recognizing the concept of environmental justice with the goals of build capacity in communities to help guide their environmental circumstances, to achieve effective integration of the concept of environmental justice into federal programs and policies, and to effective coordinate programs and agencies to further the achievement of environmental justice nationwide.
- 6) The research community and the U.S. government should monitor and evaluate the evolution of international work on the intersection of environment, health and human rights. A database of international law and principles of the right to a health environment should be maintained
- 7) All scientific research on the impacts of environmental toxins on the human body should consider impacts on women as well as men, and especially on women who are pregnant of breastfeeding, and on their children.
- 8) Integrate gender training and disseminate the results of gender research in all U.S. development and relief work.
- 9) Disseminate research results on the effects of education and empowerment of women on fertility and ultimately on population, environment, health and environmental justice.
- 10) Involve policymakers in designing research that they ultimately will be held accountable to disseminated and implementing.
- 11) Promote evidence-based behavior change communication, with an emphasis on promoting positive behaviors.
- 12) The scientific community should recognize and value non-traditional expertise and knowledge, for example including local and community actors as co-authors and/or acknowledged sources of valid information. Change scientific culture as necessary to achieve that.

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- 13) Encourage, fund and fund (through technical assistance grants, for example) community-based participatory research, by which community members and scientific experts collaborate on research and research results in which the community to a committed stakeholder. Such research should recognize major potential fault lines of diversity within communities, involving women as well as men, for example.
- 14) The U.S. government is encouraged to study and consider agreeing to the United Nations Norms on the Responsibilities of Transnational Corporations and Other Business Enterprises with Regard to Human Rights.

BREAKOUT SESSION 4: THE NATURAL ENVIRONMENT, BUILT ENVIRONMENT, AND SOCIAL ENVIRONMENT AND BREAKOUT SESSION 8: HEALTH BENEFITS OF A HEALTHY URBAN ENVIRONMENT

There should be a multi-agency effort to determine the incentives that reward healthy lifestyles.

1. There should be a significant research effort to examine the costs and benefits of green neighborhood design.
2. School systems across the country should integrate information about the relationships between built environments and human health and functioning into their curriculums.
3. Federal agencies should collaborate to assemble databases and other sources of information that provide urban planners and designers information that support the development of healthy communities.
4. Federal agencies should require collaborative research into the relationships between human habitats and healthy human functioning.
5. University administrators and professors should encourage young faculty to engage in *multidisciplinary* scholarship (discovery, learning, engagement) related to creating healthy places. (That is, there should be no tenure penalty for engaging in multidisciplinary research).
6. Federal agencies should actively support research into the disparities of health impacts related to the physical environment.
7. There should be many more opportunities for congressional science fellows (along the lines of AAAS or the NOAA Knauss Sea Grant Fellows).
8. Federal and state agencies should collaborate with the private sector to make available maps that communities can use to examine environmental equity issues.
9. Federal agencies (CDC, EPA) should double research support that seeks to identify health consequences of living in sustainable communities and in sprawling communities.

BREAKOUT SESSION 5: ECOLOGY OF WATER AND HEALTH

There should be a forum to develop tools to reach out to and educate private citizens.

1. The research community needs to better communicate results to the public, and be accountable for doing so.
2. Students should be required to develop communication skills.
3. Partners of researchers, communicators, advocates, and educators should develop novel ways of communicating to the public.
 - a. For example, film and scientific schools on college campuses should be encouraged to work together.
4. Research academic institutions and agencies should support, encourage, and reward interdisciplinary research efforts.
5. Partners need to develop the tools necessary to conduct different kinds of collaborative research.
6. Social scientists should analyze where the leverage points are in conservation problems.
7. Congress should fund system research on chemical synergies in the environment.
8. Congress should fund more systems research on contaminants..
9. New research tools for water quality in the environment are needed.
10. Social science research on how to change people's land and water use decisions and values is needed.
11. All agencies with conservation programs should be encouraged to reach out to health professionals for advice and consultation, and vice-versa.
12. New research tools need to be user-friendly.
13. Support for collaborative research and tools is needed.
14. Partnerships for participatory-based community-driven research are needed.
15. Public and private funding for more research on more systems aspects of contaminants and diseases (e.g., air/water) is needed.
16. Research into the environmental consequences of alternative fuels is needed.
17. Use wildlife as sentinels for disease emergence.

BREAKOUT SESSION 6: OCEANS AND HUMAN HEALTH

General theme:

Use systems thinking and teamwork to organize our oceans environmental and public health enterprise in an iterative fashion to:

- defining the interdisciplinary problems to
- predictive modeling, to
- developing and interpreting data, to
- bringing solutions to the public
- and developing budget priorities

Science/research:

- Scientists must communicate directly with managers and managers with scientists in order to effectively utilize the best available science in decision-making at local to national levels. This requires substantial effort on the part of people in both communities – science and policy/management – to develop personal, trusting relationships that enable rapid and effective communication.

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- Scientists need to develop integrated conceptual models extending from oceanography through organism biology, health effects/risks, and economic effects/environmental valuation. This will lead to predictive models, and can help prioritize activities in environmental health.
- Need standardized data protocols, formats, and metadata, to support activities from basic research and conceptual models to public health analysis. Need same scales of measurements.
- Integrate environmental and health data using GIS tools and demographics over time and space.
- Federal agencies should ensure that ocean observing systems are constructed as vehicles that organize, communicate and analyze data, as well as collect it, leading to interdisciplinary “systems analysis” and predictions/policy recommendations. Environmental scientists should work with physicists/IT specialists to design and locate the observing systems, including instrumentation for ocean observing systems, so that they will produce data to fit the scientific questions/problems on environmental/human health. NRC, NOAA, NASA, CDC, USGS, and other federal agencies should standardize sensing and monitoring data including epidemiological information from human and animal populations.

Formal Education

- Colleges and universities need to develop formal academic programs that integrate environment, health and conservation medicine studies. Such programs should train health professionals and marine environmental scientists and focus on breaking down walls between environmental and ocean sciences and public health departments.
- We must provide a place in the K-12 curriculum to teach the children about oceans, the environment, and health. Children will carry the message forward to the next generation and backward to their parents.

Communication and Outreach

- Ocean scientists and the medical community should develop a communication/outreach network to evaluate and communicate ocean health risks, especially for communities and populations at risk.
- There should be an institutional mechanism involving scientific experts and science “translators” to provide vetted and legitimate information to policymakers and the public, ensuring that it is presented on its merits in a nonpolitical environment. We need people who can translate science and risk in a way that does not spread fear or dull the senses, so that all citizens will participate in the solutions
- Marine scientists must frame scientific issues to appeal to the public and their priorities. .
- Federal agencies such as NOAA’s Sea Grant and Coastal Services Center should structure a community ocean observing volunteer network, “VOOS” involving community-based research and community volunteers.
- University interdisciplinary programs and industry-academia-government roundtables should develop a common language to communicate between ocean environmental scientists and the business/economics community, leading to better evaluation and prioritization of health risks.

Governmental Actions

- The federal government, with participation by the states, needs to set specific measurable goals for water quality with deadlines and mandates are needed. These should include requirements for advanced wastewater treatment and regulation of non-point source pollution.
- Local governments need to develop local ocean information systems showing where major health problems are in the marine environment. ProMED-mail is one potential model for such a system.

BREAKOUT SESSION 7: BIODIVERSITY AND HEALTH

Research

- Research should focus on understanding the drivers and modes of biodiversity change. Conduct research that investigates the etiological mechanisms that connect biodiversity and human health.
- Research the relationship between biodiversity and human health using an integrated, multi-scale approach that uses appropriate tools and data for each scale.
- Encourage more place-based projects that involve local researchers and planners in science and policy.
- A National Academy of Sciences report should be commissioned to identify current state-of-the-science and future research directions with a goal of increasing the profile within the decision-making community and among the general public.
- Economic assessments of the role of biodiversity and human health should be conducted for local, national, and international scales, particularly in development projects.
- Conduct research on non-disease aspects of health including nutrition, mental health. Related research into the role of genetic diversity of crops and diversity of dietary resources on health should be conducted.
- NSF should fully fund National Ecological Observation Network (NEON) with a specific role in identifying both biodiversity and human health effects.

Policy, Education, and Outreach

- States should put biodiversity health issues in school curriculum, including primary, secondary, and tertiary schools, and medical schools.
- NIH and NSF should fund interdisciplinary centers that produce graduates and fellows with experience and coursework across scientific and policy disciplines germane to biodiversity and human health.
- Encourage collaboration and communication among disciplines and between researchers, the public, and decision makers. Messages should be delivered in a way that target audiences can understand, including improving public relations at institutions and by teaching communication skills to scientists.
- Increase the number of trained systematists/taxonomists and resources for museum collections.
- NIH should increase the number of ecologists on their panels and increase funding opportunities for environmental health.

BREAKOUT SESSION 9: EMERGING INFECTIOUS DISEASE AND OTHER HEALTH IMPLICATIONS OF GLOBAL CHANGES AND ECOLOGICAL TRENDS

Global environmental change, including climate change and the loss of habitat and biodiversity have dramatic implications for the distribution and proliferation of infectious disease.

The connection between global environmental change and emerging infectious diseases has implications for our health, well being, nutrition, and international security.

Because diseases cross taxonomic groups and borders we offer the following recommendations.

I) Policy

A) Need policies that address the upstream drivers of these issues. Including the comprehensive plan for clean, non-fossil fuel based energy, financial and policy instruments to implement them, and policies for conservation of biodiversity and habitat. Clean energy is the first necessary though insufficient step towards healthy equitable and sustainable development.

II) Integrative initiative on global environmental change and health

A) Need interdisciplinary integrative interagency international initiative to organize the science, surveillance and response of health in the nexus of social, ecological and global climate change.

B) Study local and specific examples of emerging infectious diseases (EIDs) and environmental change for education and messaging to the media and policy makers.

C) This integrated initiative is needed because:

The transport of disease through travel, transfer of goods, extreme weather, and dust storms, and

The involvement of multiple taxonomic groups; (wildlife and livestock, trees and crops, marine life, and humans.)

III) Healthy Solutions

A) Need a life cycle analysis to assess health ecological and economic dimensions of technological solutions to climate change. When choosing among bio fuel alternatives, we also have to consider the role of emerging EIDs and climate change on crop viability and yields.

IV) Overarching Policy Framework

A) Issues of governance, terms of trade, debt, all either can propel or impede clean development. The regulations and rewards have to be aligned internationally to achieve clean and sustainable development.

BREAKOUT SESSION 10: CHILDREN'S MINDS: ENVIRONMENT, DEVELOPMENT, AND MENTAL FUNCTION

Fully fund the National Children's Study

- 1) Establish multi-stake holder councils on state and national levels to address issues related to child development
- 2) Create an educational curriculum to establish a participatory process that promotes a risk- and uncertainty-intelligent population
- 3) Develop economic analyses on the health care costs of pediatric environmental attributable diseases and disabilities in every state
- 4) Promote kids involvement in local and city government (zoning and land use councils, etc.) to address environmental health issues
- 5) Integrate precautionary approaches to decision-making on local, state and national levels
- 6) Fund the CDC to undertake social marketing campaigns related to other environmental health issues as the CDC has done in regards to other health concerns.
- 7) Fund a prospective study on children living in the demonstration residential housing built by HUD to see the impact of having a positive living environment has on them.
- 8) Develop prototypes for how to design children's environment that increases their access to healthy natural systems
- 9) Develop and pass chemical policy reform nationally
- 10) Create children's environmental health councils in every state
- 11) Work with international allies who have developed progressive policies, such as REACH, to promote similar policies in the US

BREAKOUT SESSION 11: SOCIALLY-MEDIATED LINKAGES BETWEEN RESOURCE DEPLETION AND HEALTH

Recommendation:

- take a systems based approach
 - acknowledging the complexities of the outcomes
 - look across scale/actors
- prioritizing order of care during all threats
- national code of ethics for doing community service
 - community stakeholder consultation
- formulate national league of communities like the national league of cities to share info experience
- find ways to address:
 - community mistrust
 - build community trust
 - multi level complex community dynamics
 - be consistant across all range of action
- encourage binding alternative dispute resolutions be considered in environmental justice issues
 - adapt to needs of communities
- psychometrics has to be adapted to improve the validity of community metrics surveys
- need more studies done on communities stressed to ascertain the response of communities under stress (not environmental) to understand communities being studied
- network of centers of excellence
- urban communities as ecosystems
- never neglect the cultural factor
- integrate green zoning in planning regulations reflect smart growth ideals
- incorporate projections into long term planning

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- develop a research agenda with the objective of modeling these social interactions develop models that would project the effects of natural disasters and the social linkages to assist in planning.
- funding research priorities/ balance of study areas
- accommodating climate change into city planning
 - develop a body of expertise (i.e. UKCCP) to guide community planners to develop accordingly
- use European model to develop a national adaptation plan in US to address preparedness for climate change
 - involve various organizations
- insurance agencies partner with municipalities to plan for the morbidity incurred from global climate change
 - amplifier-should be among NGO a way to disseminate findings from insurance agencies

BREAKOUT SESSION 12: ENERGY, AIR QUALITY AND HEALTH

The United States should have an energy policy that encompasses the following elements:

1. We need a diverse portfolio of energy sources to fuel our need for electricity and motor vehicle transport. It may be different in different regions of the country but in all areas it should focus on energy efficiency, green design, and smart growth.
2. Biofuels, wind, nuclear, and conventional fossil fuels can all play a role but we need to look at each choice in terms of its total life cycle costs, including its extraction, conversion, use and disposal in order to justify major new incentives.
3. The US energy strategy should encompass both long term and a strategy for bridging the current petroleum dependent economy to a low carbon future.
4. An important component needs to be creating a higher level of public awareness of the current sources and the health and security risks of our current energy mix. Government should take a leadership role in educating the public about sustainability and the need for a conservation ethic.
5. EPA needs to create a stable but ambitious regulatory climate to encourage both technological innovations, monitoring and long term research about the health effects of energy choices.
6. Government needs to consider the full range of incentives (e.g. marketing campaigns, fuel economy standards, rebates and taxes) to the private sector to invest in dissemination of cleaner energy technologies, including funding for the National Research Energy Laboratory.

B. Guiding and Fostering Multi-Disciplinary Research

BREAKOUT SESSION 13: EMERGING ISSUES IN ENVIRONMENTAL INFLUENCES ON REPRODUCTIVE HEALTH

1. Core Principles

Apply the “Belmont Principles” developed for human subjects research as basic principles for government policy on chemicals stewardship. These include equitable distribution of cost and benefits from exposure and informed consent to those affected.

Adopt the precautionary principle in both the public and private sector in chemical management principally because of widespread data gaps on health effects, especially with regard to

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endocrine disruption, and especially recognizing that the US EPA has been unable to date to develop a legally applicable validated screening and testing program.

Producers of Endocrine Disrupting Chemicals (EDCs) should have “extended producer responsibility” for assessing and minimizing the toxic effects of chemicals throughout their life, from cradle to grave or “cradle to cradle”.

2. Policy and Funding Recommendations

Broad Policies

Launch a multi-agency, multidisciplinary initiative, drawing on the best available science, avoiding economic conflicts of interest, to create a priority list of EDCs for reduction and replacement.

Government should provide incentives for safer chemical alternatives for the private sector.

Reform government “cost-benefit” analysis process of EDC chemicals, where cost-benefit analysis is required by law, so that all environmental and human health costs are captured, including trans-generational impacts and associated economic burdens on society from loss of ecosystem services and human productivity.

Targeted government policy and funding recommendations

Restore funding to the National Children’s Study
Revise ATSDR reproductive toxicology guidelines
EPA should develop EDC-related water quality standards
Increase funding for terrestrial wildlife research at EPA
Develop a pre-manufacture EDC screen

3. Communications Recommendations (“informed consent”)

Find a population champion of EDC concerns
Focused campaign on EDCs (e.g., “You’re half the man your grandfather was”).
Forge enhanced communication around product categories (e.g., cosmetics, cleaners, electronics, plastic produces, home and office furnishings, etc).
Develop a mechanism to enable consumer avoidance of existing toxic chemicals by focused communications of “Do’s”, “Don’ts” and safer alternatives.

4. Regulation Reform

1. See basic principles above.
2. First, do no harm
3. Apply Hippocratic principles to environmental regulations
4. Chemical testing on behalf of manufacturers should be done by independent third parties (e.g., like UL).

5. Research

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1. Develop treatment solution for natural estrogens in municipal wastewater streams.
2. Research required to expand chemical testing on individual chemical substances to assess “products in use”.
3. Academic researchers should contribute to development of applicable screens and tests to be used in commercial regulatory programs.
4. Continue development and enhancement of life cycle consideration techniques for use in chemicals management.

6. Positive industry incentives

Government can provide tax incentives and other forms of economic encouragement to promote industry development of green chemicals. These incentives can also include government environmentally preferable purchasing programs that promote a marketplace for green chemicals and reduce market share for putative EDCs. Private sector environmentally preferable purchasing programs have already had been shown to be successful in reducing the use of toxic chemicals.

Recommendations to Conference Organizers on Environment Health

Reach out to the socially responsible investment (SRI) communities and to corporations that have adopted policies consistent with these principles.

Ensure diversity of participants to fully incorporate environmental justice concerns in Environmental Health conferences.

BREAKOUT SESSION 14: SETTING RESEARCH PRIORITIES FOR HEALTH AND THE ENVIRONMENT 1.

- Research to find strategy to motivate people to take appropriate, effective action when disaster is imminent - CDC, NIH, NSF
- Research needed on public to capture funding for process/decision making -all agencies
- Research needed for curriculum planning that would address disaster issues– universities, NSF
- Develop methodology and database for health risk management and mitigation measures – google , NHS , NIH/NLM, NOAA, FSW, FS, USGS, State Agencies
- Develop baseline information for human and ecosystem health (mental health)
- Strengthen critical infrastructure and study effectiveness for restructuring existing hospital guidelines and physical facilities – NSF, NIST, NHS DHS DOT
- Reexamine and ensure that factors that contribute to community resilience particularly with respect to public health
- Regionalization – federal government, universities
- Scientific indicators with cost/benefits analysis to reduce risks; this should be given priority – all agencies
- Research needed to develop methodology on how to transition from national level to local responsibilities. All agencies
- Perceived Risk communication to change behavior; how to change behaviors – NSF, NIH
- Climate change needs to be considered in the disaster preparedness discussion, and considerations should be given to frequent small disasters; their effects tend to accumulate over time NOAA, CDC

BREAKOUT SESSION 15: COMMUNITY-BASED HEALTH: INCORPORATING SOCIAL SCIENCES AND HUMANITIES

We should work toward forming sustainable communities that promote environmental, social and economic health through the following ways:

- 1) Revitalize communities with ‘smart growth’ principles, such as mixed use development, using information formulated by experts from across section of disciplines.
- 2) Inform, educate and empower community members with an emphasis on identifying youth leadership such that they become their own advocates within environmental/health decisionmaking.
- 3) Seek funding for initiatives to promote community based service learning projects with appropriate supporting curricula in the environmental health fields for university and college students.
- 4) Lobby for economic incentives for corporations, governments and other entities for the development and use of cleaner technologies such as biotech and alternative fuel to achieve cleaner, healthier communities.
- 5) Promote more multidisciplinary perspectives for greater of infusion of the humanities and cultural competence into education for environmental and health careers.
- 6) Initiate funding to support local food production, ie gardens and markets for the development of healthy and economically sustainable communities.

BREAKOUT SESSION 16: MEDICAL GEOLOGY, PHYSICAL SCIENCES, AND HEALTH

The group reached consensus on 5 key recommendations. We recognize that there are relevant issues dealing with the topic including the role of beneficial impacts on human health due to geologic materials and processes (e.g. impermeable barriers), and a discussion of where to draw the line in terms of anthropogenic sources (not including occupational exposures, for instance). Another interesting discussion centered around the potentially beneficial or deleterious human health effects of interactions between and among chemical elements and other environmental factors.

Recommendations:

- 1) Integrate across disciplines in public health and earth sciences via:
 - a. Public forum (Symposia, conferences, etc.)
 - b. Curriculum development (at all levels, not just university) or reintegration existing curricula on environmental medicine with geoscience and public health;
 - c. Learn approaches used in relevant disciplines in addition to public health and earth sciences
- 2) Generate medical geological risk assessment maps based on the collection of geological, geochemical, hydrological, biological data.
 - a. Use GIS to integrate epidemiological and disease registry information with biological, agricultural, meteorological, geological, geochemical, hydrological and environmental data including natural hazards
 - b. Actively integrate historical data when available and develop user-friendly archival methods for prospective data collection
 - c. Employ computer models using integrated data to forecast pending hazards to populations, especially important for ‘silent’ chronic hazards (As, Hg) rather than the physical trauma seen with earthquakes, tsunamis, etc.

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- 3) Develop early warning systems to predict outcomes, and to enable data and information to be analyzed, compared and evaluated globally to increase understanding of actual risks.
 - a. Disseminate beyond regulatory agencies to educate clinicians and policy makers and the community.
- 4) To advance interdisciplinary research at the interface of public and earth science, we recommend facilitating a consortium of federal, state agencies and academia by the creation of a dedicated funding mechanism with the following agencies currently contributing to each field separately: NASA, NSF, NOAA, EPA, USGS, NIH, and CDC.
- 5) Develop public outreach to enhance community involvement and dialogue, and improve risk communication concepts to inform the public about ways to proactively prevent public health crises.

BREAKOUT SESSION 17: ECOLOGY AND EPIDEMIOLOGY

Training and Research

1. Academia, Private sector, and Government should foster collaborative (in addition to competitive) training. Teach leadership, communication between disciplines, and team building.
2. Academia should integrate policy or services learning courses into natural and health sciences
3. all should use integrating methods; e.g. GIS/mapping, system modeling, and adaptive management
4. private sector, government and academia should use ecosystem approaches to problems by acquiring and managing data/knowledge across sources from science to indigenous cultures
5. private sector, academia, and government should focus on the ethics of research that involve viable information on vulnerable populations
6. NASA, NOAA, USGS should bolster earth observations
7. NIEHS should put more research on the integration of ecology and diseases; e.g. disease vectors
8. Academia should develop cohesive approaches that build literature and export peer review panels) to increase understanding linkages across fields
9. Google should develop knowledge mapping to gain input from multiple experts around the world.

BREAKOUT SESSION 18: ECOLOGICAL AND HUMAN HEALTH RISK ASSESSMENT AND BREAKOUT SESSION AND 26: HEALTH IMPACT ASSESSMENT OF DEVELOPMENT POLICIES, PROGRAMS, AND PROJECTS

Federal, state, and local as well as international lending agencies should further develop holistic public health and ecological risk and impact assessments. For example, public health officials and health assessments, health human impacts in environmental impact assessments (EIAs).

- Agencies and Universities should formally engage in cross-training assessors. (Topical and Disciplinary)*
- US agencies should cross-train internationally with other experts, analysts, and other approaches.
- Risk assessment is considered primarily as a process for understanding systemic impacts and responses rather than as a tool for calculating precise values. (used as one tool)

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- Agencies involved in risk analysis should include protocols for looking at risks regulated and relegated by other agencies.
- Congress should amend TSCA to require toxicity testing, environment fate modeling, and LCA for all new products.
- Congress should develop laws that minimize human health and ecological impacts of products currently unregulated in these respects, including e.g. PPCPs and nanotechnology.
- Federal agencies that practice human health and or ecological risk and impact assessment always address individual, community, and population level effects, as appropriate.
- Funding agencies and universities should increase research that provides insights into effects of combinations of biological, chemical, physical, and psychological stressors on a variable population and understanding MOA for individual chemicals.
- Risk and impact assessments should be a mutual, recursive, analytic, and deliberative process that includes inputs from all interested and affected parties.
- International standards and trade agreements should take a holistic approach when assessing risk. NCSE should address all of the above on an international scale including materials leaving US borders.

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C. Expanding Understanding: Information, Education, and Communication

BREAKOUT SESSION 20: HEALTH PROFESSIONALS' EDUCATION AND THE ENVIRONMENT

Now more than ever it is essential that we equip our healthcare professionals with adequate environmental health information to provide better health care for all citizens.

- The number of environmental health questions, including emerging issues should be increased on certification and board examinations.
- Faculty and students from various academic backgrounds should collaborate to promote a multi-disciplinary/trans-disciplinary approach, which would include environmental health education.
- Academic institutions should create incentives for faculty members to develop expertise to incorporate environmental health into curricula.
- Government agencies such as the NIH, EPA and CDC should provide funding for the development of leaders to become experts in the field of environmental health.
- Faculty members should endorse the development of environmental health modules that are community-based.
- Medical school faculty should incorporate environmental competency into residency.
- Provide funding for developing a network of experts in environmental health, including emerging issues.
- Health professional organizations such as the APHA and AMA should develop awards and recognize individuals for integration of environmental health into health professionals' education.
- Government agencies should provide sustained funding for the development of health centers for the purpose of training health care professionals and providing consultative services.
- Incentives should be created for underrepresented individuals such as minorities to pursue careers in medicine.

Professional associations, decision-making bodies, academic institutions, and practice settings of healthcare providers endorse the need to address health conditions associated with the environmental exposure, and:

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- Adopted environmental health education and practice skill standards so that health care providers learn and integrate information about environmental exposures in clinical, educational, and preventive health care activities.
- Incorporate clearly defined environmental exposure educational competencies and practice skills, including the ability to elicit an environmental exposure history, into health care provider education and practice.
- Use validated tools and resources available through an array of mechanisms, such as professional meetings to recognize, manage, and prevent health effects from environmental exposure.
- Appoint an environmental health “faculty champion” at each medical and nursing school to ensure long-term integration of environmental health content into medical and nursing school curricula.
- Update requirements to include the recognition, management, and prevention of health effects related to environmental exposures in medical, nursing, and other health care provider education.
- Promote incentives for faculty to teach core competencies, including financial incentives in the form of grants for faculty development, curriculum development, research, instructional teaching and training aids, and expert consultants; clinical access; release time for faculty development, curricula development, and establishing appropriate clinical sites and teaching venues facilitate access to environmental health continuing education programs.

BREAKOUT SESSION 21: BRINGING HEALTH INTO ENVIRONMENTAL EDUCATION

Funding agencies, governmental and private, should provide support for innovative initiatives that integrate environment and human health by:

- adopting a more collaborative approach to create programs that support interdisciplinary research on environment and human health education;
 - developing grant programs that cross intra and inter agency divisions;
 - incorporate public participation into granting program specifications;
 - facilitating sustainable development of innovative programs and approaches by providing a sequential series of grant opportunities;
 - support infrastructure funding opportunities that focus explicitly on green building and sustainable technologies;
 - incorporate training on the link between environment and human health and system thinking in all federally sponsored public health training programs
 - private medical foundations, such as the Howard Hughes Medical Institute, should focus a series of grants on the relationship between public health and the environment.
2. Institutions of higher education should overcome disciplinary barriers to effective instruction by:
- encouraging internships and fieldwork aimed at solving environmental problems in partnership with private and public sector organizations;
 - infusing general education curricula with environment and human health examples;

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- providing professional development training for teachers to infuse environment and human health approaches into K-12 curricula.
3. K-12 educational institutions should increase environmental health literacy by:
- integrating environment and human health into reading, math, and writing units;
 - promoting enrichment outreach programs (e.g., summer camps, after-school programs, etc.);
 - encouraging the adoption of state-level mandates to teach concepts of systems thinking and environment and health;
 - consider including cultural perspectives in science education, such as Native American epistemologies
 - utilize real-life examples of the link between environment and human health that illustrate the positive benefits of environmental stewardship.
4. The Council of Environmental Deans and Directors should facilitate dialogue between health and environmental professionals to:
- develop standards and curriculum recommendations
 - encourage educational institutions to lead by example not only via curriculum reform and development but in sustainable operations

BREAKOUT SESSION 22: JOURNALISTS, MASS MEDIA, AND DECISIONMAKING

1. **On disclosure:** Scientific journals should require full disclosure of conflicts and potential conflicts of interest of authors of all material submitted for publication, including patents, relationships and entanglements; Scientists should disclose the uncertainty of their results.

Journalists should read back quotes (not whole article) in context, be open about the purpose or theme of an article and about the ownership of the publication.

Spokespeople/scientists/commentators from think tanks should be open about the funding sources of the institution.

2. **The trend for monitoring interviews and** preventing access to publicly funded scientists should be reversed. Publicly funded researchers should not be barred from talking with journalists or the public. Publicly funded research should not be sequestered.

3. **Establish a journalistically-appropriate source of funding** to support journalists expenses to attend conferences that will enhance their scientific literacy.

Educational (to help facilitate cross-cultural interactions between scientists and journalists):

For scientists:

Scientists should become more familiar with the constraints of working journalists, who may be covering many different stories with tight deadlines and minimal resources.

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Scientists should improve their skills at explaining the context in which their specific new result fits and what it means for people, in clear language, without over- or understating the significance. Apply metaphor. This would be assisted by requirements for science communication training for scientists in undergraduate and graduate programs, and by encouraging professional societies to feature science communication workshops at annual meetings.

For reporters/editors

Read the original science if possible, and have basic knowledge of how to read scientific studies.

Stories should cover what's known and what isn't known, and identify uncertainty as well as certainty. Include in the story if interviews were monitored by a PR official or if access was restricted.

Report the context of the new science, especially where it fits in the mainstream and how it compares to an existing consensus, if there is one.

Clarify what is science vs. policy vs. politics.

Reporters must be open about their methodologies in reporting and where their information has come from

Reporters should pursue sources of funding if the information is not provided.

1. **BREAKOUT SESSION 23: INNOVATIVE USES OF INFORMATION TECHNOLOGY**

- Develop and make better use of technological tools such as visualization/mapping, PDA applications.
2. establish a governmental consortia to coordinate environment and health information and foster education to the public
3. if not yet existing, develop formal standards for metadata, data exchange, and inter operability
4. Encourage interfaces that target particular user communities, audiences and promote communication between end user and generator of information.
5. promote creation of expansion of global information commons (e.g. wiki, google library)
6. promote data access and availability via:
 - a. partner with industry to share data
 - b. utilize information technology to accelerate and access real time info
 - c. encourage open access publishing
 - d. preserve, archive, and make accessible historical data (funding necessary)
7. Suggest center of excellence be established to seek innovative approaches to information generation, collection, dissemination, integrating environment and health and making this information available to decision makers. Encourage market driven approaches for this.
8. top down enforcement from managers of the creation of standardized metadata records that document data sets and databases for scientific research
9. offer training—online or in person
10. inter-governmental (multilateral) info sharing
11. incentives to disseminate information to the public

BREAKOUT SESSION 24: DESIGNING FOR COMPLEMENTARITY AMONG PROGRAMS GENERATING ENVIRONMENTAL AND HEALTH INFORMATION **Recommendations**

1. Funders and scientific professional societies need to engage users of scientific data in dialogue to determine needs and lead scientists to provide relevant data that leads to effective products, solutions, and services.
2. The International Council of Scientific Unions (ICSU), State Department, and UN should create an

International Year(s) of Health and Environment.

3. NSF should host a summit event on designing for sharing and integration among environment and health with NSF's interdisciplinary cyber-infrastructure.
4. OSTP/NSTC, NSB, NGA, NSF should establish long-term commitment as reflected through the importance of data accessibility/interoperability through national policy, institutionalized through a reward system for data management and interdisciplinary work.
5. OSTP should request that the National Academies do a case study on "climate monitoring" as an example of integration across "stressors" (e.g., disease, land use/land change, pollution).
6. The National Science and Technology Council (NSTC) should develop a national health registry and tracking system for all life: humans, non-human animals, plants, etc.
7. OSTP and OMB should request that the National Academies organize a study on training and workforce development in interdisciplinary systems (including recognition/reward) a la "Gathering Storm."

BREAKOUT SESSION 25: MEASURING THE OUTCOMES OF POLICIES AND PROGRAMS

1. Federal and State Environmental and Human Health Programs / agencies need to focus on outcomes, quantitatively track their programs, and iteratively (who, what, where and when) refine their research, activities, and other decisions based on their evaluations.
2. Agencies, when conducting outcome evaluations, should stick close to their missions and should dedicate a percentage of their funding for data collection, decision tools, and outcome evaluations. They should use outcomes and positive case studies to improve programs and make programmatic funding decisions.
3. Government agencies involved in environmental and human health should develop cross-agency iterative forums to work more closely with stakeholders and the scientific community to reframe environmental health research agendas and environmental health issues and problems.
4. The federal environmental and human health community should develop a national integrated environmental public health database and report card.
5. Agency administrators and evaluation units and GAO and OMB need to prevent oversimplification by allowing qualitative information, non-modeled data, and insights as measures. (e.g., OMB needs to relax their rules restricting surveys and data collection tools.)
6. CDC, NIH, and AHRQ need to fund and conduct a pilot project to determine if current datasets and tools are adequate for environmental health outcomes and, if not, what should be measured. The pilot project needs to link environmental exposure data to health data.
7. EPA ORD, CDC, NIEHS, NSF, state governments, and others need to dedicate a portion of their budget to develop better informatic resources (including GIS) and metrics to develop capability to generate and use more electronic data in an integrated cross-agency manner. They need to develop a *coordinated, interagency*, online, dynamic, and up-to-date report card by providing datasets that are searchable and using innovative data mining tools.

* While the group focused more on human health indicators, the intention was not to exclude the other aspects of environmental health.